CORDAGE FROM THE OZETTE VILLAGE ARCHAEOLOGICAL SITE: A TECHNOLOGICAL, FUNCTIONAL, AND COMPARATIVE STUDY

Dale Ross Croes



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by

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ABSTRACT

In this report prehistoric cordage artifacts from the Ozette Village archaeological site (45CA24) and other Northwest Coast waterlogged sites are examined on three analytical levels. First, the cordage attributes (modes) are considered and compared between sites. Second, cordage stylistic/technological classes (types) and subclasses are created using a paradigmatic classification scheme. These cordage types and subtypes are compared between sites through the use of cluster analysis techniques. The results of these comparisons indicate a continuity of cordage styles in three separate regions of the Northwest Coast for the last 2000 to 3000 years, potentially indicating cultural continuity in these regions. These results were obtained when comparing basketry modes and types from these sites (Croes 1977b) and, in combination, these data support a hypothesis of regional cultural continuity in these regions. And third, a techno-functional classification of cordage artifacts from Ozette Village and other sites is considered. The Ozette cordage materials are especially useful for this purpose since they generally are recovered in their original context in a prehistoric household. Comparisons of cordage functional categories from each Northwest Coast wet site demonstrate specific site-use differences. Not only can fishing stations be suggested by the abundance of nets or fishline leaders recovered at different sites, but the type of fishing practiced can be demonstrated. The three-level analysis of cordage from Ozette Village and other Northwest Coast wet sites demonstrates a special analytic value for cordage in Northwest Coast prehistoric research.

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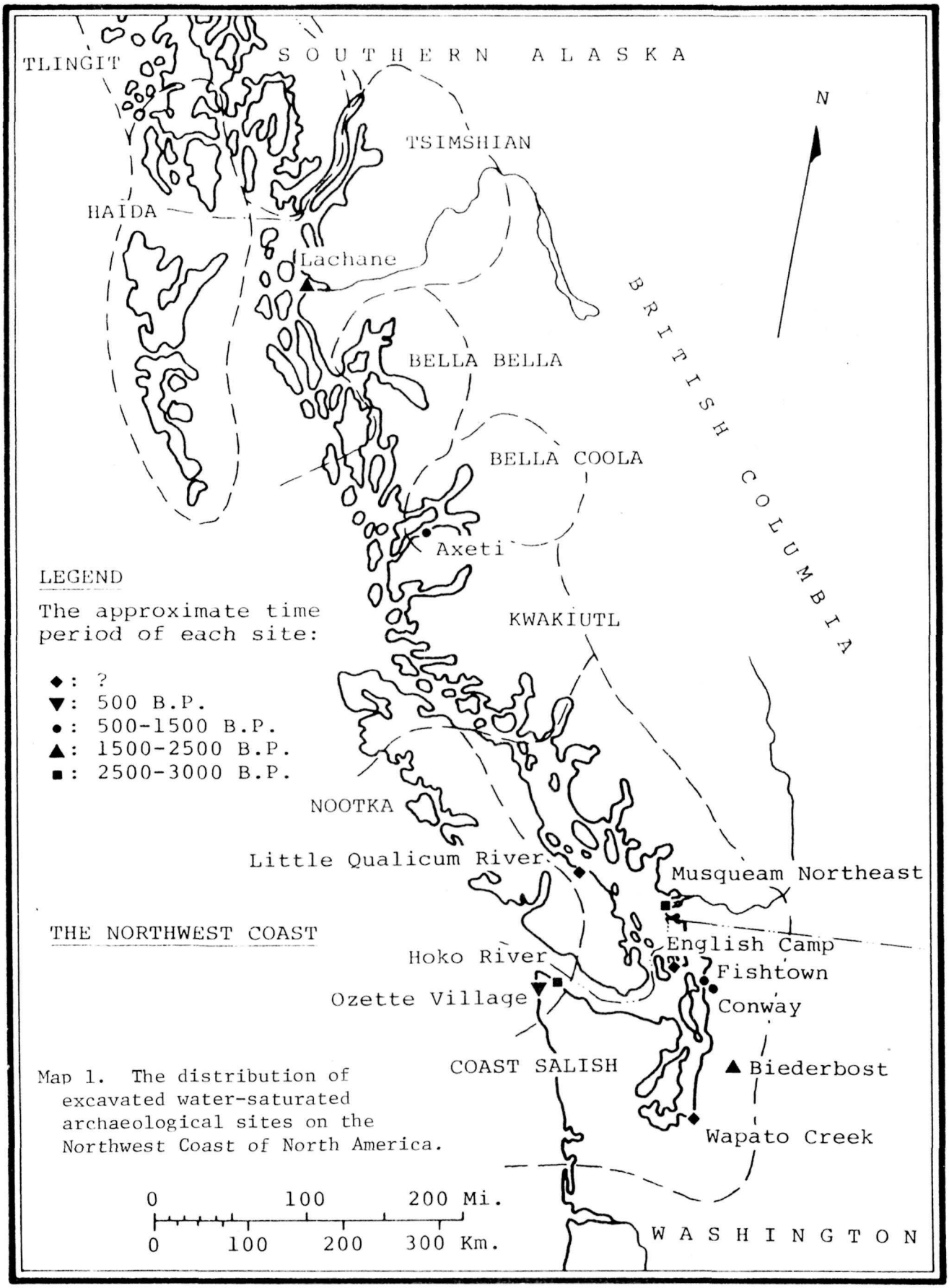
1. INTRODUCTION

Only in recent years have cordage and other perishable artifacts been recovered from Northwest Coast water-saturated archaeological sites (wet-sites). Cordage artifacts are of particular analytic and comparative value since they are often very high in frequency at these sites and are complex, analytically sensitive artifacts. The focus of the present study is on cordage artifacts recovered from the Ozette Village archaeological complex at Cape Alava near the northwestern tip of the Olympic Peninsula, Washington (45CA24, see Map 1). This site is ideal for such a study since it contains a whole section of a village, covered, encased, and preserved under a massive clay mudslide.

Thousands of pieces of cordage have been recovered in and around the excavated houses and often in their original functional context. For example, cedar bough withes are found in situ tying the house wall boards and other house components into place. Harpoon lines are found stored with other whaling and sealing equipment. Nets are stored in family areas. And cedar bark braids are tied across cradles to hold in the infant. Cordage is preserved in numerous situations which lend themselves to functional interpretations.

To better understand these materials from Ozette and other Northwest Coast wet sites, they are examined on three separate analytic levels: (1) cordage attributes (modes); (2) cordage technological classes (types); and (3) cordage functional categories. Comparisons among Northwest Coast cordage collections are made at each level and within a temporal and spatial framework. It is proposed at the outset that cordage artifacts from Northwest sites are particularly sensitive for comparative studies. They should be of considerable help in understanding technological developments and occupations of prehistoric groups on the Northwest Coast. Also, these materials can help in establishing chronologies for this area and may reflect in situ development, movement, and/or interaction of prehistoric societies on the Coast. Though the data presently available are limited, there is a high probability that many more Northwest Coast wet sites exist which will add to this data base (Croes 1976a; Daugherty 1976; MacDonald 1977). This study adds the new dimension of cordage technology to Northwest Coast prehistory and demonstrates the analytic potential of these artifacts.

The cordage to be compared in this study is from the eleven excavated Northwest Coast wet sites (Map 1). They are, from north to south: (1) Lachane (GbTo33); (2) Axeti (Kwatna) (FaSu1); (3) Little Qualicum River (DiSc1); (4) Musqueam Northeast (DhRt4); (5) English Camp (45SJ24); (6) Fishtown (45SK99); (7) Conway (45SK59b); (8) Biederbost (45SN100); (9) Hoko River (45CA213); (10) Ozette Village (45CA24); and (11) Wapato Creek Fish Weir (45PI47). Each site contains large quantities of well-preserved perishable artifacts. These sites have certain features in



Map 1. The distribution of excavated water-saturated archaeological sites on the Northwest Coast of North America.

common and can be defined as permanently water-saturated (waterlogged) deposits below a water table (or capillary fringe) in which cultural materials made from vegetal materials have been protected from decay organisms. Because of the anaerobic condition in water-saturated soils and lack of aerobic decay organisms (bacteria and, more importantly, fungi), the vast majority of the items made of vegetal matter remain intact and complete. A description of each site can be found in a symposium publication entitled, The Excavation of Water-saturated Archaeological Sites (Wet Sites) on the Northwest Coast of North America (Croes 1976a).

Ozette is unique among Northwest Coast wet sites since it contains a section of an ocean-front village that was preserved under a mudslide. Most other sites include offshore waterlogged deposits containing mostly discarded artifacts. The other sites are found: (1) at river mouths (estuaries); (2) in slough/cove areas (or areas that were slough/cove areas at one time and have since filled in); (3) beside, or in, calm tidal flat (mudflat) areas; (4) beside freshwater springs or creeks within or near a village; and (5) along river channels (Croes 1976d:286-287).

Radiocarbon dates from the water-saturated areas and levels of these sites range from approximately 500 B.P. to as early as 3000 years B.P., and fall within the following time periods (see Map 1).

General Time Period	Sites
2500-3000 B.P.	Musqueam Northeast, Hoko River
1500-2500 B.P.	Biederbost, Lachane, Little Qualicum River
500-1500 B.P.	Axeti, Conway, Fishtown
300-500 B.P.	Ozette Village
?	English Camp, Wapato Creek

Cordage artifacts will be compared from within this temporal and spatial framework. Unfortunately, only eleven sites with cordage examples for comparison exist at this time, but more should be available with future excavations and, potentially, from even earlier time periods (Croes 1976b: 6-8). For comparative studies, the closest spatial clustering of sites exists in the south-central and Puget Sound/Gulf of Georgia regions of the coast. These sites fall within a 500 to 3000 year time span. This area will be considered the most productive for comparative research. Although the context of the sites and their artifact associations are also examined, the cordage items are the main focus for comparison.

The Cordage Artifacts

The shed-roof houses, the elaborate woodworking and spectacular art, and the complex whaling and hunting gear from Ozette perhaps draw the most attention, but cordage is one of the most common artifacts in all Northwest Coast wet sites. This fact makes it valuable for comparative

purposes. Ozette provides the best situation for studying cordage since these artifacts usually are recovered in their actual functional context, or in places within the houses where they were used or stored. Thus, the unique and relatively complete data from Ozette Village serve as an important basis for a study of cordage from all sites and ethnographic (museum) collections of this area.

Before the different characteristics of cordage can be discussed, it needs to be defined. For purposes of this study, cordage is any line, commonly categorized as a rope, cord or string, that is twisted, braided or a plain thin strip of bark, limb, twig or root. Any artifact that meets these necessary and sufficient conditions is considered to be cordage. This definition includes the general categories of rope, cord, and string, and the cordage forms of lines, loops, nets, and wedge collars. Slightly over 2000 examples of cordage were recorded for this analysis from the Ozette Village House 1 area. Cordage made of sinew and animal matter are excluded since such materials have not been preserved in any of the sites considered here.

Knots are a distinct and analytically important aspect of cordage. They are defined here as any intertwining, looping, bending, hitching, folding, or gathering together of one or more pieces of cordage in such a way as to produce a tying together, fastening, binding, or connecting of the length on, to, or with itself, another length, or some other thing. Any cordage arrangement, other than accidental tangles, that meets these conditions is considered to be a knot. This definition of knots includes the general categories of hitches, splices, whips, and bends (Ashley 1944: 12). Slightly over 600 knots were recorded for this analysis from the Ozette Village House 1 area.

Cordage artifacts have numerous attributes or modes. The first task of this study is to delineate these diagnostic characteristics. Use of Ozette cordage modes for comparison with modes from other sites provides data useful for interpretive purposes. Second, cordage classes and types are delineated and compared. Third, these classes and types become the basis for functional categorization and interpretation of the cordage. Artifacts as analytically sensitive as cordage are notably scarce on the Northwest Coast. Stone, bone, and shell artifacts usually are not numerous at most sites, and many appear to change little time and across space (Croes 1977b:7). The numerous vegetal artifacts from Northwest Coast wet sites, and particularly basketry (Croes 1977b) and cordage can be incorporated into already established frameworks for Northwest Coast prehistory. This should furnish data necessary to: (1) date and clarify the origin of different cultural traditions, their development, interaction, and change through time and space; and (2) provide a more complete knowledge of the prehistoric site-use activities of the region. Preliminary statements made in this study demonstrate the importance of cordage for Northwest Coast prehistory.

A Brief Review of the Literature on Cordage

Cordage has been given very limited attention in anthropological or other literature, although earlier comparative studies of prehistoric

materials have provided significant results. These studies are used here to develop a standard terminology and a general research orientation.

The approach to the study of cordage and knots falls into four major categories: (1) ethnographic description; (2) cordage/knots construction; (3) cordage classification; and (4) systematic comparison through time and space.

Ethnographic Description

The best examples on the Northwest Coast are provided in Franz Boas' ethnographies, including "The Kwakiutl of Vancouver Island" (1909) and "Ethnology of the Kwakiutl" (1913). Both of these works contain thorough descriptions of: (1) how, when, and where cordage materials were prepared; (2) the process of manufacturing cordage described step by step by Kwakiutl informants; and (3) different kinds of cordage.

A recent study entitled Indian Fishing, Early Methods on the Northwest Coast by Hilary Stewart (1977) describes in considerable detail the construction and use of fish lines, binding elements, and nets. Beautifully illustrated, the volume clearly demonstrates the construction of these cordage forms.

Other ethnographic studies add limited information concerning Northwest Coast cordage technologies. They include: Drucker 1950, 1951; Eells 1887; Gunther 1927, 1945, 1972; Mozino 1970; Olson 1936; Swan 1869; Underhill 1945; and Waterman 1920, 1973.

Cordage/Knots Construction

Studies dealing with how ethnographic Northwest Coast cordage was constructed are all but lacking except for the descriptions in the main ethnographic references mentioned above (Boas 1909; 1913; Stewart 1977).

Numerous small publications can be found describing modern rope-making. They describe the materials used for manufacture and the different characteristics of ropes, e.g., strengths, weights, sizes, and lays (e.g., Plymouth Cordage Company 1916, n.d.). These books and others have helped identify useful and significant cordage attributes for use in cordage analysis.

Knot techniques have been the topic of several studies and especially in books dealing with nautical training (see extensive bibliographic listing in Ashley 1944:594-596). The classic work on knots is entitled The Ashley Book of Knots by Clifford W. Ashley (1944). This book considers about 4000 different knot forms. The study, as it claims, deals with "every practical knot--what it looks like, who uses it, where it comes from, and how to tie it." It deals with knots, loops, nooses, hitches, bends, and several other knot forms and rope works. A second study which illustrates numerous knotting techniques and complements Ashley's volume is Knots--Useful and Ornamental by George Russell Shaw (1972).

Cordage Classification

Studies that follow this approach deal with how cordage attributes and types can be classified and the problems involved in classifying cordage. Irene Emery's paper "Naming the Direction of the Twist in Yarn and Cordage" (1952) deals with one aspect of cordage--direction of twist--in a very comprehensive fashion, and touches on characteristics such as degree of twist, number of strands per unit length and diameters. Douglas and Carolyn Osborne's paper "Twines and Terminologies" designates diagnostic attributes or modes of cordage for analysis (1954). They discuss cordage construction materials, number of strands, degree of twist (e.g., crepe, very hard, hard, medium, soft), direction of twist (lay), regular-cable-hawser twists, and strength tests. The study demonstrates useful cordage modes for cordage analysis and classification. In dealing with cordage impressions on pottery, William Hurley has developed a very elaborate cord twist classification system (1975, 1978). In this system the cord lay and twist are designated into coded cordage types. Since cordage used to impress northeastern pottery is often multi-strand and elaborately cable or hawser twisted, numerous cord twist classes are recognized. The location or placement of impressions on pottery examples, and techniques of preparing the cordage for impressions on pottery, are also useful characteristics or features in comparing cordage impressions on pottery.

Sandra Clements Scholtz's study, Prehistoric Plies: A Structural and Comparative Analysis of Cordage, Netting, Basketry and Fabric from Ozark Bluff Shelters (1975), includes an elaborate classification of cordage with basically a paradigmatic classification framework (based on Emery 1952). Her dimensions of classification include manufacture technique (e.g., plied, braided, feather-wrapped, etc.), number of strands, material, and direction of twist (1975:10). Cordage in each class is discussed in terms of range of diameter, average diameter, range of length, range of angle of twist and range of twists per unit length. This study is one of the few attempts at detailed systematic classification of prehistoric cordage collections. It mainly classifies and describes cordage in the Ozark Mountains region, but also includes a limited comparison of styles and techniques in this region.

Systematic Comparison through Time and across Space

Studies following this approach deal with how different perhistoric cordage technologies are related and how they have changed through time and across space. Hurley effectively uses the styles of cordage impressions on pottery from mound sites in northeastern United States to offer new insights into the prehistory and cultural relationships of groups in that region (1975, 1978). In the Northwest, Earl Swanson analyzed actual examples of cordage from dry cave sites in the Eastern Washington Plateau cultural area (1962). Using eight sites in the Vantage region, phases were established based on stratigraphy and the evaluation of two-ply cordage. Swanson concludes:

> It is the two-ply cordage which supplies the links of the sequence as well as the means of distinguishing one phase from another. Where physical conditions permit, two-ply cordage is widespread; it changes uniformly throughout the Vantage region; and it is susceptible to objective treatment. This treatment consists of the description of the degree and direction of twists, the diameter of the elements, and the materials used. These appear to change, with relative uniformity, from phase to phase (Swanson 1962:36).

He also demonstrates how caves used as storage shelters as opposed to habitations had a distinct assortment of cordage due to the functional difference of the sites. The paper aptly points out the usefulness of cordage materials for analysis in a region where other categories of artifacts are not as abundant or stylistically sensitive. He also indicates how the phases developed in the cave sites could be correlated with open sites by association of projectile point types.

On the Northwest Coast the author has completed two reports dealing with the cordage from wet sites, Musqueam Northeast (1975) and Lachane (1977a). Musqueam Northeast cordage dating from approximately 3000 years B.P. (Borden 1976) is analyzed on the levels of cordage mode, technological types, and functional categories. Lines, nets, wedge collars, and other forms are distinguished. This cordage primarily is compared with the later Ozette Village site cordage (1975). Lachane cordage is from a northern Northwest Coast site and dates to approximately 2000 years B.P. (Inglis 1976). This cordage is examined on the three analytic levels, but also comparisons are made with cordage technological types from five other Northwest Coast wet sites. Cluster analysis shows that the more northerly sites, Lachane and Axeti, are most similar to each other and the cordage from these two sites is suggested to be of a style distinct from the south-central styles (or technological types) of cordage (1977a).

Although aspects of each of the four approaches discussed in this study are used, the main approach is that of the last, systematic space/time comparison (or prehistory). The cordage classification developed here employs many of the major diagnostic attributes or modes discussed in other studies. One major objective of this study that departs from most earlier works is to explicitly define the cordage attributes (modes) and the combinations of the modes into cordage classes (types). The main objective is to clearly define levels and units of comparison. To achieve this, every cordage mode and class is defined paradigmatically by a distinct combination of diagnostic features. Clarity in definition will allow collections to be compared on the Northwest Coast and elsewhere, for both historic and prehistoric periods.

The Analytic Framework

As indicated, this study evolves through three levels of classification: (1) diagnostic mode; (2) technological type; and (3) functional set or class of Ozette Village and other Northwest Coast cordage. The modes defined in the first level of classification are employed in defining the technological types, which are in turn used to define the functional

classes. The units created in these classifications are used to: (1) analyze the function and distribution of cordage within the Ozette Village site, especially focusing on the first excavated Ozette house (House 1); and (2) develop similar classifications for other Northwest Coast wet site cordage to be used in a comparative study of prehistoric cordage assemblages on the entire coast. Results provide: (1) a detailed picture of the cordage from a single household at Ozette in its prehistoric cultural context; and (2) new hypotheses concerning the prehistoric development of and interrelationships between the cordage technologies in different regions of this area.

A paradigmatic classification framework is used in this study. This is a non-hierarchical classification in which classes are formed by a distinct combination of mutually exclusive alternate features (Dunnell 1971:200). In this case, each cordage attribute (mode) is of a different dimension, e.g., the dimensions of construction materials, construction techniques, number of strands, gauge size, etc. These modes are defined, and, in turn are used in combination to define cordage types. These modes and types become the units of comparison. Conklin stated that "paradigmatic classes arrange entities which are known (1) to share a certain common feature (Lounsbury 1956), and (2) to constitute a contrast set (Conklin 1962a)" (Conklin 1969:107). For example, each class consists of items that share the definitive features of being cordage (as defined above), but differs from all other cordage types on the basis of at least one definitive mode.

2. OZETTE VILLAGE CORDAGE MODE CLASSIFICATIONS

The Dimensional Features of Cordage

The dimensions of cordage selected for analysis are considered first. The concept of dimension in classification is defined in different ways. Watson et al. state: "a dimension is some formally defined aspect of the group of objects that is being studied" (1971:138). And Lounsbury defines a dimension of a paradigm as "a set of mutually exclusive (i.e., non-concurrent) features which share some or all of the same privileges of combination ('bundling') with features not of this dimension" (1969:193). The dimensions of cordage to be considered here are:

1. construction materials
2. construction techniques
3. number of strands
4. gauge size (diameter)
5. lay (direction)
6. sizes (lengths)
7. forms (lines, loops, nets, wedge collars, etc.)
8. knotting techniques (including knots, hitches, and whippings).

The diagnostic modes in each of these dimensions are paradigmatically defined by a combination of their diagnostic characteristics. The concept of mode is defined by Rouse as "an abstraction of a recurring feature from the specimen" (1939:18). Rouse further assumes that modes "express the culture which conditions the artisan's behavior" (1939:18). Dunnell considers modes as "an intuitive cultural class of attributes of discrete objects" (1971:202). Rouse's recommended technique is used to derive cordage modes: "examine a collection in terms of the artisan's procedure, starting first with the material he used, continuing with his technique of manufacture, and then consider shape, decoration, and uses" (1961:314).

Cordage Materials

The identification of Ozette Village cordage materials and those from other sites involves three main problems: (1) the identification of the species of plant used; (2) the identification of the plant part utilized (e.g., boughs, roots, or bark of the plant); and (3) the identification of the process of modification of that plant part into a cordage material (e.g., twisting, shredding, splitting, etc.). To identify the plants used for cordage construction, a technique of microanalysis of cell structure was used. Most cordage materials can be confidently identified with a newly developed collodion peel replica technique for cell analysis (Croes n.d.), and from macro-feature comparisons and ethnographic data. With this information the Ozette Village cordage

materials are defined in Table 1. The use of these variables is based on the assumption that the cordage artisan must know what plant to seek when gathering materials, collect the part of that plant that is to be used, and finally prepare or modify that plant part, if necessary, into cordage materials. Certainly several other variables are involved in the gathering and preparing of cordage materials, but these three main dimensions are considered the main criteria for material definitions. In the definitions an idealized cross-section is drawn of the plant part (bough, root, bark, stem, leaf) to illustrate the general methods of modification: twisting, shredding, or splitting of the plant part as a cordage element.

At Ozette Village the most frequently used cordage material is cedar boughs (see Table 2). This material typically is twisted and used singly or plied into multi-strand cordage. Ethnographically, long boughs were gathered from young cedar trees and heated before twisting. To heat the boughs for making well-formed rope, each limb, with bark removed, was pushed into long bull kelp tubes, with the leafy heads cut off. The kelp tubes were arranged side by side and covered with a layer of earth. A fire was built and tended on top of the buried boughs until they became hot. They were then removed, using the cutoff leafy end of the kelp as gloves, and twisted tightly while still warm, being wrapped back on themselves for storage (William Penn, 91-year-old Makah informant, personal communication 1974).

The second most common cordage material is inner cedar bark (see Table 2). Often the flat and narrow strips of bark are braided, forming three-strand braided cordage. The bark is also shredded and beaten into fibers and then rolled or twisted into cordage strands (Boas 1909:371-372 for additional information on cedar bark materials and preparation). These strands are plied together forming multi-strand cordage.

A less frequent cordage construction material is spruce or cedar root (Table 2) which was twisted into tight cordage elements (see Boas 1909:377-379). Cherry bark was cut into long, narrow strips and used as a binding element. Leafy cedar twigs, spruce twigs, and hemlock twigs were bound or braided together into cordage-like strands. These twigs probably functioned as brushes, but they are considered under the cordage category here. A few examples of splint strips have been recorded as being used as tying elements.

Comparison of Cordage Materials Recorded at Other Northwest Coast Wet Sites

Cordage materials recovered from other Northwest Coast wet sites are recorded in Table 3. At least 85 percent of the cordage from each of the ten other Northwest Coast wet sites is included. Each example of cordage was considered a single specimen. Because of the broken condition of many pieces, however, this would not be considered an exact count of complete specimens; several pieces originally could have belonged to a single example of cordage. The frequency of occurrence of cordage examples therefore indicates only the general frequency of occurrence.

TABLE 1.--Ozette Village Cordage Construction Materials Defined.

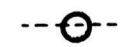
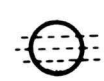
Plant	Plant Part	Modification; X-Sec.		Name
1. *Thuja plicata*	+ Bough	Twisted		Cedar bough withe
2. *Thuja plicata*	+ Inner cortex of bark	+ Split ribbon strips		Cedar bark strips
3. *Picea sitchensis*	+ Root	+ Twisted		Spruce root withe
4. *Picea sitchensis*	+ Twigs	+ Split in half		Spruce twigs
5. *Tsuga heterophylla*	+ Twigs	+ Split in half		Hemlock twigs
6. *Thuja plicata*	+ Twigs	+ Split in half		Cedar twigs
7. *Prunus emarginata (?)*	+ Bark	+ Cut ribbon strips		Cherry bark strips
8. *Thuja plicata*	+ Bark	+ Shredded and twisted fibers		Twisted cedar bark fibers
9. *Thuja plicata*	+ Root (?)	+ Split through center		Splint strip

Table 2. Frequency of Ozette Village cordage materials.

Material	#	%
Cedar bough	970	48.2
Cedar bark	786	39.0
Spruce or cedar root	85	4.2
Cherry bark	49	2.4
Cedar twigs	106	5.3
Spruce twigs	1	0.0
Hemlock twigs	1	0.0
Miscellaneous, unidentified	16	0.9
Total	2,014	100.0

Identification of cordage construction materials from other Northwest Coast wet sites could not be as carefully recorded as were the Ozette examples, because the identification of different materials usually is based only on the macro-characteristics of the cordage. Some identification errors are to be expected. However, the majority of the identifications are considered to be correct.

As can be seen in Table 3, the cordage construction materials occurring at Northwest Coast wet sites typically are cedar bough, cedar bark, and some root cordage. Also, cherry bark binding elements occur at some sites. The main contrast between sites is in the frequency of occurrence of different construction materials. The comparison of individual cordage materials occurring at each site is discussed below.

Cedar bough cordage occurs at all Northwest Coast wet sites, but with considerably different frequencies. Cedar Boughs usually are twisted into cords or ropes. This material has very strong, pliable, and non-absorbent qualities producing durable rope materials. Cedar bough cordage is the major cordage recorded at Ozette Village, Musqueam Northeast, Biederbost, Little Qualicum River, Conway, and Fishtown. It is of secondary frequency to other cordage materials at Lachane, Axeti, and Hoko River.

Cedar bark cordage occurs at most Northwest Coast wet sites. It is a relatively strong, very flexible, but absorbent cordage material. The Axeti site has a greater frequency of cedar bark cordage compared with other sites. The reason for this abundance is not clear, but cedar bark could have been a cultural preference, since cedar boughs were available throughout the Northwest (although maybe not "swamp" cedars which seem to be the best for low long boughs). Lachane, the other northern Northwest Coast wet site, has the next most frequent emphasis on cedar bark cordage materials (see Table 3).

Table 3. Cordage construction materials recorded at Northwest Coast wet site. (Percent of occurrence in parentheses).

Construction Material	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
Cedar boughs	970	124	86	56	39	11	6	5	1	27
	(48)	(19)	(72)	(86)	(5)	(42)	(55)	(56)	(100)	(57)
Cedar bark	786	28	22	1	718	15	4			15
	(39)	(4)	(19)	(2)	(95)	(58)	(36)			(32)
Spruce root (?)	85	474	10		2					
	(4)	(74)	(8)		(0)					
Twigs	108				2					
	(5)				(0)					
Cherry bark	49	10	1	8			1	3		5
	(3)	(2)	(1)	(12)			(9)	(33)		(11)
?	16	3						1		
	(1)	(1)						(11)		
Total	2,014	639	119	65	761	26	11	9	1	47

Spruce roots are of major use for cordage at the Hoko River site (Croes 1976). Small diameter roots were used to make two-strand fishline leaders and as sewing/twining elements in mats and skirts. The fishline leaders are identified as such since they often are recovered still attached to fishhooks. The high frequency of root fishline at Hoko River corresponds to the use of the site as a fishing station.

Braided or bound twigs have been found at Ozette Village and Axeti. Cherry bark strips, used as a binding material, are recorded at most sites (Table 3). This flat, strong, water-repellent, flexible material commonly is used at Ozette Village to bind bone barbs onto fishhooks, arrow points onto shafts, harpoon barbs together, feathers (fletchings) onto the ends of arrow shafts, and for other binding functions. Ethnographically cherry bark is noted for not loosening when it becomes wet.

In summary, similar cordage construction materials are recorded at most Northwest Coast wet sites, but emphasized with different frequencies. Cedar bark is emphasized at Axeti, cedar boughs at many southern sites and spruce root at Hoko River. The different emphases probably correspond to either different site-uses or cultural preference. Environmental differences are of minor importance in most cases since often the same plant is used, just different parts (cedar bark vs. boughs), and most plant species are available throughout this area.

Cordage Construction Techniques

The manufacture of Ozette cordage basically involves the use of one or another of three main techniques. These are:

1. twisting--single to multi-strand cordage
2. braiding--braided cordage
3. unmodified strips--strap cordage.

Twisting techniques are the most common at Ozette Village (Table 4). The twisting techniques are used in creating both single-strand withes and multi-strand, plied cordage.

The second most common technique is braiding (Table 4). Cedar bark is most commonly used for braided cordage, but other materials also are used.

The least frequently used technique is the production of plain unmodified strips (Table 4). These unmodified strips are mainly cherry bark, used as binding elements.

Table 4. Cordage manufacturing techniques recorded at Northwest Coast wet sites. (Percent of occurrence denoted in parentheses).

Manufacturing Techniques	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
1. Twist	1,315	611	118	56	673	22	6	6	1	36
	(65)	(96)	(100)	(86)	(88)	(92)	(60)	(67)	(100)	(77)
2. Braid	562	8		1	72	1	4			3
	(28)	(1)		(2)	(10)	(4)	(40)			(6)
3. Strips	119	18		8	16	1		3		8
	(6)	(3)		(12)	(2)	(4)		(33)		(17)
?	18	2								
	(1)	(0)								
Total	2,014	639	118	65	752	24	10	9	1	47

Comparison of Cordage Construction Techniques at other Northwest Coast Wet Sites

Cordage manufactured with twisting techniques are the most commonly recorded examples at all Northwest Coast wet sites (Table 4). The twisting techniques are used in making single-strand withes or are plied into multi-strand cordage. In general, twisted cordage is constructed from cedar boughs, roots, and bark materials. Different sites stress different materials for constructing twisted cordage. At Hoko River, cordage is mostly twisted two-strand, root strings. At Ozette Village, Musqueam Northeast, Biederbost, Conway, and Fishtown cordage mostly is twisted, one-strand, or multi-strand, cedar bough cordage. And at Axeti, cordage is mostly twisted, multi-strand, cedar bark cordage.

Cordage braiding is the second most commonly recorded technique. Ozette Village and Axeti have the largest number of braided cordage pieces. Braided cordage is commonly made with cedar bark at all sites.

The use of plain strips of materials as cordage is the least frequently employed manufacturing technique. These pieces usually are examples of cherry bark of spruce root binding elements, or plain strips of cedar bark or root.

Number of Cordage Strands

Ozette Village cordage is composed of both single and multiple cordage elements. The frequency of different numbers of cordage strands in the entire Ozette collection is recorded in Table 5 (the main techniques of twisting and braiding are separated).

The majority of Ozette Village cordage consists of from one to three strands (96.5 percent). Most of the braided cordage is three-strand braiding with only a few examples of four-strand. The twisted cordage is mainly one- and two-strand (84.7 percent), but a sizable sample is also three- and four-strand (14.9 percent). Single-strand twisted withes are not always labeled as individual artifacts at Ozette Village, but frequently are collected in level bags. However, only those labeled as artifacts are analyzed. Therefore, the actual frequency of single-strand withe is higher than recorded.

Examples of different numbers of strands used in cordage is illustrated in Figure 1.

Table 5. Number of strands used in making Ozette Village Cordage.

Number of Strands	All Techniques		Braid Cordage		Twist Cordage	
	#	%	#	%	#	%
1	613	30.4			495	37.6
2	620	30.8			620	47.2
3	711	35.3	559	99.5	152	11.6
4	47	2.3	3	0.5	44	3.3
5	3	0.2			3	0.2
6	1	0.1			1	0.1
?	19	0.9				
Total	2,014		562		1,315	

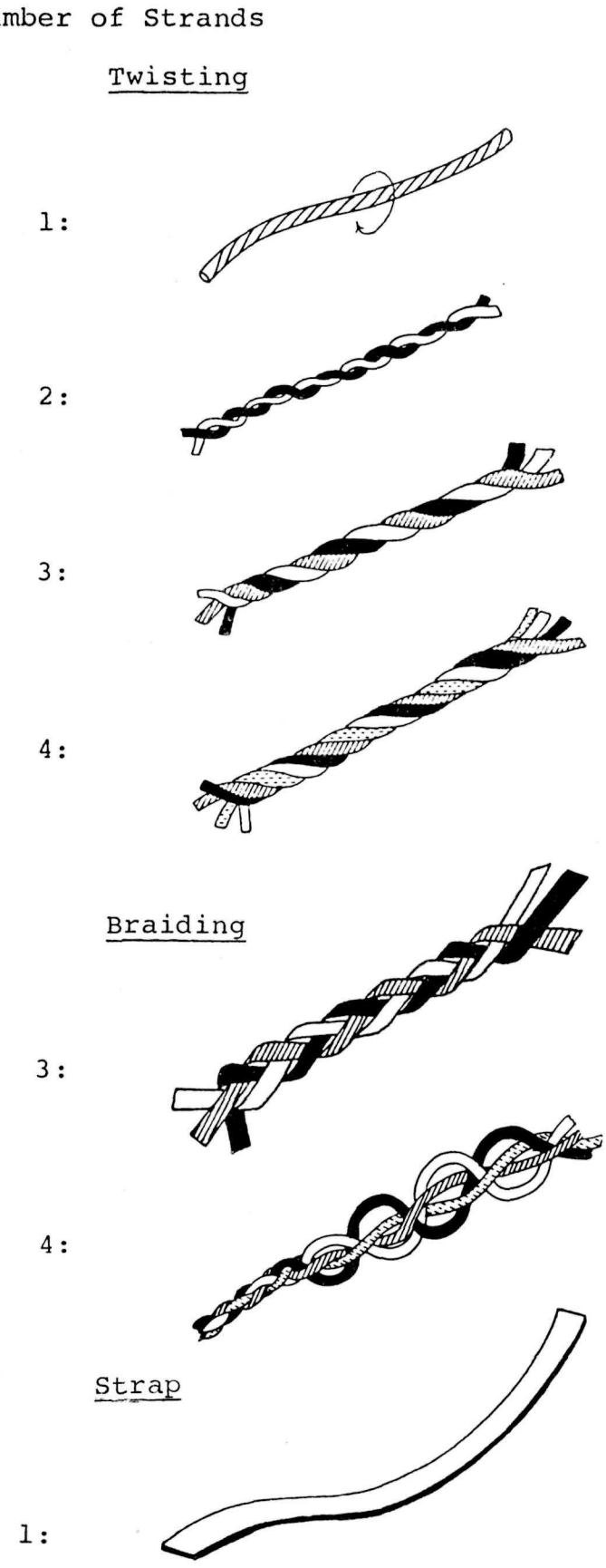


Figure 1. Number of strands used in constructing Ozette Village cordage.

Comparisons of the Number of Cordage Strands Recorded at other Northwest Coast Wet Sites

The frequency of the different numbers of strands on twisted cordage from other Northwest Coast wet sites is recorded in Table 6. Braided cordage is not listed since this cordage, where occurring, is consistently constructed with three strands. Considering the twisted cordage, most sites have examples of single-strand withe, and two- and three-strand twisted cordage. A few examples of four-strand twisted cordage occur at these sites. The frequency of occurrence of the different numbers of strands of twisted cordage at the sites varies considerably and is the basis for the following discussion.

One-strand, cedar bough withes are relatively frequent at Ozette Village, Musqueam Northeast, Biederhost, Little Qualicum River, Lachane, and Fishtown. The twisted withes are quickly made pieces of flexible cordage utilized for several tying purposes (discussed below).

Two-strand twisted cordage is most numerous at Ozette Village, Hoko River, and Axeti. Most two-strand twisted cordage at Ozette Village is constructed of cedar boughs, though a considerable number of two-strand, cedar bark strings also occur. Most two-strand twisted cordage at Hoko River is constructed of narrow gauge rootlets, creating the common strings recovered from this site. And the two-strand twisted cordage at Axeti is constructed of cedar bark, creating the cords and ropes common to that site.

Three-strand twisted cordage is most common in frequency of occurrence at Musqueam Northeast and Biederbost. At these sites the larger, cedar bough ropes are constructed in three strands. The three-strand twisted cordage at Ozette Village, Hoko River, Musqueam Northeast and Biederbost commonly is constructed of cedar boughs. The three-strand twisted cordage of the northern Axeti and Lachane sites commonly is constructed of cedar bark. At all sites the three-strand twisted cordage typically produces the larger gauge cords and ropes.

Ozette Village and some of the other sites have four-plus strand twisted cordage. This is used for larger ropes or for the wood wedge collars.

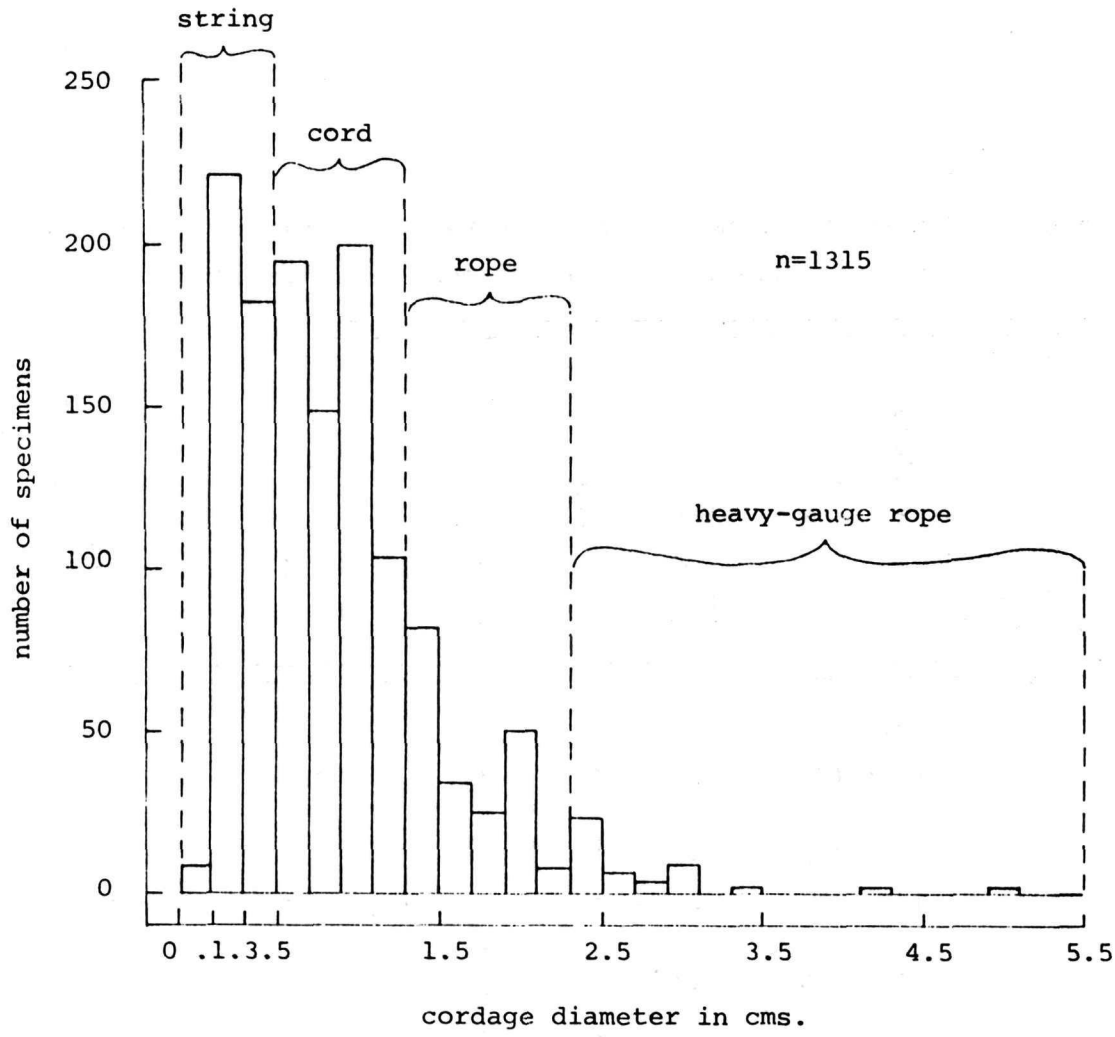
Diameter Gauge of Cordage

The diameter measurements of Ozette cordage range from 0.1 to 4.2 cm. For comparative purposes, this range is divided into different categories of string, cord, rope, and heavy gauge rope. The twisted cordage is considered separately from braided cordage because the former is measured as a diameter measurement, and braided cordage is flatter, measured as a width measurement calculated by averaging the maximum measurements taken from several points on the cordage. Two histograms demonstrate the frequency distribution of Ozette twisted cordage diameters (Figure 2) and Ozette braided cordage widths (Figure 3). The gauge range is separated into the general cordage categories of string, cord, rope, and heavy gauge rope. These designations are based upon modal distribution. Although

Table 6. Number of strands recorded on twisted cordage from Northwest Coast wet sites. (Percent of occurrence in parentheses).

Number of Strands	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
1	495	133	29	24	39	6	1	4		19
	(38)	(21)	(25)	(43)	(6)	(27)	(17)	(67)		(53)
2	620	472	48	19	504	11	5	2	1	15
	(47)	(74)	(40)	(34)	(78)	(50)	(83)	(33)	(100)	(42)
3	152	18	40	13	57	4				2
	(12)	(3)	(34)	(23)	(9)	(18)				(5)
4	44	3	1			1				
	(3)	(0)	(1)			(5)				
5	3									
	(0)									
6	1									
	(0)									
Unraveled		13			42					
		(2)			(7)					
Total	1,315	639	118	56	642	22	6	6	1	36

A.



B.

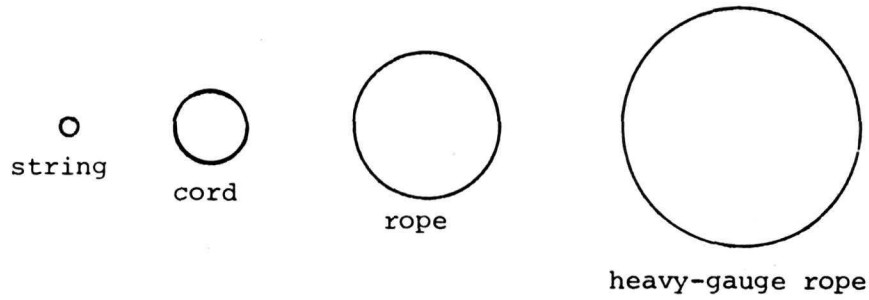
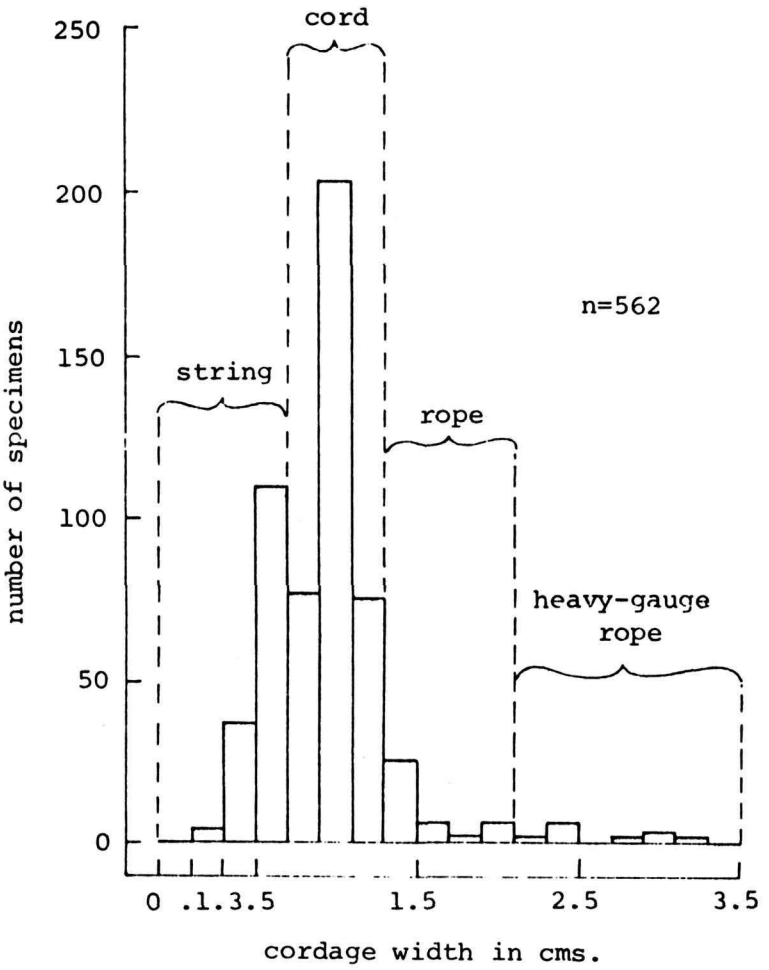


Figure 2. (A) Histogram of Ozette Village twisted cordage diameter measurements. (B) Average diameter gauge measurements in major cordage size categories.

A.



B.

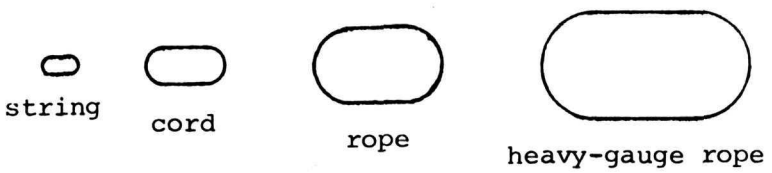


Figure 3. (A) Histogram of Ozette Village braided cordage width measurements. (B) Average width gauge measurements in major cordage size categories.

somewhat arbitrary, they are useful for general discussion and comparison with other sites. The cordage gauge designations are defined as follows:

	Twisted Cordage	
String	0.1 to 0.5 cm diameter	33 percent
Cord	0.6 to 1.3 cm diameter	48 percent
Rope	1.4 to 2.3 cm diameter	15 percent
Heavy gauge rope	2.4+ cm diameter	4 percent
	Braided Cordage	
String	0.1 to 0.7 cm wide	27 percent
Cord	0.8 to 1.3 cm wide	64 percent
Rope	1.4 to 2.1 cm wide	7 percent
Heavy gauge rope	2.2+ cm wide	2 percent

In scanning the histogram and chart, the major distinguishing feature between the gauges of Ozette Village twist and braid cordage is that braid cordage is mostly of cord gauge. There is a much lower frequency of string, rope, and heavy gauge rope braids. In terms of the mean gauge of Ozette Village cordage, these figures are calculated:

Gauge:	Mean	Standard Deviation	Number
Ozette Village twist cordage	0.91	0.64	1,315
Ozette Village braid cordage	1.00	0.47	562

There is less deviation within the range of Ozette Village braided cordage than twisted cordage, but the mean in both cases is from 0.91 to 1.0 cm diameter.

The gauge definitions given above are mainly useful for comparative purposes, especially with other sites, and for general reference when discussing the differences in cordage sizes. The terms string, cord, rope, and heavy gauge rope are applied to these defined ranges since they have a qualitative, functional meaning in our own cultural context, and, as long as the terms are explicitly defined here, they are useful labels. This certainly does not imply that the original Ozette people had this four class gauge category, but the important consideration is the occurrence of this range of different cordage diameters. The diameter gauge category is important in considering the classes and functions of Ozette cordage below.

Comparison of Diameter Measurements of Cordage Recorded from other Northwest Coast Wet Sites

The cordage diameter measurements recorded from other Northwest Coast wet sites are arranged in Table 7 according to the string, cord,

Table 7. Cordage diameter gauge categories recorded at Northwest Coast wet sites. (Percent of occurrence denoted in parentheses).

Cordage	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
Twisted:										
1. String, 0.1-0.5 cm dm	430 (33)	532 (87)	49 (41)	8 (16)	56 (9)	5 (22)		1 (17)		11 (30)
2. Cord, 0.6-1.3 cm dm	639 (48)	76 (12)	55 (47)	30 (61)	458 (75)	16 (69)	1 (17)	4 (66)		19 (53)
3. Rope, 1.4-2.3 cm dm	194 (15)	5 (1)	14 (12)	11 (23)	71 (12)	2 (9)	5 (83)	1 (17)	1 (100)	6 (17)
4. Heavy-guage rope 2.4 + cm dm	52 (4)				22 (4)					
Subtotal	1,315	613	118	49	607	23	6	6	1	36
Braid:										
1. String, 0.1-0.5 cm wide	152 (27)	1 (14)			2 (3)	1 (100)				1 (33)
2. Cord 0.8-1.3 cm wide	354 (64)	5 (72)		1 (100)	31 (52)		4 (80)			1 (33)
3. Rope 1.4-2.1 cm wide	39 (7)	1 (14)			25 (42)		1 (20)			1 (33)
4. Heavy-guage rope 2.2 + cm wide	11 (2)				2 (3)					
Subtotal	556	7	0	1	60	1	5	0	0	3
Total	1,871	620	118	50	667	24	11	6	1	39

rope, and heavy gauge rope categories established for Ozette Village. In this manner the range of different cordage gauge diameters for each site can be compared to all other sites. The twisted cordage is separated from the braided cordage. It can be seen that the frequencies of gauge categories at these sites vary considerably. Also the mean gauge cordage diameters are recorded in Table 8. These tables are the basis for the following discussion.

String gauge twisted cordage is most frequent at Hoko River, Musqueam Northeast and Ozette Village sites. Hoko River has by far the highest frequencies of examples. The strings appear mainly to have been used as fishline strings and also as weaving elements at this site. At Musqueam Northeast, an early fishing station, string cordage was used in constructing large mesh gauge nets (Borden 1976; Croes 1975). The frequency of strings common to Hoko River and Musqueam Northeast correlates somewhat with the fishing station functions of these sites. The fishline strings (leaders) at Hoko River, however are two-strand, spruce rootlet lines associated with the common bentwood and composite fishhooks common to the site, and those from Musqueam Northeast are two-strand, cedar bark strings used in constructing nets, and no doubt for fishing (Croes 1975). Strings are common to these fishing stations, but appear to have been used for two different fishing techniques. The strings at Ozette Village are commonly associated with the manufacture of clothing and blankets (below).

TABLE 8. Mean of the Cordage Diameter Measurements recorded from Northwest Coast Wet Sites

	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
Mean Diameter of twisted cordage:										
Mean	.91	.36	.76	1.07	1.03	.83	1.45	.83		.88
Standard deviation	.64	.21	.40	.45	.84	.41	.24	.41		.52
Number	1,315	613	118	49	607	23	6	6		36
Mean width of braided cordage:										
Mean	1.00	.91			1.38		1.16			1.03
Standard deviation	.47	.52			.40		.23			.67
Number	556	7			60		5			3

Cord gauge twisted cordage is especially frequent at the northern sites of Axeti and Lachane, and it is the predominant cordage category at most sites. At northern Axeti and Lachane the cords typically are manufactured of cedar bark, whereas those from more southerly sites typically are from cedar boughs.

Rope gauge twisted cordage is recorded at most sites and at lower frequencies. It is of note that ropes (cedar bough) are relatively frequent at the early sites of Musqueam Northeast and Biederbost.

Heavy gauge twisted rope is only recorded and in high relative frequency at Ozette Village and Axeti. At Ozette Village the heavy gauge ropes are commonly three-strand cedar bough ropes associated with the sea mammal hunting equipment and are considered harpoon lines. Considering the whale harpooning activities of the Ozette, these large gauge ropes are expected. At Axeti the heavy gauge rope cordage commonly is two- or three-strand cedar bark ropes. These heavy gauge ropes probably have less tensil strength than cedar bough ropes, but would have been relatively strong. Their function at this site is not known, but they probably had a function similar to that of the smaller cedar bark cords and ropes recorded from the site.

Braid cordage is common only at Ozette Village and Axeti. String gauge braided cordage is most common at the Ozette Village site, but is also found at Axeti. Rope and heavy gauge rope braided cordage is most frequent at the Axeti site. In terms of the mean gauge of braided cordage at Ozette Village and Axeti (Table 8), Axeti braided cordage typically is larger than at Ozette.

In summary cordage gauge diameters recorded at Northwest Coast wet sites relate to the activities taking place at the site. The high frequency of strings for fishlines and nets at Hoko River and Musqueam Northeast associates with the fishing activities occurring at these locations. The occurrence of heavy gauge ropes at Ozette Village is associated with the sea mammal, and especially whale and fur seal hunting activities. The frequency of occurrence of different cordage diameter gauges at Northwest Coast wet sites can be an important criterion when interpreting site use.

The Lay and Twist of Cordage

The Ozette Village twisted cordage is either constructed with a lay up-to-the-right (Z) or up-to-the-left (S). Single-strand withes of cedar bough are twisted exclusively with a twist to the right (R). When the single elements are combined or plied into multi-strand cedar bough cordage, the lay usually is up-to-the-right (Z) and the twist is left (L) or abbreviated L^{r}_{r}, where the two individual withes are twisted to the right, but plied together with a twist to the left (Figure 4). In contrast, Ozette Village cedar bark strings frequently are two-strand and plied with an S lay. The lay and twist of Ozette cordage generally corresponds with the number of strands used, the material used, and the gauge of the cordage. This information is summarized in Table 9.

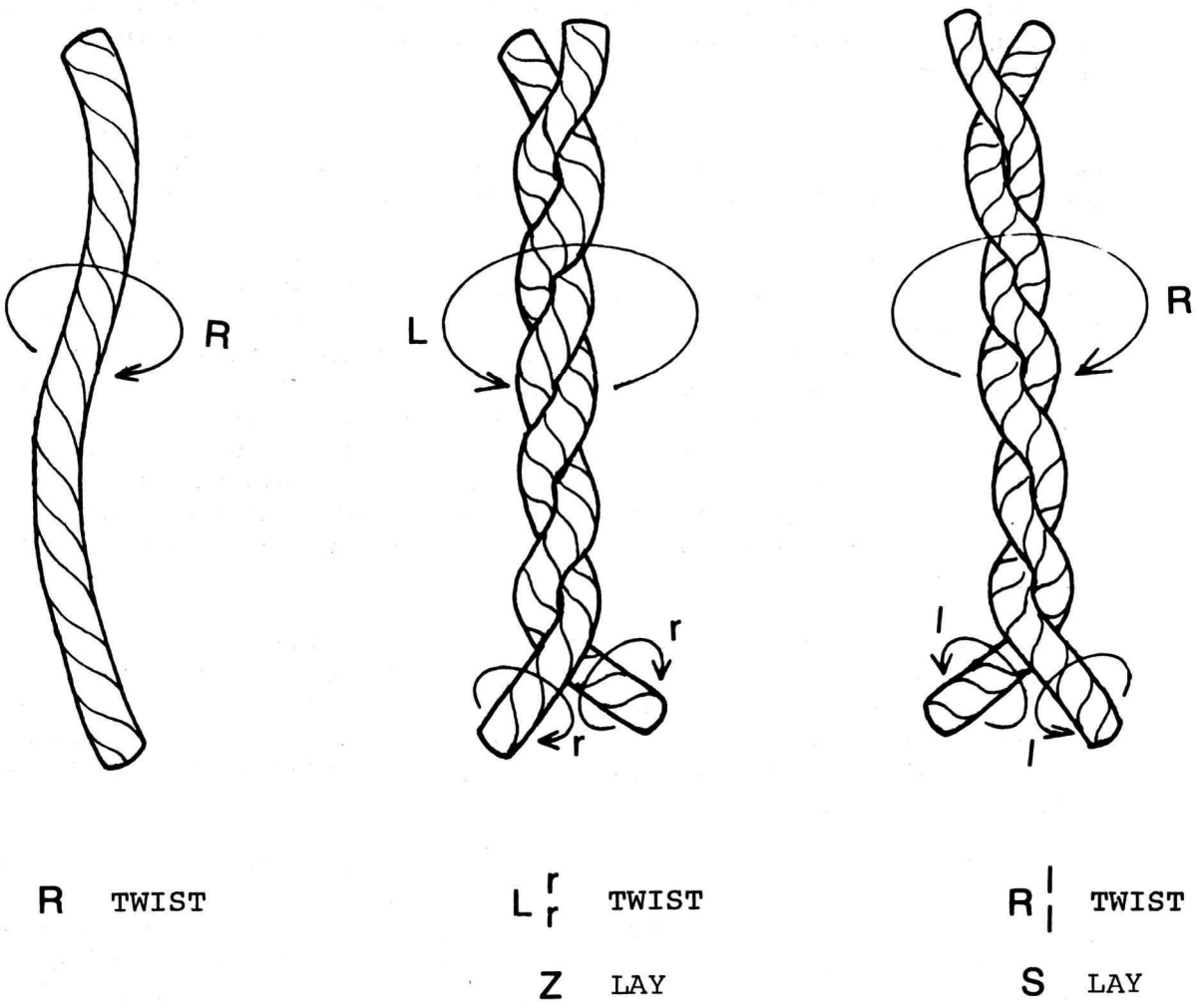


Figure 4. Directions of twist and lay.

As shown, all single-strand, cedar bough withes are twisted to the right (R). When the cedar boughs are plied together into two or more strand cordage, two-thirds of the cedar bough string gauge cordage has a Z lay and the remainder an S lay. In contrast, practically all of the cedar bough cord to heavy gauge rope cordage, with two or more strands, has a Z lay. Therefore, most of the multi-strand, cedar bough cordage is Z laid. Two-strand, cedar bark string, again in contrast, usually has an S lay. Cord size, two-strand, cedar bark cordage is less frequent, but more examples are Z laid (61.1 percent vs. 38.9 percent). Multi-strand spruce root cordage usually has a Z lay. In summary the lay of the twisted Ozette Village cordage appears to vary according to construction material, number of strands, and gauge diameter. At Ozette the main variations in cordage lay appear to be dependent on these mode combinations:

Table 9. Lay and twist of Ozette Village cordage

Construction Material	Number of Strands	Gauge Category	Lay Z/L	#	%	Twist S/R	#	%
Cedar bough	1	String				/R	105	100
Cedar bough	1	Cord to heavy-gauge rope					359	100
Cedar bough	2+	String	Z/L_r^r	22	65.6	S/R_l^l	11	34.4
Cedar bough	2+	Cord to heavy-gauge rope		444	99.8		8	0.2
Cedar bark	2	String	Z/L_r^r	45	19.8	S/R_l^l	182	80.2
Cedar bark	2	Cord		11	61.1		7	38.9
Cedar bark	3+	String to Cord		1	50.0		1	50.0
Spruce root	2+	String to rope	Z/L_r^r	75	93.8	S/R_l^l	5	6.2

Modes	Lay/Twist
Cedar bough, single-strand withe	-/R
Cedar bough, multi-strand, cord to heavy gauge rope	Z/L
Cedar bark, two-strand, string	S/R
Spruce (?) root, multi-strand, string to rope	Z/L

It is interesting that a fair number (34.4 percent) of the string gauge cedar bough cordage is S laid and most (61.1 percent) of the cord gauge cedar bark cordage is Z laid. Apparently, lay was somewhat dependent on diameter gauge criteria, where string gauge cedar bough or bark was often S laid, and cedar bough or bark cord to heavy gauge rope cordage was often Z laid. This lends some justification for considering gauge diameter categories (string, cord, rope, heavy gauge rope) as culturally significant modes, though the categories cannot be specifically defined in exact cultural divisions. The arbitrariness of these gauge categories appears to decrease upon analysis. The lay criteria are further discussed in the classification of Ozette Village cordage.

Comparison of the Lay and Twist of Cordage Recorded from other Northwest Coast Wet Sites

At all sites the one-strand cedar bough withes typically are twisted to the right (R). All two-plus strand twisted cordage from Biederbost, Conway, Axeti, Wapato Creek, and Little Qualicum River has a Z lay. This appears to have been the common manner to ply cordage over the last several thousand years in most areas of the coast. All two-plus strand twisted cordage are Z laid at Lachane, Musqueam Northeast, and Fishtown except for one specimen at each site. At both Lachane and Musqueam Northeast a multi-strand cedar bough wood wedge collar with an S lay was found, and at Fishtown (n = 1) and Hoko River (n = 8) a few strings have been recorded with an S lay. Otherwise the major technique of plying multi-strand twisted cordage on the Northwest Coast is with a Z lay.

Cordage Lengths

Pieces of Ozette Village cordage vary from 1 cm to 395 cm (approximately 13 feet) long. These generally are broken pieces when found, and few pieces could be considered finished whole examples. For this reason, little diagnostic value can be ascribed to cordage length. Some of the cordage damage apparently was caused by the mudslide, breaking the cordage binding the house structure and holding other things together. Most examples, however, probably represent broken and discarded pieces.

In comparing the lengths of 1,304 examples of twisted cordage and 558 braided cordage, the following variations occurred:

Technique	Range	Mean	Mode	Standard Deviation
Braided	1-183 cm	26.7 cm	10.0 cm	23.3 cm
Twisted	1-395 cm	30.3 cm	5.0 cm	35.9 cm

Ozette Village twisted cordage pieces generally are longer than braided pieces, but a higher frequency of the twisted cordage is recorded at the smaller end of the scale.

Comparison of the Cordage Lengths Recorded from other Northwest Coast Wet Sites

The length measurements of cordage recorded from other Northwest Coast wet sites, as at Ozette, are considered of limited diagnostic value. Most cordage pieces recovered at other sites are broken and probably discarded examples. Most have one or both ends broken and are relatively short pieces. For this reason only the maximum lengths of twisted and braided cordage recorded from each site are listed in Table 10 for comparison and discussion. At all sites very small pieces of cordage are recorded (less than 1 cm long) to much larger pieces (Table 10).

Table 10. Maximum lengths of cordage recorded at Northwest Coast wet sites.

Site	Maximum Length	No. of Strands	Diameter	Material
Twisted cordage:				
Ozette Village	395 cm (13 ft)	2	2.2 cm	Cedar bough
Hoko River	60 cm (2 ft)	2	1.0 cm	Cedar bough (?)
	[57 cm (2 ft)	2	0.2 cm	Spruce root]
Musqueam Northeast	179 cm (6 ft)	2	1.4 cm	Cedar bough
Biederbost	233 cm (8 ft)	3	1.5 cm	Cedar bough
Axeti	223 cm (7 ft)	2	0.8 cm	Cedar bark
Lachane	144 cm (5 ft)	2	0.9 cm	Cedar bark
Conway	66 cm (2 ft)	2	1.6 cm	Cedar bough
Fishtown	65 cm (2 ft)	1	0.7 cm	Cedar bough
Wapato Creek	186 cm (6 ft)	2	1.8 cm	Cedar bough
Little Qualicum River	235 cm (8 ft)	2	1.8 cm	Cedar bough
Braided cordage:				
Ozette Village	183 cm (6 ft)	3	1.2 cm	Cedar bark
Hoko River	25 cm (1 ft)	3	2.0 cm	Cedar bark
Biederbost	32 cm (1 ft)	3	1.0 cm	Cedar bark
Axeti	70 cm (2 ft)	3	1.7 cm	Cedar bark
Lachane	20 cm (1 ft)	3	0.6 cm	Cedar bark
Conway	90 cm (3 ft)	3	1.0 cm	Cedar bark
Little Qualicum River	33 cm (1 ft)	3	1.2 cm	Cedar bark

The longest recorded length of twisted cordage is recovered from Ozette Village (Table 10). This site, as an active sea mammal hunting station, has examples of relatively long, heavy gauge, harpoon lines or ropes (below). The early Musqueam Northeast and Biederbost sites have examples of relatively long multi-strand cedar bough ropes. These rope examples indicate a relatively sophisticated cedar bough ropemaking technology in this southern Northwest Coast area for the last 3000 years. Lengths of multi-strand cedar bough ropes also are recorded at the undated Wapato Creek and Little Qualicum River sites. Hoko River also has one example of a 60 cm length of cedar bough twisted cordage. The second longest example of cordage recorded at Hoko River is a two-strand, spruce rootlet string, the most common occurring form of cordage at this site (Table 10).

The northern Axeti and Lachane sites both have relatively long examples of two-strand, cedar bark, cord gauge cordage. At both of these sites twisted cedar bark cordage is emphasized.

The longest example of braided cordage is recorded at Ozette Village. Axeti has one example of a 70 cm long, rope gauge, cedar bark braided cordage.

In summary, the length of cordage examples is considered of limited diagnostic value when analyzing Northwest Coast cordage collections. Most specimens, unfortunately, are broken, discarded pieces.

Cordage Forms

Ozette Village and other wet site cordage has numerous different forms as shown in Tables 11 and 12. These forms are illustrated in Figure 5. Each cordage form is discussed separately below.

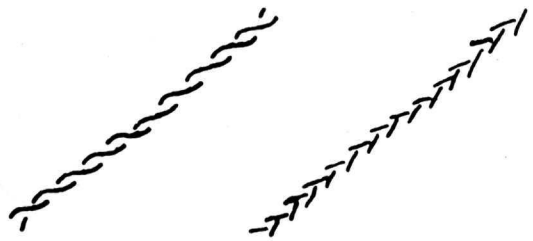
Table 11. Cordage forms recorded at Ozette Village

	Form	#	%
1.	Lines	1,672	84
2.	Collars (for wood wedges)	73	4
3.	Nets	12	1
4.	Small diameter circulettes	0	0
5.	Large diameter circulettes	18	1
6.	Twig bundles	30	2
7.	Cedar bough storage bundles	24	1
8.	Cedar bark buns	12	1
9.	Stick loops	18	1
10.	Cherry bark binding elements	71	3
11.	"Clothing" warp strings	49	2
12.	Bound hoops	4	
13.	Basket handles	7	
	Total	1,990	100

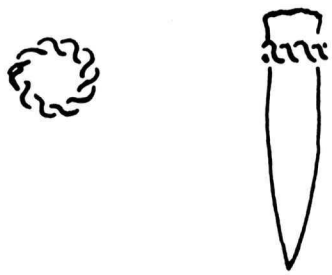
Table 12. Cordage Forms recorded at Northwest Coast wet sites.
(Percent of occurrence denoted in parentheses).

Cordage Forms	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
Lines	1,672 (84)	605 (96)	94 (80)	48 (73)	690 (99)	21 (88)	9 (90)	5 (56)	1 (100)	40 (85)
Collars	73 (4)	8 (2)	10 (8)	2 (3)	1 (0)	1 (4)				
Nets	12 (1)	2 (0)	5 (4)							
Rigid lattice work	p	2 (0)					p		p	
Small diameter circulettes			5 (4)	3 (5)						
Large diameter circulettes	18 (1)	1 (0)	1 (1)	2 (3)		2 (8)		1 (11)		
Twig Bundle "brushes"	30 (2)				2 (0)					
Cedar bough storage bundles	24 (1)	1 (0)		1 (1)						
Cedar bark buns	12 (1)				4 (1)					
Stick loops	18 (1)									
Cherry bark binding elements	71 (3)	10 (2)	1 (1)	9 (14)				3 (33)		5 (11)
"Clothing" string warps	49 (2)									
Bound hoops	4 (0)				1 (0)					2 (4)
Basket handles	7 (0)		2 (2)	1 (1)			1 (10)			
Total	1,990	629	118	66	698	24	10	9	1	47

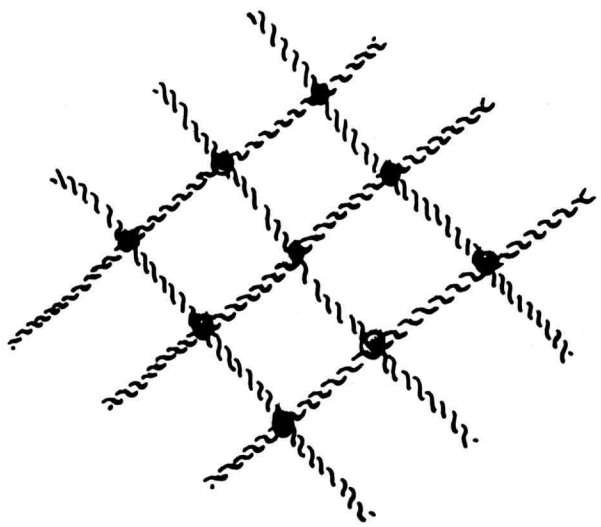
1. Lines



2. Wedge collars



3. Nets

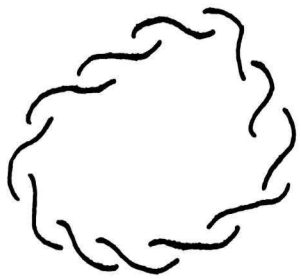


4. Small diameter circulettes
(with small diameter cordage)



Figure 5. Ozette cordage forms.

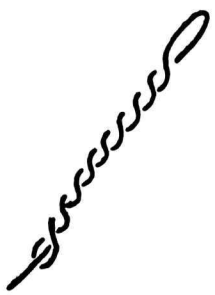
5. Large diameter circulettes



6. Twig bundle



7. Storage bundle



8. Cedar bark bun



9. Stick loop



Fig. 5. (continued)

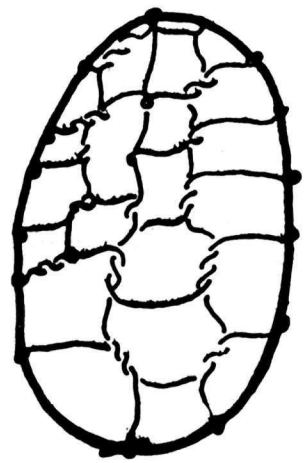
10. Binding elements



11. "clothing" warp strings



12. bound hoops



13. basket handles

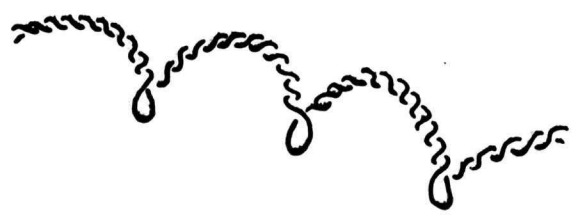


Fig. 5. (continued)

Lines

Certainly the main form of cordage recovered from all sites is the plain, linear cordage line. Some of these lines originally may have been broken parts of other forms (e.g., weirs, snares, basket handles, nets, etc.), but too fragmentary for a proper identification. The main variation in lines among sites involves the different technologies employed in production.

Collars

Cordage wedge collars are common at Ozette Village. These collars are prepared to be slipped over the tops of wedges. Their function would have been to prevent the tops (polls) of the wood wedges from splitting when hammered. Collars examined for this study were those prepared for wedges, but not slipped onto wedge crowns (polls). These will be considered in the discussion of this functional subset (below).

Most wet sites have occurrences of isolated wedge collars (Table 12). Those without examples either have examples of wood wedges with collars or probably did have wedge collars occurring, but were not recovered in the archaeological sample. From the earliest sites to the latest, wedge collars are a common cordage form. They are associated with wood splitting wedges that have remained essentially unchanged in form for at least 3000 years on the Coast (Croes 1976d:293).

Nets

Twelve net fragments were recovered from Ozette House 1. These generally are small gauge nets, varying from 2 to 3 cm between knots. Nets or net fragments have been recovered also from Hoko River and Musqueam Northeast. At Ozette Village the nets are constructed of two-strand twisted rootlets (spruce ?), at Hoko River they are constructed of spruce limb splints and at Musqueam Northeast of two-strand twisted bark and probably cedar bark.

Small Diameter Circulettes

At the early Puget Sound/Gulf of Georgia sites of Musqueam Northeast and Biederbost, a small diameter and narrow gauge circulette is common. The actual function of these small cordage rings is unclear (Croes 1975).

Large Diameter Circulettes

Eighteen large diameter circulette forms are recorded from Ozette Village. These generally are roundish loops of multi-strand cordage, too large to function as collars. The use of all of these circulettes is not clear, but some were found looped over paired house wall poles holding them together. Five other sites have the large circulettes recorded (see Table 12).

Twig Bundles

Thirty twig bundles were found at Ozette Village and these are typically bundles of cedar twigs (93 percent) with one example apiece of spruce and hemlock twigs. They are braided or bound together at the main stem end, usually after being split in half. These twigs still have their scales or needles attached. The twig bundles may have been used as sweeping brushes. Twig bundles were also found at Axeti and possible Little Qualicum River.

Cedar Bough Storage Bundles

Twenty-four storage bundles were recovered at Ozette. These bundles consist of twisted withes that are bent systematically back and forth on themselves. These are considered bundles of withes, as described ethnographically, and were stored for later use as cordage manufacturing elements. Similar bundles have been found at Hoko River and Biederbost. Probably other sites had similar practices of storing withes in bundles, but they were not recovered in the archaeological samples.

Cedar Bark Buns

Twelve cedar bark buns ("donuts") are recorded from Ozette. These are ring-like forms that are wrapped with cedar bark strips, in a spiral fashion, until they formed a completed, filled-in, "bun" of bark. They appear similar to a small cushion. Their exact function is unknown. They have been recovered also from the Axeti site.

Stick Loops

Eighteen stick loops were excavated at Ozette. These are sticks with their ends twisted and usually carefully bent back into a loop, and bound to the main stick. They probably have a specific use, possibly as the ends of spreaders on halibut fishlines, as snare triggers or for other unknown uses.

Cherry Bark Binding Elements

Seventy-one cherry bark binding elements are recorded from Ozette Village. These usually are unattached elements, but commonly are recorded at Ozette bound to arrows, harpoons, fishhooks, etc. Most Northwest Coast wet sites have examples of cherry bark bindings. These examples are found either separately or as bindings for composite fishhooks (Hoko River), pebble weights (Biederbost), and arrow shafts, harpoon shafts, fishhook barbs (Ozette Village). Ethnographically, cherry bark binding elements are recorded to have functioned well in water since they did not loosen or stretch when wet.

"Clothing" Warp Strings

Forty-nine examples of "clothing" warp strings were found at Ozette. These consist of aligned two-strand cedar bark strings, and usually are found in large concentrations. These associated strings probably are warp elements that once were woven together with yarn, strips of bird skins, sinew, or other organic materials that have since decayed. They probably represent what remains of blankets, capes, or other forms of clothing. They have not been recorded at any other site.

Bound Hoops

Large bound hoops were found at Ozette Village. There are possible examples from Axeti and Little Qualicum River. At Ozette these are large cedar bough hoops with systematic criss-cross binding throughout their central areas. These may have functioned as mud or snowshoes.

Basket Handles

Basket handles occur as separate cordage elements at a number of sites. They typically are cedar bough looped basket handle extensions, and are types common to the basketry from each site.

Summary

Most Northwest Coast wet sites have examples of cordage lines, wood wedge collars, and cherry bark binding elements. Some sites have examples of small and large diameter circulettes. Other forms of cordage have a limited occurrence, such as nets, bound hoops, braided and bound twigs, etc. The cordage forms occurring at a site often reflect functional information concerning the site and this information provides a basis of discussion when considering functional class sets of cordage below.

Knotting Techniques

Several distinct knotting, hitching, and whipping techniques occur at Ozette Village. All are considered here under the general heading of knotting techniques. Knot, hitch, and whip are defined as follows:

Knot: a complication of a piece of cordage line, or of two or more by tying

Hitch: a tying of a piece of cordage to another object (e.g., pole, fishhook, around a line)

Whip: a binding of a cordage end to prevent unwinding of the end

Considering the 2,014 pieces of Ozette Village cordage recorded, 530 knots occur (on 26 percent of the cordage), 23 hitches occur (on 1.1 percent of the cordage), and 51 whippings occur (on 2.5 percent of the cordage). Each of these categories is discussed separately.

Knots

Six different knot techniques are recorded from the Ozette Village site. In terms of actual occurrence, with some occurring repeatedly or in combination on single pieces of cordage, the following types and frequencies are listed in Table 13. Each of these knot techniques, and their manner of composition at Ozette Village, i.e., which direction they are tied, is illustrated in Figure 6.

Table 13. Knots occurring at Ozette Village.

Knot	#	%
Overhand	217	41
Sheetbend	266	50
Square	20	4
Granny	20	4
Figure 8	1	
Running noose	6	1
Total	530	100

Hitches

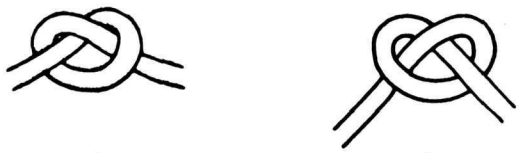
Three different hitch techniques are recorded at Ozette Village. The frequency of occurrence of each type is noted in Table 14. Each of these hitch techniques and its manner of composition at Ozette Village is illustrated in Figure 6.

Table 14. Hitching techniques occurring at Ozette Village.

Hitch	#	%
Clove hitch	21	92
Timber hitch	1	4
Half hitch	1	4
Total	23	100

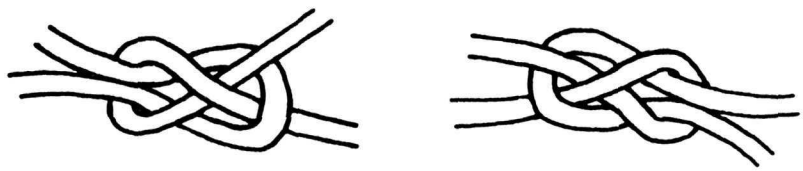
KNOTS

1. Overhand (left over right and right over left)



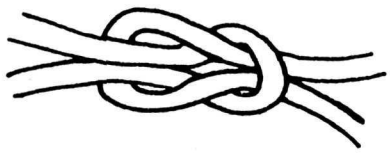
L/R R/L

2. Sheetbend (left over right and right over left)

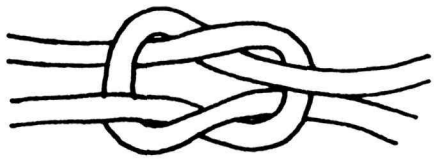


L/R R/L

3. Square



4. Granny



5. Figure 8

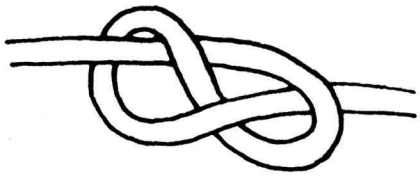
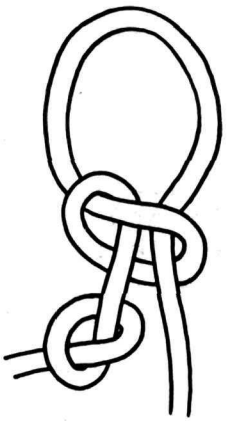


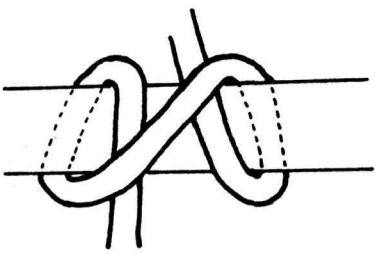
Figure 6. Knotting, hitching, and whipping techniques.

6. Running noose (with overhand whip)



HITCHES

1. Clove



2. Timber

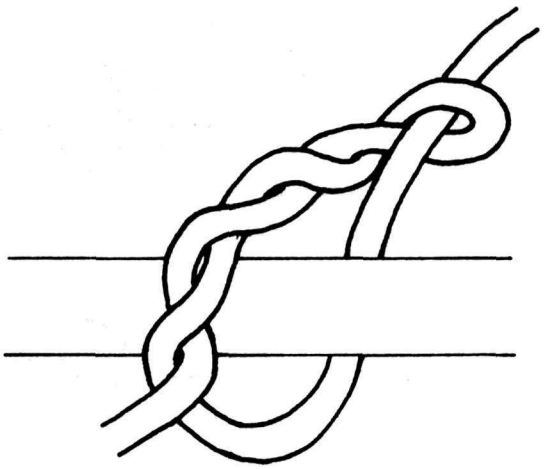
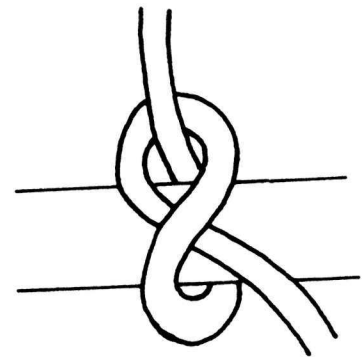


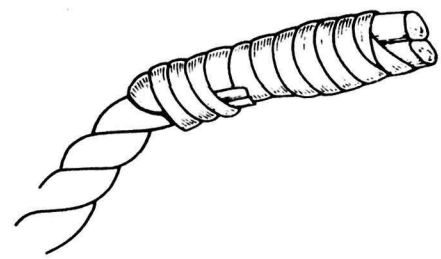
Fig. 6 (continued)

3. Half



WHIPS

1. Wrap



2. Overhand

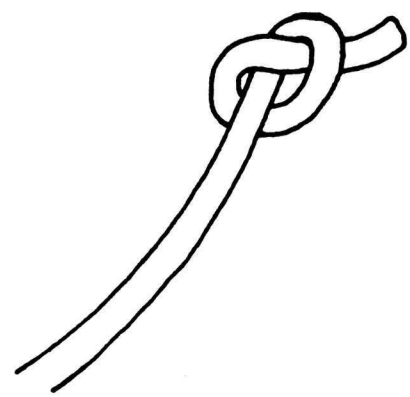


Fig. 6 (continued)

Whips

Two main forms of whip techniques are noted at Ozette Village (Table 15). Each of these and its manner of composition is illustrated in Figure 6.

Table 15. Whipping techniques occurring at Ozette Village

Whip	#	%
Overhand whipping	32	63
Wrapped whipping	19	37
Total	51	100

Each knotting, hitching, and whipping technique occurs with different frequency on different classes of cordage. The cordage classes associated with these techniques, and their recorded functions are discussed below when considering the functional categories of Ozette Village cordage.

Comparison of Knotting Techniques Recorded at other Northwest Coast Wet Sites

Many of the knotting, hitching, and whipping techniques found at Ozette Village occur at other sites. The frequency of occurrence of these techniques is listed in Table 16.

Overhand knots occur at a majority of the sites. Most sites had overhand knots which are formed in a left over right direction (Ozette had 66 percent left over right overhands). However, many Axeti overhand knots (48 percent) are in a right over left direction. The function of this knot in the historic context usually is: (1) as a stopper knot; (2) as a knot to keep cordage strands from unraveling (overhand whips, below); or (3) as a knot to keep another knot from slipping apart (Ashley 1944:14, 84, 85). Overhand knots from Northwest Coast sites are used for these purposes and others. At Musqueam Northeast overhand knots often are used as stopper knots on one end of looped handles to keep the basket handles from pulling out (Croes 1975). At other sites they are used on the end of withe sewing elements to hold one end in position or to firm up another knot.

Sheetbend knots are most common at Ozette Village and Axeti. These knots usually occur on single-strand, cedar bough withes. At Ozette Village these knots commonly are used to tie together parts of the house structure (Mauger 1978:130-131). At the Axeti Village site, these knots may also have been associated with tying together structures. Sheetbend knots are noted for their security strength and ease in untying (Ashley 1944:262). At Ozette 97 percent are tied in a left over right manner and 100 percent of those from Axeti are formed in this way (Figure 6).

Table 16. Knotting, hitching, and whipping techniques recorded at Northwest Coast wet sites. (Percent of occurrence denoted in parentheses).

Techniques	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
Knotting										
Overhand	217 (41)	51 (44)	30 (77)	12 (100)	88 (67)	4 (100)		1 (100)	1 (100)	18 (72)
Sheetbend	266 (50)	1 (1)			28 (22)					1 (4)
Square	20 (4)	34 (29)	9 (23)		7 (5)		1 (100)			5 (20)
Granny	20 (4)	24 (21)			7 (5)					1 (4)
Figure 8	1 (0)	2 (2)			1 (1)					
Running noose	6 (1)	4 (3)								
Total	530	116	39	12	131	4	1	1	1	25

Table 16. (Continued).

Techniques	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
Hitching										
Clove hitch	21 (92)	10 (84)			2 (33)					
Timber hitch	1 (4)									
Cow hitch		1 (8)			3 (50)					
Half hitch	1 (4)	1 (8)			1 (17)					
Total	23	12			6					
Whipping										
Wrap whip	32 (63)	1 (5)	1 (100)			1 (33)				
Overhand whip	19 (37)	19 (95)		1 (100)	19 (100)	2 (67)				5 (100)
Total	51	20	1	1	19	3				5

Square knots have been recovered in largest numbers at Hoko River, Ozette Village, and Musqueam Northeast. At Hoko this knot is used in the construction of the two nets recovered and it is used on the end of the common fishline leaders. At Ozette Village and Musqueam Northeast, square knots usually are used in constructing nets. Present-day netting knots commonly are sheetbends made with a netting needle. Handmade nets typically are made with the nonslip square knot, probably without netting needles. The isolated occurrence of square knots on string-gauge cordage often associates with nets reflecting netting technologies at these sites.

Granny knots occur at Ozette Village, but are most common at Hoko River. At Hoko River these knots commonly are used to tie together string lines. In tying two lines together (as a bend) it is considered better than the square knot, "for although it will slip, it does not have the same tendency to capsize and spill" (Ashley 1944:258).

Figure 8 knots and running nooses are recorded only at Ozette Village, Hoko River, and Axeti, and in low frequency.

Clove hitches are found at Ozette Village and Hoko River. At Ozette Village the clove hitch is used basically to tie the first tier of net meshes to the net headline and as hitches on posts. At Hoko River this hitch is used to attach fishline leaders to the bentwood and composite fishhooks. These bentwood hooks have a knob carved on their end to keep the hitched line from slipping off. This technique left two lines extending from the hook which are joined at their ends in a square knot. This hitch could be easily applied to the hooks even without untying the square knot joining the ends of the loop. Historic Euro-American metal fishhooks without an eye, but with a flattened end called a tad, are often secured with a clove hitch (Ashley 1944:52).

Timber hitches are found at Ozette Village and half hitches at Ozette, Hoko River, and Axeti. At Ozette these are techniques used for tying together house structural elements. Cow hitches occur at Hoko River and Axeti.

Wrap whips, on the ends of multi-strand twisted cordage, occur at Ozette Village, Hoko River, Musqueam Northeast, and Lachane. This whipping technique usually is associated with larger gauge cords and ropes. It keeps the cordage strands from unraveling and leaves a smooth end on the cordage (Figure 6).

Overhand whips are found on cordage from most sites (Table 16). The overhand knot at the end of the cordage also keeps the multi-strand or braids from unraveling. This technique creates a knobby end on the cordage, which additionally could function as a stopper knot.

In summary, many of the knotting, hitching, and whipping techniques recorded at Ozette Village also occur at other Northwest Coast wet sites, but in varying frequencies. Sheetbend knots are common at Ozette Village and Axeti. These knots are used at Ozette to tie house components together.

Square knots are common and recorded on nets from Ozette Village, Musqueam Northeast and Hoko River. Clove hitches are used to tie the net mesh to the headlines at Ozette Village and to tie the fishline leaders onto fishhooks at Hoko River. Wrap and overhand whipping techniques are common at many Northwest Coast wet sites. The different frequencies of these techniques at the sites often reflect activities occurring at the sites. Sheetbend knots are associated with house construction at Ozette Village. Square knots are linked to netting activities at Ozette Village, Hoko River, and Musqueam Northeast. Square knots and clove hitches are associated with the construction of leaders for hook and line fishing at the Hoko River site.

3. OZETTE VILLAGE CORDAGE CLASSES

The cordage dimensional features and actual modes discussed and defined in the last section are now combined into a stylistic/technological (S/T) classification of the Ozette Village cordage types. This classification is concerned with stylistic/technological features of the cordage rather than specific functional characterizations. A cordage functional classification and discussion follows this section using the classes defined in this S/T classification. The primary purpose of the S/T classification is to: (1) demonstrate clearly what range and types of cordage items occur at Ozette Village and other sites; and (2) establish the main units, classes, necessary for the later discussion, comparisons and functional analysis of the Ozette and other Northwest Coast wet site cordage. These defined units are necessary to synthesize the preceding data for comparative study.

Ozette Village Cordage Classification

The Ozette Village cordage S/T classification is constructed paradigmatically (cf. p. 8) and is composed of a specific combination of diagnostic dimensions. The Ozette cordage classes have been defined by the combination of these previously discussed dimensional features:

1. cordage materials,
2. cordage construction techniques,
3. number of cordage strands,
4. lay/twist of the cordage, and
5. gauge size (diameter).

The classification excludes the dimensions of:

6. sizes (lengths),
7. forms (lines, loops, nets, wedge collars, etc.), and
8. knotting techniques (including knots, hitches, and whippings).

These last analytic dimensions are useful, but become more pertinent when considering the functions of Ozette Village cordage. As a basic classification of cordage, the dimensions used here create a classification useful for comparative studies. Actually only the first four dimensions specifically define the cordage classes; the cordage gauge size (diameter: string to heavy gauge rope) is noted only to indicate the range of cordage diameter size. The percentage of Ozette Village cordage in each gauge category indicates the emphasis of that cordage size in a class.

The different cordage class definitions are labeled OC1, OC2, OC3, ... This means, respectively, Ozette Cordage Class 1, Ozette Cordage Class 2, Ozette Cordage Class 3, etc. (Figure 7).

STYLISTIC/TECHNOLOGICAL CLASSIFICATION OF OZETTE VILLAGE CORDAGE

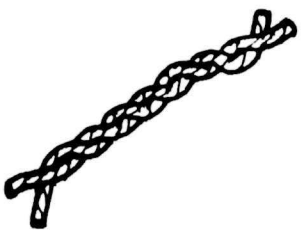
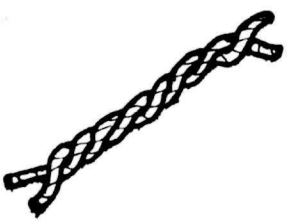
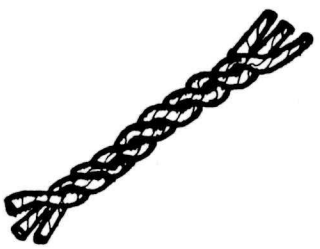
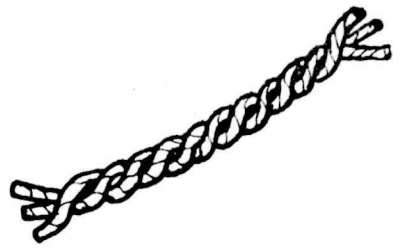
Definition	Illustration and Frequency of Occurrence
OC1. MATERIAL: cedar bough CONSTRUCTION TECHNIQUE: twist NO. OF STRANDS: 1 LAY/TWIST: -/L GAUGE SIZES (DIAMETER): a. String: n=111, 23% b. Cord: n=338, 70% c. Rope: n= 29, 6% d. Heavy-gauge rope: n= 5, 1%	 (n=483, 25%)
OC2. MATERIAL: cedar bough CONSTRUCTION TECHNIQUE: twist NO. OF STRANDS: 2 LAY/TWIST: Z/R GAUGE SIZES (DIAMETER): a. string: n= 14, 5% b. Cord: n=150, 53% c. Rope: n= 99, 35% d. Heavy-gauge rope: n= 20, 7%	 (n=283, 14%)
OC3. MATERIAL: cedar bough CONSTRUCTION TECHNIQUE: twist NO. OF STRANDS: 2 LAY/TWIST: S/L GAUGE SIZES (DIAMETER): a. String: n= 8, 57% b. Cord: n= 4, 29% c. Rope: n= 2, 14%	 (n=14, 1%)
OC4. MATERIAL: cedar bough CONSTRUCTION TECHNIQUE: twist NO. OF STRANDS: 3 LAY/TWIST: Z/R GAUGE SIZES (DIAMETER): a. String: n= 4, 3% b. Cord: n= 74, 53% c. Rope: n= 47, 33% d. Heavy-gauge rope: n= 15, 11%	 (n=140, 7%)

Figure 7. Stylistic/technological classification of Ozette Village cordage.

Definition

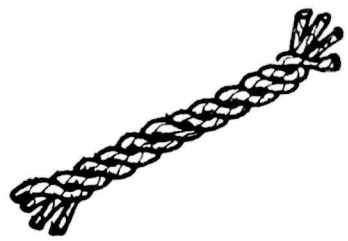
Illustration and Frequency of Occurrence

OC5. MATERIAL: cedar bough
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 3
LAY/TWIST: S/L
GAUGE SIZES (DIAMETER):
a. String: n= 2, 50%
b. Cord: n= 1, 25%
c. Rope: n= 1, 25%



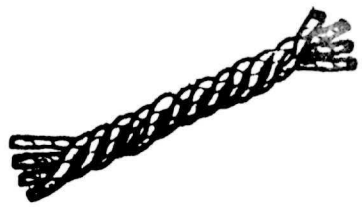
(n= 4, -)

OC6. MATERIAL: cedar bough
CONSTRUCTION TECHNIQUE: Twist
NO. OF STRANDS: 4
LAY/TWIST: Z/R
GAUGE SIZES (DIAMETER):
a. String: n= 2, 5%
b. Cord: n= 22, 52%
c. Rope: n= 14, 33%
d. Heavy-gauge rope: n= 4, 10%



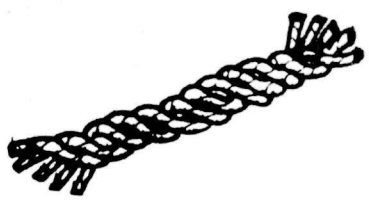
(n= 42, 2%)

OC7. MATERIAL: cedar bough
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 4
LAY/TWIST: S/L
GAUGE SIZES (DIAMETER):
a. String n= 1, 100%



(n= 1, -)

OC8. MATERIAL: cedar bough
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 5
LAY/TWIST: Z/R
GAUGE SIZES (DIAMETER):
b. Cord: n= 1, 100%



(n= 1, -)

OC9. MATERIAL: cedar bark
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 2
LAY/TWIST: Z/R
GAUGE SIZES (DIAMETER):
a. String: n= 45, 80%
b. Cord: n= 11, 20%



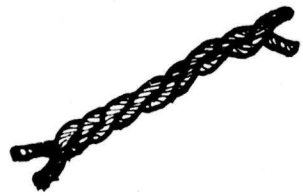
(n= 56, 3%)

Fig. 7 (continued)

Definition

Illustration and Frequency of Occurrence

OC10. MATERIAL: cedar bark
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 2
LAY/TWIST: S/L
GAUGE SIZES (DIAMETER):
a. String: n=181, 96%
b. Cord: n= 8, 4%



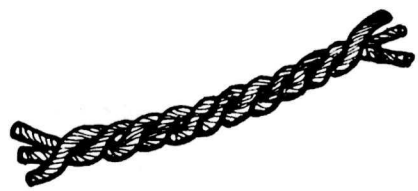
(n=189, 10%)

OC11. MATERIAL: cedar bark
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 3
LAY/TWIST: Z/R
GAUGE SIZES (DIAMETER):
b. Cord: n= 1, 100%



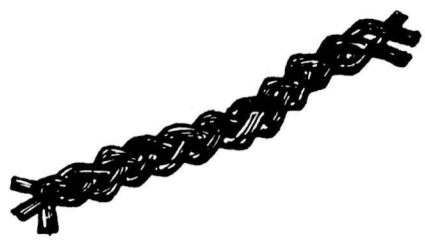
(n= 1, -)

OC12. MATERIAL: cedar bark
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 3
LAY/TWIST: S/L
GAUGE SIZES (DIAMETER):
a. String: n= 1, 100%



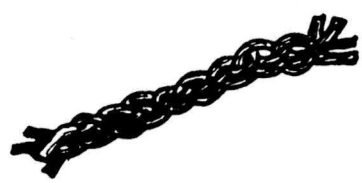
(n= 1, -)

OC13. MATERIAL: cedar bark
CONSTRUCTION TECHNIQUE: braid
NO. OF STRANDS: 3
LAY: not applicable (NA)
GAUGE SIZES (WIDTH):
a. String: n= 23, 5%
b. Cord: n=406, 87%
c. Rope: n= 33, 7%
d. Heavy-gauge rope: n= 5, 1%



(n=467, 24%)

OC14. MATERIAL: cedar bark
CONSTRUCTION TECHNIQUE: braid
NO. OF STRANDS: 4
LAY: NA
GAUGE SIZES (WIDTH):
b. Cord: n= 3, 100%



(n= 3, -)

Fig. 7 (continued)

Definition

Illustration and Frequency of Occurrence

OC15. MATERIAL: cedar bark
CONSTRUCTION TECHNIQUE: strap cordage
NO. OF STRANDS: 1
LAY: NA
GAUGE SIZES (WIDTH):
a. String: n= 18, 27%
b. Cord: n= 30, 45%
c. Rope: n= 14, 21%
d. Heavy-gauge rope: n= 5, 7%



(n= 67, 3%)

OC16. MATERIAL: cedar twigs
CONSTRUCTION TECHNIQUE: braid (some bound)
NO. OF STRANDS: 3+
LAY: NA
GAUGE SIZES (WIDTH):
a. String: n= 24, 32%
b. Cord: n= 36, 49%
c. Rope n= 8, 11%
d. Heavy-gauge rope: n= 6, 8%



(n= 74, 4%)

OC17. MATERIAL: spruce twigs
CONSTRUCTION TECHNIQUE: braid
NO. OF STRANDS: 3+
LAY: NA
GAUGE SIZES (WIDTH):
a. String: n= 1, 100%



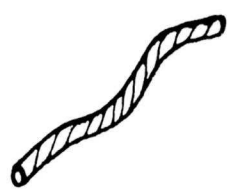
(n= 1, -)

OC18. MATERIAL: hemlock twigs
CONSTRUCTION TECHNIQUE: braid
NO. OF STRANDS: 3+
LAY: NA
GAUGE SIZES (WIDTH):
d. Heavy-gauge rope: n= 1, 100%



(n= 1, -)

OC19. MATERIAL: spruce root
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 1
LAY/TWIST: -/L
GAUGE SIZES (DIAMETER):
a. String n= 1, 100%



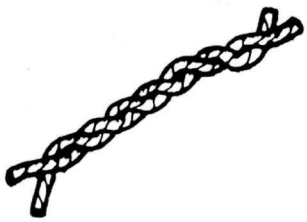
(n= 1, -)

Fig. 7 (continued)

Definition

Illustration and Frequency of Occurrence

OC20. MATERIAL: spruce root
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 2
LAY/TWIST: Z/R
GAUGE SIZES (DIAMETER):
a. String: n= 30, 43%
b. Cord: n= 37, 53%
c. Rope: n= 3, 4%



(n= 70, 4%)

OC21. MATERIAL: spruce root
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 2
LAY/TWIST: S/L
GAUGE SIZES (DIAMETER):
a. String: n= 5, 100%



(n= 5, -)

OC22. MATERIAL: spruce root
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 3
LAY/TWIST: Z/R
GAUGE SIZES (DIAMETER):
a. String: n= 3, 75%
b. Cord: n= 1, 25%



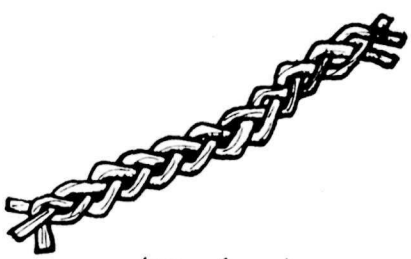
(n= 4, -)

OC23. MATERIAL: spruce root
CONSTRUCTION TECHNIQUE: twist
NO. OF STRANDS: 4
LAY/TWIST: Z/R
GAUGE SIZES (DIAMETER):
a. String n= 1, 100%



(n= 1, -)

OC24. MATERIAL: spruce root
CONSTRUCTION TECHNIQUE: braid
NO. OF STRANDS: 3
LAY: NA
GAUGE SIZES (WIDTH)
a. String n= 3, 75%
b. Cord n= 1, 25%



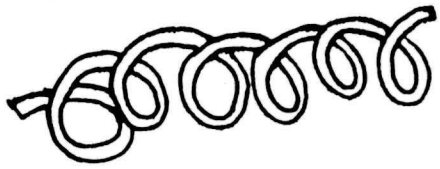
(n= 4, -)

Fig. 7 (continued)

Definition

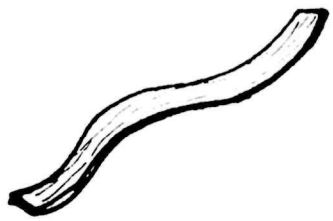
Illustration and Frequency of Occurrence

OC25. MATERIAL: cherry bark
CONSTRUCTION TECHNIQUE: strap cordage
NO. OF STRANDS: 1
LAY: NA
GAUGE SIZES (WIDTH):
a. String: n= 25, 50%
b. Cord: n= 25, 50%



(n= 50, 3%)

OC26. MATERIAL: root or limb splints
CONSTRUCTION TECHNIQUE: strap cordage
NO. OF STRANDS: 1
LAY: NA
GAUGE SIZES (WIDTH):
a. String: n= 3, 75%
b. Cord: n= 1, 25%



(n= 4, -)

TOTAL: n=1967

Fig. 7 (continued)

Potentially over 300 paradigmatic cordage classes are possible in the classification considering only the Ozette Village cordage modes in the first four major dimensions. However, only 26 cordage classes actually do occur at the site. This indicates cultural selections made by the artisan for only certain combinations of these modes. The mode combinations are defined in Figure 7, and represent the basic units for further discussion.

Cordage S/T classes that occur with a high frequency at Ozette Village include: (1) cedar bough, one-strand, twisted (L) withe (OC1;25%); (2) cedar bough, two- and three-strand twisted (Z; R1/1/(1)) cords and ropes (OC2 and OC4;21%); (3) cedar bark, two-strand twisted (S; L^r_r) strings (OC10;10%) and cedar bark, three-strand braided cords (OC13;24%). The cedar bough withes (OC1) basically are found tying the Ozette House 1 wall boards into place, and are for this reason a common form of cordage at the site. Cedar bough, two- and three-strand twisted cords and ropes (OC2 and OC4) evidently were used for several purposes, including tying the house boards and poles into place, as general ropes, as harpoon lines, and to form wood wedge collars and basket handles. The cedar bark, two-strand twisted strings (OC10) commonly are recovered in large and aligned concentrations. These probably are clothing warp strings, and the hair, skin, or sinew weft elements have since decayed. The high frequency of these strings at the site certainly is due to their use in making clothing. And the cedar bark, three-strand braid cords (OC13) mainly are used as parts of other artifacts, such as edge reinforcements on mats, as cradle loops, as basket handles and as tumpline strap extensions. The functions of these common cordage classes, and other Ozette cordage classes are discussed in detail below.

Comparison of Cordage Stylistic/Technological Classes Recorded at other Northwest Coast Wet Sites

Many of the defined Ozette Village cordage classes occur at other Northwest Coast wet sites. The frequency of occurrence of each class is listed in Table 17. The number designations are the Ozette Village cordage class numbers (OC1, OC2, OC3, . . .).

To test the degrees of similarity of cordage S/T classes among Northwest Coast wet sites the presence or absence of each cordage class and subclass is examined. If frequency of occurrence rather than presence/absence were to be used in the tests, the function of the sites might be reflected rather than potential stylistic/technological similarities. For example, the high percentage frequency of fishline leader strings at the Hoko River site would separate this site from other sites, but only because of site-use as a major fishing station. Presence/absence data most likely will reflect the cordage S/T similarities. Tests are conducted with both major cordage classes and subclasses. Potentially the use of different cordage gauge size (diameter) subclasses will increase the sensitivity of the test since the definitions of the cordage classes become more refined and a wider range occur for comparison. The arbitrary nature of the diameter gauge designations needs to be taken into account in this test, but the explicitly defined ranges and limited number of categories

Table 17. Cordage stylistic/technological classes recorded at Northwest Coast site.

Cordage Classes and Subclasses		Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC1.	a.	111 (6)	96 (15)	10 (9)	6 (10)	6 (1)	3 (13)				
	b.	338 (17)	13 (12)	18 (17)	13 (22)	27 (4)	4 (18)		4 (45)		5 (10)
	c.	29 (2)			1 (2)			1 (8)			13 (28)
	d.	5 (0)									1 (2)
	?					6 (1)					
TOTAL		483 (25)	109 (17)	28 (26)	20 (34)	39 (6)	7 (31)	1 (8)	4 (45)		19 (40)
OC2.	a.	14 (1)	12 (2)	3 (3)	6 (10)						2 (4)
	b.	150 (8)	26 (4)	7 (6)	13 (22)	2 (0)	3 (13)			1 (100)	3 (7)
	c.	99 (5)	3 (1)	6 (6)	1 (2)			5 (42)	1 (11)		
	d.	20 (1)	3 (1)								1 (2)
	?					1 (0)					
TOTAL		283 (15)	44 (8)	16 (15)	20 (34)	3 (0)	3 (13)	5 (42)	1 (11)	1 (100)	6 (13)

TABLE 17--(Continued)

Cordage Classes and Subclasses	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC3. a.	8	2								
	(1)	(0)								
b.	4	1								
	(0)	(0)								
c.	2									
	(0)									
TOTAL	14	3								
	(1)	(1)								
OC4. a.	4		5							
	(0)		(5)							
b.	74	5	25	5						
	(4)	(1)	(23)	(8)						
c.	47		8	5						2
	(2)		(7)	(8)						(4)
d.	15									
	(1)									
TOTAL	140	5	38	10						2
	(7)	(1)	(35)	(16)						(4)

TABLE 17--(Continued)

Cordage Classes and Subclasses		Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC5.	a.	2 (0)									
	b.	1 (0)		1 (1)							
	c.	1 (0)									
TOTAL		4 (0)		1 (1)							
OC6.	a.	2 (0)									
	b.	22 (1)		1 (1)							
	c.	14 (1)									
	d.	4 (0)									
TOTAL		42 (2)		1 (1)							

TABLE 17--(Continued)

Cordage Classes and Subclasses		Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC7.	a.	1 (0)									
	c.						1 (4)				
TOTAL		1 (0)					1 (4)				
OC8.	b.	1 (0)		1 (1)							
OC9.	a.	45 (2)	1 (0)	20 (18)		50 (7)	2 (9)				4 (9)
	b.	11 (1)	3 (1)	2 (2)		366 (56)	3 (13)				5 (10)
	c.		2 (0)			63 (10)					
	d.					22 (3)					
TOTAL		56 (3)	6 (1)	22 (20)		501 (76)	5 (22)				9 (19)

TABLE 17--(Continued)

Cordage Classes and Subclasses	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC10. a.	181 (9)	1 (0)								
b.	8 (0)									
TOTAL	189 (9)	1 (0)								
OC11. a.					1 (0)					
b.	1 (0)				46 (7)	5 (22)				
c.					10 (2)					
TOTAL	1 (0)				57 (9)	5 (22)				
OC12. a.	1 (0)									

TABLE 17--(Continued)

Cordage Classes and Subclasses		Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC13.	a.	23 (1)	1 (0)			2 (0)					1 (2)
	b.	406 (21)	5 (1)		1 (2)	26 (4)	1 (4)	4 (33)			1 (2)
	c.	33 (2)	1 (0)			23 (3)		1 (8)			1 (2)
	d.	5 (0)				2 (0)					
TOTAL		467 (24)	7 (1)		1 (2)	53 (7)	1 (4)	5 (42)			3 (6)
OC14.	b.	3 (0)									
OC15.	a.	18 (1)	6 (1)								3 (7)
	b.	30 (2)	2 (0)			4 (1)	1 (4)				
	c.	14 (1)	1 (0)								
	d.	5 (0)									
	?					9 (1)					
TOTAL		67 (4)	9 (1)			13 (2)	1 (4)				3 (7)

TABLE 17--(Continued)

Cordage Classes and Subclasses	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC16. a.	24 (1)									
b.	36 (2)				2 (0)					
c.	8 (1)									
d.	6 (0)									
TOTAL	74 (4)				2 (0)					
OC17. a.	1 (0)									
OC18. d.	1 (0)									
OC19. a.	1 (0)									

TABLE 17--(Continued)

Cordage Classes and Subclasses	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC20. a.	30	408								
	(2)	(64)								
b.	37	16								
	(2)	(3)								
c.	3	1								
	(0)	(0)								
TOTAL	70	425								
	(4)	(67)								
OC21. a.	5	2						1		
	(0)	(0)						(11)		
OC22. a.	3	1								
	(0)	(0)								
b.	1	2								
	(0)	(0)								
TOTAL	4	3								
	(0)	(1)								
OC23. a.		2								
		(0)								
b.	1									
	(0)									

TABLE 17--(Continued)

Cordage Classes and Subclasses		Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC24.	a.	3 (0)									
	b.	1 (0)									
TOTAL		4 (0)									
OC25.	a.	25 (1)	9 (1)	1 (1)	8 (14)				1 (11)		3 (7)
	b.	25 (1)	5 (1)					1 (8)	2 (22)		2 (4)
	c.		1 (0)								
TOTAL		50 (2)	15 (2)	1 (1)	8 (14)			1 (8)	3 (33)		5 (11)
OC26.	a.	3 (0)	2 (0)			2 (0)					
	b.	1 (0)				1 (0)					
TOTAL		4 (0)	2 (0)			3 (0)					

TABLE 17--(Continued)

Cordage Classes and Subclasses	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
OC1.--OC26. TOTAL	1967	633	108	59	671	23	12	9	1	47

should reflect general cordage diameter sizes from each cordage class. This classification scheme is considered appropriate in making the cordage classes sensitive enough for S/T comparisons among sites. It has been determined that 26 cordage classes and 66 subclasses occur among Northwest Coast wet sites. As with basketry, a significant discrepancy exists in collection sizes (i.e., especially the low number of examples from Conway and Fishtown). Therefore, in some cases, these tests and comparisons are somewhat weaker than would be desired, but they indicate the general pattern of site associations. The test used is an average linkage cluster analysis, on a matrix of Jaccard's coefficient. The resulting dendrograms of cordage class and subclass similarities among Northwest Coast wet sites are illustrated in Figure 8 and 9. As can be seen, both dendograms are similar in composition. Many of the Northwest Coast wet sites clustered in a similar regional pattern similar to basketry artifacts from these sites in earlier tests (Croes 1977b:195, 257). The resulting average-linkage dendogram for cordage, compared with the previous dendrograms based on basketry, forms the basis for the following discussions.

Ozette Village, with the largest number of cordage classes, linked best with the Hoko River site in each of the dendrograms (A, Figures 8 and 9). This is consistent with similar tests for basketry which indicated that Ozette and Hoko were most closely linked. This additional association supports a pattern of style continuity and the hypothesis of cultural continuity in this south-central coastal region for the last 2500 years (see Map 2). These sites share a wide variety of cordage classes and subclasses including cedar bough withes (OC1), two- and three-strand cedar bough cords (OC2 and OC4), two-strand cedar bark strings, cords and ropes (OC9), cedar bark braids (OC13), spruce root strings (OC20), and cherry bark strips (OC25).

In the dendrogram of the 26 major cordage classes, Biederbost and Little Qualicum River are most similar and they link to Musqueam Northeast (Figure 8). This is consistent with temporal considerations since Little Qualicum River wet deposits date to approximately 1700 years B.P. (Bernick personal communication), Beiderbost dates to older than 2000 years B.P. (Nelson), and Musqueam Northeast dates to approximately 3000 years B.P. (Borden 1976). However, the second dendrogram of the 66 cordage subclasses links Biederbost and Musqueam Northeast as closest and both linking with Little Qualicum River at a lower degree of similarity. This dendrogram may be considered more sensitive, since the diameter gauge sizes of each major cordage class is compared. It seems consistent to say that Musqueam Northeast and Biederbost cordage styles are similar, and potentially more so than with Little Qualicum River styles. The cordage subclass dendrogram also is consistent with the basketry style similarities noted between Musqueam Northeast and Biederbost in average linkage tests (Croes 1977b:195, 257). These three early Puget Sound/Gulf of Georgia sites share and have a common emphasis on cedar bough withes (OC1), two- to three-strand cedar bough strings, cords and ropes (OC2 and OC4), and narrow gauge cherry bark binding elements (OC25). These data provide additional support for an early cultural association between sites of the Puget Sound/Gulf of Georgia area (Map 2:B). Of note, the manufacture of large gauge two- to three-strand cedar bough cords and ropes at these sites indicates a sophisticated ropemaking technology at this early period. Larger cedar bough ropes

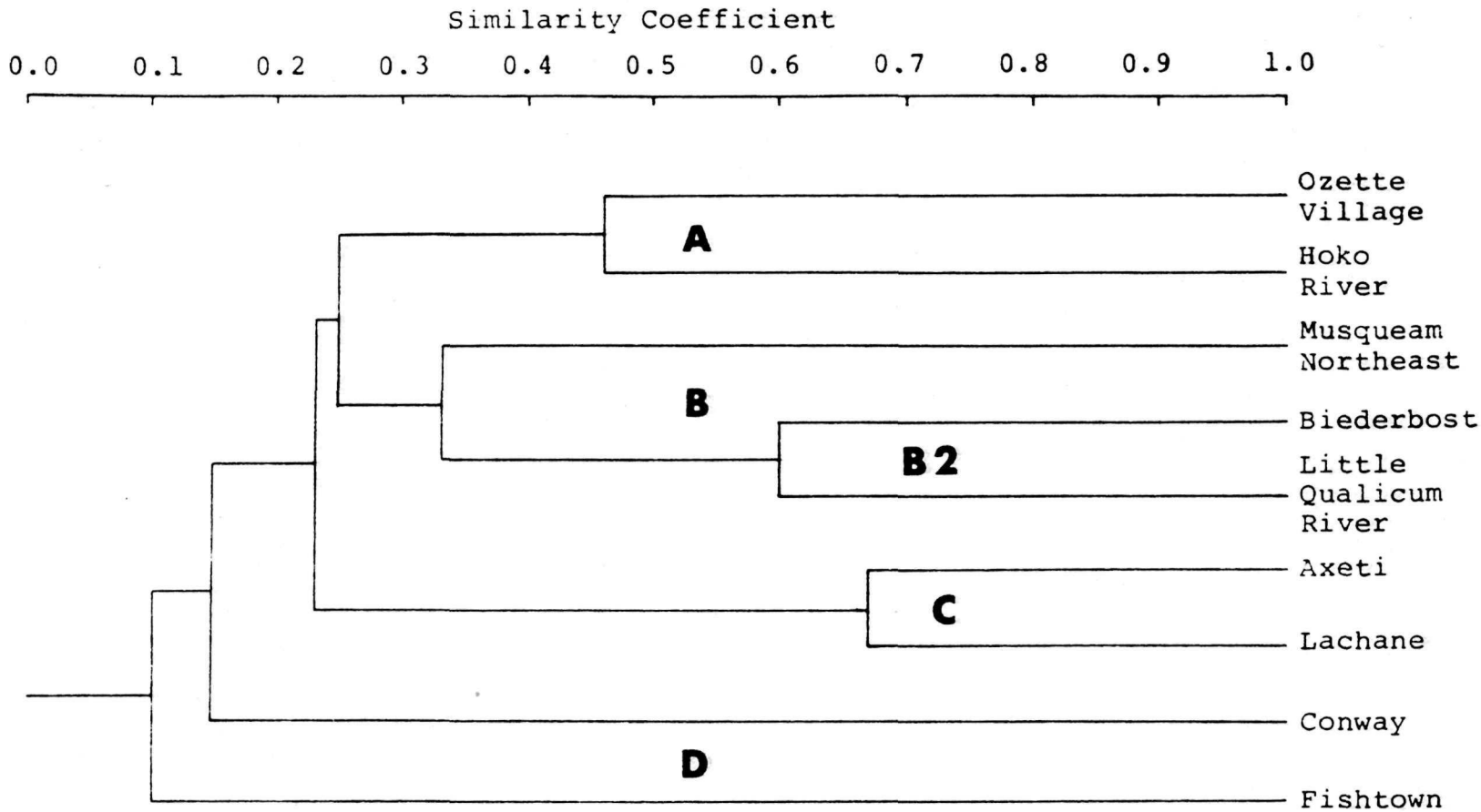


Figure 8. Dendogram representing an average linkage cluster analysis of Northwest Coast wet site cordage classes on a matrix of Jaccard's coefficients. Degrees of similarity: 1 = complete similarity to 0 = no similarity.

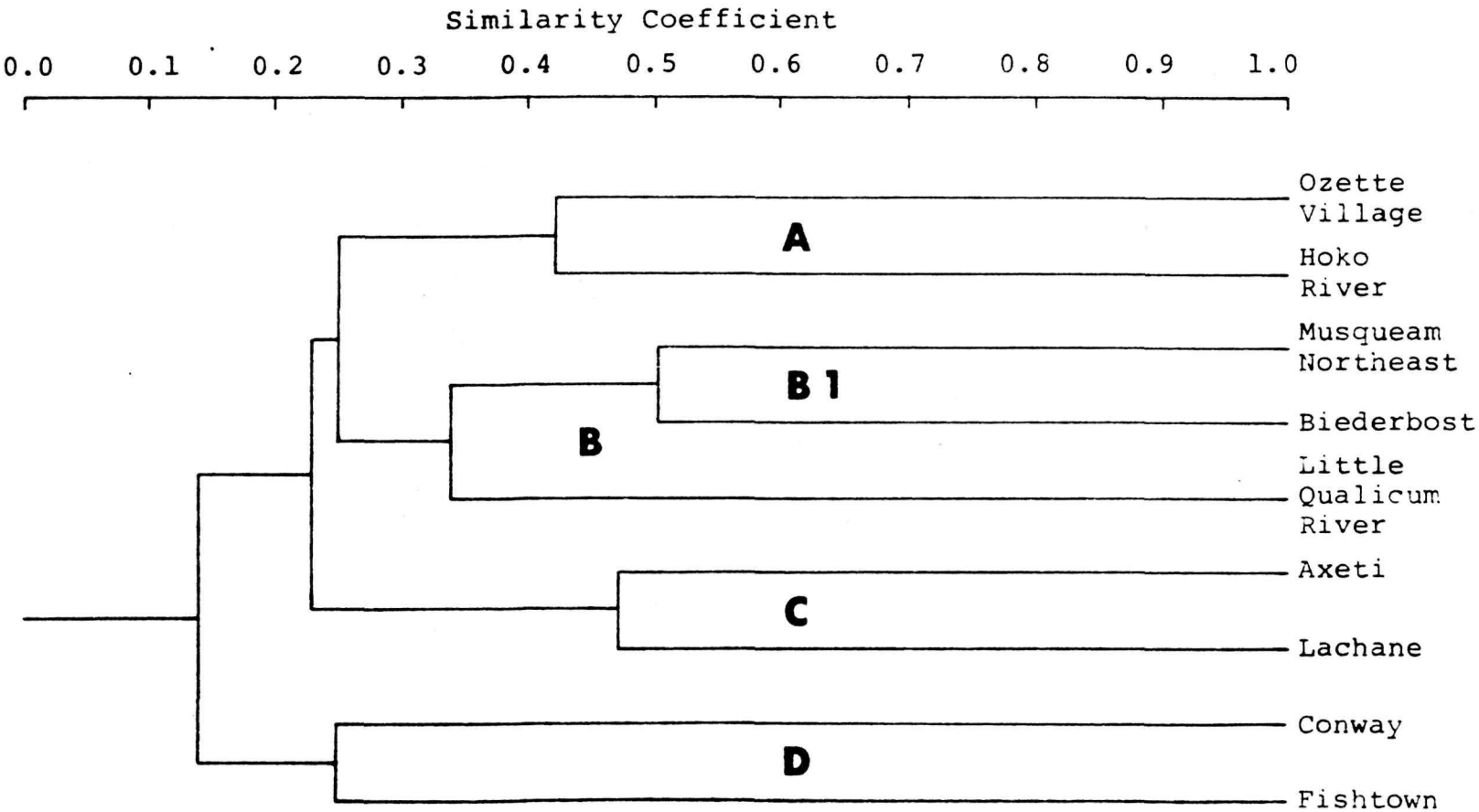
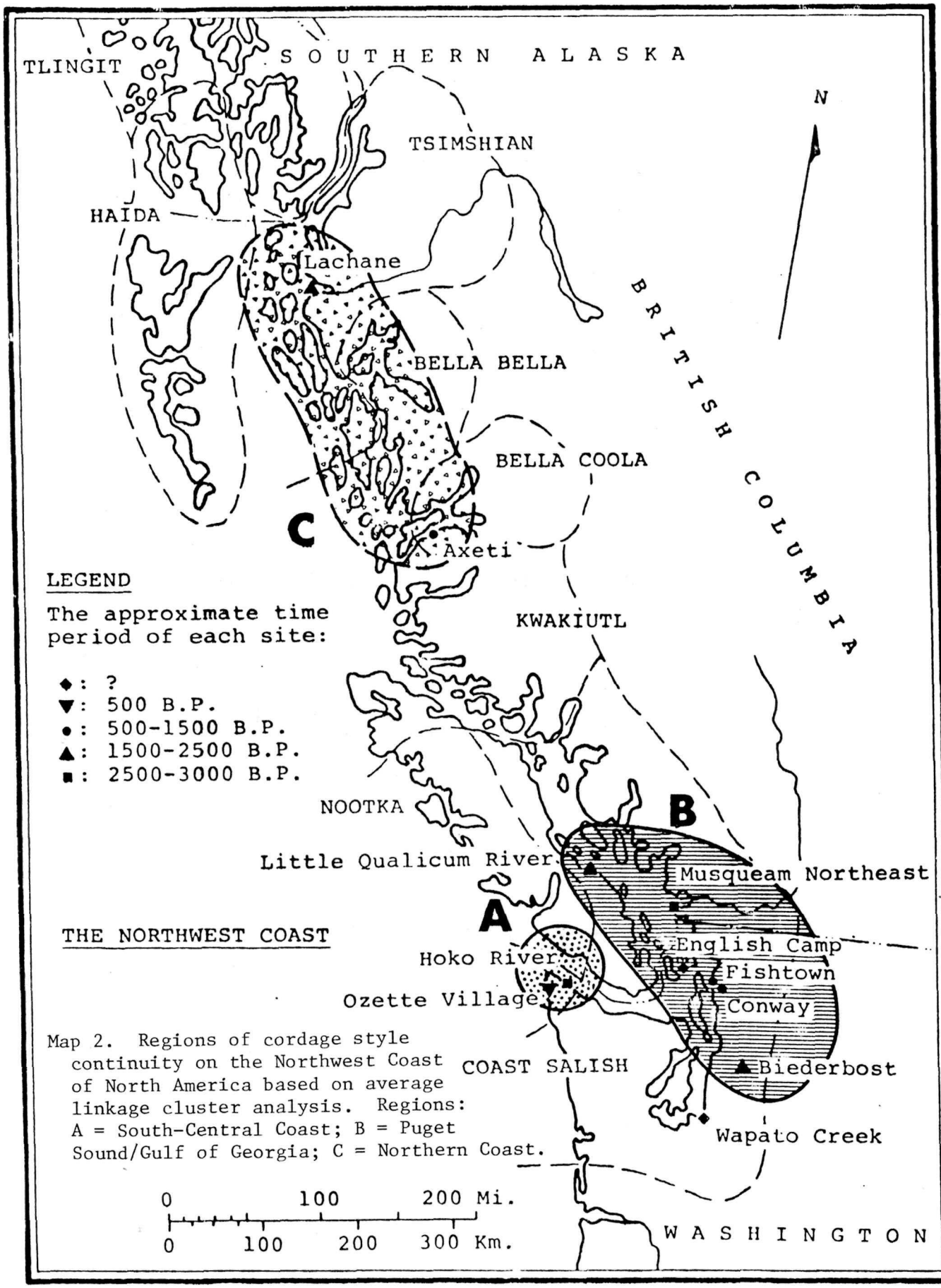


Figure 9. Dendogram representing an average linkage cluster analysis of Northwest Coast wet site cordage subclasses (based on diameter gauge) on a matrix of Jaccard's coefficients. Degrees of similarity: 1 = complete similarity to 0 = no similarity.



Map 2. Regions of cordage style continuity on the Northwest Coast of North America based on average linkage cluster analysis. Regions: A = South-Central Coast; B = Puget Sound/Gulf of Georgia; C = Northern Coast.

commonly were associated with sea mammal hunting equipment and were used as harpoon lines at Ozette Village. Their use continued into the historic period. Since Musqueam Northeast materials are directly associated with classic Locarno Beach Culture Type artifacts, which include harpoon blades, toggling harpoons, and antler foreshafts (Borden 1970), these larger gauge cedar bough ropes may have been used as harpoon lines at these sites as well (Croes 1975; Borden 1976). This will be discussed further in the functional analyses below.

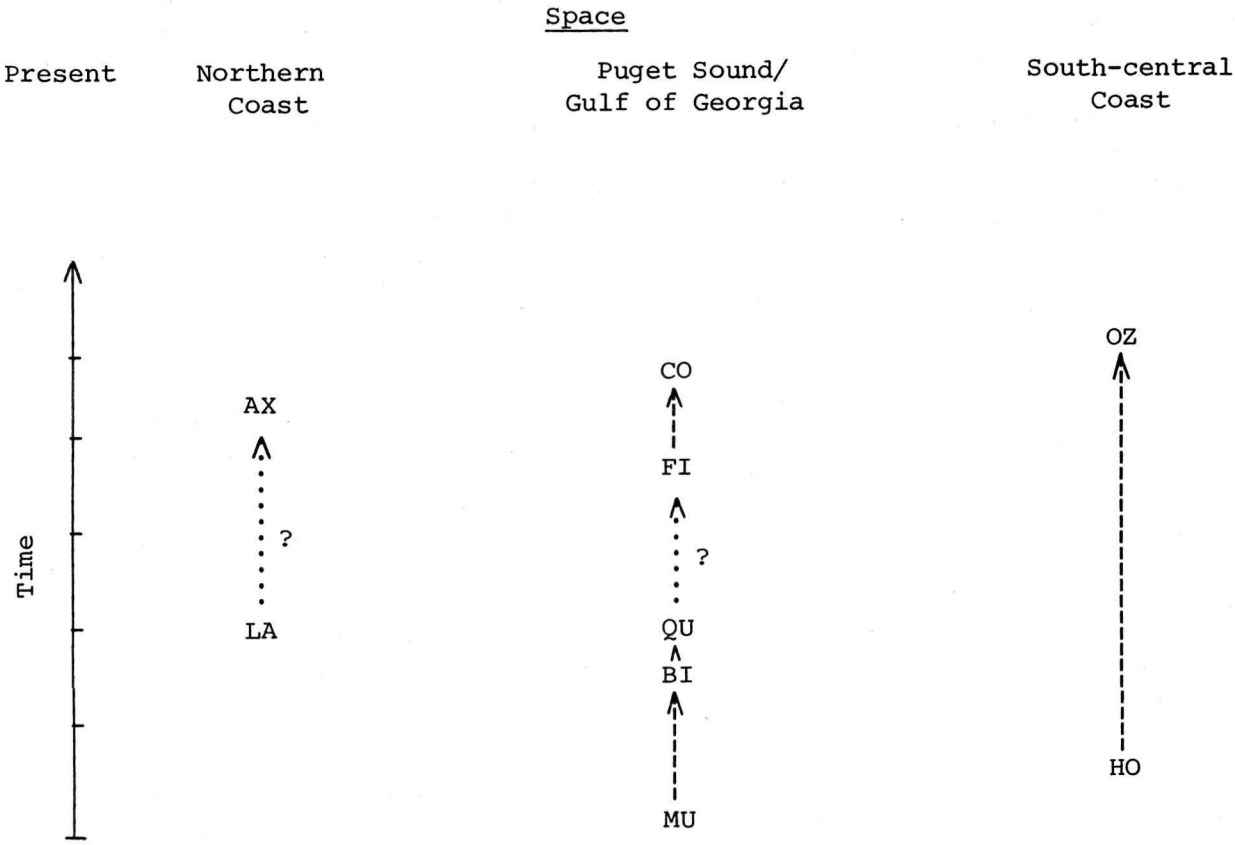
The northernmost sites, Lachane and Axeti, cluster with each other and at a close degree of similarity in both tests (Figures 8 and 9). Cedar bark two-strand cords (OC9) are more common to these two sites than to any other sites. Also cedar bough withes (OC1), two-strand cedar bough cords (OC2), and cedar bark braids (OC13) are recorded. Since these sites are temporally and spatially distant, this similarity is considered to be a general similarity, possibly indicative of a northern Northwest Coast cordage style (Map 2:C).

The late Puget Sound/Gulf of Georgia sites of Fishtown and Conway cluster with each other in the dendrograms (Figures 8 and 9), but at a low degree of similarity. They also do not closely associate with the earlier Puget Sound/Gulf of Georgia sites of Biederbost, Little Qualicum River, and Musqueam Northeast. The major problem with the Fishtown and Conway cordage data is the small sample ($n = 9$ and $n = 10$, respectively). The clustering of these two sites could be partially due to their smaller collection sizes. A larger sample of cordage would be needed from each site before a proper comparison between these sites and others would be possible.

In summary, the regional clustering of sites in the cordage average-linkage cluster analysis is in most ways similar to the regional clustering in tests of basketry styles from these same sites (Croes 1977b). The clustering of cordage and basketry techniques and styles is regional through long periods of time on the Northwest Coast. The northern sites of Lachane and Axeti, the early Puget Sound/Gulf of Georgia sites of Biederbost, Musqueam Northeast and Little Qualicum River and the south-central coast sites of Hoko River and Ozette Village are closely associated in these groupings. Conway and Fishtown have too small a sample for serious consideration, but do associate at a low degree of similarity.

The cordage data cluster some sites in terms of temporal considerations as well (e.g., Biederbost, Little Qualicum River and Musqueam Northeast). Surprisingly, the cordage tests appear to be as stylistically sensitive for comparative analysis as basketry artifacts. At least the results are consistent and these tests can be used to complement each other. The cordage tests may be considered as useful for comparing S/T similarities among these sites. For establishing hypotheses concerning the degree of similarity and cultural association among Northwest Coast wet sites, cordage modes and classes are considered of significant utility and importance, especially when compared

with those of basketry. The regional-continuity model derived from tests of Northwest Coast cordage is illustrated in Figure 10. This model adds to and is consistent with those constructed from Northwest Coast basketry data (Croes 1977b).



Legend:

AX: Axeti

LA: Lachane

CO: Conway

FI: Fishtown

QU: Little Qualicum River

BI: Biederbost

MU: Musqueam Northeast

OZ: Ozette Village

HO: Hoko River

Figure 10. Hypothetical continuity model of site interrelationships based on cordage stylistic/technological classes.

4. OZETTE VILLAGE CORDAGE FUNCTIONAL ANALYSIS

The stylistic/technological classification of Ozette Village cordage (Figure 7) is used to further discuss the technological and especially functional characteristics of the Ozette Village cordage collection. The different cordage classes are grouped into techno-functional class sets which have been constructed according to how the cordage classes correlate (1) technologically, (2) in terms of cordage forms and knots, (3) spatially, and (4) ethnographically. These techno-functional class sets are hypothetical groupings, and are based upon the presently available data. This Ozette Village functional classification is, therefore, a combination of technologically similar cordage classes that have similar forms and associated knotting techniques, have distinct spatial distributions in and around Ozette House 1, and/or are ethnographically described as functionally similar or distinct. These techno-functional sets are generalizations of the data for the purpose of establishing hypotheses concerning the functions of the Ozette Village cordage items and those from other sites.

Cordage S/T classes from other Northwest Coast wet sites that are found within each Ozette techno-functional set are discussed as sets following the Ozette analysis. Since most cordage S/T classes have been recorded at each site, the Ozette Village scheme of designation is used, but the site initials identify each site. For example, a hypothetical techno-functional class set /OC1, OC3, OC10/ is equivalent (in terms of class member definitions) to Musqueam Northeast techno-functional set /MU-C1, MU-C3, MU-C10/.

Ten techno-functional sets of cordage are designated from Ozette Village and are explained, discussed and compared separately below.

Set I. Single Strand, Cedar Bough, Twisted Withe /OC1/

Withes are common in and around House 1 (n = 483). The cedar boughs selected typically are of cord diameter (70 percent) with the bark removed (for details on withe preparation see pg. 10 and below). They are twisted to the right (clockwise). The length of the cordage withe is limited to the length of the cedar bough; they usually are small, averaging 32 cm long, but ranging from 2 cm fragments to 200 cm long.

Several knots, hitches, and whips are found on withes (Table 18), and are important in considering basic cordage functions. Withes mainly were used to secure the Ozette plank house structure, including holding wall boards and poles in place, securing partition boards, and to bind and prevent bench platforms and large boards from splitting. The large wall boards were placed, overlapping between a double row of poles and were

Table 18. Frequency of knotting techniques recorded on one strand, cedar bough, twisted withes (/OCl/).

Knotting Technique	Number	Percent
Knots		
1. no knots recorded	170	35
2. overhand	86	18
3. sheetbend	205	43
4. square	4	1
5. granny	6	2
6. running noose	2	0
Hitches		
1. clove	5	1
2. timber	1	0
3. half	2	0
Whips		
1. wrapped whip	2	0
TOTAL	483	100

supported by a sling of withe, tied between opposite upright wall poles (see Figure 11). Large partition boards have square cut holes along their ends and are tied with withes to upright poles, driven into the house floor. The large bench platforms also have square cut holes on their ends, especially where the plank might or had begun to split, and withes were sewn through adjacent holes to bind the split and prevent further splitting (see Mauger 1978:96-101 for a detailed description of binding splits in house boards). Withes, and especially those used to hold wall boards and partition boards in place, usually are tied with sheetbend knots. By far the largest number of sheetbends are found on withes (205 of 266 or 77 percent of all sheetbend knots, Figure 12). The sheetbend is rated high in terms of security strength, and "unties readily without damaging the rope" (Ashley 1944:262). These qualities would have been important at Ozette Village, since the houses are undergoing constant modifications--house wall planks were removed, replaced,

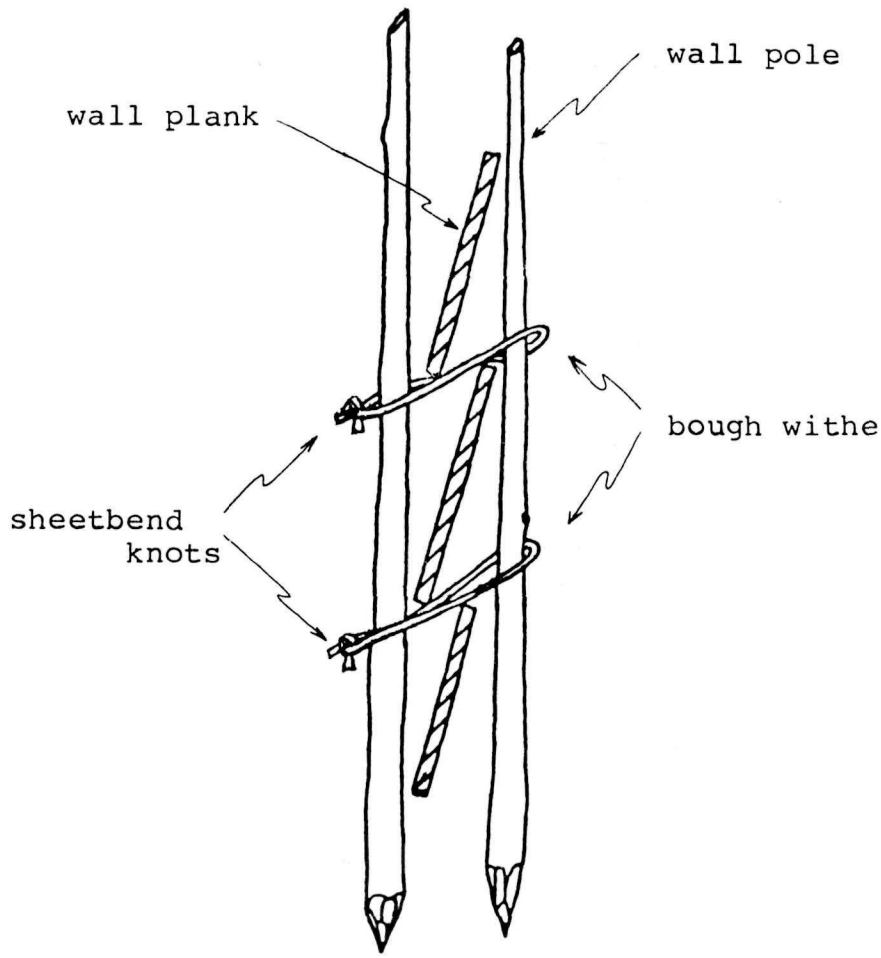


Figure 11. Withe slung wall construction using sheetbend knots (after Mauger 1978:155).

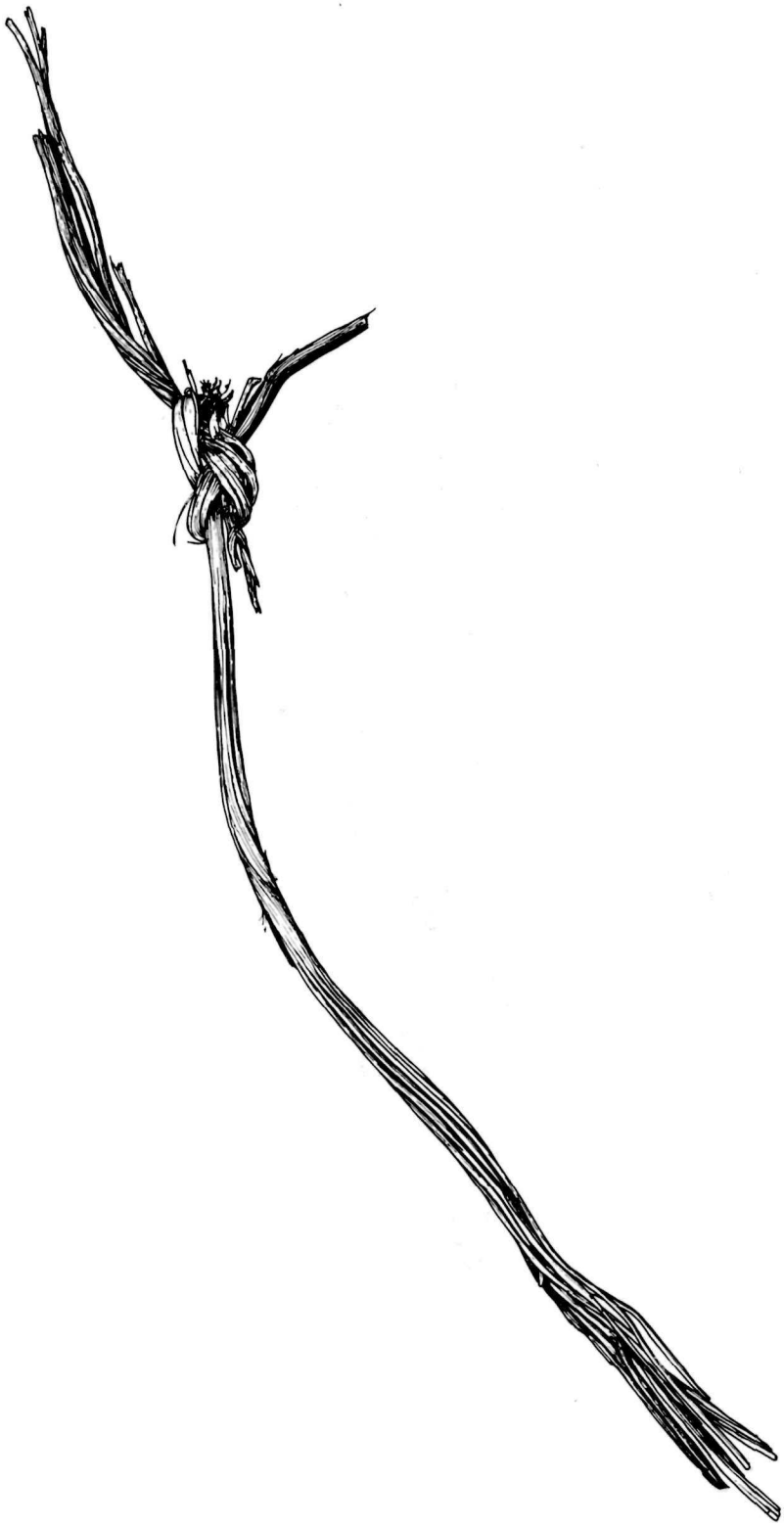


Figure 12. Cedar bough withe with sheetbend knot (178/Temp. V 6; OCl).

readjusted, etc., according to changes in residence (as in the seasonal round), or in terms of repair and replacement of house boards (cf. Mauger 1978). The withes could be easily untied, without damage, and easily reused at a new location, or to resecure a new board in the house. Another fairly common knot used on cedar bough withes is the overhand knot (Table 18; Figure 13). These knots could be used as stopper knots, to secure another knot or hold a withe in place, or as a whip, to keep the ends of withes from fraying. Square and granny knots are used on the withes, but in low frequency. The various hitches: clove, timber, and half, are infrequent, and mainly used to hitch the line to wall poles, rafter poles, and partition support poles. Most of the knotted withe cordage recovered is broken. The break in the cordage usually is next to the knot. In testing knot strength, Ashley found "the break in material almost invariably occurred at a point just outside the entrance to the knot. . . . this would seem to be due to the rigidity of the knot" (Ashley 1944:17). Many of the knotted withe artifacts probably broke during use before the mudslide, but no doubt many were broken by the force of the actual mudslide against the house structure.

In terms of cordage forms, the majority of the withes functioned as lines (Table 19) and performed the various binding and securing jobs as mentioned. Other than lines, withes are formed into bound hoops. This consists of a large cedar bough hoop that was interlaced with withes on the inside area, creating a net-like structure inside the hoop (Figure 14). Only four of the hoops have been recovered in the Ozette House 1 area, and all appear to have been broken and discarded before the mudslide. The withes are attached to the edge of the hoop with half hitches or overhand knots, and wrapped back on each other in the inside area, creating a four-cornered net-like mesh (see Figure 14). The actual use for these forms is discussed below.

Cedar bough withes were found distributed in and around the first house, with some concentrations along the wall areas. This is noticable particularly along the south wall, where much of the lower wall was left standing in the mudslide (Map 3). Other Ozette house walls had been knocked down causing a dispersed distribution of the withes near the walls.

Table 19. Frequency of cordage forms recorded on one strand, cedar bough, twisted withes (/OC1/).

Cordage Forms	Number	Percent
1. lines	451	99
2. bound hoops	4	1
	455	100

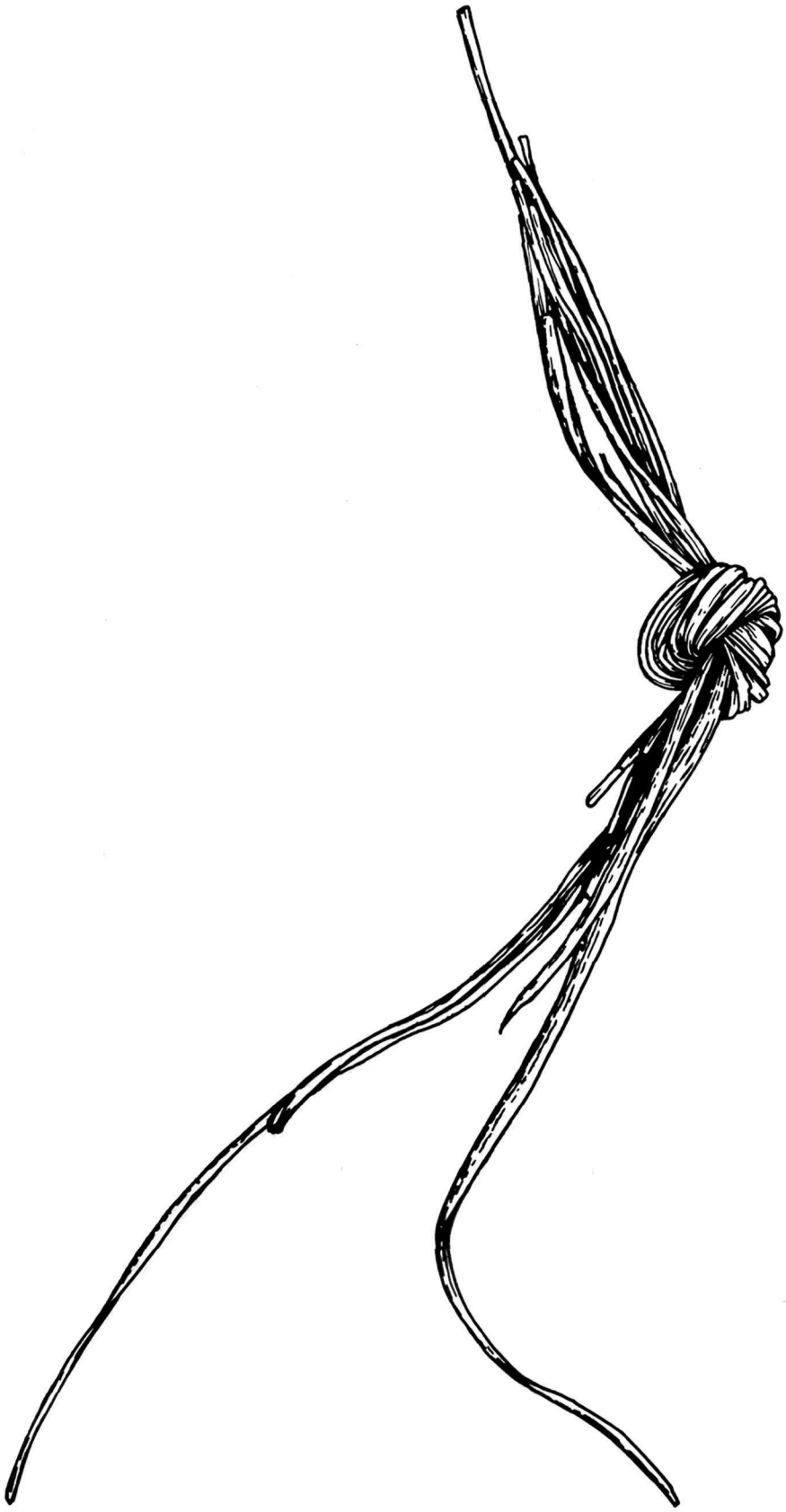


Figure 13. Withe with overhand knot (right over left; OC1).

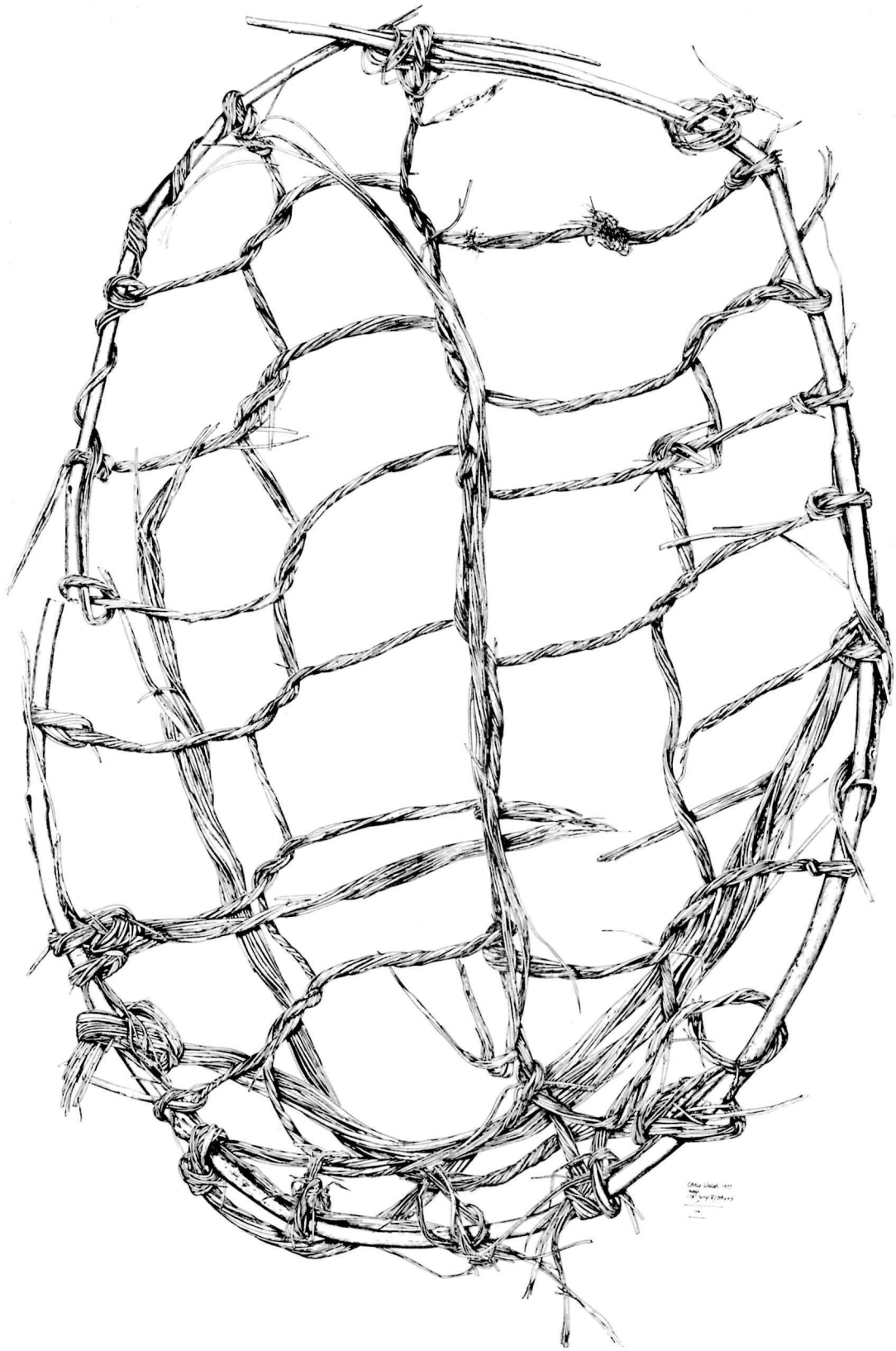
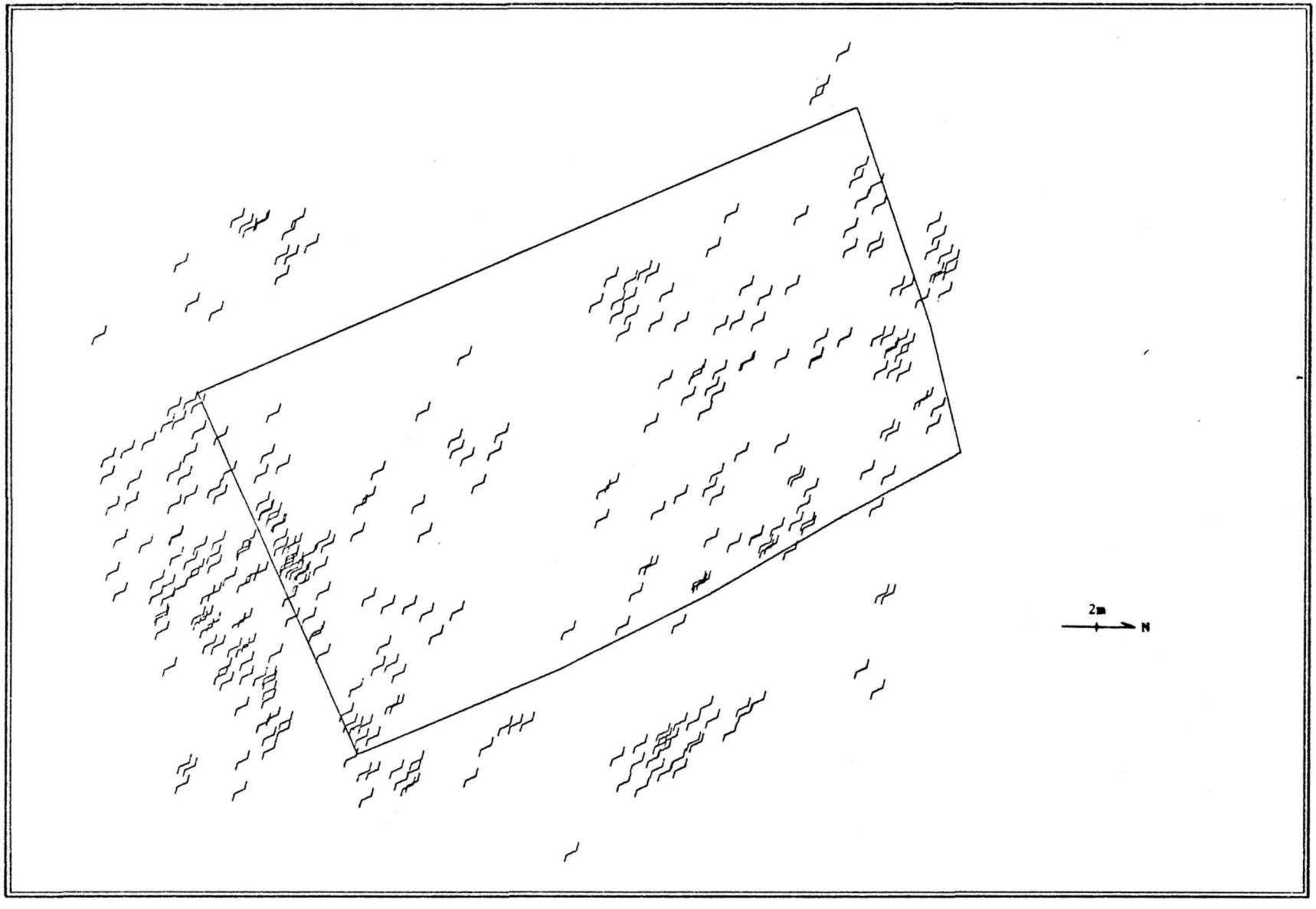


Figure 14. Ozette bound hoop (178/Temp. V 84a & b).



Map 3. Distribution of cedar bough withes in the Ozette House 1 area.

The manufacture of cedar bough withes is described in detail by many authors, but in best detail by Boas. Since this aspect of manufacture also applies to multi-strand cedar bough cordage construction, his description is quoted below.

> The thin twigs of the red cedar are cut off and heated fresh over a fire until steam forms in the sap of the wood, which loosens the bark. Then the twigs are pulled through small improvised tongs, and thus the bark and leaves are removed. The workman begins to twist each twig at the tip while it is still warm. The cedar-twig is held firmly with the left at the tip, with the right at a distance of about half a metre or less from the end; and the part up to this point is twisted, the left hand being held steady, and the twist being made while the right hand turns it away from the body. After this section has been firmly twisted, it is wound around the left hand. The right hand again takes hold of the twig a little farther down, and continues to twist (1909:375).

Gathering of cedar withes also is described by Boas (1913:111, 115). Though different in detail from William Penn's information regarding the preparation of cedar bough withes (pg. 10), the two accounts are similar.

One- and two-strand cedar bough withes are described ethnographically as being used to tie the major house parts into place. Accounts of this are provided by early explorers, including Cook in 1778 (Curtis 1916: 12-13), and Jose Mozino in 1792 (1970:17), and by ethnographers, including Gibbs in 1855 (1877:174-175), Swan (1869:5-6), and Boas (1890:563-582). Swan wrote:

> A board is then placed between these rows of poles, with one of its edges resting on the ground. Withes made from twisted cedar twigs are passed round the poles, and on these withes another board is laid, with its lower edge overlapping the one beneath, this process is repeated till the sides and ends are completed (1869:5-6).

This description corresponds well with data from the Ozette houses (see Figure 11). Also one-strand cedar withes are described as being used to tie canoe thwarts into place (Waterman 1920:21; Eells 1887:636). They are described as sewing elements used to tie together boards (Boas 1913:93), and to lash canoe bow and stern pieces into place (Olson 1936:69). At Ozette they are used to lash box parts together, and lash large plank ends to prevent continued splitting. In considering the process of sewing wood Boas wrote:

> The principal method used for joining two pieces of wood is that of sewing. Holes are drilled in the pieces that are to be joined together, and they are firmly connected by means of string fibre. The only material that is used for this purpose is twisted cedar-twigs (1909:334).

Boas also describes in great detail the different techniques for sewing canoes, large cracks in boards, and boxes (1909:334-337).

The rarer bound hoop forms may be described in ethnographies as snow or mudshoes. Eells mentions the use of snowshoes by the Twana, Chemakum and Klallam:

> Snow-shoes.--These are very scarce and are often not used, except for hunting in the mountains in the winter, as the snow is not usually deep nor does it lie long on the shores of the sound (1887:643).

Drucker mentions the use of snowshoes by the Central Nootkan, Kwakiutl, Tsimshian and Tlingit. The Kwakiutl and Tsimshian are listed as using an oval-frame snowshoe described as "a makeshift type of shoe, filled with withes" (1950:267). And Barnett describes a more elaborate snowshoe form used by the Coast Salish of British Columbia. He explains their function as follows:

> Sometimes, where the ground permitted, the mainlanders pursued deer over soft snow until the animals were exhausted, and then shot them with arrows or clubbed them to death. At such times the hunters wore snowshoes, which were used for scarcely any other purpose. The ordinary snowshoe was of the crude, roughly circular "bear paw" type; practically no other kind was made on the island. Some with "trailers" or extensions at the back (see Figs. 30 and 31) were described for the mainland groups. The toes were upturned (1955:95).

Therefore, some of the Ozette hoops may be a form of snowshoe or mudshoe. A similar bound hoop is illustrated by Mason as "a peculiar kind of mud shoe to wear when wading about in shallow marshes after roots for their basket work" (1902:215). Some of the Ozette hoops could have been used as mudshoes by hunters attempting to bog down and capture deer in the poorly drained swampy areas, or by women gathering plant products in marshy areas including Lake Ozette for bulrush and other products. However, some of the Ozette examples would be too large to be snow-mudshoes (Figure 14). Other tentative functions for these hoops include: hoops for games, small frames for stretching skins, or for scooping things (fish) from the water. All hoops so far recovered at Ozette Village are broken discarded examples, and were not found in functional contexts.

Single Strand, Cedar Bough, Twisted Withe (/OC1/) from other Northwest Coast Wet Sites

Most Northwest Coast wet sites have examples of single strand, twisted withe, which usually contributes to over 20 percent of site collections (Table 20).

Withes typically are twisted to the left (L) at all sites. The construction material is recorded as cedar boughs but, for lack of complete data, this identification in some cases remains tentative.

At all sites, except Hoko River, the majority of the twisted withes are of cord gauge size (Table 17). The Hoko River withes commonly are of string gauge.

Table 20. Occurrence of cedar bough withes at Northwest Coast wet sites.

Site	Equivalent Functional Class Sets	#	Percent of Collection
1. Ozette Village	/OC1/	483	25
2. Hoko River	/HO-C1/	109	17
3. Musqueam Northeast	/MU-C1/	28	26
4. Biederbost	/BI-C1/	20	34
5. Axeti	/AX-C1	39	6
6. Lachane	/LA-C1/	7	31
7. Conway	/CO-C1/	1	10
8. Fishtown	/FI-C1	4	45
9. Little Qualicum River	/QU-C1/	19	40

Knots are common on withes and their frequency of occurrence is indicated in Table 21.

Overhand knots have been found at most sites. The early Puget Sound/Gulf of Georgia sites of Musqueam Northeast and Biederbost have a high percentage frequency of this knot. At Musqueam Northeast this knot frequently is used as a stopper knot, to secure one end of the single loop basket handles in place under the basket rim (Croes 1975; Borden 1976:244, 246). Most overhand knots at this site probably are remnants from broken basket handles. At Biederbost this knot may have been used as stopper knots, but the basket handles were made without overhand knots. At all sites overhand knots are often on the end of the withes and may have functioned as overhand whips to keep the ends from fraying, and/or as stopper knots.

Sheetbend knots occur most frequently at Ozette Village and mainly are used in tying together house components. Axeti and Little Qualicum River have sheetbend knots recorded on withes, and these may have functioned to tie together structures.

Square knots, granny knots, and running nooses also occur at some sites.

TABLE 21--Knotting Techniques Recorded on Single Strand, Cedar Bough, Twisted Withes from Northwest Coast Wet Sites. (Percent recorded in parentheses).

Knotting Techniques	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
1. none	170 (35)	100 (92)	5 (18)	8 (40)	11 (28)	6 (86)		2 (50)		9 (48)
2. overhand	86 (18)	7 (6)	21 (75)	12 (60)	19 (49)	1 (14)		1 (25)		8 (42)
3. sheetbend	205 (43)				3 (8)					1 (5)
4. square	4 (1)		2 (7)				1 (100)			1 (5)
5. granny	6 (1)	2 (2)								
6. running noose	2 (0)									
?	10 (2)				6 (15)			1 (25)		
TOTAL	483	109	28	20	39	7	1	4	0	19

Withe lines are the major cordage form at all sites. Ozette Village is the only site with distinct bound hoop forms, but Axeti and Little Qualicum River have possible examples of bound hoop frames and fragments.

Single strand, cedar bough, twisted withes are a type of cordage and a cordage technique that was common for the last 3000 years on the Northwest Coast. They are quickly made forms of flexible cordage, with strong tensile strength. At Ozette Village these pieces of cordage were used to effectively tie together house components, bind together boxes, sew on canoe bow and stern pieces, and sew together split boards. Withes probably were used for some of these functions at other sites as well. It should be pointed out that fitting and sewing pieces of wood together with withes is recorded from even the earliest Northwest Coast wet site, Musqueam Northeast, demonstrating the longevity of this wood sewing technology (Borden 1976:253).

Set II. Multi-strand, Cedar Bough, Twisted Cordage
IIa: /OC2, OC3/
IIb: /OC4, OC5, OC6, OC7, OC8/

This form of cordage is common at Ozette Village. The techno-functional set is further divided into two subsets, IIa and IIb, according to the number of strands used in making the cordage. Subset IIa cordage is two-strand and subset IIb is three-plus strand cedar bough cordage. There does appear to be some functional variation between these two subsets, and it is best to separate these classes because of the functional considerations below. All multi-strand cordage is formed by twisting and plying single cedar bough withes together. These strand elements usually are Z laid (II:96 percent; IIa:95 percent; IIb:97 percent). The multi-strand cedar bough cordage is seldom of string gauge (4 percent), often of cord gauge (53 percent), commonly of rope gauge (35 percent), and also occasionally of heavy-gauge rope diameter (8 percent). The cordage in this functional class set represents the cordage with the strongest tensile strength. In length these cordage range from 3 cm (1 inch) to 395 cm (13 feet).

Most multi-strand cedar bough cordage has no knots (83 percent), in contrast with the single strand cedar bough withes. Sheetbend knots are the most common knot found and these are mainly associated with two-strand cedar bough cordage (Table 22). This high occurrence of sheetbends with two-strand cedar bough cordage probably again is related to their use in tying parts of the house structure, especially the wall planks, into place. Loosely plied two-strand cedar bough cordage frequently is found tying house parts together, and sheetbend knots, as discussed above, are very efficient for this purpose. Sheetbend knots are used also to tie the ends of two-strand cordage together. This may have functioned in initiating the two-strand ply (Figure 15). When overhand knots are made, they are usually at the ends of multi-strand cedar bough cordage, and functioned as whips. Overhand knots are also found at Ozette as stopper knots for running nooses (n = 4) (Figure 16). Other knots found are: square knots (Figure 15), figure 8 knots, and granny knots. Wrap (Figure 17) and overhand whips are the common whipping techniques.

Table 22. Frequency of knotting techniques recorded on multi-strand cedar bough, twisted cordage (Ozette Village Cordage Functional Class Subset IIa, IIb, and Total of Set II).

Knotting Technique	IIa #	IIa %	IIb #	IIb %	Total II #	Total II %
No Knotting Technique	229	78	172	1	401	83
Knots						
1. Overhand	15	5	7	3	22	5
2. Sheetbend	25	9	3	2	28	6
3. Square	1	0	0	0	1	0
4. Granny	1	0	0	0	1	0
5. Figure 8	1	0	0	0	1	0
6. Running noose	1	0	3	2	4	1
Hitches						
1. Clove	6	2	0	0	6	1
2. Half	3	1	0	0	3	1
Whips						
1. Wrapped whip	8	3	3	2	11	2
2. Overhand whip	7	2	0	0	7	1
TOTAL	297	100	188	100	485	100

Several different forms of Ozette multi-strand cedar bough cordage occur (Table 23). These forms tend to correlate with the particular functions and each form and its functional implications are considered separately below.

Table 23. Frequency of cordage forms recorded on multi-strand, cedar bough, twisted cordage (Ozette Village cordage functional class subset IIa, IIb, and total of set II).

Cordage Forms	IIa		IIb		Total II	
	#	%	#	%	#	%
1. lines	241	81	105	55	346	71
2. wedge collars	17	6	56	30	73	15
3. large diameter circulettes	8	3	1	1	9	2
4. cedar bough storage bundles	10	3	23	12	33	7
5. stick loops	14	5	3	2	17	4
6. basket handles	7	2	0	0	7	1
TOTAL	297	100	188	100	485	100

Multi-strand Cedar Bough Lines

Lines are the most common form of this cordage (n = 345, 71 percent). As mentioned above, many of the two-strand cedar bough lines are used to tie house wall boards into place; this correlated with the spatial distribution of multi-strand cordage since they are found mainly along the house walls as illustrated in Map 4, and especially along the partially standing and well-preserved south wall. Note also the probable alignment of the west wall area of House 2, indicated by the heavy concentration of both single strand and multi-strand cordage east of House 1 (Map 5). In addition to tying house parts into place, multi-strand cedar bough lines had many other purposes. Examples of this cordage, especially the three- and four-strand cedar bough cordage, are tightly twisted and plied into well formed cords and ropes. These are not the shorter, looser plied cordage often used in house construction, but the well-made, longer cords

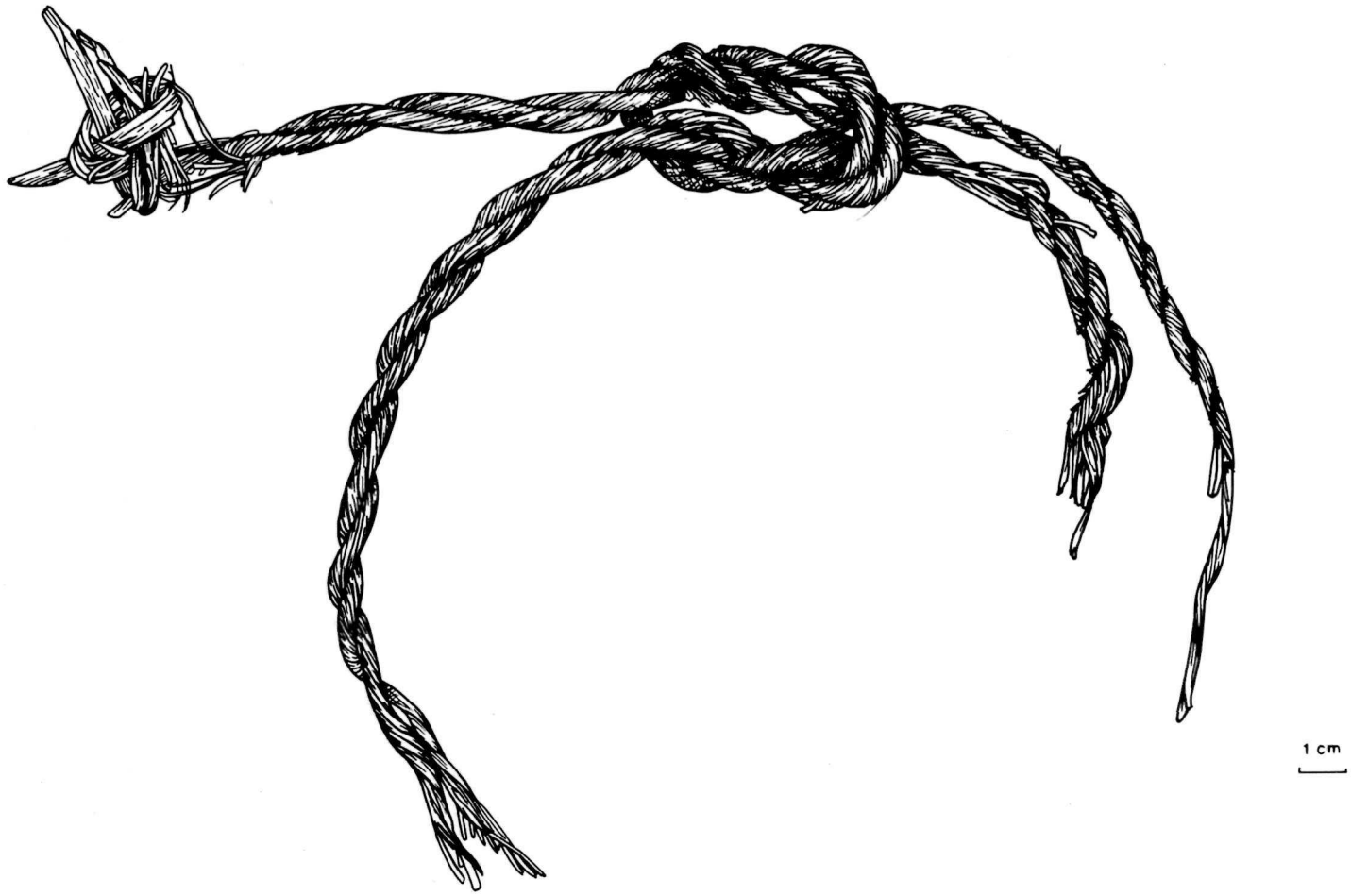


Figure 15. Two-strand cedar bough cordage with a square knot and one end initiated with a sheetbend knot (0c0/V/31; 0C2).



Figure 16. Three-strand, cedar bough rope with a running noose tied on its end (176/IV/10; OC4).

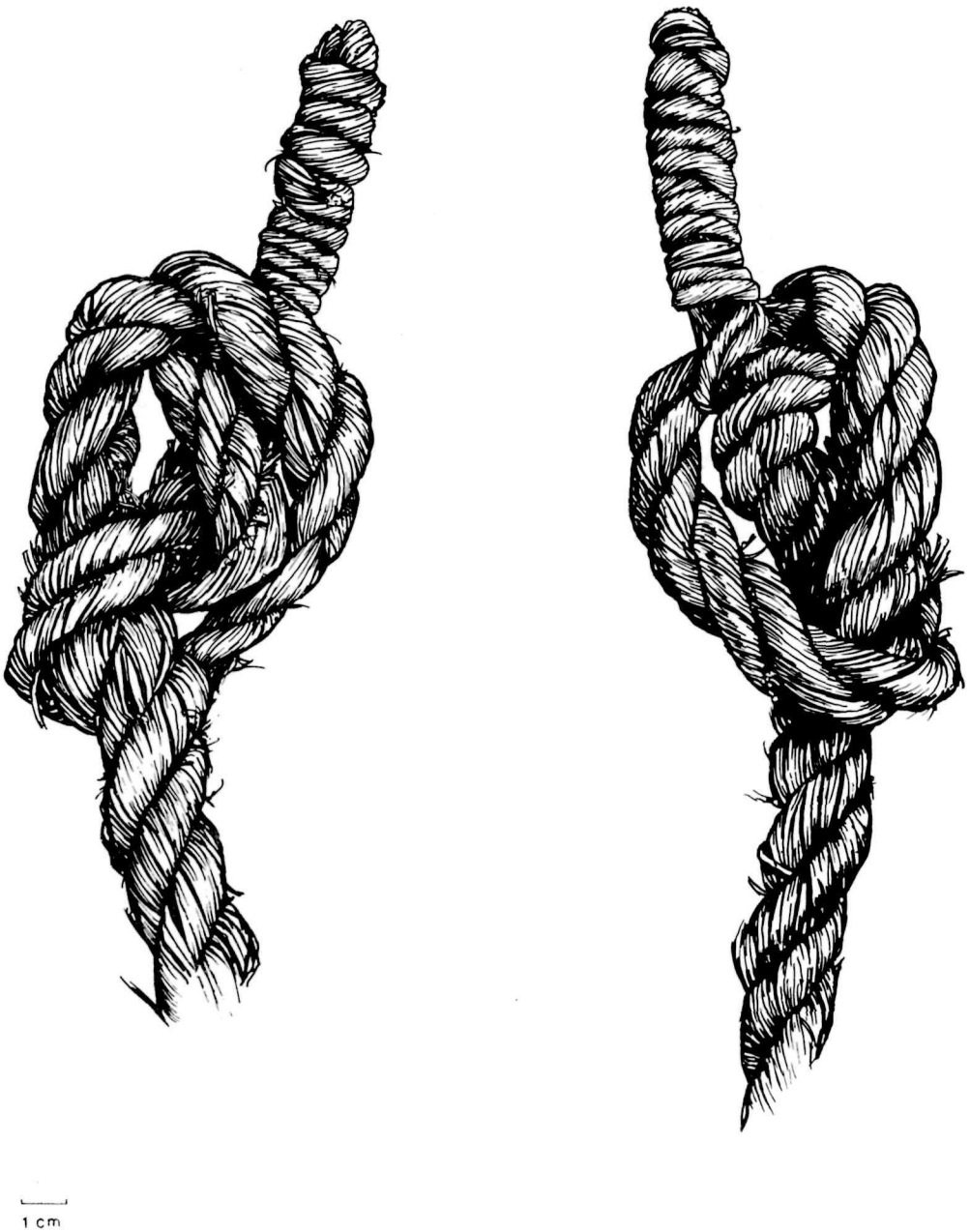
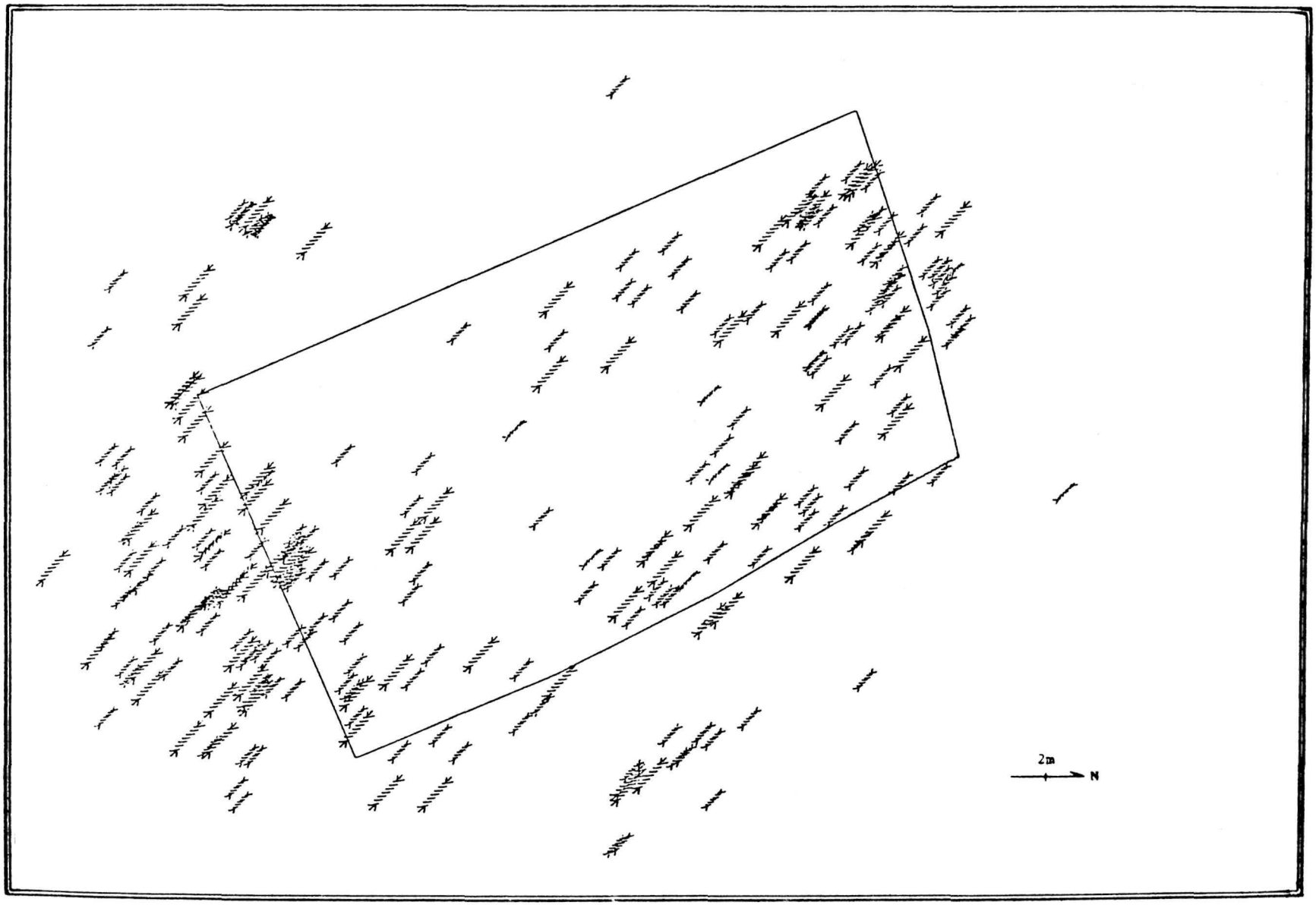
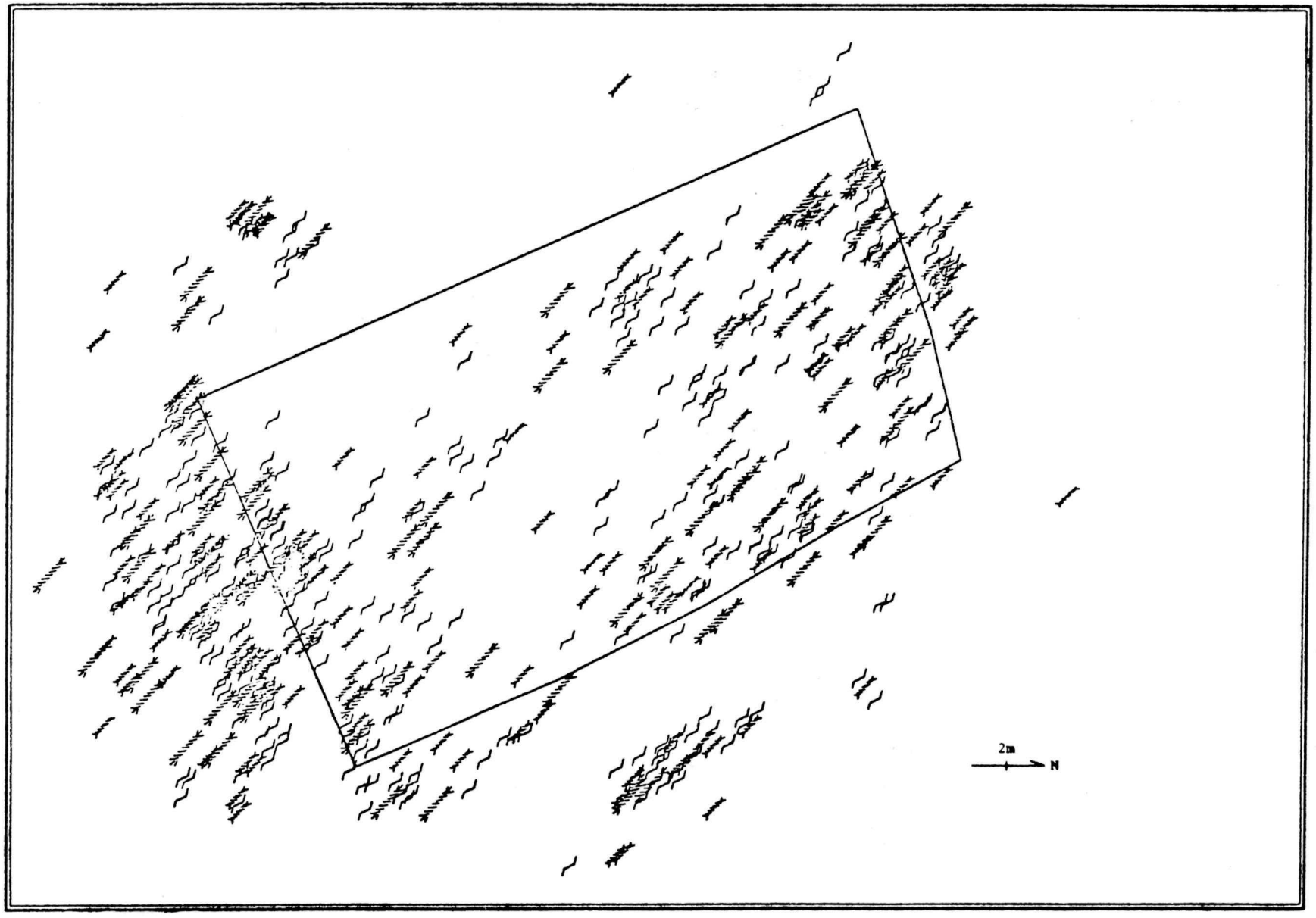


Figure 17. Wrapped whip and overhand knot at end of three-strand, cedar bough rope (142/IV/13; OC4).



Map 4. Distribution of multi-strand, cedar bough cordage lines (n =345) in the Ozette House 1 area.



Map 5. Distribution of single strand and multi-strand cedar bough cordage lines in the Ozette House 1 area.

and ropes. Many of these three-plus strand cords and ropes recovered at Ozette are the incomplete, broken pieces that had been discarded in the refuse midden or house floor area before the mudslide (note southern midden area, Maps 4 and 5). Some are smaller pieces apparently stored under the bench platforms in the house. Well-preserved pieces generally varied from 70 cm (2.3 ft) to 395 cm (13 ft) long. This cordage ranged from 0.4 to 4.2 cm in diameter, with a mean of 1.4 cm, and a standard deviation of 0.64 cm. Ethnographically, these well constructed cords and ropes are often described as harpoon lines for seal and whale hunting. As a good example of a harpoon line in Ozette House 1, one rope (30/IV/43) was found in the northeast wall area attached with an overhand knot to a large wooden seal skin float plug. This rope is approximately 3.7 m long (12 ft), broken at the end of the knot, and wrap whipped at the other end of the rope. Directly associated with the end of this rope was another length of heavy gauge two-strand rope (38/IV/27) which has a small looped end, possibly for attachment to the end of the other rope (see Figure 18 for example of rope tied to a seal skin float). This feature demonstrates the use of these ropes as harpoon lines, undoubtedly for sealing and whaling. Other broken pieces of three-strand rope (especially 30/IV/3 and 4/IV/10) were associated with the main rope (30/IV/43) and were once probably part of the harpoon line. Overhand running nooses are formed on the ends of these tightly plied ropes (see Figure 16). This provided a sturdy noose that could be attached to skin floats and other items. One heavy-gauge rope (176/IV/10), measuring 320 cm (10.5 ft) long, was found with a running noose and was stored with other cordage under a bench platform in the southwest wall area. Two other heavy-gauge ropes (145/IV/4 and 142/IV/13) had running nooses and both were directly associated with human remains. The running noose of rope 145/IV/4 was found passing around the shoulders and under the arms of one individual; the running noose, of the second rope (142/IV/13, Figure 17), was associated closely with one of the feet of a second individual. Both individuals were young females, approximately 20 years of age. The ropes appear to have been used to try and pull the individuals from the mud flow immediately after the slide. Other heavy-gauge three-strand ropes are recovered in poor condition, broken and apparently discarded in the refuse midden.

Ethnographically, as mentioned before, these multi-strand ropes frequently were used as harpoon lines for seal and whale hunting. In the mid-1800s Sproat observed that the Alberni Nootkan whalers used a main harpoon line, "which is generally made of cedar twigs laid together as thick as a 3" rope" (1868:227-228). And Reverend Eells, around the same time period, noted that the Twana, Chemakum and Klallam Indians made harpoon ropes from cedar withes. He wrote:

> The largest ropes I have seen made by these Indians are of cedar twigs twisted in much the same style as our hemp ropes, but they look coarser. These are very strong and lasting. The largest are made on the buoys employed in catching seal, and are 3/4 of an inch in diameter (1887:636).

Other detailed accounts of cedar withe multi-strand cordage used as main harpoon lines include those by Swan (1869:21), Boas (1909:380), Curtis (1913:16; 1916:16-17), and Gunther (1927:220). These well-formed cedar



Figure 18. Early photograph (approximately 1900) in Neah Bay illustrating whale harpoon lines attached to seal skin floats (Morris photograph).

withe ropes were also the main lines used to tow the killed whale to shore for butchering. As Gunther points out:

> The limbs of the cedar tree are stripped of their heavy leaves, soaked in water, and twisted into rope. The heavier grades are used by the whale-hunting tribes like the Quinault, Quileute, and Makah for towing home dead whales. It has remarkable strength (1945:20).

Some information on the Kwakiutl's method of manufacturing these multi-strand cedar withe ropes is provided by Boas:

> The long withes are twisted as here described (Ibid:375), but the rope consists of three single strands. The three strands are coiled together; and when the thin end of one of the withes nearly gives out, a new strand is simply put in. This rope has a very loose texture. Much better rope of the same sort is made by the Nootka and Quilleyut, who use it extensively for whaling-lines (1909:380).

The well formed multi-strand cedar withe cordage from Ozette Village undoubtedly was used as harpoon lines for sea mammal hunting, and to bring whales into shore. These lines would have a strong tensile strength and could have also been used to tow canoes, pull canoes ashore, tie nets onto (as a headline), help move and erect heavy house timbers, help climb trees to cut down timbers, move logs into place for carving, and certainly many other purposes. Multi-strand cedar bough lines played an important functional role in the Ozette Village lifeway and has been a well developed type of cordage along the Northwest Coast for thousands of years (see below).

Wedge Collars

The next most common form of multi-strand cedar bough cordage is the wood wedge collar (Figure 19). Seventy-three wedge collars, independent of wood wedges, were recovered from House 1. Most are formed in a single loop (89 percent, Figure 19), while others were double loops (11 percent, Figure 19). The number of strands creating these loops varied from two to five and in these proportions: two-strands--19 percent; three-strands--41 percent; four-strands--19 percent; five-strands--1 percent. In diameter, the cordage itself varied from 0.4 to 2.0 cm with a mean of 1.1 cm diameter and a standard deviation of 0.41 cm. The actual diameter of the collar varied from 3 to 6 cm with a mean of 4.37 cm and a standard deviation of 0.9 cm. These collars appear to have been prepared to slip over the top (poll) of the wooden wedge and, as the wedge was used, the pounding on top of the polls pressed the collars into place (Figure 19). The basic function of these collars is to girdle and sustain the poll so that they were much less likely to split when the wedges were pounded into a timber. In terms of distribution, the majority of the collars (approximately 86 percent) are found within the House 1 floor matrix or the outside refuse midden (Map 6). These probably are lost or discarded collars and were not in use at the time of the Ozette mudslide. In general the separate wedge collars distribute along the inside wall areas and central areas of House 1. It appears

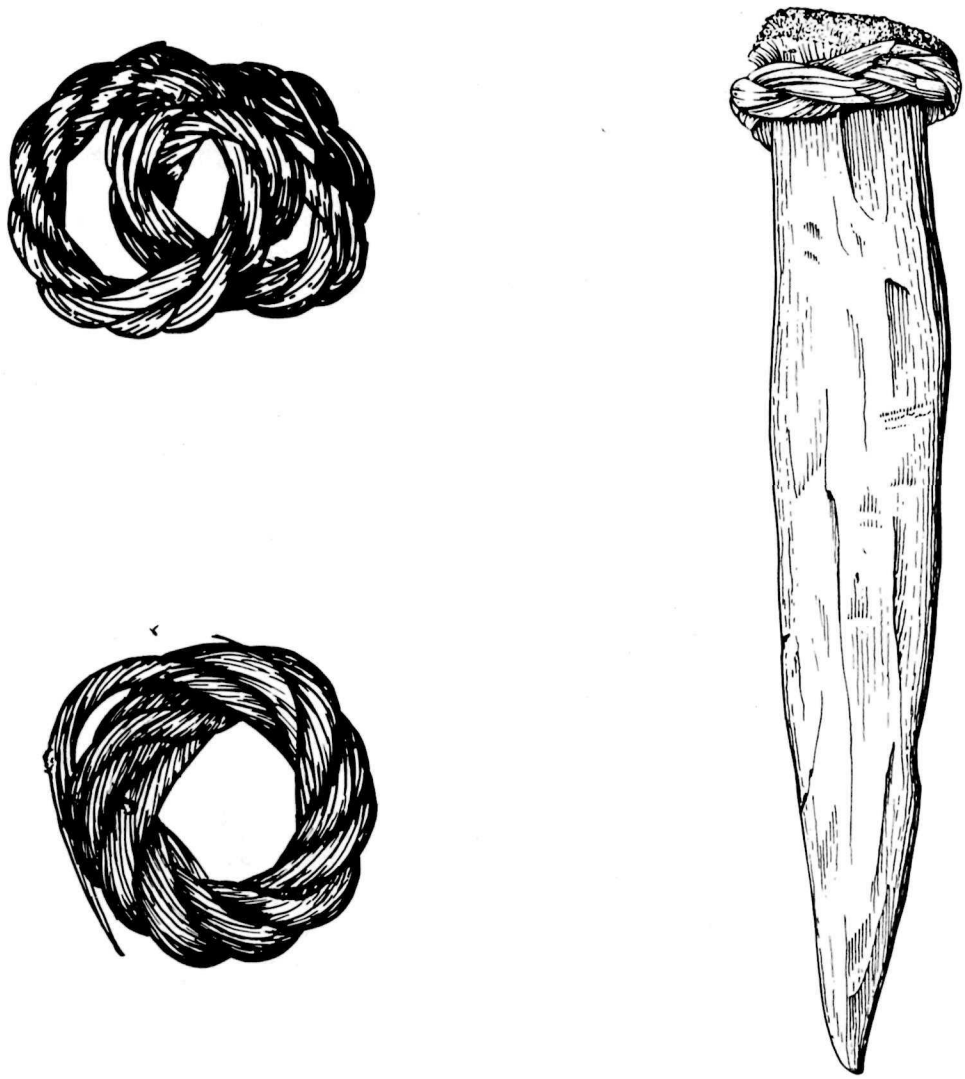
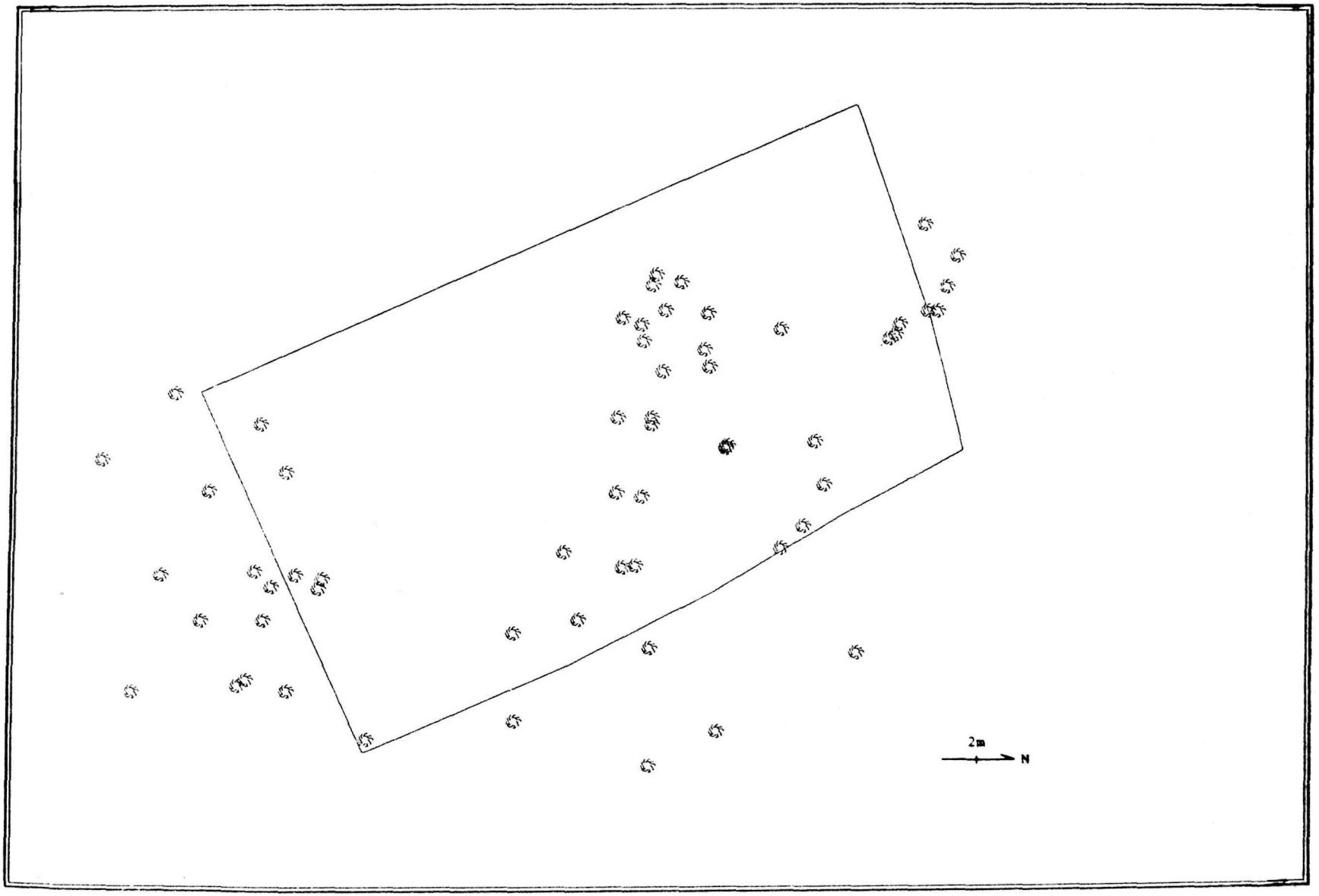


Figure 19. Examples of double and single loop wedge collars and a wedge with collar applied.



Map 6. Distribution of multi-strand wood wedge collars in the Ozette House 1 area.

that wedges were used in the central area of the house, possibly around hearths where firewood was being split or boards split for box and plank construction. A more detailed account of the actual distribution and analysis of the wooden wedges is considered in a separate study of wood-working technologies (Paul Gleeson 1980).

Ethnographically, some mention is made of wedge collars. Drucker, writing about the Nootkans, states that "a grommet of cedar or fir twig was made onto the head of the wedge" (1951:78). And Boas provides a valuable account of the manufacture of wedge collars by the Kwakiutl:

> Crowns for wedges and chisels are made of cedar-withes in the following manner: a long withe is turned into a ring about 5 cm in diameter, beginning at the middle of the withe. First the thick end is twisted in and out through the ring until one circuit has been completed. Then the thin end is treated in the same way, so that a complete ring, consisting of a three-strand rope, is made. This ring is placed on the slightly sharpened butt-end of the wedge, which is battered down until it is quite flat and the ring is held firmly in place (see p. 323) (1909:380).

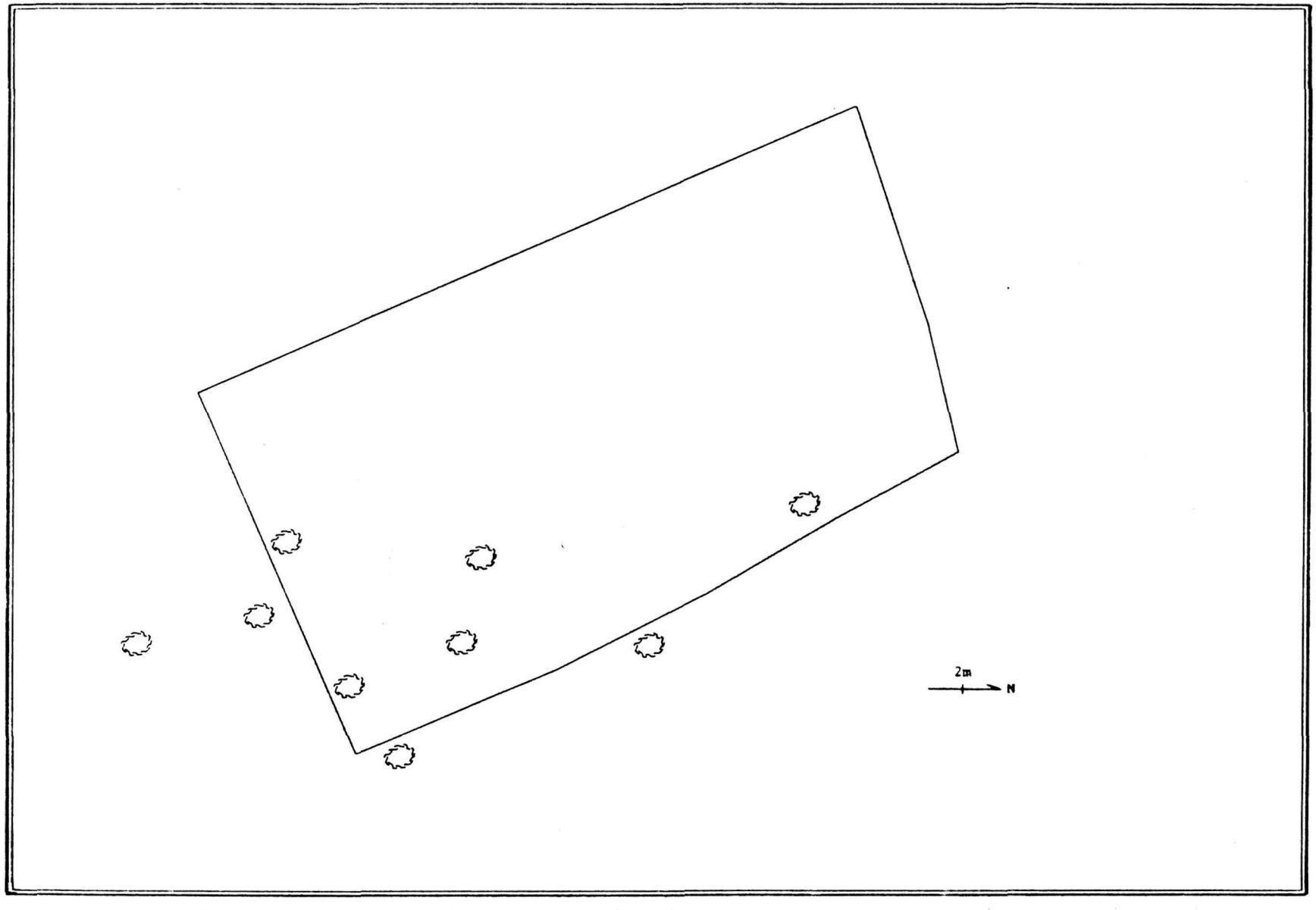
Drucker's culture element distributions list for the historic Northwest Coast indicated that wooden wedges with collars were used by Nootkan, Kwakiutl, Bella Coola, Tsimshian, and Haida groups (1950:183). The only groups using wooden wedges without withe collars were the Tlingit.

Large Diameter Circulettes

Nine multi-strand, cedar bough, large diameter circulettes are recorded from the Ozette House 1 area. These rounded loops are generally too large to function as wood wedge collars, varying from 8.9 to 23 cm in diameter, with a mean of 18.7 cm diameter and a standard deviation of 7.35 cm. In terms of actual cordage diameter, these circulettes varied from 0.7 to 2.3 cm diameter and have a mean of 1.6 cm diameter and a standard deviation of 0.61 cm. They appear to be constructed in a manner similar to, though looser than, the smaller wood wedge collars. None has been found in a distinct functional context at Ozette, but one (130/IV/1) was recorded holding adjacent house wall poles together, and similar loops are found holding poles together and supporting wall planks in between the poles. These large diameter circulettes very likely functioned to brace adjacent poles together (in the house wall, for partition board poles, etc.) as well as other uses. In terms of spatial distribution, the majority of the circulettes (7 or 78 percent) have been recovered within the House 1 floor midden or in the exterior refuse midden (Map 7). The remaining two were found on the house floor surface.

Cedar Limb Storage Bundles

Thirty-three, or 7 percent of the multi-strand cedar bough cordage specimens are storage bundles. These bundles consisted of individual cedar limbs that had been systematically twisted and bent back and forth (often 3 to 4 times) on themselves creating a multi-strand bundle (Figure 20). These prepared bundles appear to have been kept until needed for



Map 7. Distribution of large diameter, multi-strand, cedar bough circulettes in the Ozette House 1 area.

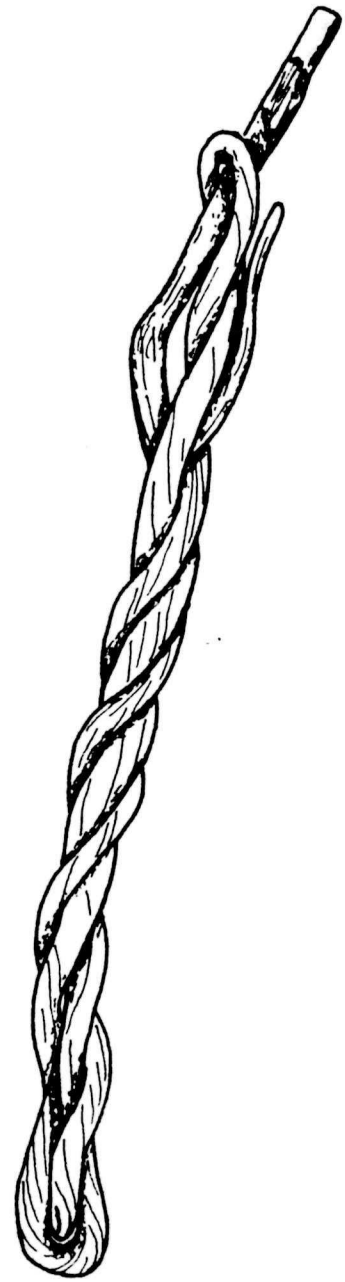


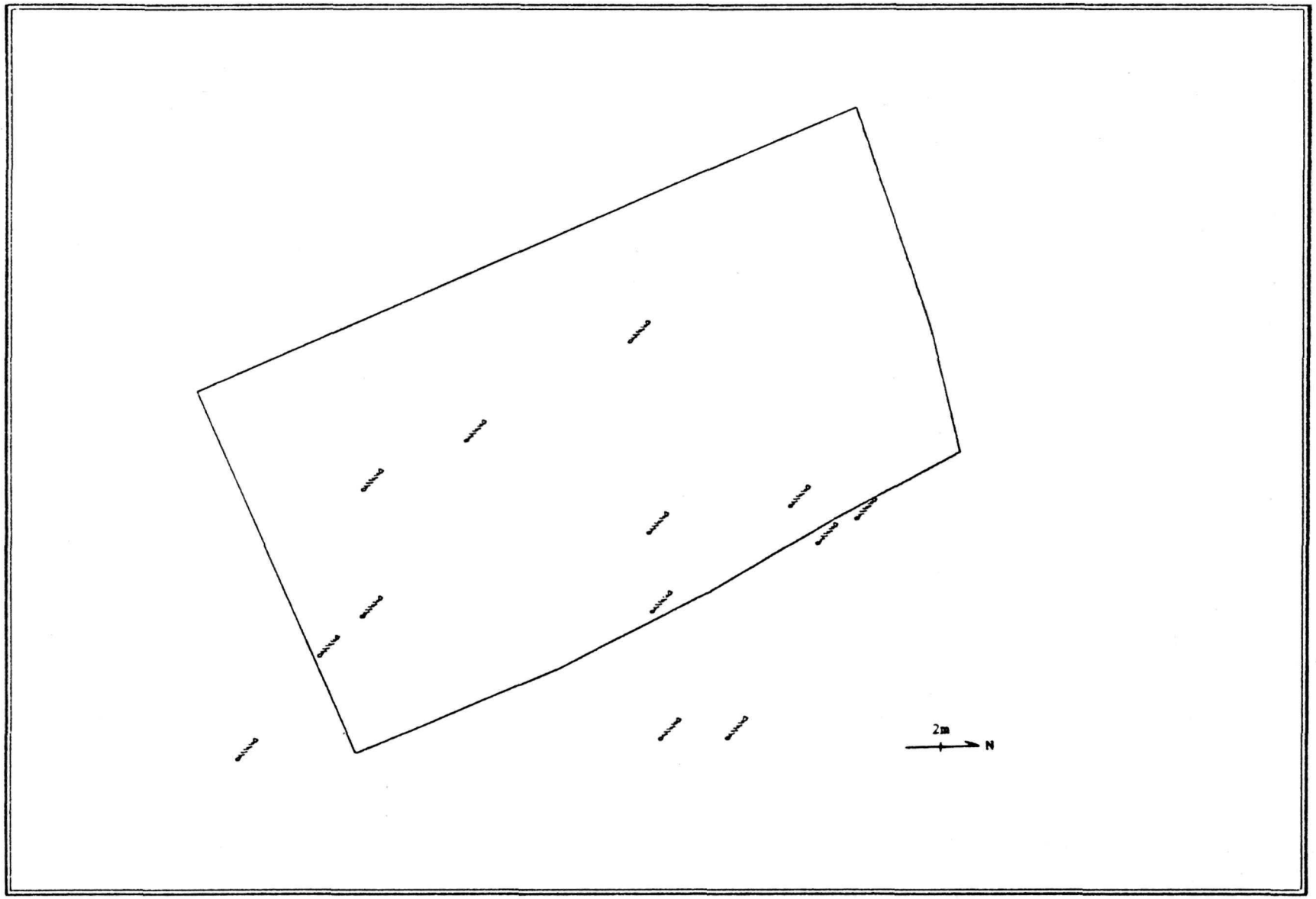
Figure 20. Ozette cedar limb storage bundle.

making cordage lines, collars, circulettes, etc. In this manner the twisted individual boughs retain their twist until needed. These cedar boughs were twisted into bundles ranging from 10.5 to 58.9 cm long, with a mean of 28.7 cm long and standard deviation of 10.3 cm. The number of plies composing these bundles include two (17 percent), three (59 percent), four (21 percent), and five (3 percent). The diameters of these bundles range from 0.5 to 1.9 cm, with a mean of .92 cm diameter and a standard deviation of 0.33 cm.

The storage bundles from Ozette Village usually were found along the inside wall areas of House 1 (Map 8). Only two were found within the outside midden refuse, and at least one of those (213/tVII/24) was associated with a buried house floor. Probably the main reason these cedar bough storage bundles were almost all "in use," and very few found discarded in the midden, is that they had not yet been made into a functional piece of cordage that would be eventually worn out and discarded. Those in the house appear to have been stored, often under bench platforms, along the wall areas. A group of six storage bundles (71/IV/55a-f) were recovered together, along with numerous other artifacts in the northwestern area of House 1. The total assemblage of artifacts associated includes:

artifact number	artifact
71/IV/52	broken 'hearth' fire starter
53 a & b	broken club with owl sculptured head and handle
54	strips of cherry bark
55 a - f	6 cedar bough storage bundles
71/IV/56 a & b	broken spindle whorl (wooden)
57	large bent wood halibut hook
58	broken halibut hook
59	pile of whale baleen
60	pile of fibrous materials, fraying on the ends, in strips about ¼ cm wide; it also could be bark of some kind
61	canoe paddle handle blank
62	broken paddle handle
63	broken seal club

These materials apparently were all stored together, probably on shelving along this wall area. Many of the artifacts are broken, and the materials may have been stored here to be repaired. One excavator states that the feature "suggests to me a repair shop" (Marian Fisken, Ozette field notes, August 12, 1971), and another notes "I would further the following hypothesis: an assemblage of broken pieces especially box pieces were collected in this area of the house to be either fixed or replaced" (Steve Caton, Ozette field notes, August 12, 1971). The broken boxes actually may have been whole at the time of the mudslide, and contained this assemblage of artifacts, but shattered spilling the contents during the mudslide. These six storage bundles undoubtedly were stored for later use



Map 8. Distribution of cedar bough storage bundles in the Ozette House 1 area.

in repairing some of the broken artifacts, or intended for manufacturing of various other cordage forms, i.e., lines, collars, circulettes, etc.

Ethnographically the best description of making a storage bundle is given by Boas in his discussion of cedar bough withe preparation.

> The workman begins to twist each twig at the tip while it is still warm. The cedar-twig is held firmly with the left at the tip with the right at a distance of about half a metre or less from the end; and the part up to this point is twisted, the left hand being held steady, and the twist being made with the right hand, which holds the twig firmly and turns it away from the body. After this section has been firmly twisted, it is wound around the left hand. The right hand again takes hold of the twig a little further down, and continues to twist. When the twig begins to be too thick to be readily twisted, it is turned over at a distance of from 25 cm to 40 cm from the butt-end, according to the strength and length of the twigs. At this point it is sharply bent over by biting, so that the untwisted thick end of the twig lies close to the twisted part. Then the twisted end is taken off from the left hand, and, on being released, at once twists itself around the standing thick end of the twig. When the free twisted end reaches the thick end, it turns over and winds itself backward. Generally the twigs are made so long that the free end twists up and down four times. In this form the twigs are kept, and keep the twist (Fig. 69). They are generally kept in bundles of three or four pieces, which are tied up with thin cedar-withe, often with the end of one of the pieces, and they are tied together. The Indians reckon that a piece of withe as long as the width of the hand requires four full twists (1909:375).

Stick Loops

Seventeen cedar bough stick loops have been recovered from the excavations at Ozette Village. These are cedar boughs that have a twisted loop formed at their narrow end (see Figures 21 and 22). Some of these have simply had their ends twisted back around themselves in a loop, similar to the formation of wedge collars, and may very well constitute unfinished collars (Figure 21). However, some have clearly prepared and finished loops (Figure 22) and were intentionally finished forms. The function of these stick loops remains a question and is discussed below. The loop at the end of these sticks range in diameter from 2 to 9 cm, with a mean of 4.75 cm diameter and a standard deviation of 1.84 cm. These loops are on sticks that ranged in length from 7.3 to 66 cm long, with a mean of 22.72 cm long and a standard deviation of 16.22 cm (66 cm is an unusually long example).

Most of the Ozette Village stick loops had been discarded within the house floor midden or in the outside refuse midden. None is found in a recognizable functional context. There is, however, a noticable association between stick loop artifacts and broken, discarded arrow shafts and points. This may have been by chance only, but may indicate some sort of related hunting role for stick loops.

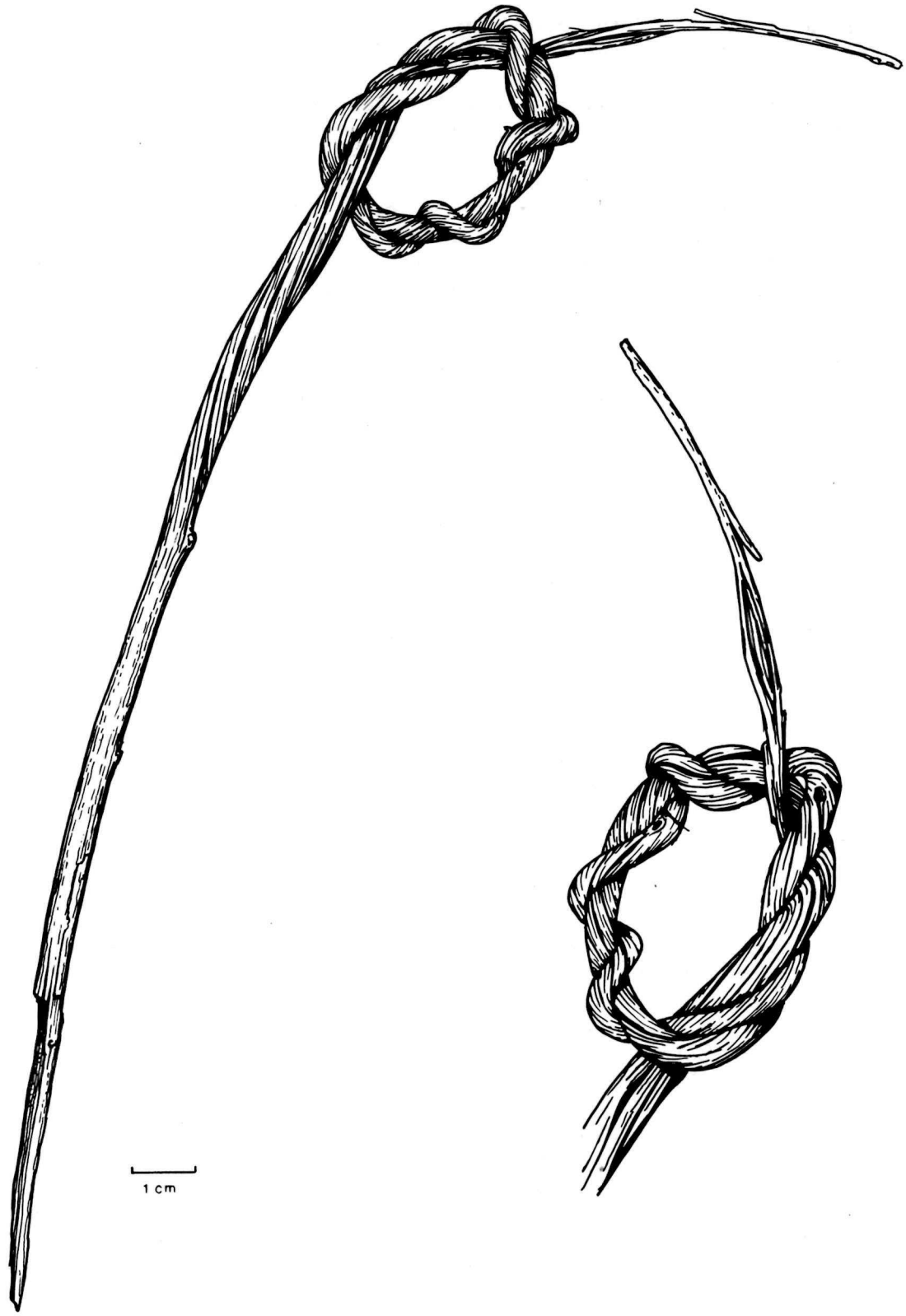


Figure 21. Twisted cedar bough stick loop (95/V/29).

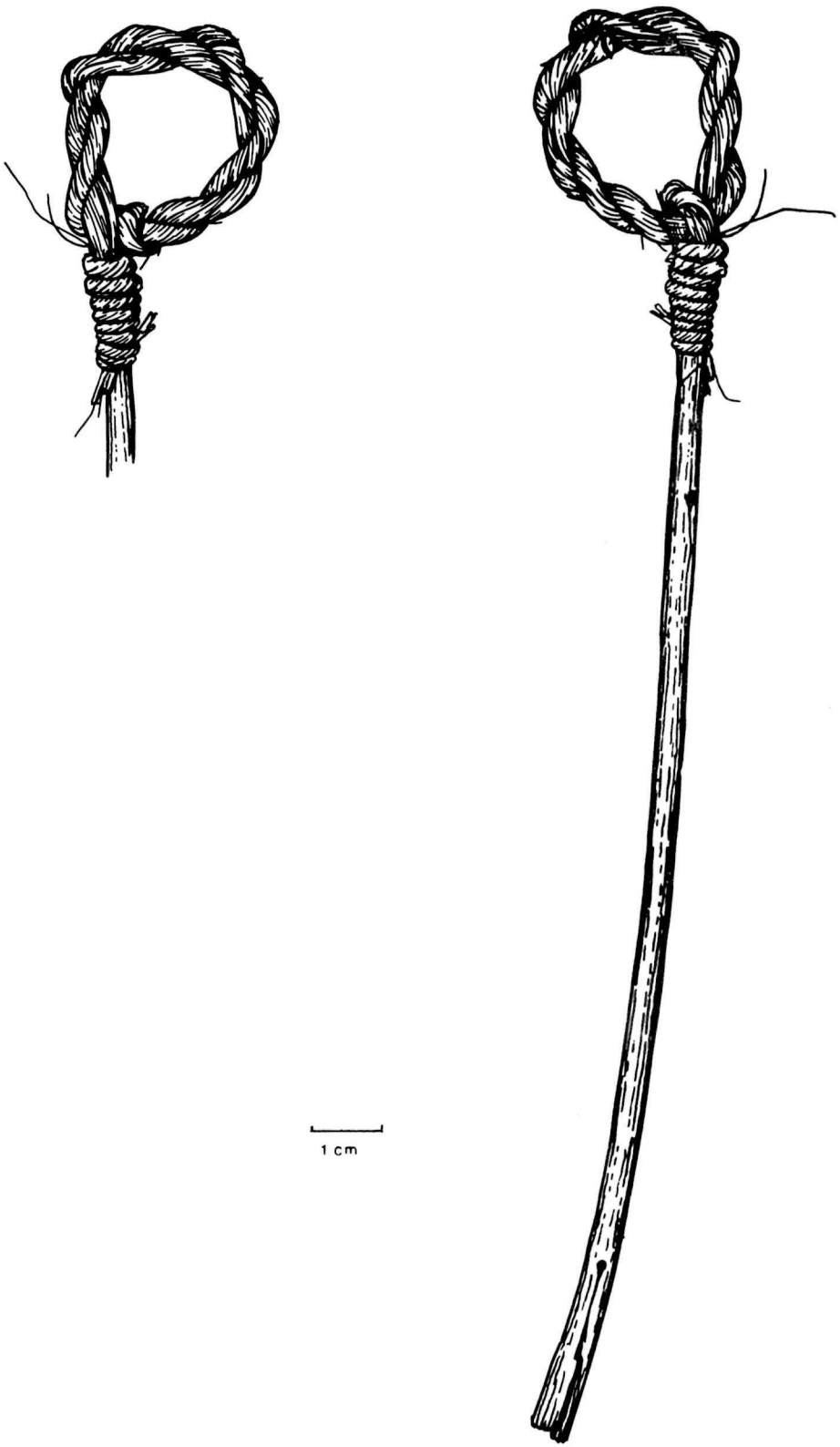


Figure 22. Twisted cedar bough stick loop with bound end (176/V/175).

In general distribution stick loops are found in many areas of the house floor matrix, and also concentration in some refuse midden areas immediately outside the south house wall (Map 9).

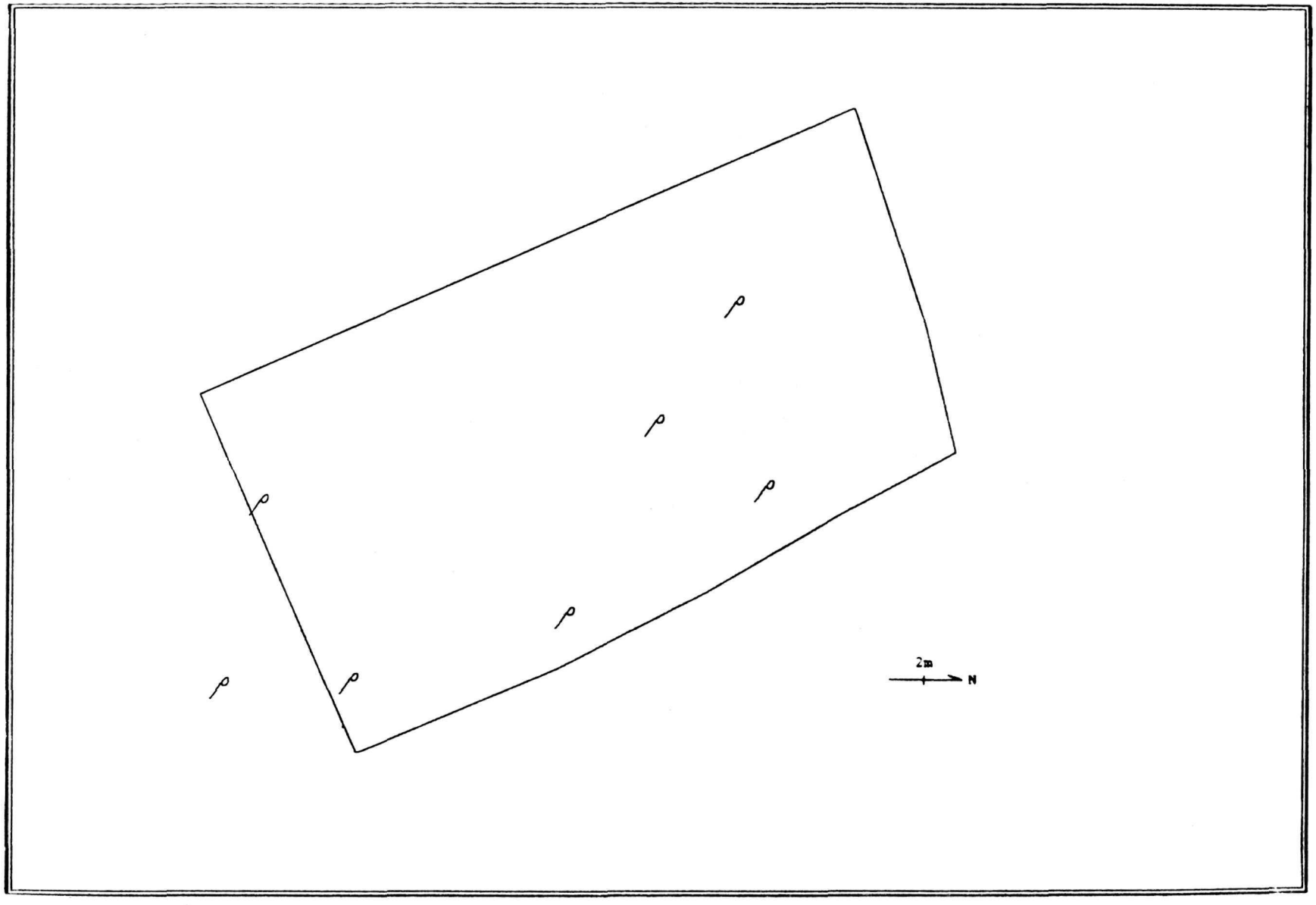
Ethnographically very little was recorded about this class of artifact. Boas described a type of stick loop used by the Kwakiutl as a snare for mountain goat hunting. This example was larger than most of the Ozette stick loops. Boas states:

> When the mountain-goat hunter goes up the mountain to hunt goats, he searches for thick, long cedar-withes. Sometimes these are two fathoms long and of the thickness of the fourth finger. They have no branches. He twistes them well, going toward the thick end. He steps on the top while he is twisting it; and when the piece that he has twisted is long he steps near the end of the twisted piece and continues twisting it. He does not stop until the whole length has been twisted; and he puts a knoted loop at one end. Now it forms a snare for catching goats where they have a single trail on a mountain (1913:173; also cf. Boas 1909:514-515).

William Penn, a Makah/Quileute senior citizen (91 years of age when interviewed) was an active land and sea mammal hunter when young. He observed these stick loops in the Ozette Project laboratory in Neah Bay, Washington. He independently felt these stick loops were involved in land mammal traps, possibly a triggering devise for deadfalls or snares. However, a positive identification was not made, and the actual role of Ozette Village stick loops remains in question. They might have been associated with some form of hunting activities, since similar forms were reported ethnographically and Ozette stick loops are frequently recovered associated with broken arrow shafts and points. And another suggestion is that these are the ends of halibut line spreaders, and the hook leaders were attached to the looped ends. Additional data are necessary for a definite identification.

Basket Handles

Seven detached multi-strand cedar bough basket handles (see definitions Figure 9, #B2, Croes 1977b:109) have been recovered from the Ozette House 1 area. These basket handles undoubtedly were once attached around the rims of baskets, such as Ozette basket classes OB 29, 30, 32, 33, 35, or 37 (Figure 25, Croes 1977b:203-210). These detached continuous looped handles are formed with two strands and have single elements hooked into loops at intervals where the handles would have once been attached to the basket rim. Many of these single handled loops still have remnants of the basket rim inside the loops. These detached basket handles had cordage diameters ranging from 0.7 to 1.3 cm with a mean of 1.0 cm diameter, and a standard deviation of 0.25 cm. In terms of manufacture these handles must have been made in a manner similar to two-strand cedar bough cordage, but as the two strands are plied together, one element would have been routinely brought under the basket rim and then reintegrated with the other element and ply twisted until the next single element was brought under the basket rim. In this manner the continuous looped handles were arranged around the top edge of a basket, with single strands attaching the handles along the mouth of the basket (see also Ozette Village Basket Functional Class Sets VI and VII, Croes 1977b:309, 321).



Map 9. Distribution of cedar bough stick loops in the Ozette House 1 area.

Multi-strand, Cedar Bough, Twisted Cordage (Cordage Techno-Functional Set II) from other Northwest Coast Wet Sites

All Northwest Coast wet sites had examples of two-strand, cedar bough, twisted cordage (subset IIa) and some had examples of three-plus strand cedar bough cordage (subset IIb). The overall frequencies of examples in each of the subsets (IIa and IIb) and the total set II are recorded in Table 24.

Most multi-strand, cedar bough cordage recorded at Northwest Coast wet sites is twisted with a Z lay. Ozette Village and Hoko River are the only sites with two-strand, cedar bough cordage with an S lay (contributing to only 1 percent of each collection). Ozette Village, Musqueam Northeast, and Lachane each have a few examples of three-plus strand, cedar bough cordage with an S lay.

Most examples from these wet sites are of cord gauge diameter with some in the string and rope gauge categories (see Table 17). Ozette Village, Musqueam Northeast, and Biederbost have rope gauge, three-strand, cedar bough cordage, and Ozette Village has 15 examples of three- and four-strand heavy-gauge rope. These large gauge ropes have functional implications concerning the activities at these sites and they will be discussed further below.

Knots are found on the multi-strand, cedar bough cordage from these sites, and their frequency of occurrence is recorded in Table 25. Most of the cordage was recovered without examples of knotting techniques.

Overhand knots are relatively frequent at Ozette Village and Musqueam Northeast. At Musqueam Northeast the common overhand knot is recorded on three-plus strand cedar bough cordage and this knot is associated with the construction of basket handles (as stopper knot; Croes 1975:25) and used to secure and finish wedge collars and small diameter circulettes. Often one or two overhand knots are tied in finishing the small diameter circulettes to secure the ends, and probably to help prevent them from unraveling.

Sheetbend knots are only recorded at Ozette Village and, again, commonly are found on loose, two-strand, cedar bough cordage used in tying house boards into place (above).

Square, granny, and figure eight knots and running nooses are infrequent, but do occur at some sites.

Hitches occur only at Ozette Village.

Wrapped whipping is found at Ozette Village, Hoko River, and Musqueam Northeast. Overhand whipping is recorded at Ozette Village, Hoko River, and Biederbost.

A wide variety of cordage forms are constructed with this type of cordage. The forms and frequencies of occurrence are recorded in Table 26. Each of these cordage forms, including the comparisons among sites, is discussed below.

TABLE 24--Frequency of Cordage Examples in Functional Subsets IIa and IIb and Total of Set II Recorded from Northwest Coast Wet Sites

Site	Equivalent Functional Class Sets	#	Percent of Collection
Subset IIa			
1. Ozette Village	/OC2, OC3/	297	16
2. Hoko River	/HO-C2, HO-C3/	47	9
3. Musqueam Northeast	/MU-C2/	16	15
4. Biederbost	/BI-C2/	20	34
5. Axeti	/AX-C2/	3	0
6. Lachane	/LA-C2/	3	13
7. Conway	/CO-C2/	5	42
8. Fishtown	/FI-C2/	1	11
9. Wapato Creek	/WA-C2/	1	100
10. Little Qualicum River	/QU-C2/	6	13
Subset IIb			
1. Ozette Village	/OC4,OC5,OC6,OC7,OC8/	188	10
2. Hoko River	/HO-C4/	5	1
3. Musqueam Northeast	/MU-C4,MU-C5,MU-C6,MU-C8/	41	38
4. Biederbost	/BI-C4/	10	16
5. Lachane	/LA-C7/	1	4
6. Little Qualicum River	/QU-C4/	2	4
Total Set II			
1. Ozette Village	/OC2,OC3,OC4,OC5,OC6, OC7,OC8/	485	26
2. Hoko River	/HO-C2,HO-C3,HO-4/	52	10
3. Musqueam Northeast	/MU-C2;MU-C4,MU-C5, MU-C6,MU-C8/	57	53
4. Biederbost	/BI-C2; BI-C4/	30	50
5. Axeti	/AX-C2/	3	0
6. Lachane	/LA-C2; LA-C7/	4	17
7. Conway	/CO-C2/	5	42
8. Fishtown	/FI-C2/	1	11
9. Wapato Creek	/WA-C2/	1	100
10. Little Qualicum River	/QU-C2/	8	17

TABLE 25--Knotting Techniques Recorded on Multi-strand, Cedar Bough, Twisted Cordage (Functional Class Set II) from Northwest Coast Wet Sites. (Percent frequency recorded in parentheses).

Knotting Techniques	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
no knotting techniques	401 (83)	45 (86)	48 (84)	28 (94)	3 (100)	4 (100)	5 (100)	1 (100)		5 (62)
Knots										
1. overhand	22 (5)	2 (4)	7 (12)	1 (3)					1 (100)	
2. sheetbend	28 (6)									
3. square	1 (0)		1 (2)							1 (13)
4. granny	1 (0)	1 (2)								
5. figure eight	1 (0)									
6. running noose	4 (1)	1 (2)								
Hitches										
1. clove	6 (1)									
2. half	3 (1)									
Whips										
1. wrapped whip	11 (2)	1 (2)	1 (2)							
2. overhand whip	7 (1)	2 (4)		1 (3)						2 (25)
TOTAL	485	52	57	30	3	4	5	1	1	8

TABLE 26--Cordage Forms Recorded for Multi-strand, Cedar Bough, Twisted Cordage (Functional Class Set II) from Northwest Coast Wet Sites. (Percent frequency recorded in parentheses).

Cordage Forms	Ozette Village	Hoko River	Musqueam Northeast	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
1. Lines	346 (71)	42 (80)	40 (72)	21 (70)	2 (67)	3 (75)	4 (80)		1 (100)	8 (100)
2. Wedge Collars	73 (15)	8 (16)	9 (15)	2 (7)	1 (33)	1 (25)				
3. Large diameter circulettes	9 (2)	1 (2)	1 (2)	2 (7)				1 (100)		
4. Small diameter circulettes			5 (8)	3 (10)						
5. Cedar bough storage bundles	33 (7)	1 (2)		1 (3)						
6. stick loops	17 (4)									
7. Basket handles	7 (1)		2 (3)	1 (3)			1 (20)			
TOTAL	485	52	57	30	3	4	5	1	1	8

Lines. Lines are the most frequently recorded form of multi-strand, cedar bough, twisted cordage (Table 26). As mentioned earlier, this cordage is rated as very strong with considerable tensile strength. Two-strand, cedar bough, twisted cordage lines have been found at most sites, though there is considerable differences in absolute and percent frequencies of occurrence (Table 27). Of sites with a cordage sample size over 20 examples, those with the most emphasis on the use of multi-strand cedar bough cordage (Set II) are Ozette Village, Hoko River, Musqueam Northeast, Biederbost and Little Qualicum River. In fact these were the only sites with occurrences of three- and three-plus strand, cedar bough cordage lines. At Ozette Village the well formed two-strand and three-plus strand cords and ropes are used as (1) harpoon lines and probably (2) for moving and positioning house and other timbers, (3) for towing canoes and sea mammals, and (4) for other general purposes. The three-strand, cedar bough cord and ropemaking technology evidently was well developed at least for the last 3000 years in this southern region of the Northwest Coast. Musqueam Northeast in particular has the highest percent frequency of well formed, three-strand, cedar bough cordage (Table 27), followed next in frequency by the other early Puget Sound/Gulf of Georgia site, Biederbost. Especially long lengths of these ropes are recorded at these sites, e.g., Musqueam Northeast--155 cm (approximately 5 ft) and Biederbost--233 cm (approximately 8 ft). These well-formed, three-strand cords and ropes at these early sites are of general interest since ethnographically this class and "grade" of cordage generally is considered a technology of south-central west coast groups. For example, when considering the ethnobotany of western Washington groups, Gunther states:

> The heavier grades are used by the whale-hunting tribes like the Quinault, Quileute, and Makah for towing home dead whales. It has remarkable strength (1945:20).

And Boas, when discussing the Kwakiutl three-strand, cedar bough cordage states:

> Much better rope of the same sort is made by the Nootka and Quilleyut, who use it extensively for whaling-lines (1909:380).

The ethnographic distribution of three-strand, cedar bough cord and ropemaking technologies should be examined since the pattern emerging tends to indicate that this specific ropemaking technology is attributed to south-central west coast sea mammal hunters. In considering this well-developed and strongly emphasized technology at the early Musqueam Northeast and Biederbost sites, the prehistoric context of these sites should be further considered. The lower wet zone of Musqueam Northeast is directly below a Locarno Beach Phase component (Borden 1976:233). Diagnostic of this phase are different forms of toggling harpoons of wapiti antler, harpoon blades, and harpoon foreshafts. Also remains of seal, sea lion and porpoise recovered from components of this phase strongly suggest the active hunting of these sea mammals with harpoons (Borden 1950, 1951, 1970, 1976: 248-251). One major function of the common Musqueam Northeast rope-gauge, three-strand lines may have been as harpoon lines (as was common at Ozette Village and historically in the south-central west coast areas). As one

Table 27. Frequency of 2-strand (Subset IIa) and 3 + strand (Subset IIb) cedar bough, twisted cordage lines recorded from Northwest Coast wet sites. (Percents are of total collection).

Site	IIa #	IIa %	IIb #	IIb %	Total of II #
1. Ozette Village	241	70	105	30	346
2. Hoko River	40	95	2	5	42
3. Musqueam Northeast	12	30	28	70	40
4. Biederbost	13	62	8	38	21
5. Axeti	2	100	0	0	2
6. Lachane	3	100	0	0	3
7. Conway	4	100	0	0	4
8. Wapato Creek	1	100	0	0	1
9. Little Qualicum River	6	75	2	25	8

possibility, harpooning activities at Musqueam Northeast may have been associated with the net fishing activities at the site. Seals may have been attracted to this specific location because of the net fishing--a typical problem for fishermen using nets--allowing them to be harpooned (Croes 1975:58; Borden 1976:248-251). This activity-specific possibility is one explanation for the high frequency of these ropes at the Musqueam Northeast location. A test of this suggestion would be to analyze the frequency of seal and other sea mammal remains occurring at this site location. Since Biederbost basketry technologies appeared to be related to those from Musqueam Northeast, and both sites had a similar stress on three-strand cedar bough ropes, the ropes at Biederbost may also be partially related to harpooning activities at that site. Unfortunately, bone artifacts and faunal remains do not preserve well, and direct evidence of harpooning equipment and activities are not evident in the artifact collection. Certainly the three-strand, cedar bough lines occurring at all these sites were used for several purposes, but at the associated Musqueam Northeast and Biederbost sites, where there is a particular stress on the larger gauge ropemaking technology, these lines may be associated with harpooning activities as indicated by the early Gulf of Georgia Locarno Beach Phase materials. The examples of the larger heavy-gauge ropes of the subset at Ozette Village (Figure 7)

reflect the eventual development of hunting the largest sea mammal, whales which was common on the historic south-central west coast. It is unlikely that these data reflect any cultural relationships through time, and it probably is the result of similar procurement and other activities.

Two-strand, cedar bough, twisted cordage (subset IIa) found at most sites probably was used for more general tying and securing purposes. At Ozette Village in particular most cordage of this subset is loosely formed and often used in tying house components in place.

Wedge Collars. Wood wedge collars, independent from the wedges, are recorded at most Northwest Coast wet sites (Table 26). Sites that did not have independent collars often have examples recorded on wooden wedges.

Wedge collars are recorded composed of from two to five strands. By far the most common examples are of three strands. The number of strands composing a collar is somewhat dependent on the length of the original cedar bough, and how many times it would have been plied around the circular loop that is formed.

Most wedge collars are formed with a Z lay, however four from Ozette Village, two from Musqueam Northeast, and a single example from Lachane have an S lay.

The average diameter of the actual cordage in the collars is approximately 1.0 cm, or of cord gauge. And collars range from 3 to 9 cm in actual diameter, with an average of approximately 4.5 cm diameter.

At most sites the pressure of the plied cedar bough composing the collars kept the collar from unraveling. However, some examples from Musqueam Northeast had an overhand knot to further secure the form.

As indicated above, wooden wedges with collars historically are recorded used by the Nootkan, Kwakiutl, Bella Coola, Tsimshian, and Haida groups; the only groups recorded using wooden wedges without cordage collars are the Tlingit (Drucker 1950:183). The prehistoric data add considerable time depth to the use of this specific form of woodworking tool. Historically wooden wedges basically are used for (1) splitting boards (especially for housing and boxes), and (2) removing wood from large carved timbers (i.e., dugout canoes, large bowls, etc.). Small wedges also are recorded used in splitting firewood in the house (cf. Boas 1909: 323-325). The collars and wooden wedges recorded at early sites, such as Musqueam Northeast and Hoko River, potentially suggest the construction of planks for dwellings and/or splitting out dugout canoes at least 3,000 years before present (cf. Croes 1976d:293).

Large Diameter Circulettes. Large diameter, multi-strand circulettes are recorded from most Northwest Coast wet sites (Table 26). These rounded loops are too large to function as wedge collars, varying from 6 to 23 cm in diameter with an average of approximately 14 cm diameter. Actual

cordage diameters of the circulettes usually is of cord to rope size gauge. All had a Z lay. Two- and three-strand examples are recorded.

The actual functions of the larger circulettes remain questionable. At Ozette Village some are recorded bracing adjacent house poles together (above). This and several other functions may have been performed by these larger cordage loops.

Small Diameter Circulettes. Smaller diameter, narrow gauge circulettes are recorded at Musqueam Northeast and Biederbost. These small circulettes usually are of string gauge size, too narrow to have been adequate wooden wedge collars. They usually are of three-strand ply and approximately 3.5 to 6 cm in circular diameter. The Musqueam Northeast examples commonly are finished and secured with two overhand knots. The actual function of these small circulettes remains questionable (cf. Croes 1975:50, 59).

Cedar Bough Storage Bundles. Storage bundles, as made at Ozette Village site, are recorded at Hoko River and Biederbost. Other sites probably also stored twisted lengths of cedar bough in a similar manner, but examples are not recorded.

Stick Loops. Stick loops, as recovered at Ozette Village, are not recorded from other Northwest Coast wet sites.

Basket Handles. Multi-strand, cedar bough, basket handles, separated from baskets, are recorded at Ozette Village, Musqueam Northeast, Biederbost and Conway. As is the case for baskets from Musqueam Northeast, Biederbost and Conway, separated basket handles typically are single cordage loop handles (see Croes 1977b:116; Fig. 10, B.1). Some still have fragments of the basket rim or reinforcement row in their looped ends. The examples from Musqueam Northeast and Biederbost are of three-strand construction, and one example from Musqueam Northeast has a stopper overhand knot at one end (see Croes 1977b:116; Fig. 10, D). The Conway example is of two-strand construction. The Ozette Village examples, as described above, are the continuous loop, two-strand handles.

Summary

Multi-strand, cedar bough, twisted cordage is found at most Northwest Coast wet sites. A general emphasis on this kind of cordage is noted in the southern sites, and particularly at Musqueam Northeast, Biederbost, Little Qualicum River, Hoko River, and Ozette Village. The northern sites of Axeti and Lachane have a lower frequency of this functional class set of cordage. In contrast, and as will be discussed in the following section, both of these northern sites (particularly Axeti) have an emphasis on multi-strand, cedar bark, twisted cordage.

Well-formed, three-strand, cedar bough cords and ropes are only recorded and in higher frequencies at the early sites of Musqueam Northeast, Biederbost and the later site of Ozette Village. Musqueam Northeast in particular has a high percent frequency of this subset. In the historic west coast context, the strong, longer, well-formed, cedar bough ropes for one are commonly used as harpoon lines. Because of the concentration of these ropes at Musqueam Northeast, a Locarno Beach Phase associated site, these ropes may well have been used, at least in part, as harpoon lines and possibly at other sites as well.

The examples of ropemaking techniques and forms discussed in this section (Techno-functional Set II) indicates close degrees of similarity in technique at most sites over the past 3000 years. This substantial period of time indicates a long, well-established ropemaking technology with little change. The only major change in three-strand, cedar bough, twisted ropes from Musqueam Northeast (approximately 3000 years B.P.), Biederbost (approximately 2000 years B.P.) and Ozette Village (approximately 400 years B.P.) is a slight increase in diameter gauge sizes--which may reflect a functional evolution, i.e., resulting from the highly developed whale hunting at Ozette Village. Multi-strand, cedar bough, wedge collars essentially remained unchanged at most Northwest Coast wet sites for 3000 years. This indicates at least a 3000-year continuity of this form of wood splitting technology and adds support to the hypothesis that plank dwellings and/or dugout canoes are being constructed during this time period. Therefore, two basic conclusions can be reached:

1. specific multi-strand, cedar bough ropemaking technologies (including the forming of wedge collars) was established early on the Northwest Coast and has undergone only slight modification; and

2. ropemaking technologies and forms in this area, unlike basketry techniques and forms, are not as stylistically sensitive an indicator of techni-cultural variability through time and across space. These techniques and forms, especially in southern Northwest Coast areas, are widespread and well-established as early as 3000 years ago. These data suggest widespread technological and functional (vs. potential "cultural") continuity of some ropemaking techniques on the Northwest Coast.

Set III. Two- and Three-Strand, Cedar Bark, Twisted Cordage /OC9, OC10, OC11, OC12/

Cordage in this techno-functional set is common (n = 247). The vast majority of these are twisted two-strand pieces, with only two (an OC11 and an OC12) composed of three strands (see Figure 7). The main difference between classes OC9 and OC10 is the lay of the twisted cordage: OC9 specimens (n = 56, 23 percent of set III) are Z laid, and OC10 specimens, the most common class (n = 189, 77 percent of set III), are S laid. The majority are S laid in contrast to the other frequent twisted cordage set (II), which typically is Z laid (also see section on lay of Ozette

cordage p. 25). This difference appears to correlate with the different cordage materials and gauges characteristic of these two sets; set II is cedar bough cordage and generally of a cord to rope gauge, and, in contrast, set III is cedar bark cordage and generally of a smaller, usually string gauge size. In terms of diameter, set III cordage has a range from 0.1 to 1.0 cm diameter, with a mean of 0.34 cm diameter and a standard deviation of 0.16 cm. This mean is well within the established definition for string gauge cordage (0.1 to 0.5 cm diameter). Of the examples, 228 or 92 percent are string gauge. The remaining 19 or 8 percent are of cord gauge diameter and none are rope or heavy-gauge rope diameter. Therefore, most of the set III cordage is strings. This cordage has been constructed of cedar bark that has been lightly shredded into fibers and reintegrated into cordage strands and plied into two-strand cordage. This process creates cedar bark strings that are very flexible and smooth. The cordage in this class set is recorded with three forms: as lines, as "clothing" warp strings, and as bound cordage storage bundles. The individual lines are most common (193 or 78 percent of the cordage) and consist mostly of cedar bark strings, usually found separately around the House 1 area. The "clothing" warp strings are large concentrations of cedar bark strings found in clumps and with the strings aligned one alongside one another. These large numbers of aligned strings (considered one artifact here) appear to represent warps that were once woven together with hair or other animal matter. Since large numbers of distinct clothing examples have not been recovered from Ozette Village, these cedar bark warp strings are considered the most probably example of clothing. This clothing may have taken the form of blankets or tailored capes and/or dresses. The string alignments are relatively common, representing 48 or 19 percent of all set III string examples. These clumps of aligned strings commonly are large, and contained literally hundreds of strings (below). Since "clothing" warp string clumps are considered as single discrete artifacts (though they consisted of sometimes hundreds of individual strings) and they constitute approximately one-fifth of the cedar bark string recovered, it is entirely possible that many, if not most, of the individual cedar bark strings recovered from around the House 1 area were once a part of "clothing" warps or were being prepared for use as "clothing" warps. Certainly most of them might have fragmented from some form of textile as represented by the "clothing" warp forms. Probably they occasionally were used separately as strings for various tying purposes, but few have been found used in this way. The "clothing" warp strings and lines are considered separately below.

"Clothing" Warps

In horizontal surface dimensions the clumps of "clothing" warp strings range from 0.29 to 20.5 square decimeters, with a mean of 4.61, and a standard deviation of 4.5 square decimeters. The actual size of these clothing examples is not accurately represented since the concentrations usually represent multiple folds of the layers of strings. If they could be unfolded, they would be much larger in area. These measurements are about as informative as would be the surface dimensions of a tightly folded blanket. In any case, many of these concentrations are fragmented, small pieces. They are composed of strings that usually have an S lay (45 examples or 94 percent). As mentioned, these warp elements

probably were held together by a weft element of animal matter that did not preserve: likely materials include dog hair, mountain goat hair, sinew, bird skins, and/or other skin strips. These woven garments probably represent the main form of Ozette clothing (if clothing was of skins, however, these would not have preserved at all).

In distribution, most of the "clothing" warp concentrations recovered from the House 1 area were along the inside wall areas (Map 10). Those examples that appear to have been in use at the time of the mudslide were (1) on bench platforms, (2) under or alongside of bench platforms, or (3) possibly stored within the badly broken boxes. Those found within the house floor midden or outside refuse midden undoubtedly had been discarded (Map 10).

Ethnographic mention is made of capes or blankets that might have been made with cedar bark string warps. Swan records that the Makahs made blankets of thread warps, probably of cedar bark, as he mentioned that threads were made of cedar bark in an earlier context, and wrapped with bird skins. He wrote:

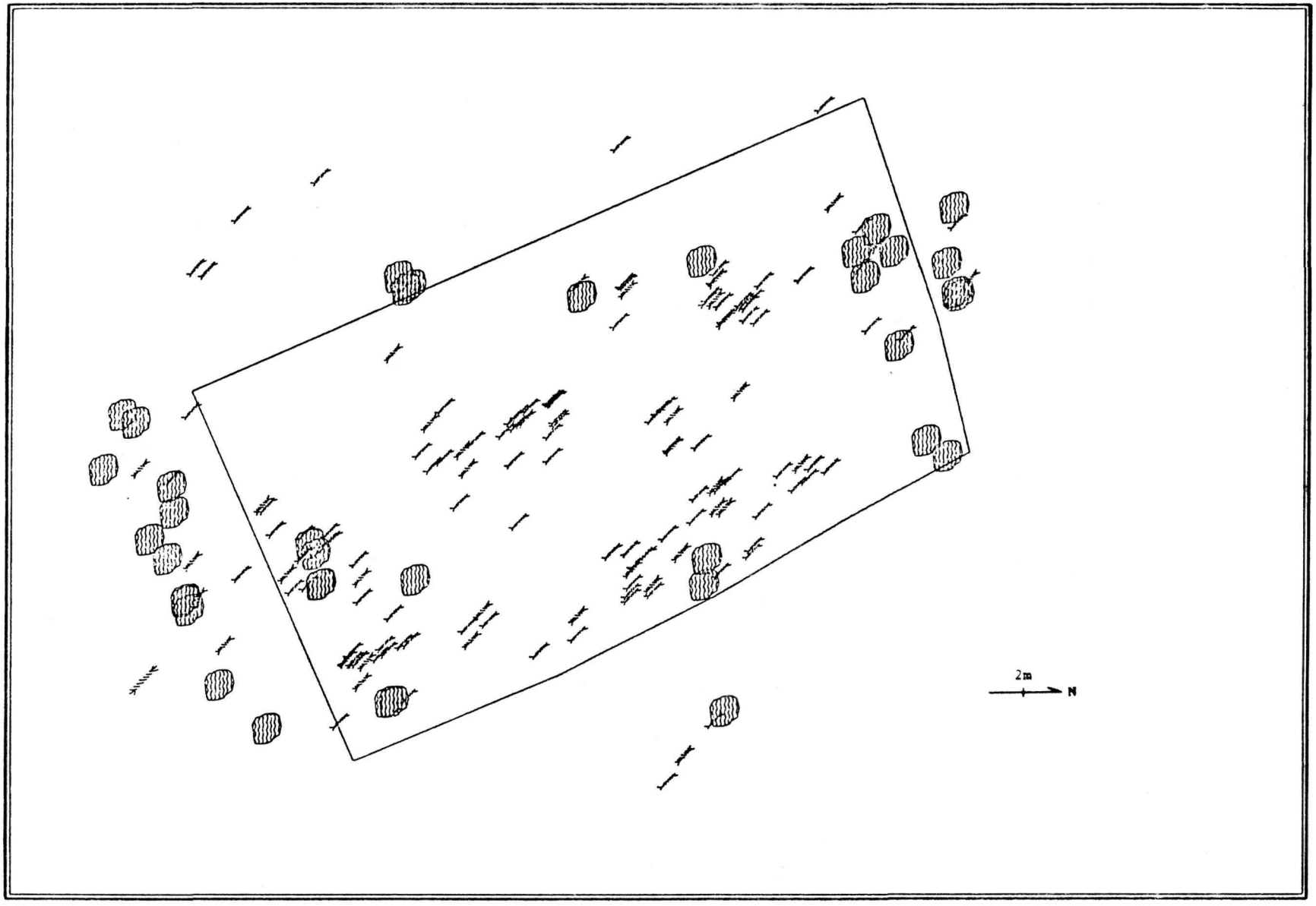
> Blankets are not only made of feathers, or rather down, and dog's hair, but also of cedar bark. The method of manufacturing the first named is to select a bird that has plenty of down, and, first picking out all the feathers carefully, to skin it, and then dry the skin with down on. When a sufficient number have been prepared they are slightly moistened, then cut into narrow strips, each one of which is twisted around a thread, leaving the down outside, which thus forms a round cord of down resembling a lady's fur boa. This is woven with twine and forms a compact, light, and very warm blanket (1869:43-44).

A blanket made in this manner was examined by the author at the Smithsonian Museum (U.S.N.M. 1894A, collected by Admiral G. Wilkes). This blanket has warps that appear to have been cedar bark strings wrapped with bird skins. The weft appears to have been of a sinew-like material and is barely visible. This cape or blanket is very thick and soft as well as compact, light and warm as mentioned by Swan. If some of the Ozette "clothing" warp strings were once part of this kind of blanket, then the bird skin/down wrapping and the sinew weft would have decomposed leaving, as is the case, only the cedar bark warp strings. Waterman also describes this same Smithsonian blanket as:

> A shoulder cape of eider down is shown in pl. XIX. . . . It is composed of twined weaving of dog and mountain goat yarn (?) with which are incorporated strips of down-bearing skin of the duck. The weft consists of a small cord of dark fiber. Width 31", length 52" (1973:36).

Reverend Eells possibly records a similar blanket for the Clallam, Twana, and Chemakum:

> Another blanket was made by them from the inner bark of the cedar, slightly beaten and woven, the strings made of goose feathers (1887:630).



Map 10. Distribution of cedar bark strings and "clothing" warp strings in the Ozette House 1 area.

And Gunther, while describing museum specimens collected by early explorers, records:

> 23. Blanket
>
> No location. Ireland, no number, Cook expedition, 1778, King collection.
>
> The blanket has a two-ply cedar bark warp with a very hard twist. It is loosely woven with the wefts ½" apart. There are borders at the top and bottom, worked in a geometric design. There is a braided border at the sides. Length: 40.5"; width 57", fringe: 7 7/8" (1972:208; Appendix 1).

Unfortunately, the exact weft material is not reported.

So, essentially two forms of blankets or capes are recorded that might have represented the original form of Ozette "clothing" warp string blankets or capes. One is with string warps wrapped with strips of bird-skins with down still attached. This blanket was twined with sinew and/or dog hair yarn. The second form is a plain cedar bark string warp twined together with an open twining of dog or mountain goat hair. In these blanket forms, all construction materials, except the cedar bark warp strings, are of animal matter and would not have preserved at Ozette. Certainly other weave techniques and elements of animal matter may have been used to hold together Ozette "clothing" warp strings, but the main conclusion is that they probably do represent clothing.

Individual Cedar Bark Two- and Three-Strand Lines

As mentioned, the vast majority of the lines are two strand, with only two examples having three strands. These cedar bark lines range in length from 1 to 94 cm long with a mean of 14.7 cm and a standard deviation of 12.9 cm long. These generally are rather small, fragmented pieces of string, most of which have an S lay (141 specimens or 73 percent). The majority of these cordage lines were recovered in unit V or the stratigraphic level below the occupation surface at Ozette (94 percent or 183 specimens) and located in strata within the house floor matrix or outside refuse midden. A few (n = 11, 6 percent) appear to have been in use at the time of the Ozette mudslide. Of these eleven, those with recorded locations (Map 10) usually were recovered along the wall, intermixed with other stored artifacts. Some were clustered (40/IV/121, 122, 129) under a bench platform and closely associated with other raw materials and a stored loom. None was found tying anything together, though some were recovered wrapped around sticks or tools (see below). The numerous examples recovered in unit V and lower levels, mostly appear to be from within the House 1 walls (Map 10). Many of these lost or discarded strings also cluster together, e.g., those in square 107 (see Map 10), and may again have been fragments of "clothing" warps. These strings and some cords certainly functioned in different ways, but many of the individual strings probably also were made for, or were once part of, warps of blankets, capes, or clothing, since one-fifth of all these strings are found in the large "clothing" warp concentrations referred to above.

Several knots are associated with the Ozette strings. These include granny (n = 2), square (n = 1), sheetbends (n = 3), overhands (n = 9), and a combination of granny and overhand (n = 1), overhand whip and overhand (n = 2), sheetbend and overhand whip (n = 2), and overhand whips (n = 6).

Ethnographically little is mentioned of cedar bark strings or cords. However, Boas does describe the manufacture of multi-strand cedar bark ropes or cords for the Kwakiutl. Since nineteen of the cordage examples in this set are of cord gauge size diameter, and one of these is three strand, and since some of the procedures for manufacturing two-strand cedar bark strings might have been similar to the Kwakiutl manufacture technique, this process is quoted:

> Other ropes are made of cedar-bark. These are made by women. The bark of the red cedar is cut into strips from 3 mm to 5 mm wide. A bundle of these, which is to form one of the strands of the rope, is held firmly in the left, and twisted to the right. Three bundles of this kind are started, and are then tied together. About 30-40 cm of each strand are twisted in this way, and then they are coiled firmly together; the end from which the rope-working begins being generally held with the big toe of the right foot. While the twisting of the rope continues, the untwisted cedar-bark which is to be made into the strands is folded up and tied in the middle; and when the twisting of the strands continues, the untwisted end of one of the strands is tied firmly around the unfinished rope to prevent it from untwisting (Fig. 70). This kind of rope is used extensively for fish-lines, carrying-straps, and also for heavy ropes. These are often made of five strands. The material is easily spliced by putting in additional strands of bark (Boas 1909:381).

The Kwakiutl were using this cedar bark material to make their much heavier ropes.

Bound Cordage

Five bound cordage forms were recovered from the House 1 area. All were found within the House 1 walls. The bound cordage consists of cedar bark string that had been bound around and around itself or a rough strip of cedar bark, forming a "ball" of string. These bound cordage examples probably functioned as storage "balls" until the string was needed (like a modern ball of string). The bound strings usually were located with other stored items along the wall areas of House 1. In the ethnographic literature Waterman illustrates a similar item, though bound in a coil, as a coil of warp strings (1973:Plate X). This suggests that Ozette "balls" of cedar bark strings were stored for later use as "clothing" warp strings.

Summary

The cordage set III basically consists of strings made from cedar bark and often with an S lay. They appear to have been used as warps in blankets or clothing. Independent strings recovered from around the house probably were fragmented pieces of warp strings, or strings being stored, as on the bound cordage forms, for later use as warp strings.

Cedar Bark, Two- and Three-Strand, Twisted Cordage (Set III) Recorded at other Northwest Coast Wet Sites

Many wet sites have examples of two-strand, cedar bark, twisted cordage and some have examples of three-strand. The overall frequency of two- and three-strand examples, and the total set III are recorded in Table 28.

Ozette Village and Hoko River are the only sites with examples with an S lay (OC10, OC12 and HO-C10) but at Ozette Village these are the majority of set III cordage examples.

At sites with set III cordage, the cordage diameter gauge sizes varied from a dominance of string gauge size (Ozette Village and Musqueam Northeast) to cord and rope gauge sizes (Axeti) (Table 29). These emphasized differences in cordage sizes have functional implications for set III cordage and is discussed below.

Knots that occur on set III cordage from these sites are recorded in Table 30. Most of the cordage found was without knots. However, a high percentage of Axeti cordage (11 percent) has knots, whips, and/or hitches, mostly overhand knots and whips.

A limited number of cordage forms were constructed with two- and three-strand, cedar bark twisted cordage. The cordage forms and frequencies of occurrence are recorded in Table 31. Each of these cordage forms and the comparisons between sites is discussed separately below.

Lines. Lines are the main form of this cordage occurring at Hoko River, Axeti, and Lachane. Approximately 80 percent of the cordage at Ozette Village and Musqueam Northeast is of this class, and 20 percent (a relatively high frequency) of two distinct cordage forms: (1) Ozette Village: "clothing" warp strings and (2) Musqueam Northeast: nets. All three forms are of string gauge. Very likely, many of the lines recovered at these two sites were fragmented pieces originally from "clothing" warp concentrations and nets.

The lines from Axeti and Lachane are mainly cords and ropes and some heavy-gauge ropes (Table 29). A considerable number were three-strand examples of large cords and ropes (Table 28). These large gauge lines are the main cords and ropes from the site (especially at Axeti where these contributed over 80 percent of the collection). This northern site emphasis on multi-strand, cedar bark, twisted cords and ropes is different from the southern emphasis on multi-strand, cedar bough, twisted

Table 28. Frequency of cordage examples in functional set III recorded from Northwest Coast wet sites. (Percents are of total collection).

	Site	Equivalent Functional Sets	2-strand #	2-strand %	3-strand #	3-strand %	Total #	Total %
1.	Ozette Village	/OC9, OC10, OC11, OC12/	245	(12)	2	(0)	247	(12)
2.	Hoko River	/HO-C9, HO-C10/	7	(1)			7	(1)
3.	Musqueam Northeast	/MU-C9/	22	(20)			22	(20)
4.	Axeti	/AX-C9, AX-C11/	501	(76)	57	(9)	558	(85)
5.	Lachane	/LA-C9, LA-C11/	5	(22)	5	(22)	10	(44)
6.	Little Qualicum River	/QU-C9/	9	(19)			9	(19)

Table 29. Frequency of cordage gauge sizes in functional set III recorded from Northwest Coast wet sites. (Percents are of total collection).

	Site	String #	String %	Cord #	Cord %	Rope #	Rope %	Heavy gauge rope #	Heavy gauge rope %	Total
1.	Ozette Village	227	(11)	20	(1)					247
2.	Hoko River	2	(0)	3	(1)	2	(0)			7
3.	Musqueam Northeast	20	(18)	2	(2)					22
4.	Axeti	51	(8)	412	(62)	73	(12)	22	(3)	558
5.	Lachane	2	(9)	8	(35)					10
6.	Little Qualicum River	4	(9)	5	(10)					9

Table 30--Occurrence of knotting techniques recorded on Set III cordage from Northwest Coast wet sites.

	Ozette Village	Hoko River	Musqueam Northeast	Axeti	Lachane	Little Qualicum River
None Recorded	218	2	17	465	8	4
KNOTS						
Overhand	11	3		43	2	2
Sheetbend	5			18		
Granny	3			6		3
Square	1		5	4		
Figure 8		1		1		
HITCHES						
Clove				2		
Cow hitch				2		
WHIPS						
Overhand	9	1		17		

Table 31. Frequency of cordage forms in functional set III recorded from Northwest Coast wet sites. (Percent of occurrence in parentheses.)

1.	Lines	193 (78)	7 (100)	17 (77)	557 (100)	10 (100)	9 (100)
2.	"Clothing" Warps	48 (19)					
3.	Bound Cordage	6 (3)			1 (0)		
4.	Nets			5 (23)			

twisted cords and ropes. The northern cedar bark cords and ropes may have been used in many of the same ways as cedar bough examples in southern sites. Ethnographically, Drucker reported the use of cedar bark cords as sealing harpoon lines by some Kwakiutl groups and by the Tsimshian (1950: 171). This was the common function assigned to cedar bough ropes on the south-central coast. The use of cedar bark as harpoon lines, and as general cords and ropes, may have been a northern pattern. This north vs. south distribution pattern of different cord and rope construction materials is not the result of different floral environments since the same plant is used (Western Red Cedar) just different parts are used (bark vs. bough). The stress on cedar bark cordage materials associates the cordage technologies of the northern sites giving them the highest degree of similarity (Figures 8 and 9). Hypothetically this pattern may have persisted until contact, providing approximately 2,000 years of potential continuity. More sites and testing are necessary to evaluate this proposed and hypothetical pattern.

The extremely high concentration of cedar bark twisted cordage at Axeti probably has direct functional implications. In this village site, housing and possibly a boardwalk were situated close to the wet site deposits. Many of the numerous pieces of cordage may have been used to tie house parts together and other structural components into place. However, fewer joining knots (e.g., sheetbends) occur than would be expected. Fishweirs and hunting of seal with cedar bark harpoon lines may also have been common at this site.

"Clothing" Warp Strings. As discussed above, these concentrations of aligned strings comprise approximately 20 percent of the cedar bark strings recovered at Ozette Village. However, such string alignments have not been recovered from other sites.

Bound Cordage. Ozette Village and Axeti (n = 1) have examples of cedar bark strings bound into string "balls," apparently for later use.

Nets. Musqueam Northeast has numerous examples of net fragments, contributing to over 20 percent of the cedar bark strings. Many of the independent two-strand strings probably were from fragmented nets. The net knots are square knots (see Table 30), as is the case with Ozette Village spruce root and Hoko River spruce splints nets (below). These nets have a wide mesh gauge, averaging 6 to 9 cm between knots, or a 2½ to 3½ inch meshes. As suggested elsewhere, these nets were probably being used in salmon fishing at Musqueam Northeast (Croes 1975:59). They may be examples of early gill nets because of their mesh gauge size (ibid.). Historically many Salishan, especially in this Gulf of Georgia area, had developed sophisticated reef-net and other net fishing procurement technologies (cf. Mitchell 1971:26-30). The early net-making and net-fishing technology at Musqueam Northeast indicates an early development. As more, and possibly earlier wet sites are discovered and excavated in this region, the evolution of net fishing and other net procurement techniques might become better understood. It can be suggested here that large mesh net fishing has at least a 3,000 year continuity in this region.

Summary. Two- and three-strand, cedar bark, twisted cordage is recorded at many sites, but with considerably variation in frequency, classes and forms. These major variations are summarized below:

	No. of Strands	Lay	Gauge Size	Form
1. Ozette Village	2	S	string	"clothing" warps
2. Axeti and Lachane	2 & 3	Z	cord & rope	lines
3. Musqueam Northeast	2	Z	string	nets

Functionally, class set III cordage appears to be (1) clothing warp strings at Ozette Village; (2) the major form of cord and rope lines at the northern sites of Axeti and Lachane; and (3) "fishing" nets at Musqueam Northeast.

Few parallels, except possibly between the northern Axeti and Lachane cordage, are seen in terms of cordage classes, forms, and functions.

Set IV. Cedar Bark Braided Cordage /OC13, OC14/

Cedar bark braids are common in the Ozette House 1 area (n = 470), comprising 23 percent of all cordage recovered. These braids typically are made with three single (not layered) strands (99 percent) and rarely with four strands (n = 3, 1 percent). Four-strand braids have a round diameter (Figure 23) whereas three-strand cordage is flat-oval or rectangular in cross section (Figure 24). Most cedar bark braided cordage examples are lines; one example has been found which forms a cedar bark "bun" (see below). These cedar bark braids ranged in gauge from 0.4 to 3.0 cm wide, with a mean of 1.01 cm wide and a standard deviation of 0.43 cm. In terms of size gauge categories, this frequency of cedar bark braid cordage categories occurs: 108 strings (23 percent); 324 cords (69 percent); 32 ropes (7 percent); and 6 heavy-gauge ropes (1 percent). As can be seen, cord-gauge lines are the most common occurring cedar bark braided cordage. In terms of cordage length, cedar bark braids ranged from 1 cm to 183 cm long, with a mean of 26 cm and a standard deviation of 23.7 cm. Most of these specimens appear to be fragments and not the original length.

Few of the cedar bark braids are found binding objects together, tying things in place, or tied to anything. However cedar bark braids are often found as part of other artifacts at the site. Frequently the large Ozette mats (Mat Functional Set III, Croes 1977b:451) have cedar bark braids as a strong, reinforcing edge elements that are bound along the edges with an around and back selvage technique. These mats, and particularly mat fragments, are common at Ozette (23 complete or relatively complete mats, 336 mat fragments, and 293 checker weave possible mat fragments, or 652 specimens, are recorded). Many of the cedar bark braids may once have been edge reinforcements on decayed and fragmented mats. Ozette braids are commonly recovered along House 1 wall areas (Map 11). As mentioned these braids usually are within the House 1 floor midden with other debris. The general distribution of braids, especially the concentration along the inside south wall area, closely corresponds to the distribution of Ozette Village mat fragments (Croes 1977b:459; Map 21).

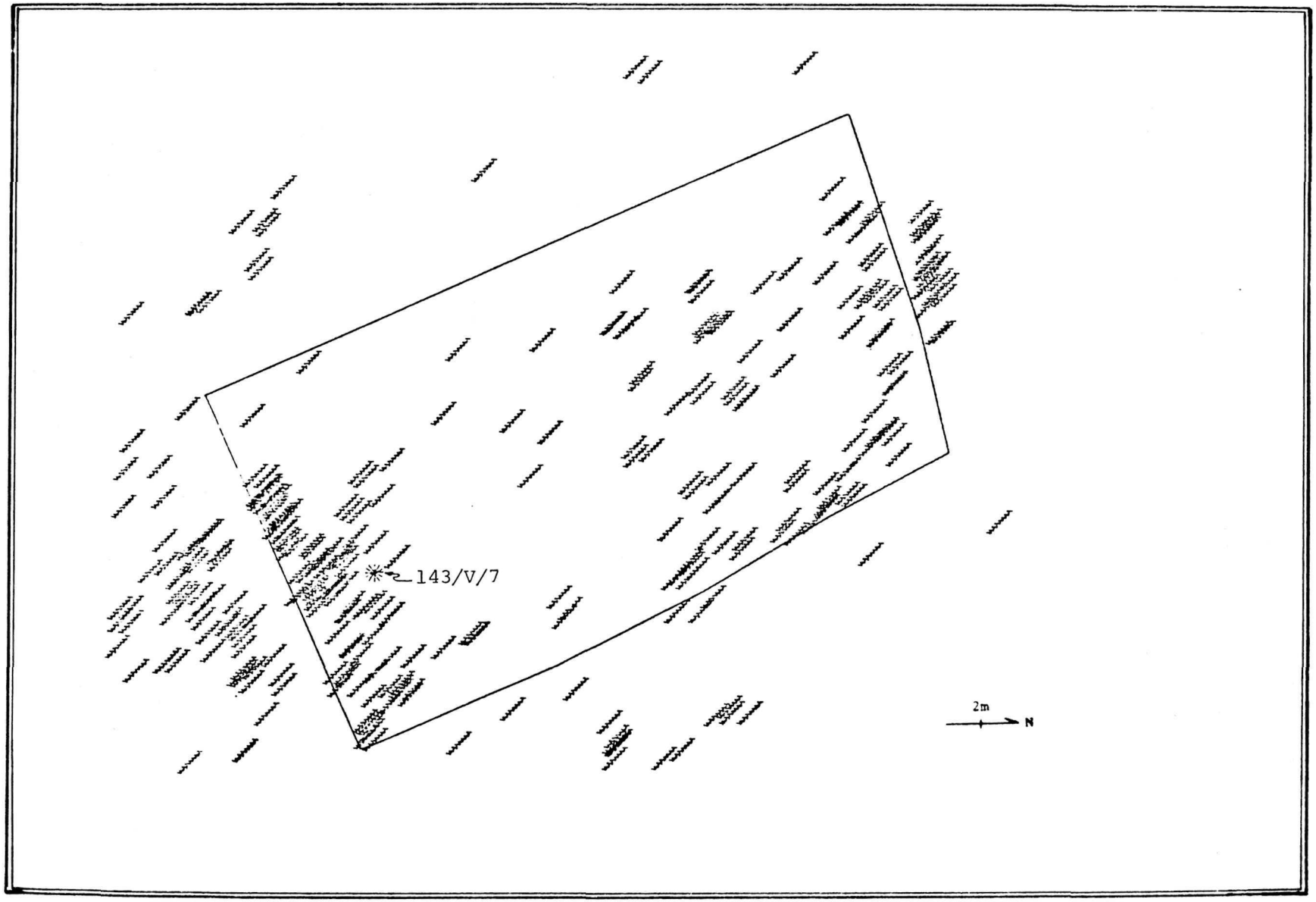
Another common artifact category at Ozette that incorporated cedar bark braids is that of tumplines (Croes 1977b:462). The ends of



Figure 23. Four-strand, braided cedar bark cordage (2/V/36) and method of construction.



Figure 24. Example of three-strand braided cedar bark cordage with overhand whipping (72/V/56).



Map 11. Distribution of cedar bark braids (set IV) in the Ozette House 1 area.

the tumplines frequently are recovered in a fragmentary condition and some of the cedar bark braided lines may have once been parts of tumpline straps. Tumplines straps often are recovered either tied with knots onto basket rims, tied to each other (opposing straps), or simply with knots on a single line. Knots used on tumpline straps include sheetbends (n = 4), square knots (n = 2), carrick bends (n = 2), overhand knots (n = 7; two tied to basket rims), and an overhand whip at the end of a strap (n = 1). Many of the knotted cedar bark braids found may have been a part of tumpline straps and since fragmented. The knots found on cedar bark braid lines at Ozette are:

Knots	#	%
Overhand	50	11
Sheetbend	15	4
Square	4	1
Granny	1	-
Running noose	2	-
Hitches		
Clove	2	-
Whips		
Overhand	2	-
No Knots	395	84
Total	470	100

Another artifact category that incorporates cedar bark braided cordage is that of Ozette cradles (Croes 1977b:381). Braid lines are often looped around a stick running through the cradle sides (ibid., Figure 9, D), and are used to run a line, possibly a cedar bark braid, from edge to edge of the cradle to hold in the infant. A small percentage of the braid cordage also may have been part of open braid basket rims or across the mouth handles on small baskets. Eleven bags or sacks (Croes 1977b:206, 278) have braid handles. Certainly braided cordage occasionally was used as cordage lines for various tying and holding purposes, however, most of the pieces recorded are or had been once associated with part of mat edges, tumpline straps, cradle sides, open braid basket rims or across-the-mouth basket handles. The few examples of heavy-gauge cedar bark braided ropes recovered may have been used for special but unknown purposes. In actual tying or binding contexts, only one Ozette braid (33/V/75) was recovered tied around a piece of wood and secured with an overhand knot.

At Ozette, most (approximately 390 or 83 percent) of the cedar bark braids were recovered in or below stratigraphic unit V. This indicates that the majority of these examples probably were lost or discarded prior to the major Ozette mudslide. Since most of the approximately 530 mat fragments are also from these levels, many of these examples may have been fragmented mat edge reinforcement elements. Of the braid cordage recovered and probably in use at the time of the Ozette mudslide, many may have been stored to be used later as mat edge reinforcements, as cradle straps, on baskets, etc., or used as lines for tying and binding objects.

Ethnographically very little is recorded concerning braided cordage. Boas does mention these lines as a form of rope made by the Kwakiutl. He writes: "Another type of cedar-bark rope (Fig. 71) is made by braiding together three strands, each consisting of three layers of strong cedar-bark about 5 mm wide" (Boas 1909:381). The use of three layers of bark is not noted at Ozette, though it is at Axeti (below). In another context Olson briefly mentions and provides good illustrations of both three- and four-strand braid cordage used by the Quinault (1936:86; Fig. 31).

In summary Ozette cedar bark braided cordage appears to have been used in connection with other artifacts, and in particular as edge reinforcements for mats, as well as straps for tumplines, handles for baskets and edge loops for cradles. They probably were used to a lesser extent as temporary cordage lines for various tying, binding and holding purposes.

The single example of an Ozette cedar bark "bun" constructed with braided cordage is made with a string gauge braid that was wound around and around a circle loop forming the "bun." Most Ozette cedar bark "buns" are constructed with plain cedar bark strips wound in this manner, and all "bun" forms are discussed below under cordage techno-functional set VIII. This single bun (143/V/7) is 5.8 x 4.4 cm in dimensions. It was located in a black sandy loam immediately below the house floor matrix in the southeast corner area of House 1 (see Map 11). This bun was simply associated with other floor debris and was not found in a functional context.

Cedar Bark, Braided Cordage (Set IV) Recorded at other Northwest Coast Wet Sites

Many wet sites have examples of cedar bark, braided cordage (Table 17). Ozette Village is the only site with examples of four-strand braids, and at Ozette this is an infrequent class (n = 3). Since Ozette Village and Axeti are the only sites with numerous examples of braided cordage (n = 467 and 53 respectively), most consideration is given to the cordage from these sites.

The percent frequency of different gauge sizes for three-strand braided cordage varies among sites (Table 17). Considering the sites with large amounts of this cordage, the Ozette Village specimens are mostly cord gauge braided cordage, whereas those from Axeti are equally cord and rope gauge. At Ozette there is a major emphasis on 1 cm wide (cord gauge) braids, but at Axeti the gauge range (cord and rope) is less standardized. This difference appears to have functional implications at these sites. At Ozette the majority of these braids may have been mat edge reinforcement elements, and a standardized gauge size probably would have been maintained. At Axeti braided cordage may have been used more as lines for various purposes and the wider range of gauge sizes, including rope sizes, could be indicative of this varied function. Mats with braided reinforcement edges, braided tumpline straps, braided loops on cradles, etc., are not recorded in the Axeti collection, and it is assumed that braids are used as independent cordage lines. A distinct difference between Ozette and Axeti braid making techniques is that Ozette examples are constructed with only single layers of bark elements, whereas

Axeti examples are made with two to three layers of bark. This would also account for diameter gauge differences and the much stronger braided lines at Axeti. Layering of braid elements is recorded ethnographically for the Kwakiutl braided ropes (Boas 1909:381, above).

Knots on braided cordage are infrequent at most sites. Eight overhand knots (some possibly as whips) are recorded from Axeti and a granny knot and overhand whip were found on braids from Hoko River.

The only braided cordage form from other Northwest Coast wet sites are lines. Ozette Village is the only site with a braided cedar bark "bun."

Summary. Cedar bark, braided cordage has been recovered from early (Hoko River and Biederbost) as well as late Northwest Coast wet sites. Axeti, with a major emphasis on cedar bark twisted cordage (Set III) also has a high frequency of cedar bark braided cordage. These lines commonly range from cord to rope gauge and probably are used as general purpose lines at the site. Ozette Village also has a high frequency of cedar bark braided cordage and these lines basically are of cord gauge and probably used in conjunction with other artifacts as mat edge reinforcement elements, tump-line strap ends, cradle loops, and basket handles.

Set V. Braided, Bound or Unmodified Conifer Twig Bundles /OC16, OC17, OC18/

Twig bundles are relatively numerous in the Ozette House 1 area (n = 76). The majority of these bundles have braided ends (n = 66, 87 percent) and the remainder are bound (n = 4, 5 percent) or unmodified (n = 6, 8 percent). The majority also are constructed with cedar twigs (n = 74, 98 percent) and one each (2 percent) of spruce and hemlock. The cedar twigs are split in half and braided so that the small branchlets protruded along one edge (see segment of braided twig bundle, Figure 25). Though most of these specimens are fragmentary, this procedure leaves a bushy edge along one side of the braid, similar to a brush.

These twig bundles range in length from 2 cm long fragments to 38 cm long pieces. The mean length is 9.19 cm with a standard deviation of 5.9 cm. The diameter of the braid or wrap of the bundles ranged from 0.2 cm to 10 cm wide. The mean width is 2.7 cm with a standard deviation of 20 cm.

These split twigs are braided creating a brush-like form. None of these braided cedar twigs has been found tied to or around anything. They probably were used as brushes in the Ozette House 1 area for such tasks as sweeping the floors and bench platform areas. Some may also have been used as "headbands" with branchlets pointing out from the head, or as interior house decorations during certain ceremonial occasions (as considered below).

In distribution, most braid or bound cedar twigs were located around the inside wall areas of House 1. Of the relatively few recovered in the outside refuse midden, some were found within early house floor deposits (Area 1, Map 12). Those inside the House 1 area are often

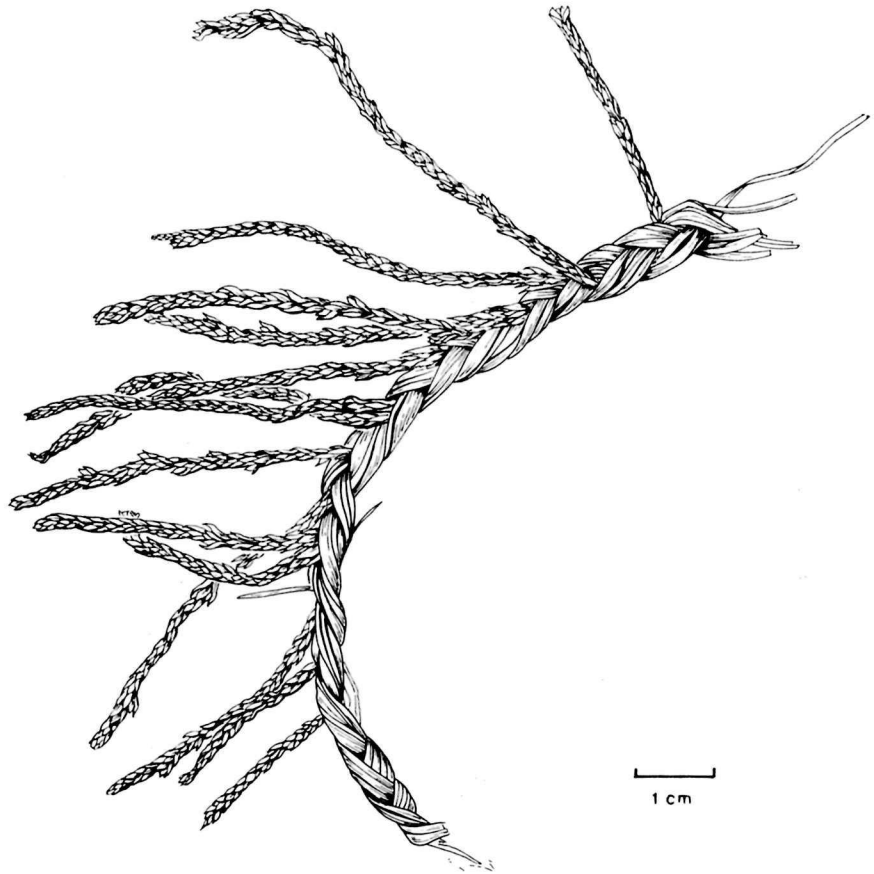
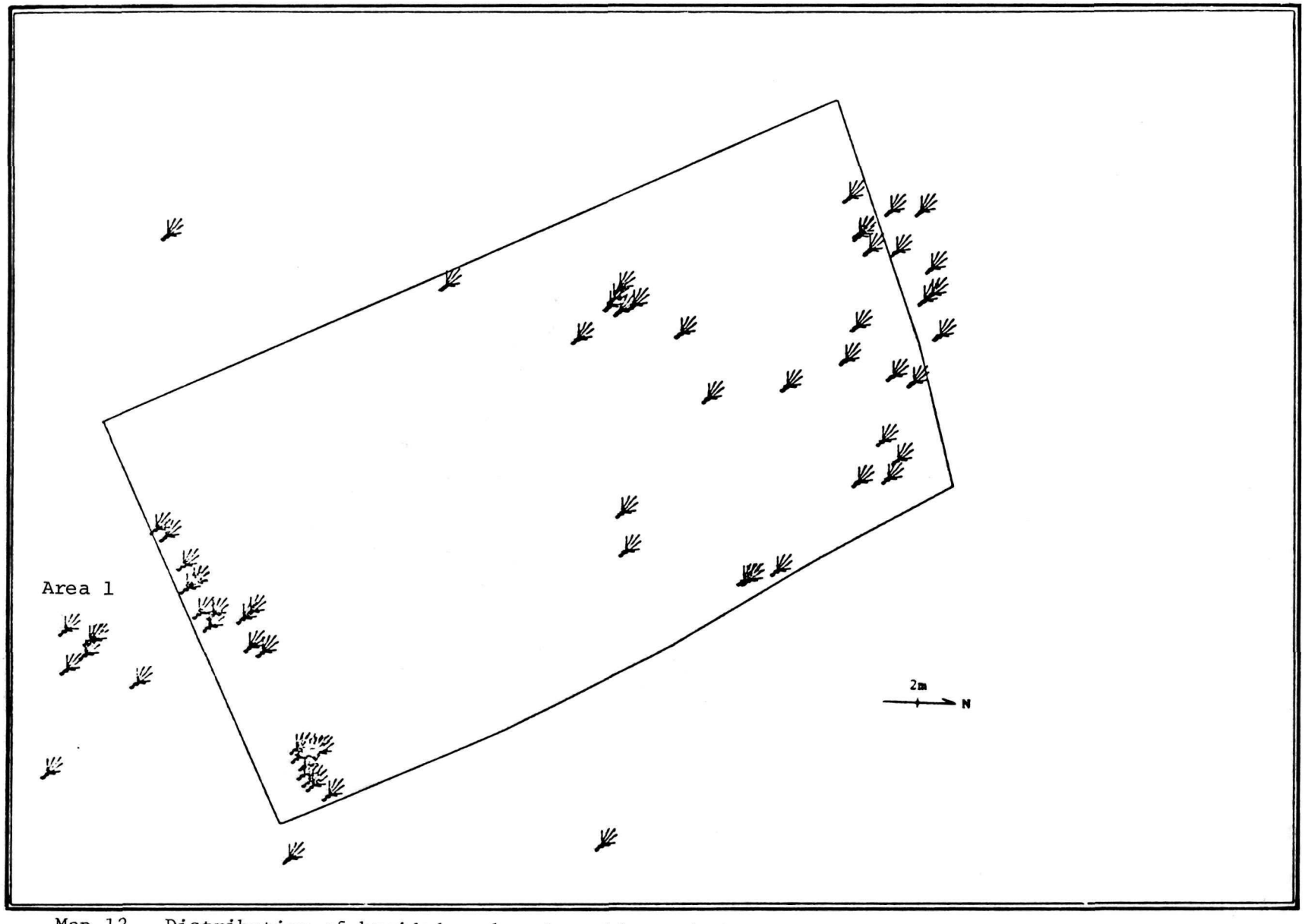


Figure 25. Braided cedar twig bundle (145/V/51).



Map 12. Distribution of braided or bound conifer twig bundles in the Ozette House 1 area.

concentrated in distinct areas. Along the south wall, and especially in the southeast corner area, these braids typically are on or within the house floor and often under bench platforms with other debris and stored materials. This was an active family area (Croes 1977b:474-485). Concentrations are noted also along the family areas in the northeast corner and the northwest wall area.

Ethnographically cedar twigs are mentioned for a variety of purposes. Gunther records these functions:

> Medicine. . . . The Skagit boil the ends of the leaves for coughs. The Cowlitz boil the tips and mix them with some roots, which the informant could not identify, for a cold medicine. . . . The Quinault make an infusion of the bark and twigs for kidney trouble. The seeds of cedar are steeped with the ends of the limbs and the infusion drunk to break a fever. . . .
>
> In addition to these medicinal uses, the leaves and limbs of cedar are used for scouring the body in bathing, both for ordinary purposes and in preparation for ceremonial occasions. This was mentioned by Swan and also by present-day informants. . . . Whalers put piles of cedar branches under their beds to make themselves ready for the hunt and to ward off bad luck.
>
> There is a strong association between cedar and death. Lummi men, burying a corpse, chew cedar tips to avoid nausea. Cedar limbs, singed, were used by the Lummi as a broom to sweep off the walls of a house after the removal of the corpse. The Skagit burned cedar limbs at night and waved them through the house to scare the ghost after death (1945:20-21).

The Ozette cedar examples could have been used for some of these medicinal, bathing and/or ritual (ceremonial) purposes. These braided or bound cedar twigs may have been prepared for scouring the body when washing (Turner and Bell 1971:71). And since they were often recovered in concentrations under bench platform areas, they may have been piled under the whalers' beds to properly prepare them for hunts, and for luck. Their general use as brushes or brooms to sweep floor and bench platform areas of the house certainly also could have been their major use. Since the braided examples are formed with most of the twig ends along one edge, which is a common brush manufacturing technique in many areas of the world (but with different materials, e.g., straw, grass, etc.) some of these probably were used as brushes. Olson reported that the Quinault made a broom from boughs as follows: "A broom was also made by tying a bunch of boughs together at the butt ends" (1936:66). At Ozette, the House 1 floor appears to have been frequently re-surfaced with sands, and, from the lack of large amounts of floor debris, the floor appears to have been frequently cleaned. These braided or bound cedar twigs could be part of the equipment for such cleaning.

For historic dance and ceremony, twigs also were used frequently to decorate the house. Greenery was used around doorways and painted screens, and twigs were used also as parts of headdresses, skirts and capes. Drucker reports the use of white fir twigs as inserts for cedar bark head and shoulder rings, and as little capes for girls in the Shaman's

Dance (Logwona) (wolf dance) (Drucker 1951:409). Holm and Drucker also recorded a similar use for the Kwakiutl Hamatsa Dance; in this case hemlock branches were incorporated into the regalia of several dancers (Drucker 1965:159; Bill Holm, personal communication). Since extensive use of cedar twigs for house and dress ornamentation is not reported (although shredded cedar bark certainly was), then the Ozette cedar twigs probably were not for this use, though the single braided hemlock example (198/VII/88) might have been.

In summary the small braided, brush-like, cedar bundles are located along House 1 wall areas, within or on the floor, and under bench platform areas (see Map 12). Ethnographically they are recorded to have medicinal, hygiene (bathing), ritual (ceremonial), domestic (sweeping) functions. However, from technological, morphological, distributional characteristics, and the general Ozette House 1 floor composition, many appear to have been brushes used in sweeping the floor and bench platform areas.

Braided, Bound, or Unmodified Conifer Twig Bundles (Set V) recorded at other Northwest Coast Wet Sites

Axeti and possibly Little Qualicum River are the only other wet sites with examples of this class of cordage. At Axeti two examples were recovered, which appear to be cedar twigs. One example is bound at the thick end and braided at the branchlet end. They average about 44 cm long. A possible example is recorded at Little Qualicum River site from hemlock (?) branches.

Since Ozette Village and Axeti are considered village sites, these twig bundles may have served a domestic function at both sites, and specifically as brushes or brooms.

Set VI. Multi-Strand Spruce Root Cordage /OC19, OC20, OC21, OC22, OC23/

Spruce root cordage (n = 81) is identified by microanalysis and by its smooth, thin plated, tight appearing twist (Figure 26). This morphological appearance is distinct from twisted bough, which is rougher, has deeper splitting, and is not usually so tight when twisted. These specimens are recorded as spruce materials from comparative analysis, but could be other types of root as well. This cordage apparently is used in two forms: (1) as lines (fishlines, cordage lines); and (2) as net elements (Figure 26). Each of these forms is considered below.

In general, multistrand spruce root cordage has a narrow diameter, ranging from 0.1 to 2.0 cm diameter, with a mean of 0.62 cm diameter and a standard deviation of 0.38 cm. The net strings have a smaller average diameter with a mean of 0.14 cm diameter and a standard deviation of 0.04 cm (n = 8). Overall these frequencies of gauge diameters are recorded: string (n = 36, 45 percent); cord (n = 41, 50 percent); rope (n = 4, 5 percent). String gauge cordage frequency is high (45 percent) and some of the fragmentary pieces originally may have been from nets. Some of

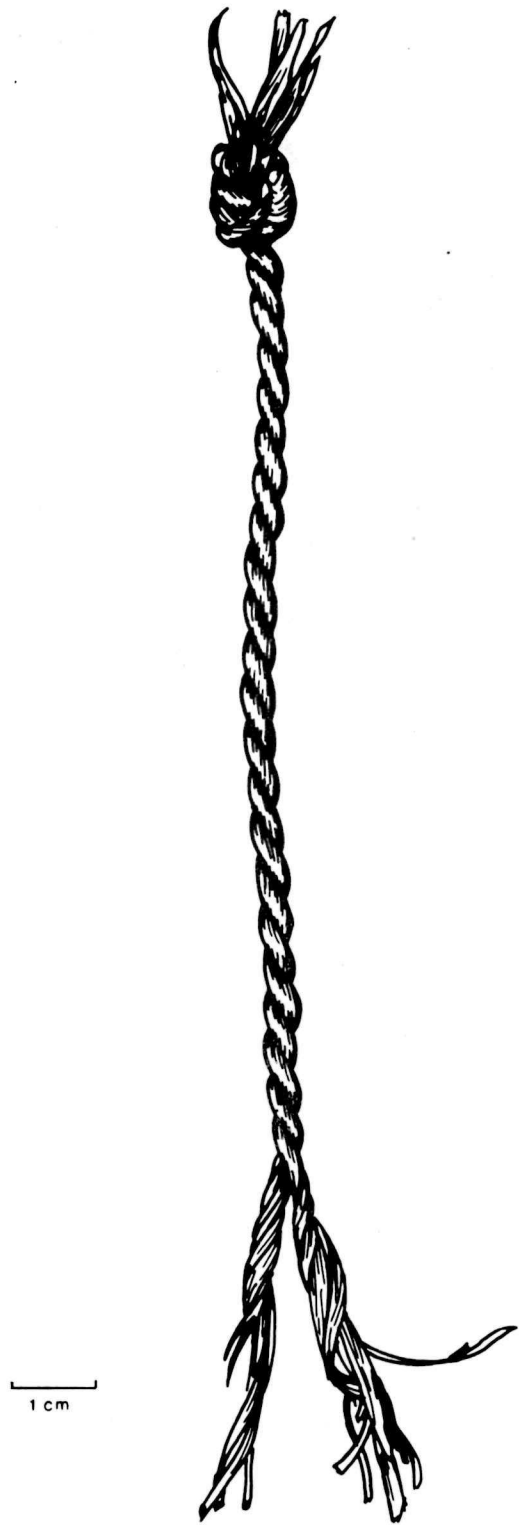


Figure 26. Two-strand spruce root cordage with an overhand whip (199/VII/1).

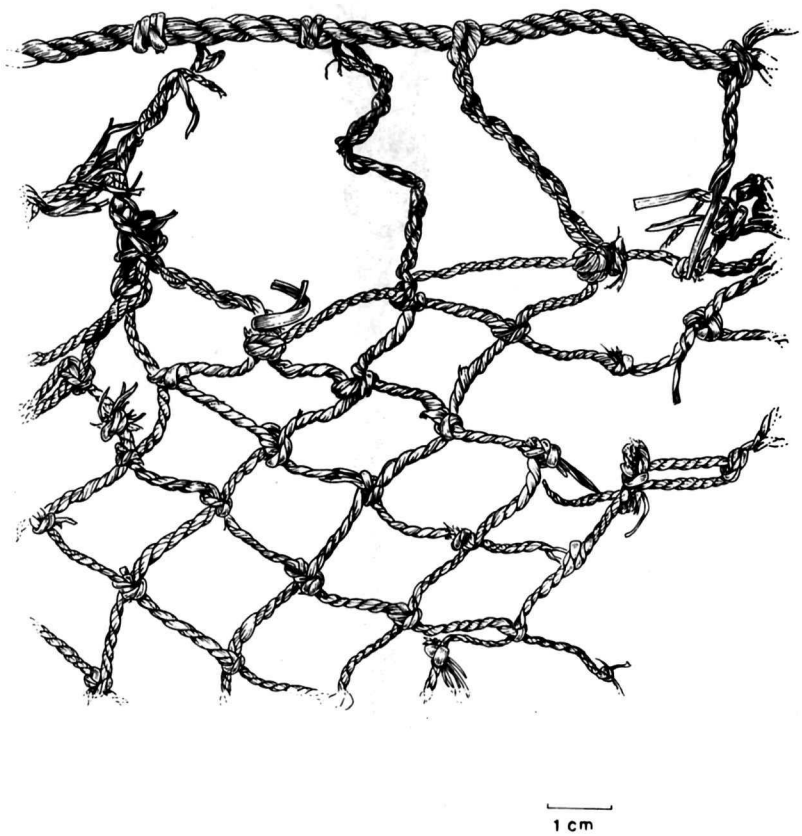


Figure 27. Ozette net constructed with two-strand spruce root cordage using square knots and attached to the headline with clove hitches (96/IV/3).

the string and cord gauge lines probably were plain cordage lines and/or fishlines (see below). In length, multistrand spruce root cordage ranged from 4 cm to 222 cm long, with a mean of 26.4 cm long and a standard deviation of 29.5 cm. Most of these pieces are broken fragments and originally probably were longer lengths.

Most of this cordage is twisted with a Z lay (93 percent), and usually is two-strand (98 percent). Most pieces have no knots or whips (n = 66, 81 percent), though a few have overhand knots (n = 4, 5 percent), some have square knots (n = 4, 5 percent) (a common net knot), some have clove hitches (n = 3, 4 percent) (a common net edge lines attachment technique), and some have overhand whips on their end (n = 4, 5 percent; Figure 26).

Multistrand Spruce Root Cordage Lines and Fishlines

Sixty-nine (85 percent) of the recorded spruce root cordage examples are plain lines and/or fishlines. The fishlines (or leaders)

are identified as such because they are recovered attached to fishhooks or stone weights commonly used ethnographically in halibut fishing. Much of the independent string to cord size spruce root line may have functioned as fishline. A plain spruce root line was found attached to the rim of a large whale harpoon bag (71/IV/32, OB24, Croes 1977b:295, 298). This line was used to hang this and another whale harpoon bag (71/IV/33) on the house wall in the northwest corner of House 1 (ibid.). Of the other two spruce root cordage pieces found in a functional context, one is attached to a bentwood halibut hook (198/tV/25B) and the other, found stored under a bench platform, is tied to a large girdled stone weight, typically associated ethnographically with halibut fishing (144/IV/164 and 144/IV/161 A and B). Many of the narrow gauge spruce root lines may have formed the leaders on halibut hooks and the line weights that are attached to the spreaders used in halibut fishing (Stewart 1977:39).

Many of the spruce root lines and one fishline "leader" (144/IV/164) were recovered stored along the inside wall areas of House 1. These were usually found stored under bench platforms.

Spruce root cordage is rarely discussed in detail in the ethnographic literature. Boas mentions the use of finely split spruce roots for binding, for wrapping open-work baskets, for tying the barb of the hook to the shank, and for string twinings (strings) (1909:377). Turner and Bell, in their ethnobotany, recorded this observation concerning spruce:

> Sitka spruce is not common in the Coast Salish territory on the Island. At least the Cowichan and Comox, and undoubtedly some of the other groups were familiar with it, though perhaps only through trade with Kwakiutl and Nootka. The strong pliable roots are extremely valuable on the west coast for making hats, baskets, and ropes, and for "sewing" wood as in box-making (Boas 1935; Drucker 1951; Densmore 1939) (Turner and Bell 1971:70).

In areas such as Ozette with easy access to good stands of spruce, this root cordage is probably used for basketry and cordage more than in eastern areas where spruce is less common. As fishhook and fishline weight leaders they probably had some particularly good qualities. Fishhook leaders and lines found in other areas include twisted human (female) hair (Boas 1913:158), deer sinew (ibid.), cedar bark fishline (ibid.), kelp fishlines (Gunther 1927:220; Sproat 1868:225; Boas 1909:382; Eells 1887:634; Swan 1869:23, 40), nettle fiber leaders (Drucker 1951:22), and sinew (Swan 1869:41) (see also Stewart 1977). Kelp fishlines commonly are mentioned and remnants of kelp lines are recovered in the Ozette House 1 area. since spruce root cordage has been found as a leader on one halibut hook, and tied as a leader on one stone sinker, this type of cordage may have been used for these purposes at Ozette. Certainly other cordage may have been used as leaders and fishlines, including sinew materials and hair, which would not preserve at Ozette.

Multistrand Spruce Root Nets

As pointed out above, many of the nets are constructed of spruce root strings, though some appear to have been made of willow (?) bark and/or nettle (?) fibers. These were in extremely fragile condition

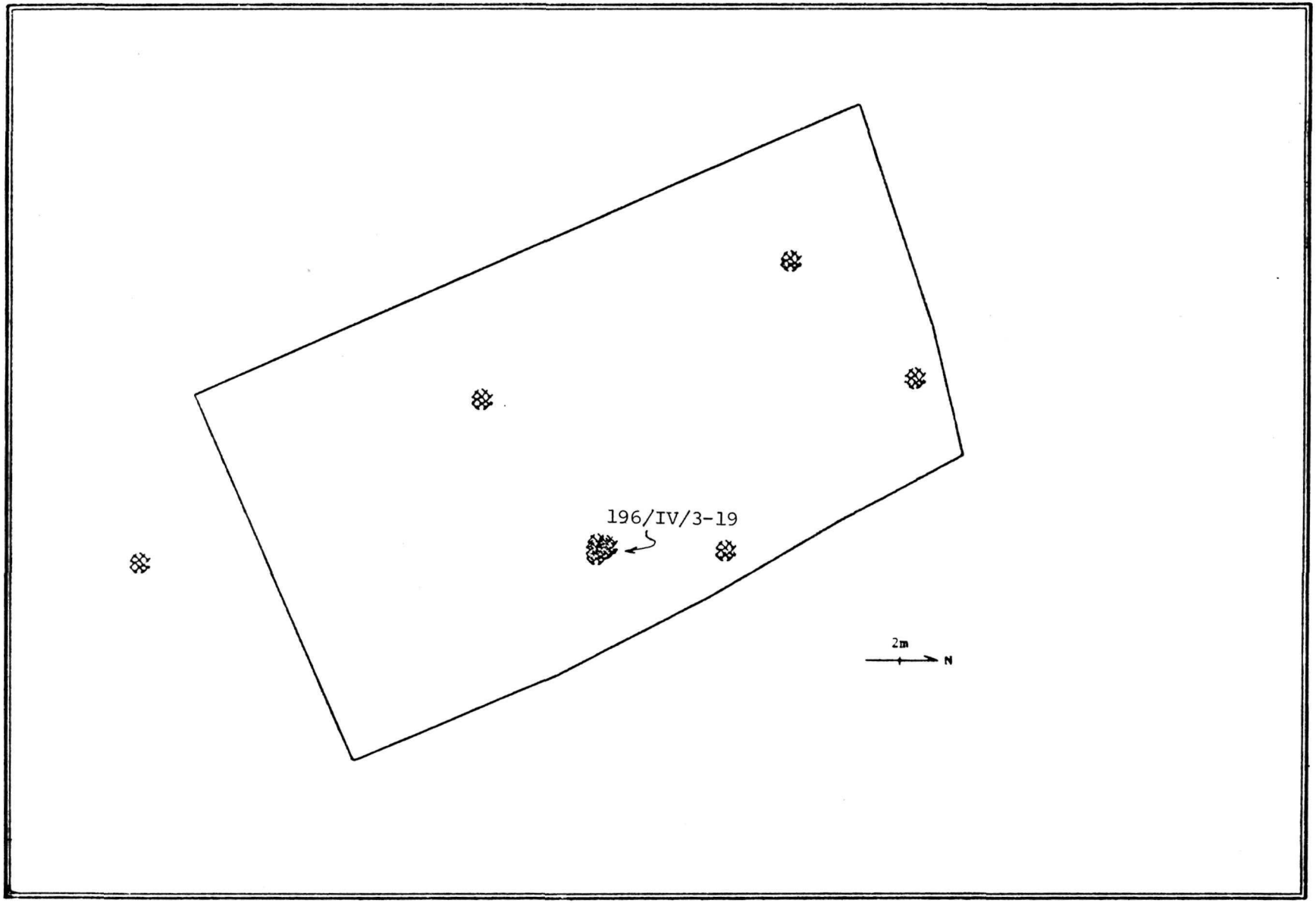
when discovered. These root cordage nets, which usually are of a narrow net gauge, range from 1.5 to 2.0 cm between net knots, and average approximately 1.9 cm (Figure 27). The nets are made with square knots, which is a noslip knot, practical for nets. Present-day netting knots commonly are made with a netting needle using a sheetbend knot (a knot certainly well known at Ozette). However if the netting needle is not available, then nets are made with the reef or square knot (Ashley 1944:64-65). Ozette nets are constructed with square knots, and probably without netting needles. Nets also had edge lines or headlines that are large gauge root cordage (mean = 0.38 cm diameter, standard deviation = 0.10 cm) which are attached to the nets with clove hitches. The lines running directly off the headlines are double cordage lines (Figure 27).

Although eleven net pieces were recovered from Ozette House 1, this figure is deceptive since net fragments from a single net are assigned separate artifact numbers (96/IV/3, 12-14, 16, 17, 19). Actually about six good examples from different nets were recovered from the Ozette House 1 area (Map 13). Many of these nets are fragmentary and were recovered either within the house floor deposits or from within the refuse midden. Net 196/IV/3-19 apparently was in use at the time of the mudslide and probably was fragmented by the mudslide.

All of these nets probably are remnants of dip nets. They are the right gauge size, and would have functioned well in such activities as smelt and other small fish netting. Smelt spawn in the shallow tidal pools in the Ozette area, and nets of this size would be ideal for at least this netting activity. They also would function well in trapping other small fish or animals.

Nets and netting are mentioned frequently in the ethnographic literature. However no reference could be found mentioning nets constructed of root materials. Most nets are either made of twisted nettle fibers (Uritica lyallii), willow bark (Salix hookeriana) (Gunther 1945: 17), or alder bark (Alnus sp.) (Eells 1971). Boas does mention the use of spruce root strings to tie the nets to hoops (Boas 1913:163). Some nets from Ozette do appear to be constructed of either a fibrous willow or nettle bark material, but most are of root materials.

Women are recorded as making nets (Underhill 1945:106). The net knot is the square knot (Drucker 1951:24-25; Stewart 1977:84). Nets constructed in the Nootkan area usually are described as small gauge nets, and most are dip-nets. In reference to this Mozino, discussing the Nootka in 1792, recorded that: "their nets are small and cannot be used except for catching the smallest fish" (1970:46). Drucker describes Nootka dip nets that are suspended on hoops (1951:24-25). He states that these nets are made by hand, and no gauge or shuttle is used (ibid.). Though small dip-nets appear to be characteristic of the Nootka/Makahs, large reef and drift nets are reported for Puget Sound/Gulf of Georgia Salishan groups, and Washington Coast Salishan groups (Stewart 1977). (This also corresponds to the large gauge nets found at the prehistoric Musqueam Northeast site on the Fraser Delta.) For constructing nets many of these groups used gauges and netting needles (Underhill 1945: 106; Stewart 1977:84). Boas illustrates and discusses netting and netting needles used by the Kwakiutl of Vancouver Island (1909:399).



Map 13. Distribution of spruce root nets in the Ozette House 1 area.

Historically dip nets, apparently similar to those used at Ozette Village are described as being used to catch smelt, candlefish, herring, trout, cod and possibly ducks and rabbits (Stewart 1977:88-91).

In summary multistrand spruce root cordage is relatively common at Ozette (n = 81); it varied in gauge size from small strings to ropes. The strings and cords were often used in constructing small-gauge nets, and were used as leaders for a halibut hook and stone anchor weight. The various fragmented lines originally may have been parts of nets or fishline leaders, but also were used as cord or rope lines. One two-strand cord was found attached to the rim of a large whale harpoon bag at Ozette and was used to tie that bag to the wall in the northwest area of Ozette House 1. Though not as common as cedar bough cordage, this finer root cordage functioned as nets, fishline leaders, and cords at Ozette.

Multi-strand, Spruce Root Cordage (Set VI) recorded at other Northwest Coast Wet Sites

Ozette Village and Hoko River are the only wet sites with a significant number of pieces of multi-strand spruce root cordage. Fishtown has a single example (Table 32).

Hoko River site has a particular emphasis on the use of this cordage (68 percent of all cordage recovered), and the majority of the examples are two-strand strings (Table 33). At Hoko River these numerous strings are used (1) as double-strand fishhook leaders, attached to bentwood and composite fishhooks, (2) as attachment lines to anchor stones, (3) as sewing elements in forming sewn tule mats, and (4) as edge reinforcement and twining elements in finishing the tops of shredded cedar bark skirts. Numerous examples are also found independently, though they may have once been part of one of the above items. In comparison to the prehistoric Hoko River examples, museum collections of west-coast halibut hooks have identical double-strand fishhook leaders that are attached to the hooks with a clove hitch and tied at their ends with a square knot (in British Columbia Provincial Museum collections). Many of these leaders and their rigging are remarkably similar, though separated through time by approximately 2,500 years. The use of these strings at Hoko River, Ozette Village and historically in this area to make fishline leaders for deep-sea fishhooks and as lines for anchor stones indicates a considerable degree of techno-cultural continuity.

The general use of spruce root for cordage at the two west-coast sites may be partially a result of environmental factors since the best stands of spruce are found in these areas. Spruce is much less common in the Puget Sound/Gulf of Georgia region.

Set VII. Spruce Root Braided Cordage /OC24/

This cordage is rare at Ozette Village (n = 4) and not recorded from other Northwest Coast wet sites. Those specimens recovered from Ozette are lines. They are typically string gauge (0.4 to 1.4 cm wide) (n = 3). These specimens appear to have been fragmented and are not of original lengths.

Table 32. Frequency of cordage examples in functional set VI recorded from Northwest Coast wet sites. (Percents are of total collection.)

Site	Equivalent Functional Sets	(1 &) 2 strand #	%	3 (& 4) strand #	%	Total #	%
1. Ozette Village	/OC19, OC20, OC21, OC22, OC23/	76	(4)	5	(0)	81	(4)
2. Hoko River	/HO-C20, HO-C21, HO-C22, HO-C23/	427	(67)	5	(1)	432	(68)
3. Fishtown	/FI-C21/	1	(11)			1	(11)

Table 33. Frequency of cordage gauge sizes in functional set VI recorded from Northwest Coast wet sites. (Percents are of total collection.)

Site	String #	%	Cord #	%	Rope #	%	Total
1. Ozette Village	39	(2)	39	(2)	3	(0)	81
2. Hoko River	413	(65)	18	(3)	1	(0)	432
3. Fishtown	1	(11)					1

Only one of the braided lines has been recovered in a functional context (30/V/20). This line was found in a tangled mass. According to field notes and fragments found with the cordage, this example once was part of "clothing," possibly an edging on a shredded cedar bark or yarn garment. Possibly the other examples also functioned as special lines that were incorporated into clothing.

The three remaining examples were recovered within the house floor midden or outside the house in the refuse midden.

Ethnographically no mention was found of this form of cordage, possibly because of its infrequent occurrence.

Set VIII. Cedar Bark Strap Cordage /OC15/

Plain cedar bark strips used as cordage were found at Ozette (n = 67, 4 percent of the collection) and other Northwest Coast wet sites. Most examples are lines, though a unique form, the cedar bark "bun," also is recorded (below). The cedar bark strips typically are of cord width (45 percent) with some string (27 percent), rope (21 percent), and heavy gauge rope widths (7 percent). They range in length from 3 to 45 cm, with a mean of 12 cm and a standard deviation of 8.9 cm.

Forty-two percent of the cedar bark strap cordage was found with knots, and these are all on lines (n = 28) (only 11 of the lines do not have knots recorded). When examples are found without knots they could just as likely be considered basketry strips and not identified as cordage. Most of the knots are overhands (n = 13), sheetbends (n = 6), and grannies (n = 5). Two square knots, a single half hitch and overhand whip are recorded.

Three basic forms of cedar bark strap cordage are recorded: lines (n = 39, 58 percent), cedar bark "buns" (n = 12, 18 percent) and bundles (n = 16, 24 percent). The lines typically are found independently, unattached to anything. They probably were used for quick and general tying purposes. The cedar bark "buns" undoubtedly had a definite function, though their exact use remains unknown. They may have been small "balls" used in a game, cushions for use in infant head forming (flattening), or had several other possible uses. Unfortunately, none are found in what can be considered a distinct functional context. They are formed by systematically spiralling cedar bark strips through a formed ring, filling in the space (Figure 28). Bundles of long cedar bark strips probably are examples of stored lengths. Strips in these bundles would have been used for either cordage or basketry, and may have been strips stored for later use in constructing cedar bark braids.

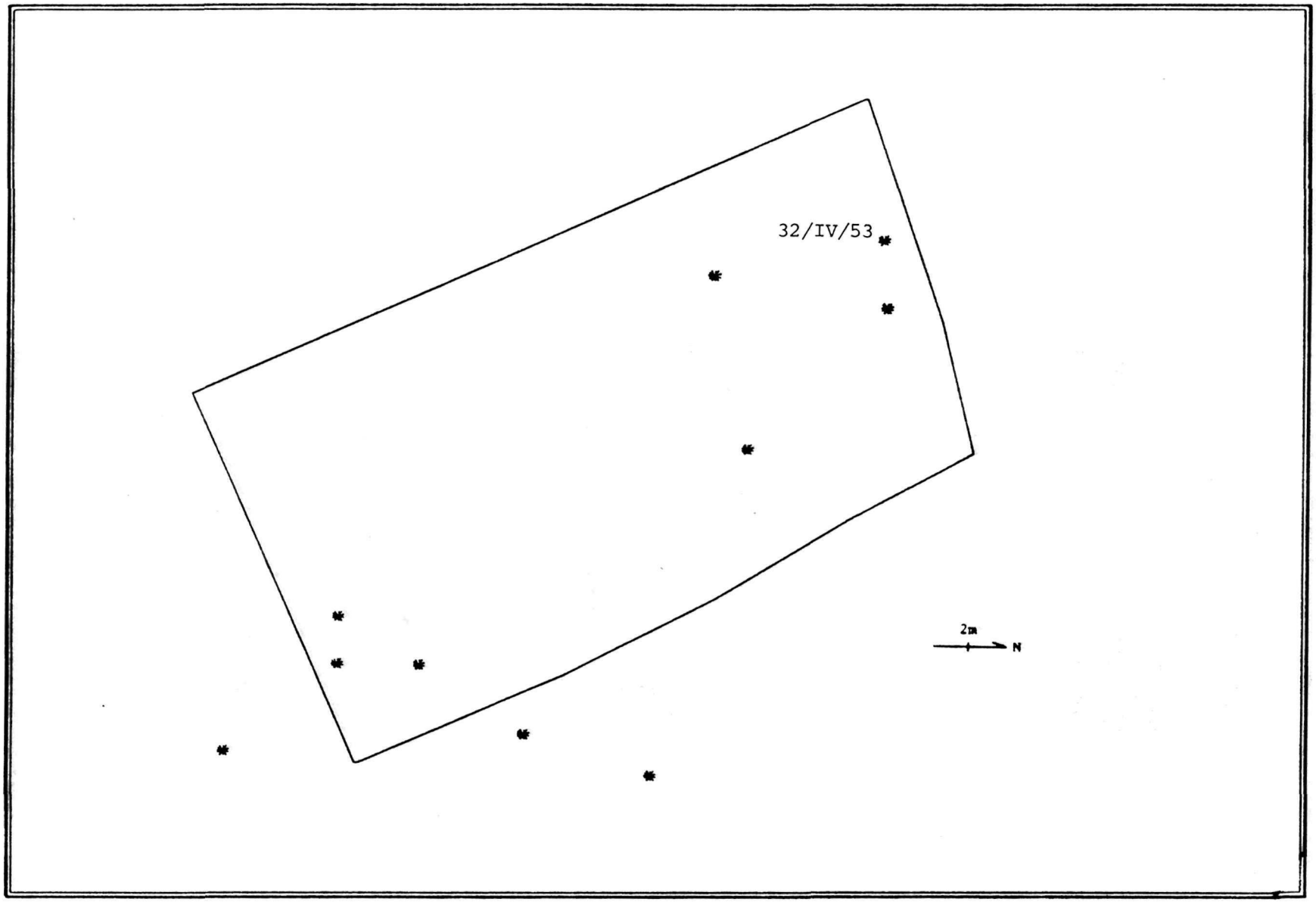
Most (n = 60 or 90 percent) of the cedar bark strap cordage was found in or below unit V levels. This indicates that the majority of the examples probably were lost or discarded prior to the major mudslide. Only one of the cedar bark "buns" appears to have been in "use" at the time of the mudslide (32/IV/53) (Map 14). This bun was associated with a large cedar bark mat (32/IV/54) and several other objects that appear to have been stored or kept on the bench platform in this area of the house. Unfortunately this example was not in direct association with any other artifacts. Other "buns" were found in the floor midden litter, often under bench platform areas, or were recovered from the outside refuse midden. One was found in the house floor area of an upper stratigraphic unit, Unit III, indicating the persistence through time of this type of artifact.

There are no ethnographic references to cedar bark strap cordage or "buns." Several informants have examined the "buns," but none was familiar with their function.

In summary, cedar bark strap cordage probably provides a quick-to-use piece of line that had multiple tying uses. These straps also are coiled into "buns" that undoubtedly had a specific but unknown use.



Figure 28. Cedar bark "bun" (66/V/32) from Ozette House 1.



Map 14. Distribution of cedar bark "buns" (set VIII) in the Ozette House 1 area.

Cedar Bark Strap Cordage (Set VIII) recorded at other Northwest Coast Wet Sites

Some examples of cedar bark strap cordage are reported for other sites (less than 7 percent of any collection; Table 34). These usually are short pieces from string to cord gauge. A variety of knots is recorded (Table 35). Without the knotting these pieces probably would not be considered cordage, but basketry waste strips or raw materials.

TABLE 34--Occurrence of Cedar Bark Strap Cordage at Northwest Coast Wet Sites

Site	Equivalent Functional Class Sets	#	%
1. Ozette Village	/OC15/	67	4
2. Hoko River	/HO-C15/	10	1
3. Axeti	/AX-C15/	13	1
4. Lachane	/LA-C15/	1	4
5. Little Qualicum River	/QU-C15/	3	6

TABLE 35--Knotting Techniques Recorded on Cedar Bark Strap Cordage from Northwest Coast Wet Sites

Site	Overhand	Sheetbends	Grannies	Squares	None	Total
1. Ozette Village	13	6	5	2	41	67
2. Hoko River	1		2	4	3	10
3. Axeti	3	4		2	4	13
4. Lachane		1				1
5. Little Qualicum R.	1				2	3

Cedar bark strap cordage recorded at most sites is in the form of lines or binding element strips. The Axeti site does have examples of cedar bark "buns" (n = 4). However the use at that site also remains questionable. Interestingly both Ozette and Axeti have this unique bun occurring, suggesting a widespread temporal/spatial use for this object.

In summary cedar bark strap cordage occurs infrequently at most sites and probably was a quickly formed cordage used for rapid tying purposes. These strips were shaped into distinct "buns" at two prehistoric sites, but their exact purpose is unknown.

Set IX. Splint Limb/Root Strap Cordage /OC26/

Lengths of thin splint limb or root elements occasionally were used as strap cordage elements at Ozette Village (n = 4) and other Northwest Coast wet sites. Typically of root, probably spruce or cedar, these splints were rapidly produced and were used as tying elements or as binding elements. Since several types of Ozette basketry are made from limb/root splints (Croes 1977b), an individual element, without knots or being bound to anything, would probably be labelled a basketry element. Most of the pieces recorded at Ozette or other sites, therefore, have knots, are bindings on other objects, or are formed into nets.

The only form of splint strap cordage recorded at Ozette consists of individual lines. Two were of string and two of cord gauge. Ends of two examples exhibit knots, a granny and a sheetbend. None was recorded in a distinctive functional context.

As might be expected of this simple and uncommon form of cordage line, ethnographic references could not be found describing it. Boas and others do describe in detail the forming of root/limb splints for basketry, which undoubtedly is the identical technique for making lines or binding elements (see Boas 1913:116-119).

In summary splint strap cordage occurs infrequently at Ozette and, except for binding elements, is probably a substitute or expedient form of cordage for quick tying purposes.

Splint Limb/Root Strap Cordage (Set IX) recorded at other Northwest Coast Wet Sites

Splint strap cordage has been found at two other sites, Axeti (n = 3) and Hoko River (n = 2). Axeti examples are strap lines of string (n = 2) and cord (n = 1) width gauge. As at Ozette, the splint root (?) lines have sheetbend (n = 2) and granny (n = 1) knots. A functional association could not be seen for the Axeti specimens.

At Hoko the splint strap cordage appears to have been formed from split spruce limbs (boughs) (Roy James Barbour, personal communications). At Hoko these lines were formed into nets (n = 2). One fairly large piece of fragmented net was recovered (215/AS/1) (approximately 40 x 30 cm in area). The mesh was approximately 5 cm between adjacent knots. This net

was tied to a conical sandstone anchor weight with a square or transom lashing. The net knots, as at Ozette and Musqueam Northeast, were square knots and probably tied by hand without a netting needle (Ashley 1944: 64-65). The gauge of this net, the attached anchor stone, and the river-side site context suggest that this net was used to catch fish, probably salmon, at the Hoko River site.

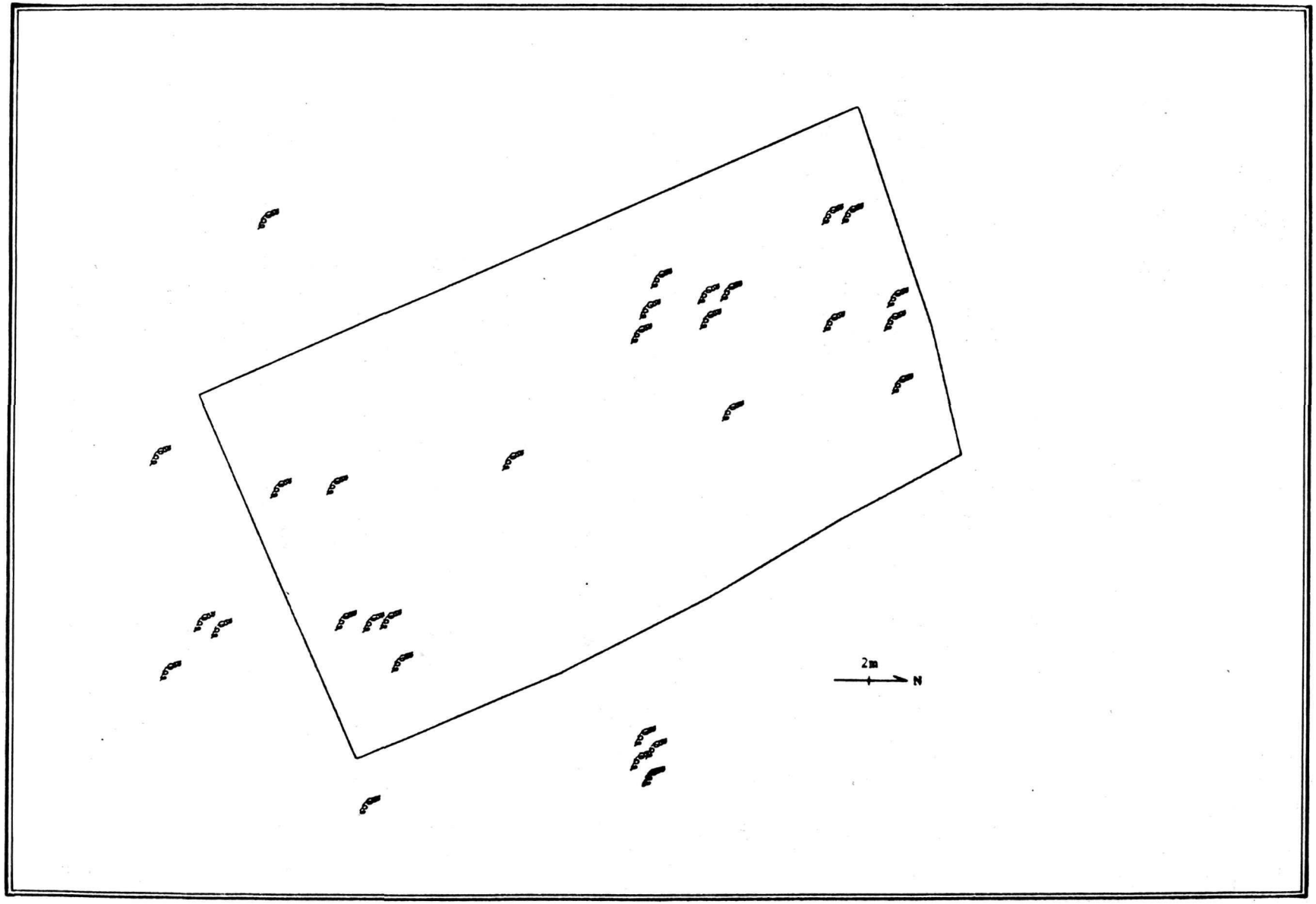
In summary, splint root/limb strap cordage is not common at most Northwest Coast wet sites. The only site where it has distinct significance is at Hoko River where nets were made from splint spruce boughs.

Set X. Cherry Bark "Binding" Elements /OC25/

Coiled strips of cherry bark have been found at Ozette (n = 50, 2 percent of the collection) and other Northwest Coast wet sites. All examples are plain strip lines. They typically are from string to cord width gauge and are found in long pieces either in a clump or wound around sticks for storage. None is recorded with knots, which is to be expected of binding straps. Cherry bark strips are found binding together composite whale harpoon shafts, composite fishhooks, composite harpoon heads, and harpoon lanyards attached to these harpoon points. They are also seen as fletching and point binding elements on arrows, as hand grip binding on bows, as weft wrapping elements on burden baskets and as decorative overlay elements in imbricated coiled baskets.

Two forms of cherry bark "binding" are found: lines (n = 45) and bound sticks (n = 5). The lines are plain spiralling strips and the bound sticks probably are storage "balls" of cherry bark. The largest example of material wound on a stick (164/V/8) has two layers, a lower one with spiral binding at right angle to the stick and an upper layer with figure eight, oblique binding. The stick itself is hollow.

Many of the cherry bark strips and bound sticks appear to have been in "use" or stored in the House 1 area (Map 15). Those found in the outside refuse or within the house midden evidently were discarded pieces. The three examples found in the southeast corner area, including the elaborately bound stick (164/V/8), appear to have been stored with other equipment along that wall. Those in the front central area (71/IV/45 and 71/IV/54) were in a definite functional context. One, 71/IV/45, is a large concentration of long cherry bark coils that once bound whale harpoon lanyard lines. These lanyards were once attached to whale harpoons and were found protruding from the individual harpoon sheaths (OM1; Croes 1977b:439-446) that were contained within large whale harpoon baskets (OB24; Croes 1977b: 295-302). They once bound sinew or other animal matter materials composing the main line of the whale harpoon lanyard. The other, 71/IV/54, is a large concentration of cherry bark binding materials stored with numerous artifacts and other raw materials for later use. The associated artifacts are listed on page 99. These materials apparently were all stored together, probably on shelving in this wall area. A box or basket may have once held these materials and had fallen during the mudslide, spilling the contents. The large concentration of cherry bark may have been owned by the family members occupying this corner and used to make whale harpoon shafts,



Map 15. Distribution of cherry bark "binding" elements (Set X) in the Ozette House 1 area.

lanyards, and/or whale harpoon points, all of which were recovered in this general area. The cherry bark strips found in the northwest corner (32/IV/70 and 73; 4/IV/38) were recovered in the floor litter, probably stored under or upon bench platforms (Map 15).

Cherry bark is mentioned as a valued binding material in several ethnographies. It is described as tough, fibrous, decay resistant, and as making smooth unions (Turner and Bell 1971:87). A continuous cherry bark strip was "peeled in a spiral line around the tree, a cut slanting upward being first made. It is kept wound up on reels" (Boas 1909:382, Fig. 73; also see reel illustrated in Stewart 1977:102). Typically a spiraling cut was made around a cherry limb or trunk and a continuous and long strip of bark was removed.

The most common use of cherry bark at Ozette Village is in the construction of the whale harpoon equipment and this is also well documented in the ethnographic literature. The Makah and Nootka used the smooth, strong bark to (a) lash together the whale harpoon valves and mussel shell points (Swan 1869:39; Waterman 1920:32, 33; Underhill 1945:45); (b) wrap the sinew lanyard attached to the point (Waterman 1920:34); and (c) splice and bind together the scarfed sections of the whale harpoon shaft (Waterman 1920:30). Other general uses mentioned include: bindings for projectile or spear points (Boas 1909:492; Gunther 1945:17; Barnett 1955; Stewart 1977:66, 102); binding elements for anchor stones (Barnett 1955:86); wrapping elements in lattice work (Stewart 1977:102); imbrication on coil basketry (Gunther 1945:17; Waterman 1973:3); and weft wrapping elements in open wrapped west coast burden baskets (Drucker 1951:92, 98; 1950:193, 265-266). Drucker states that Nootkans and a few Kwakiutl used cherry bark for wrapping elements in burden baskets and that the use to the south "was learned in recent times from the northern Nootkans (among whom it is an old custom)" (1950:265-266). The prehistoric Ozette, however, have examples of this kind of basketry dating back to 400 B.P. (Croes 1977b: 339). Cherry bark is also found as imbrication on Ozette coiled basketry (ibid.:353-365), and it had medicinal uses as well. Gunther records that "the Makah burn the bark of the spruce together with that of wild cherry (Prunus emarginata) and the charcoal powder is put on an infant's navel when the cord comes off;" also "the Lummi chew the bark to facilitate childbirth" (1945:17). The bark is boiled and the liquid drunk by the Quinault as a laxative, and by the Upper Skagit and Skokomish for a cold (Gunther 1945:37; also see Turner and Bell 1971:87).

Many of these same artifact uses were seen with the Ozette artifacts, and cherry bark probably was considered a form of medicine as well. Additional uses for cherry bark recorded at Ozette, but not seen in the ethnographic literature, include as binding for fletching on the ends of arrows, as a hand grip in the middle of bows, and to bind fishhook barbs.

Cherry Bark Binding Elements (Set X) recorded at other Northwest Coast Wet Sites

Cherry bark binding elements have been found at most Northwest Coast wet sites, and for at least the last 3,000 years (Table 36). Few

Table 36. Frequency of cordage examples in functional set X recorded from Northwest Coast wet sites. (Percents are of entire collection).

Site	Cordage Functional Set	#	%
1. Ozette Village	/OC25/	50	2
2. Hoko River	/HO-C25/	15	2
3. Musqueam Northeast	/MU-C25/	1	1
4. Biederbost	/BI-C25/	8	14
5. Conway	/CO-C25/	1	8
6. Fishtown	/FI-C25/	3	33
7. Little Qualicum River	/QU-C25/	5	11

knots are recorded on these strips since they are mainly binding rather than tying elements. They generally occur as independent coils of bark, probably examples that were stored for later use, unwound from artifacts or were discarded surplus from the ends of strips. In terms of functional contexts, cherry bark strips have been found as binding fishhook shanks (Hoko River) and binding otherwise unmodified anchor stones (Conway: Munsell 1976b:121; Biederbost: Nordquist 1961:3-4, 1976:200). Their usefulness as sturdy, smooth, decay resistant binding materials must have been well-known at an early time on the Northwest Coast.

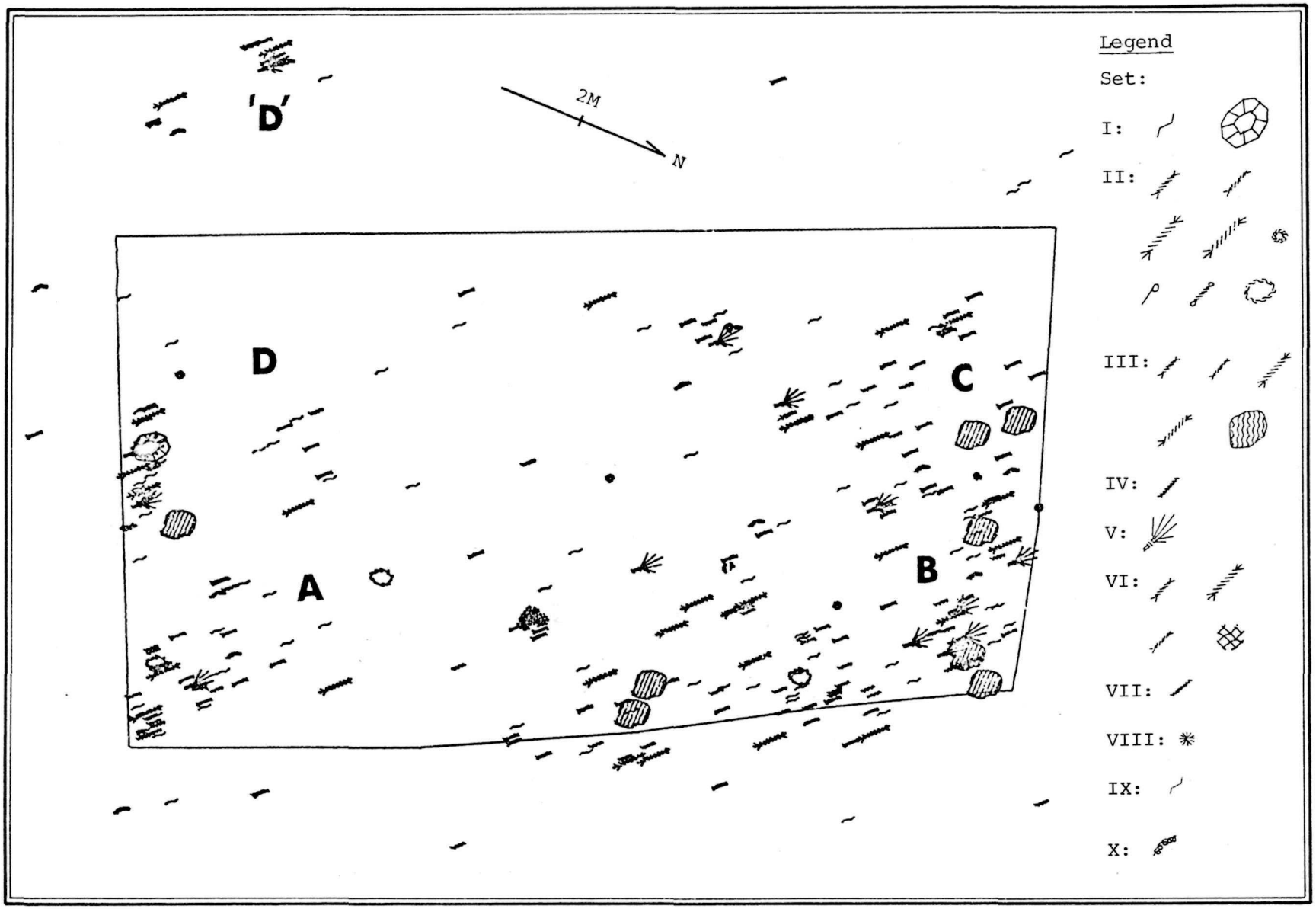
Summary of the Ozette Village Cordage Functional Analysis

The functional analysis of Ozette Village cordage has demonstrated a wide range of uses for these items within the Ozette House 1 area. The cordage functional sets and their frequency of occurrence are listed in Table 37.

Computer Map 16 illustrates the locations of cordage that was in-use at the time of the Ozette mudslide (stratigraphic unit IV cordage). Cordage class symbols are used to differentiate the types of cordage recovered. In general the inside wall and corner areas of the house appear to have the highest concentrations of cordage, with the central area being relatively clear. This corresponds to the storage and family living areas commonly located along wall and corner shelves and benches (also see similar basketry distributions and family areas: Croes 1977b:479, Map 24). Corner D and the western wall have relatively few cordage artifacts, but these are the

Table 37. Frequency of Occurrence of Ozette Village Cordage Functional Sets

Cordage functional sets and names	Cordage class members	Number of examples in each set	% of total cordage category
I. Single strand, cedar bough, twisted withe	OC1	483	25
II. Multi-strand, cedar bough twisted cordage	OC2, OC3; OC4 OC5, OC6, OC7 OC8	485	25
IIa. 2-strand, cedar bough, twisted cordage	OC2, OC3	297	15
IIb. 3+ strand, cedar bough, twisted cordage	OC4, OC5, OC6 OC7, OC8	188	10
III. 2 and 3-strand, cedar bark, twisted cordage	OC9, OC10, OC11, OC12	247	12
IV. Cedar bark braided cordage	OC13, OC14	470	24
V. Braided, bound or modified conifer twig bundles	OC16, OC17, OC18	76	4
VI. Multi-strand spruce root cordage	OC19, OC20, OC21, OC22, OC23	81	4
VII. Spruce root braided cordage	OC24	4	0
VIII. Cedar bark strap cordage	OC15	67	3
IX. Splint limb/root strap cordage	OC26	4	0
X. Cherry bark 'binding' elements	OC25	50	3
	Total	1,967	



Map 16. Distribution of cordage items that were in use in the Ozette House 1 area at the time of the mudslide. Letters indicate separate "family" corner areas.

beach-facing areas that were heavily eroded by wave action before excavation. A large slump block located off the southwest corner of the house ("D") is a remnant of the house floor from corner D.

Half of the Ozette cordage (n = 968, 50 percent) was made from twisted cedar boughs (Sets I and II). One-strand withes (Set I) were used mostly in house construction and in sewing. They are most concentrated along wall areas (Map 16) where they typically are found tying house wall structures together. The north and east walls fell into the house causing a more scattered distribution of withes in areas B and C.

Two- and three-strand cedar bough twisted cordage functioned as general lines; well-formed examples are the sea mammal harpoon lines. This cordage is common along most wall areas (Map 16) and probable harpoon lines are found in each family corner area. Some found along the north wall were tied to float plugs and were associated with whale harpoon bags containing a number of whale harpoon points and lanyards.

Several unique forms were created with Sets I and II cordage, including bound hoops, wedge collars, stick loops, large diameter circulettes, and basket handles. These can be seen distributed in all areas of the house, with no individual clusters (Map 16).

Approximately 25 percent of the Ozette cordage is cedar bark braids (Set IV). These typically function in association with other artifacts and especially as reinforcement elements on mats. Most independent braid fragments probably are from fragmented mats. In Map 16 it can be seen that they are rare since most were recovered below unit IV, discarded in the house floor layer or refuse midden. When in-use, they mainly were mat edge reinforcement elements, and would not have been recorded as independent lines around the house. Others form parts of artifacts such as basket handles, tumpline lines, and edge loops on cradles.

Two- and three-strand, cedar bark, twisted cordage (Set III) contributes approximately one-eighth of the collection. These S twist strings are mainly associated in large aligned concentrations and once were warp strings. The assumed animal matter weft (hair, down, skin, sinew, etc.) has decayed leaving the warps behind. They probably are indicative of major blanket or clothing forms at Ozette and probably were twined together with dog hair yarn or wrapped with bird down/skin strips then twined with thin sinew. These string alignments were recovered along the south, east and north wall areas, with most in areas C and B (Map 16). Persons in these areas probably used these as blankets and/or clothing.

Braided or bound conifer twig bundles (Set V) contributed 4 percent of the collection, and are seen in most wall areas of the house. These probably were kept by family members to brush out or clean areas of the bench and floors. The floor stratigraphy reveals numerous cleaned and restored surfaces and probably this was in part accomplished with these brush forms.

"Spruce" root cordage (Sets VI and VII) is infrequent. Fishline leaders and nets are made from this cordage. One large sample of a close-gauge net, probably a dip-net, is recovered along the central eastern wall areas of House 1 (Map 16).

Strap cordage of cedar bark, splint limb/root, and cherry bark (Sets VIII, IX, and X) are uncommon as independent examples but form a major binding element at the site. The long flat, ribbon-like form of the strap cordage makes it a good binding material for composite harpoons, arrows, composite fishhooks, hafted woodworking tools, etc. Independent strips of these materials are found in several areas of the house (Map 16).

In summary several different kinds (Sets) of cordage are used in the Ozette House 1 context. They typically have distinctive functional roles and appear to be well-suited for these usages. Cordage is used in house construction (Set I), as harpoon lines in hunting sea mammals, as wedge collars in woodworking, as utility basket handles and tumpline loops (Set II), as "clothing" warp strings (Set III), as mat edge reinforcement elements (Set IV), as brushes (Set V), as fishline leaders and nets (Set VI) and as strap binding elements (Sets VIII, IX, and X). Since cordage is a general-use type of artifact, all "family" areas of House 1 appear to have most forms represented. Every family unit probably had general needs for most cordage forms and therefore they are seen in each area. As artifact associations or "kits" of whale hunting gear, fishing gear and woodworking tools are more carefully associated in the house, some of the more functionally specific cordage forms will undoubtedly associate in these kits. One example is the concentration of cherry bark binding elements in corner C with the whaling equipment and used as binding elements for lanyards, harpoon points and harpoon shafts.

At a more general level these synthesized cordage data reflect the Ozette cultural "plans" for incorporating cordage artifacts into their lifeways. Undoubtedly the artisan followed certain culturally defined parameters when making and using cordage for different tasks. This synthesis reflects these cultural parameters and plans for a household at Ozette Village which dates from 400 years ago.

Comparison of Cordage Techno-Functional Sets from all Northwest Coast Wet Sites

When comparing cordage techno-functional sets from all sites it becomes apparent that cordage from different sets can be used for similar purposes (Table 38). For example, multi-strand lines are mainly two- and three-strand cedar bark cordage (Set III) at Axeti and Lachane, whereas sites farther to the south stress two- and three-strand cedar bough cordage (Set IV, Table 38). Nets are recorded at three sites and each is made of cordage from different techno-functional sets, Ozette (VI), Hoko River (IX), and Musqueam Northeast (III). It is obvious that different forms or sets/types of cordage can be used for similar functions. This occurrence probably reflects the multi-purpose characteristics of cordage in general, and probably is partially the result of culturally developed preferences for using different general classes of cordage (sets here) for similar functions.

In comparing cordage techno-functional sets among sites, several average linkage cluster analyses on a matrix of Jaccard's coefficient and close-proximity cluster analyses using percent frequency data and Robinson's

TABLE 38--Major Uses of Cordage Categories, as Recorded in Functional Sets, at Northwest Coast Wet Sites

Functional Categories	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
withe lines	I	I	I	I	I	I	I	I		I
multi-strand lines	II	II,VI	II	II	III,IV	III	II		II	II
wedge/collars	II	II	II	II	II	II				
nets	VI	IX	III							
rigid lattice works	VI	VI					VI		VI	
small diameter circulettes			II	II						
large diameter circulettes	II	II	II	II		II		II		
twig bundle "brushes"	V				V					
cedar bough storage bundles	II	II		II						
cedar bark buns	VIII				VIII					
stick loops	II									

TABLE 38--(Continued)

Functional Categories	Ozette Village	Hoko River	Musqueam North-east	Biederbost	Axeti	Lachane	Conway	Fishtown	Wapato Creek	Little Qualicum River
binding elements	VIII, IX, X	VIII, IX, X	X	X			X	X		X
"clothing" warp strings	III									
bound hoops	I				I					
basket handles	II		II	II			II			
fishhook leaders	VI	VI								
mat edge reinforcement	IV									

method to form the coefficient of similarity matrix were conducted. Some of the more detailed comparisons were between specific ranges of cordage gauge diameter at sites, cordage functional form categories, and/or cordage knot-type frequencies. In none of these tests did sites cluster in a manner that would reflect general site-use patterns. Similar tests with basketry from these sites did cluster sites by proposed site-uses (Croes 1977b:488-494), with high concentrations of burden baskets found at fishing-gathering stations, and a wide variety of basketry and high-frequency of cedar bark checker mats recorded at major village sites.

Cordage functional form categories, no matter how they are compared, would not cluster sites in diagnostic patterns. The proposed explanation for this is that cordage is much more variable or multi-purpose in terms of uses or functions, and site-use locations such as fishing-gathering stations would not necessarily associate as a separate group by presently defined cordage criteria alone. For example, the cordage from the fishing stations of Hoko River and Musqueam Northeast do reflect fishing activities, however, Hoko River has an abundance of cordage leaders attached to fishhooks and Musqueam Northeast has a high frequency of cordage string net fragments. Cordage from both sites reflect fishing, though different forms and classes of cordage are used in fish procurement. If tests are conducted using cordage gauge sizes, Hoko River and Musqueam Northeast will cluster because of the string gauge fishhook leaders and nets, but Ozette will also cluster with these sites because of the abundance of "clothing" warp strings. No combination of cordage attributes successfully separated all sites by general site-use. However, cordage, when analyzed by functions attributed to specific cordage classes, provides an extremely sensitive and useful indication of the specific kinds of activities that were taking place at different sites.

If we view cordage at this specific level, we see certain overall patterns occurring on the Northwest Coast through time and across space. The following discussion considers some of these patterns.

Withe cordage (set I), generally of twisted cedar boughs, is a common form at most Northwest Coast wet sites. Many specimens can be considered preforms for constructing multi-strand cordage, especially in the south. At Ozette Village withes had specific functions: (1) temporarily tying up the house wall boards; and (2) as sewing elements for sewing together boxes, cracked boards, and sewing canoe thwarts into place. At other sites the functional context is not always so obvious since most of the pieces are broken, discarded examples. However, even at the 3000 years B.P. Musqueam Northeast site, there is, for one, evidence of sewing with withes to combine pieces of wood (Borden 1976:253).

Multi-strand lines are the major form of cordage from all Northwest Coast wet sites. They range from string to heavy-gauge rope sizes. In terms of cord to rope sizes, there is a difference in construction material emphasis from north to south. The northern cords and ropes typically are constructed of cedar bark and the southern examples are made with cedar boughs. The same plant/tree is used, just different parts. This appears to be a difference of cultural preference. As more sites are examined in different areas, this pattern will need to be further tested.

In general multi-strand cords and ropes would have specialized functional significance to maritime oriented Northwest Coast cultures. Fish procurement requires fishlines, nets, and weirs, and sea mammal hunting requires sturdy harpoon lines. Canoes need sturdy lines for anchoring and for various towing and construction purposes. Multi-strand cordage lines have been a well-developed technology on the Northwest Coast for at least 3,000 years.

Wedge collars, basically of multi-strand cedar withes, are also common through time and across space. The use of wedge collars associates directly with wooden wedge splitting practices along the coast.

Nets are constructed with three different forms of cordage at three different sites. This again appears to result from a cultural preference for various materials or possibly with nets made for different purposes. Nets have been a significant part of the Northwest Coast procurement inventory for at least 3,000 years.

Binding elements of cedar bark, cherry bark and spruce root also are common and basic to constructing many pieces of procurement equipment including harpoons, arrows, fishhooks, lanyards and anchor stones.

The multi-purpose usage of cordage on the Northwest Coast is obvious, and its important place in the technologies of this region is basic and early. The groups of this region have been involved in a complex maritime adaptation for at least 3,000 years, and the importance of cordage to such an adaptation is easily demonstrated with wet site data.

5. SUMMARY AND CONCLUSION

Ozette Village cordage and those from other Northwest Coast wet sites have been analyzed on three levels: the level of cordage attribute (modes); the level of cordage class (types); and the level of techno-functional categories or sets. The first two levels are concerned with specific stylistic/technological characteristics of cordage, and the third basically is concerned, at a more general level, with the functional role of cordage artifacts in the Ozette cultural context and at other Northwest Coast sites. The results of these levels of analysis will be summarized separately below, and the implications of these combined results considered.

Cordage Mode Analysis

The first level of analysis involved the definition, description and comparison of individual Ozette Village cordage modes based upon the different analytic dimensions of cordage. These include: construction materials, construction techniques, number of strands, gauge size (diameter), lay, sizes (lengths), forms, and knotting techniques. The number of modes examined in each dimension demonstrated the range of variability and the discussion considers the usefulness of each for either stylistic/technological and/or functional comparisons among sites.

Intersite comparisons indicate that the Ozette Village cordage modes occur at most Northwest Coast wet sites, but with distinct differences in relative frequencies. In some cases this appeared to be the result of cultural preference for materials or techniques (e.g., Axeti and Ozette cordage materials); in others the results of general differences in site-uses (e.g., villages vs. fishing camps and different techniques at different stations). Since there is a large amount of overlap in the occurrences of cordage modes at sites, the manner of combination of these modes into specific cordage classes (types) is the best level for comparison.

Cordage Class (Type) Analysis

Cordage classes (types) and subclasses (subtypes) were paradigmatically defined by the combination of specific cordage dimensional features: cordage construction materials, cordage construction techniques, number of cordage strands, lay/twist of the cordage and gauge size (diameter). This classification provided a means to define the range and kinds of cordage being made at Ozette Village and other Northwest Coast sites. These data indicate the Ozette cultural patterns for combining materials, techniques and gauge sizes to produce cordage artifacts.

The cordage classification also provides the explicit units needed for systematic comparisons among all Northwest Coast wet sites. At this level the data become sensitive enough for cordage stylistic/technological comparisons. Using presence/absence data, average linkage cluster analyses created dendrograms illustrating the degrees of similarity between sites (Figures 8 and 9). Significantly, the sites cluster in a regional arrangement, though spatial data are not involved in the tests. The most similar classes of cordage occur through time in three separate regions: the northern coast, south-central coast, and the Puget Sound-Gulf of Georgia regions. These tests support a model of regional continuity in cordage styles for the last 2,000 to 3,000 years. Significantly, comparisons of basketry modes and types from these sites produced very similar patterns of regional style continuity, with highest degrees of similarity among spatially associated sites, regardless of their age (Croes 1977b). The combination of these two categories of artifact data provide a solid base to support a model of cultural continuity for the past 2,000 to 3,000 years in these regions. This is based on available data, and as more sites are examined these results can be further elaborated, evaluated, and refined.

Overall cultural contintuity models are not new for Northwest Coast prehistory. They have been suggested for the southern coast by Mitchell (1969) and for the northern Tsimshian archaeological area by MacDonald (1969). The cordage and basketry artifacts from Northwest Coast wet sites, however demonstrate stylistic/technological continuity for three separate regions. This probably results from comparing more sensitive artifact categories than have been previously available. Basketry and cordage are very complex artifacts for comparison, and similar kinds of sensitive artifacts are rare from non-wet or dry sites on the Northwest Coast. As more wet sites become excavated, other categories of artifacts, such as art, should prove valuable for similar comparisons. These and other materials can be used to test and evaluate the above hypothesis of regional cultural continuity on the Northwest Coast.

Based upon a study of the cordage from the Ozette Village site and extensive comparison with cordage from other Northwest Coast wet sites, and the similarities of other tests with basketry data, the following conclusions are reached:

1. Lachane and Axeti sites have a high degree of similarity because of a distinct emphasis on cedar bark, two-strand cords. Since these sites are temporally and spatially distant, this similarity is considered to be a general northern style of cordage, but does not necessarily link the two sites in any direct cultural association.

2. The south-central sites, Hoko River and Ozette Village, have cordage (and basketry) technologies that demonstrate the closest degrees of similarity. These data produce a pattern of techno-cultural style continuity in this region for at least 2,500 years and are the basis for a hypothesis of cultural continuity between these two sites and the historic groups of this region.

3. The early Puget Sound/Gulf of Georgia sites of Musqueam Northeast (approximately 3000 years B.P.), Biederbost (approximately 2000 years B.P.), and Little Qualicum River (approximately 1700 years B.P.) have similar cordage technologies. Musqueam Northeast and Biederbost especially demonstrate similarities in both cordage and basketry technologies. Musqueam Northeast is within a Locarno Beach phase archaeological component; therefore interrelated aspects of this phase were common throughout this Puget Sound/Gulf of Georgia region 2000 to 3000 years B.P., distinct from what appears to be happening in the south-central west coast region at this time.

4. The late Puget Sound sites of Fishtown and Conway unfortunately do not have a significant sample of cordage for comparison. However in tests they do link together and with larger numbers of basketry samples (Croes 1977b) they produce the highest degree of similarity. Therefore if larger numbers of cordage artifacts were available from these two sites it is predicted that they would be closely associated and probably linked with earlier Puget Sound/Gulf of Georgia sites (Croes 1977b).

Functional Analysis of Cordage

Ozette Village has provided an ideal opportunity for recording the functions of cordage items from a pre-contact village. Many of the strings, cords and ropes were in use at the time of the mudslide. Also, since Ozette is of a relatively late time period, many of these cordage classes and their common uses were observed in the historic period. Because of these unique data, we have a much clearer perspective of these materials in a prehistoric cultural context than previously had been possible.

Cordage was involved in house construction, procurement equipment, clothing, basketry, woodworking, box and canoe construction, and other activities. Houses were tied together with cedar bough withes and loosely twisted two-strand cedar bough cordage. This enabled the houses to be easily disassembled for moving and readjusted for ventilation or plank-replacements. Cordage procurement equipment included multi-strand cedar bough harpoon lines, essential to sea mammal hunting, possible "mud or snow-shoes," spruce root nets and string fishline leaders. Binding elements of cherry bark, cedar bark, and split roots were used to construct composite harpoons, arrows, composite fishhooks, harpoon shafts, lanyards, bows, burden baskets, and anchor stones. Blankets and/or clothing was constructed with cedar bark string warps. Mats had cedar bark braids as edge reinforcement elements; braids were also used on the ends of tumplines, as basket handles, and as loops on cradles. Cordage collars were a basic component for wooden wedges. Boxes, planks and undoubtedly canoe pieces were sewn together with twisted cedar bough withe strands. Household brushes were made from braided cedar twigs. Cordage had numerous uses, in part because of its multi-purpose characteristics. The functional analysis illustrates the wide variety of uses in a prehistoric Ozette household and its numerous uses in activities outside the village. Cordage was certainly a major component of the maritime adaptation at Ozette and other Northwest Coast sites.

The compilation of functional information about cordage from Ozette by techno-functional sets has aided in comparing and deriving functional information concerning cordage from other wet sites. The multi-purpose characteristic of cordage is well illustrated, with several similar forms of cordage being made with different kinds (classes) of cordage. For example, the basic multi-strand twisted cords and ropes at Lachane and Axeti northern sites are made with cedar bark, whereas those from most southern sites are made from twisted cedar boughs. Nets are another example; they are all made in a similar way at sites in which they occur, that is with square knots, but the construction materials are different. Certain general similarities are seen among sites, with common uses of cedar bough withes, twisted bough wedge collars, and varieties of binding elements.

Cordage does reflect site-use in several instances. Not only do the numerous nets at Musqueam Northeast and fishline leaders at Hoko River indicate fishing localities or stations, but the emphasized kind of fishing--net vs. hook-and-line--are suggested. Site by site cordage functional analyses often provide sensitive data for specific site-use interpretations.

Conclusion

The three-level analysis of cordage from Ozette Village and other Northwest Coast wet sites demonstrates a special analytic value for cordage artifacts in Northwest Coast prehistory research. The first two levels of cordage analysis demonstrate the wide range of materials, techniques and cordage forms at Ozette and ten other wet sites. Comparison of cordage styles provides a basis for establishing a cultural continuity model in three separate regions of the Northwest Coast. Previous tests using basketry data (Croes 1977b) generated a similar cultural continuity model. The combined independent results are complementary and support a hypothesis of regional cultural continuity for 2,000 to 3,000 years in three regions of the Northwest Coast.

On the last level, the functional analysis, Ozette cordage provides information on several activities (from woodworking to resource procurement) and aspects of material culture (from house construction to clothing). This plus other information is applied to the cordage functional analysis at other sites. Each wet site has a distinct functional range of cordage and the cordage forms--such as fishline leaders, nets, wedge collars and ropes--reflect some of the specific activities emphasized at a location. As other wet sites are found, cordage artifacts will provide more information about the development and evolution of cultural adaptation on the Northwest Coast, which will ultimately, through functional analysis, reflect on the development of coastal adaptation systems.

Cordage was an important item within the adaptive technologies of prehistoric Northwest Coast peoples. This is not surprising considering the maritime subsistence base and many uses for cordage in this kind of economy. Cordage typically plays an important role among coastal fishing societies and is most often associated in present-day cultures with nautical activities. Because of its analytic sensitivity and functional importance, cordage artifacts undoubtedly will play an increasingly

significant role in understanding many new aspects of Northwest Coast prehistory. The Ozette Village site and other Northwest Coast wet sites provide a unique opportunity for an initial study of prehistoric Northwest Coast cordage. The eleven excavated wet sites have provided the data necessary for preliminary comparative studies. Undoubtedly numerous additional wet sites and collections will be recovered in the future, providing the basis for testing, evaluating and expanding the conclusions reached with presently available prehistoric Northwest Coast cordage.

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