RECONSTRUCTING IDENTITY IN THE BONNEVILLE BASIN: HOLOCENE-AGED CORDAGE AND COILED BASKETRY FROM THE EASTERN GREAT BASIN

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
In partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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December 2020

Major Subject: Anthropology

ABSTRACT

This dissertation examines perishable artifacts to contribute to current studies on the multi-scalar identity of past people, and the flexibility and situational qualities of social organization in prehistoric populations in the eastern Great Basin, western North America. I take both a diachronic and synchronic view of technological variability in perishable artifacts of the Bonneville Basin in the eastern Great Basin to compare the role of the environment on prehistoric forager subsistence strategies and other social processes. I apply a *chaîne opératoire* approach of studying technological organization to explore the manufacture and use of artifacts in a holistic and quantifiable way, which reflects overlapping gendered-tasks in a prehistoric community, and the significance of perishable artifacts in the daily lives of Great Basin people.

This dissertation is divided into two analyses which seek to characterize variability through time and across the region, followed by an application of these data to tests models of technological change in the region. First, I present an analysis of cordage, coiled basketry, and cordage manufacturing debris from the entire assemblage at Bonneville Estates Rockshelter, spanning 13,000 years of human prehistory. This study shows variability over time in the type of perishable artifacts constructed at the site and the ways cordage and basketry were manufactured and used, particularly in the late Holocene. Some of this variability indicates site occupants' reactions to fluctuations in climate, but likely is also influenced by changing craft traditions throughout the Holocene.

Second, I present an analysis of curated cordage and coiled basketry from nine additional cave and rockshelter sites in the Bonneville Basin temporally assigned to the late Holocene, within the last 4,400 years of the region's prehistory. Comparing the technological organization of these artifacts using simple statistics indicates variability of site function across the region. This study provides further support for basketry craft reorganization in the late Holocene, but it also indicates a maintenance of netting manufacturing methods diachronically and regionally. This analysis also reinforces the value of reanalyzing curated collections.

Comparing patterns over time with patterns across a culturally-shared region during the late Holocene provides a way to explore theoretical approaches to mechanisms of culture change in the region, as well as to test previous models developed to explain observed trends in behavior and demographics. Although all sites in this study are associated with flexible subsistence strategies including seed processing and small-game hunting, I propose that the variability in technological-stylistic traits in late Holocene basketry is a result of diverse populations of women marrying into a stable, craft-conservative population of men. This practice in the late Holocene is potentially reflective of increased contact with diverse populations of people on the foraging and farming spectrum of subsistence. This dissertation demonstrates the informative value of perishable artifacts in reconstructing complex subsistence practices as well as dynamic scales of identity in prehistoric populations.

DEDICATION

For my mother Jeanne and sister Emily, and my husband Josh.

ACKNOWLEDGMENTS

This dissertation is the result of many years of research, and many people have contributed to its development.

Thank you first to my dissertation committee chair, Dr. Ted Goebel, and my committee members Dr. Suzanne Eckert, Dr. Kelly Graf, Dr. Angela Hudson, and Dr. Maxine McBrinn for their guidance and support throughout the course of this research. As chair, Ted was there every step of the way as advisor and advocate. Thank you, SuS for being an invaluable mentor for so many things inside and outside of this project. And thank you Maxine for all of your thoughtful input throughout this project.

The analysis of Bonneville Estates Rockshelter (Chapter 3) and Four Siblings Rockshelter (Chapter 4) were made possible by the National Science Foundation for funding excavations and dating of the sites, as well as efforts by Ted Goebel, Kelly Graf, Bryan Hockett, David Rhode, Lisbeth Louderback, Sergei Vasil'ev, and others during excavation and subsequent analyses. Thank you for allowing me to contribute to this interdisciplinary research.

I am grateful for all of the support from the Center for the Study of the First Americans (CSFA) at Texas A&M University, including Mike Waters, Ted Goebel, and Kelly Graf. Funding for radiocarbon dates was provided through the Roy J. Shlemon Geoarchaeology Award (2015) through the CSFA. Additional financial support from the CSFA through the Graduate Student Emergency Fellowship (2020), as well as employment on excavations and in the labs all contributed the culmination of this research.

Funding was also provided by through the OGAPS Dissertation Writing Fellowship (2018) and the Summertime Advancement in Research Award for Dissertation Writing (2017) through the Texas A&M University College of Liberal Arts. Other research support was provided by the Texas A&M University Department of Anthropology Pilot Research Award (2016) for travel to the Utah Natural History Museum, as well as travel awards to present results of this project at national and regional conferences (2014 and 2016). Thank you also to the College of Liberal Arts for their grant which allowed me to organize the Department of Anthropology Perishable Technologies Workshop (2014) with guest Edward Jolie at Mercyhurst University.

Thank you to Dr. Glenna Nielsen-Grimm, Anthropology Collections manager at the Natural History Museum of Utah, who generously granted me access to curated collections which make up the bulk of this project (Chapter 4). Without her substantial assistance in locating artifacts for me and overseeing their careful curation, this research would not be possible.

I am grateful to Tim Murphy (BLM, Elko) for taking me on a personal guided ethnobotany tour of eastern Nevada, and to Brenda Pace (Idaho National Laboratory), Amy Commendador (Idaho Museum of Natural History), the Ray J. Davis Herbarium (Idaho State University), and the Texas A&M University Herbarium for facilitating additional ethnobotanical research. Thank you also to Tim Riley (Utah State University, Prehistoric Museum), Gene Hattori (Nevada State Museum), Ed Jolie (Mercyhurst University), Bryan Hockett (BLM, Reno), and Vaughn Bryant (TAMU) for consultation when developing this project.

And finally, thank you thank you to my family and friends, who have humored, visited, and morally supported me. Biggest thanks to my mother, Jeanne, and my sister, Emily and her husband Rob, my grandmother, Clara, and of course, Uncle Kevin, who accompanied me on my plant expeditions in Utah and Nevada. And all my other friends and colleagues through Texas A&M, especially Jessi Halligan, Angela Gore, Laura White, Staci Willis, Heather Smith, Josh

Lynch, Tyler Laughlin, Neil Puckett, Sunshine Thomas, and Adam Burke, and all the rest of my cohort, whose discussions, distractions, and emotional support made all of this possible. And the biggest thank you of all, to my beloved husband Josh Keene, whose contributions this project (and everything) are innumerous.

CONTRIBUTORS AND FUNDING SOURCES

This work was supported by a dissertation committee consisting of committee chair Professor Ted Goebel of the Department of Anthropology, and committee members Professor Kelly Graf of Department of Anthropology, Professor Angela Pulley Hudson of Texas A&M University Department of History, Dr. Suzanne Eckert of the University of Arizona, and special appointment Dr. Maxine McBrinn.

The AMS dating of 13 textiles for Bonneville Estates (Chapter 3) were performed by the Center for Applied Isotope Studies at the University of Georgia, using funds from the Roy J. Shlemon Geoarchaeology Award (2015) through the Center for the Study of the First Americans. Age ranges of strata from Bonneville Estates Rockshelter (Chapter 3) were provided by Professors Ted Goebel and Kelly Graf at Texas A&M University, who also provided provenience information for the Bonneville Estates assemblage. Field notes from Four Siblings Rockshelter were provided by Kelly Graf. Excavation notes for Thermal Point were provided by the Utah Natural History Museum. Access to collections (Chapter 4) were provided by Dr. Glenna Nielsen-Grimm, at the Natural History Museum of Utah.

Graduate funding was supported in part by the CSFA through the Graduate Student Emergency Fellowship (2020), the OGAPS Dissertation Writing Fellowship (2018), the College of Liberal Arts Summertime Advancement in Research Award for Dissertation Writing (2017) through the Texas A&M University College of Liberal Arts, the Department of Anthropology Pilot Research Award (2016), and the College of Liberal Arts grant for the Department of Anthropology Perishable Technologies Workshop (2014).

All other work conducted for the dissertation was completed by the student independently.

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CHAPTER 1

INTRODUCTION

This study examines perishable artifacts to contribute to current studies on the multi-scalar identity of past people, and the flexibility and situational qualities of social organization in prehistoric populations in the eastern Great Basin, western North America. Where previous studies of archaeological perishable artifacts in the region frequently have referred to past people as defined ethnic categories and oftentimes simplistic markers of normative gender divisions (i.e. textiles = women), this study embraces the potential of this broad artifact class to inform on complex activities in the past, including interactions between social groups of varying scales and the complex role subsistence strategies play on the manufacture and use of perishable artifacts. This epistemological approach contributes to traditional studies of hunter-gatherer socio-cultural behavior and ethnogenesis in the Great Basin from the late Pleistocene through Holocene, but problematizes our acceptance of broadly defined ethnic groups and lifeways. Emphasizing the physical process of creating cordage and coiled basketry is a way of showing the overlapping roles of people within a community, and the significance of perishable artifacts in the daily lives of Great Basin peoples.

In this study, I take both a diachronic and synchronic view of technological variability in perishable artifacts of the Bonneville Basin in the eastern Great Basin. My dataset consists of cordage and coiled basketry from the entire assemblage at Bonneville Estates Rockshelter, dating from the late Pleistocene through late Holocene, and curated cordage and coiled basketry from nine additional cave and rockshelter sites in the Bonneville Basin temporally assigned to the late Holocene, within the last 4,400 years of the region's prehistory. Comparing patterns over time with patterns across a culturally-shared region during this single time period provides a way to explore theoretical approaches to mechanisms of culture change in the region, as well as to test previous models developed to explain observed trends in behavior and demographics. Hence, this study specifically seeks to understand the reorganization of subsistence strategies as a result of environmental variability since the late Pleistocene, the innovation of basketry types in the late Holocene, the potential appearance of demographic change in the late Holocene, and the nature of trade and external contact with farming groups in the late Holocene.

Through this study, I intend to demonstrate that an analytical process that emphasizes the preparation and combination of individual elements of coiled basketry and cordage rather than assigning a completed artifact to a designated typology provides a more complex characterization of both the functionality of an artifact, as well as the ability for the artifact to communicate about the social community in which it was made and used. Different artifacts had different functions within the subsistence tradition of hunting and gathering. For instance, netting was used differently from tumplines, and parching trays were used differently from carrying baskets. I intend to show, however, that there is between-artifact variability in the individual elements that make up baskets and cordage used for a similar purpose that is not random, but rather, indicative of craft traditions. I also demonstrate that while basketry is nearly universally associated with feminine activities in small-scale communities outside of a market economy (Byrne 1999; Murdock and Provost 1973), cordage as a broad material class is potentially associated with gendered-tasks, depending on the intended function of the artifact. Thus, cordage is uniquely positioned in a gendered approach to artifact analysis to inform on the gendered craft traditions. While gender is nonbinary in modern and past human populations, gender roles in North American Indigenous groups often have been divided by social and economic tasks in a way that is binary. I use the terms “feminine” and “masculine” to discuss binary tasks and “women” and “men” to refer to people performing these binary tasks, recognizing that a third gender was accepted, but this was most commonly men taking on feminine activities.

This work reveals patterns of spin direction potentially associated with the function of the artifact which may reflect the division of labor along gender lines. I suggest that the consistency of z-spin direction of cordage associated with netting observed throughout the Holocene at Bonneville Estates Rockshelter, as well as synchronously in late Holocene Bonneville Basin sites, is the result of a consistency in masculine craft tradition in the region. Conversely, the inconsistencies in work direction and foundation types that occur throughout the Holocene shows a variability in feminine-directed craft traditions of the Bonneville Basin. Unlike men who were net-makers, multiple craft traditions are present among women basket-makers. After the middle Holocene, right-to-left work direction became the dominant pattern in basketry, potentially indicating a shift in craft traditions; however, there is a variability in proportions of work direction as well as other traits embedded in markers of technological style markers (a term I use to differentiate from decorative style) across the region, revealing a complex system of basketry manufacture. I suggest that this complexity in the late Holocene is a result of diverse populations of women marrying into a stable, craft-restricted population of men, and this is potentially reflective of increased contact with diverse populations of people on the hunter-gatherer and farming spectrum of subsistence. I suggest that this change in the late Holocene is potentially the result of changes in marriage practices in neighboring groups outside the band structure to be exogamous and patrilocal.

This interpretation does not support a large-scale population replacement or migration of Numic people in the late Holocene, but it does support a potential incorporation of women from outside the immediate Bonneville Basin through time in the late Holocene, no matter whether they were on the foraging or farming spectrum. This also suggests that technological-stylistic norms were relatively flexible. Women entering the social system of the Bonneville Basin from outside were not necessarily pressured to adopt the manufacturing style of Bonneville Basin hunter-gatherer women, although most basketry could still be assigned to functional subsistence categories within the forager subsistence strategy.

The presence of coiled basketry and cordage integral to hunter-gatherer subsistence reveals the importance of gendered technological organization and scheduling in the Bonneville Basin. If the material culture preserved at each of the sites is viewed as the result of foraging events within a broad economic community, regional variability in functional traits shows the complex and flexible subsistence activities practiced, like seed-parching and trapping small game. But when artifact traits associated with steps in the decision-making process vary across the region, the Bonneville Basin may instead be viewed as a dynamic community of foragers (and farmers) who, while they practiced a similar set of subsistence activities associated with seasonal mobility as a result of environmental variability, may have also made decisions based on differing traditions, societal norms, and community interactions. Future studies which focus on directly dating these artifacts and comparing basketry and cordage to neighboring regions of the Great Basin, Colorado Plateau, and Southwest will likely further elucidate the dynamic cultural environment which existed throughout the Holocene.

The Informative Value of Perishable Artifacts

Hunter-gatherer archaeology focuses primarily on durable stone tools and bones, largely because these are the only cultural materials preserved in most archaeological sites. Stone tools, however, are only one facet of hunter-gatherer technology, whereas perishable materials may represent as much as 95 percent of material culture (Croes 1997). Therefore, models entirely based on lithic and faunal materials are incomplete in characterizing the lives of prehistoric peoples, and resulting studies often limit focus on hunting or small-seed gathering and processing. The Great Basin is well-suited to the inclusion of perishable artifacts because, when compared to other parts of the world, organic materials are relatively well-preserved in dry caves and rockshelters, often for many millennia. The region's perishable-artifact class is broad and complex, including basketry, matting, bags, clothing, nets, string, snares, and footwear. These artifacts were used for a variety of tasks potentially by all members of the foraging community.

Worldwide, studies of perishable artifacts have addressed a multitude of subjects, including ethnicity (Adovasio 1976, 1986; Croes 1989; Goldberg 2018; Weltfish 1932), ecological adaptation and subsistence (Adovasio et al. 2009; Fowler and Bath 1981; Geib and Jolie 2008; Greenwald 2017; Noshiro et al. 2019; Piqué et al. 2018), social learning and craft traditions (Carr and Maslowski 1995; Custer 2004; Geib 2000; Haas 2006; Jolie 2014a; Minar and Crown 2001; Osborne and Riddell 1978; Thulman 2014), social boundaries and identity (Barker 2009; Camp 2018; Connolly and Barker 2004; Connolly et al. 1998, 2016; Custer 2004; Geib 2000; Haas 2001; McBrinn 2002, 2008; Newton 1974; Petersen et al. 2001; Teague 1998; Tuohy and Hattori 1996), gender (Soffer et al. 2000; Washburn 1987), status (Drooker 2011; Jakes et al. 2010; Kuttruff 1993; Thompson and Jakes 2005), and trade (Fowler and Hattori 2011, 2012; Washburn 1987). In the northern and western Great Basin, on the Colorado Plateau, and in the Southwest and California, similar questions have been posed of perishables, often with ceramic artifacts incorporated to complement the datasets (Allison 2008; Eckert 2012; Eerkens 2011; Fowler and Hattori 2011; Hattori and Fowler 2009; Jolie 2014b; Geib 2000; McBrinn 2008). In the eastern Great Basin (i.e. the greater Bonneville Basin of western Utah and easternmost Nevada), perishable research has primarily focused on function and ethnicity, largely the result of Adovasio's (2010) and Weltfish's (1932) perspectives that basketry is the most suitable artifact class for determining distinct cultural traditions. As these studies have pointed out, perishable artifacts are well-suited for studies of social interaction, including economic and marriage networks, migration, population movement, and identity. Perishable artifacts provide a unique opportunity to build a holistic understanding of the overlapping nature of identity and membership, and curated perishable collections in the region's museums represent a prime resource for building inclusion of under-represented perspectives.

Developing a Middle-Range Theory

Perishable artifacts are a complex material class with great antiquity, and they are still manufactured today throughout the world for functional and decorative purposes (Adovasio et al. 1996; Soffer et al. 2000; Wadley 2010; Warner and Bednarik 1996). Whereas studies of stone tools in archaeology frequently use actualistic and experimental studies to interpret manufacture and function, perishable objects are infrequently the subject of experimental studies, with a few exceptions that almost invariably take an ethnoarchaeological approach (e.g. Brown and Morgan 1983; Jolie and McBrinn 2010; King et al. 2019; Kuttruff et al. 2004; Minar 2001; Petersen et al. 2001; Yoder et al. 2005). This paucity of experimental studies of perishable artifacts likely limits some archaeological inference (Clark 2002); however, archaeologists are fortunate to be able to make extrapolations about the function and manufacture of archaeological materials based upon ethnographic observations and collaborations. The standardized process that has been established for basketry and cordage analysis (Adovasio 2010; Emery 1980; Hurley 1979; Weltfish 1932; Wendrich 1991) was developed using observations of expert basket and cordage manufacturers, as well as reconstructing the manufacturing process for these materials (Geib 2000). Additionally, the additive nature of basketry and cordage directs the researcher to consider the series of hierarchical decisions that have been made to construct a useable object (Carr and Maslowski 1995; Jolie and McBrinn 2010), so an understanding of the dynamic context of how perishable artifacts functioned in a society physically and psychologically is an integral line of inquiry in most modern studies of basketry and cordage.

Ethnographic Analogy

It is common for archaeological studies to implicitly use ethnographic analogy to make inferences about archaeological materials, and this study follows this tradition. Ethnographic analogy is considered most successful when archaeological and contemporary groups share the same environmental setting, economic strategy, and resource structure, among others (Ascher 1961). When modern groups are used as a proxy for their archaeological predecessors using a direct-historical approach, it must be recognized that they have been affected by external factors like colonialism, population displacement, climate change, and participation in a market economy, or by internal factors like the development of new technology, population shifts, and ideological change (Ascher 1961; Clark 2002; Gould and Watson 1982; Owen 1999). Observer bias must also be considered, as early ethnographies of hunter-gatherers generally focused on groups considered “traditional”, although they were marginalized societies living in environments unfavorable to agriculture and industrialization. As a result, these studies tended to deemphasize perceived outside influences or present-day changes to equivalent technologies in an effort to document traditions while they were still practiced (Gould and Watson 1982; Sassaman 2010; Wobst 1978). Archaeological interpretations depending on ethnography risk inappropriately equating prehistoric societies with economically depressed, depleted, and isolated modern societies (Hitchcock and Biesele 2000). Dependence on North American ethnography and ethnohistoric accounts for archaeological interpretation can be especially problematic when it is considered that most early ethnographers and ethnohistorians were men operating within a European context of gender roles and gender dichotomy, often employing exclusively male informants (Conkey and Gero 1991; Duke and Vasquez 1994; Fowler 1980; Hill 1998; Kehoe 2013; McGuire and Hildebrandt 1994). There also have been, however, prominent female ethnographers in the Desert West like Isabel Kelly and Catherine Fowler, who made important contributions to the study of feminine activities in the Great Basin, although these are the minority of ethnographic projects (Fowler 1980; Fowler and Garey-Sage 2016). Despite this, great risk still exists in over-generalizing interpretations of past activities based on biased observations of the "ethnographic present" or modern groups (Gould and Watson 1982).

Despite these potential pitfalls in the use of analogy (Wylie 1985), the present study assumes that an economic strategy based on hunting, gathering, and fishing of wild natural resources is an essential consideration in the everyday lives of modern and prehistoric forager groups (Hitchcock and Biesele 2000), and that such a strategy has a major influence on material culture. Although social, political, and technological organization is fluid and likely shifted through time, this project assumes that objects recovered in archaeological contexts were used similarly as observed in modern groups. In this study, behavioral and functional interpretations of archaeological materials, especially mobiliary perishable artifacts, are considered in the context of scheduling and management of tasks in a flexible, but characterizable, social organization. These interpretations are made based on ethnographic, ethnohistoric, and first-person accounts of Indigenous peoples' activities in the Great Basin, California, and Colorado Plateau.

Chaîne Opératoire and Technological Organization

Social context and human agency are essential for understanding basket and cordage technology. Moreover, the empirical reconstruction of technological manufacture based on ethnographic observations of expert basket- and cordage-makers is an important approach. The *chaîne opératoire,* or operational sequence, approach for interpreting technological organization in artifact manufacture was developed for lithic-artifact studies (Jelinek 1991; Lemonnier 1986; Schlanger 1994; Sellet 1993) and incorporates ideas regarding the maintenance of culturally-transmitted patterns of artifact manufacture. Recently, there are increasing calls in textile research to consider the operational sequence of manufacture, from the gathering of plants, to the processing of fibers, to the manufacture of tools themselves (Adovasio and Pedler 1994; Berihuete-Azorín 2016; Beugnier and Crombe 2007; Bongers et al. 2018; Farmer 2012; Gassin et al. 2020; Hurcomb 2007, 2014; King et al. 2019; Leach 2018; Maynard and Rost 1988; Norton 1990; Strand 2012; Tiballi 2010; Willis 2016). As a result, traditional plant knowledge has been increasingly incorporated into textile studies, from locating resources to subsequent "tending the wild" through fire, coppicing, and pruning (Anderson 2005; Anderson and Keeley 2018; Fowler 2000; Fulkerson 1995; Hurcombe 2014; Ingold 2009; Noshiro et al. 2019). Recognition that the environment in which indigenous people lived was not completely "wild" but instead maintained (Deur and James 2020; Fowler 2000) also underscores the contribution of perishable-artifact manufacturers to biodiversity in the past (Ortiz 1993).

The reconstruction of the *chaîne opératoire* of coiled basketry and cordage through reviewing published historic, ethnographic, and ethnobotanical accounts from the Desert West and California is a means of promoting a form of empirical inquiry that emphasizes the materiality of its technology and the social context in which it is manufactured and used (Clark 2002). The present study identifies four stages of perishable production. First is "selection", including travel to plants in the wild, coppice management and pruning, selection of appropriate branches or bark, and transport to a manufacturing site. Second is "preparation", including shredding, retting, soaking, splitting, and shaping of fibers or basketry materials. Third is "construction", which includes twisting, coiling, plaiting, weaving, and combining elements. Fourth is "use/repair/reuse", which is the context in which the object is used, recycled, repaired, and eventually discarded (Figure 1.1).

Basketry. To illustrate this approach of understanding the "life-history" of an artifact, the manipulation of willow (*Salix* sp., including *S. exigua, S. lasiandra,* and *S. amygdaoides*), commonly used for basketry foundations and stitches throughout the Great Basin in the past, is described (Figure 1.1) (Anderson 2005; Bocek 1984; Chamberlin 1909, 1911; Coville 1892; Dean et al. 2004; Ebeling 1986; Janetski 1991; Kelly 1932; Kissel 1916; Lowie 1909, 1924; Malouf 1940; Mason 1902; Ortiz 1993; Powell 1875; Rhode 2002; Riddell 1978; Steward 1938; Stoffle et al. 1990, 1999; Sutton 1989; Vestal and Schultes 1939; Wheat 1967). Women selected and maintained (or coppiced) a willow patch in a riparian ecotone of the mountain woodland/pinyon-juniper zone in the spring or autumn (Dean et al. 2004; Ortiz 1993), which may have been in a sense "owned" by that woman (Dean et al. 2004; Janetski 1991). One-year-old shoots were cut with a knife as leaves were starting to grow or after their leaves had fallen, tying them into bundles for transport to a camp or home base, then sometimes burning the stand

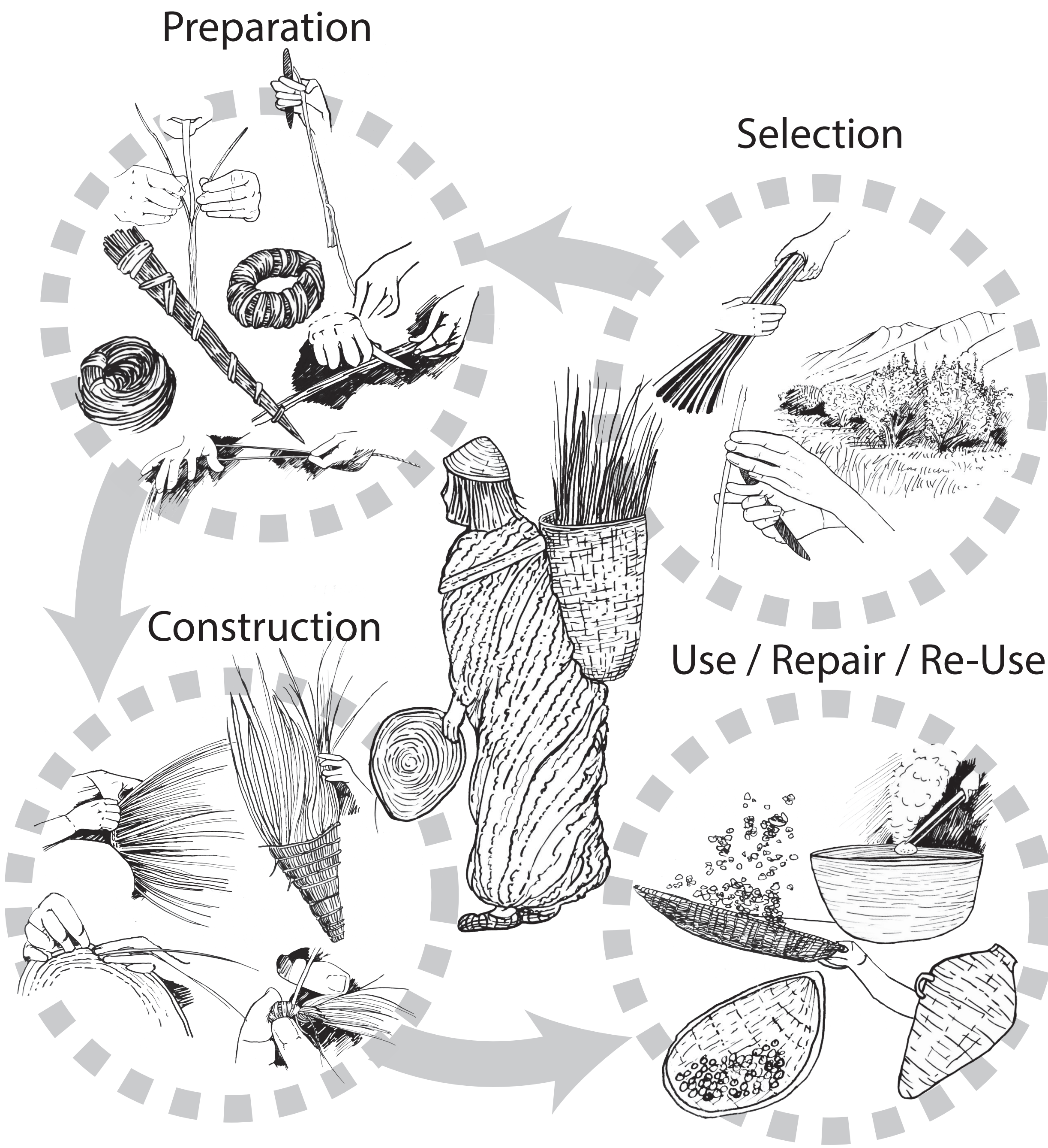

Figure 1.1. ***Chaîne opératoire*** **of cordage and basketry manufacture**

to encourage growth the following year (Dean et al. 2004; James 1902; Janetski 1991). Sometimes men assisted in carrying bundles, and children too, if procurement patches were not far from residential sites (Steward 1938).

An estimated four-hour-long preparation process began immediately after transport to the residence by either sprinkling the shoots with water or soaking them, then removing the bark with a knife, scraping in one direction away from the worker; and to produce stitches, the stems were split into three sections, using hands and teeth (Dean et al. 2004; Kelly 1932; Malouf 1940). The Panamint Shoshone in Death Valley emphasized boiling and scraping off the bark when the stems were still fresh (Kissel 1916), but in other cases, bark was removed after splitting and drying the willow stems (Dean et al. 2004). This process of gathering, splitting, and scraping stems was similar for the other common basketry plant: sumac (*Rhus tribolata* and *Rhus glabra*) (Farmer 2012; James 1902; Palmer 1878; Rhode 2002; Smith 1974; Stoffle et al. 1990) in the sagebrush vegetative zone, as well as serviceberry (*Amelanchier alifolia)* in the aspen/fir vegetative zone (Malouf 1940; Riddell 1978). For coiled basketry, the split, dried, and scraped rods and stitches were then sized, carefully using a knife or stone flake, arranged in straight bundles (rods) or wrapped into coils (stitches) and covered with willow bark for indefinite storage, later soaking them in water to rejuvenate for weaving (Anderson and Keeley 2018; Dean et al. 2004; Kelly 1932; Kissel 1916; Lowie 1924; Wheat 1967).

When constructing the basket, a bone awl was employed as the primary specialized tool, and depending on the cultural context, the awl was used to insert a stitch to the left or right of the previous stitch, for narrow and small baskets usually working from the exterior side of the basket, and for large baskets and trays, from the interior (Adovasio 2010; Kelly 1932; Malouf 1940; Morris and Burgh 1941; Weltfish 1932). Depending on the placement of the stitches, coiled baskets could have locking or interlocking stitches, and the stitches could engage with the foundational elements in a variety of configurations (Adovasio 2010; Malouf 1940). One time estimate for Owens Valley Paiute women to weave a twined winnowing basket was seven hours, while a finer-woven water basket could take 100-200 hours (Dean et al. 2004).

Everyone in a community benefited from this valuable material class, including eating seeds collected and processed in baskets by shaking them with hot coals in a tray to be later ground into meal (Powell 1875), boiling plants or bone to extract nutrients, and carrying infants in cradleboards. Baskets were valuable and often repaired by patching holes with hide, adding fresh stitches for reinforcement, or tying with cordage. According to one account, repairs to baskets usually occurred in the winter, when the group was less mobile (Dean et al. 2004). Much of the basketry observed in archaeological collections is fragmentary and was likely discarded as a result of irreparable damage from heavy use in food preparation.

Cordage. The selection, preparation, construction, and use and reuse of cordage can also be explored through a *chaîne opératoire* approach. Two of the most important plants selected for making strong rope for nets, fine string, slings, and rabbit-skin blankets in the Great Basin were the inner bast fibers from *Apocynum* sp. (dogbane) (Anderson 2005; Chamberlin 1911; Ebeling 1986; Janetski 1991; Kelly 1932; Malouf 1904; Mason 1902; Powell 1875; Rhode 2002; Riddell 1978; Sapir 1910; Simpson 1869; Smith 1974; Steward 1938; Turner 1998; Vestal 1939; Wheat 1967) and *Asclepias* sp. (milkweed) (Anderson 2005; Bocek 1984; Chamberlin 1909; Ebeling 1986; Howard 2003; Rhode 200; Turner 1998; Vestal 1939; Zigmond 1981), which were selected from the mountain forest/pinyon-juniper zone, and to a lesser extent *Linum lewisii* (prairie flax) (Ebeling 1986; Rhode 2002) from the aspen/fir zone, and *Urtica dioica* (stinging nettle) (Chamberlin 1911; Ebeling 1986; Janetski 1991; Rhode 2002; Turner 1998; Zigmond

1981) from the sagebrush zone. In California populations, patches of *Apocynum* sp. were maintained with fire to yield long straight stems (Anderson 2005), which were then cut in the late fall or winter (Anderson 2005; Rhode 2002; Turner 1998). Many plants were required to make string. One estimate is five *Apocynum* sp. stalks were needed to make one foot of string, and therefore a forty-foot net requiring around 7000 feet of string would combine the stalks of about 35,000 plants (Anderson 2005). Like *Apocynum* sp., *Asclepias* sp. was selected in the late summer or fall, when stems were dry (Rhode 2002). In addition, *Urtica dioica* was gathered in the late summer or fall when plants were drying.

In the case of *Apocynum* sp., after stems were cut, they were prepared by soaking in water to soften bark from fibers, and stems were then washed to separate long fibers (Rhode 2002). The Uintah Utes processed *Apocynum* sp. stems when dry by crushing dried stems to remove fibers (Smith 1974). Other groups in the Great Basin scraped bark from dried *Apocynum* sp. bark from stems with a knife (Wheat 1967). *Asclepias* sp. fibers were procured by scraping away the bark or pounding on a rock or chewing to separate fine fibers from the inner pith of the plant, and then wetting or briefly soaking in water before being rolled on the thigh (Rhode 2002; Zigmond 1981). *Urtica dioica* leaves were removed when stems were cut, and stems were left to dry longer (Turner 1998). Stems were then beaten to remove the bark, or cracked in short pieces to remove fibers from inner pith and worked to removed outer bark, and then separated fibers were moistened by dipping in water (Turner 1998; Zigmond 1981).

After fibers were separated, the construction process began, in which bundles of fibers were rolled on the thigh to create plies, and then combined with one or two other plies to make a cord either by rolling up or down the thigh (Malouf 1940; Rhode 2002; Wheat 1967). Both men and women used this method of creating string; however, in several groups in the Great Basin, men created string used in netmaking to catch jackrabbits, fish, waterfowl, and sage-grouse (Kelly 1932; Malouf 1940; Smith 1974; Steward 1938), employing a net gauge and a shuttle, or using a series of loops (Osborne and Riddell 1978). Women created most of the string used for a multitude of other purposes like fishing line, fish traps, tumplines, slings, loop snares for waterfowl, basket thongs, rabbit-skin blankets, carrying loops, and sewing materials (Anderson 2005; Ebeling 1986; Janetski 1991; Rhode 2002; Sapir 1910; Smith 1974; Turner 1998; Malouf 1940; Wheat 1967). Cordage made from *Asclepias* sp. was used to construct fine string for sewing, handles and straps for basketry, joining together mats and clothing, as well as bundles in the foundation of basketry, because it swells when wet (Anderson 2005; Bocek 1984; Chamberlain 1911; Ebeling 1986; Turner 1998; Vestal 1939; Zigmond 1981). There are fewer ethnographic accounts of *Asclepias* sp. string being used in net-making, as *Apocynum* sp. may have been preferred (as in Salish communities [Turner 1998]), or early ethnographers may not have accurately specified the difference between the many fine fibers (Howard 2003) used in net-making. For example, Powell (1875) refers generally to “native flax,” and Simpson (1869) refers to “a species of flax”; both may be referring to *Asclepias* sp., *Apocynum* sp., *Urtica dioica*, or other fine fibers.

Coarse fibers from the bark of trees and shrubs were also used to make a variety of objects in the Desert West, particularly the bark of big sagebrush (*Artemisia tridentata*) from the sagebrush zone and juniper (*Juniperus* sp.) from the mountain forest/pinyon-juniper zone, and to a lesser extent, cliffrose (*Purshia stansburiana*) and the closely-related bitterbrush (*Purshia tridentata*) in the sagebrush zone (Chamberlain 1911; Kelly 1932; Rhode 2002; Turner 1998). Details about the seasonality of the harvesting of coarse fiber material are unfortunately not recorded in the ethnographic record. Strips of the fibrous bark of *Artemisia* sp. were processed by scraping, shredding, and dampening the material to soften into more pliable fibers. Like *Apocynum* sp. and *Asclepias* sp., fiber cordage of *Artemisia tridentata* and *Juniperus* sp. was constructed by rolling separated fibers on the thigh to consolidate loose fibers, and occasionally mixed with the fibers of other plants (Kelly 1932; Lowie 1924; Riddell 1978). *Artemisia* sp. and *Juniperus* sp. both yield coarse, soft materials that are generally unsuitable for strong cordage commonly used in net-hunting (Kelly 1932), although there are accounts of early-spring antelope hunts using netting made from *Artemisia* sp. and *Juniperus* sp. (Frison et al. 1986; Riddell 1978; Smith 1974). Outside of rope, both plant types were used to also make clothing like skirts and sandals, blankets, bags, braided snares, and stoppers for jugs (Steward 1938; Ebeling 1986; Lowie 1909; Malouf 1940).

The Value of a Technological-Organization Approach. Highlighting the technological organization of perishable-artifact procurement, manufacture, and use enables us to use this material to address a variety of subjects of interest in archaeology outside of the traditional normative framework of basketry analysis, emphasizing behavior instead of culture-history (Carr and Maslowski 1995; Nelson 1991). The flexibility of this approach encourages a multi-dimensional exploration of cultural variation, so that perishable technologies may be used to discuss their economic, environmental, and social constraints and opportunities on people. A technological-organization analysis of this material class can also offer insight into the form, function, and value of an artifact, as well as aspects of human seasonality, mobility, population demographics, and site functions. Understanding the stages of production for these materials, and the way that decision-making processes embedded in this sequence relates to the final form of the material culture provides a middle-range theory for this study (Carr 1995). I integrate this detailed *chaîne opératoire* into my analysis of coiled basketry and cordage in the Bonneville

Basin as a way of establishing and comparing variables which reflect and influence decision-making processes and final artifact forms, integrating an understanding of the role of style in these materials.

Style in Archaeology

Style in archaeology can be most broadly defined as a way of doing something (Hegmon 1995). The concept of style is originally tied to culture history, wherein a series of stylistic signatures are classified to reconstruct distinct ethnic groupings. In his reaction to cultural-historical theory applied to Mousterian lithic assemblages, Binford (1973) sought to refocus archaeological analysis from ethnic differentiation to behavioral organization. This led to a debate about defining "function" versus "style" (Sackett 1982). Binford early in his career addressed artifacts (mostly stone tools) as having technomechanic, sociotechnic, and idiotechnic attributes (1962). This created Binford's implicit definition of style as any attribute of material culture that is not functional or technological, and this is the most classic definition applied by archaeologists (Binford 1989; Close 1989). Studies of lithic artifacts which differentiate between style and function are largely in agreement that style is associated with cognitive actions that cannot be addressed by archaeologists except on the broadest level of social groupings (Close 1989; Stout 2002).

The main debates about style have shifted to the communicative value of artifacts and their component parts by defining the difference between active signaling versus passive signaling. Of concern is the implicit and explicit communication which occurs between the maker and user (unconsciously or consciously), as well as the traditional learning complex in which it was made, the context it was used, who used it, and for what purpose (Bourdieu 1977;

Hegmon 1995; Hodder 1979; Plog 1978, 1983). The persistence of the traditional usage of "function vs. style" may be a problematic dichotomy, because style is shown to "function" in a society (Conkey 1989); however, terminology in literature still usually reflects the perceived dichotomy of function versus nonfunction, albeit qualified to refer to those attributes which do not seem to affect the final functionality of an artifact. For instance, terms like iconological vs. isocrestic style (Sackett 1986), emblemic vs. assertive style (Wiessner 1983; Wobst 1977), and decorative or technological style (McBrinn 2008) all seek to address the conscious and unconscious ways that those traits which are considered "nonfunctional" communicate to makers, users, and observers.

Technological Style. In this study, the term "technological style" is used in opposition to decorative style, and it is defined as nonfunctional attributes created without intent to actively communicate, which are learned and reinforced through a craft tradition (Lechtman 1977, 1984). A complex artifact (i.e. one which requires many decisions and labor to create [Kuttruff 1988]) has an increased potential to exhibit technological style, because passive traits decline in visibility when active traits are added (Lemmonier 1986). As shown previously in the discussion of basketry and cordage manufacture, a specific formula created through the *chaîne opératoire* is predictably followed and passively perpetuated and maintained through repeated practice and instruction, and therefore technological style rather than decorative style is viewed as the best way to track social groupings.

For example, Clark and colleagues (2013) emphasized scales of visibility of stylistic traits in Kayenta/Salado pottery as a way to characterize scale within and between cultures. They focused on "message-less" technological-stylistic traits, showing that conservative non-decorative attributes in domestic spheres are less likely to change after migration or enculturation

(Clark et al. 2013). Washburn (1987) studied basketry to characterize interaction and patterns of activity in California groups. She focused on the unconscious symmetry of decorative elements that is replicated within social groups, contributing to studies of marriage, trade patterns, ethnicity, and language, concluding that physical proximity is a better influence on stylistic similarity than language (Washburn 1987). In her work with late Archaic projectile points, sandals, and cordage from the Mogollon area and Tularosa Basin in New Mexico, McBrinn (2002, 2008) similarly defined stylistic categories to reflect scales of visibility of communicative traits. She showed that the overlapping nature of social identity, including economic network and marriage groups, was reflected in visible and nearly-invisible stylistic traits, which showed that affiliation was consciously and subconsciously demonstrated. In these examples, the authors similarly defined technological style as low-visibility, but still tied to nonverbal communication, and they highlighted the context of the manufacturing process (*chaîne opératoire*) of artifacts as the distinguishing characteristic of social groups and learning processes as keys to communicating identity.

Applying Middle-Range Theory

In this study of undecorated coiled basketry and cordage from the eastern Great Basin, technological style is considered the most appropriate style designation for these materials. The *chaîne opératoire* of basketry and cordage manufacture illustrated above reflects the series of decisions encountered in the manufacture process. Some of these decisions affect the intended function of the object: in basketry, these are the initial stages of manufacture of selecting and preparing plant materials which may inform on the size and intended final use of the coiled basket. For instance, a basket-maker would need to consider how many elements to prepare for stitches and foundations, and whether to prepare fiber to include in the foundation as a bundle for holding water. In a similar way, the initial decisions about selecting and preparing cordage materials will help direct the final function of the cordage: the inherent difference in strength in plant fibers will be a necessary consideration if the cord is intended to be part of a net (which requires strong fibers that can withstand being stretched and pulled) versus blankets (which are made from fibers that are soft but weak).

In basketry, although these are functional characteristics, they are still directed by and embedded in the community in which the basket-maker learned and developed their craft; however, technological style can be seen in the manifestation of these craft traditions. Technological style is most visible in the construction stage of the *chaîne opératoire*. This may be the decision of whether to insert the awl to the right or left of the previous stitch, affecting the work direction, or deciding whether to pierce the previous row of stitches, which manifests as a basket having split stitches. Other decisions like whether to include three thin rods or one larger rod in the foundation, or whether to finish a rim by wrapping the active element around itself or braiding it, are all decisions which do not change the ability of basketry to physically function as a parching tray or boiling basket, but nonetheless are part of the decision-making process. In cordage, technological style is expressed immediately in the construction stage through the decision to consolidate fibers by rolling them up or down the thigh, affecting the final twist direction of cordage. Both methods of consolidating fibers create equally functional cordage, but it is the decision to do one or the other that is unconsciously and habitually made (McBrinn 2005; Minar 2001; Petersen et al. 2001).

These physical processes of constructing perishable artifacts are communicated nonverbally, but primarily to others observing the construction phase. Their nonverbal and passive communicative potential, as well as the unconscious maintenance of these constructive processes throughout the lifetime of the weaver make these elements of technological style valuable expressions of craft tradition and the social context of the physical artifact. These technological-stylistic elements can be compared alongside functional elements of use/repair/reuse of these materials to characterize the dynamic role of perishable artifacts in past cultures in the eastern Great Basin.

Theoretical Approaches to Cultural Variation

The Great Basin has been a testing ground for many theoretical anthropological and archaeological approaches to the characterization of cultural change and variability. Some researchers have sought to characterize the role of paleoecology among hunter-gatherers throughout the cultural occupation of the Great Basin (e.g. Kelly 2001), while others have focused on sociological changes as a result of migration, interaction, or modifications in social organization (e.g. Allison 2008). These two theoretical paradigms have traditionally been developed in isolation of each other, and ecology-based theories and social-based theories have rarely been combined in the Great Basin in a way that reflects the complexity of the experience of people there (McBrinn and Roth 2016; Upham 2000). I aim for a theoretical perspective that combines the Great Basin theoretical tradition of human ecology as applied to hunter-gatherers, with the Southwest theoretical tradition of social interaction more commonly applied to farmers (Allison 2008). In this following section, I discuss the traditional theoretical frameworks employed in Great Basin perishable-artifact analysis.

Ecological Theory

Hunter-gatherer studies world-wide most commonly emphasize the relationship between ecology and subsistence, a trend developed and reflected in Great Basin theoretical discussions (Kelly 2001; Steward 1938; Thomas 1983). The prevailing academic theory practiced by Great Basin archaeologists and anthropologists falls under cultural ecology, in which human actions are considered to be heavily influenced by the natural environment (Steward 1938). Much of this research has led to other key theoretical frameworks in light of New Archaeology's emphasis on hypothetico-deductive reasoning, including human evolutionary ecology and human behavioral ecology, which explore human cultural practices in the context of principles of natural selection; this in turn has developed into optimal foraging theory, among others (Bettinger 1999; Kelly 2001, 2013; Winterhalder and Smith 1992, 2000). Optimal foraging theory emphasizes survival success, but is continually reevaluated to include other resource management concerns deemed necessary in hunter-gatherer societies, like diet-breadth or prey-choice, storage, travel, transport cost, processing time, pursuing non-food resources, and time-allocation (Barlow 2008, 2016; Bettinger 2009; Greenwald 2017; Jackson 1991; Ugan et al. 2003; Whelan et al. 2013; Winterhalder and Smith 2000).

Defining modern and past people based on their assigned subsistence strategy and relationship to the natural environment is well-accepted, and is perpetuated in this study. It should be noted, though, that this classification system has been considered a problematic assumption by some Indigenous writers as totalizing, overly abstract, and having roots in imperialist emphasis on categorization and ranking (Tuhiwai Smith 2008). The attachment and sometimes equating of Native Americans to the land has significant historical implications, which has fed into an assumption of pan-Native American or pan-Indigenous identity (Deloria

1988; Harkin and Lewis 2007; Krech 1999; Lomawaima 2004; Ranco 2007; Sturm 2011). Defining people based on their predictable relationship to the environment has also been a practice in Darwinian evolutionary archaeology, which is often criticized because of its assumed universalities, promotion of environmental determinism, implications of linear development from simple to complex as being "improvements" or progress, implication of a static past separate from the present, and the overall lack of agency in its explanations (Hegmon 2003; Ronaasen et al. 1999; Steward 1955; Thomas 2000). Scholars opposed to an emphasis on people's ties to the natural environment assert that other aspects of culture, like agency, innovation, idiosyncrasies, religion, inefficient activities, social groupings, and ceremonies are deemphasized in ecological models (Jones 2005; McGuire and Hildebrandt 2005; Ronaasen et al. 1999). Despite these criticisms, this study continues to employ categories like "hunter-gatherers" and "farmers", as well as differentiating between "prehistoric" and "historic" periods, as well as categories of complexity of culture, which may unfortunately perpetuate implicit assumptions about cultural characterization and categorization; however, I attempt to emphasize that subsistence strategy is only one aspect of the identity of past peoples in the eastern Great Basin region.

Social Theories

In other regions in the Desert West, such as the Southwest, where semi- and fully-sedentary groups practiced farming, archaeologists have focused on other aspects of human culture. Perhaps as a result of increased social complexity, the preservation of more highly decorated and technologically complex material culture like ceramics, and more permanent residential sites, archaeologists working in the Southwest typically incorporate theoretical frameworks that speak more to social theory, including discussions about how and why sociocultural change occurs through social interaction, networking, migration, and identity (Allison 2008; Clark 2013; Collar et al. 2015; Cordell 2008; Hegmon 2003; Peeples and Haas 2013; Schiffer 2000). Similar ideas have been applied to hunter-gatherer studies in the Southwest as well, although this is not as common (McBrinn 2008). Some social theories generally emphasize identity, and its pluralistic and situational qualities, which is discussed in more detail later in this chapter (Bourdieu 1977; De Vos 1995; De Vos and Ross-Romanucci 1975; Eckert 2008; Ferguson 2004; Lightfoot et al. 1998). One social theory is practice theory, which may incorporate concepts of style, as discussed in the above sections. Although practice theory seeks to address agency and past peoples' conceptions of themselves as belonging to a particular group, it does not require that archaeologists understand the intent of stylistic markers (Bourdieu 1977; Cordell 2008; Dobres and Hoffman 1994). Other approaches include cognitive-processualism, in which cognition and ideology are considered active contributors to change, with the role of human cognition (knowledge, ideology, and process) in the manufacture of and interaction with artifacts being considered through the construction of lines of inference (Renfrew 1994). Much of this work on characterizing cultural traditions is grounded, distantly, in culture history, but is being revived as a part of "processual-plus" archaeology (Hegmon 2003; Jordan 2013). Current studies incorporate multiple theoretical approaches to characterizing the social lives of past people under the umbrella of "Archaeology of the Human Experience" (Hegmon 2016); these studies use empirical methodologies to contextualize the actions of past people on a more personal socio-cultural level along the lines of gender, age, inequality, political structure, agency, and household, among others (Costin 2016; Hegmon 2016; Yanicki 2019). Approaches like network analysis address activities of past people as defined according to a variety of potentially overlapping markers like settlements, households, regions, and exchange patterns, which may be compared diachronically or synchronically (Fitzhugh et al. 2011; Knappett 2012; Mills et al. 2012; Sauvet 2017).

Evolutionary Archaeology and Cultural Transmission

Evolutionary archaeology, which focuses primarily on broad changes within a single culture, uses Darwinian evolutionary concepts as an analogy for change in material culture, and shares terminology as part of dual inheritance theory, like diffusion, transmission, and drift, which are helpful when applied to observed changes in material culture through time in populations. Cultural-transmission or dual-inheritance models have the potential to characterize cultural interactions, within and between elaborate social groupings and boundaries (Stark et al. 2008). Cultural transmission focuses on the decision-making process of artifact manufacture: the method of transmitting knowledge of the "correct" way of manufacturing artifacts across and between generations through instruction, and the conscious and subconscious conservative maintenance and reinforcement of these traits (Aoki et al. 2011; Jordan 2013; Jordan and Shennan 2003; Neiman 1995; Seki and Ihara 2012). Other studies emphasize the behavioral and biological causes of retention of manufacturing methods, using terminology of optimal foraging theory to explain the adoption of various technologies as being based in decisions related to maximization of time and energy (Bettinger et al. 2006; Ugan et al. 2003). Other studies characterize how muscle memory, nondeclarative memory, and habit maintain and reinforce traditions over generations (Aoki et al. 2011; Carr and Maslowski 2001; Eerkens 2000a; Minar 2001; Minar and Crown 2001; Thulman 2014). Cultural transmission is also combined with cognitive archaeology in studies of learning (Collard and Shennan 2008; Jordan and Shennan

2003; Stark et al. 2008), and the role of apprenticeships and craft traditions have all fed into discussions of social groupings and the maintenance of distinct identities on micro- and macro-regional scales, frequently in studies of basketry and cordage (Crown 2014; Jolie 2014a; McBrinn and Jolie 2008; Minar 2001; Petersen et al. 2001; Tehrani and Collard 2009; Van Keuren et al. 2013; Wendrich 2013a).

Summary

This brief discussion of theoretical approaches to the interpretation of prehistoric hunter-gatherers illustrates the potential approaches available to researchers studying material culture. Combining these theoretical approaches, rather than collecting and interpreting data through a narrow lens of a single theory, is seen as the best and most modern way to characterize and conceptualize the lifeways of past people (McBrinn and Roth 2016). In this study, I work under a cultural-ecological framework when contrasting subsistence strategies of past people and the associated functional interpretations of coiled basketry and cordage, as well as site function and mobility. But perishable artifacts also provide the opportunity to interpret other complex aspects of the daily lives of past people through incorporating social theories about performing identity and craft learning, through the collection of empirical evidence.

Reconstructing Prehistoric Identity and Social Organization

The discussion above of theoretical approaches to studying archaeological populations has made a series of assumptions about the identity of past peoples. Identity as a broad concept is subjective, and in this project, identity is considered situational, relational, and in flux. It has been defined in anthropology as pluralistic and nested (De Vos 1995; De Vos and Ross-

Romanucci 1975; Eckert 2008; Ferguson 2004; Lightfoot et al. 1998). An individual has multiple simultaneous identities which incorporate gender, sex, class, race, caste, ethnicity, age, marriage group, and craft group, and these, in addition to being overlapping and sometimes contradictory, are also transient and fluid. Characterizing these dynamic identities, therefore, is a challenge in prehistoric archaeology, which focuses most frequently on indirect, physical evidence on the population-scale rather than the identities of the individual. The material culture of small-scale societies focused on hunting and gathering and sometimes mixed with farming may potentially reflect broad identities and social organization, such as subsistence or economic categories, ethnicity, gender, and kinship, including marriage systems and residence patterns. In the following section, I define these broad social groupings and how they may be visible in the archaeological record.

Subsistence

Hunter-gatherers world-wide frequently are defined according to their multilevel sociality, in which social organization and membership is considered a fluid boundary, with social hierarchy ranging from nuclear families to collection of bands (Fitzhugh et al. 2011; Migliano et al. 2020). In modern populations of hunter-gatherers, this flexible social organization can greatly affect cultural development and maintenance, as well as cooperation and innovation (Migliano et al. 2020; Weissner 1983). In the Bonneville Basin of the eastern Great Basin, historic Native American people (without horses) were considered similar in demographic makeup, speaking related languages, practicing seasonal mobility as a result of environmental variability, maintaining an egalitarian social structure, emphasizing flexible group sizes from family level to larger seasonal communities of connected families, and assignment to specific but looselyorganized historic tribes (Service 1962; Steward 1938). As discussed above, it is generally assumed that prehistoric groups of the Great Basin practiced lifeways similar to modern hunter-gatherers, especially in relation to mobility (Kelly 1990, 2001), and while there may have been some ethnic differences between these groups, difference in archaeological material culture may also be the result of variation in site function related to this subsistence strategy.

This characterization of isolated hunter-gatherer groups depending on wild resources may be simplistic, because foraging in modern groups and in the recent past may be viewed on a spectrum when neighboring groups practice other subsistence strategies, like farming (Kelly 2013). Defining the parameters of hunter-gatherer subsistence strategies is important in Great Basin cultural ecological models, driving debates in the eastern Great Basin over the presence of late Holocene farmers alongside hunter-gatherers, which will be discussed in greater detail in Chapter 2 and Chapter 5 (Grayson 2011). The presence of domesticated plants in hunter-gatherer-attributed sites, or wild foods in farming-village sites, challenges our notion of how to categorize sites and the identity of past people; however, recent studies embrace this adaptive diversity across the hunter-gatherer foraging spectrum (Kelly 2013; Roth 2016; Simms 1999, 2008).

In archaeology, this form of social identity is most visible in utilitarian artifacts associated with subsistence-related tasks. The mobile hunter-gatherer lifestyle of Great Basin people is traditionally thought to preclude the manufacture and use of non-mobiliary material culture, with the exception of permanent natural landforms, such as in the case of drive or trap features (Hockett and Murphy 2009), bedrock mortars (Jackson 1991), graves, or rock art interpreted as hunting-magic (Heizer and Baumhoff 1962). Ceramic artifacts, although associated with significant time investment for gathering and processing of clay and a degree of sedentariness for building, drying, and firing pots, are still present in some mobile hunter-gatherer settings. At these sites, they are interpreted as utilitarian and used at the family or individual scale rather than for prestige, trade, or display (Eerkens et al. 2002). Therefore, even though material culture may look similar at hunter-gatherer and mixed-farming sites, the application and context of material culture in hunter-gatherer groups may be generally contrasted with groups practicing other subsistence strategies on this broad level of social organization.

Ethnicity

Historically, archaeologists have defined ethnicity as a broad-scale social grouping or formal and conscious group identity, with shared traditions, history, geographic origin, and values which operate in opposition to other groups (Barth 1969; Clark 2004; De Vos 1995). In the past, others have defined an ethnic group as one that is self-perpetuating with shared cultural values, and is self-consciously distinguishable from other ethnic groups (Barth 1969; De Vos 1995; De Vos and Ross-Romanucci 1975). Other definitions also emphasize symbolic elements in culture, for example ideas of "emblems" as a means of self-identification in contrast to other groups (De Vos and Ross-Romanucci 1975; Schermerhorn 1978). Ethnicity is therefore considered cultural, not biological, and though it is subjective and emic, it is not as in flux as other forms of identity. Another important aspect of defining ethnicity is the maintenance of psychological—not necessarily physical—boundaries. With a sense of membership, ethnicity can be perpetuated, and boundaries can be reinforced through conscious and subconscious craft manufacture (Barth 1969; Bourdieu 1977; De Vos 1995).

In archaeology, culture-historical models commonly compared technological variation of artifacts, building typologies and describing the interplay between types across time and space to address this aspect of human identity. Critics of the culture-historical paradigm, however, frequently react to the assumptions of ethnicity in past people, because categorization may not accurately reflect perceived human groupings in the past, or interpretations may be at odds with the world views of descendant populations (Binford 1973; Ferguson 2004; Jones 2005; Shoemaker 2002; Zimmerman 2008). Ethnic membership in the past is a challenge to define given its cognitive nature, but with a focus on material culture that appears to communicate opposition to other groups, archaeologists may be able to tease apart ethnic groupings. Defining traits of ethnic populations and their archaeological origin may make visible migrant populations from local groups, and how potential interaction with opposing groups may have redefined or reinforced ethnic identity. Archaeologists have investigated which traits are best indicators of ethnicity and how to confirm this emic identity. When choosing variables of material culture for this purpose, the expectations are that (1) ethnicities will be visible in material culture through markers that actively communicate membership (in opposition of other groups), and (2) that they will passively indicate a shared tradition of craft production retained through membership maintenance (Clark 2004; De Vos 1995).

Gender

While gender is acknowledged to be nonbinary in modern and past human populations, often defined on the basis of context, gender roles in North American Indigenous groups often have been defined according to technology, craft, or labor in a way that is binary. Ethnographers across the Desert West made note of women's and men's roles in daily tasks, and often remarked on individuals whose gender roles deviated from their biological sex (e.g. Steward 1938). Whether this focus on gender norms is more reflective of the perspectives of white, male outsiders, or the filter of modern American/European views of gender (Conkey 2013), many tasks and technologies do indeed seem to be associated with a binary of masculine versus feminine (Hegmon et al. 2016; Murdoch and Provost 1973; Senior 2000). Although *individuals* who made and used technologies may have internally and/or externally identified on a non-binary spectrum of gender (Ghisleni et al. 2016), it is reasonable to associate some technologies and behaviors with broad categories of men's and women's *roles* (Jolie 2014a). In this study, I use the terms "men" and "women" to refer to the practiced gendered behavior that is exhibited in material culture. I do not intend to imply that all individuals who practiced the manufacture of women-associated artifacts like basketry were cisgender, and nor do I intend to suggest an individual's association with the creation and use of material culture is static. Instead, I assume that an individual's perceived and ascribed gender was likely in flux and dynamic, and redefined according to context and age. But because this study is not focused on the individual, but rather, the community in which material culture was created and used, I discuss material culture as embedded in gendered tasks, as is supported by ethnographic research.

Feminist and gender studies in archaeology recently have considered both women's *and* men's effects on culture, rather than searching for evidence of women in prehistory (Senior 2000). This perspective depends on observations made by early ethnographers who often did not put as great a focus on defining gender roles, which continued to promote the "Man the Hunter" perspective for archaeological interpretation (Conkey and Gero 1991; Fulkerson 2017; Kehoe 2013). Broadly speaking, in many small-scale hunter-gatherer groups world-wide, ethnographers noted women practicing tasks like plant gathering, processing, and cooking, as well as firewood and water hauling, activities more often located nearby habitations and seen as coinciding with child-rearing (Jackson 1991; Kelly 1932; Murdock and Provost 1973; Steward 1938). Men were considered more mobile, broadly associated with hunting, warfare, and trading (Jackson 1991). Unfortunately, a hierarchy reflecting European values was implicitly assumed by researchers, and as a result, the importance of the activities of women, specifically in regards to plant subsistence and other domestic tasks, was traditionally de-emphasized by archaeologists, despite ethnographic evidence that plant materials make up the bulk of non-arctic hunter gatherers' diets (Lee and DeVore 1968; Waguespack 2005). Furthermore, male activities like large-game hunting by lone hunters was overemphasized, and the integral role of communal hunting of medium and small game like deer, rabbits, and birds was de-emphasized (Elston and Zeanah 2002; Hildebrandt and McGuire 2003). In addition, this traditional perspective rarely incorporated age groups outside of young adults, even though children, post-menopausal women, and elderly men also held prominent roles in hunter-gatherer societies.

It is important to note that even within prescribed men's and women's activities, there was community involvement: men may have hunted large game, but women skinned, butchered the meat and processed the hide; and, alternatively, women may have gathered pine nuts or acorns, but men assisted in climbing trees and roasting food (Anderson 2005; de Beaune 2019; Steward 1938, 1970). Women gathered roots, but the entire community likely assisted in constructing earth ovens to cook them. Similarly, in the realm of textile technology, women were associated with basketry and plant foods, but the entire community's mobility may have been influenced by access to appropriate plant products (Jackson 1991). Men made and owned netting, but all members of the community could assist in driving rabbits to the nets. Therefore, rather than thinking of material culture as existing within distinct, impenetrable spheres of adult women and adult men's activities, it may be more fruitful and more reflective of past humans for archaeologists to study community involvement in the gathering, processing, manufacture, use, and repair of material culture (Crown 2014). I will continue to reference divisions of tasks based on basket and cordage gendered activities, but I continue to emphasize that the boundaries of these gendered spheres are flexible and not isolated from participation by the wider community.

Kinship, Marriage, and Community

Gender is an integral component of other scales of social identity, like kinship, marriage practices, and post-marital residences. Kinship organization has a valuable function of organizing labor and building social ties for establishing trade and ensuring resource sharing (Bahn 1982), and kinship is also the social environment for building communities by which craft traditions are taught and learned (Crown 2014; Deetz 1965; Hill 1966; Lyons and Clark 2008; Mills 2018; Minar and Crown 2001; Wendrich 2013b). In anthropology, kinship is generally addressed as a cultural rather than biological organization (although, some recent studies use mtDNA and Y-chromosome variation to compare post-marital residences of modern populations [Bolnick 2011; Bolnick et al. 2006]), and kinship identities may also be based on locality (Clemmer 1991). Kinship can be explored through material culture, using approaches which apply concepts of evolutionary biological processes (Collard and Shennan 2008; Jordan and Shennan 2003; Tehrani and Collard 2009). Material culture may also be understood as an expression of kinship by targeting technological-stylistic traits to determine potential fictive kinship ties and contexts (Hill 1966; McBrinn 2008; Sanger et al. 2019; Washburn 1987). Boundaries between groups of people can be maintained through defining and reinforcing kinship, but these boundaries are also collapsed through marriage and blending (Fowler 2011). A sense of scale is also integral in kinship studies, because kinship can be understood in a hierarchy from the household level (Douglass and Gonlin 2012) (although Joyce and Gillespie [2000] would argue that a household should be considered separate from kinship), through marriage group (McBrinn 2008) and “corporate” or extended household group (Ensor 2015; Hill 1966; Wiessner 1983), to generational lineage.

Kinship in socially complex groups is frequently a consideration for property ownership, and although little physical property was owned in small-scale hunter-gatherer groups, rites of access to valuable resources as property may be transferred through kinship design. For instance, matrilocality was practiced in some Sierran California groups like the Mono because of inheritable ownership of female-associated oak stands, natural mortar features for grinding acorns, and granaries for storing surplus (Jackson 1991). However, among the Miwok and Yokuts of the Sierras, patrilocality was favored, because women shared mortar features with the husband’s family (Jackson 1991). Language is an overemphasized barrier for ethnic groups, because people may be multi-lingual, and studies also suggest that dialect boundaries were permeable across the prehistoric Desert West and did not restrict exogamous marriage until historic times (Hage et al. 2004). The role of kinship in directing mobility, interaction, exchange, and trade has become a significant part of the interpretation of some recent archaeological studies (e.g. Byrd 2014; Coltrain and Janetski 2019; Habicht-Mauche 2008; Hildebrandt and McGuire 2003; Kemp et al. 2010; McBrinn 2005, 2008; Yanicki 2019), which will be discussed in greater detail in Chapter 5.

Initial criticisms of reconstructing kinship of people in the past mostly addressed the potential generalizations of the cognitive and emic perspectives of past people, as well the dependence on categories of post-marital residence and descent established by Murdock’s (1949, 1957) cross-cultural surveys, which may or may not reflect all possible residence patterns, or may be overly simplified (Allen and Richardson 1971). Criticisms of kinship reconstruction are extensions of familiar trepidations of using ethnographic analogy in general, namely that archaeologists risk making flawed interpretations by using biased sources grounded in European concepts of normative behavior (Gillespie 2000; Joyce 2000). There are also criticisms of the implicit functionalist assumptions of kinship (Gillespie 2000; Joyce 2000). Despite these criticisms, kinship still is shown to be practiced world-wide, influencing socio-economic behaviors, political structure, settlement organization, craft tradition, and patterns of exchange. It is a valuable perspective for addressing potential synchronic variation and diachronic change in the social organization of archaeological populations (Ensor 2011, 2015; Kelly 1932; Yanicki 2019).

Summary

With this understanding of the potential applications of basketry and cordage to hunter-gatherer studies, this project seeks to engage in ongoing debates in the eastern Great Basin addressing the nature of subsistence and the nature of human identity in the past. By utilizing ethnographic accounts of hunter-gatherer activities to reconstruct the complex decision-making process of constructing utilitarian objects and the cultural causes and effects of these decisions, as well as applying a rich set of theoretical paradigms in tandem, this study prominently positions coiled basketry and cordage to characterize human identity and experience in the eastern Great Basin. In the following chapters, I present my study of basketry and cordage in the Bonneville Basin. Chapter 2 provides a geographic and cultural overview of the Bonneville Basin, and I present the significant ongoing debates in the archaeology of the eastern Great Basin. In Chapter 3, I provide a diachronic analysis of perishable artifacts from Bonneville Estates Rockshelter, applying *chaîne opératoire* to characterize the technological organization of artifacts, and I explore potential variability in artifact function and manufacturing methods over time. In Chapter 4, I present a synchronic analysis of artifacts from nine additional cave and rockshelter sites in the Bonneville Basin assigned to the late Holocene to further consider the temporal variability observed at Bonneville Estates Rockshelter within a regional context. Chapter 5 serves as an application of these data to develop and test models of ethnogenesis in this region. Chapter 6 concludes the study and positions it in the context of future work on perishable artifacts in the Desert West.

CHAPTER 2

ECOLOGY, HUMANS IN THE GREAT BASIN, AND CURRENT DEBATES

Geography and Ecology

Modern Geography and Ecology

The Bonneville Basin is located in the eastern Great Basin, which includes much of Utah, parts of eastern Nevada, and southeastern Idaho. It is geographically bounded on the east by the western slopes of the Wasatch Range, on the south by the southern edge of the Sevier Basin, on the west by the eastern edge of the Snake Range (east of Great Basin National Park) and Goshute-Toano Range in Nevada, and to the north by the Snake River Plain in Idaho. During the late Pleistocene, it was filled by Lake Bonneville, to an elevation of around 1,560 m (Oviatt 2015) (Figure 2.1). The region is comprised of flat-floored valleys with north-to-south trending mountain ranges, part of the Basin and Range physiographic region. It is a cool desert, with a mosaic of ecozones including permanent wetlands, playas, dunes, salt deserts, and mountains. The highest elevation within the Bonneville Basin is Ibapah Peak in the Deep Creek Range (3,663 m asl), while the lowest is in the Great Salt Lake Desert (1,295 m asl) (Grayson 2011). The region includes geographic landmarks like the Great Salt Lake and Great Salt Lake Desert, the Blue Lake Marsh, the Sevier subbasin (Sevier Lake, Sevier River, and Sevier Desert), Tule Valley, and the Bear River in northern Utah.

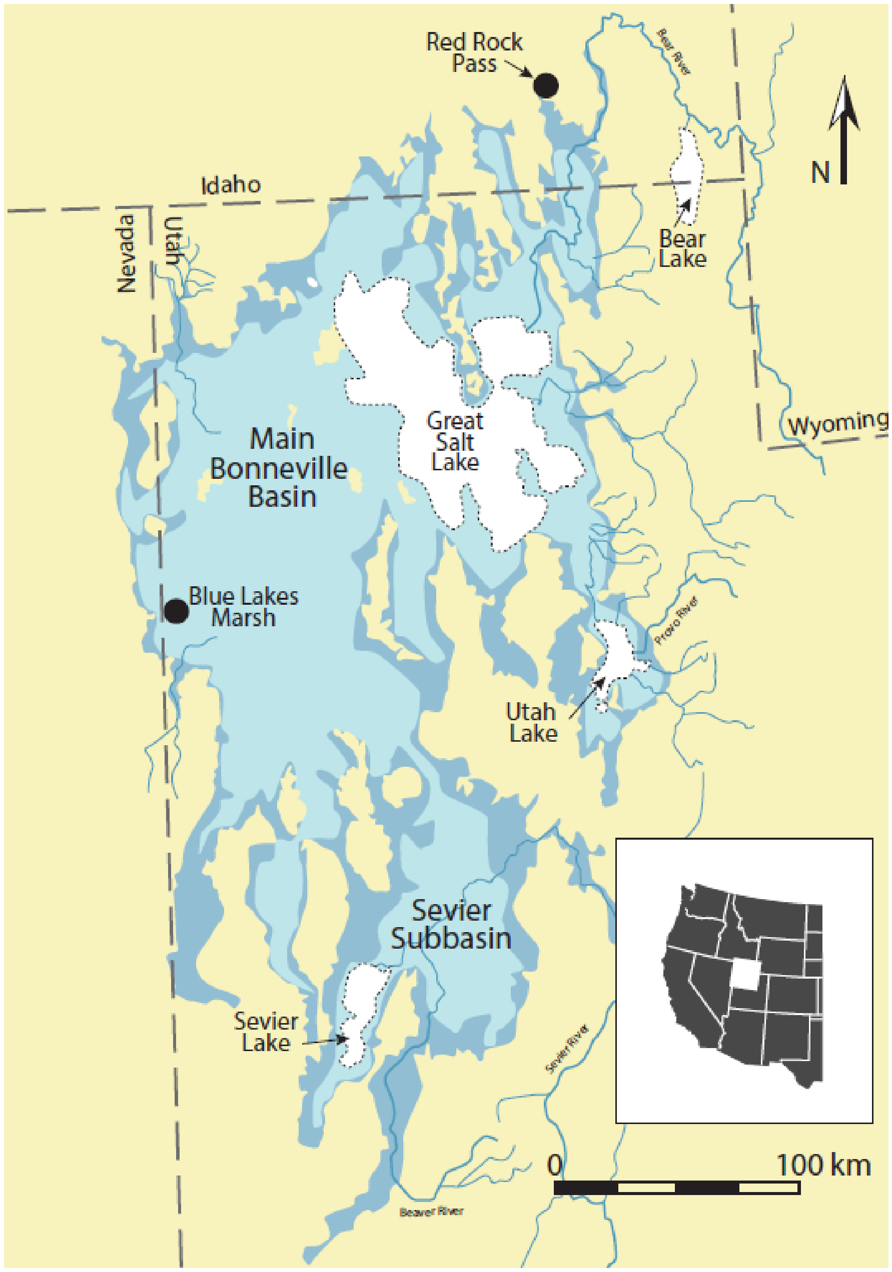

Figure 2.1. Map showing greatest extent of Pleistocene Lake Bonneville (dark blue), basins sub-basins during the latest Pleistocene (light blue), and modern lakes (white). The study area is the Main Bonneville Basin. Adapted from Louderback and Rhode (2009), Oviatt (2015) and Adams (Oviatt and Shroder 2016).

Vegetative Zones. The floristic Great Basin, per Grayson (2011), includes regions outside the hydrographic and physiographic Great Basin, including a significant portion of southeastern

Oregon and all of the Snake River Plain. The plant communities of the Great Basin are regionally variable, and throughout the literature these communities have been used to create "vegetation zones" (Schultz and Schultz 1984). Some researchers group plant communities into three regional zones: semiarid valleys, terraces and alluvial fans, and mountains (Rhode 2002). Other researchers have a more complicated separation of these zones, referring to them as salt flats, salt desert scrubland, sagebrush grassland, desert woodland (pinyon-juniper zone), montane forest, montane shrubland, and alpine grassland (Schultz and Schultz 1984). The Bureau of Land Management (BLM) defines the "Intermountain Sagebrush Province" as consisting of juniper/pinyon woodland, ponderosa forest, sagebrush, and saltbrush/greasewood (BLM Utah 1991). While plants are sensitive to a variety of conditions in the eastern Great Basin, in terms of substrate, precipitation, temperature, salinity, and latitude, desert plants are specially adapted to extreme fluctuations in temperature and precipitation; therefore, altitude is considered the most important variable in this study (Laity 2008).

Clinal variation in altitudinal distribution of plants allows for the characterization of definable vegetative zones (Grayson 2011; Schultz and Schultz 1984). I compared 26 locations in the Bonneville Basin where elevation and annual precipitation data were available, using BLM wilderness service reports (BLM Utah 1985, 1999), US and state geologic survey reports (Gardner and Kirby 2011; Hood and Waddell 1968; Lowe et al. 2004), National Weather Service documents published online (nws.gov), and Rangeland Resources of Utah reports (extension.us.edu; Gillies and Ramsey undated) (Figure 2.2). Although there is some overlap and variability, there is a general trend of lower precipitation in the valleys and greater precipitation in the mountains. For my purposes here, and in keeping with previously published studies of Bonneville Basin vegetation (Grayson 2011; Louderback 2007; Lull and Ellison 1950; Rhode

2002; Schultz et al. 2002), these zones are defined according to elevation as: shadscale and salt flat zone in the low valley floors (1,200-1,800 m asl); sagebrush zone in the lowlands (1,500-1,870 m asl); mountain-brush/pinyon-juniper zone in the midlands (1,730-2,300 m asl); and aspen/fir zone (2,300-2,900 m asl) and subalpine/alpine grassland zone (2,900-3,650 m asl) in the uplands (Figure 2.3). These vegetative zones represent a general distribution, and it is recognized that there is some overlap between these zones, especially the sagebrush and desert woodland. Additionally, not all zones are represented in all parts of the eastern Great Basin, and not all plants associated with these zones are observed throughout all of the Bonneville Basin. The Deep Creek Range is the highest elevation in the Bonneville Basin at 3,663 m asl, and although there is no aspen/fir zone in these mountains, aspen (*Populus tremuloides*) and Douglas-fir (*Pseudotsuga menziesii*), and lodgepole pine (*Pinus contorta*) (another higher-elevation conifer), as well as an alpine grassland zone do occur in the Deep Creek Range as well as in the Raft River Mountains in the northern Bonneville Basin (Schultz and Schultz 1984).

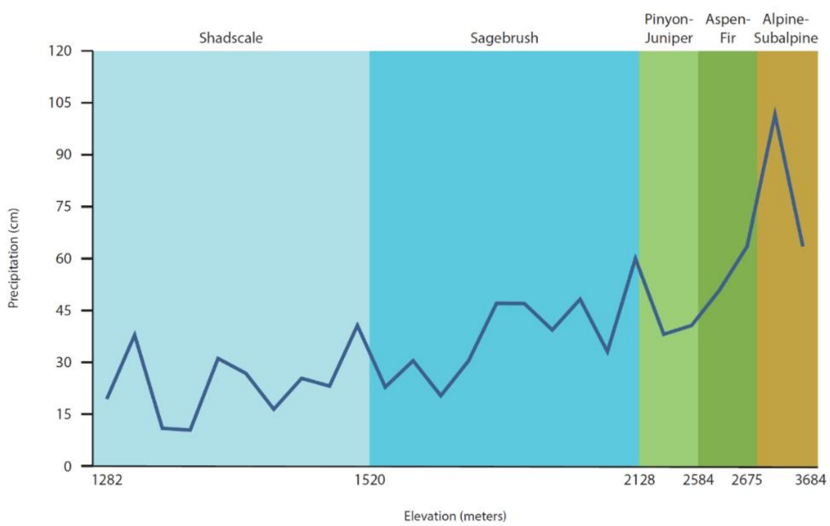

Figure 2.2. Precipitation according to elevation in the Bonneville Basin, determined using 26 locations. Data from BLM Utah 1985, 1999; Gardner and Kirby 2011; Hood et al. 1968; Lowe et al. 2004; National Weather Service documents at nws.gov; Rangeland Resources of Utah report extension.us.edu; Gillies and Ramsey (n.d).

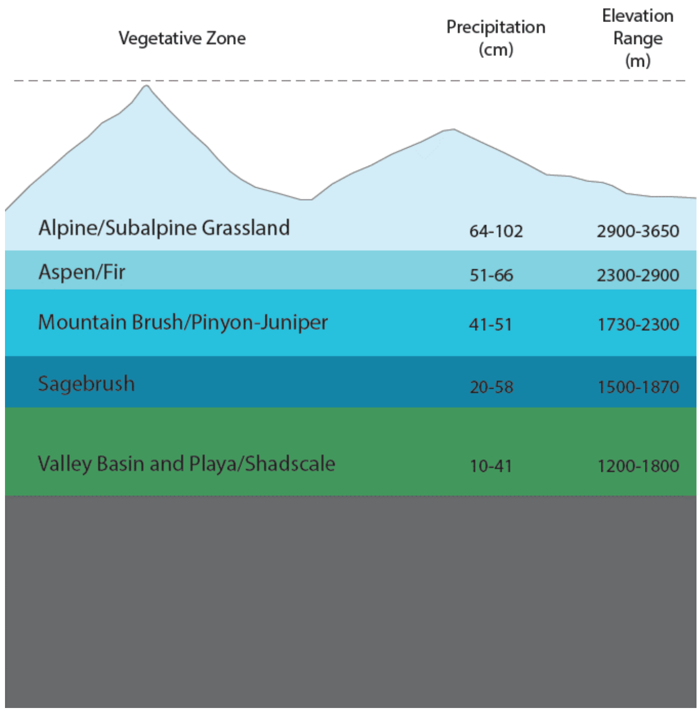

Figure 2.3. Modern vegetative zones in the Bonneville Basin.

As part of this study, I conducted a literature survey of the growing conditions of 108 plants in the modern Bonneville Basin (Figure 2.4, Table 2.1), which included plants with strictly-bounded growing conditions based on elevation and precipitation, although some plants overlap in clinal distribution. This list of observed plants in the Bonneville Basin was compiled using plant-identification guides (Blackwell 2006; Kershaw et al. 1998; Mozingo 1987; Perryman and Skinner 2007; Rhode 2002), palynological studies (Louderback 2007; Louderback and Rhode 2009; Lull and Ellison 1950), BLM and US Forest Service reports (BLM Utah 1991, 1999; www.fs.fed.us), and other Great Basin sources (Grayson 2011; Laity 2008; Louderback 2007; Louderback and Rhode 2009; Schultz and Schultz 1984). The purpose of this literature survey was to establish a modern proxy of growing conditions of plants to compare to pollen in the paleoecological record. Many of these particularly sensitive plants are forbs and seasonal

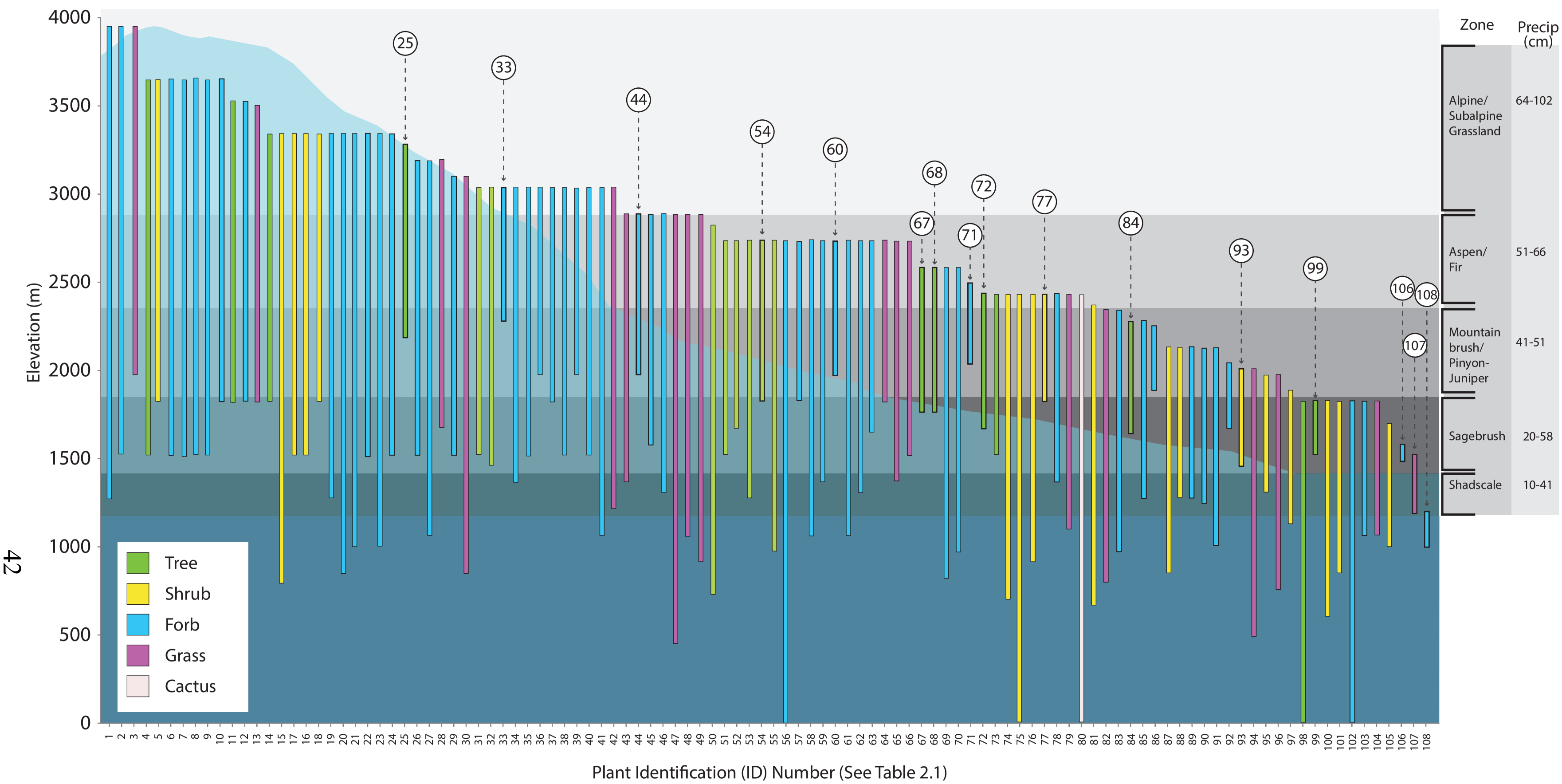

Figure 2.4. Growing conditions of plants in the Bonneville Basin, according to elevation. See Table 2.1 for the index of plant identification (ID) numbers. The plants considered most sensitive to clinal variation in elevation are denoted by circles. These are: ID 25 (bristlecone pine, *Pinus longaeva*), 33 (larkspur, *Delphinium occidentale*), 44 (swamp onion, *Allium validum*), 54 (curlleaf mountain mahogany, *Cercocarpus ledifolius*), 60 (buckbean, *Menyanthes trifoliata*), 67 (Rocky Mountain juniper, *Juniperus scopulorum*), 68 (pinyon pine, *Pinus monophylla*), 71 (Deep Creek stickweed, *Hackelia ibapensis*), 72 (Utah juniper, *Juniperus osteosperma*), 77 (golden currant, *Ribes aurem*), 84 (Gambel's oak, *Quercus gambelii*), 93 (skunkbush sumac, *Rhus tribolata*), 99 (cottonwood, *Populus augustifolia*), 106 (passey onion, *Allium passeyi*), 107 (broadleaf cattail, *Typha latifolia*), and 108 (pickleweed, *Salicornia rubra*).

Table 2.1. Survey of Bonneville Basin Plants.

Zone	ID	Family	Genus / Species	Common name	Elevation (low) (masl)	Elevation (high) (masl)	Type
All	1	POLEMONIACEAE	*Leptodactylon pungens*	prickly phlox	1277	3952	forb
	2	LILIACEAE	*Zigadenus elegans*	elegant camas	1520	3952	forb
Subalpine/Alpine Grassland/Meadow	3	AVENEAE	*Trisetum spicatum*	spike trisetum	1976	3952	graminoid
	4	SALICACAEA	*Populus tremoloides*	quaking aspen	1520	3648	tree
	5	GROSSULARIACEAE	*Ribes cereum*	wax currant	1824	3648	shrub
	6	POLYGONACEAE	*Eriogonum* sp.	buckwheat	1520	3648	forb
	7	BRASSICACEAE	*Cardamine cordifolia*	heart-leaf bittercress	1520	3648	forb
	8	HYDROPHYLLACEAE	*Phacelia hastata*	silverleaf phacelia	1520	3648	forb
	9	FABACEAE	*Astragalus whitneyi*	locoweed	1520	3648	forb
	10	ONAGRACEAE	*Epilobium angustifolium*	fireweed	1824	3648	forb
	11	PINACEAE	*Pinus flexilis*	limber pine	1824	3527	tree
	12	ASTERACEAE	*Arnica mollis*	soft arnica	1824	3496	forb
	13	POACEAE	*Leucopoa kingii*	kingspike fescue	1824	3496	graminoid
	14	PINACEAE	*Pinus contorta*	lodgepole pine	1824	3344	tree
All	15	ASTERACEAE	*Chrysothamnus viscidiflorus*	green rabbitbrush	791	3344	shrub
Aspen/Fir	16	ASTERACEAE	*Artemisia tridentata*	big sagebrush	1520	3344	shrub
	17	CAPRIFOLIACEAE	*Symphoicarpos rotundifolius*	snowberry	1520	3344	shrub
	18	CAPRIFOLIACEAE	*Sambucus* sp.	elderberry	1824	3344	shrub
	19	ASTERACEAE	*Machaeranthera canescens*	hoary tansy-aster	1277	3344	forb
	20	ROSACEAE	*Rosa woodsii*	Woods' rose	851	3344	forb
	21	SCROPHULARIACEAE	*Penstemon* sp.	penstemon	1003	3344	forb
	22	POLYGONACEAE	*Eriogonum umbellatum*	sulphur flower	1520	3344	forb
	23	ASTERACEAE	*Chaenactis douglasii*	dusty maiden	1003	3344	forb
	24	ROSACEAE	*Holodiscus dumosus*	bush oceanspray	1520	3344	forb
	25	PINACEAE	*Pinus longaeva*	Great Basin bristlecone	2189	3283	tree
	26	LILIACEAE	*Smilacina stellata*	star flowered false solomons seal	1520	3192	forb
	27	ONAGRACEAE	*Oenothera caespitosa*	tufted evening primrose	1064	3192	forb
	28	POACEAE	*Elymus multisetus*	big squirreltail big bottlebrush	1672	3192	graminoid
	29	FABACEAE	*Lupinus argenteus*	silver lupine	1520	3101	forb
	30	JUNCACEAE	*Juncus balticus*	baltic rush	848	3101	graminoid
	31	ROSACEAE	*Amelanchier utahensis*	serviceberry	1520	3040	shrub
	32	ROSACEAE	*Prunus virginiana*	western chokecherry	1459	3040	shrub
	33	RANUMCULACEAE	*Delphinium occidentale*	western larkspur	2280	3040	forb
	34	LINACEAE	*Linum lewisii*	prairie flax	1368	3040	forb
	35	RANUMCULACEAE	*Aquilegia* sp.	columbine	1520	3040	forb
	36	APIACEAE	*Ligusticum grayi*	grays lovage	1976	3040	forb
	37	BORAGINACEAE	*Hackelia patens*	pale stickseed	1824	3040	forb
	38	FABACEAE	*Lupinus* sp.	lupine	1520	3040	forb
	39	GERANIACEAE	*Geranium richardsonii*	richardson's geranium	1976	3040	forb
	40	ONAGRACEAE	*Gayophytum diffusum*	diffuse gayophytum	1520	3040	forb
	41	MALVACEAE	*Sidalcea oregano*	bog mallow	1064	3040	forb
	42	POACEAE	*Festuca* sp.	idaho fescue	1216	3040	graminoid
	43	POACEAE	*Pseudoroegneria spicata*	bluebunch wheatgrass	1366	2891	graminoid
	44	LILIACEAE	*Allium validum*	swamp onion	1976	2888	forb
	45	APIACEAE	*Heracleum lanatum*	cow parsnip	1581	2888	forb
Mountain Forest/Pinyon-Juniper	46	ASTERACEAE	*Achillea millefolium*	yarrow	1307	2888	forb
	47	POACEAE	*Achnatherum hymenoides*	indian ricegrass	456	2888	graminoid
	48	POACEAE	*Leymus cinereus*	wild rye	1064	2888	graminoid
	49	POACEAE	*Stipa comata*	needleandthread	912	2888	graminoid
	50	CHENOPODIACEAE	*Krascheninnikovia lanata*	winterfat	730	2827	shrub
	51	CORNACEAE	*Cornus sericea*	creek dogwood	1520	2736	tree
	52	ERICACEAE	*Arctostaphylos patula*	green-leaf manzanita	1672	2736	tree
	53	SAPINDACEAE	*Acer grandidentatum*	bigtooth maple	1277	2736	tree
	54	ROSACEAE	*Cercocarpus ledifolius*	curlleaf mountain mahogany	1824	2736	shrub
	55	ROSACEAE	*Purshia tridentate*	bitterbrush	973	2736	shrub
	56	BRASSICACEAE	*Descurainia* sp.	tansy mustard	0	2736	forb
	57	LAMIACEAE	*Agastache urticifolia*	horsemint	1824	2736	forb
	58	ASTERACEAE	*Balsamorhiza sagittata*	arrow-leaf balsam root	1064	2736	forb
	59	LILIACEAE	*Zigadenus paniculatus*	sand corm	1368	2736	forb
	60	MENYANTHACEAE	*Menyanthes trifoliata*	buckbean	1976	2736	forb
	61	PAPAVERACEAE	*Argemone munita*	prickly poppy	1064	2736	forb
	62	ASTERACEAE	*Erigeron* sp.	rayless daisy	1307	2736	forb
	63	RUBIACEAE	*Galium* sp.	northern bedstraw	1650	2736	forb
	64	POACEAE	*Elymus elymoides*	bottlebrush squirreltail	1824	2736	graminoid
	65	POACEAE	*Poa secunda*	sandberg bluegrass	1368	2736	graminoid
	66	POACEAE	*Deschampsia elongata*	slender hairgrass	1520	2736	graminoid
	67	CUPRESSACEAE	*Juniperus scopulorum*	Rocky mountain juniper	1763	2584	tree
	68	PINACEAE	*Pinus monophylla*	pinyon pine	1763	2584	tree
	69	ASCLEPIADACEAE	*Asclepias* sp.	milkweed	821	2584	forb
	70	SCROPHULARIACEAE	*Verbascum* sp.	wooly mullein	973	2584	forb
	71	BORAGINACEAE	*Hackelia ibapensis*	deep creek stickseed	2037	2493	forb
	72	CUPRESSACEAE	*Juniperus osteosperma*	Utah juniper	1672	2432	tree
	73	PINACEAE	*Pseudotsuga mensieii*	douglas fir	1520	2432	tree
	74	SALICACAEA	*Salix exigua*	sandbar willow	700	2432	shrub
	75	CHENOPODIACEAE	*Sarcobatus vermiculatus*	greasewood	0	2432	shrub
	76	ASTERACEAE	*Chrysothamnus nauseosa*	rubber rabbitbrush	912	2432	shrub
	77	GROSSULARIACEAE	*Ribes aurem*	golden currant	1824	2432	shrub
	78	FABACEAE	*Astragalus newberryi*	newberry's milkvetch	1368	2432	forb
	79	CYPERACEAE	*Scirpus sp.*	bulrush, tule	1101	2432	graminoid
	80	CACTACEAE	*Opuntia* sp.	prickly pear	0	2432	cactus
	81	CHENOPODIACEAE	*Atriplex canescens*	fourwing saltbrush	669	2374	shrub

Table 2.1. Survey of Bonneville Basin Plants Continued

Zone	ID	Family	Genus / Species	Common name	Elevation (low) (masl)	Elevation (high) (masl)	Type
continued	82	POACEAE	*Sporobolus airoides*	alkali sacatan	798	2344	graminoid
	83	APOCYNACEAE	*Apocynum cannabinum*	dogbane	973	2341	forb
	84	FAGACEAE	*Quercus gambelii*	gambel's oak	1642	2280	tree
	85	ASTERACEAE	*Sphaeralcea* sp.	mallow	1277	2280	forb
Sagebrush	86	BORAGINACEAE	*Cryptantha compacta*	mound cryptanth	1885	2250	forb
	87	CHENOPODIACEAE	*Atriplex confertifolia*	shadscale	848	2134	shrub
	88	ROSACEAE	*Purshia stansburiana*	stansbury cliffrose	1277	2128	shrub
	89	CHENOPODIACEAE	*Grayia spinosa*	spiny hopsage	1277	2128	forb
	90	POLEMONIACEAE	*Phlox* sp.	phlox	1247	2128	forb
	91	LILIACEAE	*Calochortus bruneaunis*	sego lily	1003	2128	forb
	92	SAXIFRAGEAE	*Jamesia americana*	engler	1672	2037	forb
	93	ANACARDIACEAE	*Rhus tribolata*	skunkbush sumac	1459	2006	shrub
Sagebrush	94	POACEAE	*Distichlis spicata*	inland saltgrass	486	2006	graminoid
	95	CHENOPODIACEAE	*Atriplex gardneri*	gardners saltbush	1307	1976	shrub
	96	POACEAE	*Phragmites australis*	common reed	760	1976	graminoid
	97	SALICACAEA	*Salix gooddingii*	goodings willow	1125	1885	shrub
	98	BETULACEAE	*Alnus tenuifolia*	mountain alder	0	1824	tree
	99	SALICACAEA	*Populus augustifolia*	cottonwood	1520	1824	tree
	100	EPHEDRA	*Ephedra viridis*	mormon tea	608	1824	shrub
	101	ASTERACEAE	*Gutierrezia* sp.	snakeweed	851	1824	shrub
	102	SCROPHULARIACEAE	*Castilleja angustifolia*	indian paintbrush	0	1824	forb
	103	UTICACEAE	*Urtica dioica*	stinging nettle	1064	1824	forb
	104	POACEAE	*Achnatherum speciosum*	desert needlegrass	1064	1824	graminoid
	105	AMARANTHCEAE	*Allenrofea* sp.	iodinebush	1000	1700	shrub
	106	LILIACEAE	*Allium passeyi*	passey onion	1490	1581	forb
Shadscale	107	TYPHACEAE	*Typha latifolia*	broadleaf cattail	1186	1520	graminoid
	108	CHENOPODIACEAE	*Salicornia rubra*	pickleweed	1000	1200	forb

annuals (Deep Creek stickseed, buckbean, and larkspur), and therefore do not have a strong pollen signature. Other plants, however, do have a strong pollen signature, including terrestrial plants in the Chenopodia and Amaranth (Cheno/Ams) families, Poaceae plant family, the genera *Artemisia* sp., *Juniperus* sp., and *Pinus* sp., and aquatic pollen such as *Typha* sp., which also have strictly bounded growing conditions according to elevation.

Establishing a modern vegetative proxy record is a common method for paleoenvironmental reconstruction, because these vegetative zones are flexible and may shift depending on precipitation patterns. In addition to understanding paleoclimate, as well as the location of food resources, the growing conditions of plants are also an important consideration for understanding the initial stages of perishable material culture. Plants which are recorded to be most important for basketry and cordage are presented in Table 2.2, according to the vegetative zone in which they are generally found, and (if ethnographic accounts are available) the season during which they are recorded to have been gathered (Figure 2.5). Based on these modern and historical studies, a model for the seasonal mobility of the basket and cordage-makers of the Bonneville Basin may be constructed. Because the Deep Creek Range has the highest elevation within the Bonneville Basin, this range is used to illustrate a model of seasonal mobility required to gather plant resources in a basin/range geographic region (Figure 2.6). Mobile hunter-gatherers would have traveled to culturally-known locations to tend and gather these plants, potentially as an embedded task or a special trip. For instance, higher-elevation plants like snowberry were gathered in the autumn, but traveling to this resource may have overlapped with seasonal higher-elevation hunting trips (Figure 2.7). This schematic does not show actual recorded locations of plants and should not be used to measure travel distance to these resources (as is sometimes calculated in provenance studies of obsidian or clay). Instead it provides a

Table 2.2. Significant Basketry and Cordage Plants.

Genus/Species	Common Name	Zone	Elevation Range (masl)	Part Used	Applications	Season Gathered	Reference
Amelanchier glabra / alnifolia / utahensis	serviceberry, saskatoon berry, shad bush	Aspen/Fir	1,520-3,101	stem	bows, basket rims, large carrying baskets, water vessels coated with piñon pine, seed baskets, cooking-bowls, winnowing fans, cradleboard frames	unknown	Chamberlin 1911; Lowie 1909, Mason 1904; Rhode 2002; Riddell 1978; Smith 1974; Steward 1938; Zigmond 1981
Linum lewisii	western blue flax, prairie flax	Aspen/Fir	1,384-3,040	fiber	cordage, rabbit nets	unknown	Ebeling 1986; Rhode 2002
Symphoricarpus vaccinoides, S. longiflorus, S. oreophilus	snowberry	Aspen/Fir	1,520-3,344	bark	string, brooms, drying racks, hollowed twigs for pipe stems	autumn	Rhode 2002; Steward 1938; Turner 1998
Rosa woodsii, R. fendleri	Woods' rose	Aspen/Fir	852-3,344	stems	rims for twined baskets (Kwaiisu)	unknown	Chamberlin 1909; Rhode 2002; Turner 1998; Zigmond 1981
Juncus balticus, J. effusus	baltic rush, wiregrass, common rush, bog bush	Aspen/Fir	848-3,101	stems, leaves	cordage, tumplines and string when combined with cattail, mats, leaves for stuffing baskets, practice basket material, duck decoys, insulation in dwelling walls, yellow patterns in basket designs	unknown	Bocek 1984; Chamberlin 1909; Lowie 1909; Mason 1904; Rhode 2002; Turner 1998; Zigmond 1981
Apocynum androsacmifolium, A. cannabinum, A. androsaemifolium	dogbane, wild hemp, Indian hemp	Mountain forest/Pinyon-juniper	973-2,341	bark, bast fibers	string, bow strings, nets, fishing lines, fish nets, rabbit nets, deer nets, tumplines, slings, carrying loops, basket thongs, rabbit skin blankets	late autumn or winter	Anderson 2005; Chamberlin 1911; Ebeling 1986; Fowler and Matley 1979; Janetski 1991; Kelly 1932; Malouf 1940; Mason 1904; Powell 1875; Rhode 2002; Riddell 1978; Sapir 1910; Simpson 1869; Smith 1974; Steward 1938; Turner 1998; Vestal and Schultes 1939; Wheat 1967
Asclepias speciosa, A. erosa, A. fascicularis	showy milkweed, desert milkweed, mexican whorled milkweed (common milkweed), wild cotton	Mountain forest/Pinyon-juniper	820-2,584	fibers	cordage, rope, cloth, can be mixed with *Apocynum* , foundation for basketry because swells when wet, sewing together tule and willow mats, belts, handles and straps, pack strap, snowshoes, bowstring	late summer or autumn	Anderson 2005; Bocek 1984; Chamberlin 1909; Ebeling 1986; Howard 2003; Rhode 2002; Turner 1998; Vestal 1939; Zigmond 1981
Chrysothamnus nauseosus	rabbitbrush	Mountain forest/Pinyon-juniper	912-2,432	young stems	baskets, water jug	spring	Stoffle et al. 1999
Cornus californicus; stolonifera	dogwood; creek dogwood, red osier dogwood, kinnikinnick	Mountain forest/Pinyon-juniper	1,520-2,736	stems, bark	basket rims, dye, fishing weir, drying racks	unknown	Bocek 1984; Chamberlin 1909; Turner 1998; Zigmond 1981
Elymus condensatus, cinereus	wild rye	Mountain forest/Pinyon-juniper	1,064-2,888	stem, leaves	house thatching when tule was unavailable, beds, mats, doorflap, tubes	unknown	Riddell 1978; Steward 1938; Turner 1998
Juniperus utahensis, osteosperma	juniper or cedar	Mountain forest/Pinyon-juniper	1,672-2,584	wood, bark	ropes, bags, stoppers for jugs, mats, blankets, skirts, sandals, necklaces	unknown	Chamberlin 1909, 1911; Steward 1938; Ebeling 1986; Kelly 1932; Malouf 1940; Palmer 1878; Rhode 2002; Simpson 1869; Stoffle et al. 1999; Sutton 1989; Wilke 1988
Leymus cinereus	desert needlegrass	Mountain forest/Pinyon-juniper	1,064-2,888	stems, leaves	leaves used for matting, shingles, bedding, cradleboards	unknown	Rhode 2002
Purshia glandulosa / P. tridentata (P. cowania)	desert bitterbrush, buckbrush, greasewood	Mountain forest/Pinyon-juniper	972-2,736	bark	rope, string, bags, skirts, sandals, infant blankets, diapers, mats, dye from berries	unknown	Chamberlin 1911; Rhode 2002; Stoffle et al. 1990; Turner 1998; Zigmond 1981
Salix sp., S. gooddingii, S. amygdaoides, S. lasiandra, S. exigua	willow general	Mountain forest/Pinyon-juniper	700-2,432	stems, roots	twined baskets, water jug, green bark used for foundation in coiled baskets, rope, cradles, ring as frames for hats (Deep Creek Gosiute)	spring	Anderson 2005; Bocek 1984; Chamberlin 1909, 1911; Coville 1892; Dean et al. 2004; Ebeling 1986; James 1902; Kelly 1932; Kissel 1916; Lowie 1909, 1924; Malouf 1940; Mason 1904; Ortiz 1993; Powell 1875; Riddell 1978; Steward 1938; Stoffle et al. 1990; Vestal 1939; Wheat 1967
Cowania mexicana stansburiana, Purshia stansburiana	cliffrose or quinine bush	Sagebrush	1,277-2,128	bark, stem	cordage, basketry, clothing, sandals, mats, rope, dye	unknown	Chamberlin 1909; Ebeling 1986
Distichlis spicata	inland saltgrass	Sagebrush	487-2,006	stem	basketry, matting, rope, sandals	unknown	Rhode 2002
Artemisia tridentata	big sagebrush	Sagebrush	1,520-3,344	wood, bark	baskets, stopper for water baskets, bags, rope, snares, garments, winter shoe lining, mats, quiver case, shoes, torches, tinder	unknown	Chamberlin 1909, 1911; Lowie 1924; Rhode 2002; Riddell 1978; Smith 1974; Steward 1938; Turner 1998; Simpson 1869; Zigmond 1981
Phragmites communis, P. vulgaris, P. australis	reed or cane	Sagebrush	760-1,976	stem, leaves	cordages for nets, snares, baskets, mats, thatching, fire drills, gaming pieces	unknown	Ebeling 1986; Kissel 1916; Mason 1904; Rhode 2002; Riddell 1978; Steward 1938; Turner 1998; Zigmond 2002
Populus angustifolia, P. balsamifera, P. fremontii	cottonwood, northern black cottonwood	Sagebrush	1,520-1,824	shoots, wood	baskets	spring	Chamberlin 1909, 1911; Kissel 1916; Malouf 1940; Turner 1998
Purshia stansburiana, P. mexicana	cliffrose	Sagebrush	1,276-2,128	bark	rope, string, skirts, sandals, infant blankets, diapers, mats	unknown	Rhode 2002; Stoffle et al. 1990
Rhus tribolata, R. glabra	sumac, squaw bush, sourberry, skunkbush, upland sumac	Sagebrush	1,460-2,007	stem; roots (Kiowa)	dip nets, baskets, basket for fermenting berries for pink dye, small branches for basket foundation, color white in basketry, black dye from twigs and leaves, yellow or orange dye, winnowing trays, cradleboards	spring	Anderson 2005; Chamberlin 1909, 1911; Ebeling 1986; Halmo et al. 1993; James 1902; Janetski 1991; Mason 1904; Palmer 1878; Rhode 2002; Steward 1938; Stoffle et al. 1990; Sutton 1989; Vestal 1939; Zigmond 1981
Urtica dioica	nettle, stinging nettle, indian spinach	Sagebrush	1,064-1,824	fiber	string, bow strings, rabbit nets, carrying bags	autumn	Chamberlin 1911; Janetski 1991; Rhode 2002; Turner 1998; Zigmond 1981
Schoenoplectus (Scirpus) americanus, Scirpus laustris, Scirpus maritimus	tule bulrush, alkali bulrush (*S. maritimus*)	Shadscale	1,101-2,432	roots, leaves, stem	cordage, mats, baskets, decoys, blankets, footwear (California), a-frame fishnets, mats, rafts/balsas, insulation in winter houses	late summer or autumn	Chamberlin 1909, 1911; Ebeling 1986; Janetski 1991; Lowie 1924, 1925; Mason 1904; Ortiz 1993; Palmer 1978; Riddell 1978; Turner 1998
Typha latifolia, T. domingensis, T. angustifolio	broadleaf cattail, southern cattail	Shadscale	1,185-1,520	leaves, bark	string, baskets, storage baskets for camas, caulking material for canoes and houses, boats, duck decoys, mats, bags, hats, cradles	late summer	Chamberlin 1911; Ebeling 1986; Fowler 2000; Kissel 1916; Mason 1904; Rhode 2002; Riddell 1978; Stoffle et al. 1999; Turner 1998

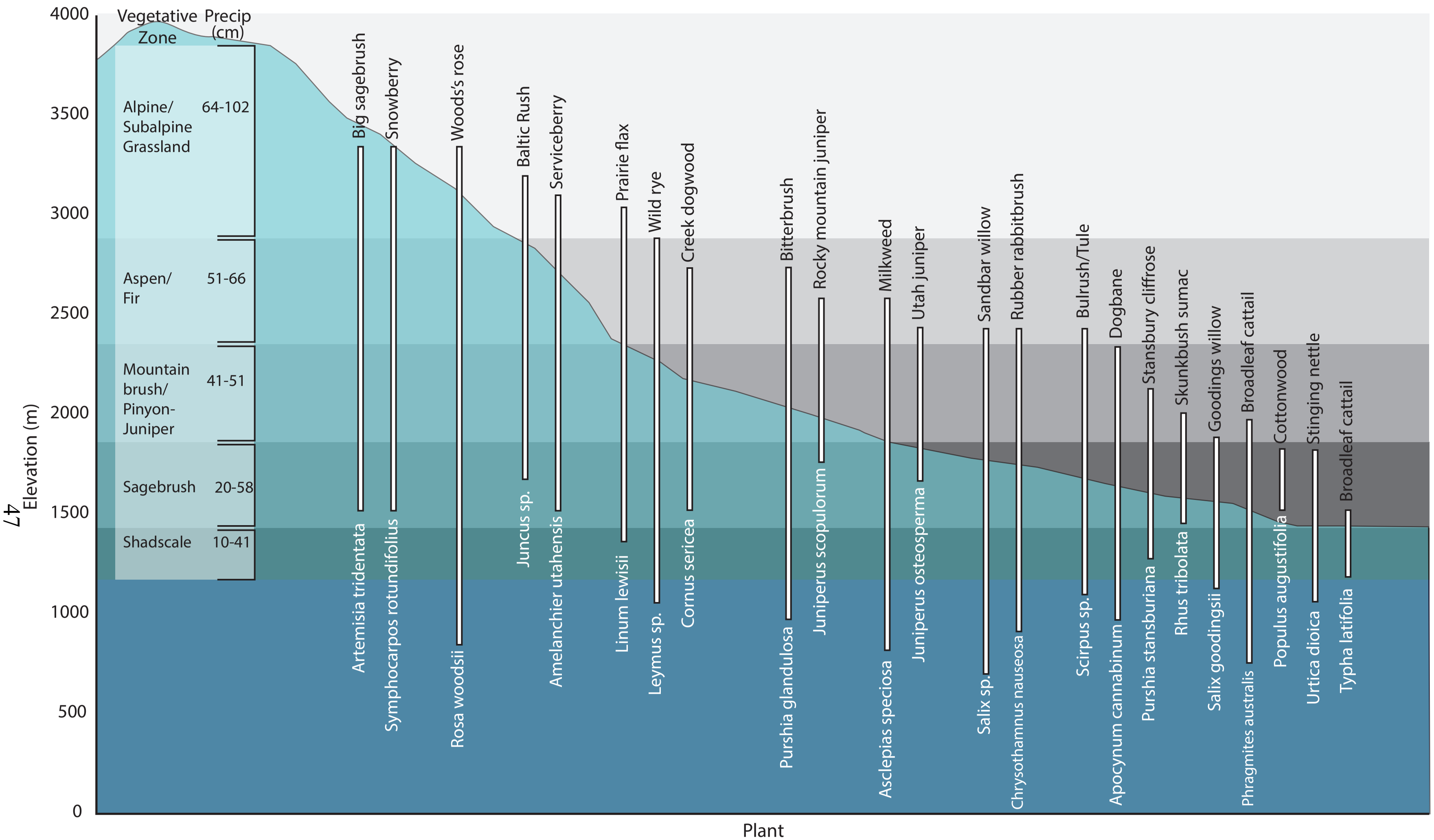

Figure 2.5. Growing range according to elevation of plants commonly used to make perishable artifacts. See Table 2.2 for additional ethnographic details.

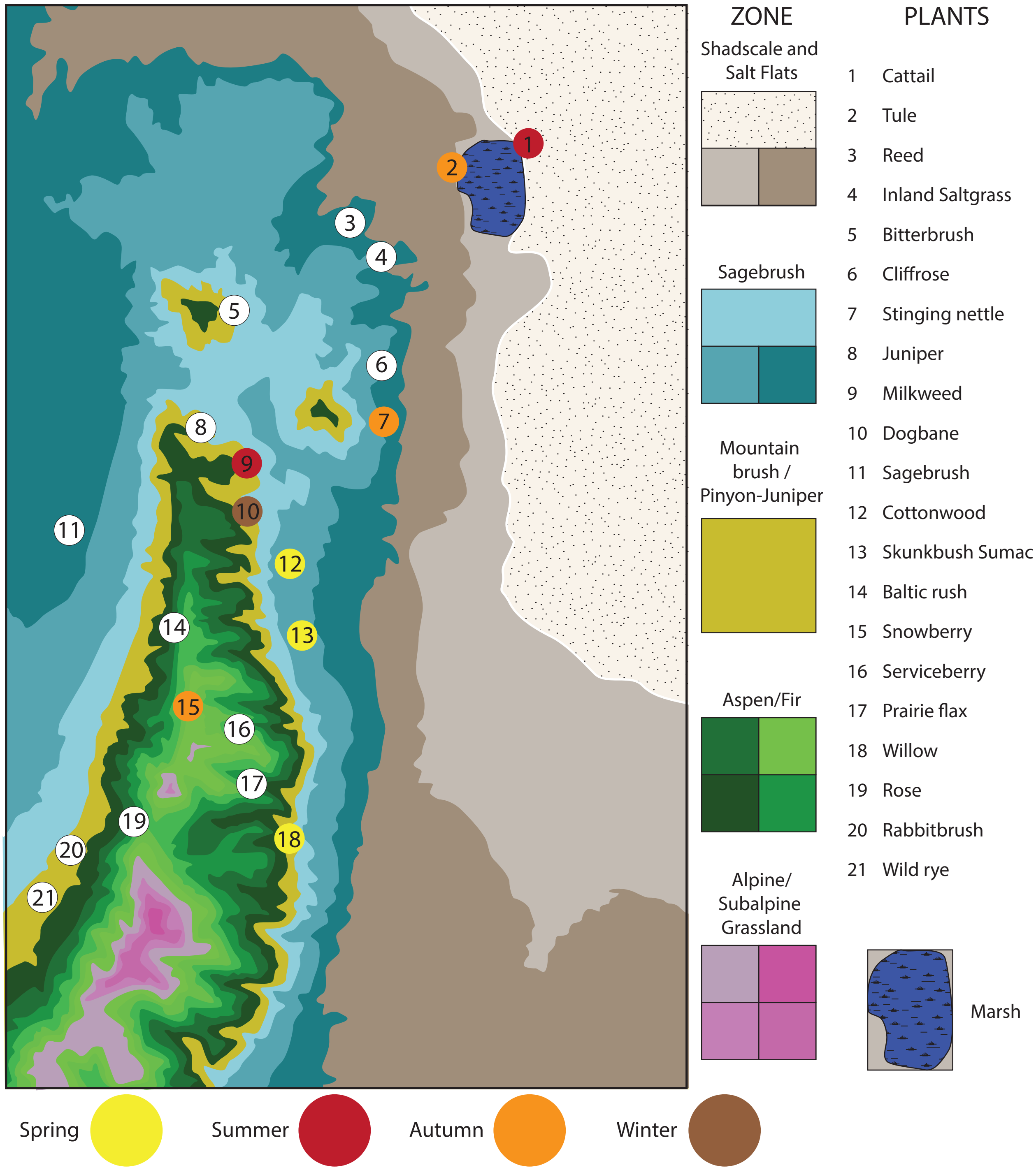

Figure 2.6. A model for seasonal mobility based on the gathering seasons of plants. Based on the Deep Creek Range, this map illustrates a model showing a basin and range landscape with all vegetative zones present according to elevation. Plants sensitive to elevation and with ethnobotanical significance are mapped according to known gathering seasons based on ethnographies. Mobility is required to access raw plant materials to make cordage and basketry. This does not show the recorded location of plants, and it should not be used to measure actual travel distance to resources. See Table 2.2 for ethnographic information about these plants.

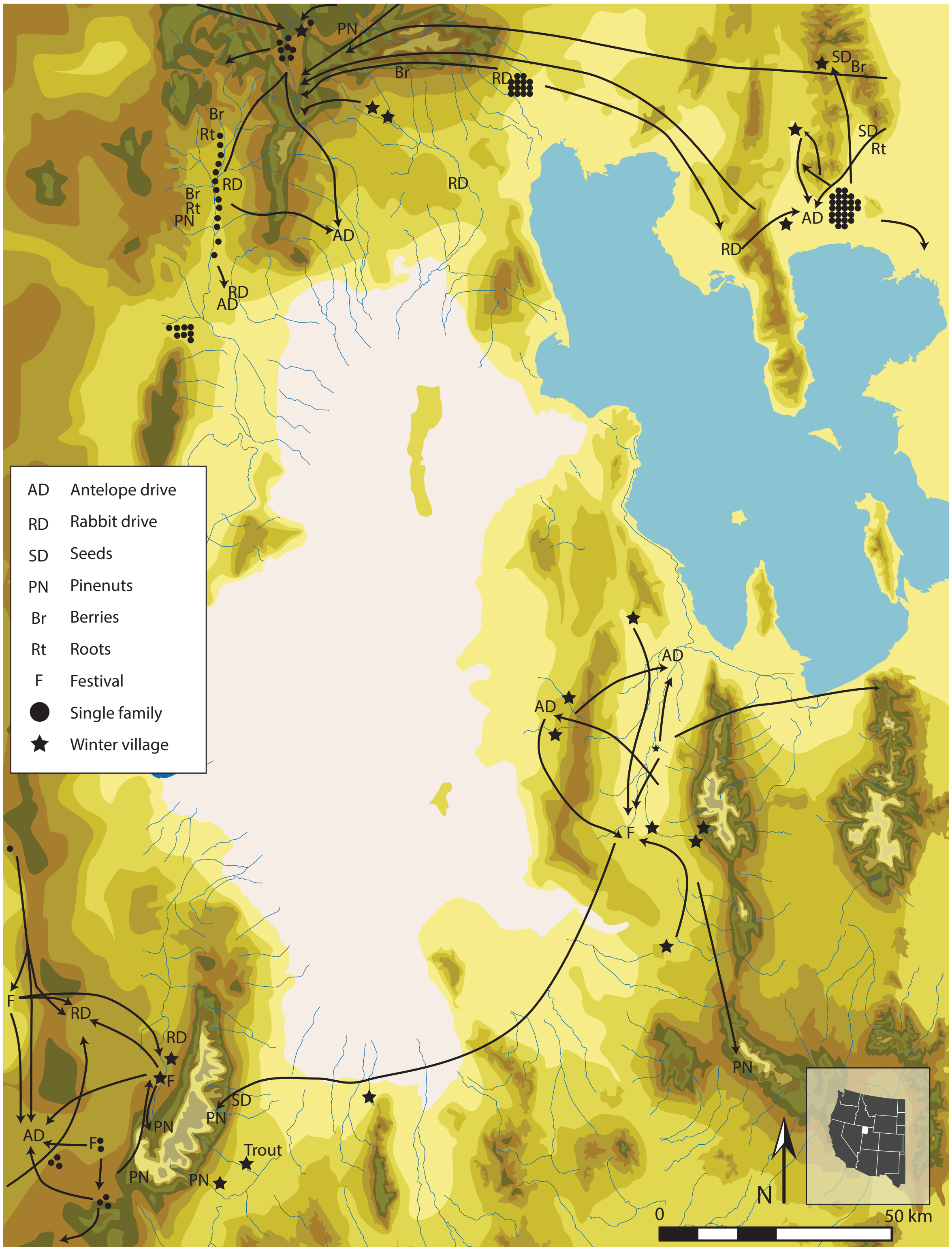

Figure 2.7. Map of human activities in the Bonneville Basin (redrawn from Steward 1938, figures 9, 10, and 12). Steward observed the seasonal activities of Western Shoshone peoples in the Bonneville Basin, from subsistence to housing. The Deep Creek Range is observed to the southwest, which can be compared with Figure 2.5 to show overlapping subsistence activities and artifact manufacture.

framework for addressing the initial stages of the *chaîne opératoire* of cordage and basketry manufacture, and the social and ecological complexity of overlapping tasks and demographics among Bonneville Basin hunter-gatherer people.

Bonneville Basin Paleoecology

Paleoecological conditions in the Bonneville Basin may be characterized by comparing proxy records with known growing conditions of modern-day plants, and these records demonstrate climatic instability throughout the Holocene. During the late Pleistocene, this part of the eastern Great Basin was dominated by Lake Bonneville. After reaching its high stand between ~18,600-17,500 cal BP (Benson et al. 2011; Oviatt 2015), the massive lake breached the natural dam at Red Rock Pass, Idaho, and drained to the Provo level by approximately ~15,000 cal BP. It declined toward the Gilbert level sometime following 15,200 cal BP (Benson et al. 2011), although the timing and definition of this shoreline is debated (Oviatt 2015; Thompson et al. 2016). The lake then fell to the current level of Great Salt Lake by ~11,600 cal BP, completely drying up in the western Bonneville Basin (Benson et al. 2011).

The relatively cool, wet late Pleistocene, after the recession of Lake Bonneville, was characterized by pine forests and juniper, and the formation of isolated wetlands (Louderback and Rhode 2009). Transitioning into the early Holocene between 12,800 and 10,600 cal BP, pollen and packrat-midden records indicate a decline in limber-pine woodlands and the replacement of mesic species by sagebrush, indicating that there was a drying period during this time (Rhode 2000; Rhode and Madsen 1995). The Blue Lakes pollen record (Louderback and Rhode 2009), Wasatch Mountain pollen core at Snowbird Bog (Madsen and Currey 1979), Great Salt Lake Core C (Rhode 2000; Spencer et al. 1984), and Ruby Marsh pollen core (Thompson

1992), show an expansion of xeric plant species, indicating rapid warming and drought in the early/middle Holocene transition, likely occurring between 9,500-9,200 cal BP in the Bonneville Basin. This is further supported by a decline in mesic-adapted mammals (yellow-bellied marmot and pygmy rabbit) and the subsequent increase of xeric-adapted mammals (kangaroo rat) around this time at Homestead Cave (Broughton et al. 2000; Grayson 2000; Grayson and Madsen 2000), Camels Back Cave (Schmitt and Madsen 2005), and Bonneville Estates Rockshelter (Schmitt and Lupo 2012, 2018). Diatom fossil assemblages in Bear Lake, Utah, reflecting fluctuations in river inputs and lake evaporation, also appear to indicate a dry period in the early/middle Holocene between 10,800-9,200 cal BP (Moser and Kimball 2009). These dry conditions may have persisted until around 7,600 cal BP, when an increase in mollusks and decrease in organic matter at Stonehouse Meadow indicate a restriction of moist conditions (Mensing et al. 2013). Later in the middle Holocene, pollen records at Blue Lake and Snowbird Bog indicate an eastern Great Basin increase in moisture between 7,500 cal BP and 6,500 cal BP (Hockett 2007; Louderback and Rhode 2009; Mensing et al. 2013).

The transition to the late Holocene was regionally variable and gradual, marked by many fluctuations in aridity and temperature. A shift from drought conditions in the middle Holocene to cooler and wetter conditions at the beginning of the late Holocene is supported by proxy records showing an increase in precipitation, a decline in xeric-adapted plant and animal species, and an increase in juniper between 4,400-3,300 cal BP (Hockett 2005; Livingston 2000; Louderback and Rhode 2009; Madsen and Currey 1979; Mensing 2001; Rhode 2000; Schmitt and Madsen 2005; Spencer et al. 1984; Thompson 1992). Pollen cores at Potato Bog Canyon in central Nevada and Swan Lake in Idaho, along with late Holocene packrat middens in the region including Cherry Creek, Silver Island Canyon, western Goshute, Golden Spike, and others, indicate an increase in mesic-adapted plants such as juniper and green Mormon tea (Bright 1966; Madsen 1985; Rhode 2000). Another dry period between 2,800 and 1,850 cal BP is seen at Stonehouse Meadow, Blue Lake Marsh, and Snowbird Bog, as well as at Diamond Pond and Fish Lake in southeastern Oregon (Louderback and Rhode 2009; Madsen and Currey 1979; Mensing 2001; Mensing et al. 2013; Wigand 1987; Wigand and Rhode 2002). Tree-ring data of submerged tree stumps in Mono Lake and Fallen Leaf Lake in the western Great Basin indicate less seasonal precipitation and warmer temperatures during the Medieval Climatic Anomaly, which occurred around 1,200-750 cal BP (Kleppe et al. 2011; Stine 2000). This global event may have been caused by cooling of Indo-Pacific sea-surface temperature (Graham et al. 2011), ending with a transition to the Little Ice Age, until around 100 cal BP.

Humans in the Prehistoric Great Basin

Traditionally, archaeologists and anthropologists note that human presence in the Great Basin appears to reflect the instability of the climate, and they often correlate hunter-gatherer cultural adaptation to climatic variation (Baumhoff and Heizer 1965; Madsen 1982; Simms 2008; Steward 1938). In the late Pleistocene/early Holocene, sites such as Danger Cave, Hogup Cave, Old River Bed Delta, and Sunshine locality reflect broad subsistence practices, including big-game hunting and small-mammal and bird hunting, as suggested by stemmed points, fluted points, netting, and associated faunal remains (Beck and Jones 2009; Goebel et al. 2011; Hockett et al. 2008; Madsen et al. 2015; Rhode et al. 2005). The Bonneville Estates Rockshelter record additionally suggests Paleoindian plant consumption, possibly even seeds, but no grinding technology (Rhode and Louderback 2007). Changes in technology during the early Holocene, including a decrease in projectile-point size, may reflect megafaunal extinctions, the eventual spread of atlatl technology, and the reorganization of subsistence to include small-seed plants with new technologies such as ground stone and coiled basketry implying a broadening diet (Adovasio 1986; Grayson 2011; Jennings 1957; Simms 2008). A recent study at Hogup Cave, however, suggests that equating coiled basketry with small-seed production may be overstated (Herzog and Lawlor 2016).

Following the Paleoindian period, there is a relative paucity of middle-Holocene archaeological sites between 9,500 and 4,500 cal BP (Kelly 1997), especially in the central and western Great Basin, but this trend is not as pronounced in the eastern Great Basin (Aikens 1970). Goebel et al. (2007) suggested, however, that many of the eastern Great Basin rockshelters, for example Danger Cave and Smith Creek Cave, reveal breaks in occupations at this time. Regional summed-probability curves of radiocarbon dates also appear to indicate a reduced density of people in the Bonneville Basin at this time (Louderback et al. 2011); this interpretation, however, has been criticized because of the potential for taphonomic bias against sediments being deposited during the middle Holocene, oversampling of specific time periods and larger sites, and the potential inclusion of problematic radiocarbon dates in chronologies (Louderback et al. 2011; Rhode et al. 2014; Ross 1985; Surovell and Brantington 2007). The effects of the drying trend at the beginning of the middle Holocene may have been more muted in the eastern Great Basin as well, yielding a significantly shorter hiatus in the Bonneville Basin than in other regions (Aikens 1970; Louderback et al. 2011), as well as the permanence of marshland-focused populations living there continuously (Kelly 1997; Madsen and Berry 1975). Hockett (2005) suggests that the appearance of communal game drives using trap features during the middle/late Holocene transition may indicate a switch from lone hunters pursuing single animals to communal hunting pursuing multiple animals (Hockett and Murphy 2009; Hockett et al. 2013); however, trapping was potentially a part of Desert West Paleoindian subsistence as well (Adovasio et al. 2009; Frison et al. 1986; Jennings 1957).

Archaeological sites increase in the late Holocene after around 4,500-4,000 cal BP, alongside a reoccupation of other sites outside the eastern Great Basin and an expansion into alpine settings (Grayson 2011; Hockett 2005). This expansion is usually attributed to increased human population size and density, related to decreased xeric conditions, seen as an environmental improvement (Bettinger 1999; Frison 1975; Grayson 2011; Kelly 1997; Louderback et al. 2011), though the speed of population increase and potential changes in social interaction are still debated (Hildebrandt and McGuire 2002; Hockett 2005; Kelly 1997; McGuire and Hildebrand 2005). Social interaction regarding gender division, supra-family organization, and residential patterns may have shifted between the middle and late Holocene, perhaps as a reaction to an expansion of artiodactyl herds with the return to more mesic conditions at the end of the middle Holocene, or a greater investment in prestige-hunting or increased diet-breadth (Hildebrandt and McGuire 2003; McGuire and Hildebrand 2005). Specialized resource-procurement strategies are reflected in new technologies like duck decoys and slings at Lovelock Shelter (Heizer and Johnson 1952; Tuohy and Napton 1986), seed beaters and winnowing trays for seed processing (Bettinger 2015), snares (Janetski 1979), and eventually arrow points replacing dart points (Bettinger 1999). There is also more ornamentation like feather-decorated basketry (Jolie and Burgett 2005), and more evidence of long-distance trade, with *Olivella* and abalone shell beads from the Pacific (Bennyhoff and Hughes 2011; Smith et al. 2011) and turquoise from the Southwest (Janetski 2002). Importantly, the late Holocene was marked by major demographic changes. Groups such as the Fremont (~1,300-700 cal BP), the appearance of groups assumed to be ancestral to modern Numic speakers (1,000-700 cal BP)

(Bettinger 2015), and Ancestral Dene migrants (also known as Promontory Cave or Ancestral Athabaskan peoples) (740-650 cal BP) (Ives et al. 2014) had unique archaeological signatures including new types of architectural features, new subsistence strategies, changes in burial traditions, and varying influences from neighboring groups outside of the Great Basin. This cultural florescence will be discussed in greater detail later in this chapter and in Chapter 5, as they are subject to major debates in Bonneville Basin archaeology.

Throughout the human occupation of the Bonneville Basin, archaeologists have consistently emphasized that material culture of prehistoric hunter-gatherer people was generally utilitarian and mobiliary, dedicated to subsistence including objects associated with hunting, trapping, fishing, plant gathering, and food preparation (Adovasio et al. 2009; Bettinger 2015; Fowler and Bath 1981; Janetski 1979; Loud and Harrington 1929; Mason 1901, 1902; Shaffer and Garner 1995; Wheat 1967; Wylie 1974), as well as other day-to-day activities including clothing, fire preparation, and child care (Burgett 2004; Egan 1917; Jolie and Jolie 2008; Steward 1938; Tuohy 1985). Much of this material culture has been preserved in dry cave and rockshelter sites, which are the subject of this present study.

Ethnohistoric and Ethnographic Background

Much of what is known about Native American groups in the eastern Great Basin comes from the works of Julian Steward (1933, 1938) and other anthropologists (Bye 1972; Chamberlain 1911; Davis 1963; Driver and Massey 1957; Fowler 1989, 1990, 1995; Fowler and Matley 1979; Kelly 1932; Knack and Stewart 1984; Lowie 1909; Malouf 1940; Murphy and Murphy 1986; Palmer 1878; Stewart 1939), as well as first-hand accounts by European explorers, traders, trappers, geologists, and missionaries in the region in the eighteenth through early twentieth centuries (Egan 1917; Escalante 1776; Powell 1875, 1895; Simpson 1869; Wilson 1910). The ethnographies collected by Isabel Kelly (1932), Carling Malouf (1940), and Julian Steward (1938) of the Southern Paiute, Goshute, Ute, and Western Shoshone are the most relevant sources for this current study. Most early ethnographic basketry studies of the Desert West come from collectors like Mason (1901), Pepper (1902), and Powell (Fowler and Matley 1979), whose primary interest was highly decorative and specialized basketry from Californian groups like the Mono, Maidu, Pomo, and Yurok people (Barrett 1908; Chestnut 1902; Dixon 1902; Hudson 1893; James 1902; Kroeber 1905; Murphey 1959; Weltfish 1930, 1932). Additional ethnographic studies were dedicated to documenting the function of Native American basketry and ethnobotanical uses of plants for manufacturing other perishable tools, like cordage (Chamberlin 1911; Merril 1923; Palmer 1878; Wheat 1967). Many of these traditional approaches to artifact manufacture and plant manipulation are maintained today; however, these ethnographic sources remain invaluable references for ethnobotanical and technological studies of perishable-artifact manufacture in archaeological studies (Anderson 2005; Dick-Bissonnette 2003; Ebeling 1986; Farmer 2010, 2012; Fowler 2011; Halmo et al. 1993; Hurcombe 2007, 2008; Minar 2001; Rhode 2002; Salls 1989; Tiedemann and Jakes 2006).

At the time of Euro-American contact, Native American people living in the Great Basin, Snake River Plain, and parts of eastern California and Colorado Plateau were primarily mobile hunter-gatherers who spoke Numic languages (Uto-Aztecan linguistic family) and traded with groups living in the Southwest, Colorado Plateau, Columbia Plateau, Mojave Desert, Sierra Nevada Mountains, and Pacific coast (Steward 1938). Eastern Great Basin people followed a seasonal subsistence strategy based upon the differential availability of plant and animal resources resulting from dramatic changes in elevation and precipitation in the basin and range topography, as well as a mix of marshland, seasonal lakes, and salt- and fresh-water resources (Chamberlin 1911; Ebeling 1986; Steward 1938). They emphasized small family groups who occasionally congregated in winter villages, and they built seasonal animal drive lines using natural and artificial traps, which required the participation of multiple family bands, and there was some division of labor along gender lines (Arkush 1986, 2013; Chamberlain 1911; Dean et al. 2004; Egan 1917; Hockett et al. 2013; Lubinski 1999; Murphy and Murphy 1986; Raymond 1982; Stansbury 1852; Steward 1938). This flexibility of social organization emphasized by Steward became a hallmark of the region, which, as stated in Chapter 1, may be an overstated representation (Ronaasen et al. 1999; Stewart 1939).

Steward's elaborate maps depicting the seasonal mobility and social activities of native people of the twentieth century are a valuable illustration of their relationship with a region that has been occupied for millennia. A remade version of one of those maps of the Bonneville Basin is Figure 2.7, which shows the variety of activities Steward (1938) observed regionally including seed gathering, rabbit and antelope hunting, seasonal festivals, and variability in residential sizes. This map illustrates Steward's observation about the mobility of native peoples in this region, but it also shows that the Bonneville Basin was an enclosed system, the mountains and valleys providing necessary resources depending on season. Steward (1938, 1955, 1970) asserted that these seasonally-flexible egalitarian family groups were patrilineal bands, who practiced a variety of post-marital residence patterns. Service (1962) later emphasized postmarital residence patterns as the more accurate kinship description, referring to most hunter-gatherers as patrilocal or virilocal (i.e. children grow up among the father's relatives) because of the perceived emphasis on men having solidarity in hunting and the practice of cross-cousin marriage (Service 1962). Polyandry was also practiced by the Northern Paiute around Pyramid Lake (Park 1937).

Steward has been criticized as downplaying the complexity and importance of Great Basin kinship ties by emphasizing the subsistence practices of people as the primary driver of social organization in the region, rather than the maintenance of cohesive family groups (Ronaasen et al. 2011). Whether or not Steward accurately categorized the complex lifeways of people in the region, in later publications (1955) he observed that seasonal communal animal hunts and rabbit drives using netting were ways kinship was expressed and manipulated (Eggan 1980; Steward 1938). Significantly, Steward (1938) and Service (1962) acknowledged that the culture of twentieth-century native people of the Bonneville Basin had been severely altered by Euro-American colonization, the introduction of farming, and the spread of horses.

This rich corpus of ethnography is the foundation upon which much of Great Basin archaeological theory and site interpretations has been built. The majority of eastern Great Basin ethnographies focused on seasonally-mobile hunter-gatherers who did not live in caves but had base villages, and Great Basin archaeologists working under an ecological framework have frequently focused on cave and rockshelter sites, as well as less-well preserved short-term open-air sites. Archaeologists have emphasized environmental variability as a prime influencer of economic and technological change in Great Basin hunter-gatherer societies, even applying this formula to permanent village sites (Barlow and Metcalfe 1996; Bettinger 2015; Coltrain and Leavitt 2002; Eerkens 2004; Fowler 1995; Herzog et al. 2017; Jones and Madsen 1989; Madsen and Rhode 1990; Madsen and Simms 1998; Rhode and Louderback 2007; Rhode et al. 2005). As discussed in Chapter 1, although there are complicated reasons why caution should be reiterated when using ethnographic analogy to make archaeological interpretations, this rich history of detailed ethnographic work provides a proxy to pose and test questions regarding the nature of human environmental, economic, and social interaction from the late Pleistocene through Holocene.

Current Debates in Great Basin Archaeology

This brief, but detailed discussion of modern-day ecology, paleoecology, archaeological evidence of humans as well as ethnographic accounts is provided to build the context for broad debates in eastern Great Basin archaeology. These debates frequently are at the intersection between an understanding of ecology and its influence on human behavior, and social issues that can be manifested through archaeological evidence. These major debates are discussed in the following section as an epistemological approach to re-evaluating the status of these questions. This section demonstrates that these debates are as contested today as they were when first posed, and the ways perishable artifacts potentially may address these broad questions. These major debates and the application of cordage and basketry to these subjects direct this major study of perishable artifacts in the Bonneville Basin.

1) *What is the role of paleoecology on the subsistence strategies of Great Basin hunter-gatherer people from the late Pleistocene through late Holocene? Are changes in subsistence strategies contemporaneous with climatic changes observed through paleoecological proxy records? To what degree are human subsistence practices responses to ecological constraints on resource availability, as opposed to socially-guided decisions?*

The basin-and-range topography of the Great Basin has been demonstrated to create an ecological mosaic, and rich paleoecological proxy records have been applied to address the nature and timing of climatic events and the environmental influence on human interaction. The long-lived human presence in the Great Basin in many ways appears to reflect the instability of the climate throughout the late Pleistocene and Holocene, an observation which encourages many Great Basin archaeologists to primarily focus on the influence of environmental change on hunter-gatherer cultural adaptation through the lens of optimal foraging models, as discussed in Chapter 1. In this traditional approach to Great Basin archaeology, the research questions posed above about the role of environmental instability on hunter-gatherers continue to flourish alongside the refinement of measuring paleoecological change with new sources and applications of paleoclimatic data, improved dating, as well as new ways of measuring human subsistence and foraging patterns.

Like other material culture, perishable artifacts are positioned to address the role of ecology on subsistence and mobility. Cordage used in netting is found in sites throughout the Great Basin, Colorado Plateau, and Southwest spanning the late Pleistocene and Holocene, which suggests that communal small-game hunting was a significant subsistence strategy for most of humanity's presence in the Desert West. Netting may speak to site function, population size, length or frequency of site occupation, as well as seasonality—all important considerations in cultural ecological debates. Basketry also had significant subsistence-related functions. For example, coiled basketry was used for a variety of subsistence tasks like gathering foods, parching and boiling seeds, water-handling, and storage. Therefore, basketry at a site may address site activities, task organization, division of labor related to subsistence activities, as well as seasonality. Additionally, the botanical identification of manufacturing materials may also address other ecological considerations, like mobility (where manufacturers traveled to tend and acquire the plants), scheduling (how acquiring and processing plants could have been embedded with other tasks), and seasonality (because each plant has specific growing and collecting seasons, as previously discussed). Comparing modern Bonneville Basin ecological and ethnobotanical records of perishable artifacts to paleoecological trends is a way to address questions regarding the influence of ecology on human activities. Additionally, the unique association of cordage with communal small-game hunting and basketry with feminine-oriented tasks creates a more complex picture of activities frequently under-represented in the archaeological record.

2) *Who were the Fremont people and how are they best defined? What was the nature of their subsistence strategy? How did they interact with contemporaneous neighboring groups of hunter-gatherers, Ancestral Puebloans, and Ancestral Dene? What marked the end of the Fremont period and where did they "go"?*

Fremont Culture. Explorers, pioneers, and later archaeologists noted a series of communal architectural features reminiscent of Southwest Ancestral Puebloan material culture along the western side of the Wasatch Mountains and Uinta Basin (Morss 1931). Later studies revealed artifacts which were culturally similar to Southwestern groups, like domesticated plants, pottery, complex burials, religious objects, and nonlocal trade materials, and importantly researchers observed seemingly contradictory elements of hunter-gatherer culture like pursuing wild food and occasional residential mobility (Adovasio 1976; Adovasio et al. 2002; Allison 2010; Aikens 1967; Coulam and Simms 2002; Fisher 2012; Hockett 1998; Holmer and Weder 1980; Janetski 2002, 2003; Janetski et al. 2012; Keyser 1975; Madsen and Simms 1998; Simms 1990, 1999; Smith 1994; Talbot 2000, Talbot et al. 2000; Ugan 2005). Researchers have debated whether this enigmatic culture should be classified as the northern boundary of Southwest culture (Morss 1931) or arising in situ out of Great Basin hunter-gatherers (Adovasio et al. 2002; Jennings 1957;

Simms 1999). They have questioned how the Fremont should be defined: Are the Fremont a cohesive ethnic group? Should they be defined according to a complex set of behaviors including a flexible, mixed subsistence strategy of domesticated plants and hunted game (Madsen and Simms 1998)? Or instead, are they best defined according to their shared cultural affinities with Southwest Ancestral Puebloan culture and interaction with neighboring populations (Allison 2010; Janetski et al. 2012; Talbot 2000)? Additionally, the disappearance of the Fremont cultural complex is also debated: did Fremont people abandon horticulture and return to hunting and gathering, or did they move to the Southwest and integrate with Puebloan villages, or did they integrate with Ancestral Dene big game hunters? Was their culture destroyed by a wave of new Numic migrants, or did shifting climate patterns cause the collapse of farming in the region?

Promontory People / Ancestral Dene. Although this study will not include materials from sites attributed to the Ancestral Dene, the presence of this cultural group contemporaneous with Fremont and traditional eastern Great Basin hunter-gatherers further complicates the cultural landscape of the eastern Great Basin. Based upon his excavations at Promontory Point Caves, Steward (1937) observed that there was evidence of a separate ethnic affiliation of archaeological groups and historical Great Basin populations. This idea of population discontinuity became a part of the debate of a potential expansion of Numic peoples (see Question 3), although Steward emphasized that they were big-game hunters. Recent excavations at these Great Salt Lake sites supports the idea that there was a brief episode in the eastern Great Basin of big-game-focused migrants reminiscent of Ancestral Athabaskan culture from modern-day Alberta and later Plains culture that was contemporaneous with Fremont, which may precede the Numic expansion (Billinger and Ives 2014; Ives 2014; Ives et al. 2014; Johanssen 2013). Current studies address the chronology and direction of this migration into and out of the

Bonneville Basin, seek to define Ancestral Dene cultural signatures, address social interactions between contemporaneous Great Basin hunter-gatherers and Fremont farmers, and debate the influence of this short-lived occupation of the eastern Great Basin on current tribes in the Great Basin, Snake River Plain, Greater Yellowstone Region, and Great Plains (Yanicki 2019).

Since basketry is a complex artifact class embedded in craft traditions, style may indicate ethnicity in the past, as discussed in Chapter 1. Ethnicity has been the main application of important basketry studies in the eastern Great Basin (see Chapter 5), but assumptions should be re-evaluated using modern approaches. The appearance of Fremont-attributed basketry at both village sites, short-term hunter-gatherer sites, and Ancestral Dene sites indicates a complex cultural landscape that complicates attempts to establish a unified constellation of Fremont traits. Placing an emphasis on technological-stylistic attributes and use-life stages, rather than a constellation of traits of completed baskets, may assist in identifying whether separate, contemporaneous craft traditions are present in the region (especially at sites with evidence of both hunter-gatherers and farmers), and the potential interaction between regional cultural groups. A diachronic analysis of these technologically-based stylistic traits may also address the antiquity and continuity of these craft traditions, contributing to debates of the ethnogenesis and dissolution of Fremont culture. In a similar way, technologically-based stylistic traits of cordage may also characterize the function of hunter-gatherer/Fremont sites, as well as the maintenance of craft traditions across cultural boundaries, because cordage may have functioned differently among groups who netted small game and groups who emphasized big-game hunting.

3) *Was there a replacement of in situ eastern Great Basin hunter-gatherers by Numic-language-speaking people? From where did the Numic people come, and when did they migrate? Was there a population replacement or some other shift?*

Based on potential discontinuities of archaeological complexes at Lovelock Cave (Loud and Harrington 1924) and Promontory Point Caves (Steward 1937), early archaeologists in the Great Basin suggested that there may have been a potential demographic replacement at some point in antiquity. The Desert Culture concept (Jennings 1957), however, became the prevailing notion, which contradicts the idea of demographic change, and historical ethnographies were used as a model for interpreting all chronological periods in the eastern Great Basin. In the mid-twentieth century, with the development of historical-linguistic theories established by Lamb (1958), which suggested that there was a recent spread of the Numic language likely within the past 1,000 years, as well as improved chronometric dating methods, researchers challenged this notion of population continuity in the region, and the idea of a recent population replacement gained widespread acceptance across the Great Basin. Since then, archaeologists have sought to determine whether there is additional evidence of a proposed demographic shift, the timing of this expansion, the homeland of Numic people, and the relationship between new migrants and "host" occupants of the region (Adovasio and Pedler 1994; Aikens 1994; Aikens and Witherspoon 1986; Bettinger 2015; Bettinger and Baumhoff 1983; Cabana et al. 2008; Eerkens 2004, 2010; Fowler 1972, 2004, 2011; Fowler and Dawson 1986; Grayson 2011; Hamilton-Brehm et al. 2018; Johnson and Lorenz 2006; Jones 2005; Kaestle and Smith 2001; Madsen 1993; Madsen and Simms 1998; Magargal et al. 2017; O'Connell et al. 1982; Parker et al. 2019; Quinlan and Woody 2003; Simms 1983). Despite decades of research on the subject, the Numic expansion remains a hotly contested subject in Great Basin archaeology and ethnography, which will be discussed in greater detail in Chapter 5.

As in the Fremont case study discussed above, traditional studies of basketry have sought to identify a cohesive constellation of traits associated with pre-Numic and Numic people. For example, a shift from coiled basketry to twined basketry as the dominant type, and the appearance of new seed-beater technology in the eastern Great Basin during the late Holocene, may represent a demographic replacement (Adovasio 1986; Bettinger 2015). Coiled basketry persisted as a basketry type, however, so comparing the way it was made and functioned before and after the proposed appearance of the Numic cultural complex may be a way of addressing the nature and timing of this potential expansion and the relationship between pre-Numic and Numic peoples. Technological-stylistic traits and initial stages of basketry manufacture can potentially illustrate separate or shared craft traditions. In a similar way, cordage functional applications and manufacturing techniques may be characterized to illustrate potential changes over time. Pre-Numic and Numic people are both described as hunter-gatherers who practiced seasonal mobility as a result of environmental regional and seasonal variability. Both groups pursued the same plant and animal resources, both groups had generally small group sizes with seasonal hunting, and both groups used diverse cordage for netting and other tasks. Comparing the craft traditions of coiled basketry and cordage and the functional applications of these artifacts may be a way of determining whether there indeed was a population change in the late Holocene in the eastern Great Basin, and if so, the cultural context of these changes.

Characterizing the Current Study

Perishable artifacts have been demonstrated as invaluable tools to characterize both subsistence activities as well as complex cultural interactive activities. This study compares these two processes—ecological adaptation and social interaction—both through time and across space by comparing aspects of perishable artifact technological organization using the *chaîne opératoire* approach (Chapter 1), contrasting aspects associated with the function of the artifact as a subsistence tool, or with aspects associated with craft learning behaviors. By comparing these categories of functional and technological-stylistic traits using statistical measures, and integrating variables to reflect the nature of technological style as a passive, low-visibility trait manifested through the process of manufacturing a utilitarian artifact, I can detect the degree to which ecological adaptation or social interaction influences changes in perishable artifact assemblages. For instance, a change in functional traits may reflect a change in how an artifact was used in reaction to ecological change, whereas a change in technological-stylistic traits may be a reflection of shifts in socio-cultural processes affecting learned behaviors of manufacture. These functional and technological-stylistic variables will be discussed in greater detail in chapters 3 and 4.

This study addresses the above debates in eastern Great Basin archaeology by comparing diachronic variability and stability at Bonneville Estates Rockshelter (Chapter 3), and considering synchronic variability and stability in the region of the Bonneville Basin during the late Holocene (Chapter 4). The diachronic study addresses a series of questions designed to characterize Bonneville Estates' perishable-artifact collection and the nature of the human experience from the late Pleistocene throughout the Holocene, and it provides a detailed study of the *chaîne opératoire* of cordage and basketry through the analysis of manufacturing waste collected during excavation. The synchronic study addresses questions directed at comparing observed diachronic trends at Bonneville Estates Rockshelter with regional synchronic variation in the Bonneville Basin in the late Holocene (4,400-100 calendar years ago). In Chapter 5, these case studies are compared to address the major debates discussed in this chapter (Chapter 2). Basketry and cordage may potentially illustrate whether diachronic trends are associated with climatic variability and site function, as well as the nature of interaction between mobile and sedentary communities as distinct craft communities sharing ideas over generations and across the region, and mechanisms of ethnogenesis in the eastern Great Basin.

CHAPTER 3

BASKETRY, CORDAGE, AND PERISHABLE ARTIFACT MANUFACTURE AT BONNEVILLE ESTATES ROCKSHELTER: DIACHRONIC TECHNOLOGICAL VARIATION

Introduction

In this case study, I provide a diachronic analysis of a collection of basketry, cordage, and related manufacturing waste from Bonneville Estates Rockshelter, a multi-layered "dry cave" archaeological site in the eastern Great Basin. This assemblage provides a window to view long-term technological change in the western Bonneville Basin from the late Pleistocene through the Holocene, and this study contributes to the ongoing analysis of a variety of materials from the site's large-scale excavation. Through these materials, I address the relationship between people and the environment, as well as complex social interaction among hunter-gatherers by considering the timing and changes in technology at the site, and the seasonality of activities. Changes in basketry manufacture and the importance of small-game net hunting throughout the Holocene at Bonneville Estates Rockshelter emphasizes variation in community participation in subsistence activities through time. Additionally, the waste and manufacturing material related to textile production demonstrate that Bonneville Estates Rockshelter functioned as a multi-seasonal manufacturing and repair site for cordage and coiled basketry, and suggest their use in exploiting resources from mid-elevation shrubland and low-elevation wetland environments. This chapter demonstrates the efficacy of applying simple statistics and a *chaîne opératoire* approach to technological organization in this complex material class, and it suggests that a combination of technological and functional stylistic attributes are useful to characterize the complex ways gender influenced the manufacture and use of a material class ethnographically associated with women's work in the eastern Great Basin.

Specifically, I seek to address three major questions in this chapter: 1) What is the timing and nature of changes in technological organization of perishable artifacts? 2) What can perishable artifacts tell us about seasonality of site occupation, use, and artifact manufacture? 3) Are observed changes in perishable material culture correlative to environmental and adaptive change; are they the result of social change, or both? A corollary goal is to demonstrate the versatility of this important, though archaeologically rare, material class when reconstructing the prehistoric lifeways of Native American populations in western North America. To do this, I rely on both ethnographic analogy and a *chaîne opératoire* approach to artifact analysis, differentiating between functional traits in basketry and technological-stylistic traits, defined below.

Archaeological Background

Site Background

Bonneville Estates Rockshelter is a stratified, multicomponent site located in northeastern Nevada, along the western edge of the Bonneville Basin (Figure 3.1). It was excavated between 2000-2009 by Ted Goebel, Kelly Graf, Bryan Hockett, David Rhode, and students from numerous universities, chiefly the University of Nevada Reno, University of Nevada Las Vegas, and Texas A&M University. Recovered materials include diagnostic projectile points, formal lithic tools and debitage, bone and other faunal materials, coprolites, macrobotanical remains, wood, and other perishable artifacts. Publications so far have emphasized the rich late Pleistocene and early Holocene components (Goebel 2007; Goebel et al. 2007; Goebel et al.

2018; Graf 2007; Hockett 2007, 2015; Hockett et al. 2017; Rhode and Louderback 2007; Schmitt and Lupo 2012). Jolie and Burgett (2002) preliminarily analyzed the cordage and coiled basketry from the early years of the excavation; however, until now no detailed studies of the perishable artifacts have been reported.

Bonneville Estates' long occupation record has been divided into seven components, which in recent reports and publications (e.g. Hockett 2015) are assigned to phases following a framework developed by Elston and Budy (1993) for northeastern Nevada. Table 3.1 shows this chronological sequence of components and characterizes their respective ages and stratigraphic associations and climatic contexts. Throughout this study, component number and broad climatic period are the primary terms used to discuss the artifact assemblage. No perishable artifacts were recovered from Component 6, so this was excluded from the analysis.

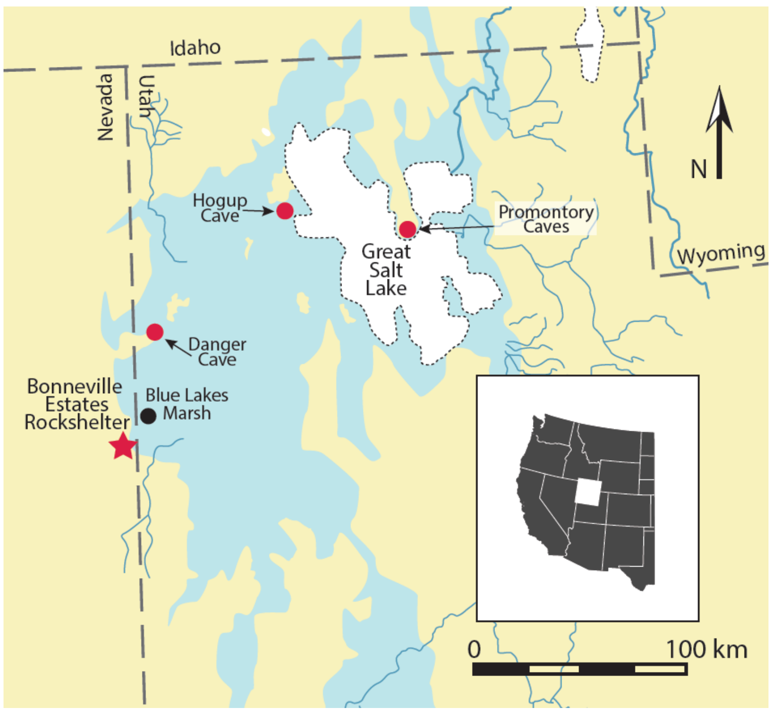

Figure 3.1. Location of Bonneville Estates Rockshelter in the Bonneville Basin along with other important sites mentioned in text.

Table 3.1. Bonneville Estates Rockshelter Chronology

Component	Phase	Cultural Period	Climatic Period	Age (cal BP)	Stratigraphic Association
1	Eagle Rock	Late Prehistoric	Late Holocene	800-400	1-2
2	Maggie Creek	Late Archaic, possibly Fremont	Late Holocene	1,500-800	3a
3	James Creek	Middle Archaic	Late Holocene	4,100-1,500	3b-10
4	South Fork	Early Middle Archaic / Transitional	Middle Holocene	4,700-4,100	11
5	Pie Creek	Early Archaic	Middle Holocene	8,300-4,800	13-17a
6	No Name	Paleoindian/Early Archaic?	Early Holocene	10,500-8,300	17b
7	Dry Gulch	Paleoindian	Late Pleistocene / Earliest Holocene	12,900-10,500	17b'-18b

Methods

Bonneville Estates Rockshelter's perishable assemblage includes artifacts made from flora and fauna; however, here I focus specifically on cordage and basketry. Overall, there are only three twined basket fragments in the assemblage, so these are excluded from statistical analysis. Included are 226 of the 280 cordage fragments and 32 of 33 coiled basket fragments, with some artifacts being excluded because they cannot be assigned to a specific stratigraphic context or are too fragmented (Appendices A and B). However, textile samples representing eight unprovenienced baskets from looted deposits and a beaded necklace were submitted for accelerator radiocarbon dating at the University of Georgia Center for Applied Isotope Studies, to directly determine their ages. Based on these dates, they were assigned to a respective component/phase as summarized in Table 3.2.

Table 3.2. Distribution of Perishable Cultural Materials.

Component	Phase	Coiled Basketry		Cordage		Manufacturing Debris		Total Used in the Analysis
		Total	Final Analysis	Total	Final Analysis	Total	Final Analysis	
0	Unknown	1	0	45	0	5	0	0
1	Eagle Rock	1	1	5	4	4	4	9
2	Maggie Creek	8	8	8	8	2	2	18
3	James Creek	14	14	49	49	13	13	76
4	South Fork	1	1	10	10	1	1	12
5	Pie Creek	9	8	144	139	43	43	190
7	Dry Gulch	0	0	19	16	3	3	19
Total	--	33	32	280	226	71	66	324

Note: Artifacts without established context or those that were too fragmented are excluded from the final analysis.

Manufacturing Debris

An additional analysis of manufacturing waste from the early stages of perishable artifact production was conducted by identifying plant macrofossils collected during excavation originally not classified as cultural material. These were plants which were likely not growing at Bonneville Estates Rockshelter, showed signs of modification like cutting, stripping, scraping, retting, or twisting, or were plants with ethnographic, ethnohistoric, or archaeological association with perishables manufacture. This sample of 66 isolated specimens (Appendix C) was analyzed according to size class (Table 3.3), weight, plant material type, and nature of modification (Table 3.4). Bonneville Estates is rare in that so much floral material was systematically collected; however, this is still likely an incomplete assemblage of waste material, since the abilities to identify manufacturing debris in the field may not have been uniform among all excavators.

Table 3.3. Manufacturing Waste Size Class.

Size Class	Measurement (cm)
1	0—1
2	1—2
3	2—4
4	4—8
5	8—16
6	>16

Note: Although analyzing manufacturing debris for perishable artifacts is not a standard practice, size class is measured here, based on ceramic and lithic analyses of fragments or debitage.

Table 3.4. Attributes Analyzed Per Material Class.

Basketry	Cordage	Manufacturing Debris
Work direction	Initial and final twist direction	Size class
Foundation spacing	Twist method	Weight
Measurement of foundation elements	Number of plies	How material was processed
Foundation type	Tightness/angle of twist	Plant category and identification
Stitch type	Twists per cm	Material type
Stitch alignment	Length	
Stitch engagement with foundation	Strand and cord diameter	
Stitch width	Knot type	
Stitches per cm	Raw material	
Stitch gap		
Use wear		
Form		
Work surface		

Note: See Appendices A, B, and C for these data, and Appendices D and E for original forms provided by the Rhonda L. Andrews Center for Perishables Analysis at Mercyhurst University.

Cordage and Basketry

All cordage and textiles were analyzed at Texas A&M University following techniques developed by researchers from the Rhonda L. Andrews Center for Perishables Analysis at Mercyhurst University (Appendices D and E). These attributes are categorical or continuous data, and they include 13 attributes for coiled basketry and 9 for cordage (Table 3.4). These attributes were selected because they have the potential to address aspects of technology, function, seasonality, learning networks, and potentially demographics (Adovasio 2010). Below is a detailed description of these variables. Measurements were taken using digital calipers with 0.1-mm precision and a handheld goniometer.

Cordage Variables. I have divided traits into variables associated with the function of the artifact as a subsistence tool and variables associated with technological style, which do not affect the function of the artifact. Functional traits on cordage include raw material type, knot type, ply and cord diameter, twists per cm and tightness. Throughout the analysis, I categorize plant fibers broadly as “coarse” versus “fine” material, as artifacts made from these different textured materials likely functioned differently according to the strength of the plant (Haas 2001). Coarse fibers include juniper, sagebrush, and bitterbrush, the bark of which was easily shredded and required minimal processing, but, was also brittle. Fine materials include milkweed, dogbane, and wild flax, which were more heavily processed to acquire fine cambium fibers and were generally stronger. Diameter is a by-product of raw material, and twist number and twist tightness limit the amount of tearing when a cord is stretched (Teague 1998). Twist tightness was measured following Emery (1966; Table 3.5). Knot-type is another indication of the application of the cordage, because nets, traps, and snares are associated with sheet-bend knots, slip-knots, girth-hitches, and loops (Adovasio et al. 2009; Emery 1966), whereas overhand knots are non-diagnostic and more expedient. Traits identified as technological style are initial spin and final twist. I emphasize initial spin as the best indicator of the habitual behavior of cordage manufacture, rather than final twist, because final twist is nearly always the reverse of initial spin. By emphasizing the initial spin, this also allows me to incorporate single-plied cordage into statistical analyses, which would not be possible if measuring only final twist direction. As discussed above, technological style is low-visibility and reproduced as a result of learning behavior on the way to producing a functional object, so it is expected that technological-stylistic traits may overlap with functional traits.

Table 3.5. Cordage Tightness Based on Emery's (1966) Cordage Tightness Scale.

Category	Angle
Very tight	> 45°
Tight	26-45°
Medium	11-25°
Loose	< 10°

Basketry Variables. As in cordage, I compared traits associated with how the artifact functioned in regards to subsistence technology and technological-stylistic traits. For basketry, functional traits include form, foundation type, and use wear. Using ceramic artifact analysis as a model for determining intended form, baskets were assigned to the following categories: trays and wide bowls, or narrow jars and small bowls. These were identified according to base shape and informal measures of circumference. Basketry would have had a variety of uses, like carrying belongings, gathering foods, parching seeds, hauling water, and boiling food, among others. These activities may leave physical traces like charring from toasting seeds with hot coals or boiling with hot stones, abrasion and polishing from handling and transporting, or staining when used for cooking or as a storage container. Use wear was determined through visual analysis. Foundation type has been divided primarily into half-rod-and-bundle and baskets without bundles, because the inclusion of a bundle is proposed to be evidence of a water-tight basket (Adovasio 1970), and likewise, other metrics associated with foundation may also influence how the basket functioned. Other types of foundation may be stylistic: Weltfish (1932) considered three-rod basketry arranged in a triangular formation to be a stylistic trait, because the wall thickness created by this rod arrangement could be functionally the same as any other rod type.

Attributes I consider associated with technological style are work direction, stitch type, stitch alignment, and stitch engagement with the foundation. These attributes are associated with habitual manufacture of the basket, and associated with learning rather than affecting directly the function of the basket as a utilitarian object. As technological-stylistic traits, these are low-visibility and produced in the process of manufacturing the useable object, and as a result, technological style and function overlap on many traits including work surface, which may be functional and/or habitual. The difference between concave and convex work surfaces refers generally to whether a basket was manufactured when facing the basket maker along the far-edge of the basket (concave), or the near-edge of the basket (convex), although variation in orientation is observed (Adovasio 2010; Morris and Burgh 1941; Weltfish 1930). In the manufacturing process, after a basket-maker began working on the concave or convex surface, the basket was either worked to the right or left of the weaver (i.e. right-to-left or left-to-right, respectively). Weltfish (1930) considered this an attribute that was mechanically different from work face, but still related in terms of initial stages of basketry manufacture, as it is tied to the motor habits of the weaver. She acknowledged the possibility that the appearance of both work directions within a tribe may be explained by the proportion of right- and left-handed people; however, Weltfish

(1930) was successful in differentiating California tribes based on work direction, so she considered this trait more associated with learned craft traditions rather than handedness.

Statistical Comparison

Statistical analyses have not been standardized for basketry and cordage studies, so attribute analysis of lithic artifacts was used as a model (Andrefsky 2005). Categorical data were compared through Fisher's Exact tests (deemed most appropriate for small samples sizes) (VanPool and Leonard 2011), and data are presented without a test statistic, as is standard for Fisher's Exact tests. For metric data, significance was measured using nonparametric Mann-Whitney U tests. Also, in some cases F-tests were used to compare Coefficients of Variation (CV). All statistics were computed using MyStat 12.02. I assumed that all cordage pieces included in these tests represent independent artifacts, although I recognize that there may be redundancies. Following standard practice, alpha was set at 0.05 for rejection of the null hypothesis.

Results

Manufacturing Debris Analysis

Manufacturing debris was found in nearly all cultural components at Bonneville Estates, except for Component 6 (Table 3.2). These plant fragments are generally characterized as shredded sagebrush and juniper bark, cut cane, dogbane and milkweed fibers with some cortex still attached, retted and cut tule bulrush, loosely twisted and coarse tule bulrush, and sagebrush, and juniper bark, and trimmed pieces of wood (Figure 3.2). Modifications such as cutting were more

Figure 3.2. Examples of manufacturing waste material in the macrobotanical assemblage. a: 22940 (fine *Asclepias* sp. or *Apocynum* sp. for cordage production); b: 559 (*Apocynum* sp. bast fibers with outer bark attached); c: 28299 (trimmed fine fibers with bark removed); d: 29463 (retted fine fibers with bark removed); e: 25639 (twisted and retted *Schoenoplectus* sp.); f: 31316.02 (cut *Schoenoplectus* sp.); g: 25681.02 (retted but unconsolidated fine fibers); h: 22466 (trimmed *Asclepias* sp. with outer bark partially removed); i: 22651 (retted fine fibers); j: 22754 (possible porcupine quill); k: 26127 (basketry foundation fragment, cut on both ends, with impressions of stitches); l: 28292.02 (*Apocynum* sp. fiber with some outer bark still intact); m: uncatalogued (*Artemisia* sp. bark, cut and twisted); n: 31046 (end of trimmed *Asclepias* sp. stem); o: 28531 (cut *Asclepias* sp. consolidated fibers); p: 28294 (cut and twisted *Juniperus* sp. bark); q: 2 5464 (cut *Phragmites* sp.); r: 25018 (twisted *Schoenoplectus* sp.); s: 22826 (shaped unknown wood); t: uncatalogued (shaped unknown wood).

readily identifiable on larger specimens, although some fine fiber also showed modification through cutting and twisting. The bulk of the waste material was found in the Pie Creek and James Creek assemblages, components 5 and 3 (Table 3.2). In these deposits, there were more coarse plant elements (cut stems and processed coarse fibers) than fine fibers, which may reflect collection bias during excavation or the activities at the site (Figure 3.3, Table 3.6). Class 3-sized (2-4 cm) waste materials predominate and include a variety of coarse and fine fibers, while the largest materials (Class 6 >16 cm) were cane and tule bulrush. Throughout all components, waste material included marshland plants and plants used for fine cordage manufacture, for example wild flax and milkweed (Table 3.6). Only in components 5 and 1 did the proportions of marshland plants exceed others (Figure 3.4). Additional woody plants which showed human modification (e.g. Figure 3.2k, 3.2s, and 3.2t) may be associated with basketry repair of foundational elements.

Table 3.6 Distribution of Plant Classification of Manufacturing Debris.

Plant Category	Component					
	7	5	4	3	2	1
Wetland [a]	2	21	1	6	1	3
Fine Fiber [b]	1	13	0	4	1	1
Coarse Bark [c]	0	3	0	1	0	0
Other (unidentified wood)	0	6	0	2	0	0
Total	3	43	1	13	2	4

[a] *Typha* sp., *Phragmites* sp., *Scirpus* sp.
[b] *Apocynum* sp., *Asclepias* sp., *Linum lewisii*
[c] *Artemisia* sp., *Juniperus* sp.

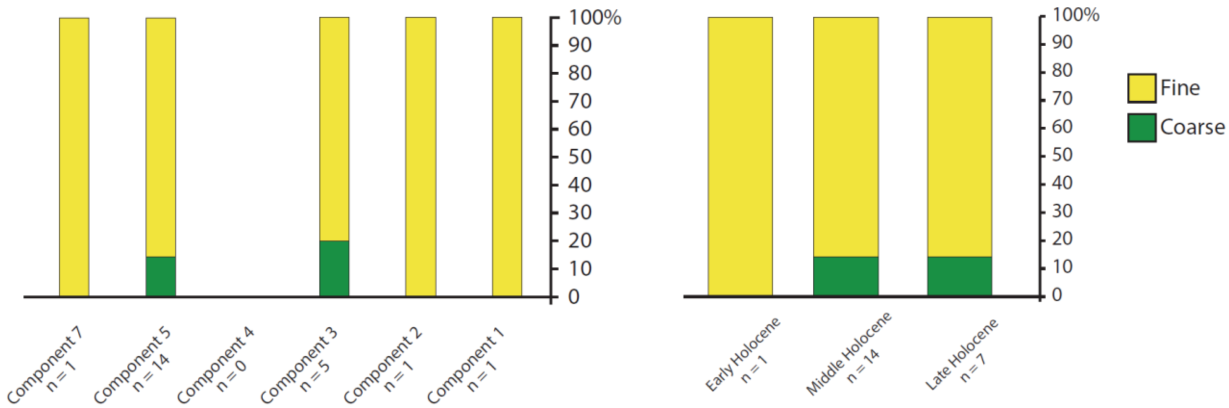

Figure 3.3. Relative proportions of coarse and fine waste material.

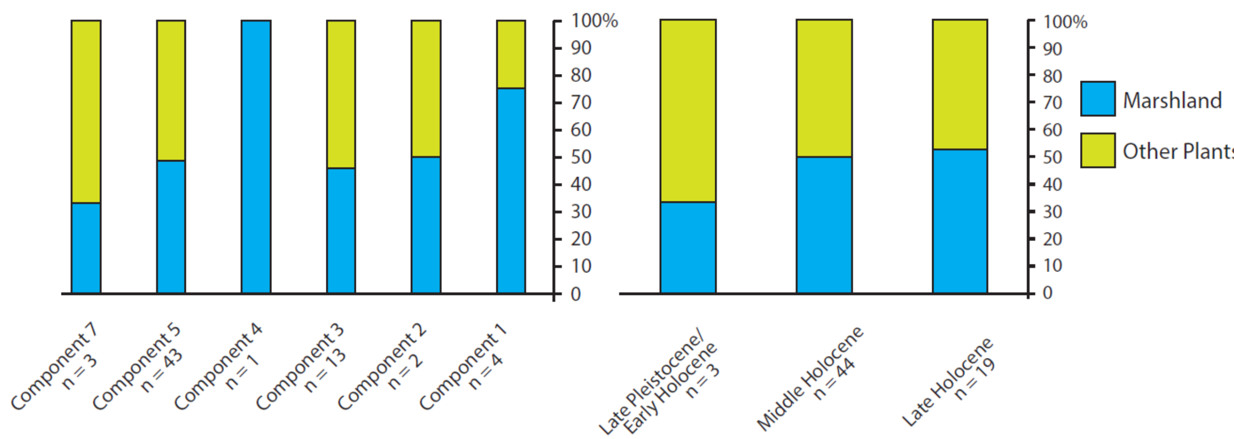

Figure 3.4. Relative proportions of marshland plants and other plant manufacturing debris.

General Descriptions of Finished Cordage and Basketry

Cordage was predominantly two-ply twisted and was made mostly from plants, while animal by-products like sinew, fur, hide, and tanned leather were used less frequently. Some diagnostic cords include snares (artifact no. 18445 [Figure 3.5n], Component 5, Pie Creek Phase; artifact no. 25665 [Figure 3.5j], Component 3, James Creek Phase; and possibly artifact no. 15265 [Figure 3.5b], Component 7, Dry Gulch Phase). It also includes possible netting (artifact 3409 [Figure 3.5e], Component 3, James Creek Phase; artifact no. 25013 [Figure 3.5g], unknown

Figure 3.5. Fine cordage. a: 3772, noose-knotted cord (Component 5); b: 15265, bent twig with knot (Component 7); c: 23533, cordage fragment (Component 5); d: 5141, twisted cordage fragment with burned end (Component 5); e: 3409, possible netting fragment with sheet-bend knot (Component 3); f: 12133, very fine knotted fragment (Component 4); g: 25013, possible knotted netting (unknown context); h: 9133, cordage fragment with sheet-bend knot (Component 3); i: 8914, cordage fragment (Component 3); j: 25665, snare fragment with wooden peg (Component 3); k: 20734, overhand knotted cordage fragment (Component 5); l: 19863, netting fragment (Component 5); m: 22691, knotted cordage (Component 5); n: 18445, snare fragment with knotted cord (Component 5); o: 22729, knotted cordage (Component 5); p: 24122, burned overhand knot (Component 5); q: 32766.02, cordage with slip knot (Component 5); r: 25013.01, composite knotted plant and leather cordage (unknown context); s: 18435, cordage fragment (Component 5); t: 22728, knotted netting (Component 5).

Figure 3.6. Sample of coarse cordage. a: unaccessioned, rope fragments (unknown context); b: 26921, cordage fragment with overhand knot (Component 5); c: 3862, cordage fragment with burned end (Component 5); d: 8922, match or fire bundle with twisted cordage (Component 1); e: 25534, cordage fragment with cut ends (Component 3); f: 9610, cordage fragment with possible red ochre staining (Component 4); g: 31691, cordage fragment (Component 5); h: 5644, loosely consolidated fiber (Component 3); i: 26910, cordage fragment (Component 5); j: 5717, knotted, loosely consolidated fiber (Component 2); k: 11121, cordage fragment with overhand knot (Component 4).

Figure 3.7. Coiled basketry at Bonneville Estates Rockshelter (a: 5145, coiled basketry (Component 3); b: 8762, coiled basketry (Component 3); c: 5138, coiled basketry (Component 1); d: 18790, coiled basketry (Component 2); e: 3718, coiled basket rod (Component 5); f: 3638, coiled basket rod (Component 5); g: 3710, coiled basket rod (Component 5); h: 10039, complete coiled basket (Component 3); i: 5137, coiled basket (Component 2); j: 5304, coiled basket (Component 2); k: 19533, coiled basket with repair stitches (Component 5); l: 26982, coiled basket with possible red ochre staining (Component 5); m: 5143, coiled basketry (Component 3); n: 2321, coiled basketry (Component 3); o: 10682, coiled basketry with repair (Component 2); p: 5144, coiled basketry (Component 3); q: 16920, coiled basketry (Component 3).

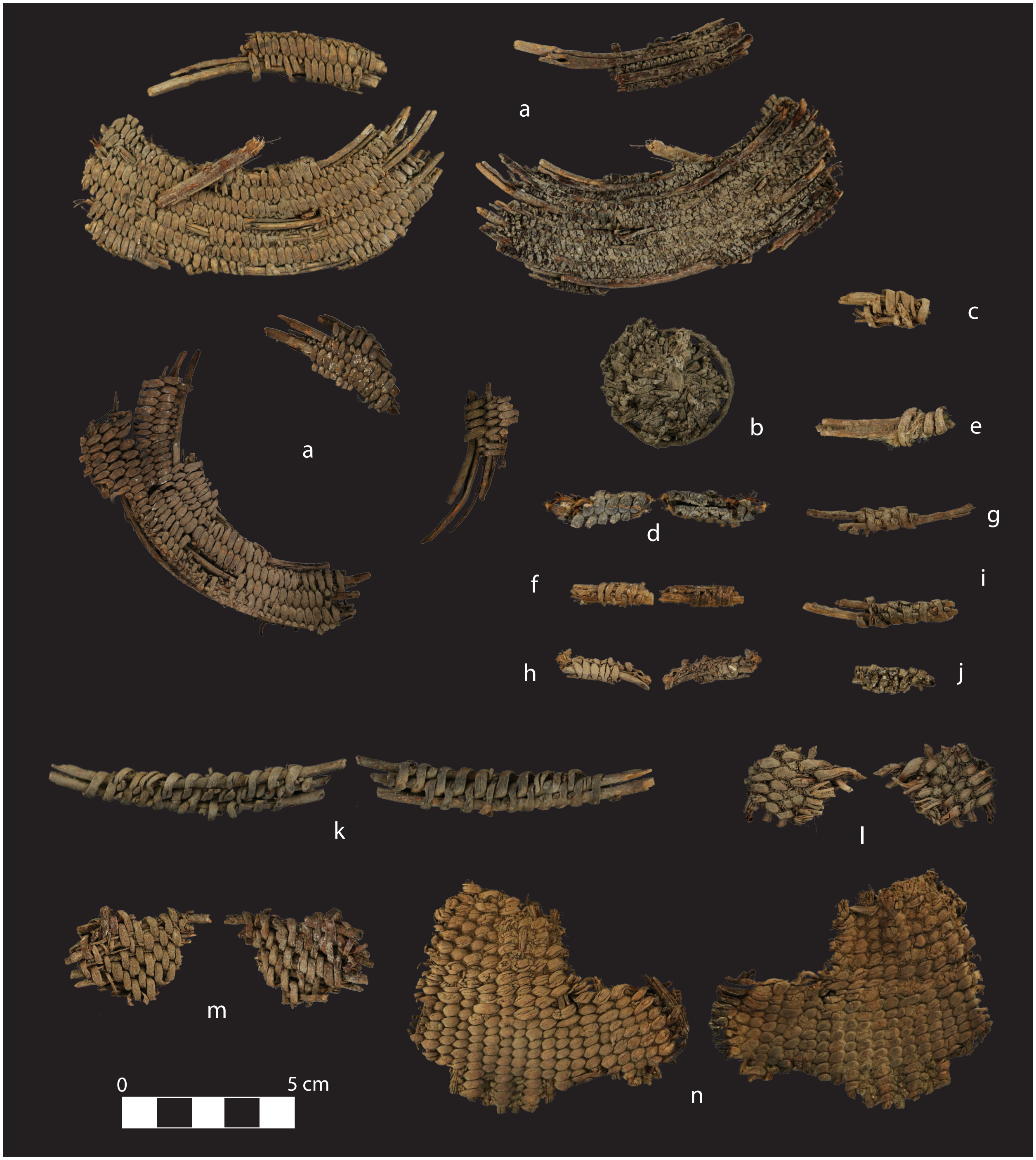

Figure 3.8. Coiled and twined baskets. a: 874, fragments of coiled basketry (Component 5); b: 18791, coiled basketry start (Component 2); c: 972, coiled basketry (Component 3); d: 25567, coiled basketry (Component 3); e: 10518, coiled basketry (Component 2); f: 10923, coiled basketry (Component 4); g: 3537, coiled basketry (Component 5); h: 22579, coiled basketry (Component 5); i: 3536, coiled basketry (Component 5); j: 12060, coiled basketry (Component 3); k: 5198, coiled basketry (Component 2); l: 22727, twined basketry (Component 5); m: 22915, coiled basketry (Component 5); n: 18263, twined basketry (Component 4).

context; artifact no. 19863 [Figure 3.5l], Component 5, Pie Creek Phase; and artifact no. 22728 [Figure 3.5t], Component 3, James Creek Phase). The collection also includes a possible fire bundle or match (artifact no. 8922 [Figure 3.6d], Component 1, Eagle Rock Phase). There is one small, complete basket in the assemblage (artifact no. 10039 [Figure 3.7h], from Component 3, James Creek Phase) which may represent the work of a novice basket-maker (E. Jolie, personal communication 2014). All other baskets are fragmentary, with some as small as a single row of stitches (e.g. artifact no. 10923 [Figure 3.8f], Component 4, South Fork Phase; artifact no. 5143[Figure 3.7m] and artifact no. 12060 [Figure 3.8j], Component 3, James Creek Phase; artifact no. 5615, Component 2, Maggie Creek Phase). Six basket rods with impressions of stitches as well as several solitary stitches also occur (Figure 3.2k, Figure 3.7e-g). Most baskets show close spacing, there being one exception with open spacing (artifact no. 5198 [Figure 3.8k], Component 2, Maggie Creek Phase).

There are three mended coiled baskets, two of which use cordage to reinforce damaged stitches (artifact no. 5142, Component 3, James Creek Phase; artifact no. 10682 [Figure 3.7o], Component 2, Maggie Creek Phase), and one with large stitches spanning across multiple stitches to repair splitting (artifact no. 19533 [Figure 3.7k], Component 5, Pie Creek Phase). There are three rims in the assemblage, including one false-braided rim (artifact no. 18061, Component 3, James Creek Phase) and two self-rims (artifact no. 10039 [Figure 3.7h], Component 3, James Creek Phase; artifact no. 10682 [Figure 3.7o], Component 2, Maggie Creek Phase). One of the self-rim baskets is considered complete, although unfinished (artifact no. 10039 [Figure 3.7h]). There are also two centers, both reinforced normally (artifact no. 10039 [Figure 3.7h], Component 3, James Creek Phase; artifact no. 18791 [Figure 3.8b], Component 2, Maggie Creek Phase). There are also three twined basketry fragments not included in the analysis, including one potential large burden basket with close, simple, wrapped twining (artifact no. 32210 [Figure 3.9], Component 5, Pie Creek Phase), and two smaller close, simple, wrapped twining fragments (artifact no. 18263 [Figure 3.8n], Component 4, South Fork Phase; artifact no. 22727 [Figure 3.8l], Component 5, Pie Creek Phase).

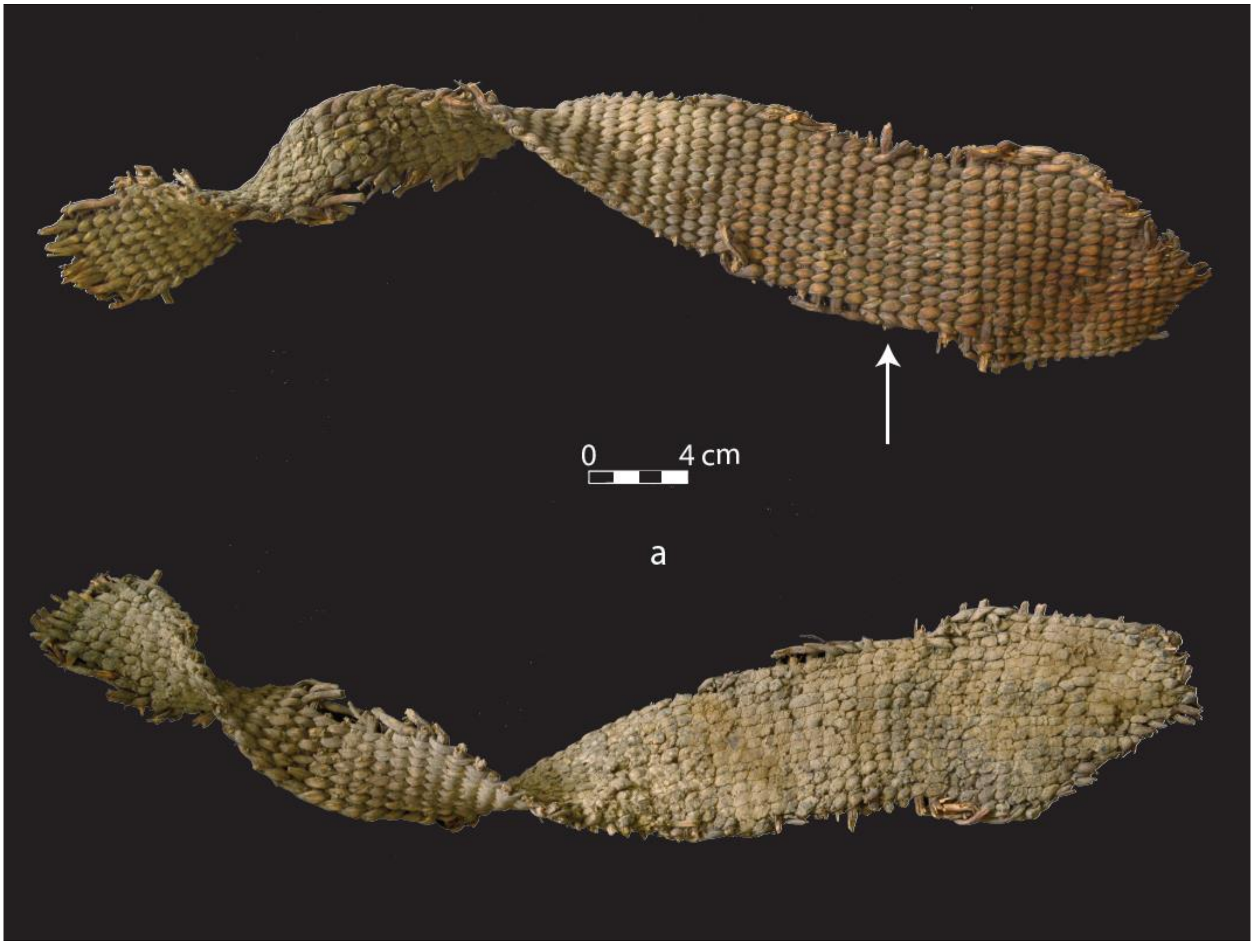

Figure 3.9. Twined basket from Bonneville Estates Rockshelter: (32210 (Component 5). Arrow indicates row with reversed weft direction).

Decoration

Most of the perishable cultural objects in the Bonneville Estates assemblage are utilitarian, but there are 16 perishable artifacts displaying decoration or have an unknown function in the

Figure 3.10. Decorative or unknown function artifacts: a: 4274, thin cord with tassel (Component 3); b: 5140, knotted bundle (Component 3); c: 22650, knotted sagebrush bundle (Component 5); d: 9099, knotted bundle with composite materials (Component 1); e: 3863, knotted bundle (unknown context) ; f: 32209, beaded jewelry (Component 3); g: 7592, bone bead preform (Component 3); h: 6395, bone bead preform (Component 2); i: 8918, bone bead preform (Component 3); j: 8963, bone bead preform (Component 3); k: 2527, bone bead preform (unknown context); l: 24435, bone bead preform (Component 1); m: 10047, bone bead preform (unknown context); n: 6983, bone bead preform (Component 3); o: 7162, abalone shell pendant (Component 1); p: 5137, possibly dyed cordage with seed bead (Component 5); q: 2722, bone bead (unknown context); r: 7666, wood bead (Component 2); s: 3542, knotted cord (Component 5); t: 4882, dew claw rattle with leather cord (Component 5); u: 24716, cord with possible red ochre staining (Component 5); v: 32852.01, elaborate 10-ply cord with a mix of twist directions (Component 5); w: 15272, knotted feathers (Component 7); x 14777, knotted feathers (Component 7).

assemblage (Figure 3.10). In Component 7 (Dry Gulch Phase), there are four cut and knotted feathers (artifact nos. 15272 and 14777 [Figure 3.10w and 3.10x]). Objects that are decorative or unknown in function from Component 5 (Pie Creek Phase) include a twined basket which reverses weft direction for one row (artifact no. 32210 [Figure 3.9]), a cord with possible red-ochre staining (artifact no. 31574.1), a basket with possible red-ochre staining (artifact no. 26982[Figure 3.7l]), a knotted bundle whose function is unknown (artifact no. 22650 [Figure 3.10c]), an elaborate 10-ply fine cordage made with a mix of s- and z-spin plies (artifact no. 32852.01 [Figure 3.10v]), a cord with a single strung juniper seed (artifact no. 5139 [Figure 3.10p]), and part of a possible dew claw rattle with a leather cord (artifact no. 4882 [Figure 3.10t]). In Component 4 (South Fork Phase), decorative and functionally unknown objects include cords with possible red-ochre staining (3862 [Figure 3.10u]) and a fiber bundle (artifact no. 5140 [Figure 3.10b]). In Component 3 (James Creek Phase) there is a very fine cord with a delicate fur tassel at one end (artifact no. 4274 [Figure 3.10a]), and a beaded cord (artifact no. 32209 [Figure 3.10f]). Decorative perishable artifacts in Component 2 (Maggie Creek Phase) include a wood bead (Figure 3.10r). In Component 1 (Eagle Rock Phase), the only decorative perishable artifact is a knotted fiber bundle whose function is unknown (artifact no. 9099 [Figure 3.10d]). Secondary evidence of cordage associated with decoration includes isolated cases of worked wood and bone found in every component, but primarily in Component 5 (Pie Creek Phase) and Component 3 (James Creek Phase) (Figures 3.10g-n, q-r). There are also cut potential porcupine quills (artifact no. 22754.02 [Figure 3.2j], Component 5, Pie Creek Phase) and an abalone shell pendant (H. Thakar, personal communication 2018) (artifact no. 7162 [Figure 3.10o], Component 1, Eagle Rock Phase). I did not analyze the twined basketry, nor the shell, bone, and wood objects.

Cordage

Initial Spin Direction. Initial spin rather than final twist direction was measured to incorporate single-ply cordage and to increase the sample size, and I excluded untwisted faunal material from this analysis (Figure 3.11, Table 3.7). By convention, upper-case S or Z indicates final twist direction, and lower-case s or z indicates initial spin. Cordage is found in all components at Bonneville Estates Rockshelter except Component 6, and the greatest numbers are found in the middle and late Holocene assemblages of Component 5 (Pie Creek Phase) and Component 3 (James Creek Phase) (Table 3.2). In all components, s as an initial spin direction is more prevalent, except for Component 3 (James Creek Phase), Component 2 (Maggie Creek Phase) (where they are equal), and Component 1 (Eagle Rock Phase) (Table 3.7). The late Holocene, therefore, is the only period when z-spin direction is dominant in the assemblage (77.6%); however, in Component 2, 50% of the assemblage is z-spin, though the sample size (N = 6) is small. For components 7-4, proportions of s-spin direction slightly dominate (53.8-60.5%). This relationship between spin direction in the late Holocene (Component 3 especially) versus the late Pleistocene/early Holocene and middle Holocene is significant (p = 0.0001, N = 209).

Table 3.7. Initial Spin Direction.

Component	s	z	Total
1	2	3	5
2	3	3	6
3	6	32	38
4	6	4	10
5	83	54	137
7	7	6	13
Total	107	102	209

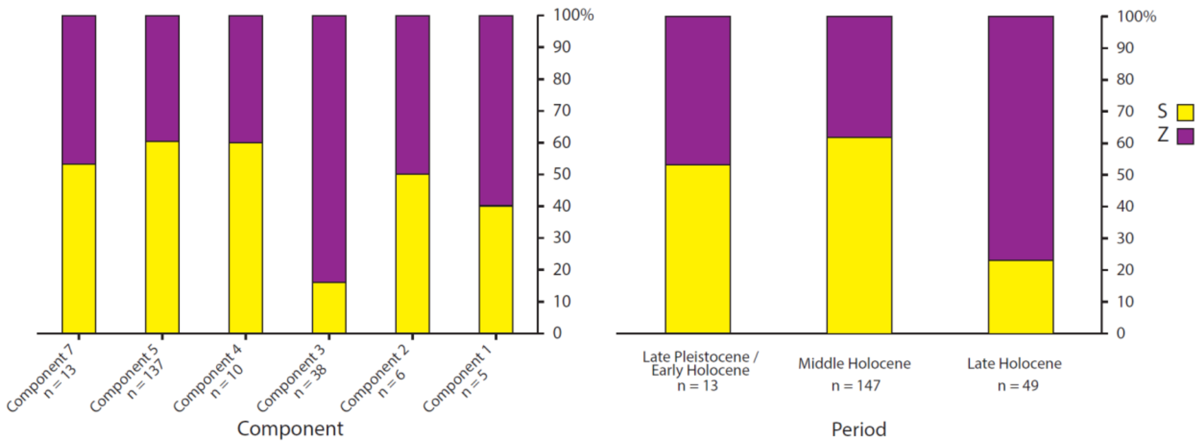

Figure 3.11. Relative proportions of cordage initial spin direction across components and climatic period. While the proportion of s- and z-spun cordage is generally equal in the early and middle Holocene with a slight s-spin dominance, there is a significant shift to a greater proportion of z-spun material in the late Holocene.

Material. In the case of plants, I broadly classify fibers as "coarse" versus "fine" material, as artifacts made from these plant materials may have functioned differently according to strength of the plant (Haas 2001). Coarse fibers include juniper, sagebrush, and bitterbrush, whose easily-shredded bark was used with minimal processing; however, these fibers were also more brittle (*N* = 62). Fine materials include milkweed, dogbane, and wild flax, which were more heavily processed to acquire fine cambium fibers and were generally stronger (*N* = 153). Fauna, principally in the form of twisted hide, also occurs in small amounts in most components (*N* = 17). Broadly speaking, fine material represents the majority of material types across all climatic periods (Table 3.8). Most of the coarse material occurs in Component 4 (South Fork Phase), where there is 70% coarse and 30% fine cordage, although the sample size (*N* = 10) is quite small (Figure 3.12, Table 3.8). In Component 3 (James Creek Phase) and Component 2 (Maggie Creek), there is a decline in the amount of coarse material and an increase in faunal material. While coarse material represents the majority in Component 4 (South Fork Phase), when grouped with Component 5 (Pie Creek Phase) as part of a middle Holocene representation (Figure 3.12), the proportion of coarse and fine material between the late and middle Holocene is similar, with fine material dominating the collection throughout the record, but the decline in coarse material in the late Holocene is significant (p = 0.0162). A notable change in the late Holocene is the strong decline in coarse material and conversely a strong increase in cordage made from faunal materials (this increase in faunal material in the late Holocene is found to be significant (p = 0.0001). Like coarse cordage, faunal cordage is considered generalized in application as there is no ethnographic documentation of faunal cordage being used in specialized tools like netting, and when compared with coarse cordage as being functionally similar, the middle and late Holocene periods are nearly identical.

Table 3.8. Cordage Material Type.

Component	Coarse	Fine	Fauna	Total
1	1	4	0	5
2	0	6	2	8
3	6	29	11	46
4	7	3	0	10
5	45	97	2	144
7	3	14	2	19
Total	62	153	17	232

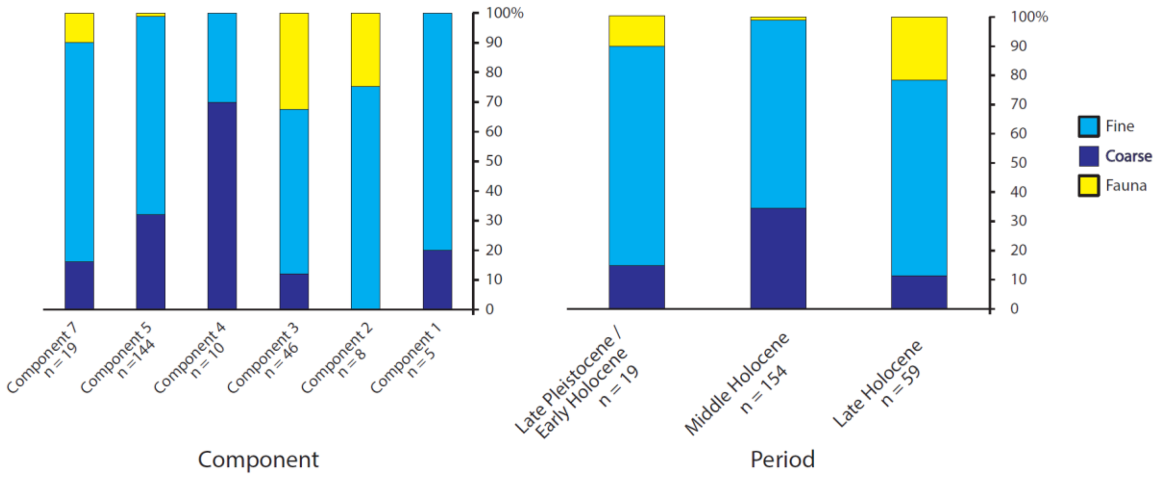

Figure 3.12. Relative proportions of coarse, fine, and faunal cordage. Cordage made on faunal materials consistently occurs at a smaller proportion than cordage made on plant material. In the late Holocene, there is a decrease in the proportion of coarse material and an increase in cordage made on faunal material, which was statistically significant. Totals include unspun material excluded from other analyses.

Most of the faunal material used as cordage at Bonneville Estates is untwisted, so I excluded faunal material from variables dependent on spin direction. When cordage raw material is grouped into the main categories "coarse" versus "fine" (excluding fauna), there is a strong relationship with spin direction (Table 3.9). For the entire assemblage, z-spin cordage is usually found on fine materials, while s-spin cordage is more evenly split across both material types (p = 0.0001, N = 210) (Figure 3.13, Table 3.9). When comparing time periods, there is notable variation between material type and spin direction. The proportion of s-spin fine cordage is highly variable, fluctuating between being the majority type in Component 7 (Dry Gulch Phase), to declining in Component 5 (Pie Creek Phase), and being absent in Component 4 (South Fork Phase). In components 3 (James Creek Phase) and 2 (Maggie Creek Phase), s-spin on fine cordage becomes the dominant type, which then declines in Component 1 (Eagle Rock Phase), where it is in equal proportion with s-spin coarse material. The greatest numbers of spun cordage are found in the middle and late Holocene, so cordage from these periods are tested using a Fisher's Exact test. In the early part of the middle Holocene (Component 5, Pie Creek Phase), s-spin occurs almost equally across both coarse and fine cordage, although there is no fine s-spin cordage in the later part of the middle Holocene (Component 4, South Fork Phase). This changes in the late Holocene (Component 3, James Creek Phase; Component 2, Maggie Creek Phase; although in Component 1, Eagle Rock Phase s-spin is equally on fine and coarse cordage), with s-spin occurring more frequently on fine cordage ($p = 0.0158$). Across the assemblage, z-spin cordage is consistently predominantly on fine cordage. The lowest proportions of z-spin fine cordage are in Component 4 (75%) and Component 3 (80.6%). When comparing s-spin by climatic phases, the significant trend lies in the relatively higher proportion of s-spin fine materials in the early Holocene (85.7%) and conversely the lower proportion of s-spin fine cordage in the middle (50.6%) ($p = 0.0207$), despite the lower proportion in Component 1 (50%). Although Component 1 is temporally assigned to the late Holocene, it differs from components 3 and 2 in the greater proportion of coarse s-spin plant material.

Table 3.9. Cordage Material and Spin Direction.

Component	Coarse		Fine		Fauna		Total
	s	z	s	z	s	z	
1	1	0	1	3	0	0	5
2	0	0	3	3	2	0	8
3	0	6	6	25	3	8	48
4	6	1	0	3	0	0	10
5	38	6	45	49	1	1	140
7	1	0	6	7	2	0	16
Total	46	13	61	90	8	9	227

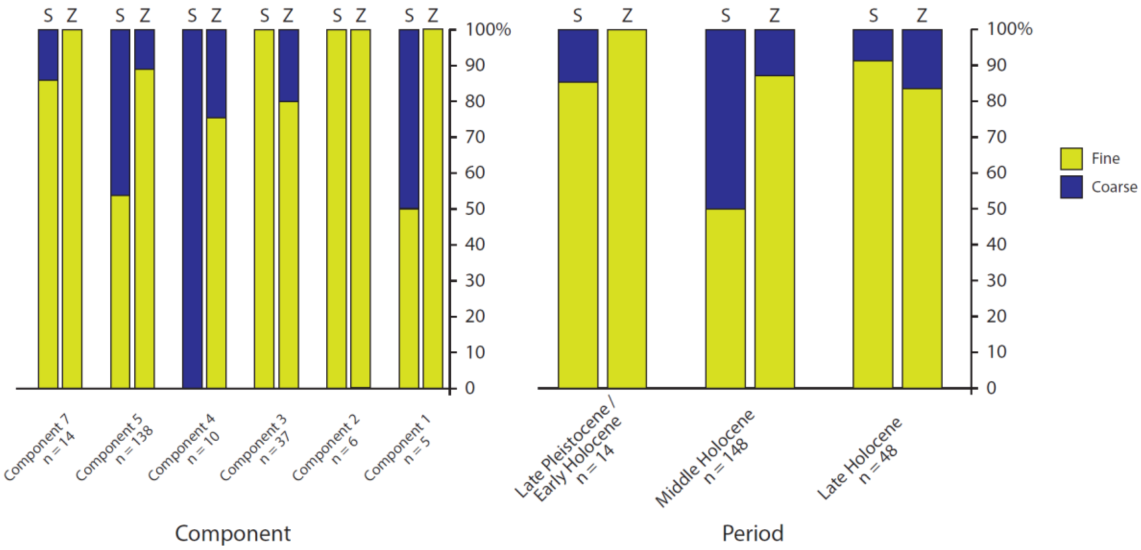

Figure 3.13. Relative proportions of spin direction according to material type. A Fisher's Exact test shows that there is a significant difference in the proportions of z- and s-spun cordage made on fine material, with z-spun cordage more frequently made on fine material, and s-spun material fairly evenly distributed across plant material types when the entire assemblage is pooled. When compared according to component and climatic periods, there are more subtle changes in proportions of the plant materials and associated spin directions.

Tightness. On average, I classify most cordage in the Bonneville Estates assemblage as "tight" according to Emery's (1966) scale (Table 3.5; Appendix A). When comparing the relationship between average tightness and material type (i.e., coarse versus fine cordage) for the 179 cords where both of these variables can be measured, a Mann-Whitney U test failed to show a measurable difference (U = 3089.5; Z = -0.43402; p = 0.6672), likely because the sample size of cordage made on coarse material in which this trait was present (N = 50) was too weighted toward s-spun cordage to be compared using these statistical tests (Table A.1). When using the same test to measure the average tightness of fine cordage by spin direction on cordage where this attribute is present, a significant difference was inferred (U = 1561.5; Z = -2.51779; p = 0.01174), with s-spun fine cordage on average being twisted more tightly (46°) than z-spin fine cordage (40°) (Figure 3.14, Table A.1). This difference in fine twist direction and tightness is further amplified when the period with the most robust sample size with this attribute present, the middle Holocene, is isolated (U = 605.5; Z = -2.96653; p = 0.00298). Because there is apparently a significant variation in mean angle of the s-spin and z-spin cordage, this attribute was further explored using an F-test to measure the Coefficient of Variation (CV) of the angle of s- versus z-spin direction cordage made on fine fiber materials. This test indicates that there is a significant distinction between the tightness of cordage made on fine plant material as measured by angle and spin direction, in which fine z-spun cordage has a smaller standard deviation from s-spun cordage, which I interpret as z-spun material having less variability than s-spun material ($F_{53,76}$ = 3.06, p = 0.0000056).

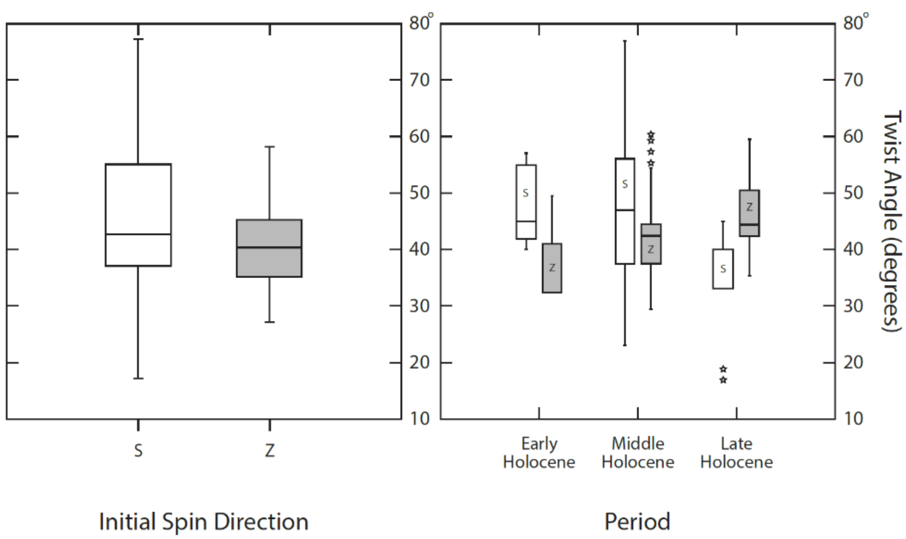

Figure 3.14. Twist angle of fine cordage. These plots illustrate a Mann-Whitney U-test demonstrating that the mean angle of fine cordage is statistically significant when separated according to spin direction across the BER assemblage.

Twists per centimeter (TPC) is another way to determine the "fineness" of cordage, as finer cordage is expected to have more twists per centimeter than less-fine cordage (Teague 1998). Similarly, cordage used for netting is expected to be generally uniform in manufacturing

(Riddell 1978), so these should be less variable in number of twists per centimeter, if multiple cords were indeed combined to manufacture nets. By nature of the strength of raw material, I expect cords made on fine bast fibers (which are stronger and therefore capable of being twisted tightly, and are smaller in diameter) to have more twists per centimeter than those made on coarse bark material (which are brittle, cannot be twisted tightly, and are thicker in diameter). Therefore, comparing the TPC of fine material cordage to coarse material cordage is redundant, as fine fibers will yield "fine cordage", per Teague (1998). Instead, as in the case of twist angle, spin direction is compared within material type, but because there are only nine pieces of z-spin coarse cordage where angle can be measured, and all coarse cordage has only between 1-3 TPC, the sample size is considered too small for statistical tests (Appendix A). Instead, fine cordage with this attribute present was compared using a Mann-Whitney test to compare spin direction and TPC, and s-spin has an average TCP (3.7) that is significantly less than z-spin (4.9) (U = 1219; Z = 4.0189; p = 0.00001) (Figure 3.15, Table A.2). This trend is seen in the middle and late Holocene, but not in the early Holocene, in which s-spin (5.9 TPC) has on average more TPC than z-spin (5 TPC), although the sample size is small (s-spin, N = 6; z-spin, N = 5). The standard deviation is nearly equal in spin directions, (s-spin, 1.508895; z-spin, 1.67285), so an F-test measuring the CV of TPC across the entire assemblage did not indicate a significant difference between the two twist directions ($F_{53,76}$ = 0.814, p = 0.428791).

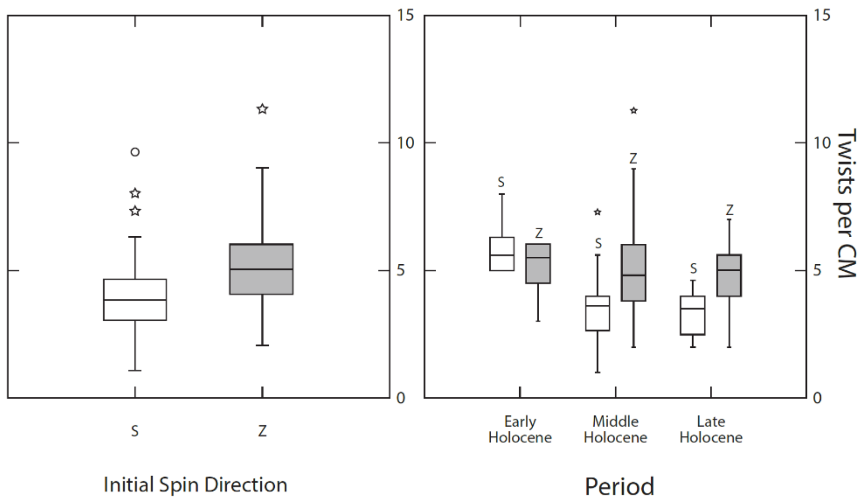

Figure 3.15. Twists per centimeter (TPC) in fine cordage. These plots illustrate that generally, the average number of TPC is higher in z-spun cordage than in s-spun cordage.

Diameter. Similar to twist angle and twists per centimeter, classifying coarse versus fine cordage influences the diameter of strands and completed cords. However, a change in diameter within coarse or within fine cordage sub-assemblages may also indicate change in the proportion of these types of cords. When comparing cordage diameters within fine materials along the lines of cordage spin-direction (when this attribute is present) in the entire assemblage (Figure 3.16, Table A.3), there again appears to be a significant difference in the average diameter of cordage (U = 1504; Z = -2.87961; p = 0.00398), with z-spun cordage on average having a smaller diameter than s-spun cordage. This pattern is also visible in all climatic periods at Bonneville Estates. An F-test on the data indicates no statistical significance in the CV of the two sub-assemblages ($F_{53,78}$ = 1.548754, p = 0.0776559), because the standard deviations of s-spin (1.11 mm) and z-spin (0.89 mm) are similar.

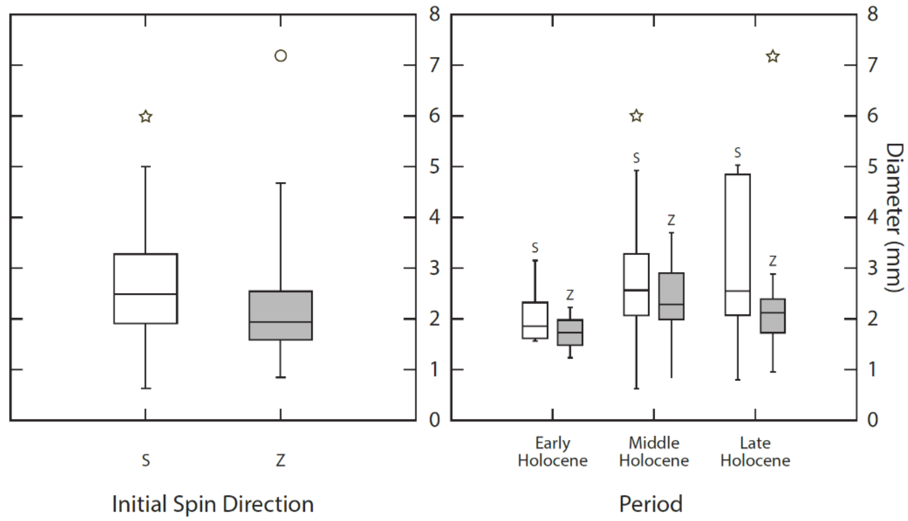

Figure 3.16. Diameter of fine cordage. A Mann-Whitney test suggests that there is a significant difference in cordage diameter when compared according to spin direction, where s-spun cordage is on average thicker than z-spun cordage.

Knots. There are only 60 knotted specimens of two-ply twisted plant-based cordage material, and the majority of this knotted cordage (81.7%) is found in the middle Holocene (Table A.4, Figure 3.17). Most knotted cordage is fine plant material (58.3%). If knot type is considered with material type across all climatic phases at Bonneville Estates, fine cordage is more often associated with sheet-bend knots and other knots that are commonly used for snares and traps ethnographically (nooses, slip-knots, and girth-hitches [Adovasio et al. 2009; Emery 1966]) than coarse cordage, which is more commonly associated with overhand knots (Fisher's Exact $p = 0.0041$, $N = 60$). Sheet-bend and other non-overhand knot types are found more commonly on z-spin (30%) than s-spin cordage (16.7%), however, this is not found to be statistically significant ($p = 0.3604$).

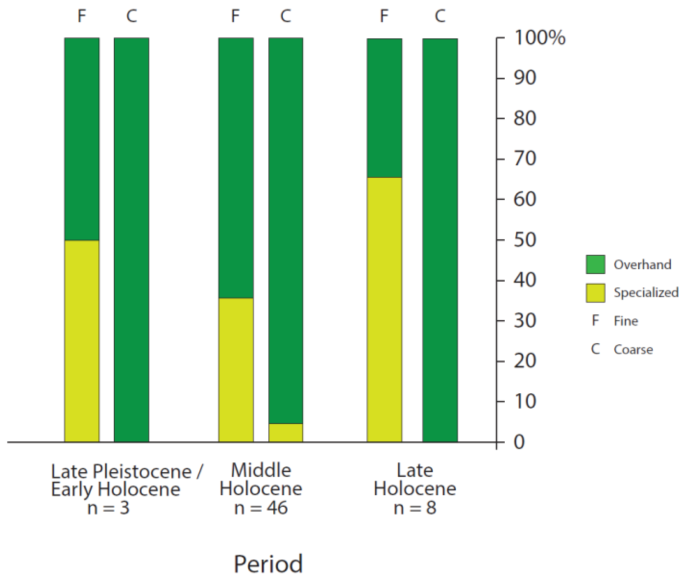

Figure 3.17. Proportions of knot types on plant material types. This chart illustrates the results of a Fisher's Exact test which shows that fine cordage is more often associated with sheet-bend and knots associated with snares and traps than coarse cordage, which is more commonly associated with overhand knots.

Summary. These statistical tests indicate a potential relationship between raw material, tightness, and knot-type when compared according to spin direction, which have potential social implications discussed later in this chapter. Tests consistently show trends which vary according to component and broad climatic periods, most consistently maintained diachronically when focusing on z-spin cordage. The possible correlation between these attributes suggests that the common practice of simply reporting the twist direction of cordage independent of other functional attributes in an assemblage is muting the potential value of cordage statistical analysis.

Coiled Basketry

There is no basketry from the oldest components (Components 7 and 6) at the site; the oldest coiled basket at Bonneville Estates Rockshelter is from Component 5 (Pie Creek Phase)

(Appendix B, Table 3.2). There are more basket fragments dating to the late Holocene (components 3-1, *N* = 23) than the middle Holocene (components 5 and 4, *N* = 8); however, the number of baskets from each climatic period is still sufficiently large for statistical analyses for some measured attributes. For comparison, therefore, I pooled coiled basketry to reflect middle Holocene and late Holocene periods. Not all attributes were present on all basket fragments in the assemblage, so sample sizes vary according to the presence of these attributes.

General Construction. Although among basketry both work directions are represented across both periods, left-to-right work directions occur in higher proportions in the middle Holocene (75%) (Component 5), and become less common in the late Holocene (21.4%, only in Component 3) (*p* = 0.0026, *N* = 31) (Table 3.10, Figure 3.18). In both climatic periods, the work face is most often concave (66.7% in the middle Holocene and 55.6% in the late Holocene, *N* = 24, Table 3.11), although four baskets in the middle Holocene and four in the late Holocene have indeterminate work surfaces. In the middle and late Holocene, stitches are sometimes split (66.7% in the middle Holocene, 47.8% in the late Holocene); however, this distribution is not significant (p = 0.4440, *N* = 32) (Table 3.12).

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Table 3.10. Basketry Work Direction.

Component	Right-to-Left	Left-to-Right	Total
1	1	0	1
2	8	0	8
3	11	3	14
4	1	0	1
5	1	6	7
Total	22	9	31

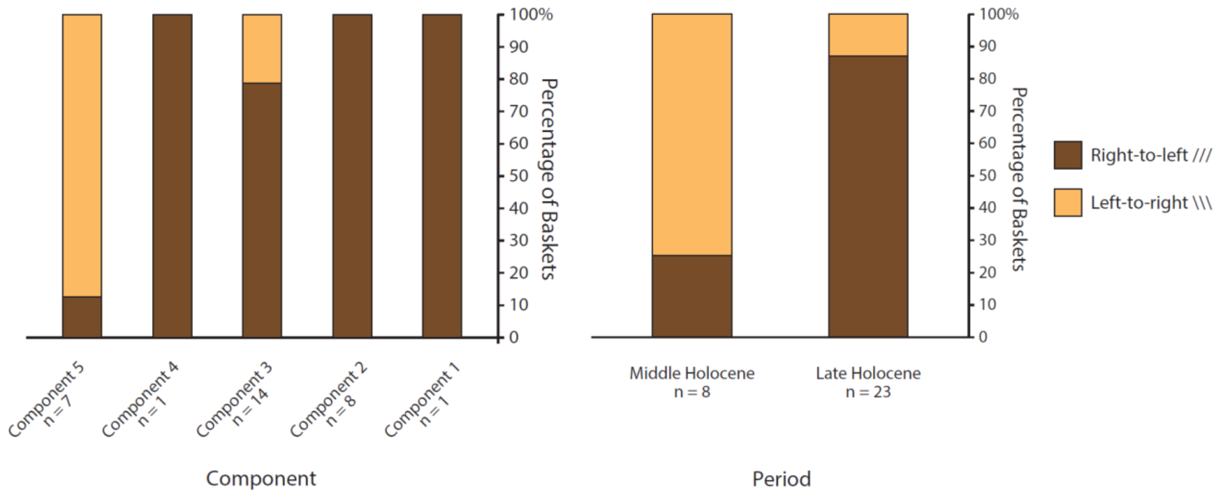

Figure 3.18. Basketry work direction. Left-to-right work direction is more common in the middle Holocene than the late Holocene.

Table 3.11. Basketry Work Face.

Component	Concave	Convex	Total
1	0	0	0
2	4	3	7
3	6	5	11
4	0	0	0
5	4	2	6
Total	14	10	24

Table 3.12. Presence of Split Stitches on Basketry.

Component	Split	Not Split	Total
1	0	1	1
2	3	5	8
3	8	6	14
4	0	1	1
5	6	2	8
Total	17	15	32

Foundation. Foundations with a welt (*N* = 1) are only found in the middle Holocene (Component 5, two-rod welt), and three-rod foundations (*N* = 2) are only found in the late Holocene (one is in Component 3 and the other is in Component 2) (Appendix B). Foundations with a bundle occur less frequently in the middle Holocene (28.6%) than in the late Holocene (78.2%), a statistically meaningful proportional difference ($p = 0.0256$, $N = 30$) (Figure 3.19, Table 3.13). Most baskets with intact foundations (*N* = 21) are made with half-rod or whole-rod foundations, sometimes including a bundle. Comparing half-rod to whole-rod baskets, middle Holocene baskets predominantly have whole-rod foundations (66.7%), whereas in the late Holocene, 88.2% of those baskets have half-rod foundations; this increase in proportion is not statistically significant ($p = 0.0549$, $N = 22$) (Figure 3.20, Table 3.14).

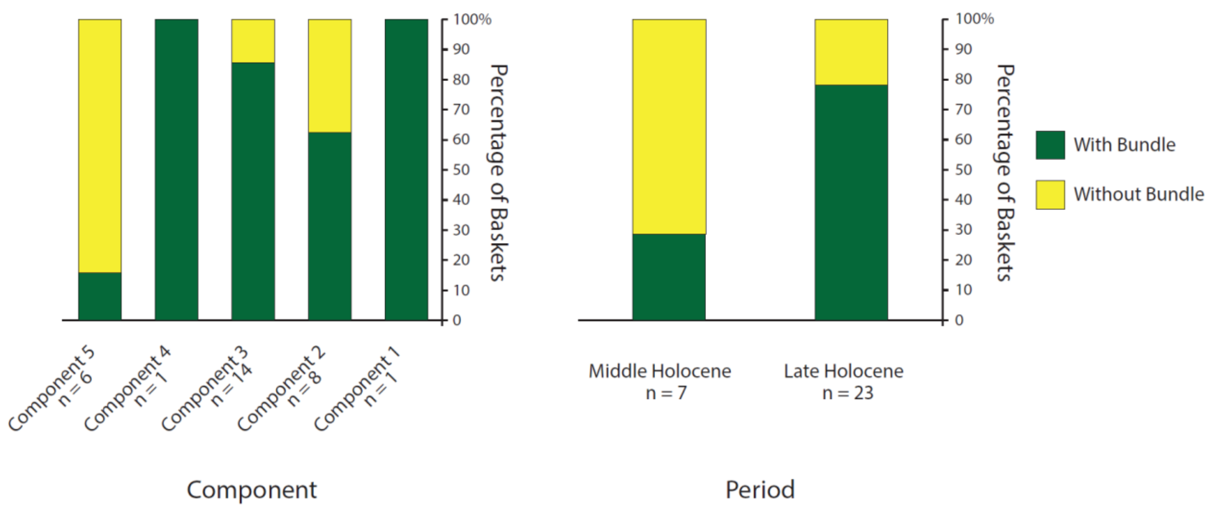

Figure 3.19. Bundles in basketry foundations. There is a significant increase in relative proportions of baskets with bundles in the late Holocene.

Table 3.13. Presence of Bundles in Basketry Foundations.

Component	Bundle	No Bundle	Total
1	1	0	1
2	5	3	8
3	12	2	14
4	1	0	1
5	1	5	6
Total	20	10	30

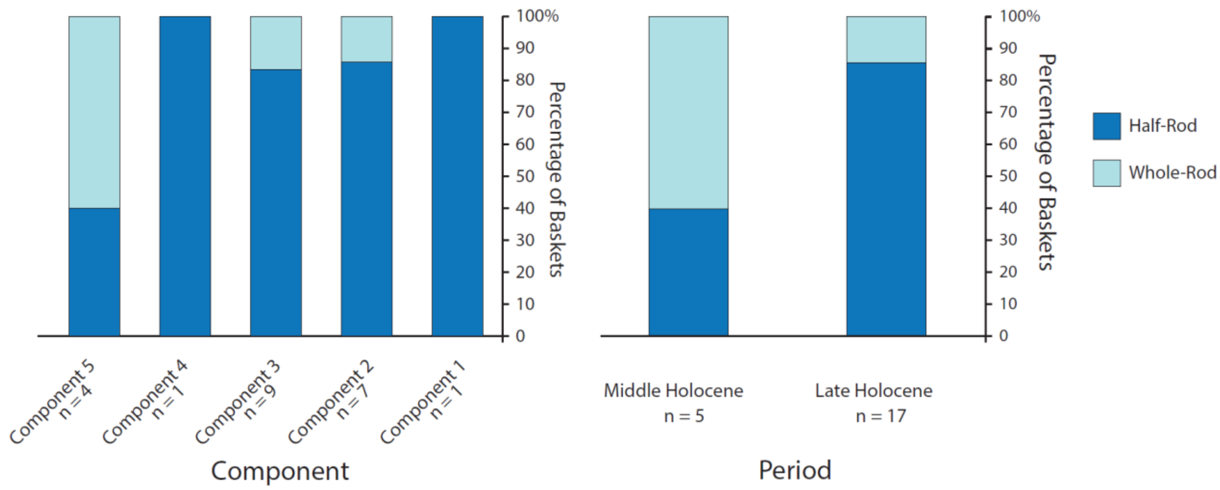

Figure 3.20. Rod types in basketry foundations. In the late Holocene, there is an increase in the relative proportions of baskets with a half-rod foundation.

Table 3.14. Rod Type in Basketry Foundations.

Component	Half-Rod	Whole Rod	Total
1	1	0	1
2	6	1	7
3	8	1	9
4	0	1	1
5	2	2	4
Total	17	5	22

Foundation Unit Diameter. This metric attribute was determined to be significantly different between the middle and late Holocene, as constrained by sample size. On average, rod measurements within baskets with half-rod configurations are significantly smaller in the middle Holocene than the late Holocene (N = 15) (Figure 3.21a, Appendix B) (U = 45; Z = 2.32829; p = 0.0198). The variance in size of foundation unit diameter (in baskets with this available element) between the middle and late Holocene, however, is not statistically significant ($F_{22,7}$ = 0.393, p = 0.0951). Other measurable traits like average stitch width, which can integrate loose stitches in the assemblage (U = 100; Z = 0.30317; p = 0.76418) (Figure 3.21b) and stitch gap (U = 56; Z = -0.67298; p = 0.50286) (Figure 3.21c) (when these attributes were present on basket fragments) were not found to be significantly different when using a Mann-Whitney test, or testing variance using an F-test (stitch width: $F_{23,9}$ = 0.673, p = 0.4226; stitch gap: $F_{23,6}$ = 0.591, p = 0.3361).

Use Wear. Burning is the most common expression of use wear, being found on 76.7% of baskets (Appendix B). Although evidence of burning varies considerably by component (Figure 3.22, Table 3.15), by period it is roughly proportional in the middle and late Holocene (p = 1.0000, N = 31). On baskets where work face could be determined and had use wear present, work face and non-work face are burned in equal proportions. Although across the assemblage a greater proportion of concave work surfaces are burned (77.8%) than convex work surfaces (50%), this comparison is not statistically significant (p = 0.6968, N = 17) (Table 3.16). Other basket fragments are stained or heavily worn, and nine baskets (30%) are free of some obvious form of use wear.

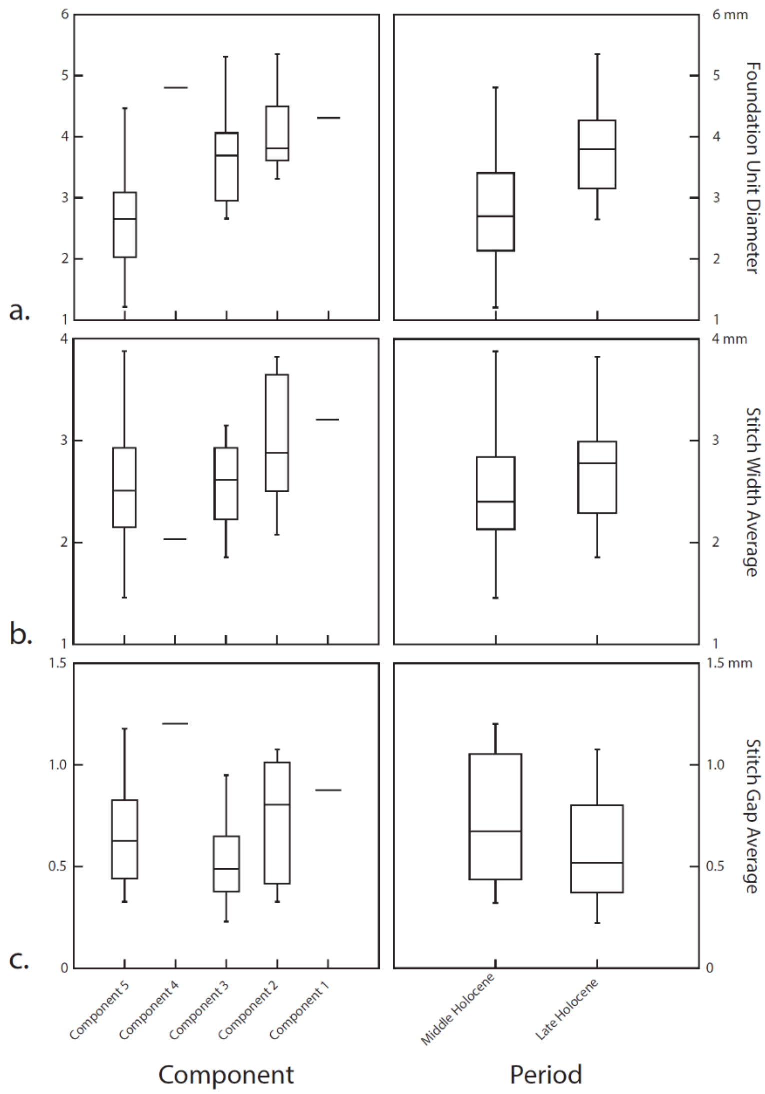

Figure 3.21. Average measurements of basketry foundation and stitches: a. Foundation Unit Diameter; b. Stitch Width; c. Stitch Gap.

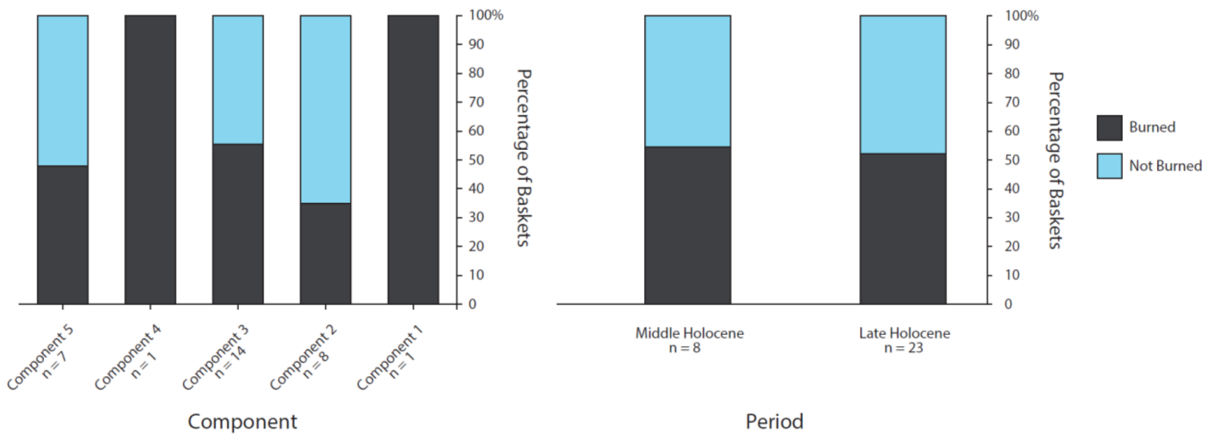

Figure 3.22. Burning on basketry. This attribute is roughly proportionate in the middle and late Holocene, although there is some variability across the components.

Table 3.15. Evidence of Burning on Basketry.

Component	Burned	Not Burned	Total
1	1	0	1
2	3	5	8
3	8	6	14
4	0	1	1
5	4	3	7
Total	16	15	31

Table 3.16. Burning on Basketry According to Work Face.

Component	Concave		Convex		Total
	Burned	Not Burned	Burned	Not Burned	
2	0	0	1	2	3
3	4	1	2	1	8
4	0	0	0	0	0
5	3	1	1	1	6
Total	7	2	4	4	17

Synthesis of Results

The presence of cordage in all components and basketry in Component 5 through Component 1 (Pie Creek, South Fork, James Creek, Maggie Creek, and Eagle Rock phases) at Bonneville Estates Rockshelter broadly supports previous interpretations of a multi-component, multi-purpose site occupied from the late Pleistocene through the Holocene (Goebel 2007; Graf 2007; Hockett 2015). Variation in cordage and basketry reveals the hunter-gatherers who occupied the site practiced a diverse array of activities with technological and functional changes through time. The diachronic analysis presented here demonstrates that there is value in comparing artifact attributes both associated with artifact manufacture and function. These measurable differences provide the opportunity to discuss questions related to the social nature of artifact manufacture and use, as well as site function and subsistence.

Technological Organization and Operational Sequence. The *chaîne opératoire* or operational sequence approach to the analysis of basketry and cordage from Bonneville Estates Rockshelter allows for the deconstruction of manufacturing processes. All stages excluding selection (i.e. traveling to the growing site, selection of appropriate materials, and transport) in the manufacturing process of cordage are represented at Bonneville Estates Rockshelter: the stages represented are preparation (waste debris from preparing usable elements through shredding, retting, and splitting), construction (consolidated and twisted fibers forming single-ply elements), and use/repair/reuse (cordage used as netting, as well as cordage used in the repair of basketry). By identifying waste material, plant-collection for cordage sites can be inferred using the model presented in Chapter 2 (Figure 2.5). Based on modern vegetative zones (which likely varied over time), sagebrush and juniper for coarse cordage manufacture may have been procured near Bonneville Estates, but such manufacturing debris is surprisingly low in frequency in the assemblage. The rockshelter itself was not likely a collection site for other more common materials used in cordage construction, for example wetland plants as well as milkweed and dogbane. Instead, these and other plant materials used in cordage manufacture were often transported to and prepared at the site in every period except Component 4 (South Fork Phase), and these were used most commonly to prepare fine cordage.

There is little direct evidence of basketry-material selection, initial stages of preparation, or construction at the site. Stages of construction in basketry manufacture can be addressed through the initial stages present in finished basketry like the starting face of basketry construction or work direction of finished baskets. There is evidence for the use/repair/reuse stage: use wear indicates use of baskets in seed parching, and many baskets were repaired, for example, through foundation and stitch reinforcement with new elements and cordage. Technological organization is described in greater detail in the following discussion section, when reviewing the specific research questions directing this study.

Cordage, Baskets, and Discerning Gendered Activities. I have divided cordage throughout the study into coarse versus fine materials; however, a dichotomous relationship of cordage may be realized as the difference between cordage used for specialized tasks, such as net-hunting or other small-game traps, and generalized cordage. In other archaeological studies, fine cords associated with net hunting and trapping were twisted more tightly than cords for more general purposes, resulting in a stronger cord (Haas 2001; McBrinn and Smith 2006). Cordage craft specialization related to function of the cord has been noted in other studies outside of the Great Basin (Romero-Brugués et al. 2018). Ethnographic and ethnohistoric evidence indicates that traditionally, men in the eastern Great Basin most often made and owned cordage for communally-used nets in jackrabbit and sage-grouse hunting, sometimes to make rabbit-skin blankets (depending on the group), and sometimes sewing hide clothing, while generalized cordage tasks were considered feminine (Adovasio 1986; Dean et al. 2004; Kelly 1932; Lowie 1924; Malouf 1940; Murdock and Provost 1973; Steward 1933; Wheat 1967). Steward (1938) observed a great deal of overlap between genders in the case of materials shared by the community, like rabbit-skin clothing. With little detailed discussion of the manufacture of cordage for traps and snares in small-game hunting by individuals in ethnographic and ethnohistoric accounts, it is not known which gender(s) was traditionally associated with manufacturing this particular tool class. In some North American ethnological accounts, however, men were most often associated with small-game hunting activities (Dean et al. 2004; Murdock and Provost 1973), whereas in others, men and women both hunted rodents (Kelly 1932; Simms 1998; Steward 1933, 1938).

For this analysis, I pooled knots associated with specialized small-game hunting (sheet-bend, noose, slip-knot, square-knots, and potentially girth-hitches). Other generalized tasks were categorized as using overhand knots. This analysis of knot type, material type, and twist direction may yield possible interpretations of gender throughout the Holocene. In this study, net knots were most often associated with fine cordage, although not exclusively; likewise, overhand knots were mostly associated with coarse materials, though also not exclusively. If ethnographic accounts of Great Basin Shoshone, Ute, and Paiute people are analogous to similar subsistence strategies of prehistoric occupants of the Great Basin, these possible correlates suggest men (associated ethnographically with small-game hunting) were more often associated with the sheet-bend knots, nooses, and slip-knots observed on fine cordage, while women (associated ethnographically with generalized tasks) were associated with overhand knots observed on coarse and fine cordage. Recent studies have noted gender likely played a significant part in the construction and use of cordage across the Great Basin and Southwest (Leach 2018).

Most coarse cordage and associated overhand knots in the middle Holocene at Bonneville Estates have an initial s-spin direction. Most z-spun, sheet-bend, and “other” knots are on fine cordage. To further this interpretation, perhaps masculine cords were most often made of fine material (and rarely on coarse materials) and more likely z-spun. Feminine cords were both coarse and fine, but women were more likely associated with s-spun cordage. If this broad categorization of feminine//generalized function//coarse//s-spin is accepted, then women made the majority of cordage at Bonneville Estates Rockshelter during the middle Holocene, as indicated by the majority of s-spun cordage during this period. The cordage assemblage for this period is also more diverse in function than at other times. Men traditionally were more specialized in their perishable-manufacturing activities, but their mark on the cordage assemblage at the site is notable throughout all components, although their specialized//fine//z-spun cordage is the majority type only in Component 3 (James Creek) and Component 1 (Eagle Rock) (Figure 3.23).

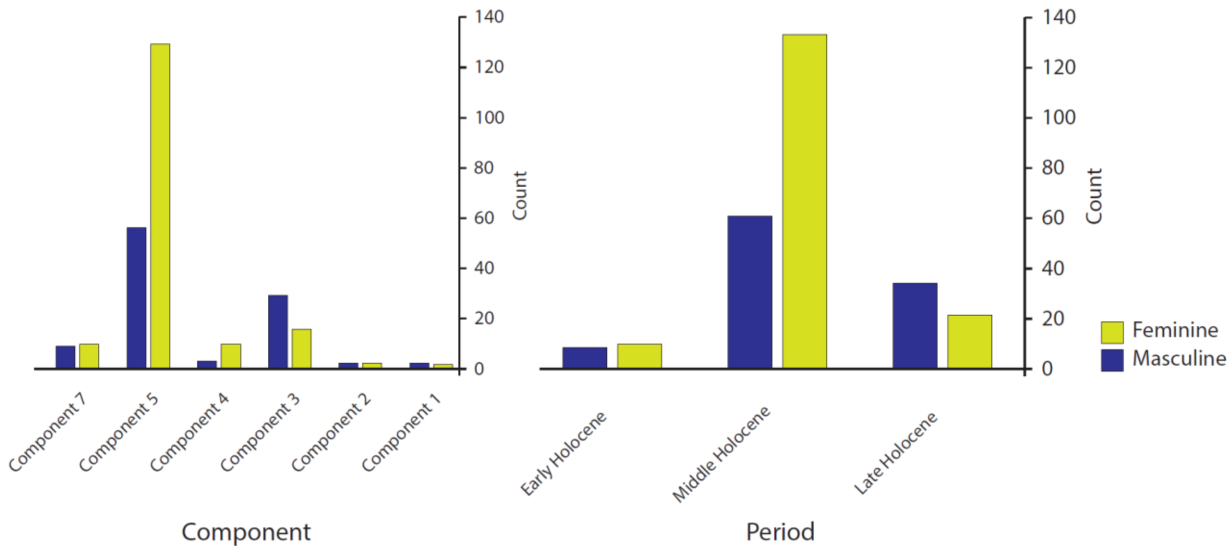

Figure 3.23. Cordage types according to inferred gender of manufacturer. Masculine cordage is defined most narrowly (specialized function//fine//z-spun), whereas feminine cordage is defined more broadly (generalized function//coarse//s-spin). All coarse material, all s-spun fine material, and all overhand knots are charted here as feminine. Masculine cordage is only z-spun fine material and specialized knots on fine material.

Basketry manufacture and use, assumed to be a nearly exclusively feminine artifact class regardless of age of the manufacturer (Adovasio et al. 2014; Murdock and Provost 1973; but see Dean et al. 2004; Greenwald 2017), may also contribute to gender-based interpretation at Bonneville Estates Rockshelter. To summarize the above results, primary variability is a shift in work direction at the beginning of the late Holocene (Component 3, James Creek Phase) from left-to-right to right-to-left, and changes in foundation such as the new appearance of three-rod bunched foundation and the increased prevalence of half-rod with bundles in the late Holocene. Some of these changes may reflect shifts in the utilitarian applications of basketry (in the case of bundles), but technological-stylistic traits like work direction and foundations with unknown functions (three-rods) suggests that shifts in feminine craft traditions occurred in the late Holocene (Minar 2001; Minar and Crown 2001; Petersen et al. 2001). In addition, the use of these baskets reflects feminine tasks, such as activities requiring liquid handling (presence of bundles) (Adovasio 1970), as well as seed processing through parching or potentially boiling (burning). The combination of rod-and-bundle foundations and burning used in single baskets supports a recent study that demonstrates that basketry was likely multi-purpose rather than specialized (Herzog and Lawlor 2016), illustrating flexibility of feminine activities at Bonneville Estates.

To compare these analyses of cordage and coiled basketry, some additional observations may be made. The decline in coarse “feminine” cordage in the late Holocene (i.e. cords of coarse plant fiber, generalized function, s-spin), synchronous with a proportionate increase in specialized small game-associated cordage (fine plant fiber, z-spin, netting and snare knots) (Figure 3.23), suggest a shift in subsistence activities, but these may not have been solely gender based. The increase in basket quantity and innovation in foundation configurations do not support the interpretation of a decline in feminine activities at Bonneville Estates Rockshelter. Additionally, net-hunting in modern groups was a communal activity, so while there is less evidence of the manufacture of generalized cordage at Bonneville Estates Rockshelter during the late Holocene, all members of the community likely still occupied the site during this time. In other words, even though feminine manufacture of cordage may have changed from the middle to late Holocene, they women were still present in the rockshelter during the late Holocene, preparing and using baskets, and participating in seed gathering and communal hunting. Thus, the patterns recognized in the perishable-artifact analysis may represent a more general shift in site function from generalized tasks in the middle Holocene to focused small-game hunting in the late Holocene. However, seed processing appears to have continued through the late Holocene, as evidenced by burning on baskets, and there appears to have been a greater emphasis on watertight baskets, which may have been used for holding water or potentially stone-boiling, as evidenced by an increased prevalence of bundles in basketry in the late Holocene.

Another possible explanation of the changes in cordage and basketry is that they represent a shift in learning networks or change in manufacturing norms. Most obvious is a shift in the dominant work direction of basketry in the late Holocene (when combining Component 3, James Creek Phase; Component 2, Maggie Creek Phase; and Component 1, Eagle Rock Phase) from left-to-right to right-to-left. This may be related to a simultaneous change in spin direction in cordage, during which s-spin occurs more frequently on late Holocene fine cordage than previous periods (although z-spun cordage still dominates the assemblage). These stylistic shifts in basketry and cordage may reflect a population shift at the start of the late Holocene, as suggested by Aikens (1994, 1998; Aikens and Witherspoon 1986) and Thomas (1994) for the spread of Numic-speaking peoples, or other population movements, which will be discussed in greater detail in Chapter 5. Finally, it should also be noted that the decline in coarse, generalized-function cordage in the late Holocene occurs alongside an increase in faunal cordage in components 3 (James Creek Phase) and 2 (Maggie Creek Phase), the latter with no known gender association. This increase in faunal cordage may also be a reflection of gender division of hide-working: potentially, processing animal skins for rabbit-skin blankets was a feminine task, leading to a general exclusion of masculine spin direction on faunal materials as animal-processing was emphasized.

Discussion

The above analysis provides insights into the three broad research questions concerning perishable artifacts at Bonneville Estates Rockshelter, and in the Great Basin region in general.

What are the timing and nature of changes in technological organization of perishable artifacts at Bonneville Estates Rockshelter?

Changes in technological organization at Bonneville Estates Rockshelter are broadly associated with climatic phases. In the late Pleistocene/early Holocene, there are unique perishable objects like knotted feathers and a possible snare, but otherwise, the earliest assemblage of perishable artifacts does not differ significantly from those in the middle Holocene, except in its small sample of artifacts and lack of basketry. In Component 7 (Dry Gulch Phase), cordage was predominantly tightly twisted, z-spun, and on fine plant material, with a mix of generalized and specialized cordage inferred.

During the middle Holocene (components 5 and 4), cordage continued to have been predominantly tightly twisted, z-spun, and on fine plant material, like during the late Pleistocene, inferring a continuation of the pattern of production and use of a mix of generalized and specialized cordage. The most diverse and extensive period of perishable manufacture and use is the middle Holocene, particularly during Component 5 (Pie Creek Phase), a period during which cordage represent diverse activities including specialized small-game hunting with fine cordage, as well as generalized cordage tasks with coarse cordage, and coiled basketry was used for water-handling and plant-food parching.

The most significant changes in perishable technology occur at the beginning of the late Holocene in both cordage and basketry. Specifically, as coarse raw materials used for making generalized cordage became less prevalent in Component 3 (James Creek Phase) and Component 2 (Maggie Creek Phase), spin direction shifted to a majority of z-spun cordage on fine materials in these components rather than other spin directions on coarse and fine plant material. Basketry work direction shifted to a majority right-to-left work direction starting in Component 3, and foundation construction shifted to more half-rod baskets with bundles starting in Component 3 than were present in earlier components 5 (Pie Creek Phase) and 4 (South Fork Phase). The apparent significance of the increase in proportion of s-spin cordage in Component 2 is noteworthy when material type is considered, because there is no spun coarse material in this period, and none of the faunal cordage is z-spun. The proportion of s-spin on coarse cordage shifts throughout the Holocene, but z-spin cordage consistently is primarily found on fine material, regardless of time period. There are no significant differences in basketry from components 3 and 2, but there are no baskets with left-to-right work direction in Component 2, which are present in a small proportion in Component 3. Although sample size is small especially in regards to basketry in Component 1, there is a perceived increase in size of the basketry foundation likely resulting from foundation changes throughout the Holocene. These changes, however, do not appear to be associated with specific environmental events, but instead represent gradual change.

What can perishable artifacts tell us about seasonality of site occupation, use, and artifact manufacture?

Perishable artifacts and waste material suggest predominantly summer or fall manufacture of tools at the rockshelter. As discussed in Chapter 2, Figure 2.5 illustrates the modern growing conditions according to elevation of plants in the Bonneville Basin as a means of showing the potential required seasonal mobility of humans to access the plant material selected for the construction of cordage, and this model may be applied to the Bonneville Estates Rockshelter artifact assemblage. As discussed, the figure is an illustration of established vegetative zones (Grayson 2011; Louderback 2007; Lull and Edison 1950; Rhode 2002; Schultz and Schultz

1984; Schultz et al. 2002), a representative landscape of modern conditions where all vegetative zones are present (e.g. the nearby Deep Creek Range). Importantly, however, the elevation ranges of these vegetative zones shifted over time because of periods of wet and dry conditions and changes in seasonal precipitation patterns. At Bonneville Estates, the wetland plants present in the waste-material assemblage indicate people likely utilized the marshland nearest the site (8 km), Blue Lake Marsh. The presence of sagebrush (*Artemisia* sp.), juniper (*Juniperus* sp.), dogbane (*Apocynum* sp.), and milkweed (*Asclepias* sp.) indicates people traveled to midland elevations of the sagebrush and mountain brush/pinyon-juniper zones, and the presence of prairie flax (*Linum lewisii*) indicates people traveled to the aspen-fir zone. The increase in marshland plant waste during the middle Holocene supports the palynological record at Blue Lake suggesting increased moisture and an expanding marsh after 7,000 cal BP, and it could also indicate a lifeway reliant on marsh resources.

Netting and evidence of small-game trapping with snares is represented throughout the assemblage, supporting other evidence of an emphasis on small-game hunting at Bonneville Estates Rockshelter and other Great Basin sites (Hockett 2007, 2015; Hockett et al. 2017). Ethnographic accounts indicate communal jackrabbit and sage-grouse net-hunting occurred either in the spring or fall, and was generally a social event (Kelly 1932; Powell 1875; Simpson 1869; Smith 1974; Steward 1938). The presence of small-game trapping implements, such as snares, also suggests the site was associated with solitary hunting strategies common in other hunter-gatherer groups outside the Great Basin, in which small-game traps were set passively while pursuing large game or completing other time- or labor-intensive activities (Hurcombe 2014; Lupo and Schmitt 2002, 2005). Additionally, although I assume that men were associated not only with the manufacture of nets (Adovasio 1986; Kelly 1932; Malouf 1940) but also other small-game-hunting supplies as in the ethnographic record, this does not preclude the use of these items by all genders and all ages at all times of the year (Smith 1974). Additionally, women may have processed fibers, while men converted cordage into specialized tools (Kelly 1932). Burned baskets may indicate seed processing in the late summer/early fall, and the few unburned baskets in the Bonneville Estates assemblage could have been used for carrying, gathering grass seeds and grasshoppers in the fall, further processing seeds, roots, and bones through stone-boiling during all times of the year, and possibly even fermenting drinks (Anderson 2005; Dick-Bissonnette 1999; Fowler 1990; Powell 1875).

While completed cordage and basketry could have been used year-round for a variety of tasks, manufacturing debris of cordage does indicate seasonality. Dried stalks of dogbane (*Apocynum* sp.), for instance, would have been gathered in the fall or winter, and they were immediately processed by either soaking and scraping off the bark, or cracking and scraping the bark after drying (Anderson 2005; Rhode 2002; Smith 1974; Turner 1998; Wheat 1967). Similarly, milkweed (*Asclepias* sp.) was processed in the fall, briefly dipped in water, and rolled (Rhode 2002; Turner 1998; Zigmond 1981). The presence of dogbane and milkweed manufacturing debris at Bonneville Estates Rockshelter in all components except for Component 4, therefore, suggests fall or winter cordage manufacture at the site. Loosely coiled sagebrush and juniper fibers in components 3 and 1 indicate coarse-material manufacture, although ethnographic and ethnohistoric records provide no evidence of seasonality of this activity. Tule bulrush (*Schoenoplectus* sp.) debris is found in every component; however, although this was a common manufacturing material for perishable artifacts ethnographically, there are no perishable artifacts made from this plant deposited at Bonneville Estates Rockshelter. This wetland resource was used historically around Stillwater Marsh, Ruby Valley, and the Sevier River to make small boats (or balsas), lashed together with dogbane cordage for communally hunting ducks and driving mud hens in late summer and fall, as well as footwear (Fowler 1990; Lowie 1924; Stewart 1942). In the Pacific Northwest, tule bulrush stems were harvested in the late summer or early fall when they were easier to separate from their rhizomes, and processed simply through drying (Turner 1998), whereas in the western Great Basin, they were harvested and used while still green for some tools, and dried in the summer for other purposes (Fowler 1990). The bulrush stems at Bonneville Estates may be debris from making these objects, or are debris from some other unknown activity. The presence of cane stalks may indicate arrow shaft manufacture, but in western Nevada, insects associated with these plants were used as a sweetener for cooked cattails (Fowler 1990), so cane may have had multiple applications in this part of the Great Basin.

Are observed changes in perishable material culture at Bonneville Estates Rockshelter correlated with paleoecological change and adaptation, or are they the result of social change? To reiterate, some of the changes in cordage and coiled basketry manufacture at the rockshelter do occur alongside major climatic and environment changes, although changes in twist direction and basketry are gradual between components. Occupation intensity appears to have increased in the early-middle Holocene at Bonneville Estates (after 7,500 cal BP) and other rockshelters in the eastern Great Basin, contrary to other regions of the Great Basin. According to this analysis, however, site function does not appear to have varied drastically in the middle and late Holocene, as baskets were likely used for seed processing throughout the record. There may have been a growing importance of impermeable baskets in the late Holocene beginning in Component 3, as suggested by the increased inclusion of bundles in basketry, although this foundation type was also used, but in smaller numbers, in the middle Holocene (components 4 and 5). This change in foundation emphasis could also indicate a shift in processing seeds, roots, or other foods. The presence of similar types of cordage throughout the Holocene reinforces the conclusion that the function of Bonneville Estates Rockshelter as a small-game-hunting/plant-gathering location changed little during the Holocene; although in the middle Holocene, small-game hunting may not have been the primary focus because there is a greater proportion of coarse cordage, but small-game hunting was still practiced. Faunal evidence of artiodactyl, rabbit, and hare hunting throughout the Holocene (Hockett 2015), and gathering of wild seeds including pickleweed, saltbush, and ricegrass, as well as cacti (Rhode and Louderback 2007), all indicate consistent subsistence activities in this mid-elevation site.

The decline of sagebrush and juniper artifacts after the middle Holocene likely does not reflect changing climatic conditions, as the palynological record of Blue Lake Marsh actually shows an *increase* in juniper and sagebrush after 4,400 cal BP, during the late Holocene (Louderback and Rhode 2009), suggesting more such plants growing in the vicinity of Bonneville Estates. Instead, the decline in juniper and sagebrush cordage may represent a change in the material used by the site's occupants, being correlated with the increased use of faunal cordage, or simply a decline in the need for generalized cordage.

Importantly, some of the greatest changes I observed throughout the Holocene are attributes not associated with technological functionality, but rather changes in the construction phase of *chaîne opératoire*: initial spin direction of cordage and work direction of basketry. Basketry is generally associated with feminine tasks, and change in work direction may indicate broad modifications in learning networks in the late Holocene, for example, new marriage practices or influence of people outside of the western Bonneville Basin. In addition, the innovation of three-rod basketry without bundles in the late Holocene, appearing for the first time in Component 3 (James Creek), which had no clear functional advantage (and whose function is not discussed in archaeological or ethnographic literature), is an interesting stylistic change. The manifestations of social organization in material culture are much more complex than changes in ethnicity, the latter a strong focus of basketry studies.

There are two periods which have unique cultural elements. In Component 5, these include dyed basketry and twined basketry with decorative stitches, as well as a beaded cord, an elaborate 10-ply cord, and a dew-claw rattle, all of which indicate diverse cultural elements not simply associated with subsistence strategies in the middle Holocene/early Archaic cultural periods. The other period which demonstrates a potential cultural shift is Component 3, with the appearance of three-rod basketry and shifts in work direction, as well as other decorative cultural materials associated with cordage, like beads and beaded cordage. Component 2 (Maggie Creek Phase) may relate to nearby Fremont occupations in the southern Bonneville basin. The perishable artifact assemblage during this period, however, does not provide evidence of a cultural shift following Component 3, as would be expected with a new Fremont occupation. The abalone pendant (an indirect evidence of cordage) from Component 1 (Eagle Rock Phase) indicates trade with people outside of the Great Basin, and it is similar to an abalone bead found by Steward (1937) at Promontory Cave, as well as similar marine shell found at Fremont sites including Round Spring and Evans Mound (Bennyhoff and Hughes 2011; Janetski 2002). At 800-400 cal BP, the earliest occupations represented by Component 1 may still fall within the Fremont period, although recent studies point to Fremont culture dating to between 2,000-700 cal BP (Janetski and Talbot 2014; Talbot 2018). The presence of exotic materials provides some evidence of a dynamic social environment in the Bonneville Basin. The majority of Component 1, however, is potentially associated with the hypothesized late Numic expansion ~1,000 cal BP (as introduced in Chapter 2 and discussed more fully in Chapter 5), but the basketry and cordage from this component do not indicate a strong cultural shift: z-spun fine cordage is consistently associated with specialized small-game hunting as in previous periods, and foundation types and work directions are similar to the rest of the late Holocene components. Thus, any potential reorganization of perishable crafts at Bonneville Estates occurred at the beginning of the late Holocene, around 4,400 cal BP, rather than more recently. It should be reiterated, though, that the sample size of the Component 1 assemblage is quite low in comparison to other components; a larger collection of late Holocene materials may have provided a better test of cultural variability in the Bonneville Basin in the last millennium.

Conclusion

The long occupation of Bonneville Estates Rockshelter provides a rare opportunity to study diachronic change in perishable technology from the late Pleistocene/early Holocene through the late Holocene. The preservation of technologically-complex perishable artifacts provides an invaluable dataset for tracing technological, functional, and stylistic changes across millennia, and interpreting these in the contexts of ecology, demographics, and social interaction. Applying a *chaîne opératoire* approach to understanding cordage and basketry manufacture has resulted in a complex site characterization as a location of some cordage manufacture, particularly from wetland resources and fine plant fibers, but with no evidence of initial basketry manufacture. The presence of heavily-used and fragmentary baskets with evidence of repair instead associate Bonneville Estates Rockshelter with later stages of the operational sequence: use and repair. This may reflect mobility and subsistence pursuits of the rockshelter’s occupants, and it further contributes to a detailed characterization of site function. Likely, manufacture of cordage at the rockshelter occurred during the summer or fall, and netting indicates there was also spring or fall communal hunting. Wetland plants represented in the perishable assemblage indicate people regularly visited nearby marshlands, while juniper, sagebrush, dogbane, and milkweed indicate they also traveled to mid- to upper-elevation vegetation zones including the sagebrush/pinyon-juniper zone and upland aspen-fir zone. Also, social organization was certainly a considerable contributor to variation seen in perishable artifacts throughout the rockshelter's long sequence of occupations, as variation in technological-stylistic traits not attributable to intended functions of artifacts like spin direction and work direction of cordage and basketry, respectively, show clear variation throughout the Holocene. The spin direction of artifacts associated with specialized tools for small-game hunting reveals little reorganization over time in z-spun fine cordage (although there in an increase in s-spin on fine cordage in the middle Holocene), while greater variation is seen among cordage used for generalized tasks and basketry manufacture. This study posits that these changes in stylistic traits may indicate a consistency in masculine cordage manufacturing behavior since the early-mid Holocene, and a reorganization of feminine generalized tasks in the late Holocene, beginning in Component 3, around 4,000 cal BP.

Consideration of the technological organization of perishable artifacts, along with the application of statistical analyses to cordage and basketry analysis, allows for a more thorough characterization of the social and environmental contexts of artifact manufacture. Although small sample sizes have long hindered perishable artifact analyses, demonstrating that statistics can still be applied with some success to an assemblage of cordage is important. Comparing stylistic and technological/functional traits can also allow Great Basin perishable-artifact analysis to move away from cultural-historical interpretations of observed changes, and instead attempt to characterize human interactions with the environment in terms other than the broadest ecological interpretations or the broadest scope of human groupings, ethnicity. It has been demonstrated that it may be possible to characterize more subtle interactions, such as gender variation, by comparing a combination of elements. Additionally, it is important to incorporate ethnography, ethnohistory, and traditional knowledge into studies of this complex material class. Furthermore, it should be emphasized that perishable artifacts as a broad material class cannot simply be characterized as representing “women’s work,” because the manufacture of specific artifacts often involved men and mixed gender groups. Incorporating these types of data when characterizing site activities further confirms the complexity of community interactions and the overlapping role of gender in Great Basin subsistence strategies.

The Bonneville Estates Rockshelter perishable assemblage has provided a strong illustration of diachronic tradition as well as change in the region. In the next chapter, I present a synchronic examination of cordage and coiled basketry from a series of rockshelter and cave sites in the Bonneville Basin dating to the late Holocene. Comparing diachronic and synchronic variability may address similar subjects of site function, mobility, and seasonality, but is also a way of characterizing the regional community of hunter-gatherer groups in the Bonneville Basin, and how this community directed shared craft traditions.

CHAPTER 4

LATE HOLOCENE CORDAGE AND COILED BASKETRY IN BONNEVILLE BASIN CAVES AND ROCKSHELTERS

Introduction

In this chapter, I present my study of curated cordage and coiled basketry from ten late Holocene dry caves and rockshelters in the Bonneville Basin, a period associated with the potential expansion of human occupations in the Bonneville Basin and the proposed development of distinct eastern Great Basin societies. This regional, synchronic analysis accompanies the diachronic study presented in Chapter 3 of cordage and coiled basketry from Bonneville Estates Rockshelter spanning from the Paleoindian to late prehistoric eras. I continue to apply a behavioral approach with analytical methods focusing on reconstructing technological organization and the *chaîne opératoire* of cordage and basketry use-life to explain variation between sites. As in Chapter 3, I apply simple statistics to characterize patterns of variation in Bonneville Basin sites. In this analysis, I treat late Holocene strata at sites as a single chronological unit. This approach, although it limits a characterization of fine temporal patterns, circumvents the issues of dating, provenience, and small sample sizes that have long plagued researchers of curated perishable artifacts in the Great Basin. This study also adds further support for the value of reanalyzing curated museum collections (Knoll 2011; Leach 2018; Nielsen-Grimm 2011; Sager 2011).

I compare these assemblages with the intention of characterizing variability across a contemporaneous culturally-shared region. Through this analysis, I demonstrate that some functional aspects of cordage and basketry, like final form and use wear, are indicative of the artifacts' intended role in food procurement and processing; however, other technological-stylistic traits like spin direction and work direction imply a social connection between sites which cannot be explained using functional interpretation. This incongruity of site similarity based on stages of perishable artifact manufacture may be evidence of a divergence of masculine and feminine craft traditions on a regional scale, which is further explored in Chapter 5.

Early Bonneville Basin Archaeological Surveys

Archaeological sites were described in Utah for hundreds of years by Euro-American explorers, geologists, and Mormon pioneers (Fremont 1845; Palmer 1876; Stansbury 1852), most notably Fremont "mound" sites and architectural features on the Colorado Plateau, as well as rock-art sites at Nine Mile Canyon, among others. These village sites were seen as peripheral to more well-known archaeological sites in the American Southwest (Gunnerson 1959; Osborne 1941), and they became the focus of museum collectors from the Smithsonian Institution, Harvard University Peabody Museum (Palmer 1876), and University of Utah (Montgomery 1894). Many other Fremont sites were destroyed in the nineteenth and early twentieth centuries because of their proximity to prime farmland and easy accessibility (Fowler 1980; Judd 1917; Morss 1931).

Other parts of Utah, however, remained archaeologically unexplored, particularly the Great Salt Lake Desert, and while Robert Heizer noted approximately ten cave and rockshelter sites in the Wendover area of the Bonneville Basin in the 1930s, these sites were not well documented or systematically excavated (Rudy 1953; Taylor 1939). Some of the first systematic excavations in the Great Salt Lake area were completed by the head of the University of Utah Anthropology Department, Julian Steward (1937), in the Promontory Point and Black Rock areas of the Great Salt Lake, followed by Enger (1942) and Smith (1950). Similarly, researchers from the University of Utah reported small rockshelter and cave sites in the Great Salt Lake Desert region (Malouf et al. 1940; Smith 1941), and this catalog grew after the establishment of Jennings' Statewide Archaeological Survey at the University of Utah in 1949, which prioritized the Wendover area (Gunnerson 1959; Janetski 1997). As part of this program, Rudy (1953) also led a large survey around Wendover, locating additional sites, and he attempted to synthesize work completed by Heizer in the 1930s to varying success. Not all sites identified by Heizer were relocated by the Statewide Archaeological Survey, and as a result, many artifacts Heizer collected have no provenience information. Most of the material collected by these early archaeological investigations are currently managed by the University of Utah Natural History Museum. Despite this flurry of early Bonneville Basin archaeology and the influences of these excavations on archaeologists' interpretations of chronology and prehistoric lifeways in the eastern Great Basin, many of these collections have not been re-analyzed since they were excavated.

Archaeological Assemblages Used in This Study

I selected sites based on the following criteria: 1) the preservation of cordage and coiled basketry; 2) the presence of documentation of the archaeological sites' geographic location as being within or nearby the Bonneville Basin; 3) an approximated late Holocene age of the artifacts; and 4) cave and rockshelter sites rather than village sites. These sites include the Nevada sites of Bonneville Estates Rockshelter (as discussed in Chapter 3) and Four Siblings Rockshelters, and the Utah sites of Danger Cave, Hogup Cave, Swallow Shelter, Juke Box Cave, Crab Cave, Thermal Point, Tube Cave, and Remnant Cave (Figure 4.1, Table 4.1, Appendix F). Because cordage from Danger Cave and Hogup Cave were unavailable due to ongoing analyses by other researchers, all cordage data from these sites reported here are from published

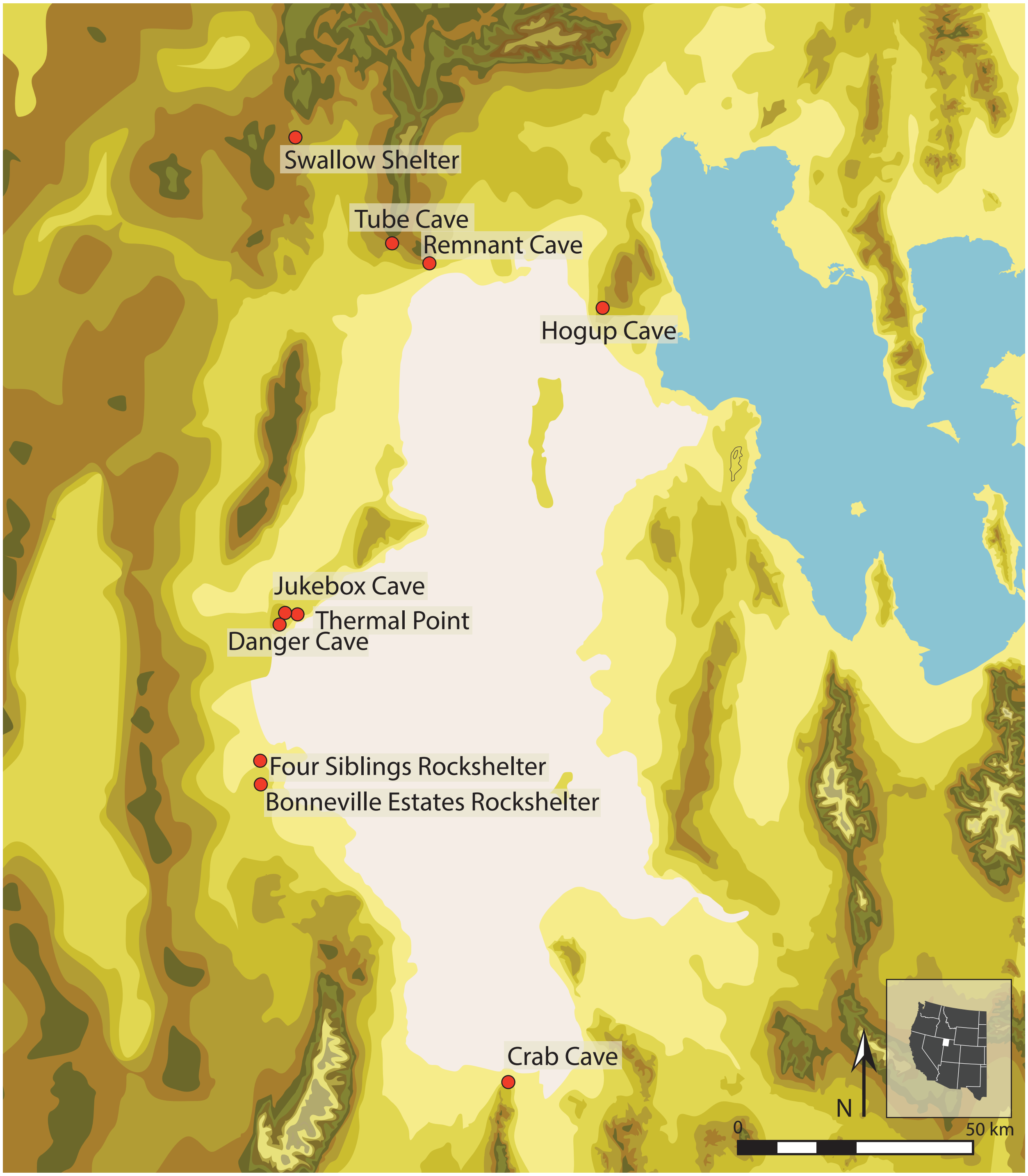

Figure 4.1. Cordage and coiled basketry assemblages used in the analysis.

monographs (Aikens 1970; Jennings 1957). Additionally, one assemblage from the sites at Promontory Point was excluded from this study due to another ongoing analysis (Goldberg 2018; Ives et al. 2014). Although some sites I analyzed have in the past been assigned to "Archaic" and "Fremont" occupations, I have intentionally conflated these potential ethnic variations in this study, as there continues to be debate on defining the relationship of these archaeologically-determined groups within sites primarily associated with mobile hunter-gatherers (Adovasio et al. 2002; Fowler 2002). A brief description of each site follows.

Table 4.1. Assemblages Used in this Study.

Site	Age Range (cal BP)	Number of ^{14}C Dates	Cordage	Basketry
Bonneville Estates Rockshelter	4,094-3,889 to 518-424	18	61	23
Four Siblings Rockshelter	2,285-1,950 to 305-70	5	20	0
Swallow Shelter	3,228-2,760 to 1,279-898	3	27	16
Remnant Cave	2,711-2,352 to 527-416	3	25	4
Juke Box Cave	Middle/Late Archaic	0	53	8
Tube Cave	Middle/Late Archaic	0	7	1
Crab Cave	5,479-4,789 to 2,324-1,694	2	5	1
Thermal Point	Middle/Late Archaic	0	13	8
Hogup Cave	5,058-4,956 to 572-422	20	145[a]	29
Danger Cave	5,302-3,693 to 2,434-1,327	2	183[b]	36

Note. See Appendix F for the full table of radiocarbon dates, provenience, and sources.
[a] Not analyzed. All cordage data from Aikens (1970); [b] Not analyzed. Cordage data from Jennings (1957) used in this analysis.

Bonneville Estates Rockshelter (CRNV-11-4893). This site is located about 50 km south of West Wendover, Nevada, and it was first discovered by Steve Dondero and Tim Murphy of the Elko Field Office of the U.S. Department of the Interior Bureau of Land Management (BLM) in 1986. At the time, it had been heavily looted (Graf 2007). Alan Schroedl and P-III Associates conducted preliminary testing in 1988; Ted Goebel, Kelly Graf, Bryan Hockett, David Rhode and others then conducted full-scale excavations from 2000-2009. Bonneville Estates is a large, south-facing rockshelter at an elevation of 1,580 m asl on the Bonneville high shoreline, overlooking the Great Salt Lake Desert and the Lead Mine Hills of eastern Nevada. Excavations focused on the eastern and western areas within the rockshelter, with a trench connecting the two blocks (Graf 2007). There is a series of well-dated occupations spanning about 13,000 calendar years, represented by 168 radiocarbon dates recovered from hearth charcoal, bones, and organic artifacts (Figure 4.2, Table 4.1, Appendix F). In addition to diagnostic stone tools, the assemblage includes well-preserved organic materials, floral and faunal remains, and a large collection of artifacts made from plant and animal materials from throughout the late Pleistocene and Holocene (Goebel 2007; Goebel et al. 2011, 2018, 2020; Hockett 2007; Jolie 2002; Rhode and Louderback 2007). The occupational periods have been delineated according to a series of cultural components, as discussed in Chapter 3. The components used in this analysis are components 3, 2, and 1, which elsewhere have been assigned to the Middle Archaic James Creek Phase (4,100-1,500 cal BP), Maggie Creek Phase (1,500-800 cal BP), and Late Prehistoric Eagle Rock Phase (800-400 cal BP), respectively (Figures 3.5 — 3.8, 4.2; Hockett 2015).

Four Siblings Rockshelter (CRNV-11-7736). This site is located in the Lead Mine Hills of eastern Nevada about 5 km east of Bonneville Estates Rockshelter, and around 45 km from West Wendover, Nevada. It is associated with the Provo shoreline complex at 1,463 m asl (Graf et al. 2006). First discovered in the mid-1990s by BLM archaeologists Tim Murphy and Bryan Hockett, the site consists of four small caves. In 2005, two of the shelters (Little Sister East Shelter and Big Brother West Shelter) were test excavated by Ted Goebel, Kelly Graf, Lisbeth Louderback, Bryan Hockett, and Sergei Vasil'ev to determine the degree of previous looting

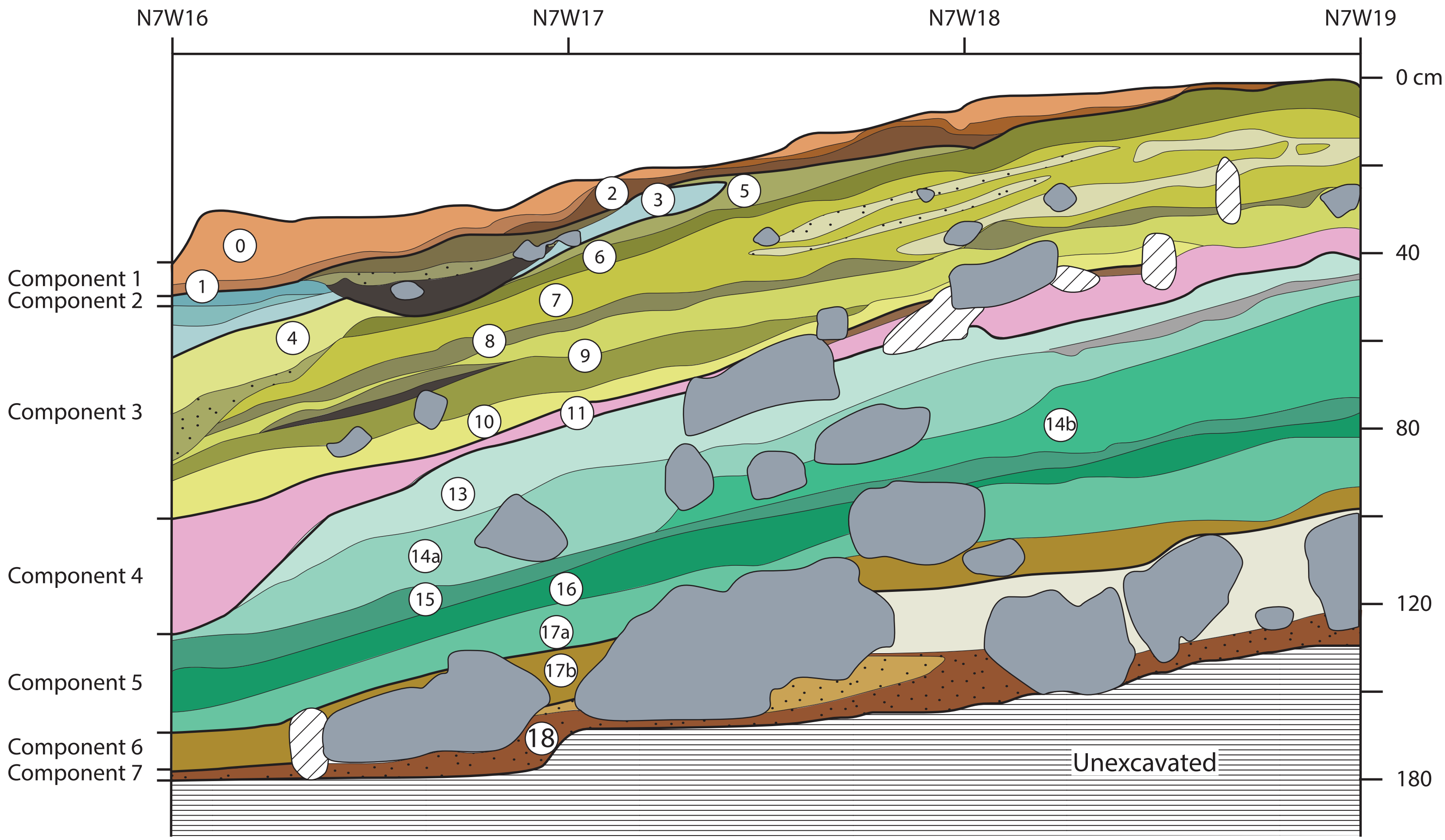

Figure 4.2. Bonneville Estates Rockshelter profile, west block, south wall (adapted from Graf 2007).

damage and to explore the shelters' cultural stratigraphy (Graf et al. 2006). Two 1-x-2-m test pits revealed deep deposits dating from the early middle Holocene through Historic periods. Little Sister East Shelter (LSER) has the oldest deposits, spanning 11,500 calendar years, although the oldest cultural layers date to around 5,000 cal BP. Big Brother West Shelter (BBWR) spanned from 7,000 cal BP to late prehistoric times. The assemblage at both shelters includes lithic materials, bones, and artifacts made from plant and animal remains; the perishable artifacts were the subject of an earlier preliminary study (Coe 2012). The stratigraphic units used in this analysis are materials from strata 4-1 at LSER and material from strata 2-1 at BBWR. These strata date to throughout the late Holocene, from 2,300-100 cal BP (Figures 4.3, 4.4).

Danger Cave (42TO13). This site is located about 1.5 km northeast of Wendover, UT, at an elevation of 1,318 m asl, and faces the Great Salt Lake Desert with a southeastern opening. It is situated alongside a small marsh at the Gilbert Shoreline. Danger Cave was first recorded and excavated in 1937 by Robert Heizer, and it was variably called U-145 (sometimes U-144), "site #4", Lamus Cave, Hands and Knees Cave, and On Your Knees Cave (Rudy 1953; Taylor 1939). There was a short excavation in 1939 by Elmer Smith and colleagues, with excavators recording features and collecting pottery, stone tools, bones, seeds, and baskets (Taylor 1939). Following additional excavations by Smith in 1941, it gained the name Danger Cave after a rockfall during excavation (Jennings 1957). The site was subject to vandalism and pot-hunting in the 1940s (Jennings 1957; Rudy 1981), and was then the focus of major excavations led by Jesse Jennings from 1949-1953 as part of the Statewide Survey project by the University of Utah. Site interpretations were updated during the later Hogup Cave excavations (Aikens 1970), and in 1968, Gary Fry (1976) revisited the site. Finally, in 1986 and 1998 David Madsen and David Rhode (Madsen and Rhode 1990; Rhode and Madsen 1998) exposed the deepest cultural

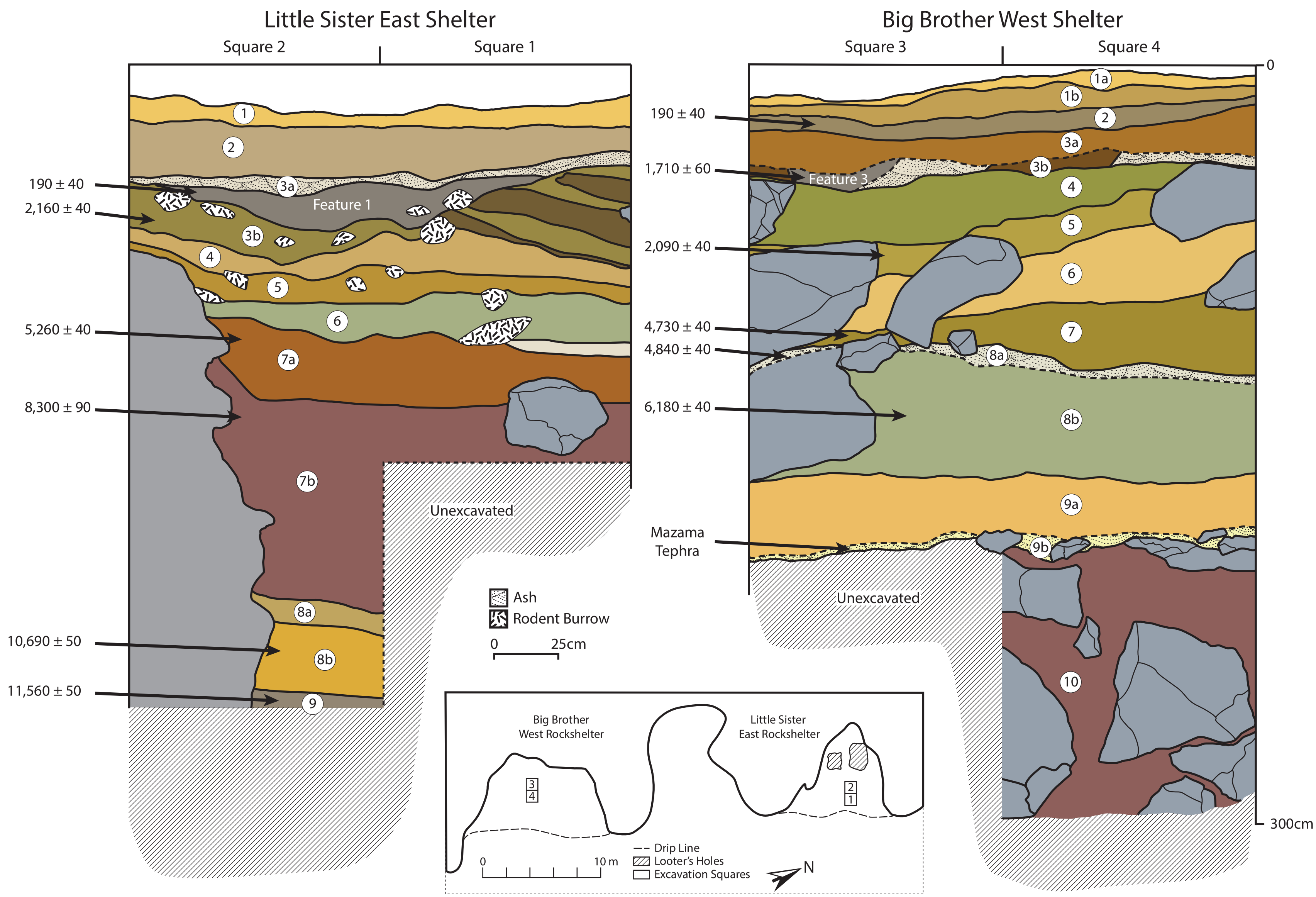

Figure 4.3. Four Siblings Rockshelters profiles (adapted from Graf et al. 2006).

Figure 4.4. Sample of Four Siblings Rockshelter artifacts (a: 7736W-10; b: 7736E-277; c: 7736E-67; d: 7736E-96.2; e: 7736W-95; f: 7736E-143; g: 7736E-96.1; h: 7736W- 32; i: 7736E-223; j: 7736E-70; k: 7736E-127).

deposits near the mouth of the cave, collecting new samples for accelerator radiocarbon dating. Jennings' Danger Cave excavations were instrumental in establishing the feature method of excavating Great Basin caves and rockshelters, in which each stratigraphic change identified in the field is given a feature number, and artifacts and field specimens collected are numbered according to grid location and stratigraphic feature (Coulam 1988). Jennings also was among the first to use radiocarbon dating to establish chronology at an archaeological site, and based largely on these excavations, he established the Desert Culture concept. In the more recent excavation, Jennings' five depositional units, identified as DI-DV, were difficult to replicate because of lateral variation in cultural and natural deposits, so recent studies have specified cultural component rather than stratigraphic associations of features and artifacts (Madsen and Rhode 1990). There are more than 47 radiocarbon dates, primarily from the lowest levels at Danger Cave (Fry 1976; Goebel et al. 2007; Harper and Alder 1972; Jennings 1957; Madsen and Rhode 1990; Mullen 1997; Rhode et al. 2006; Tamers et al. 1964), but there are only two dates from the period of focus in this study (Jennings 1957). Human activity at the site began around 12,100 cal BP. Danger Cave's artifact assemblage includes thousands of lithic artifacts, culturally modified bones, as well as perishable artifacts (Rudy 1957). I focus on occupation period DV, which dates broadly to the late Holocene, and includes artifacts from the Jennings excavations (Figures 4.5, 4.6).

Hogup Cave (42BO36). This site is located about 120 km northwest of Salt Lake City, east of the Great Salt Lake Desert, in the Hogup Mountains, Utah. The site faces south, and is situated between the Provo and Stansbury shorelines, at around 1,432 m asl (Aikens 1970). Prior to major excavation, there had been extensive looting in the outer chamber of the cave, and these areas were isolated during the primary systematic excavations led by C. Melvin Aikens and

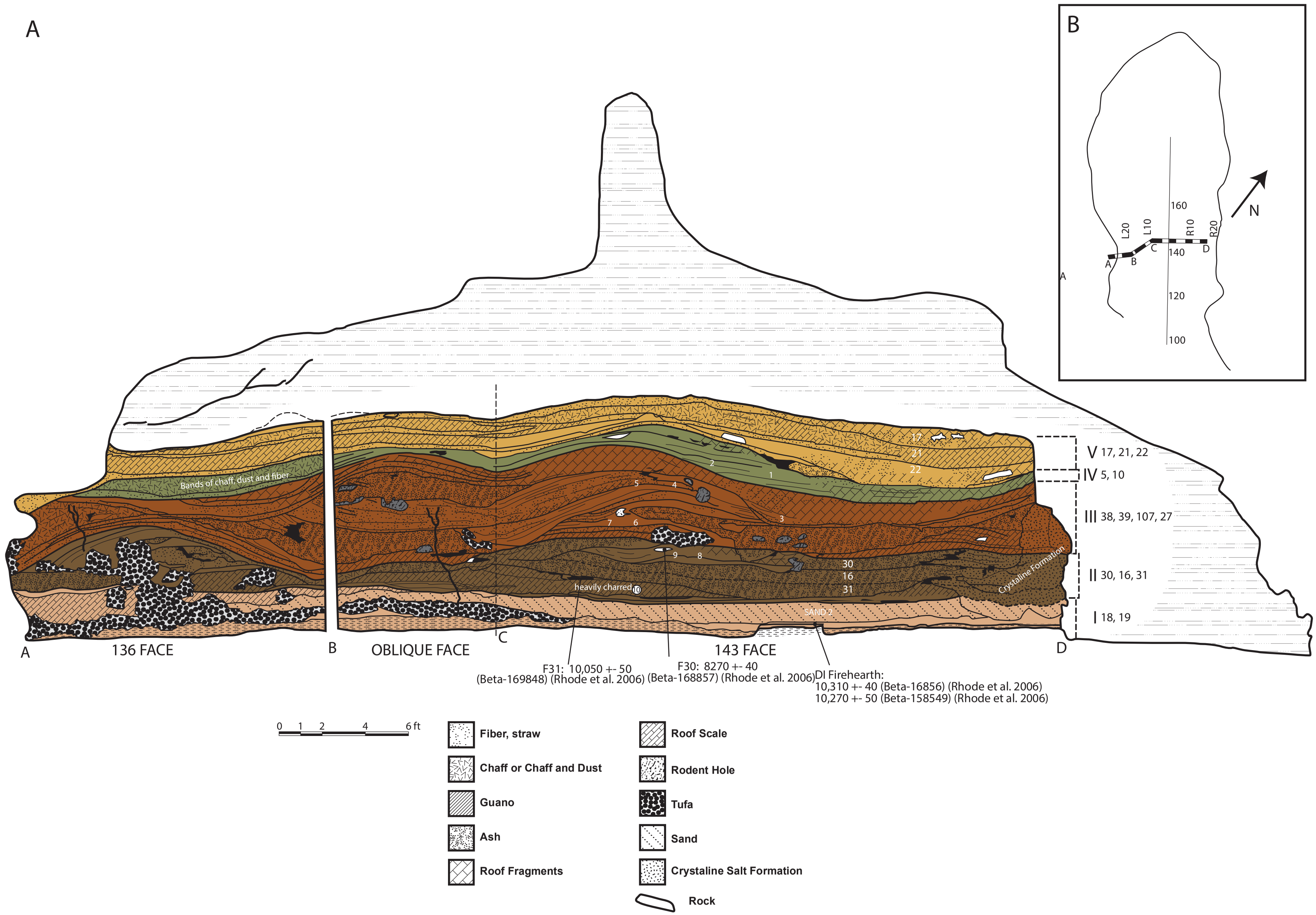

Figure 4.5. Danger Cave profile (a) and plan view (b) (adapted from Jennings 1957).

Figure 4.6. Sample of Danger Cave coiled basketry (a: 2296; b: 23108; c: 22949-1; d: AR59043; e: 22811-220; f: 22996; g: AR59037; i: 22995-3; j: 23011-1; k: 23334-3).

colleagues in 1967 and 1968. They focused on the two chambers of the cave (inner and outer), and 75% of the outer chamber was excavated to bedrock, with a 5-foot trench being excavated to connect the chambers (Aikens 1970). Aikens identified 16 stratigraphic units, and archaeological materials included thousands of lithic, bone, shell, feathers, leather, and perishable artifacts, as well as a large paleontological collection, plant macrofossils, and human coprolites, which have since been extensively studied (Adovasio 1970; Byers and Hill 2009; Fry 1970; Hockett 1994). The 32 radiocarbon dates providing chronological control indicate a long occupation of the site from around 8,400 to 150 cal BP (Byers and Hill 2009; Martin et al. 2017). The extensive occupation, established chronology, and wide array of artifacts from Hogup Cave have positioned this site as an invaluable resource in tracking human adaptations to climate and environmental change throughout time in the Great Basin. Martin and colleagues (2017) recently provided new dates for cave materials and identified potential mixing in the back of the cave; as a result, they suggest that the original identification of stratum 8 in the north part of the cave is problematic because early excavators may have misidentified stratum 6 as stratum 8. Basket FS649.42 was found in this potentially problematic section of the cave, so future dating may reveal the correct context for this artifact. Even with additional dating, stratum 8 has a long age range (5,840-3,330 cal BP), according to Martin and colleagues' (2017) Bayesian model of all radiocarbon dates from the site. For this project, rather than focusing on cultural periods, I selected strata attributed to the late Holocene, which are strata 8-16, with stratum 8 included, because its broad age range overlaps with the beginning of the late Holocene (Martin et al. 2017) (Figures 4.7, 4.8). In future studies, directly dating of baskets from stratum 8 would clarify whether they are accurately assigned to the late Holocene.

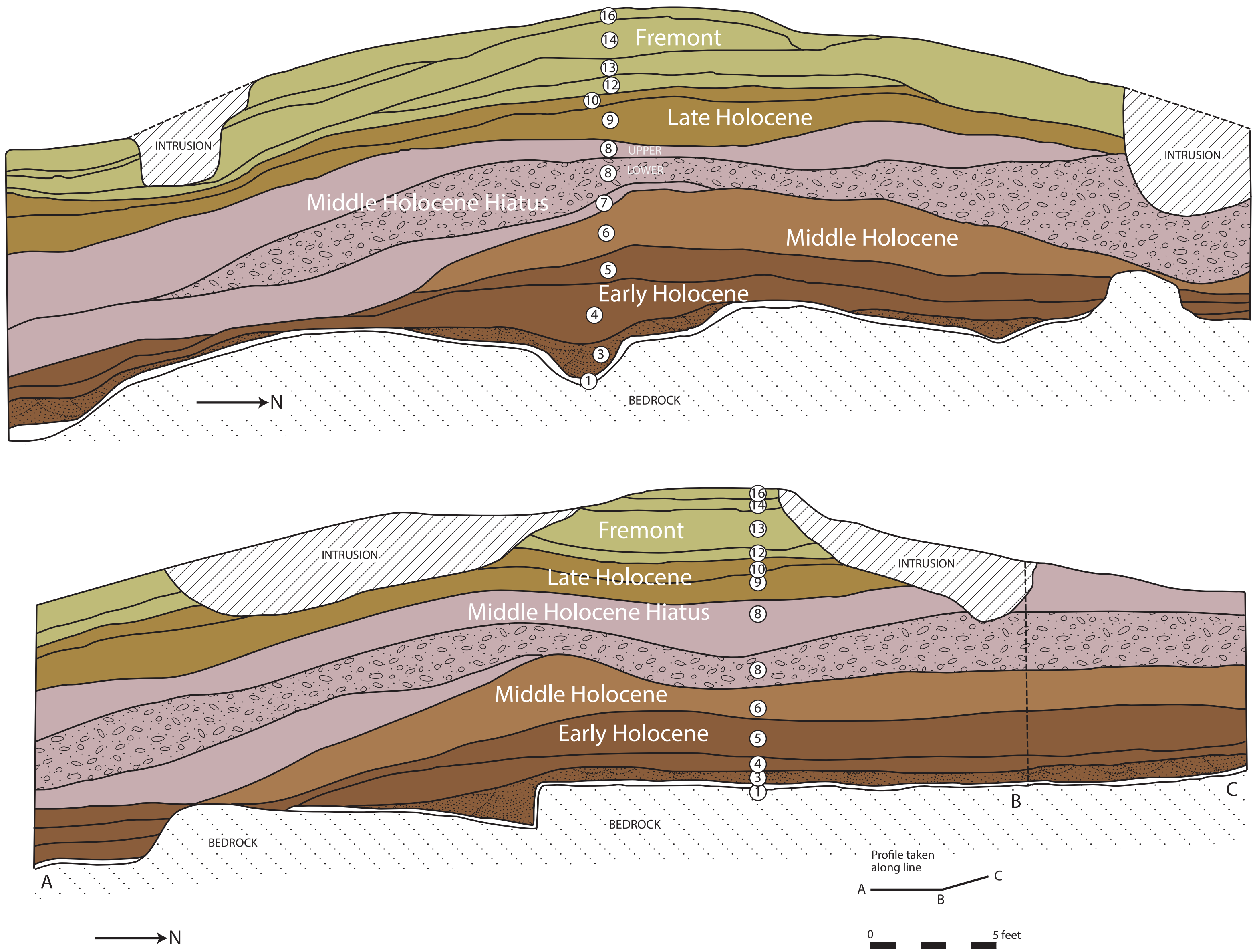

Figure 4.7. Hogup Cave profiles (adapted from Aikens 1967 and Martin et al. 2017).

Figure 4.8. Sample of coiled basketry from Hogup Cave (a: 60.1; b: 233-215; c: 47-10; d: 47-13; e: 107-47; f: 649-42; g: 116- 27; h: 47-54; i: 669-198; j: 420-2; k: 420-1; l: 245-112; m: 131- 75; n: 435-411; o: 669-42; p: 48-619; q: 416-223; r: 62-6; s: 669-350; t: 241-126).

Swallow Shelter (42BO268). This site is located in northwestern Utah in the Goose Creek Mountains about 10 km northwest of Etna, Utah, near the Nevada state line. Swallow Shelter was discovered as part of regional exploration of sites in northwestern Utah and northeastern Nevada by the University of Utah Department of Anthropology between 1969-1971 (Dalley and Berry 1977). At the time of excavation, the site was untouched by looter activity, but the excavators did note some previous undocumented systematic excavations (Dalley and Berry 1977). The site rises about 30 m above the South Fork valley floor, about 1,768 m asl. There are many small springs in close proximity of the shelter. It is a large shelter that faces south, around 46 m at its mouth. A 5-x-5-foot test pit was expanded into a 35-foot-long trench running north-south across the shelter, and another 5-x-18-foot trench was excavated later in the east portion of the shelter. Excavations followed the feature system established by Jennings, digging according to broad stratigraphic changes, with each stratum being screened separately. Five radiocarbon dates were collected on scattered charcoal and hearths, ranging from around 5,900-900 cal BP, the oldest date being from a scattered-charcoal concentration associated generally with a sparse amount of cultural materials (Figure 4.9). Most of the occupation, however, took place in the late Holocene, based on the presence of diagnostic dart and arrow points like Elko corner-notched and eared, Rosegate, Pinto, and Desert side-notched points, among others. Artifacts also included bone beads, awls, gaming pieces, jewelry, incised clay tablets, unfired clay figurines, wooden awls, arrow shafts, cordage, basketry, leather, and hide (Figure 4.9). Artifacts from all stratigraphic units were included in this analysis.

Juke Box Cave (42TO20). This site is located about 4 km northeast of Wendover, Utah, and about 4 km northeast of Danger Cave. It faces the southeast overlooking the Great Salt Lake

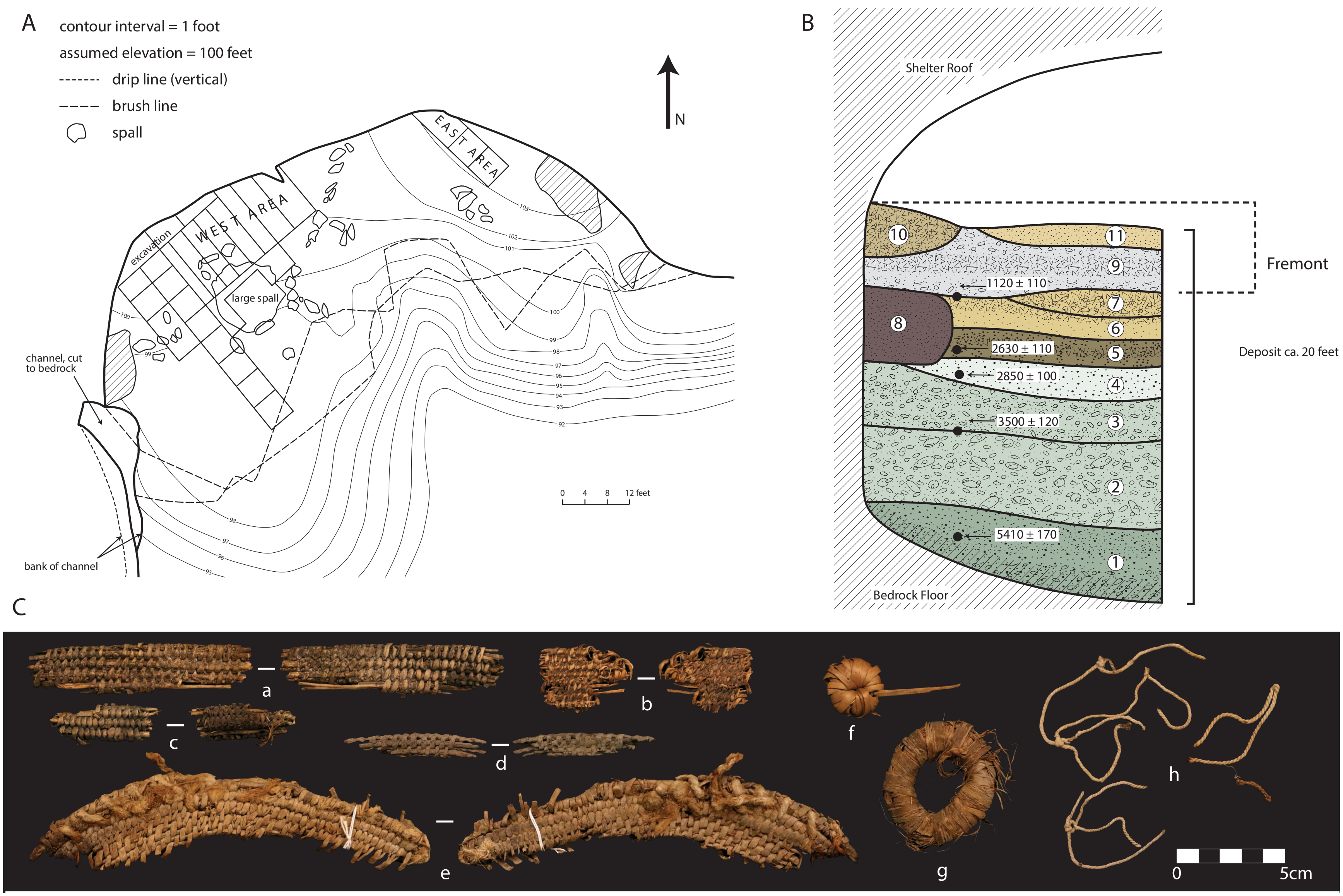

Figure 4.9. Swallow Shelter representative profile (A) and plan view (B) (adapted from Dalley 1976); Sample of Swallow Shelter artifacts (C) (a: 250-8; b: 117-11; c: 267-7; d: AR60227; e: 279-2; f: 253-2; g: 79-18; h: 217-20).

Desert at around 1,341 m asl, below the Stansbury Terrace, nearby the same marsh as Danger Cave. It is a large cave, measuring around 38 m with high ceilings and rock art. The site was first visited by Heizer in the 1930s and was originally identified as "site #5" (Rudy 1953) as well as U-149 (Smith 1941). In these early surveys, Juke Box Cave was recorded as minimally disturbed; however, during World War II, the floor of the cave was leveled to be used as a dancefloor for the nearby air base, so the upper portion of the deposits was severely disturbed. Large-scale excavations began in 1949 during the revival of the University of Utah field survey led by Jennings. Like other sites in the Wendover region during this period, excavation followed the Jennings feature system, with a long central trench from the entrance of the cave to the rear, and with a series of lateral trenches across the cave (Jennings 1957). Trenches were excavated to within sterile deposits, and two pits were excavated to reach the bedrock floor. Deposits were excavated according to strata identified in the field, but they were inconsistently screened. Two major periods were identified, called Jukebox I and II, and within these designations, four more periods of human occupation were identified. There are no radiocarbon dates reported for this site, although its record has been described as "similar to Danger Cave" throughout excavations and subsequent publications (Jennings 1957; Murchison 1989). Juke Box II is the largest cultural occupation at the site and is assumed to post-date the early Holocene. The assemblage includes well-preserved plant fiber, wood, bones, and charcoal, as well as awls, an eyed needle, pottery, beads, cordage, and basketry. I have focused on Jukebox II because its inferred age includes the late Holocene and it has the largest collection of perishable artifacts from the site (Figure 4.10).

Crab Cave (42JB8). Located 44 km to the northeast of the town of Trout Creek, this site was discovered as part of a survey of Fish Spring Wildlife Refuge Area (Madsen 1982) in the southwestern Great Salt Lake Desert. The cave is 300 m from Fish Spring marsh and faces north

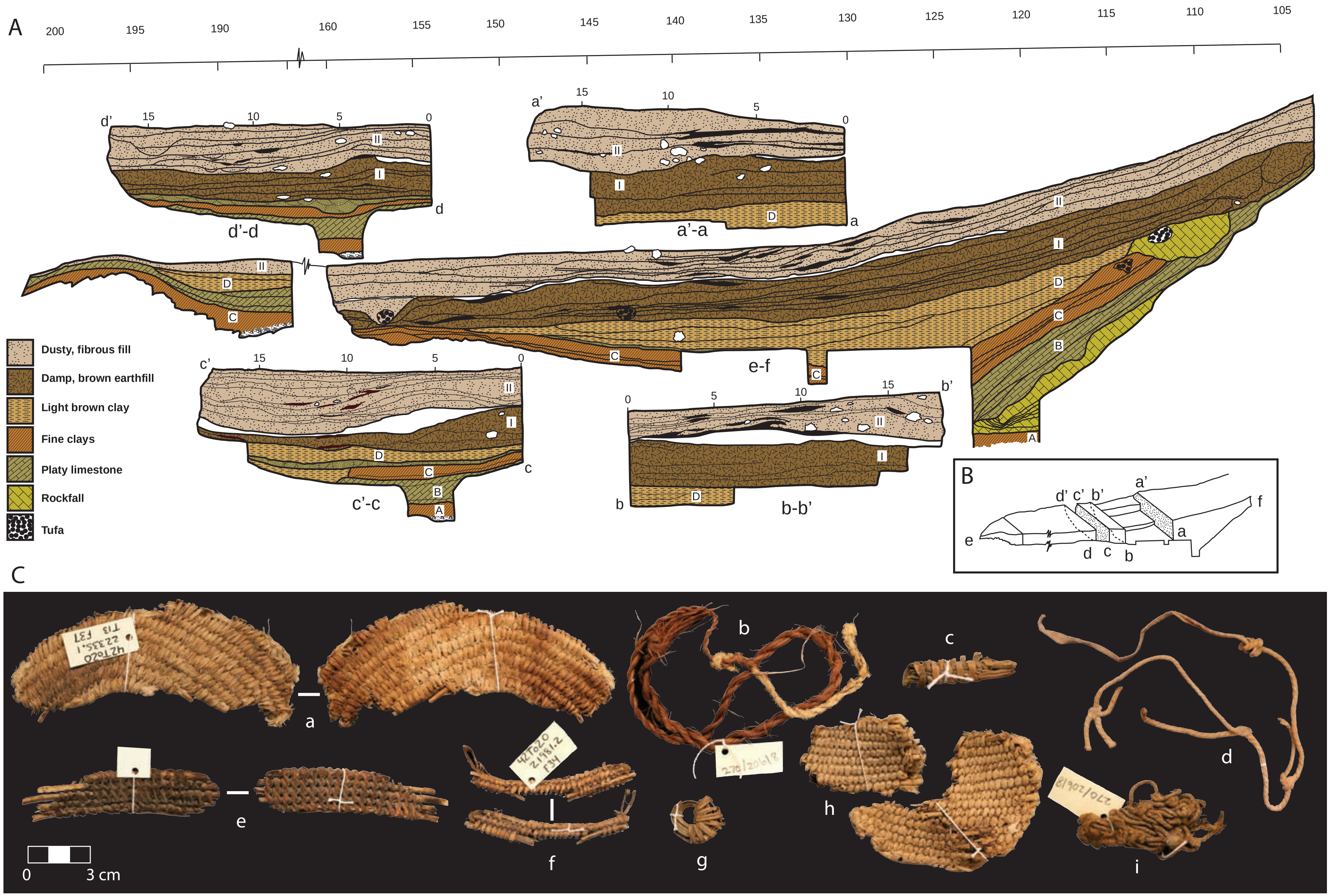

Figure 4.10. Juke Box Cave profile (A) and three-dimensional map (B) (adapted from Jennings 1957); Juke Box Cave perishable artifacts (C) (a: 22335; b: 21999-9; c: 21999-6; d: 22132-8; e: 21899-1; f: 21981-2; g: 22280-2; h: 22102-1-2; i: 21955-4).

at an elevation of 1,360 m, overlooking the Great Salt Lake Desert and several hot springs. David Madsen and colleagues test excavated Crab Cave in 1978 after the site had been looted, and excavations focused on cleaning the 4-x-6-m looters pit to establish a profile. Excavation was completed quickly, and only three main stratigraphic units were identified, despite the acknowledged presence of additional stratigraphic deposits. Two late Holocene dates were obtained from the cultural deposits. The assemblage consists of projectile points, nondiagnostic lithics, ground-stone, ceramics, textiles, leather, quids, coprolites, and modified bone, including bone awls. The entire basketry and cordage assemblage was used in this analysis (Figure 4.11).

Thermal Point (42TO32). This rockshelter is located 2.5 km northeast of Wendover, UT, and around 1,338 m asl and below the Stansbury Shoreline, and it is located around 1 km from a brackish water source at Danger Cave. Thermal Point was excavated as part of a regional study of eastern Salt Lake Desert sites during excavations at Danger Cave (Price 1952). The site consisted of a series of depressions, two of which were rock- and sagebrush-lined and assumed to represent house constructions. Thermal Point was first recorded in 1949, and excavations followed in 1950 by Sara Sue Price. Following a similar excavation method as Danger Cave, excavators dug three trenches, seeking to identify the subsurface architectural features and to define distinct strata. The trenches were excavated until sterile “conglomerate” material was reached, and there is no specification that the site fill was screened. During excavation, researchers identified four occupations. The assemblage consists of projectile points, ground-stone, potsherds, worked bone including horn awls and game counters, wood promontory pegs, arrow shafts, wooden beads, cordage, basketry, leather and hide, as well as unmodified plant macrofossils. No dates have been obtained for the site, but diagnostic projectile points not originally identified in the report (Price 1952) include dart and arrow points such as Elko and

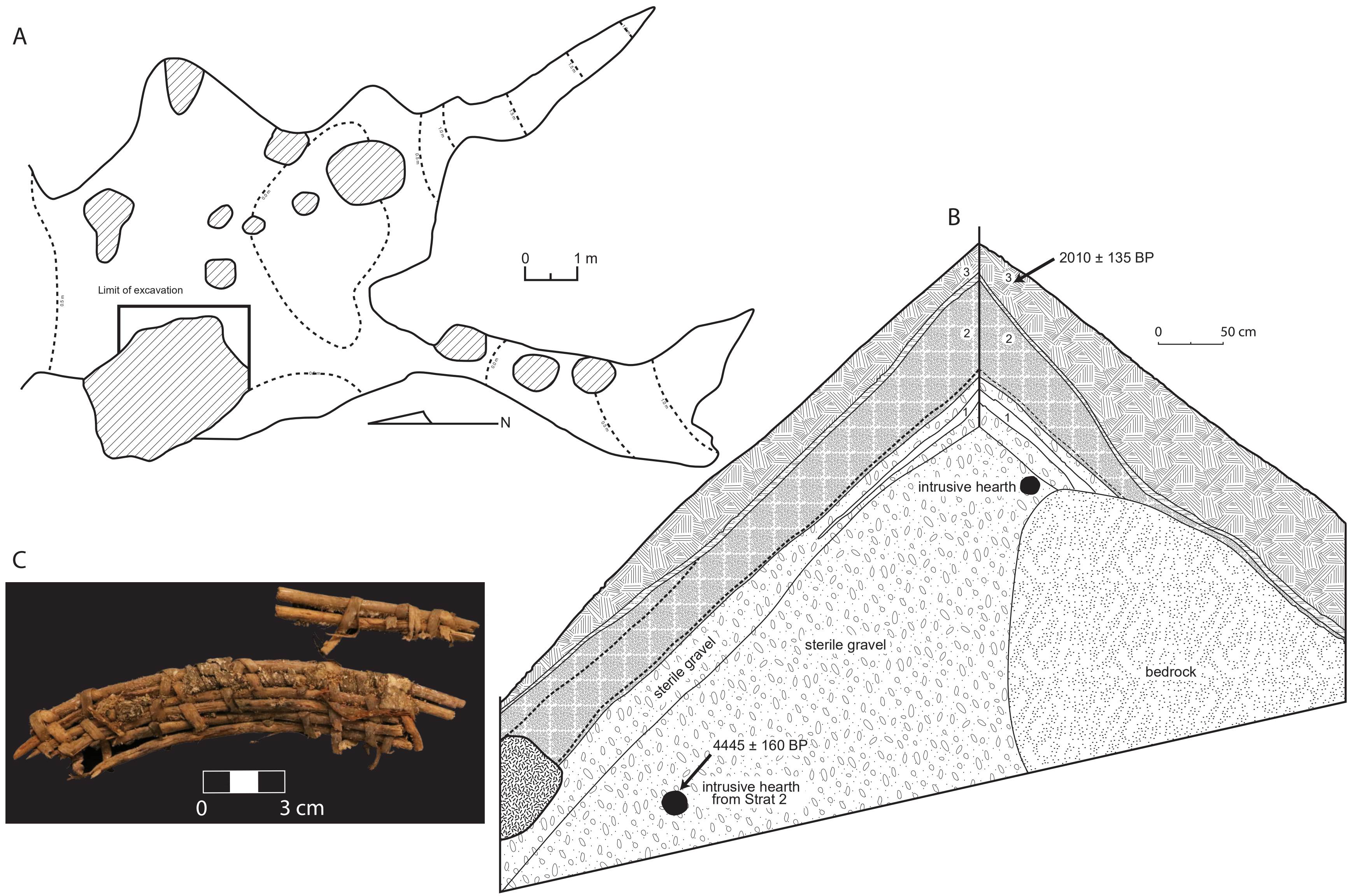

Figure 4.11. Crab Cave plan view (A) and profile view (B) (adapted from Madsen 1979); basket (C) (cat no. 78.27.7.2).

Rosegate points. This, along with Fremont and Shoshone pottery, suggests a late Holocene occupation span (Figure 4.12).

Tube Cave (42BO184). This cave is south-facing and located in the Grouse Creek Mountains about 33 km northwest of Lucin, Utah at about 1,615 m asl, and it is nearby Rabbit and Owl Springs. The cave has a narrow opening, 3.5-4 m across, but is significantly deeper at the back. It was investigated as part of the University of Utah Anthropology Department survey of northwestern Utah sites between 1969-1971, along with Swallow Shelter (Dalley and Berry 1977). At the time of recorded excavation, the site had been previously excavated by amateur archaeologists, but no records of these earlier excavations have been located. Dalley and Berry (1977) excavated a test pit in one of the few undisturbed portions of the cave, and five strata were identified within deposits reaching a depth of 1.8 m. No radiocarbon dates were obtained for the site, but diagnostic Elko-eared and Eastgate points in Stratum 4 and Elko, Large side-notch, and Black Rock concave-based projectile points in Stratum 2 indicate various Holocene occupations. The artifact assemblage includes eight projectile points and other lithic tools, modified bone beads, leather and hide, and cordage. Artifacts from strata 4-5 were included in this analysis (Figure 4.13).

Remnant Cave (42BO365). Like Swallow Cave and Tube Cave, Remnant Cave was recorded as part of a survey by the University of Utah Anthropology Department between 1969-1971 (Dalley and Berry 1977). It is located in the Grouse Creek Mountains on Bovine Hill, overlooking the Great Salt Lake Desert, about 6 m above the Provo Shoreline, ~1,450 m asl, and it is about 23 km northeast of Lucin, Utah. Remnant Cave is located about 10 km from Tube Cave, discussed above. It was heavily looted before formal excavations were completed by the University of Utah, and like Tube Cave, an unknown, unrecorded professional excavation had

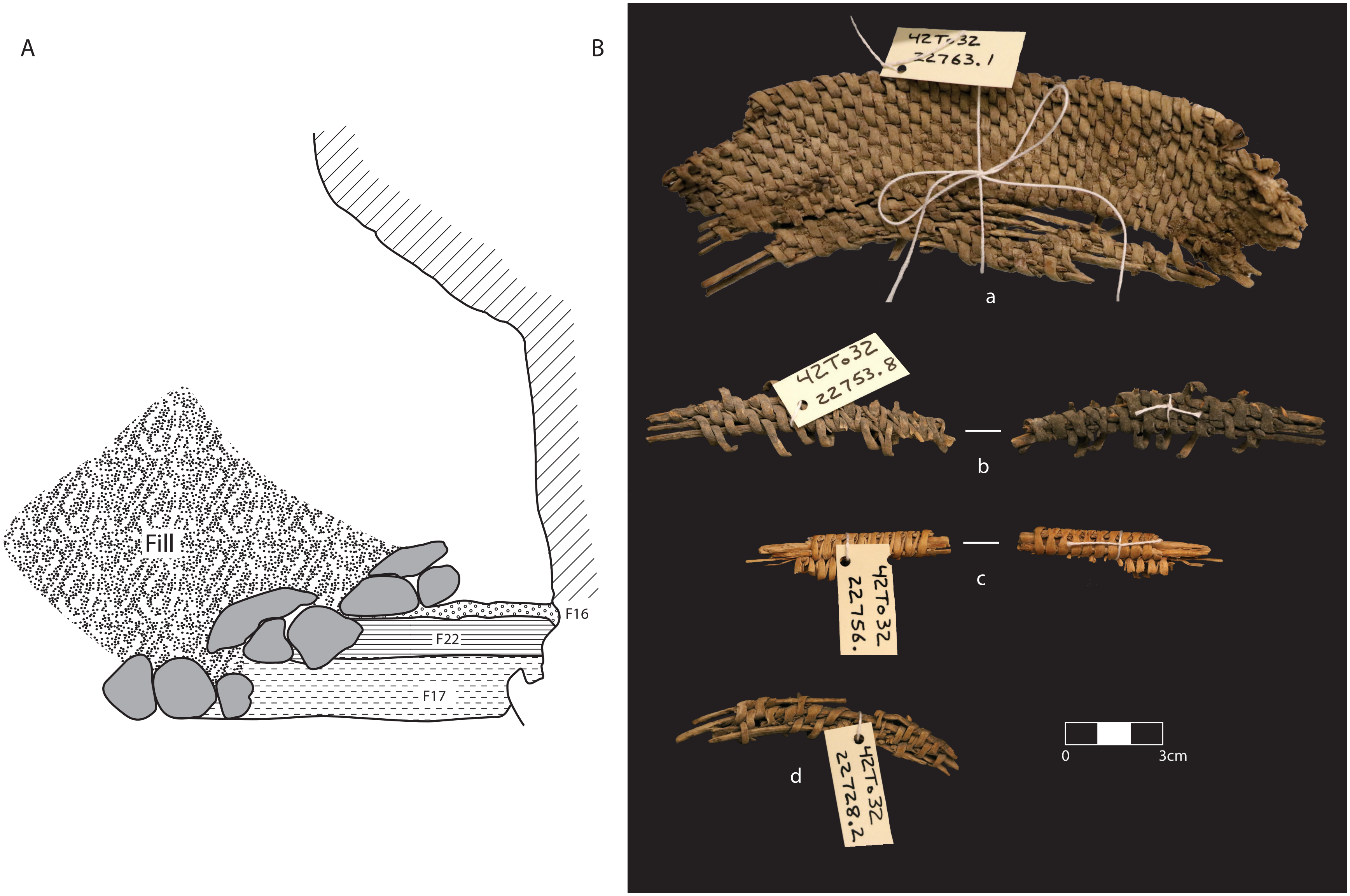

Figure 4.12. Thermal Point representative profile (A) (adapted from Price 1952) and Thermal Point basketry (B) (a: 22763.1; b: 22753.8; c: 22756.3; d: 22728.2).

A

B

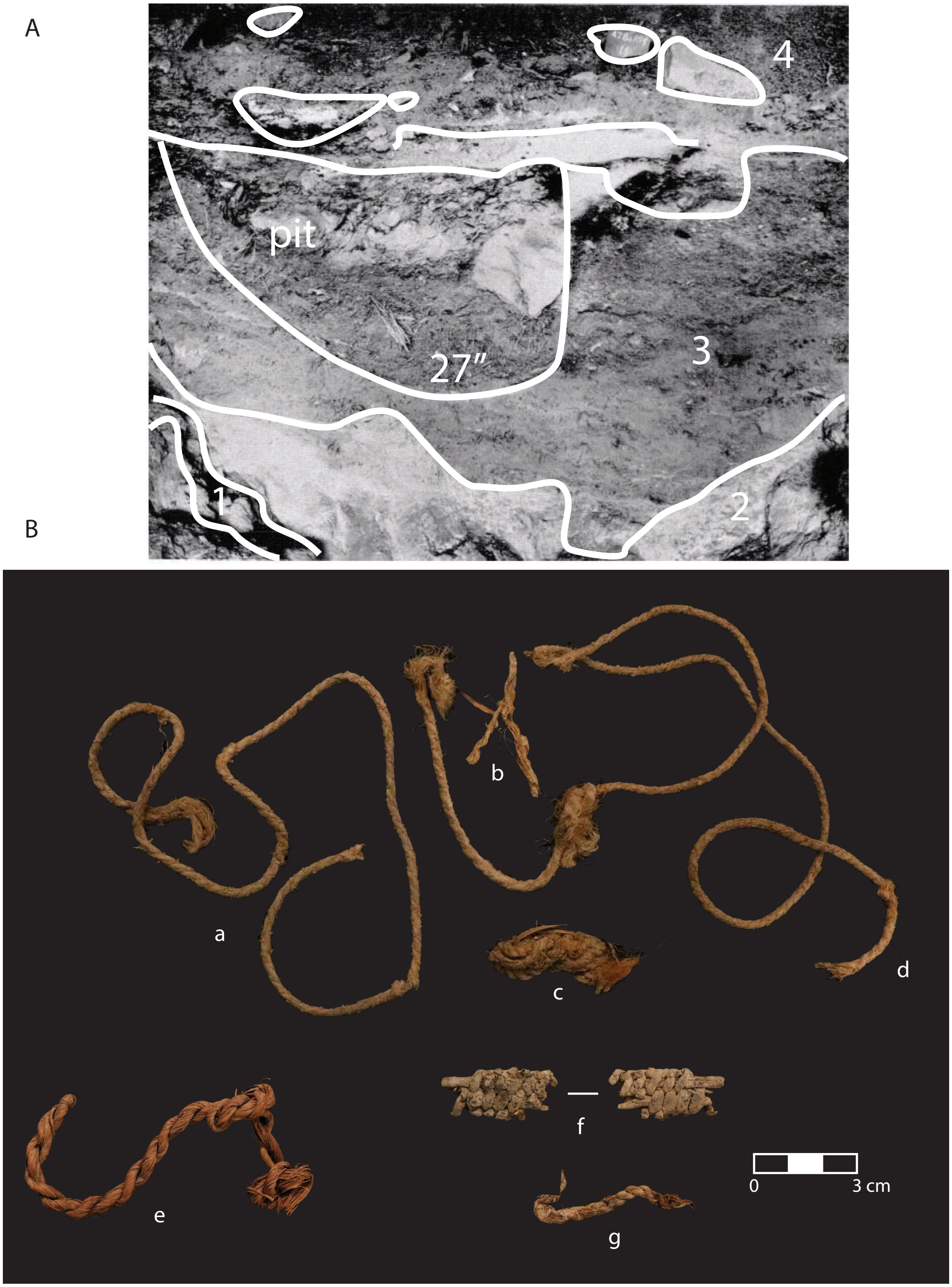

Figure 4.13. Tube Cave profile (A) (reproduced and adapted from Dalley and Berry 1977, figure 45, page 110; lines added) and artifacts (B) (a: 15.43-1; b: 15.43-4; c: 15.43-3; d: 15.43-2; e: 15.46; f: 2.42; g: 3.43).

extensively destroyed the context of much of the deposits at this site (Dalley and Berry 1977). Excavation procedures consisted of revealing the stratigraphy of trenches and looters' pits, and digging a 5-x-5-foot test pit in an undisturbed portion of the site. A larger excavation was then completed following identified stratigraphic features, like Swallow Shelter, using the feature method. Five radiocarbon dates were obtained on materials from the cultural levels, and they range from 5,400-450 cal yr BP, indicating artifacts date to the late Holocene. A radiocarbon age from Stratum 6 was collected from a *Phragmites* sp. arrow shaft, which yielded an unexpectedly old date of 3,485 ± 370^{14}C BP (~2,900-4,700 cal BP) (Coulam 1988); this anomalous date may be the result of reservoir effect potentially associated with aquatic/semi-aquatic plants, which can take up dissolved inorganic carbon that is older than atmospheric carbon from terrestrial plants (Marty and Myrbo 2014). Artifacts include projectile points and other lithic tools, ground-stone, Shoshone pottery, worked bone including bone awls and beads, modified wood like dart and arrow shafts and a promontory peg, hide, cordage, basketry, and a mat. Cordage and coiled basketry from the entire sequence was included in this analysis (Figure 4.14).

Samples Analyzed

I focused on the cordage and coiled basketry from these ten sites, assigning sites and components to the late Holocene through either associated radiocarbon dating or time-diagnostic projectile points. These assemblages are from Bonneville Estates (*N* = 61 cords, *N* = 23 baskets), Swallow Shelter (*N* = 27 cords, *N* = 16 baskets), Remnant Shelter (*N* = 25 cords, *N* = 4 baskets), Tube Cave (*N* = 7 cords, *N* = 1 basket), Juke Box Cave (*N* = 53 cords, *N* = 8 baskets), Thermal Point (*N* = 13 cords, *N* = 8 baskets), Crab Cave (*N* = 5 cords, *N* = 1 basket), Four Siblings Rockshelter (*N* = 20 cord, *N* = 0 baskets), Hogup Cave (*N* = 145 cords, *N* = 59 baskets), and Danger Cave (*N*

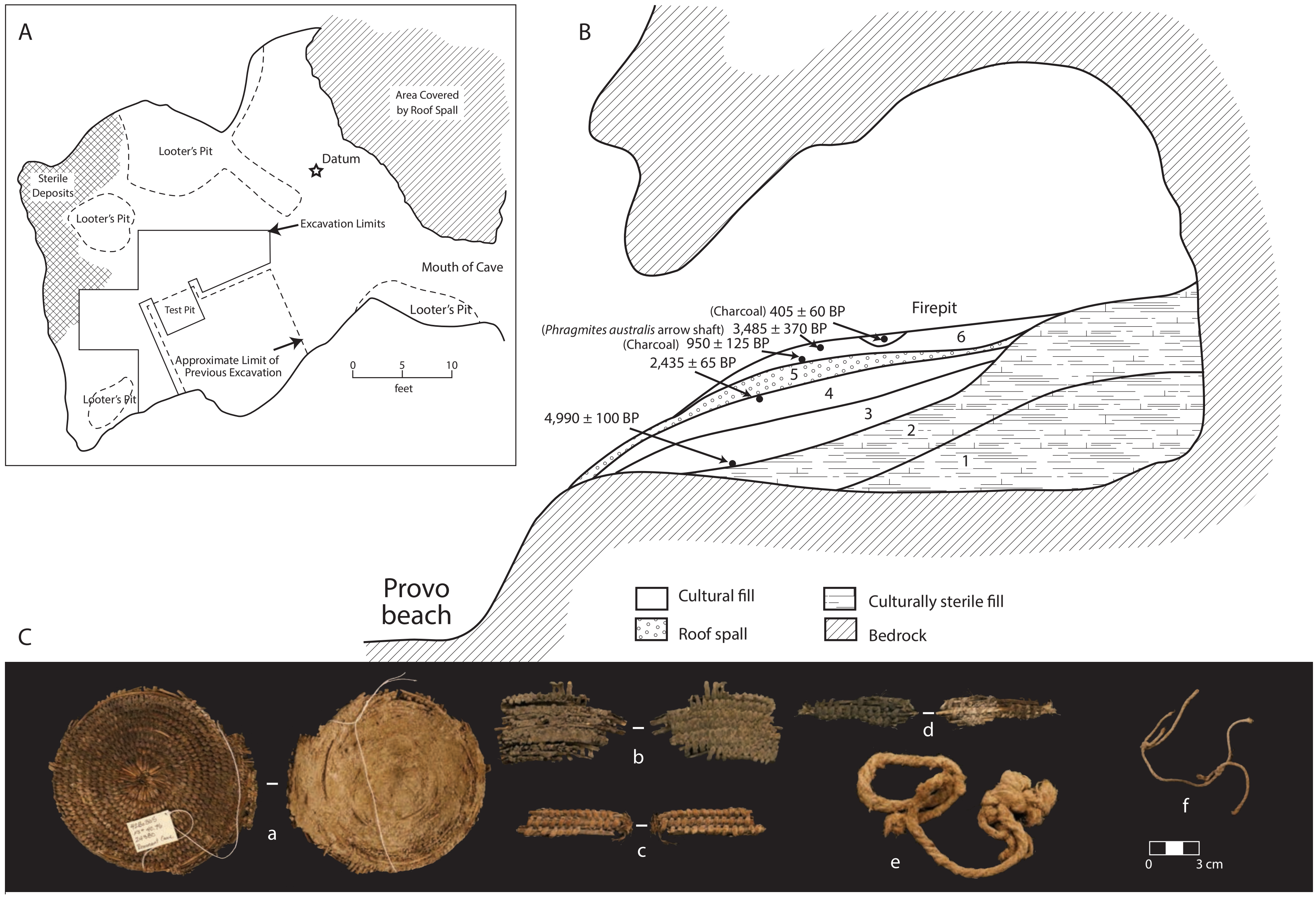

Figure 4.14. Remnant Cave plan view (A) and profile (B) (adapted from Berry 1976); and perishable artifacts (C) (a: 40-76; b: 24-111; c: 61-8; d: 18-32; e: 33-1; f: 81-46-2).

= 183 cordage, N = 36 baskets) (Table 4.1). As noted above, the Danger Cave and Hogup Cave cordage assemblages were unavailable for laboratory analysis in this study because of other pending analyses, so the cordage data from these sites are based on published reports which presented final twist direction.

Methods

The primary focus of this study is cordage and coiled basketry. The perishable artifact collection for Bonneville Estates Rockshelter and Four Siblings Rockshelters are currently housed at Texas A&M University, and all analysis was completed in the Department of Anthropology. All other assemblages were analyzed at the Natural History Museum of Utah in Salt Lake City. Similar to my previous study of the complete cordage and coiled basketry collection at Bonneville Estates Rockshelter, presented in Chapter 3, my analysis follows techniques developed by researchers from the Rhonda L. Andrews Center for Perishables Analysis at Mercyhurst University (Appendices D and E). In addition, ceramic vessel analysis is used as a model to infer the possible form and function of basketry fragments, because the artifact classes share some terminology and serve similar functions in domestic context (Rice 1987). The attributes analyzed are nominal and continuous data which broadly include twelve attributes for coiled basketry and nine for cordage (Table 3.4). These attributes seek to characterize morphology as well as technology, function, and technological style. These traits are discussed in detail in Chapter 3. Measurements were taken using digital calipers with 0.1 mm precision and a handheld goniometer.

Statistical analyses are not standardized for basketry and cordage studies, so attribute analysis of lithic artifacts is used as a model (Andrefsky 2005). Nominal data were compared by using Fisher's Exact tests deemed most appropriate for small samples sizes (Shennan 1997). For metric data, significance was measured using Mann-Whitney U and Kruskal-Wallis H tests. Also, in some cases F-tests were used to compare Coefficients of Variation (CV), and Shapiro-Wilk tests were used to test normality of distribution. Site assemblages were compared according to similarity in functional and technological-stylistic traits using cluster analysis. All statistics were computed using MyStat 12.02. I assumed that all cordage fragments measured in these tests represent independent artifacts, although I recognize that there may be redundancies, given their fragmentary nature. Following standard practice, alpha was set at 0.05 for rejection of the null hypothesis.

Results

Cordage

General Observations. Most cordage at all sites are made from twisted plant fiber, with the exception of the Crab Cave assemblage, which is predominantly cordage made from animal fiber (Appendix G). Six sites have twisted rabbit-skin robe fragments (Swallow Cave, Juke Box Cave, Crab Cave, Bonneville Estates Rockshelter, Danger Cave, and Hogup Cave), and five sites have cordage made from other faunal materials like sinew, hair, and leather (Swallow Cave, Tube Cave, Juke Box Cave, Little Sister East Shelter, Bonneville Estates Rockshelter, Danger Cave, and Hogup Cave). Although nearly all cords are two-ply with internally-consistent twist directions and plant characterizations, there are some exceptions: at Remnant Cave there is a three-ply cord that has a mix of s- and z-spin; and at Juke Box Cave there is a composite plant-and-animal cord, a wrapped ring, and a cordage-wrapped stick. Swallow Shelter has a composite cordage of various plant materials. Most cordage is fragmentary and not clearly diagnostic, with some exceptions: at Thermal Point there is a wrapped stick, which is likely a promontory peg; at Little Sister East Shelter there is a wrapped bundle of sedges and a juniper bundle with unknown functions; there are netting fragments from Swallow Shelter (*N* = 1), Remnant Cave (*N* = 2), Juke Box Cave (*N* = 2), and Bonneville Estates (*N* = 1); and at Bonneville Estates Rockshelter, there is a wrapped fire bundle, two cords with a fur tassel on one end, one snare, and two leather-threaded fragments of moccasins or bags.

Initial Spin Direction. Initial spin rather than final twist direction was measured to incorporate single-ply cordage, and thus increase the sample size, with Danger Cave and Hogup Cave being included, since these data are reported in the respective site monographs (Aikens 1970; Jennings 1957) (*N* = 560). Across the region, there is a strong preference (62.5% of the total assemblage) for initial z-spun cordage, but s-spun cordage is not rare (37.5%) (Figure 4.15, Table 4.2). When comparing each of the sites' proportion of spin direction, there is variation, with some sites (Remnant Cave, Juke Box Cave, and Danger Cave) showing a dominance of s-spun cordage (52-56.6% s-spin dominance), some sites (Swallow Shelter, Crab Cave, and Hogup Cave) showing over 80-88.9% z-spin dominance, and still others (Tube Cave, Thermal Point, Bonneville Estates Rockshelter, and Four Siblings Rockshelter) have a more equal representation of both spin directions but still a z-spin preference (58-72% z-spin dominance).

Table 4.2. Initial Spin Direction.

Site	s	z	Total
Bonneville Estates	15	46	61
Swallow Shelter	3	24	27
Remnant Cave	13	12	25
Tube Cave	3	4	7
Juke Box Cave	30	23	53
Thermal Point	4	9	13
Crab Cave	1	4	5
Four Siblings	8	12	20
Danger Cave	102	81	183
Hogup Cave	31	135	166
Total	210	350	560

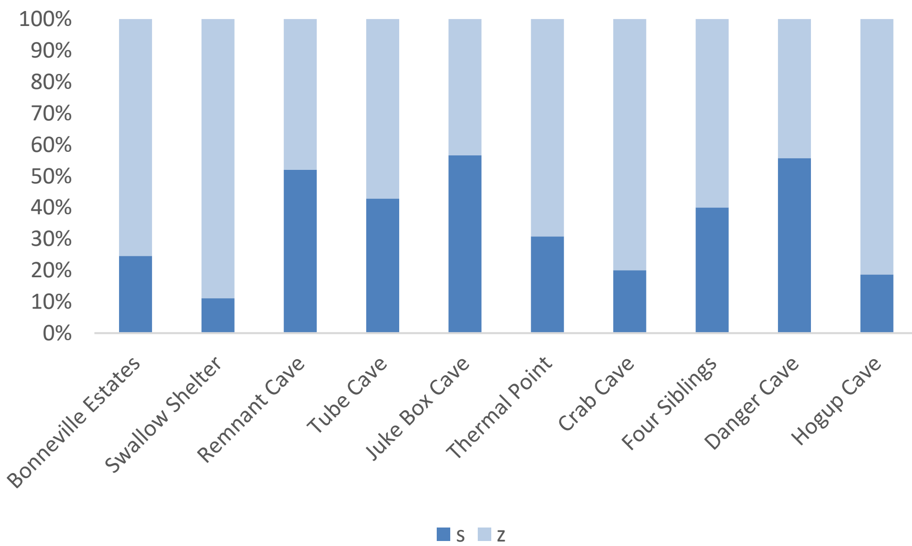

Figure 4.15. Relative proportion of initial spin direction across assemblages. Most cordage is z-spun across the region, but there is inter-site variability. At Remnant Cave, Juke Box Cave, and Danger Cave, s-spun cordage dominates the sub-assemblages.

Material Type and Texture. In the previous chapter on Bonneville Estates Rockshelter, cordage diameter was found to be associated with cordage plant material type, with coarse material yielding thicker cords and fine material yielding thinner cords. Across the Bonneville Basin, most cordage is made on fine plant material (69.5% of all cordage). The site with the most equal proportion of coarse and fine plant material is Juke Box Cave, where 50% of the total cordage is coarse plant fiber (Figure 4.16, Table 4.3). Tube Cave has the lowest percentage of coarse plant material (14.3%). Fauna, principally in the form of twisted hide, also occurs in sites in the Bonneville Basin, but at lower proportions (only 14.5% of the total assemblage) (Figure 4.16, Table 4.3). Crab Cave is the only site at which fauna cordage is the dominant type (80%). Swallow Shelter and Bonneville Estates have the next-highest percentages (18.5%, 25.6%, respectively) of cordage made on faunal material.

Table 4.3. Broad Cordage Material Type Comparing Coarse and Fine Plant Material to Fauna.

Site	Coarse	Fine	Fauna	Total
Bonneville Estates	8	35	15	58
Swallow Shelter	6	16	5	27
Remnant Cave	8	17	0	25
Tube Cave	1	6	0	7
Juke Box Cave	24	24	4	52
Thermal Point	3	10	0	13
Crab Cave	1	0	4	5
Four Siblings	3	15	2	20
Total	54	123	30	207

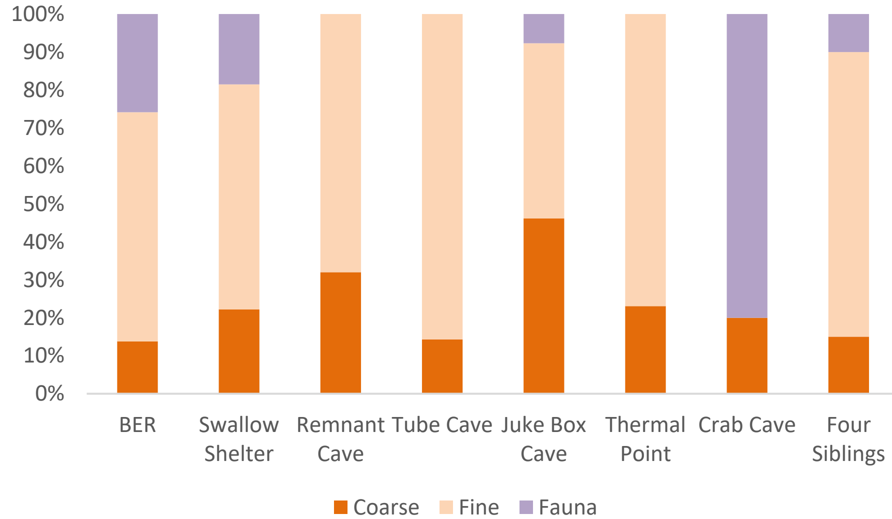

Figure 4.16. Cordage material type. At all sites except Crab Cave, fauna is the least common raw material, and it is not present at Remnant Cave, Tube Cave, or Thermal Point. Fine plant material is the most common manufacturing material at all sites. Coarse material occurs in highest proportions at Juke Box Cave and Remnant Cave.

Cordage spin direction as discussed previously is more often initial z-spin; however, when considered according to coarse versus fine plant fiber, which can also be read as generalized versus specialized in function (see Chapter 3), there is added complexity. Overall, in the total assemblage (excluding Danger Cave and Hogup Cave, for which this attribute is not analyzed), cordage made on fine plant material is more commonly z-spin (68.3%), whereas coarse cordage is almost equally z- and s-spin (48.1% of the coarse sub-assemblage is z-spin) (Figure 4.17, Table 4.4). This more frequent association of fine material with z-spin cordage is considered statistically significant ($p = 0.0123$, $N = 84$). At Remnant Cave, Tube Cave, Juke Box Cave, and Four Siblings, the proportions of s- and z-spin fine cordage types are nearly equal (50-54.2% z-spin fine material). Coarse plant material, while as a total assemblage being nearly equally s- and z-spin, though slightly more commonly s-spin (51.9% s-spun), site-by-site varies, with Bonneville Estates, Swallow Shelter, Tube Cave, and Four Siblings having coarse material dominated by z-spin cordage (with z-spin ranging from 66.7 to 100% of the coarse sub-assemblage). At Remnant Cave, Juke Box Cave, Thermal Point, and Crab Cave, coarse cordage is more commonly s-spin (62.5-100%) (Table 4.4). Spun faunal cordage is more frequently z-spin across the sub-assemblages (70%) (Table 4.4).

Table 4.4. Initial Spin Direction According to Material Type.

Site	Coarse		Fine		Fauna		Total
	s	z	s	z	s	z	
Bonneville Estates	1	7	8	27	5	10	58
Swallow Shelter	2	4	0	16	1	4	27
Remnant Cave	5	3	8	9	0	0	25
Tube Cave	0	1	3	3	0	0	7
Juke Box Cave	17	7	11	13	2	2	52
Thermal Point	2	1	2	8	0	0	13
Crab Cave	1	0	0	0	0	4	5
Four Siblings	0	3	7	8	1	1	20
Total	28	26	39	84	9	21	207

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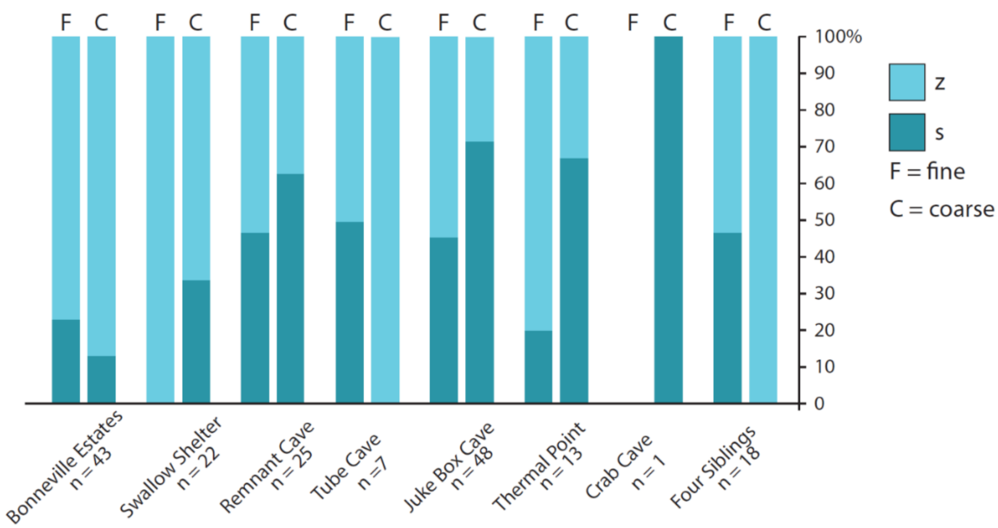

Figure 4.17. Cordage initial spin direction according to plant material. Most fine plant material is z-spun, whereas coarse material is more equally distributed across s- and z-spin, and slightly more frequently s-spin.

Diameter and Tightness. As demonstrated in Chapter 3, classifying coarse versus fine cordage influences the diameter of strands and completed cords, but a change in diameter within coarse or within fine cordage sub-assemblages may also indicate change in the proportion of these types of cordage. When comparing cordage diameters within fine materials along the lines of cordage spin direction in the entire assemblage (Figure 4.18), there appears to be a significant difference in the average diameter (U = 907; Z = -2.40371; p = 0.0164), with z-spin fine cordage on average having a smaller diameter than s-spin fine cordage. An F-test indicates that there is a statistically significant difference between CV of fine z- and s-spin, although the data are not normally distributed and there are outliers ($F_{75,33}$ = 4.646; p = 0.00001). When outliers are removed from the Bonneville Estates (cat no. 5130), Swallow Shelter (cat no. 177.43), Remnant Cave (cat no. 33.1), Juke Box Cave (cat nos. 21901.43 and 22275.1), and Tube Cave (cat no. 4.119) assemblages, there is a statistically significant difference between the z- and s-spin cordage ($F_{69,32}$ = 0.249, p = 0.000001), with z-spun cordage having significantly smaller standard deviation (0.559 mm) than s-spin cordage (1.12 mm). When coarse material is compared according to spin direction, there is a statistically significant difference within these populations, but they are not normally distributed ($F_{15,24}$ = 0.2763, p = 0.01256). When an outlier from Swallow Shelter (cat no. 13.36) is removed, there is no statistical significance ($F_{15,22}$ = 1.215, p = 0.661933). An F-test shows that the CVs are not statistically different when comparing fine z- and s-spin angles ($F_{69,32}$ = 0.758, p = 0.3358), excluding the outliers identified in the F-test of diameter. Fine cordage is consistently tightly twisted. Coarse cordage twist angle is also not found to be statistically significantly different when compared according to spin direction ($F_{15,23}$ = 1.4359, p = 0.4228), although z-spin coarse cordage is not quite normally distributed according to a Shapiro-Wilk Test (W = 0.886035, SD = 7.609, p = 0.0465).

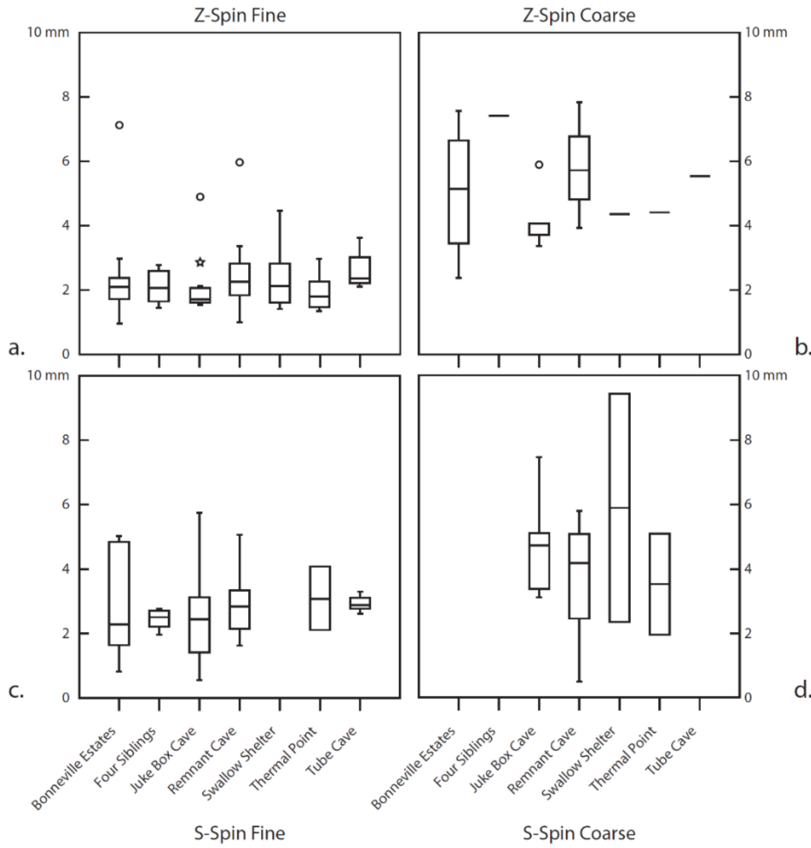

Figure 4.18. Cordage diameter. When cordage diameter is compared according to plant material texture and spin direction, and outliers are excluded, (*a*) z-spin fine cordage diameters are considered on average to be smaller than (*c*) s-spin fine cordage. The diameter of coarse cordage does not have a statistical difference on average or CV between (*b*) z-spin or (*d*) s-spin direction.

Knots. There are 66 cordage specimens with knots made from plants across the combined assemblage, most of which (59.1%) are on fine plant material (Table 4.5, Figure 4.19). Fine cordage fragments in Bonneville Basin sites I examined are more often associated with sheet-bend and more complex knots, like girth-hitches, nooses, and slip-knots (61.5%), and they are associated with specialized functions like netting and traps (Figure 4.20, Table 4.6). Coarse cordage is rarely associated with sheet-bend and other specialized knots (14.8% of the cordage on coarse plant material has a sheet-bend or other specialized knot), and they are more commonly overhand knots (85.2%). This association of sheet-bend/complex knots and fine cordage, and low frequency of these knot-types on coarse cordage, is found to be statistically significant (Fisher's Exact $p = 0.0002$, $N = 66$). When cordage knot type is further compared according to spin direction, there is no statistically significant difference across the assemblage between the knot type and spin directions, as both spin directions have similar proportions of overhand and specialized knots ($p = 0.8033$, $N = 65$) (Table 4.7).

Table 4.5. Presence of Knots on Plant Material.

Site	Coarse	Fine	Total
Bonneville Estates	2	4	6
Swallow Shelter	1	7	8
Remnant Cave	7	10	17
Tube Cave	1	2	3
Juke Box Cave	14	12	26
Thermal Point	2	4	6
Total	27	39	66

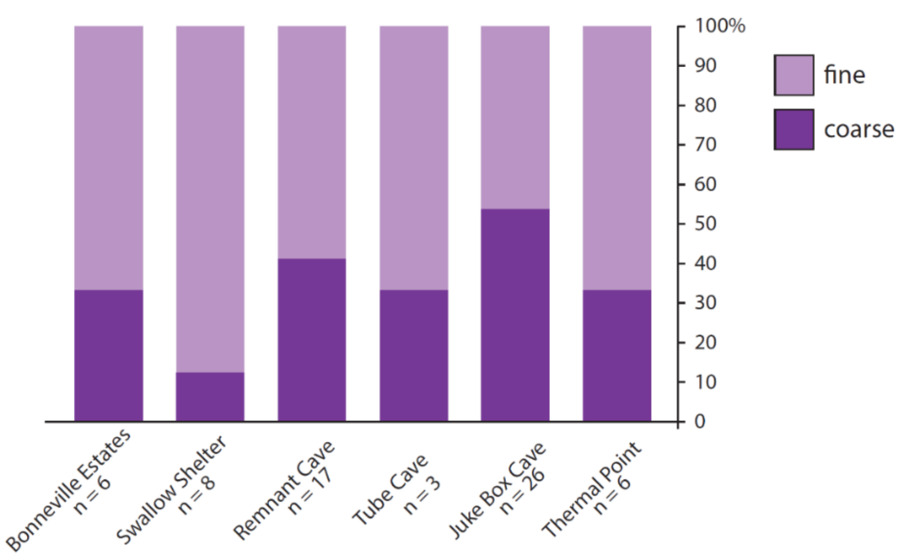

Figure 4.19. Presence of knots on plant cordage. Knotted cordage is more frequently on fine plants across the assemblage, but knots on coarse cordage outnumber knots on fine cordage at Juke Box Cave.

Table 4.6. Function of Knots on Cordage Made from Plant Material.

Site	Coarse		Fine		Total
	Generalized	Specialized	Generalized	Specialized	
Bonneville Estates	2	0	1	3	6
Swallow Shelter	1	0	5	2	8
Remnant Cave	7	0	1	9	17
Tube Cave	1	0	1	1	3
Juke Box Cave	11	3	4	8	26
Thermal Point	1	1	3	1	6
Total	23	4	15	24	66

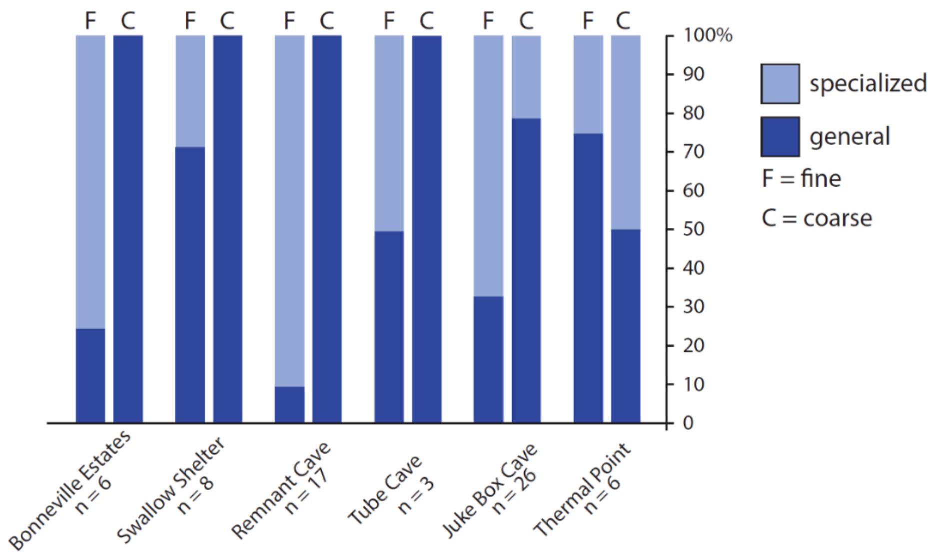

Figure 4.20. Function of knots on cordage distributed across plant types. The knots associated with generalized tasks are overhand knots, and specialized knots are sheet-bend, girth-hitch, slip-knot, and noose, which may have been used for nets and traps. Specialized knots are more frequently made on fine plant materials, and generalized knots are more frequently made on coarse plant materials.

Table 4.7. Knot Functions According to Initial Spin Direction.

Site	s		z		Total
	Generalized	Specialized	Generalized	Specialized	
Bonneville Estates	0	0	3	3	6
Swallow Shelter	1	0	5	2	8
Remnant Cave	4	5	4	4	17
Tube Cave	0	0	2	1	3
Juke Box Cave	8	6	6	5	25
Thermal Point	3	0	1	2	6
Total	16	11	21	17	65

Cordage Comparative Groupings

Sample sizes of assemblages are often uneven, and this may have an effect on showing true inter-assemblage variation. Mobile hunter-gatherers in the Bonneville Basin likely had group sizes that varied seasonally and by task, so I sought to determine whether individual sites clustered together to reflect similarity in measured attributes. This became especially useful in the case of presence/absence data or when two categorical attributes were compared. Throughout the analysis, sites appeared to repeatedly group together based upon similarity of specific attributes, so the nature of these attributes was further explored by testing the relationships of multiple attributes, and whether these observed site groupings were statistically independent groups (Figure 4.21, Table 4.8).

Table 4.8. Cordage Attributes According to Presence/absence, and Group Assignment of Sites According to Similarity of Stylistic Traits.

Attribute	Bonneville Estates	Swallow Shelter	Thermal Point	Crab Cave	Hogup Cave	Danger Cave	Four Siblings	Tube Cave	Remnant Cave	Juke Box Cave
Spin direction: presence z-spin	●	●	●	●	●	○	○	○	○	○
Spin direction: presence s-spin	◌	◌	◌	◌	◌	○	○	○	○	○
Material type: presence plant	●	●	●	◌	◊	◊	●	●	●	●
Material type: presence fine	●	●	●	◊	◊	◊	●	●	●	○
Material type: presence coarse	◌	◌	◌	●	◊	◊	◌	◌	◌	○
Material type: presence fauna	◌	◌	◊	●	◊	◊	◌	◊	◊	◌
Presence fine z spin	●	●	●	◊	◊	◊	○	○	○	○
Presence fine s-spin	◌	◊	◌	◊	◊	◊	○	○	○	○
Presence coarse z-spin	●	○	◌	◊	◊	◊	●	●	○	◌
Presence coarse s-spin	◌	◌	○	●	◊	◊	◊	◊	○	●
Knot type: presence specialized	○	◌	◌	◊	◊	◊	◊	◌	○	○
Knot type: presence overhand	○	●	○	◊	◊	◊	◊	○	○	○

Key		
High	67-100%	●
Moderate	34-66%	○
Low	1-33%	◌
Absent	0%	◊
Style		
	Group 1	
	Group 2	
Function		
	Group 1	
	Group 2	

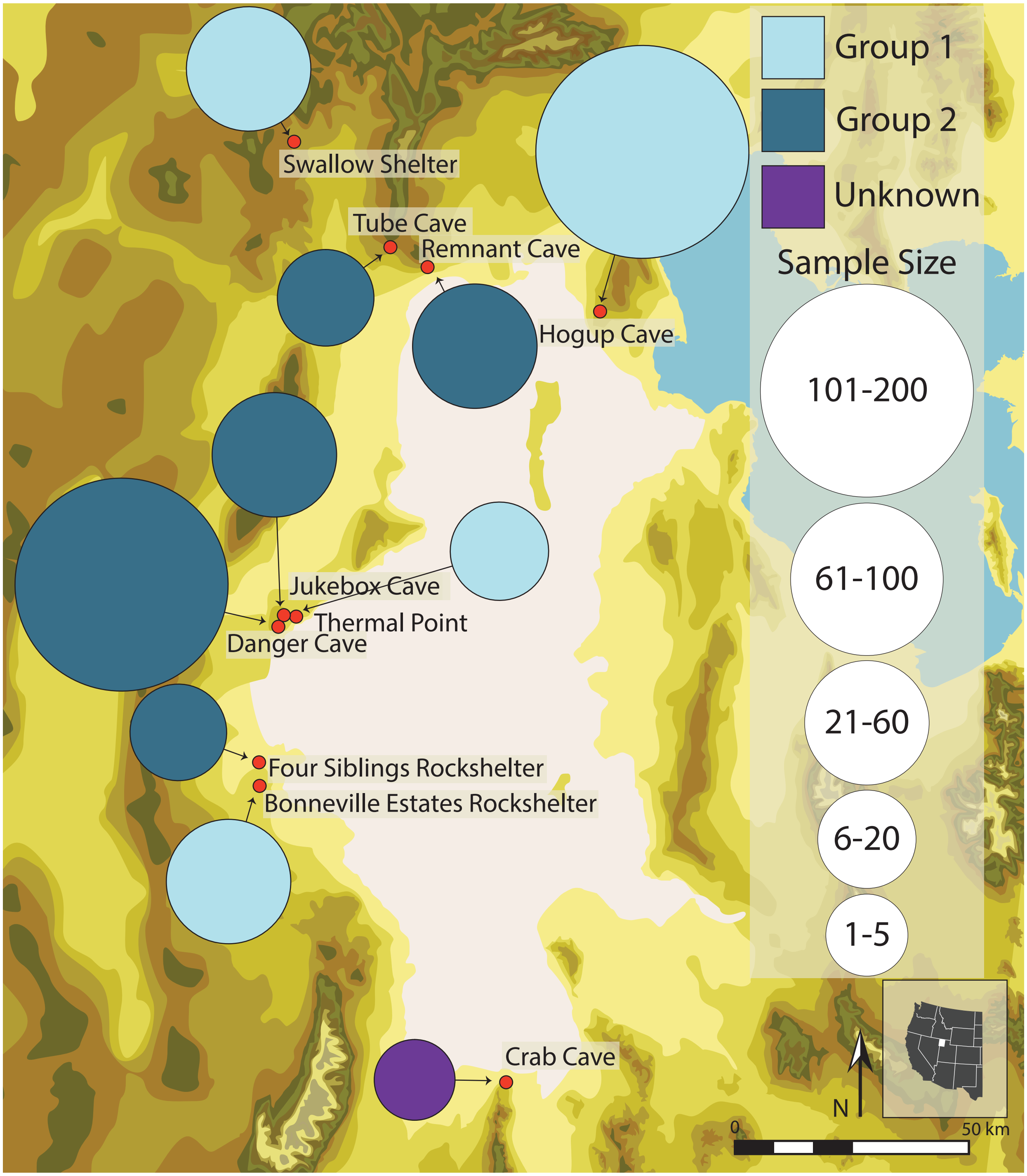

Figure 4.21. Cordage stylistic groups across the Bonneville Basin. Two groups were created based on similarities of the technological-stylistic trait spin direction and its statistically significant relationship with fine plant texture. When sites were compared using the functional traits material type and knot type, sites were too similar to be differentiated, and therefore are not included on this map. Crab Cave is considered an anomaly because it differs from other sites in important ways (it is mostly faunal cordage), but is most similar to Stylistic Group 1 in terms of spin direction.

A major observation in artifact comparison was in regard to the nature of the attribute: whether the attribute is considered essential to the functionality of the completed artifact, or conversely, whether it is associated more with the way the artifact was made outside of functionality, or technological style, as defined in Chapter 1 and Chapter 3. The cordage attributes I assigned to the functional category are raw material and knot-type because the type of fiber and associated knots direct and reflect how that cord could have been used (Table 4.8; see also Chapter 3). The attribute considered stylistic is spin direction, because spin direction has no effect on the functionality of the completed cord. While spin direction is considered a stylistic attribute, it is demonstrated to appear alongside functional attributes, a feature of technological style. The series of site-by-site univariate analyses above and in Chapter 3 indicate that there is likely a complex interaction between spin direction and functional traits, given that technological style is the unconscious expression of the group responsible for manufacturing the technology. Therefore, while spin direction is a stylistic attribute, it is included in some of the following tests of functional traits, since in the tests above, individual tests showed similarities between sites when compared this way. For the following comparison, two types of groups of synthetic variables were created: Stylistic Cordage Group (Figure 4.22), determined by sites that share similarity within spin direction, and Functional Cordage Group, determined by sites that share similarity within raw material and knot type. Fisher's Exact tests and hierarchical cluster analyses were used to measure whether these observed inter-site relationships were maintained.

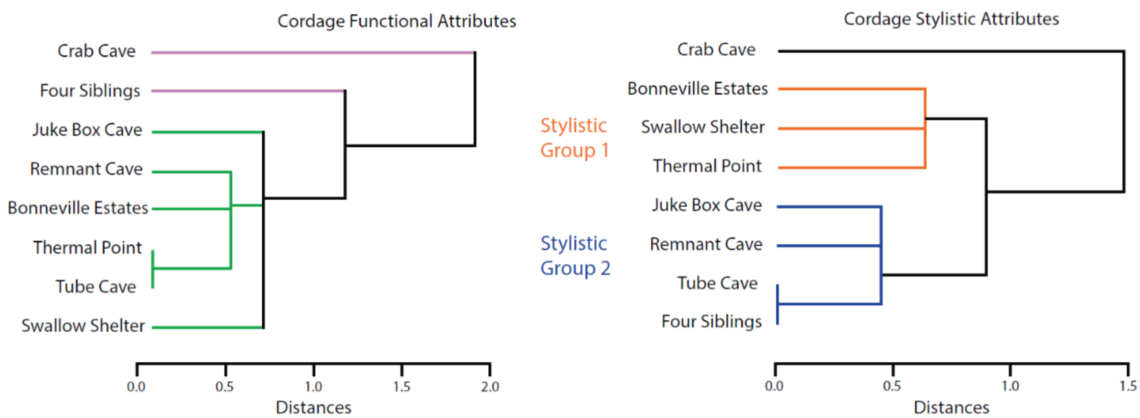

Figure 4.22. Results of cluster analysis of cordage functional and technological-stylistic attributes. (*Left*) Sites were analyzed using the functional traits material type and knot function. Sites were generally similar using these attributes, so no groups were created. Four Siblings differs from the other sites because there were no knots on plant cordage, and Crab Cave cordage is predominantly faunal material. Danger Cave and Hogup Cave are excluded from this cluster analysis. (*Right*) Two major groups were established based on spin direction and traits which are statistically significant when compared along spin direction: fine material type. Danger Cave and Hogup Cave are excluded from this cluster analysis, but Hogup Cave is considered most similar to Stylistic Group 1 based on spin direction data, and Danger is assigned to Stylistic Group 2. The cordage from Crab Cave is anomalous, because it is predominantly unspun faunal material.

Spin Direction. Two stylistic groups were created based on the relative proportions of spin direction (Figure 4.22): Stylistic Cordage Group 1 (Bonneville Estates, Swallow Shelter, Thermal Point, and Hogup Cave) which are 69.2-88.9% z-spin (N = 267), and Stylistic Cordage Group 2 (Remnant Cave, Tube Cave, Juke Box Cave, Four Siblings, and Danger Cave) which are 43.4-60% z-spin (N = 293). This distinction is significant (p = 0.0001, N = 560).

Cordage Raw Material. Coarse and fine cordage were found to vary based on assumed function of the artifact as either specialized (nets and traps being made on fine cordage) or generalized (coarse cordage not being suitable for nets or traps). There are no clear groups created, because at all sites with the exception of Juke Box Cave and Crab Cave, fine cordage is the dominant plant raw material. The above analysis of each site indicates that fine cordage used for specialized tasks was more frequently associated with z-spin direction at some sites. When the assemblage is compared according to the stylistic groups developed above, there is a statistically significant difference between the sites when comparing fine cordage material alongside z-spin direction (p = 0.0004, N = 123) (Figure 4.22). At Stylistic Group 1 sites, fine cordage is most commonly z-spin (83.6%), but at Stylistic Group 2 sites, s-spin fine cordage is also common (46.8%). When coarse cordage is compared according to stylistic groups, this relationship is also significant (p = 0.0397, N = 54). At Stylistic Cordage Group 1 sites, coarse material is more commonly z-spin (70.6%), whereas at Stylistic Cordage Group 2 sites, coarse material is more commonly s-spin (62.2%).

Knot Type. In Bonneville Basin sites, there is a general trend of fine cordage being associated with sheet-bend and other specialized knots (61.5%), and coarse material being proportionately associated with overhand knots (85.2%), and there is no statistical significance between sites when comparing them according to knot types on coarse or fine cordage. Although the z-spin direction and fine material type is found to be related, and specialized knots are found more commonly on fine material, spin direction and knot type do not have a significant relationship across the assemblage (p = 0.8033), nor when comparing stylistic groups (p = 1.000, N = 65).

Summary of Cordage Findings

Although many cordage patterns were explored, the attributes found to be the more pertinent to this study are spin direction, cordage plant texture, and the knots associated with these two attributes. With the exception of Crab Cave, cordage in all sites when compared according to strictly functional characteristics appear to have been used in a similar way. Fine plant material likely was consistently used for specialized activities like making nets and traps, across the region, and coarse plant material was used for more generalized activities at all sites. Sites in the region do not appear to vary significantly according to these functional characteristics. However, when cordage is examined according to technological-stylistic attributes, sites can more clearly be assigned to specific groups, potentially a reflection of the way cordage was made at these sites. When functional characteristics are compared according to these technological-stylistic groups, some trends may be observed (Figure 4.23): z-spun specimens are more commonly found on fine cordage used for specialized tasks, but at some sites (Remnant Cave, Tube Cave, Juke Box Cave, and Four Siblings) s-spun specimens are also commonly found on specialized cordage. When coarse material is compared according to technological style, there is no major difference between sites in the region (Figure 4.23). The social implications of these patterns are discussed later in this chapter.

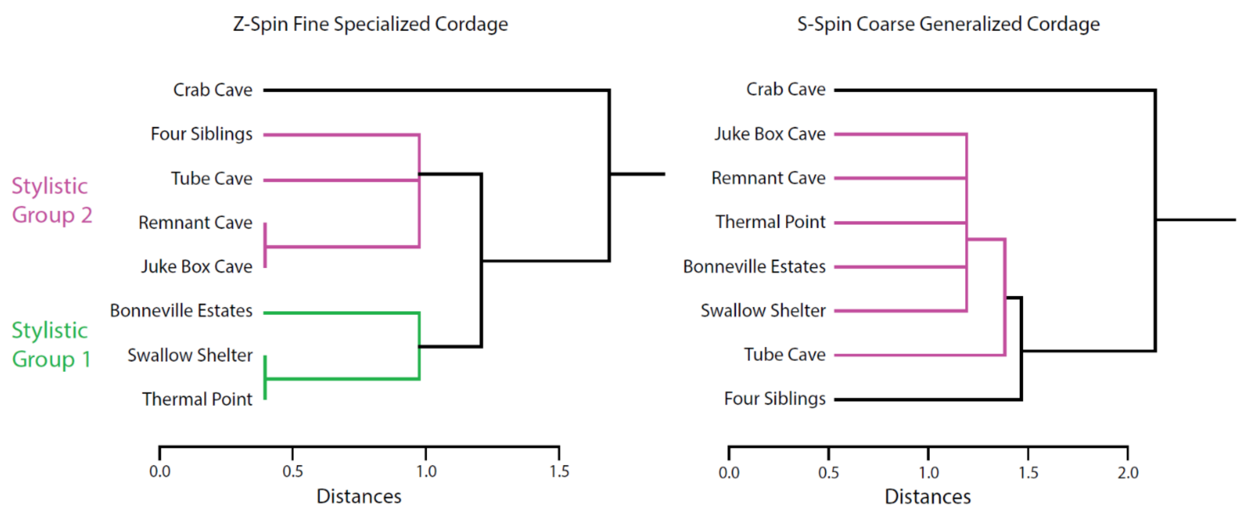

Figure 4.23. Cluster analyses isolating spin direction and cordage function: (*Left*) When z-spin cordage is analyzed according to its being used in the manufacture of specialized cordage, two groups of sites are created. The difference between these sites is the more common association of s-spin with specialized cordage in Group 2 (Four Siblings, Tube Cave, Remnant Cave, and Juke Box Cave) than Group 1 (Bonneville Estates, Swallow Shelter, and Thermal Point). (*Right*) When generalized cordage is compared, there is no major difference between sites according to technological style.

Coiled Basketry

Most late Holocene coiled basketry in the western Bonneville Basin is rigid, close-coiled, and undecorated (Appendix H). Basket samples are primarily wall fragments, although the eight rims from Bonneville Estates, Crab Cave, Thermal Point, Hogup Cave, and Danger Cave are simple wrapped and unwrapped self-rims. The single basket fragment from Crab Cave is reinforced with a strip of leather. The 13 centers from Bonneville Estates, Remnant Cave, Juke Box Cave, Hogup Cave, and Danger Cave are all normal, reinforced and unreinforced, with very narrow apertures. Stitches are generally split or unsplit and interlocking, with three examples of intricate stitches from Swallow Shelter. Only one basket fragment has any prominent decorative elements: at Hogup Cave a basket has broken feathers arranged in a chevron pattern.

Work Face. Unfortunately, the fragmentary nature of the assemblage inhibits the identification of whether a fragment side is the concave or convex side of the basket, so 39 (26%) of the baskets in the assemblage could not be scored according to this attribute. In the rest of the assemblage (Figure 4.24, Table 4.9), there is variation between the sites according to this attribute, with Bonneville Estates, Hogup Cave, Remnant Cave, and Tube Cave being dominated by concave work surfaces (56-100%), and Danger Cave, Thermal Point, and Juke Box Cave being dominated by convex work surfaces (66-100%). Swallow Shelter exhibits an even proportion (50%) of both types of work face.

Table 4.9. Basketry Work Face.

Site	Concave	Convex	Total
Bonneville Estates	11	5	16
Swallow Shelter	4	4	8
Remnant Cave	1	3	4
Tube Cave	1	0	1
Juke Box Cave	2	4	6
Thermal Point	3	4	7
Hogup Cave	27	14	41
Danger Cave	10	21	31
Total	59	55	114

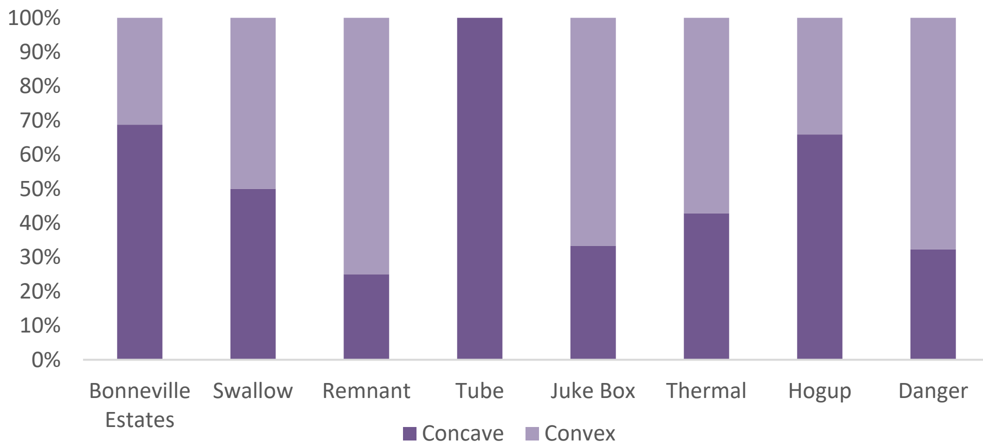

Figure 4.24. Basketry work face. Regionally, concave and convex work surfaces are nearly equally distributed across basketry, but there is inter-site variability. Due to the fragmentary nature of most baskets, 26% of the total basketry assemblage was excluded from this analysis because work face could not be determined.

Inferred basket form was compared to work face, indicating whether the work face was on the concave or convex face. Form was unidentifiable for most of the assemblage, because the artifacts are mostly fragmentary, but when identifiable forms are compared, there is a significant relationship with trays and wide bowls being disproportionately associated with concave work faces (61.5% of the available baskets), while narrow and small baskets are associated with convex work surfaces (90.9%) (p = 0.0043, N = 37) (Table 4.10).

Table 4.10. Basketry Work Face According to Inferred Basketry Form.

Site	Tray/Large Bowl		Narrow		Total
	Concave	Convex	Concave	Convex	
Bonneville Estates	6	2	0	0	8
Swallow Shelter	3	0	0	0	3
Remnant Cave	1	0	0	0	1
Tube Cave	1	0	0	0	1
Juke Box Cave	0	0	0	2	2
Thermal Point	0	0	0	0	0
Hogup Cave	4	5	1	2	12
Danger Cave	1	3	0	6	10
Total	16	10	1	10	37

Work Direction. Both work directions are represented across the western Bonneville Basin, with most baskets (85%) manufactured right-to-left. Interassemblage variability occurs, however, with Bonneville Estates Rockshelter, Swallow Shelter, Remnant Cave, Tube Cave, Hogup Cave, and Danger Cave, which have 85.7-100% right-to-left, versus Thermal Point, Juke Box Cave, and Crab Cave which have 25-100% left-to-right work direction (Figure 4.25, Table 4.11).

Table 4.11. Basketry Work Direction.

Site	Right-to-Left	Left-to-Right	Total
Bonneville Estates	20	3	23
Swallow Shelter	16	0	16
Remnant Cave	3	1	4
Tube Cave	1	0	1
Juke Box Cave	6	2	8
Thermal Point	2	6	8
Hogup Cave	52	6	58
Danger Cave	30	5	35
Total	130	23	153

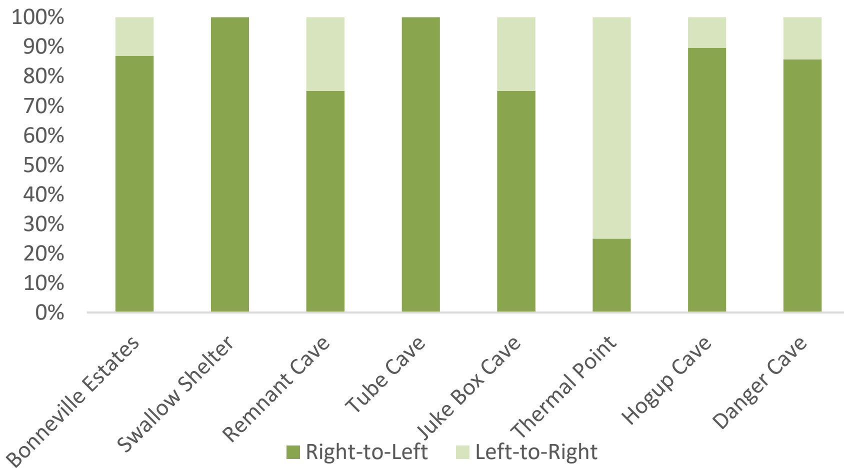

Figure 4.25. Basketry work direction. Most baskets are made from a right-to-left work direction, but left-to-right work direction occurs in smaller quantities at Bonneville Estates, Remnant Cave, Juke Box Cave, Hogup Cave, and Danger Cave. Thermal Point is the only site where left-to-right work direction outnumbers right-to-left work direction.

When work direction and work face are compared across the region, right-to-left work directions are more equally found on concave and convex work surfaces (47.8% and 52.2%, respectively), whereas left-to-right work directions are more commonly found on concave work faces (77.8%), a relationship which is statistically significant ($p = 0.0222$, $N = 110$) (Figure 4.26, Table 4.12). There is some inter-site variation, when comparing right-to-left work direction: at Bonneville Estates, Tube Cave, and Hogup Cave, more commonly right-to-left work direction is on baskets with concave work surfaces (62.9-100%), while at Swallow Shelter, Remnant Cave, Juke Box Cave, Thermal Point, and Danger Cave, right-to-left work direction is more frequently on baskets with convex work surfaces (50-100%).

Table 4.12. Basketry Work Direction and Work Face.

Site	Right-to-left		Left-to-right		Total
	Concave	Convex	Concave	Convex	
Bonneville Estates	9	5	2	0	16
Swallow Shelter	4	4	0	0	8
Remnant Cave	1	1	0	0	2
Tube Cave	1	0	0	0	1
Juke Box Cave	1	4	1	0	6
Thermal Point	0	2	3	2	7
Hogup Cave	22	13	4	1	40
Danger Cave	6	19	4	1	30
Total	44	48	14	4	110

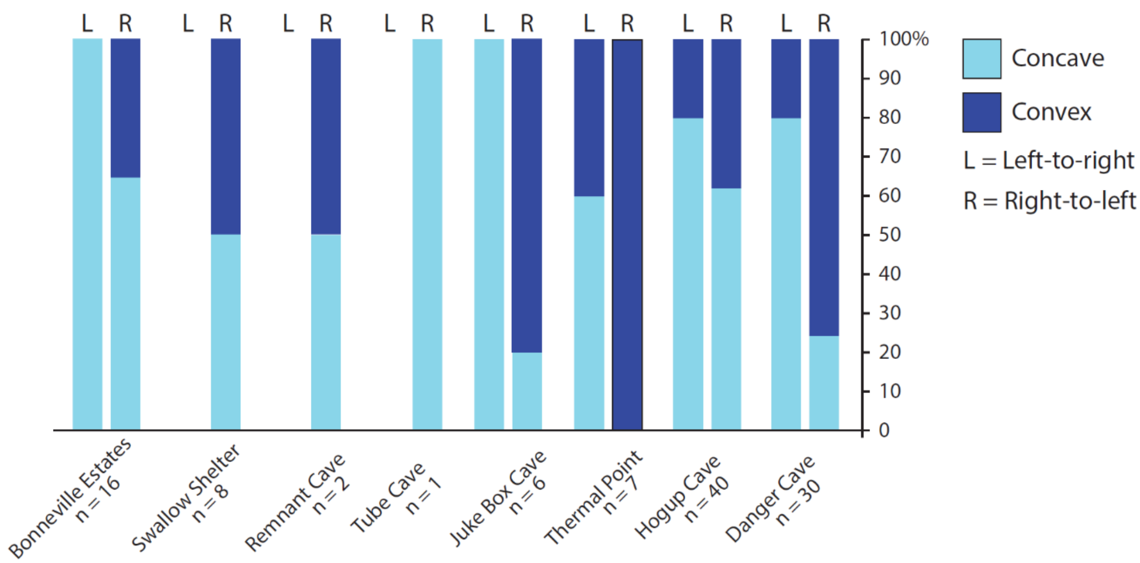

Figure 4.26. Basketry work direction and work face. Left-to-right work direction is most frequently associated with concave work surfaces, but right-to-left work direction is made on concave and convex work surfaces variably across the region. Work face and work direction are both early stages in the basketry manufacturing process, and work face may indicate the planned form of the basket. Work direction is a stylistic trait that does not indicate form or use, but it is interconnected with a functional trait.

Use Wear. Pitch is present on one basket from Hogup Cave and five baskets from Danger Cave, which is a basketry waterproofing method. The most common use wear is burning (36.8% of the entire assemblage), and at most sites (with the exception of Thermal Point) occupants at the site used some baskets for parching (Table 4.13). Some of these baskets likely served as parching trays or boiling baskets, but some burning may be post-depositional. Many baskets also are stained (31.6% of the assemblage) or abraded (31.6%). Importantly, use wear is not mutually exclusive, and some baskets include multiple types of use wear, evidence that baskets were multifunctional (Figure 4.27, Table 4.13).

Table 4.13. Major Types of Use Wear on Basketry, Showing that Baskets were Multi-functional.

Site	Burned	Stained	Abraded	Polished	Residue	Pitched	None	Sample size
Bonneville Estates	10 (43.5%)	7 (30.4%)	0 (0.0%)	0 (0.0%)	6 (26.1%)	0 (0.0%)	8 (34.8%)	23
Swallow Shelter	2 (12.5%)	4 (25.0%)	9 (56.3%)	0 (0.0%)	1 (6.3%)	0 (0.0%)	3 (18.8%)	16
Remnant Cave	1 (25.0%)	3 (75.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4
Tube Cave	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1
Juke Box Cave	3 (37.5%)	4 (50.0%)	2 (25.0%)	1 (12.5%)	1 (12.5%)	0 (0.0%)	3 (37.5%)	8
Thermal Point	0 (0.0%)	4 (50.0%)	2 (25.0%)	0 (0.0%)	3 (37.5%)	0 (0.0%)	0 (0.0%)	8
Hogup Cave	24 (40.7%)	20 (33.9%)	30 (50.8%)	14 (23.7%)	13 (22.0%)	1 (1.7%)	3 (5.1%)	59
Danger Cave	16 (44.4%)	7 (19.4%)	5 (13.9%)	13 (36.1%)	14 (38.9%)	5 (13.9%)	4 (11.1%)	36
Total	57 (36.8%)	49 (31.6%)	49 (31.6%)	28 (18.1%)	38 (24.5%)	6 (3.9%)	21 (13.5%)	155

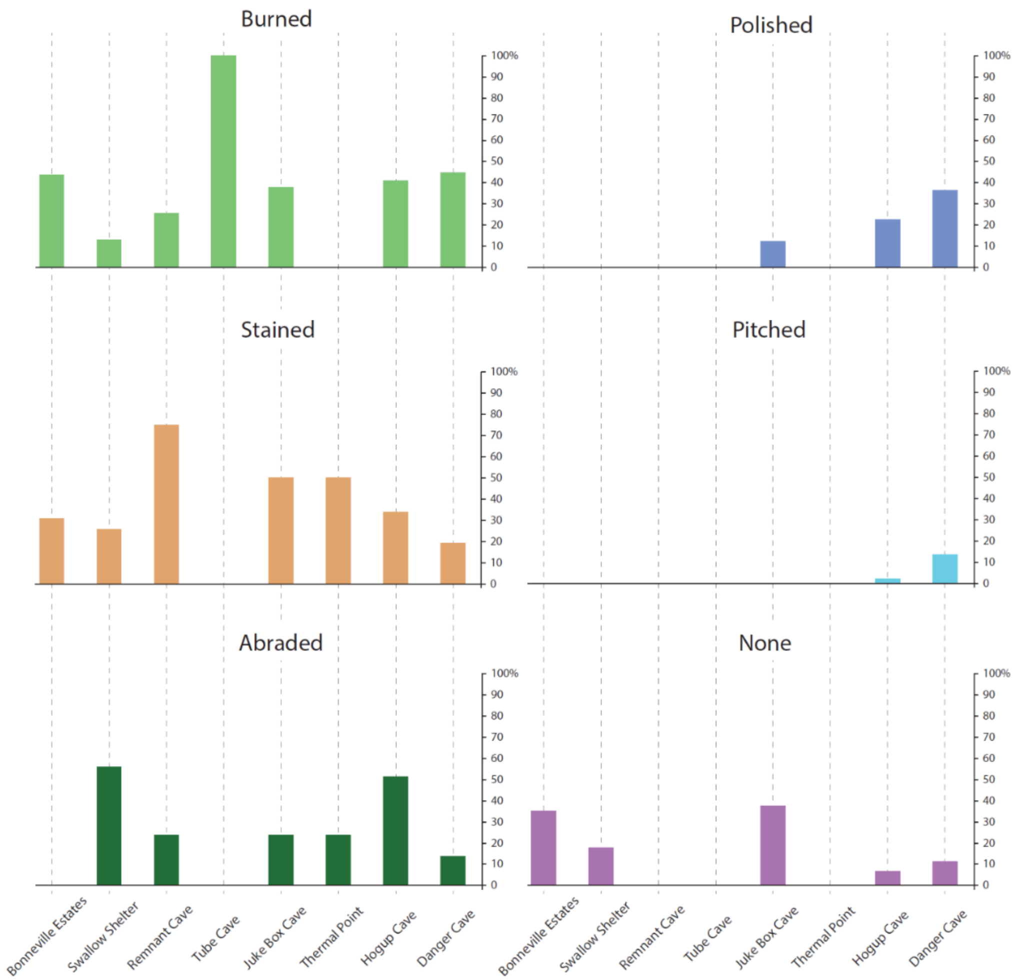

Figure 4.27. Basketry use wear. Each graph shows the percentage of an independent variable of use wear across the sub-assemblage, not the relative percentage for each sub-assemblage. Use wear is not mutually exclusive, and baskets frequently exhibit more than one type of use wear as a result of having multiple functions.

Foundation. A comparison of basket foundations with and without bundles indicates regional variation. At Bonneville Estates, Juke Box Cave, and Hogup Cave, 66% of basket foundations have bundles, while at Remnant Cave, Tube Cave, Swallow Shelter, Thermal Point, and Danger Cave, 33% of baskets have bundles (Figure 4.28, Table 4.14). However, when rod type is compared (i.e. half-rod versus whole-rod), most baskets in the entire assemblage are half-rod foundation (69%). Bonneville Estates Rockshelter, Thermal Point, Remnant Cave, and Hogup Cave baskets have 66-91% half-rod foundation, whereas at Swallow Shelter, Juke Box

Cave, and Danger Cave baskets more frequently have whole-rod foundations (Figure 4.29, Table 4.15). Across the assemblages, half-rod foundations are more frequently associated with bundles (87.5%), whereas whole-rod foundations less frequently have bundles (18.2%), a difference that is statistically significant (p = 0.0001; N = 91) (Table 4.16).

Table 4.14. Presence of Bundles in Basketry Foundations.

Site	Bundle	No bundle	Total
Bonneville Estates	18	5	23
Swallow Shelter	7	9	16
Remnant Cave	3	1	4
Tube Cave	1	0	1
Juke Box Cave	5	3	8
Thermal Point	0	8	8
Hogup Cave	37	22	59
Danger Cave	8	28	36
Total	79	76	155

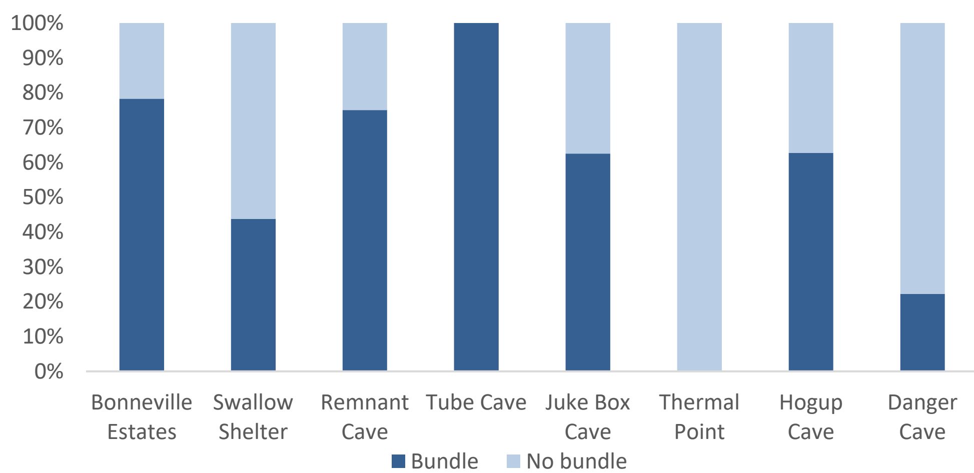

Figure 4.28. Proportion of bundles in basketry. Regionally, about half of the basketry foundations contain bundles, but not exclusively. Swallow Shelter, Thermal Point, and Danger Cave are the only sites where foundations without bundles outnumber baskets with bundles.

Table 4.15. Major Foundation Types, Focusing on Rod Type.

Site	Half-rod	Whole- and One-rod	Three-rod	Total
Bonneville Estates	16	2	2	20
Swallow Shelter	6	0	9	15
Remnant Cave	1	0	2	3
Tube Cave	1	0	0	1
Juke Box Cave	5	1	2	8
Thermal Point	2	4	1	7
Hogup Cave	41	0	12	53
Danger Cave	12	15	4	31
Total	84	22	32	138

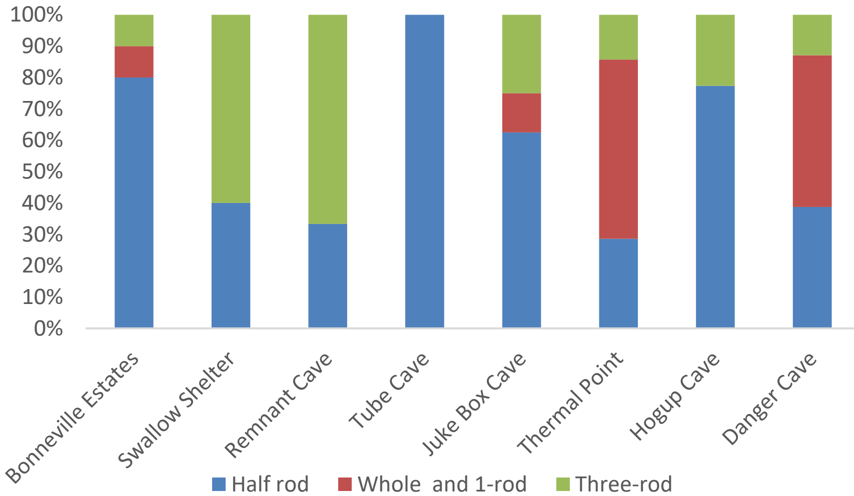

Figure 4.29. Foundation rod type. There are other foundation types in the region not included in this figure, included in Appendix H.

Table 4.16. Rod Foundations Associated with Bundles.

Site	Half-Rod		Whole-Rod		Three-Rod		Total
	Bundle	No Bundle	Bundle	No Bundle	Bundle	No Bundle	
Bonneville Estates	14	2	1	1	0	2	20
Swallow Shelter	6	0	0	0	0	9	15
Remnant Cave	1	0	0	0	0	2	3
Tube Cave	1	0	0	0	0	0	1
Juke Box Cave	5	0	0	0	0	2	7
Thermal Point	0	2	0	4	0	1	7
Hogup Cave	36	5	0	0	0	12	53
Danger Cave	7	1	1	5	0	4	15
Total	70	10	2	9	0	32	124

Another foundation type—three-rod bunched foundation arranged in a triangular configuration—represents 23% of the total basketry assemblage analyzed (Table 4.16). Crab Cave, Bonneville Estates, Thermal Point, Hogup Cave, and Danger Cave have the lowest proportions of three-rod foundation (0-29%), whereas Swallow Shelter, Remnant Cave, Tube Cave, and Juke Box Cave more frequently have three-rod-foundation baskets (67-100%). No three-rod foundation baskets have a bundle. Considering use wear, rod-and-bundle and rod-without-bundle basket foundation types were associated with burning 43% of the time. However, burning occurs on three-rod-foundation only 21.9% of the time, and when comparing three-rod foundations with non-three-rod foundations, there is a statistically significant difference (p = 0.0400; N = 152), in which three-rod foundations are less commonly burned than other baskets (43.3% of other baskets are burned) (Figure 4.30). Most baskets with three-rod foundation have a right-to-left work direction (80.6%) a trend represented across the sites; however, overall, there is no statistically significant relationship when comparing work direction and three-rod and half-rod foundations (p = 0.1876; N = 109), or three-rod and whole-rod foundations (p = 0.1903, N = 40) (Figure 4.31, Table 4.17).

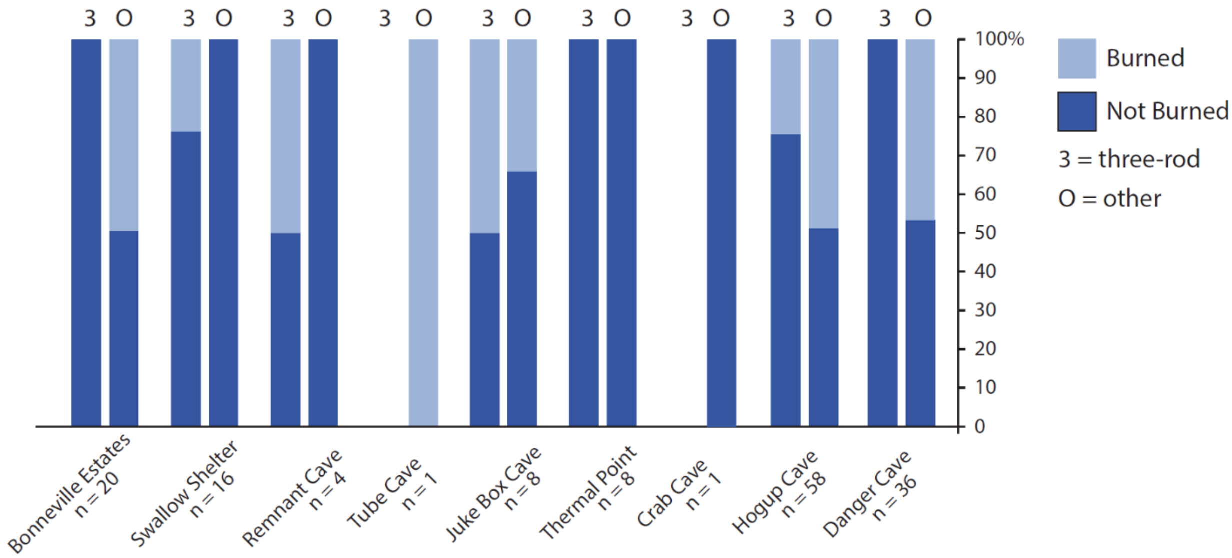

Figure 4.30. Burning on foundation type. Three-rod foundations are less frequently burned than other foundation types.

Table 4.17. Work Direction and Foundation Rod Types.

Site	Three-rod		Half-rod		Whole-rod		Total
	R-L	L-R	R-L	L-R	R-L	L-R	
Bonneville Estates	2	0	14	2	2	0	20
Swallow Shelter	9	0	6	0	0	0	15
Remnant Cave	2	0	1	0	0	0	3
Tube Cave	0	0	1	0	0	0	1
Juke Box Cave	0	1	5	0	0	0	6
Thermal Point	1	0	1	1	0	4	7
Hogup Cave	9	3	37	3	0	0	52
Danger Cave	2	2	6	1	3	0	14
Total	25	6	71	7	5	4	118

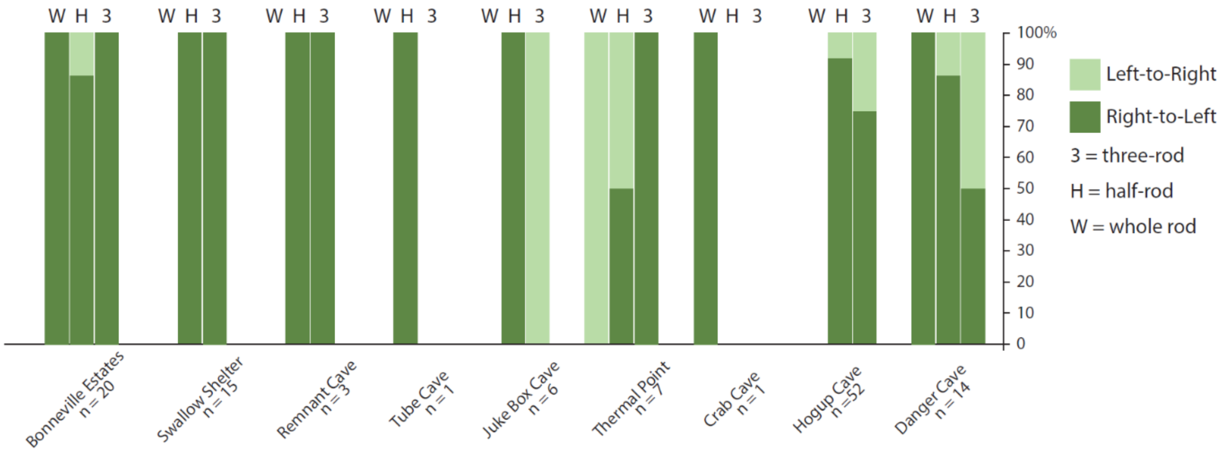

Figure 4.31. Work direction and foundation type. Half-rod and three-rod foundations are most frequently right-to-left work direction, but there is inter-site variability.

Stitches. Past reports have observed variation in "fineness" of baskets in the assemblages (Adovasio 1977), but this trait has not been defined. I have interpreted "fineness" to be defined as narrow in width; however, in this analysis the average width of stitches in basketry across the region is very similar, at around 2.58 mm, with a standard deviation of 0.462 mm. A comparison of the sites with the largest number of baskets where this attribute was measured (Bonneville Estates, Swallow Shelter, Juke Box Cave, Hogup Cave, and Danger Cave) by using a Kruskal-Wallis test fails to show a significant difference between the stitch width in these sites (H = 5.0104; N = 154; p = 0.28623) (Table 4.18).

Table 4.18. Variation in Basketry Stitch Width.

Site	Stitch Width Mean (mm)	Stitch Width Standard Deviation	Sample Size
Bonneville Estates	2.72	0.548902	23
Swallow Shelter	2.54	0.476259	16
Remnant Cave	2.89	0.398173	4
Juke Box Cave	2.53	0.495775	8
Thermal Point	2.56	0.440323	8
Hogup Cave	2.49	0.470678	59
Danger Cave	2.64	0.364697	36
Average	2.58	0.461918	154

There is regional variation in the presence of split stitches in basketry: Bonneville Estates Rockshelter, Swallow Shelter, Remnant Cave, Tube Cave, Crab Cave, and Thermal Point have low proportions of split stitches (0-50%), whereas at Hogup Cave, Danger Cave, and Juke Box Cave most baskets have some split stitches (62.5-75%) (Figure 4.32, Table 4.19). It is also important to note that although some of these split stitches may be unintentional, I have identified most as intentional, because of their consistent appearance on the basket (Appendix H). Weltfish (1930) observed inter-tribal variation in the location of split stitches on a basket, in terms of work surface, so I compared this attribute with work face as well. Across the region, split stitches on baskets are nearly evenly found on work, non-work, and both work faces, but there is inter-site variability in the proportions of the location of split stitches (Figure 4.33, Table 4.20). At Bonneville Estates and Remnant Cave, stitches are most commonly on the non-work surface. Juke Box Cave and Thermal Point have no baskets with split stitches on non-work surfaces. Swallow Shelter is unique in that most baskets with split stitches are split on both faces. At Hogup Cave and Danger Cave, split stitches are almost evenly distributed across both faces.

Table 4.19. Presence of Split Stitches.

Site	Split	Not split	Total
Bonneville Estates	10	13	23
Swallow Shelter	8	8	16
Remnant Cave	1	3	4
Tube Cave	0	1	1
Juke Box Cave	5	3	8
Thermal Point	2	6	8
Hogup Cave	38	20	58
Danger Cave	27	9	36
Crab Cave	0	1	1
Total	91	64	155

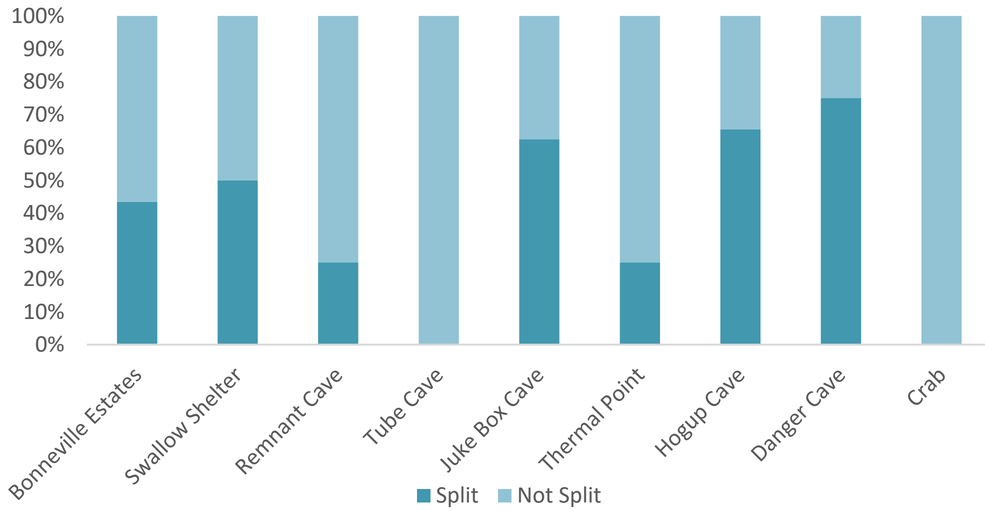

Figure 4.32. Split stitches across assemblages. There is variability in the proportion of baskets with and without split stitches.

Table 4.20. Location of Split Stitches on Basketry According to Work Face.

Site	Work	Non-work	Both
Bonneville Estates	1	8	1
Swallow Shelter	2	1	5
Remnant Cave	0	1	0
Tube Cave	0	0	0
Juke Box Cave	3	0	2
Thermal Point	2	0	0
Hogup Cave	12	10	14
Danger Cave	12	6	8
Crab Cave	0	0	0
Total	32	26	30

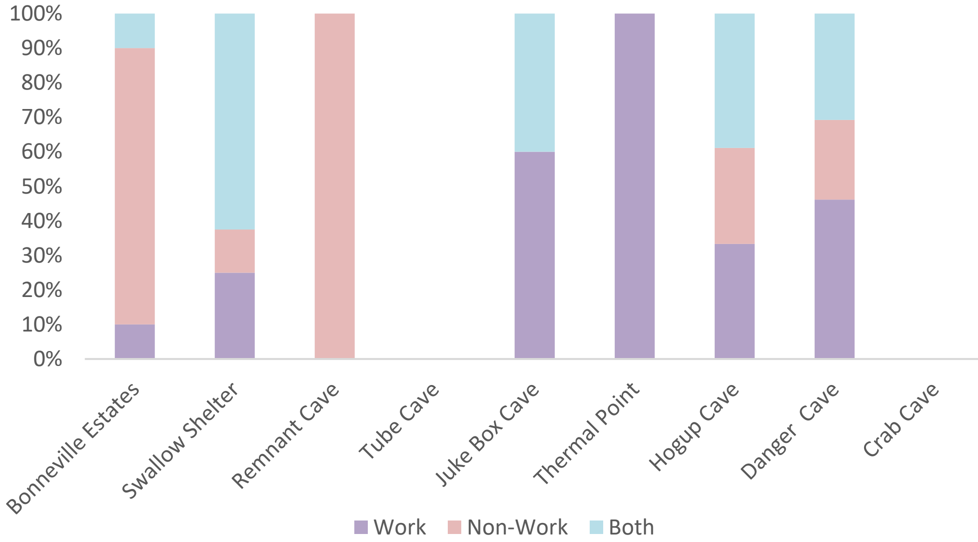

Figure 4.33. Location of split stitches. Regionally, split stitches are found almost evenly across work, non-work, and both faces, but there are site-by-site differences.

Non-interlocking stitches are the most common method of stitch engagement, representing 73.5% of the total assemblage, and Thermal Point and Crab Caves are the only sites in which interlocking stitches represent the majority type of stitch engagement (87.5% of the assemblage) (Figure 4.34; Table 4.21). Weltfish (1930) observed regional variability in the employment of interlocking and non-interlocking stitches, alongside regional trends in the work direction of the basket weaver. When I compared this type of stitch engagement with work direction, although right-to-left was the most common direction regionally, interlocking stitches in greater proportions are made from a left-to-right work direction (interlocking stitches are 34.2% left-to-right, whereas only 6.6% of non-interlocking stitches are left-to-right), which is considered statistically significant (p = 0.0001, N = 144; Figure 4.35, Table 4.22). Unlike split stitches, regional comparisons show that there is no statistical association between stitch engagement and work face (p = 1.0000; N = 112).

Table 4.21. Presence of Non-interlocking and Interlocking Stitches

Site	Non-Interlocking	Interlocking	Total
Bonneville Estates	21	2	23
Swallow Shelter	6	5	11
Remnant Cave	2	2	4
Tube Cave	1	0	1
Juke Box Cave	5	1	6
Thermal Point	1	7	8
Hogup Cave	44	14	58
Danger Cave	28	7	35
Crab Cave	0	1	1
Total	108	39	147

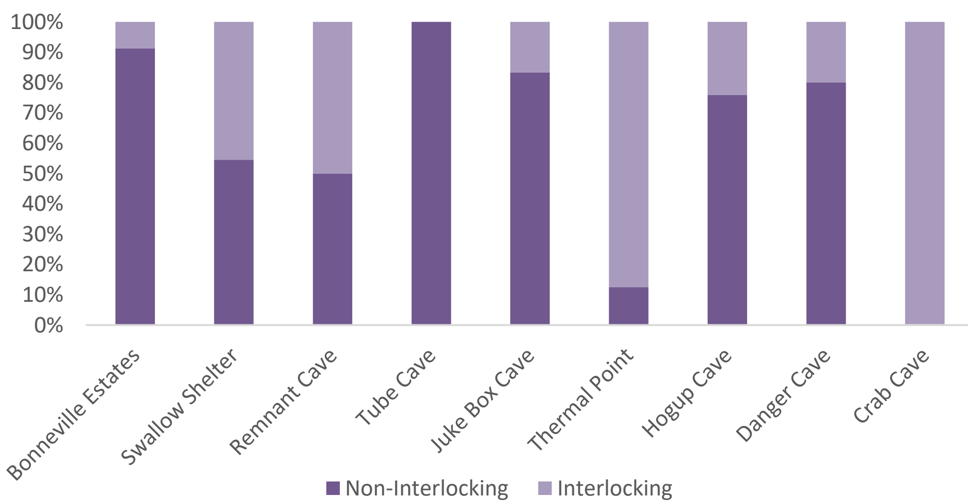

Figure 4.34. Proportion of interlocking stitches. Regionally, most baskets are made with non-interlocking stitches, but individual sites vary.

Table 4.22. Interlocking and Non-interlocking Stitches According to Work Direction.

Site	Interlocking		Non-interlocking		Total
	Right-to-Left	Left-to-Right	Right-to-Left	Left-to-Right	
Bonneville Estates	1	1	19	1	22
Swallow Shelter	5	0	6	0	11
Remnant Cave	1	0	2	0	3
Tube Cave	0	0	1	0	1
Juke Box Cave	1	0	5	0	6
Thermal Point	1	6	1	0	8
Hogup Cave	9	5	43	1	58
Danger Cave	7	0	22	5	34
Crab Cave	0	1	0	0	1
Total	25	13	99	7	144

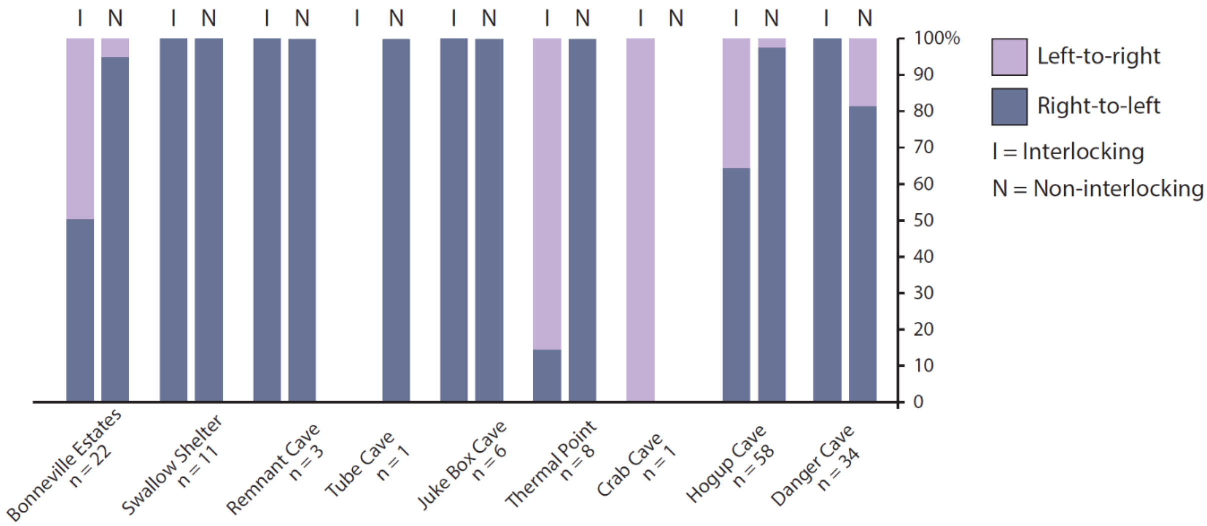

Figure 4.35. Proportion of interlocking and non-interlocking stitches according to work direction. Left-to-right work direction occurs more frequently on baskets with interlocking stitches than on non-interlocking stitches.

Foundation Unit Diameter. This metric attribute demonstrated little variation across the region. A Kruskal-Wallis test does not indicate a significant relationship within this attribute when comparing the sub-assemblages with largest sample sizes (Bonneville Estates, Swallow Shelter, Juke Box Cave, Hogup Cave, and Danger Cave; $H = 2.1622$; $N = 137$; $p = 0.70595$) (Table 4.23).

Table 4.23. Average Foundation Unit Diameter Across the Region.

Site	Foundation Unit Diameter Mean (mm)	Standard Deviation	Sample Size
Bonneville Estates	3.83	0.78348069	22
Swallow Shelter	3.99	1.091067629	15
Remnant Cave	3.77	0.499322458	4
Tube Cave	4.23	N/A	1
Juke Box Cave	3.79	0.870344759	8
Thermal Point	2.56	1.649120437	8
Hogup Cave	4.04	1.09333197	56
Danger Cave	3.82	0.750170285	36
Average	3.85	1.026498354	150

Basketry Comparative Groupings

As in cordage, the uneven sample size between sites may affect true determination of variation. Thus, individual sites were grouped to reflect attribute similarities identified during analysis, and tested to see whether these groups consistently were considered unequal populations. Like cordage, basketry attributes may also be divided into those associated with the functionality of the completed artifact and those that do not affect the functionality of the basket, or technological-stylistic elements. This simplistic division is complicated by the likelihood that some functional and stylistic traits, as in cordage, are entwined and dependent on other functional or stylistic traits. In this analysis, functional traits are considered form (trays and large bowls rather than small baskets, as indicated by work face), foundation (presence of bundle), and use wear, while the identified technological-stylistic traits are work direction, the presence of interlocking and split stitches, and potentially three-rod foundation types. Three-rod foundation, however, may have a functional association, because it is never associated with bundles, pitch, or burning; however, there are no studies which specifically discuss the function of three-rod basketry.

Two types of synthetic groups were created based on the attribute-type. First is a Functional Basketry Group, determined by sites that share similarity within basket form, use wear, and bundled foundation. Second is a Stylistic Basketry Group, determined by sites that share similarity within work direction, stitch sewing method, and engagement with the foundation. When two types of attributes overlapped in the above analysis, as in foundation (half-rod versus three-rod) and work face (work direction and split stitches), statistical tests were measured on both sets of groups (Table 4.24). Cluster analyses were conducted to confirm these groups (Figure 4.36), and they can be viewed regionally (Figures 4.37, 4.38).

Table 4.24. Comparing Presence/absence and Categorical Data of Basketry.

Attribute	Bonneville Estates	Danger Cave	Hogup Cave	Tube Cave	Juke Box Cave	Remnant Cave	Swallow Shelter	Thermal Point	Crab Cave	Sample Size
Work Face: Concave	○	◌	○	●	◌	◌	○	○	◊	114
Form: Tray/Wide Bowl	●	○	●	●	◊	●	●	◊	◊	37
Work Direction: Right-to-left	●	●	●	●	●	●	●	◌	◊	153
Foundation: Presence Half rod	●	◌	●	●	○	◌	○	◌	◊	138
Foundation: Bundle Presence	●	◌	○	●	○	●	○	◊	◊	155
Foundation: Presence 3-rod	◌	◌	◌	◊	◌	●	○	◌	◊	138
Use wear: Charred	○	○	○	●	◌	◌	◌	◊	◊	155
Use wear: Pitched	◊	◌	◌	◊	◊	◊	◊	◊	◊	155
Use wear Abraded	◊	◌	○	◊	◌	◌	○	◌	◊	155
Stitch Type: Interlocking	◌	◌	◌	◊	◌	○	○	●	●	147
Stitch Type: Split	○	○	○	◊	○	◌	○	◌	◊	155

Key		
High	75-100%	●
Moderate	40-74%	○
Low	1-39%	◌
Absent	0%	◊
	Functional	
		Group 1
		Group 2
	Stylistic	
		Group 1
		Group 2

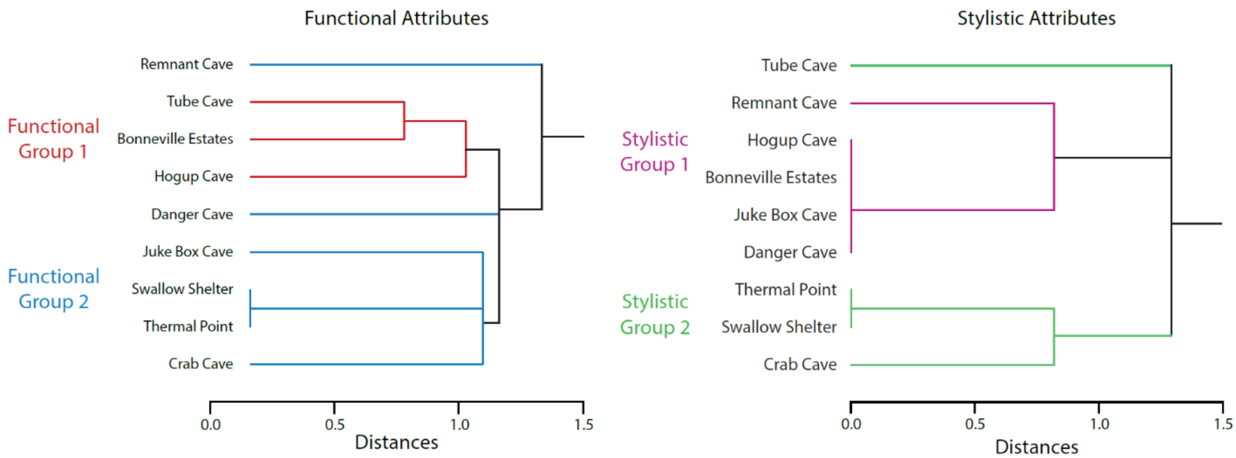

Figure 4.36. Cluster analyses of basketry attributes. (*Left*) When compared, the functional traits work face, form, half-rod-and-bundle foundations, and use wear form two sets of groups. (*Right*) The stylistic traits are not associated with the function of the artifact, which are work direction, three-rod foundations, and stitch types.

Work Face. Because work face in the above analysis may be associated with the intended form of a basket, two groups were created based on the relative proportion of concave versus convex work surfaces: Functional Basket Group 1 (Bonneville Estates, Hogup Cave, and Tube Cave), in which most baskets were made on the concave face (65.9-100%), and Functional Basket Group 2 (Swallow Shelter, Remnant Cave, Juke Box Cave, Thermal Point, and Danger Cave), in which most baskets were made on the convex side (50-67.7%). This is statistically significant, with two groups being distinguished ($p = 0.0013$, $N = 114$).

Work Direction. Table 4.12 illustrates that nearly all baskets at the sites are right-to-left work direction, with the exception of Thermal Point and Crab Cave, which are predominantly left-to-right work direction. When sites are compared according to the stylistic groups determined by cluster analysis, there is no statistically significant difference between these sites based on this characteristic ($p = 0.0738$, $N = 153$). When I compared work direction and work face, a functional trait that may overlap with work direction in the previous analysis, there appears to be a significant difference in stylistic basketry groups ($p = 0.0008$) when comparing

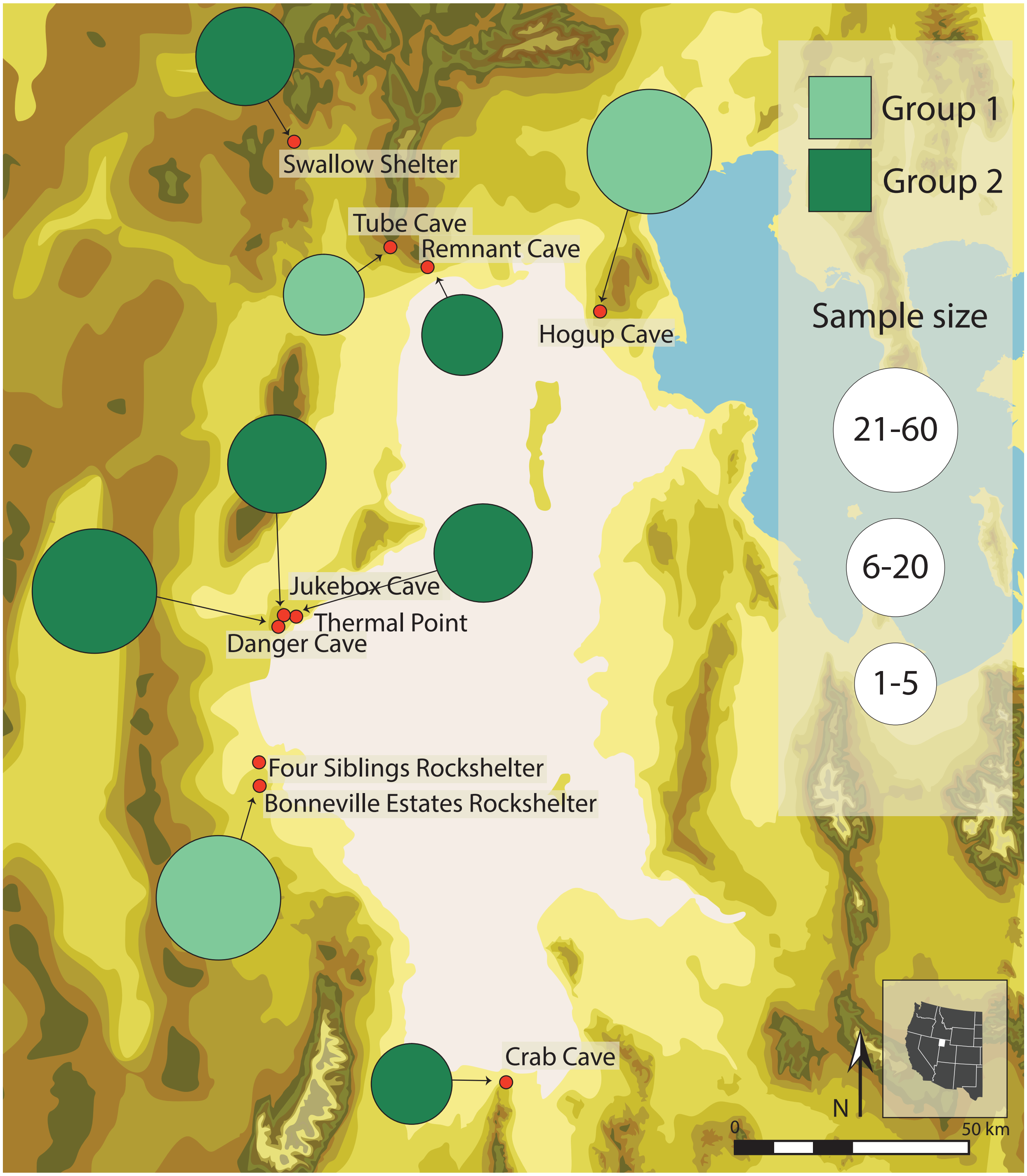

Figure 4.37. Basketry functional groups across the Bonneville Basin. Two groups were created based on similarities between the functional traits form, work face, half-rod and bundle foundations, and use-wear. Baskets from Group 1 are more associated with water handling and seed parching, whereas Group 2 sites have fewer trays and wide bowls and less parching. There were no baskets from Four Siblings Rockshelter.

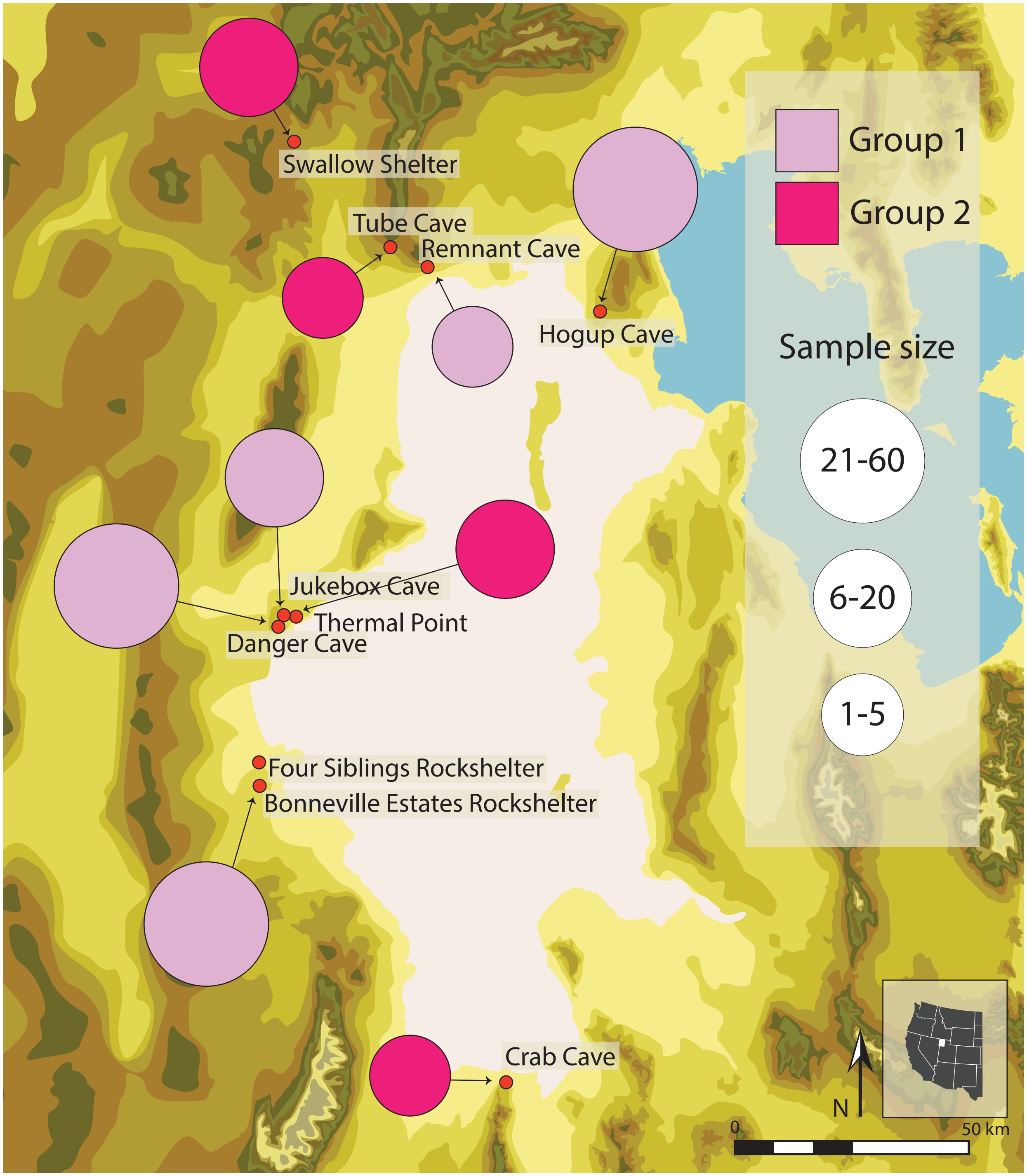

Figure 4.38. Basketry stylistic groups across the Bonneville Basin. Two groups were created based on similarities between the technological stylistic traits work direction, three-rod foundations, and stitch type. There were no baskets from Four Siblings Rockshelter.

right-to-left work direction and its appearance on work face. In Stylistic Basketry Group 1, right-to-left work direction is more commonly found on baskets with concave work surfaces (64% of the sub-assemblage), whereas in Stylistic Basketry Group 2, right-to-left work directions are more frequently on baskets with convex work surfaces (71.5% right-to-left work directions are on convex work surfaces). At all sites, left-to-right work directions are most frequently on concave work surfaces, and there is no difference between stylistic or functional groups (p = 1.000; p = 1.000).

Half-rod-and-Bundle Foundations. In Functional Basket Group 1 (Bonneville Estates, Hogup Cave, and Tube Cave) baskets have a dominance of bundled-baskets (67% of their assemblage), and in Functional Basket Group 2 (Swallow Shelter, Remnant Cave, Juke Box Cave, Thermal Point, and Danger Cave) baskets have a lower proportion of bundled-baskets (31% of their assemblage has a bundled foundation), and the comparison between these groups is found to be statistically significant (p = 0.0001, N = 80). Half-rod foundations are likely related to the presence of bundles, because whole-rod foundations are not commonly used alongside bundled foundations. Functional Basket Group 1 and Functional Basket Group 2 are found to be statistically unequal (p = < 0.0001), with Functional Basket Group 1 sites having proportionately higher numbers of bundles (78.4%) than Functional Basket Group 2 sites (40.6%).

Three-rod Foundation. I tested both group types when comparing this foundation type, because while half-rod-and-bundle foundation can be assigned to a functional category (watertight basketry), three-rod foundation is not clearly associated with any specific function. Relationship according to functional basketry groups is not demonstrated to be statistically significant (p = 0.5418, N = 32), because in both functional groups, there is a lower proportion of three-rod-foundation basketry. When analyzed according to stylistic basketry groups, there does appear to be a significant relationship (p = 0.0271), with Stylistic Group 1 sites having fewer three-rod foundation baskets (19.1%) than Stylistic Group 2 sites (43.5%). I consider three-rod foundations to be a stylistic trait, therefore, but this does not preclude the function of these baskets in an unknown context (Weltfish 1932).

Use Wear. When comparing assemblages according to functional basketry groups, however, there does not appear to be a statistically significant difference between the use of baskets across the region (p = 0.1813, N = 98), which may reflect the multi-functional nature of the most common basket type: half-rod and bundle foundation. When comparing stylistic groups, which in this case may be read as comparing sites that vary in their proportion of three-rod basketry, which is not associated with burning, there is a statistically significant difference (p = 0.00011). Stylistic Group 1 baskets are more frequently burned (41.5%) than Stylistic Group 2 sites (10.7% burned). Regarding other comparisons of use wear such as incidence of abrasion, there is no difference between functional group sites (p = 0.2269) or stylistic group sites (p = 0.1630). Staining is also not a statistically significant attribute in functional groups (p = 0.8631) or stylistic groups (p = 1.000).

Stitch Width. Stitch width was found to be similar across the entire region, but this attribute was compared according to groups identified above. When stitch width was compared according to stylistic basketry groups, the two populations were found to be equal using a Mann-Whitney test (U = 1580; Z = 0.21649; p = 0.82588), and an F-test also supports that the two stylistic groups are not statistically different ($F_{129,24}$ = 1.0702; N = 155; p = 0.8878). When groups are compared based on functional basketry groups, the two populations similarly are not found to be statistically significant (U = 2714; Z = -0.98125; p = 0.32708), because the standard deviations between the groups are similar ($F_{82,71}$ = 1.462, p = 0.102453).

Split and Interlocking Stitches. Sites were compared according to stylistic basketry groups for this attribute, and split stitches were more common in Stylistic Basketry Group 1 sites (Bonneville Estates Rockshelter, Remnant Cave, Juke Box Cave, Hogup Cave, and Danger Cave) (62.8%) than in Stylistic Basketry Group 2 sites (Swallow Shelter, Thermal Point, Crab Cave, and Tube Cave) (38.5%) ($p = 0.0287$, $N = 155$). The presence or absence of split stitches are not considered to have an effect on the functionality of the basket, and a comparison of functional basketry groups supports this ($p = 1.000$). However, when split stitches were compared according to work face, as in the previous analysis, there is a statistically significant difference, in which Functional Basketry Group 1 sites (Bonneville Estates, Tube Cave, and Hogup Cave) are more commonly split on the non-work surface (58.1%), whereas Functional Basketry Group 2 sites (Swallow Shelter, Remnant Cave, Juke Box Cave, Thermal Point, Danger Cave, and Crab Cave) have few baskets with split stitches on the non-work surface (29.6%) ($p = 0.373$). Whether stitches interlock when engaging with the foundation is considered in this analysis to be a stylistic attribute that does not have an effect on the functionality of the basket. The two stylistic groups are maintained with this analysis, with Stylistic Group 1 baskets less frequently having interlocking stitches (20.6%), and Stylistic Group 2 baskets having more interlocking stitches (61.9%), an observation that is statistically significant ($p = 0.0002$, $N = 147$).

Summary of Basketry Findings

This analysis illustrates that there is an intertwined relationship between traits which are associated with the function of basketry, but also the non-functional or technological-stylistic traits. The use wear recorded on baskets indicates that baskets throughout the region were multi-functional and generally utilitarian. The functional traits work face, form, half-rod-and-bundle foundations, and use wear when compared illustrate two sets of groups. Functional Group 1 sites (Tube Cave, Bonneville Estates, and Hogup Cave) have more baskets used for water handling and seed parching (trays/wide bowls and foundations with bundles) and are made more frequently on concave work surfaces, whereas Functional Group 2 sites (Danger Cave, Juke Box Cave, Swallow Shelter, Thermal Point, Crab Cave, and potentially Remnant Cave) have some of these same attributes, but with less of an emphasis on seed processing or water-handling.

The stylistic traits do not influence the function of the artifact, which are work direction, three-rod foundation, and stitch type, and two separate groups were identified: Stylistic Group 1 sites (Remnant Cave, Hogup Cave, Bonneville Estates, Juke Box Cave, and Danger Cave), which more frequently have right-to-left work directions, fewer three-rod foundations, more non-interlocking stitches, and split stitches. Stylistic Group 2 sites (Tube Cave, Thermal Point, Swallow Shelter, and Crab Cave) have a higher incidence of left-to-right work directions, more three-rod foundations, more interlocking stitches, and fewer baskets with split stitches. Although work face and use wear are considered functional traits, both of these attributes are associated with stylistic trends. The social implications of these observations will be discussed in the following section.

Comparison of Cordage and Basketry Groups

While attributes in both artifact types could be classified as functional, stylistic, or in some cases both, the groups identified through comparative analyses yielded different combinations of sites (Figures 4.22, 4.36; Table 4.25). In cordage, Stylistic Cordage Group 1 included Bonneville Estates, Hogup Cave, Swallow Shelter, and Thermal Point, while Stylistic Cordage Group 2 included Danger Cave, Tube Cave, Juke Box Cave, Crab Cave, Remnant Cave, and Four Siblings. Alternatively, in baskets, Stylistic Basketry Group 1 included Bonneville Estates, Danger Cave, Hogup Cave, Juke Box Cave, and Remnant Cave, while Stylistic Basketry Group 2 included Tube Cave, Swallow Shelter, Thermal Point, and Crab Cave.

In cordage, most sites have a similar distribution of functional traits, but Juke Box Cave, Crab Cave, and Four Siblings could not be assigned to a single group, and there are no data from Danger Cave and Hogup Cave that currently can be considered. Alternatively, when comparing sites grouped through function in basketry, Functional Basketry Group 1 sites include Bonneville Estates Rockshelter, Hogup Cave, and Tube Cave, and Functional Basketry Group 2 sites include Danger Cave, Juke Box Cave, Remnant Cave, Swallow Shelter, Thermal Point, and Crab Cave (Figure 4.37). In both functional and stylistic traits, site grouping is variable when comparing sites according to similarity in cordage and basketry, which may be a reflection of separate functional and social contexts of how these cultural materials were made and used.

This method of creating groups of sites may be justified by acknowledging that these sites were likely seasonally occupied by various mobile groups, so potentially the assemblages at the sites may be associated with the activities of a networked community, rather than treating each site as independent. Importantly, although groups could be created based on similarity of measurements of a variety of analyzed attributes, groups established using cordage attributes were not the same groups established with basketry attributes (Figure 4.39, Table 4.25). This suggests that there is a difference in terms of a combination of possible elements, such as the activities at the site, variable uses of material culture, processes associated with the manufacture of the material culture, and potentially the identity of people making the material.

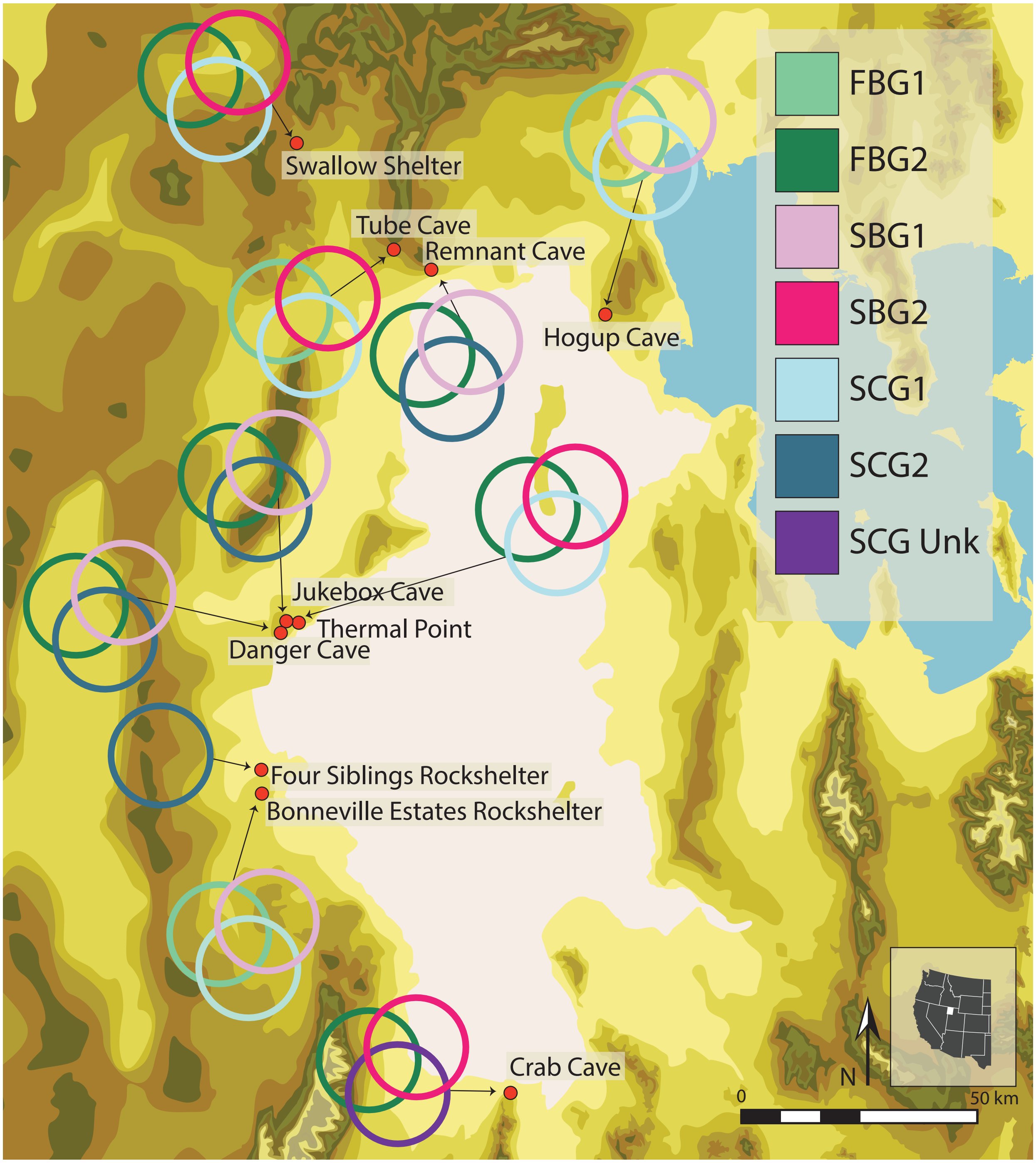

Figure 4.39. Cordage and basketry groups. Cordage was functionally similar, so there are no cordage functional groups. Groups were inconsistent when compared according to basketry and cordage, or functional or stylistic traits. Hogup Cave and Bonneville Estates are similar to each other, and Danger Cave, Juke Box Cave, and Remnant Cave are consistently similar. Thermal Point and Swallow Shelter are consistently similar to each other. Tube Cave is most like Swallow Shelter and Thermal Point when stylistic groups are compared but dissimilar from those sites when comparing functional basketry groups.

Table 4.25. Assigned Site Groupings According to Attribute Types.

Site	Cordage		Basketry	
	Functional Group	Stylistic Group	Functional Group	Stylistic Group
Bonneville Estates	1	1	1	1
Danger Cave	-	2	2	1
Hogup Cave	-	1	1	1
Tube Cave	1	2	1	2
Juke Box Cave	2	2	2	1
Remnant Cave	1	2	2	1
Swallow Shelter	1	1	2	2
Thermal Point	1	1	2	2
Crab Cave	2	2	2	2
Four Siblings	2	2	-	-

Discussion

A few caveats must be acknowledged and reiterated before interpreting the above findings. While my study is an improvement on past studies which often conflated deep time periods, my interpretation of late Holocene materials in the Bonneville Basin would still benefit from better chronological control. This conflation was a necessary step, however, because most of the early excavations of the sites included did not clearly distinguish such finer stratigraphic or chronological distinctions when compared to sites excavated later in time. The late Holocene is a period of notable cultural changes, and it is likely that there is a great deal of variation within the ~4,400 years attributed to the study. Bonneville Estates is the only site with a well-dated late Holocene assemblage, and it will provide a good comparison for future studies using directly dated artifacts to track changes through the late Holocene. For this analysis, I have focused on regional patterns rather than temporal patterns.

Cordage Chaîne Opératoire

Characterizing the *chaîne opératoire* of cordage manufacture in the Great Basin to the assemblages is a starting point for interpreting similarities and differences of sub-assemblages. For the first stage, selection, it is unknown whether cordage raw materials were gathered in close proximity to each site. There is a general trend of sites containing fine and coarse plant material and faunal cordage, in declining order of relative proportion, indicating a regional consistency in the selection of cordage material. Plant selection is an active decision made by the cordage-manufacturer likely based on the intended final function of the cord: coarse plant fiber is weaker and ill-suited for making nets, traps, and rabbit-skin blankets, whereas plants with fine fibers are stronger and best suited for those tasks.

For the second stage, preparation, the specific method of preparing the plant raw materials into usable elements is assumed to be similar to those observed historically, and there is no archaeological evidence otherwise. Fine plant fibers were isolated using methods outlined in Chapter 1, whereas coarse plant material required less preparation and was potentially more expedient. As in the selection stage, people preparing fibers would have made active decisions based on the proposed function of the cordage, following a standardized method of isolating fibers. It is unknown whether materials were prepared at the sites in the assemblage, but the presence of fine cordage in higher proportions than coarse cordage indicates that regionally, specialized cordage was especially important for occupants of these sites. The raw material used and prepared is assumed to have little communicative impact to the community of cordage-makers and users, unless there was specialization or division of labor for the process of preparing raw plant materials.

For the third stage, construction, most sites in the Bonneville Basin have a majority of fine and tightly-twisted cordage made by consolidating prepared fibers into typically two spin plies. Spinning fiber is a necessary method in construction, which allows for plies to be combined, strengthening the cordage. As discussed in Chapter 1, the method of spinning plies either by rolling loose fibers either up or down, then reversing the spin to combine multiple plies, yields equally functional cordage, regardless of the starting construction method. Regionally, most cordage is z-spin, and in most cases, z-spin cordage is found mostly on fine cordage. Fine z-spin cordage has little variability in diameter measurements across the region, which suggests that there is a consistency in how people made z-spin cordage. S-spin cordage is also found on fine cordage and in greater proportions at Four Siblings, Remnant Cave, Tube Cave, and Juke Box Cave, but there is limited consistency in average diameters of this cordage. The construction phase also includes adding sheet-bend knots and loops for nets and traps, and these are found most often on fine cordage. Coarse cordage more frequently has simple overhand knots.

Even though all fine, tightly twisted cordage may be used for specialized tasks, the variability in the two spin directions show different trends in this construction phase of the *chaîne opératoire*. Spin direction is considered a technological-stylistic trait, and the first trait in the *chaîne opératoire* associated with a decision made based on how a person was taught and acquired motor habits, rather than an active choice for decoration or for functional reasons. Spin direction is considered a low-visibility trait with little communicative impact, as discussed in Chapter 1. It is not an invisible trait, however, and the process of creating a z- or s-spun cord is an activity that would have been observed by members of the community. Ethnographers recorded that there was a division of labor based on the intended function of cordage, with men more frequently making nets than women (Kelly 1932; Malouf 1940; Smith 1974; Steward

1938), which may be projected onto the manufacture of archaeological specimens. Spin direction, a necessary step in the construction stage, therefore, may be an expression of different traditions of gendered tasks. Men may have been observed in the community as spinning and plying cordage for netting by rolling fibers up the thigh (z-spin), and teaching boys to do the same, and women and girls were observed rolling fibers both up and down the thigh, with less standardization. The social implications of these observations will be discussed in greater detail in Chapter 5.

The fourth stage of the *chaîne opératoire*, use, repair and discard, is the inference that many of these fine, tightly-twisted cords are potentially associated with net-hunting or trapping small game. Coarse cordage also is found in nearly all sites, further emphasizing the presence of other activities at the site outside of hunting. Most cordage I studied across the region are small, torn and cut pieces, not cached, completed nets. Nets were repaired as they became damaged, and the fragments of fine cordage in most sub-assemblages likely represent the repair and discard stage in the *chaîne opératoire*. Coarse cordage, assumed to be more expediently made, appears to be more associated with generalized tasks, and much of the coarse cordage may have less frequently been maintained to the same degree of fine cordage. Coarse cordage is also mostly fragmentary and torn, not cached completed artifacts, which were disposed of after they were damaged.

Basketry Chaîne Opératoire

The use-life of basketry also follows a clear *chaîne opératoire*, which may be traced through the attributes I measured. The attributes associated with the initial two stages—selection and preparation—with one exception, statistically indicate no significant variability within the late

Holocene of the Bonneville Basin, and this is discussed in greater detail in Chapter 5. These attributes associated with preparation are stitch width and foundation unit diameter. Ethnography discussed in Chapter 1 indicates similarity in the selection of willow stems based on a preferred size and straightness, and preparing elements by soaking plant stems and splitting them into three parts (Dean et al. 2004; Farmer 2012; Kelly 1932), and this method likely yields a comparable size of elements. The observation that there is little variation in the metric attributes of foundation and stitches suggests that the initial stages of preparing elements for basketry manufacture were similar across the region in the late Holocene, and into the ethnographic present.

There are, however, important regional differences in other categorical attributes associated with the third manufacturing stage, construction, including work face, work direction, foundation type, and the way stitches engage with each other and the foundation. Not only were these broad attributes variable, when these attributes were further compared with each other, it became clear that individual attributes like work direction or work face were more meaningful when analyzed according to multiple characteristics. Work face, which although it does not necessarily have an effect on the ability for a basket to be able to hold water, store seeds, parch seeds, etc., is part of the initial decision-making steps of basketry manufacture. The ethnographic record indicates there may be a correlation between which face is worked and the intended function of the basket, because it is more convenient to make a small basket from the outside where it is easier to manipulate an awl (Weltfish 1930). Alternatively, a flat tray or large basket is not necessarily any more or less conveniently made from the inside or outside of the basket. Weltfish (1932) also observed that in archaeological specimens, some baskets were worked on both faces: in Southwestern Basketmaker assemblages, large baskets were worked on the concave face until the basket shoulder was reached, and then the basket was worked on the convex surface as the basket opening constricted.

In my analysis, there is a nearly standardized method of manufacture of small bowls, in which 91% are worked on the convex face, which supports Weltfish's (1930) assertion that work face is associated with efficacy of manufacture in smaller or more narrow baskets. Wide bowls and trays are nearly equally worked on both faces, indicating that there was still a less standardized method of manufacture for larger baskets across the region; although wide bowls and trays are slightly more commonly made on the concave work surface. The above analysis of functional basketry groups indicated that there is a functional difference between these sites according to this attribute. Bonneville Estates, Tube Cave, and Hogup Cave had a larger proportion of concave work faces than other sites, and these sites also have proportionately higher percentages of concave work surfaces. This further supports that this early step in the construction stage of basketry is likely a decision based upon the intended final form of the basket.

The configuration of foundation elements is the next step in the construction phase. Some foundation types, such as whether the basket is open or close or if it includes a bundle, have an effect on final functionality of the artifact, primarily in terms of the ability of a basket to hold water, and these functional decisions would have been consciously made. Beyond this inferred function of bundles in foundations for making water-tight baskets and including a half-rod rather than whole-rod likely to control the wall thickness of the basket, other configurations of a foundation, such as the number of rods, whether they are whole, or the arrangement of rods as stacked or triangular, have little functional influence on the proposed use of a basket; however, a conscious decision was still made in their selection. Foundation is a trait that is hidden after the completion of the basket, at least in the case of close-coil baskets, and therefore it has little active communicative value outside of the construction stage, other than the context in which a basket was used. For instance, a basket weaver who chooses to construct a three-rod basket would have predicted that it will not be used for handling water or seed parching.

After deciding on the foundation type, work direction is the next important step in the construction stage. This is not likely a conscious decision made by the basket weaver when considering the final form or function of the basket. This trait is largely homogeneous across the Bonneville Basin, except in subtle differences between Thermal Point (the only site with equal proportions of right-to-left and left-to-right basketry) and Swallow Cave (the only large site with only one type of work direction). But when work direction is analyzed alongside other attributes associated with the function of the completed artifact and other stylistic traits, a multi-scalar relationship between these attributes is noticeable. The fact that most sites include both work directions likely indicates that there is some variation in how people are learning to make baskets, where most women work right-to-left, but some women who learned to work from left-to-right pass on this construction method to their apprentices. This trait is overlaid on top of the initial decisions about basketry form, work face, and foundation type, because work direction appears to not be predictive of foundation type or the final form of the basket. In the case of work face, right-to-left work direction was found more commonly on baskets made on the concave face at Bonneville Estates, Hogup Cave, and Tube Cave, whereas right-to-left was worked on convex work faces more frequently at the other sites. Left-to-right-worked baskets were much more commonly to have concave work faces at all sites. Therefore, this stage does not appear to be a random decision made by the basket weaver, at least in the case of wide bowls or large baskets. Stitch slant, although a visible trait in a finished basket, is considered low-visibility with little communicative value (Weltfish 1930). Weltfish’s (1930, 1932) and Steward’s (1938) comparisons of finished basketry and manufacture do suggest that craft traditions between tribes are expressed through this construction trait, whether actively or passively.

After the basket weaver begins working from right-to-left or left-to-right, stitches are engaged with the foundation. The nature of stitches, in terms of their being split or not split, is also generally homogeneous across all sites, with split stitches occurring less frequently on basketry than unsplit stitches. There is no functional reason why a basket-weaver would choose to make a basket with split stitches, and no perceived relationship between work face or where a split stitch side is located; however, most baskets with split stitches are only split on one side of the basket. This may support Weltfish’s (1930) assertion that split stitches may sometimes occur as an unintentional result of work face, the split stitches occurring more frequently on the less visible, and therefore less tidy, face of the basket. Split stitches may also be a decorative trait. There also does not appear to be a relationship between foundation type and whether a basket has split stitches or not. Because there appears to be no relationship between the function of a basket and whether stitches are split, this is considered a technological-stylistic attribute, as is supported by statistical tests. This is a fairly visible characteristic when it occurs on the most commonly used side, but because it can appear not only for decoration, its communicative value is limited. The presence of both types of stitches across the region may indicate some flexibility in the preferred method of manufacture. The application of pitch similarly effects the impermeability of the basket, and this may explain why at Danger Cave, where there are fewer baskets with bundles, there are proportionately more pitched baskets than at other sites with more bundled-baskets. The function of these baskets may be further explored by analyzing baskets according to the fourth stage in basketry manufacture: use/repair/reuse.

This fourth stage of the *chaîne opératoire* in basketry, use/repair/reuse, may be addressed with use wear. Burning on the inside of a basket may be evidence that it functioned as a seed or nut-roasting tray or perhaps used for stone boiling (Burrillo 2015; Eerkens 2004; Ellwood et al. 2013), and this has been observed on baskets with and without bundles. Unlike other foundation types, three-rod basketry is not commonly associated with burning. There is only one example of pitching on three-rod basketry, which is from Hogup Cave (cat. no. FS 245.112c), so this also suggests that this type of basketry was generally not used for carrying water or cooking. I suggest that this basketry foundation type was not intended to serve the same function as other basketry, whether it is single rod or contains bundles. Instead, three-rod basketry is associated with abrasion, polishing, and staining, which unfortunately does not clearly show how such basketry was used, only that it was used.

Few baskets in these assemblages are complete, and instead they are heavily worn, burned, or damaged. Cordage and stitches were used to repair holes in some baskets at Bonneville Estates (cat. nos. 5142, 10682), Swallow Shelter (cat. no. 279.2-1), Hogup Cave (416.223), and Danger Cave (cat. nos. 22545.1, 19657.3), or reinforced with a leather strip, such as at Crab Cave (cat. no. 78.27.7.2), all evidence of attempts to extend the use-lives of the baskets. At the point when baskets were discarded in the case of parching trays, stitches were burned through to expose the foundation, which could not be repaired. Other baskets were discarded when foundations were too broken to be repaired.

Conclusion

Cordage and coiled basketry from these ten sites reinforce the importance of mobiliary material culture in the everyday lives of late Holocene hunter-gatherers. These perishable artifacts served an important role in seed processing and cooking, storage, and the procurement of small game, but they also served unknown and flexible functional roles at the sites in which they were used and discarded. Statistical analyses indicate relationships between the assemblages, which have been interpreted as potential evidence of some standardized methods of artifact manufacture that influence how the artifacts were used. The differential relationship between site assemblages when compared according to the inferred categorical distinction of attributes—i.e. the difference between functional and technological-stylistic traits in cordage and basketry—reemphasizes the complex nature of perishable artifacts as both functional and communicative objects. Attributes such as final form and use wear are indicative of the artifacts' intended roles in food procurement and processing; however, other stylistic traits like spin direction and work direction unify sites outside of the inferred function of the site or artifact. This incongruity of site similarity based on elements of perishable artifact manufacture may point to differential variation in craft tradition among men and women.

In the next chapter, I apply the results of this synchronic analysis and the diachronic analysis of Bonneville Estates Rockshelter from Chapter 3 to a series of competing models developed to explore potential mechanisms of ethnogenesis and the maintenance of craft traditions. These models direct interpretations of inter-site variability, and demonstrate how cordage and coiled basketry archaeological assemblages represent expressions of a dynamic cultural landscape within a bounded geographical landscape. Using this framework, curated perishable artifacts continue to serve their traditional interpretive role of contributing to large issues like paleoecological reconstruction and subsistence strategies of mobile hunter-gatherers, but in a more nuanced fashion that incorporates updated perspectives on complex societal interactions.

CHAPTER 5

TESTING MODELS OF TECHNOLOGICAL AND SOCIAL PATTERNS

Introduction

Throughout this dissertation, I have revisited common themes in Great Basin archaeology regarding the ways in which ecology influences patterns of technology, subsistence, and settlement in hunter-gatherer societies, and the ways perishable artifacts can inform on overlapping scales of social interaction and identity. These broad themes seek to characterize the ethnogenesis of Great Basin hunter-gatherer groups, especially during the late Holocene. In this chapter, I explore the results of the analyses presented in chapters 3 and 4 in the context of traditional explanations for observed patterns in perishable-artifact variability. First, I will outline a series of models which synthesize the commonly invoked explanations for observed trends, illustrating the justifications for these models when applied to studies of social change in the eastern Great Basin. Second, I evaluate these models alongside my diachronic and synchronic observations of coiled basketry and cordage in the Bonneville Basin. By comparing traits associated with the function of an artifact or the stylistic traits associated with a tradition in which a craft was produced, basketry and cordage can reflect patterns in subsistence, gender, community, and kinship, potentially providing evidence that these patterns may be the result of multiple models. Third, I survey basketry and cordage from other culture areas of the Desert West to contribute to a broader, deeper understanding of technological borders between the Bonneville Basin's foragers and farmers and the inhabitants of the larger Desert West geographic region. I demonstrate that the traditional view of large-scale migrations in the Bonneville Basin is incorrect, but a more complex understanding of gradual, small-scale migration resulting in a diffusion of technological traits is the most parsimonious explanation for the appearance of new basketry stylistic attributes in the Bonneville Basin, and that this was potentially driven by kinship practices which brought women into the region from craft traditions outside of the Bonneville Basin.

A Note on Terminology

Ethnogenesis is a term frequently applied to the development of historic ethnic groups post-colonization (Hill 1996); however, in Chapter 1, I discussed the problematic assumptions of defining and assigning ethnicity in archaeology, because our archaeological perspective is etic and often at odds with the perspectives of indigenous people (Cipolla 2017; Jones 2005; Shoemaker 2002; Yanicki 2019; Zimmerman 2008). When I use the term "ethnogenesis", I use it in a more inclusive sense to include the development and reinforcement of cultural norms within a broad-scale identity (Rouse 1986; Voss 2015; Weik 2014). While I emphasize the flexibility of identity, group membership may be detected in archaeology because craftspeople adhere to and perpetuate traditions of craft production. The cultural designations of Fremont, Archaic "pre-Numic" hunter-gatherers, Ancestral Puebloan, Ancestral Dene (or Promontory Cave people), and Numic are part of the common parlance of the archaeology of the late Holocene in the Desert West, so I continue to use these names when discussing understood human cultural and geographic boundaries during this period. Although these archaeological groups may not perfectly map onto emic ethnic groups of the past, I argue that the material cultural traits archaeologists use to define these cultural groups are often the same as those used by ethnic groups, both consciously and unconsciously to signify their identity. These culture areas are illustrated in Figure 5.1. For other time periods in the eastern Great Basin, I broadly refer to groups by their geographic location and broad climatic time period, as I have throughout this study.

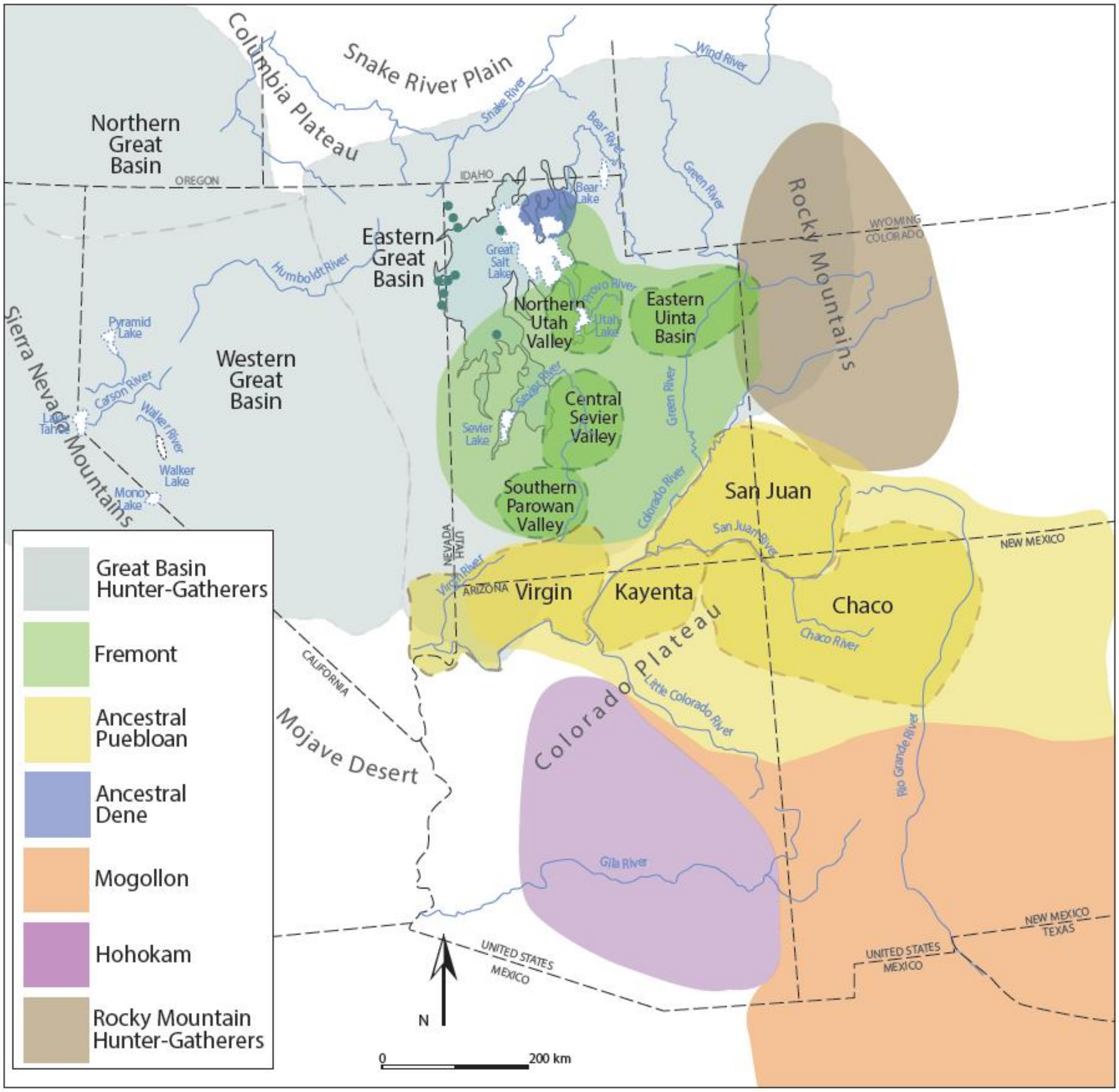

Figure 5.1. Culture areas in the Desert West and surrounding areas in the late Holocene, dating to ~1,450-500 cal BP. Fremont and Ancestral Puebloan (Basketmaker III-Puebloan III) sub-cultural areas are also depicted (based on maps from Allison 2008; Geib 2011; Leach 2018; Ure 2013).

Models

Migration is the most cited mechanism to explain why basketry and cordage technological change is observed in Great Basin hunter-gatherer societies, particularly in the late Holocene, but other alternative explanations are posited for other types of technological variation. These major models to determine the cause of observed technological variability include 1) large-scale ethnic migration; 2) adoption of new technology from neighbor introduced through diffusion or small-scale migration; 3) cultural drift, or random local development in isolation from neighbors; and finally, 4) change occurring as a necessary and conscious response to environmental change. These mechanisms are frequently short-hand explanations in the Great Basin, without solid establishment of parameters and expectations, and are unfortunately treated as exclusionary, rather than addressing the overlapping nature of cultural processes. These explanations are often provincial, lacking a wider understanding of how these mechanisms operate in reality or in other regions, and these models may also lack nuance. Below, I provide a discussion of the history of these explanations, the potential evidence for them having played out in the eastern Great Basin during the late Holocene, and expectations for how they may be expressed in coiled basketry and cordage in the Bonneville Basin. Table 5.1 characterizes these alternative models as they are traditionally presented, and expectations relevant to my data.

Table 5.1. Traditional Models of Perishable Technological Change in the Great Basin.

Process	Impetus	Speed of Change	Relation to Rest of Material Culture	Stylistic Variation	Functional Variation	Scale	Assemblage-scale Homogeneity	Expectations in Cordage and Basketry
Population Replacement (large-scale migration)	Population replacement by large-scale ethnic group	Rapid	Suite of traits across multiple technologies	Yes	Maybe	Large scale, regional	Homogeneity of stylistic traits across assemblage	Both cordage and basketry should show a major shift, especially in stylistic traits
Adoption of new technology through diffusion/small-scale migration	Introduction via trade or local replication of technology introduced through small-scale migration	Rapid or gradual	Suite of traits in single technology	Yes	Maybe	Small scale, localized	Homogeneity if a trade good, less homogeneous and hybridized if replicated	Cordage or basketry should show a major shift in multiple traits, but not both artifact types
Random drift / in situ development	Local unconscious innovation unrelated to adaptation	Gradual	Some stylistic and functional traits in some technologies	Maybe	Maybe	Small scale, localized	No homogeneity	Cordage or basketry should show a gradual shift in how they are made or used
Environmental adaptation	External environmental stressors require technological innovations	Rapid or gradual	Changes only to functional traits on subsistence-related technologies	No	Yes	Large scale, regional	Homogeneous across functional categories	Cordage or basketry should show a gradual shift in functional (subsistence), but not stylistic traits

Model 1: Technological Change is the Result of Population Replacement

Large-scale ethnic migration is traditionally the default explanation (Adovasio 1986, 2012; Adovasio and Pedler 1994) invoked for basketry technological change in the eastern Great Basin during the late Holocene. Because migration is so frequently proffered for the appearance of Fremont- and Numic-attributed artifacts in the late Holocene, this epistemological discussion requires the most nuanced discussion of all the models. A key element to a traditional migration model is the establishment of broad-scale groupings or ethnicities in the past, as discussed in detail in Chapter 1 (see also Barth 1969; Clark 2004; De Voss 1995), embedded in a culture historical approach. Ethnicity is commonly associated with shared history, language, and spiritual practices, etc., and membership is assumed when there is multigenerational reproduction of cultural traditions and norms. The identification of a specific ethnicity, therefore, is an integral part of tracing broad human movement across a landscape, and this form of social grouping is reinforced through the maintenance of cultural norms in material culture and practice.

In the traditional use of the term, migration involves the permanent relocation of a distinct ethnic/cultural population into a new region, either as a single event or a series of events, which in the eastern Great Basin, is generally assumed to be one-way, with immigrants sometimes also maintaining contact with kin-groups' homelands (Fowler 2011). This is differentiated from small-scale migration, discussed as part of Model 2. In the eastern Great Basin, migration is traditionally understood to be done on a large, community-wide, multi-family scale, resulting in new challenges to identity maintenance and negotiation (Barth 1969). In this understanding of migration, it is proposed that if the new region was already inhabited, the immigrants may have supplanted the local population, replaced them, assimilated them, or were assimilated by the local population, but immigrants may also have cohabitated in the same region, or creolized (Rouse 1986). All of these interactions would have heightened identity negotiations and may have resulted in the establishment of new cultural norms and new social ties, or developed into a creation of a new identity. In establishing migration in archaeology, it is important to be able to establish relative chronology of the region and to identify patterns of cultural signatures of cohesive groups (Rouse 1986). Migration here is differentiated from seasonal movements common in hunter-gatherer groups in the Great Basin (Steward 1938). A frequent focus of migration is determining not just the effect of migration but also its cause (i.e. social pressures, reaction to changing environment, adoption of a new subsistence strategy) (Rouse 1986).

Expectations. Although migration is best characterized on multiple scales ranging from family groups to ethnic groups, the model most frequently employed in Great Basin studies in the late Holocene is a large-scale, ethnic population migration resulting in supplanting local populations rather than hybridizing or blending cultural identities. This model also assumes that if there is a large-scale migration and not acculturation or assimilation of a migrant group into a native group, evidence of identity maintenance, will be observed. Within this understanding of a migration model, an abrupt change in technology (basketry and/or cordage) is expected representative of a new population, along with changes in other technologies in the assemblage (other perishable artifacts and non-perishable artifacts). There should be simultaneous and homogeneous technological change across multiple sites, because it is assumed the technology is arriving as a suite, and it is expected that there will also be a change in technological and decorative style, as the new population will have been trained in a separate craft tradition. In perishable technology, this large-scale migration should be expressed through shifts in technological-stylistic traits like cordage initial spin direction and basketry work direction, which is evidence of separate craft traditions of local and immigrant populations. The large-scale migration model requires that there is variability in both cordage and basketry, because these crafts represent a larger community population, not just craft histories of a subsection of the community.

Defining Fremont Ethnicity. Large-scale migration is a major explanation for technological change in the Fremont period in the late Holocene, because the construction of ethnic identities in archaeology necessarily includes consideration of a geographic homeland. Migration may be responsible for the appearance of Fremont archaeological traits, but it may also be responsible for the end of the Fremont period. With the late Holocene appearance of new cultural traits like maize, permanent residential and ceremonial architecture, storage facilities, clay figurines, nonlocal shells and turquoise, and grayware ceramic vessels in the eastern Great Basin and Colorado Plateau, this has been presented as evidence of a migration of a new ethnic group into the region (Coltrain and Leavitt 2002; Gunnerson 1969; Janetski et al. 2012; Talbot 2000). There is an ongoing debate among Great Basin and Southwestern archaeologists regarding Fremont genetic and cultural origins, cultural time span, geographic distribution, relationships with nearby cultural groups, and level of dependence on domesticated plants versus wild resources (Adovasio 1976; Adovasio et al. 2002; Aikens 1967; Allison 2010; Coulam and Simms 2002; Fisher 2012; Hockett 1998; Holmer and Weder 1980; Janetski 2002, 2003; Janetski et al. 2012; Keyser 1975; Madsen and Simms 1998; Smith 1994; Talbot 2000; Ugan 2005). In defining Fremont ethnic identity, some archaeologists point to decoration, architecture, ceramic technology, and apparent Fremont influence from and affinity toward Southwestern Ancestral Puebloan groups (Allison 2010; Janetski 2003; Talbot 2000). Differentiating Fremont identity is difficult, however, when considering their flexible subsistence practices, lithic technology, and basketry technology, which may not be distinct from other late Holocene hunter-gatherers in the Great Basin (Holmer and Weder 1980; Madsen and Simms 1998). Unfortunately, many Fremont sites are poorly dated, complicating the reconstruction of Fremont geographic and cultural homelands and the timing of the proposed migration. Traditionally, Fremont culture is thought to date from 1,300 to 500 cal BP (Madsen and Simms 1998), which I will continue to perpetuate in further discussion of the Fremont period literature, but recent studies suggest 2,000 to 700 cal BP (Janetski and Talbot 2014; Talbot 2018) is more likely, based on the appearance of domesticated crops in the region. Regardless of specific dates, evidence suggests variation exists for the start of the Fremont period at different sites.

Fremont basketry is commonly identified as a distinct collection of traits, employing eight kinds of foundation types of coiled Fremont basketry (Adovasio et al. 2002; Fowler 2002) (Table 5.2). These are mostly close-coiled, half-rod-and-bundle stacked, with non-interlocking stitches, but also include other configurations (Adovasio et al. 2002). A more simplified definition of Fremont basketry is that there are three major foundation types: half-rod-and-bundle stacked, half-rod-and-welt stacked, and whole-rod-and-bundle (Talbot 2018). Most basketry is identified as having a right-to-left work direction, concave work surface on bowls and trays, a convex work surface on deep bowls and carrying baskets, and use-wear indicating seed parching, storage, and transport (Adovasio et al. 2002). Adovasio's identification of Fremont typology reinforces the construction of this archaeological ethnic identity, although he does not use the development of this distinct typology as evidence of migration but rather drift (see Model 3). Criticisms of Adovasio's research on Fremont-type basketry includes his overstating the distinctness of Fremont basketry, because some Fremont-types like half-rod-and-bundle foundations are also found in Ancestral Puebloan assemblages contemporaneous with Fremont, potentially evidence of migration from the Southwest (Horting 2000; Talbot 2018) (Table 5.2).

Although Fremont ethnic ethnogenesis is not necessarily the result of migration from the Southwest, this construction of a Fremont basketry typology also has led to problematic assertions that any time Fremont-type basketry appears in the archaeological record, a Fremont person is associated with it either directly through migration or indirectly by way of trade (Adovasio et al. 1982). For instance, sites in Idaho, like Jackknife Cave, Pence Deurig, and Little Lost River Cave No. 1, have in the past been considered Fremont sites, based on the presence of Fremont-type basketry (Adovasio et al. 1982; Butler 1981). Fremont basketry has also been found in Promontory Cave assemblages post-dating Fremont culture, implying a potential continuity between Fremont and Ancestral Dene sites (Horting 2000), although the occupants of Promontory Caves and Fremont villages are considered separate demographic groups (Allison 2010; Billinger and Ives 2015; Ives 2014; Steward 1937). Similarly, Fremont-attributed rock art was used as a marker of a Fremont occupation and migration, even in the absence of other Fremont markers (Murphey 1987), an approach which recently has been criticized (Quinlan and Woody 2003). Another criticism is of the Fremont basketry typology itself, because the supposed cohesive Fremont traits in basketry, from another perspective, may be interpreted as one with great diversity, as I illustrate in Table 5.2. Specifically, when looking at basketry traits in contemporaneous Fremont, Archaic Great Basin hunter-gatherer, and Ancestral Puebloan assemblages, typology frequently overlaps because these groups used similar combinations of foundation, form, and stitch type.

Because ethnic migration is expected to be visible on a large scale, focusing on only one artifact class like basketry or rock art while excluding other parts of an archaeological complex limits the potential to determine migration over other models of cultural change. Goff's (2010) study of Fremont cordage from the Colorado Plateau demonstrates the limitations of looking at a single artifact class. Cordage twist direction at first seems to indicate that a single social group occupied the cave and cached material before and during the Fremont period. However, other cached materials like moccasins, head-dresses, quills, and feathers may indicate that Ancestral Puebloans may have also occupied Mantle's Cave at varying times (Goff 2010). Goff (2010) suggests influences like division of labor by gender, variation in craft tradition, and time

Table 5.2 Great Basin and Southwestern Basketry Characteristics.

Basketry Period / Ethnicity		Additional Ethnic Details	Form	Work surface	Foundation	Stitch	Work Direction	Rim	Additional Notes	Source
"Western Archaic" Eastern Great Basin	8500-6600 BP	eastern Utah, "Stage II"	parching trays	-	1-rod	unsplit, interlocking	L-R and R-L, R-L dominates later	-	-	Adovasio 1970
	6600-4000 BP	eastern Utah, "Stage III"	-	-	1-rod, 1-rod-and-welt, 1-rod-and-bundle (most popular), multiple rod	split (non-work), unsplit	-	-	-	Adovasio 1970, 1980
	4000-800 BP	eastern Utah, "Stage IV"	-	-	1-rod-and-bundle, 1-rod, 1-rod-and-welt, 3-rod bunched (most common)	split	-	-	-	Adovasio 1970, 1980; Jolie and Hattori 2005
Fremont	500-800 AD	-	-	-	1-rod, 1-rod-and-welt, 1-rod-and-bundle (most popular)	-	-	-	-	Adovasio 1970
	800-1300 AD	-	-	-	-	split (non-work), non-interlocking, intricate	-	-	-	Adovasio 1970
	general	-	parching trays	-	1/2-rod-and-bundle stacked	non-interlocking	-	-	-	Adovasio and Pedler 1994
	general	-	parching trays (most common), large bowls, carrying, water jugs, storage, no cooking	concave (shallow bowls), convex (deep bowls, carrying)	1/2-rod-and-bundle stacked (most popular), 1/2-rod-and-welt stacked, whole-rod, 3-rod-bunched	interlocking, non-interlocking, split (both faces), unsplit	R-L (dominant), L-R	self rim (dominant), false braid	some decoration	Adovasio 1980
	general	-	shallow bowls, deep bowls, carrying, parching trays, general storage and transportation	concave (shallow bowls), convex (deep bowls, carrying)	1/2-rod-and-bundle stacked, 1/2-rod-and-welt stacked, whole-rod, 3-rod bunched	interlocking, non-interlocking, intricate, split	R-L (dominant), L-R	self rim (dominant), false braid	nearly 0% decorated	Adovasio 1994
	general	-	flat shallow bowls, carrying basket, parching tray, globular, pitched water bottle, dipper	-	1/2-rod-and-bundle, 1/2-rod no bundle, 2-1/2-rod-and-bundle stacked (rare)	non-interlocking (dominant), some interlocking, some split		false braid	darker stitches for simple decoration	Gunnerson1969
	400-1300 AD	-	-	-	1/2-rod-and-bundle stacked (50%), 1/2-rod-and-welt stacked, 3-rod-bunched (96%), whole-rod	-	R-L (dominant), L-R later	self rim and false braid (intrusive)	-	Adovasio et al 2002
Promontory / Ancestral Dene	1250-1290 AD	Promontory Caves 1 and 2	-	-	1-rod, 1-rod-and-bundle	interlocking and non-interlocking, some split	R-L	-	-	Ives et al. 2014; Steward 1937
Snake River Plain	500-1250 AD	Jackknife Cave, Pence-Duerig Cave, Little Lost River Cave No. 1	parching tray, large bowl	concave (tray and bowl), convex (bowl)	whole-rod-and-welt stacked, 1/2-rod-and-welt stacked, 1/2-rod-and-bundle stacked, 3-rod bunched	non-interlocking, interlocking, split, not split	R-L, L-R	-	little decoration (red ochre staining)	Adovasio et al. 1982
Numic	general	Southern Pauite	parching trays, bowls, jugs	concave and convex	2-rod, 3-rod bunched	non-interlocking, split, unsplit	-	buckskin and cloth-wrapped	some dyed stitches in zig-zag pattern or star, pitched	Fowler and Matley 1983
	general	White River Ute	berry basket, water jug	concave	2-rod stacked	split, non-interlocking	R-L and L-R	-	pitched	Fowler and Matley 1983
	general	Deep Creek Gosiute	bowls, water jugs	concave and convex	2-rod stacked	non-interlocking	R-L and L-R	-	-	Fowler and Matley 1983
	general	Numic	winnowing and parching trays, boiling, eating bowls	convex	whole-rod, 1/2-rod, 2-rod stacked, 3-rod bunched, 3- and 4-rod stacked and bundle (rare)	non-interlocking, split	R-L (dominant), and L-R	self rim	-	Adovasio and Pedler 1994
	general	Dirty Shame	-	-	whole-rod, 1/2-rod, 2-rod-and-welt	interlocking	-	-	-	Adovasio and Pedler 1994
	general	Monitor Valley	-	-	3-rod bunched	non-interlocking	-	-	-	Adovasio 1970
	general	-	winnowing and parching trays, boiling, eating bowl	convex	1/2-rod, whole-rod, 2-rod stacked, 3-rod bunched, 3- and 4-rod stacked and bundle (rare)	non-interlocking	R-L	self rim	"individually and collectively distinctive"	Adovasio et al 2002
	general	Shoshone	large circular or elliptical bowls, lidded, no parching trays	concave	whole-rod, 3-rod stacked, 2-rod horizontal, 3-rod bunched	non-interlocking, some split (non-work)	R-L	self rim (dominant), false braid	some decoration with colorful stitches or painted, little use-wear	Adovasio et al 1982
	general	Northern Paiute	small serving or eating bowls, large cooking (rare), trinket storage	convex	1-rod, 3-rod, multi-rod (introduced)	non-interlocking	leftward	-	-	Fowler and Dawson 1986, Fowler 1994
	general	Owens Valley Pauite	mixing and boiling (truncated flat base), eating bowls, "treasure basket", cups and dippers, sifting and gambling trays, boiling, large bowls (rounded base)	convex	3-rod bunched, few standardized	-	leftward	-	-	Fowler and Dawson 1986
	general	Western Shoshone	eating bowls, boiling, water bottles	-	3-rod bunched, 2-rod stacked (rare)	-	leftward	-	-	Fowler 1994; Fowler and Dawson 1986
	general	Panamint Shoshone	winnowing trays, eating bowls, women's hats, narrow necked jar, boiling	convex (narrow jars)	-	non-interlocking, split on convex (accidental)	R-L (dominant), and L-R	self rim	simple decoration and feather quills	Fowler and Dawson 1986
	general	Northern Shoshone-Bannock	water bottles with narrow or flaring necks, storage, food collection, lidded	convex	3-rod stacked and bunched, 2-rod stacked, 4-rod stacked	non-interlocking	-	-	horsehair loops	Fowler and Dawson 1986
	general	Eastern Shoshone	berry baskets, gambling trays, water bottles	concave (trays), convex (water)	2-rod stacked, 3-rod stacked	-	-	-	-	Fowler and Dawson 1986

Table 5.2 Great Basin and Southwestern Basketry Characteristics Continued.

Basketry Period / Ethnicity		Additional Ethnic Details	Form	Work surface	Foundation	Stitch	Work Direction	Rim	Additional Notes	Source
Numic continued	general	Southern Paiute	parching trays, cooking, eating bowl, water bottle, hats, burden	-	3-rod (trays), 2- and 3-rod bunched (cooking and trays)	non-interlocking	leftward	self rim (bottles and 3-rod)	simple decoration	Fowler 1994; Fowler and Dawson 1986
	general	Ute	cooking, eating bowl, winnowing and parching trays, water bottles (convex bottom, pitched, clay exterior sometimes)	convex	2-rod stacked, 1-rod stacked, 3-rod stacked (rare)	-	leftward	false braid (water bottles)	-	Fowler and Dawson 1986
	general	General	-	-	"rule-free foreign medium open to experimentation"	-	-	-	-	Fowler and Dawson 1986
American Southwest	3500-1450 BP	Basketmaker II	-	-	2-rod-and-bundle, 1-rod-and-bundle	non-interlocking, interlocking, split stitch	-	-	local innovation (2-rod-and-bundle non-interlocking) and diffusion (1-rod-and-bundle interlocking) from Great Basin and Mexico	Adovasio 1971, 1980
			carrying, conical deep bowl, shallow bowl, tray, water bottle, small globular bowl	-	1/2-rod-and-bundle stacked, 2-rod-and-bundle bunched	interlocking, non-interlocking	R-L	self rim, false braid	colored stitches	Morris and Burgh 1941
	AD 500-750, 1450-1200 BP	Basketmaker III	large carrying, conical, deep bowl, small bowl, trays	-	2-rod-and-bundle (most common), 1- or 1/2-rod-and-bundle, 1-rod (divergent)	non-interlocking	-	-	Outside Kayenta more diverse	Adovasio 1971, Webster and Hays-Gilpin 1994
			tray, carrying, water bottle, globular baskets	-	1-rod, 3-rod bunched, bundle	interlocking, non-interlocking, some split	R-L (one rod, bundle)	self rim, false braid (dominant)	colored stitches	Morris and Burgh 1941
			-	-	2-rod-and-bundle bunched, 1/2-rod-and-bundle	non-interlocking	R-L	false braid	decoration	Adovasio et al 2002
	750-1350 AD, 1200-600 BP	Ancestral Puebloan (also Pueblo I--III)	-	-	2-rod-and-bundle, 1-rod-and-bundle	non-interlocking, split	-	-	-	Adovasio 1970, 1971
			burden (burial), gambling trays, serving trays	-	3-rod bunched		-	-	willow, dyed stitches	Pepper 1902
			cone shaped large bowl, trays, lidded bowls, small containers	-	3-rod bunched, 3-rod stacked, 1-rod, 1/2-rod-and-bundle, 2-rod stacked, 2-rod and bundle bunched, 2-rod and bundle stacked, 1-rod	interlocking, non-interlocking, some split	R-L (1 rod, 1/2-rod-and-bundle, 2-rod, 2-rod-and-bundle, 3-rod), R-L and L-R (3-rod)	self rim	colored stitches, bird quills	Morris and Burgh 1941
			trays, large bowl	-	-	-	-	false braid (dominant), self rim		Morris and Burgh 1941
	AD 800-1400, 1150-550 BP	Hohokam: Ventana Cave	-	-	1-rod-and-bundle, 1-rod-and-welt, 2-rod stacked, 2-rod-and-bundle, 2-rod-and-welt, 3-rod bunched (rare)	interlocking (most common)	-	-	-	Adovasio 1971

conflation (because the caches are not well-dated) may also contribute to the overlap in these assemblages, so she restrains from creating a Fremont typology based solely upon cordage.

Other archaeological evidence supports the role migration may have played in the end of the Fremont period. An increase in granaries near the end of the Fremont period may reflect territorial reactions against migrant populations, although this territoriality may have been passive (i.e. not marked by violence) depending on variable mobility, as indicated by the presence of refuge structures presumably used to wait out raids (McCool and Yaworsky 2019). In the Southwest, violence is a marked aspect of population change, and this behavior may have occurred in Fremont societies as well (Spielmann 1986).

Although basketry and cordage do not explicitly show that Fremont ethnogenesis is the result of a large-scale migration of Fremont people into the Colorado Plateau and Great Basin, other data do suggest such behavior. Fremont genetic data have been used to support the argument for migration. O'Rourke and colleagues' (1999) analysis of 47 Fremont-aged burials indicate a continuous biological population that appears genetically distinct from human remains in the western Bonneville Basin and Ancestral Puebloan contexts, as well as modern populations; however, the authors are careful to point out small sample sizes may inflate the genetic differences (O'Rourke et al. 1999; Parr et al. 1996). Another genetic study of Great Salt Lake remains also identified Fremont people as being distinct from Athabaskan (i.e. Promontory or Ancestral Dene people) (Parr et al. 1996), but recent archaeological studies suggest that Fremont and Ancestral Dene people had fluid cultural and biological boundaries orchestrated through exogamous marriage, rather than a large-scale migration (Yanicki 2019).

The large-scale migration model as presented here for development of Fremont ethnicity and the decline of Fremont cultural traits is still contested on a regional scale in the eastern Great

Basin and Colorado Plateau, especially in village sites which were abandoned after the Medieval Climatic Anomaly. Although assemblages I studied are generally not from sites considered to be Fremont, some do have Fremont-attributed components, or basketry and other material culture may be considered Fremont-like. As discussed below, my data do not support a large-scale migration, but may be associated with a more nuanced understanding of smaller scale migration.

Numic "Spread", "Expansion" or "Migration". Large-scale migration and subsequent population replacement is the primary model for the Numic era, and therefore this discussion is especially thorough. This model is based on the apparent appearance of a new language throughout the Great Basin, and some potential but contested archaeological evidence of discontinuity between Numic-speaking groups in the historic era and predecessors.

Language is a potential, although not essential, defining attribute of ethnicity (De Vos 1995), so a shift in language is frequently considered one of the markers of a population migration (Rouse 1986; Sutton 1993). Lamb (1958), using historical linguistics and glottochronology formerly applied to Mexican languages (Swadesh 1955, cited in Grayson 2011), postulated that there was an expansion of people who spoke a subgroup of Uto-Aztecan language out of the Mojave Desert into the rest of the Great Basin during the late Holocene (Bettinger and Baumhoff 1982; Fowler 1972; Lamb 1958). This contradicted some early archaeological suggestions of a population continuum (Jennings 1957; Steward 1937), but it potentially coincided with the appearance of bow-and-arrow technology and other changes to subsistence practices noted in the late Holocene (Bettinger 2015). This model suggests that Numic speakers supplanted small populations of hunter-gatherers around 1,000-700 cal BP (Allison 2010; Bettinger and Baumhoff 1982; Codding and Jones 2013; Fowler 1972, 1983; Lamb 1958; Madsen 1975; Madsen and Simms 1998; Merril et al. 2009; Shaul 2014).

Glottochronology is a problematic application of linguistics because it falsely assumes that the rate of change and diversification of dialects and language are constant and absolute (Goss 1977; Nichols 1997; Simms 1983). Nevertheless, an updated lexicostatistics approach which is considered more appropriate for this shallow time period (Haugen et al. 2020; Hill 2011; Nichols 1997; Shaul 2014), suggests the Numic language spread occurred broadly within the past 4,000 years, not specifically at 1,000 cal BP (Hill 2011). This supports the archaeological interpretation that Numic-speaking people were living in the Great Basin by at least 3,500 cal BP, and potentially further dispersed after 1,000 cal BP (Aikens 1994; Aikens and Witherspoon 1986). Other linguistic studies posit this expansion occurred as early as 8,900 cal BP, if a non-Mesoamerican homeland for the language is accepted (Merrill et al. 2009). Potentially, the Uto-Aztecan language family might be derived from Penutian which would also support a long in-situ presence of Numic language in the Great Basin (Aikens 1998), which essentially supports observations that there is no archaeological evidence of a cultural or linguistic discontinuity coincident with the glottochronological prediction of a 1,000 cal BP transition (Jones 2005).

The nature and timing of the spread of the Uto-Aztecan language family out of Mesoamerica is similarly debated in Southwestern archaeology, and Southwestern studies generally place the spread of this language family out of Mesoamerica after 4,000 cal BP (Fowler 1983; Hill 2001), but more likely slowly between 3,000-1,200 cal BP alongside the spread of agriculture (Carpenter et al. 1997; Hill 2000). This timing contradicts Great Basin models which favor a more ancient spread of Numic language in the Great Basin (i.e. up to 8,900 cal BP) (Aikens 1998; Merrill et al. 2009), as well as those which propose a rapid late spread (1,500-700 cal BP) (Watson 2010). Linking language and agricultural dispersal highlights a major difference in the mechanism of language spread in cultures with farming versus foraging

(Bellwood 2001; Renfrew 1996), although Merrill and colleagues (2009) suggest that language and agriculture spread as separate events. Inherently problematic to this linguistic model, however, is that a spread of language equals a spread of physical people.

Despite the migration model being initiated by a problematic linguistic observation, many Great Basin archaeologists continue to argue that a population replacement did indeed occur at some point in the late Holocene. The spread of a language is frequently associated with the spread of other cultural elements (Kemp et al. 2010; Nichols 1997). Language is overstated as a boundary in archaeology, because it does not limit sharing of cultural elements and is based in Euro-American bias against multilingualism (Cordell and McBrinn 2016; Jordan and Shennan 2003; Pryor and Carr 1995). Some researchers argue that using a linguistic model to look for archaeological change is nothing more than circular reasoning (Jones 2005). Despite updated understanding of the flexible interplay between language and cultural identity especially in hunter-gatherer societies (Güldemann et al. 2020), in the Great Basin a large-scale migration and replacement of in-situ hunter-gatherer people remains a frequent explanation for perceived major changes in subsistence strategies during the late Holocene. These changes include the adoption of new types of technology associated with increased intensity of resource procurement, like seed beaters, triangular winnowing trays, hooks for pine nut harvesting, Desert side-notched projectile points, and a new method of upland green-cone harvesting that favored a low-return rate subsistence strategy, often considered a conflict between “travelers” (pre-Numic) and “processors” (Numic) (Bettinger 2015; Bettinger and Baumhoff 1983; Magargal et al. 2017). These different subsistence method changes between pre-Numic and Numic hunter-gatherers, however, may be overstated.

Like Fremont basketry, Numic basketry typology reveals a diverse collection of foundation and stitch types, including at least 10 combinations of traits (Table 5.2). Numic coiled basketry includes one-, two- and three-rod foundations, stacked and bunched rods, occasionally bundles (but fewer than previous periods), interlocking- and non-interlocking-stitches, split and unsplit stitches, and both work directions (Adovasio and Pedler 1994; Adovasio et al. 2002; Fowler 1994; Fowler and Dawson 1986; Fowler and Matley 1983). Forms are similar to earlier periods, including winnowing/parching trays, bowls, water jugs, and boiling baskets. Adovasio (Adovasio and Pedler 1994) nevertheless states that there is a distinct typology of Numic basketry that differentiates it from other basketry traditions. This differentiation is based primarily on twined basketry, which is the dominant form of the period, but this is also applied to coiled basketry, although Adovasio does not clearly define what makes this basketry distinctive from earlier periods or other regions (Adovasio and Pedler 1994). Both Fowler (Fowler and Dawson 1986) and Adovasio (Adovasio and Pedler 1994) identify a less-standardized construction of coiled basketry than twined basketry, contradicting a unified view of Numic coiled basketry.

As a complex and conservative craft tradition, Adovasio emphasizes that the level of basketry technological change — although again, he is unclear about what this change actually is — which occurs 1,000 cal BP is unlikely to have developed within a group or be adopted wholesale from a neighboring group (diffusion) (Adovasio and Pedler 1994). While he does grant that there may be some subtle, individual changes that are not widespread, he uncompromisingly asserts that a population-replacement model through large-scale ethnic migration is the only reasonable explanation for his identified changes, and that “only those who are never permitted outdoors without their keepers” (Adovasio and Pedler 1994: 122) may consider diffusion or in-situ change as explanation for Numic-era change. Contrary to this position, however, some of these Numic traits *are* found in baskets older than 1,000 cal BP (Adovasio and Andrews 1983; Grayson 2011) (Table 5.2), which suggests either a greater antiquity of the Numic spread or more likely, that these traits are not limited to just Numic-attributed baskets. In support of the latter explanation, Fowler's (2004) work with Southern Paiute basketry shows flexible and inconsistent basketry traits across the region, which overlap with geographic neighbors like Ancestral Puebloans, Great Basin pre-Numic hunter-gatherers, and other Numic groups.

Additional archaeological evidence that may characterize prehistoric Great Basin populations is rock art. At least four phases of rock art have been identified in the Great Basin, with the three earlier phases being characterized based on style: 1) older, abstract, hunter-gatherer-associated Coso; 2) abstract hunter-gatherer and horticulturalist-associated Basin and Range Tradition; and 3) more figurative horticulturalist-associated Fremont/Ancestral Puebloan styles. This was followed by a lack of rock art after the presumed collapse of Fremont culture. One study that compared these phases argued that the three stylistic phases represent separate demographic populations, and their relative ages and the interaction of styles of varying time periods (i.e. scratching out of old rock art versus avoidance) may indicate migrations (Quinlan and Woody 2003). Quinlan and Woody (2003) suggest that the loss of cultural memory of how to make specific rock art and the interpretation of rock art imagery in historic tribes is an indication of the spread of Numic peoples after the departure of Fremont people in the eastern Great Basin. Issues of dating rock art and emic interpretations of the meaning of imagery are problematic concerns in this idea of a Numic population replacement.

Steward's (1933, 1938) historical studies of the subsistence strategies of Shoshone, Ute, and other Numic-language groups of the Great Basin have formed the basis of cultural-ecological interpretations of archaeological populations for decades. If a Numic migration was a recent event, historical tribes are problematic analogies for archaeologists because earlier groups may have had vastly different cultural practices (Bettinger 2015). A few traditional Northern Paiute and Shoshone legends about defeating enemy tribes have been interpreted by folklorists and archaeologists as evidence of some population movements in prehistory (Barker et al. 2000; Smith 1940 in Sutton 1993; Sutton 1993); however, employing oral history as literal evidence of recent population replacement by modern groups is criticized as misinterpretation and misuse of mythology and an inappropriate application of chronology to ground these stories as specific historical events (Jones 2005; Liljebad 1986; Mason 2000; Sapir 1916). Most oral traditions of Native American tribes in the Great Basin do not reflect a population replacement by a large-scale ethnic migration. Instead they generally support in-situ development of modern groups (Jones 2005; Spoon and Arnold 2012). Euro-American ethnohistoric accounts of intergroup violence have also been used as evidence of increased territoriality as a result of an expansion of invading people (Loud and Harrington 1929; Sutton 1986, 1993), but the filter of European colonialism and etic perspectives color these accounts. Oral-history studies suggest a peaceful relationship between Southern Paiute people in Utah and Fremont or Ancestral Puebloan people in the Southwest, but that other hunter-gatherer groups (the Ute and Shoshone people) raided Fremont villages (Pendergast and Meighan 1959). This peacefulness is contradicted by other Southern Paiute studies that indicate violence and displacement in the Mohave Desert (Kelly 1932; Sutton 1986). European explorers also noted violence between hunter-gatherer groups in the Great Basin; and while this frequently occurred in groups with access to horses, tribes in contact with each other likely had conflict before the spread of horses (Murphy and Murphy 1986; Sutton 1986).

The differences between foraging strategies of historic-era Northern Paiute and Northern Shoshone people in Utah and Nevada are seen as echoes of the Numic expansion, with Shoshonean people generally operating in smaller territories with more nutrient-dense patches than Northern Paiute, who emphasize larger territories with lower energy density (Parker et al. 2019). Relevant to this discussion as well is the historic-era observation that groups of Shoshonean and Paiute people were defined according to the food they ate, and therefore the region in which they primarily subsisted (Steward 1938). Boundaries appear to be established between Great Basin tribes in the contact era, which suggest some degree of community social-identity differentiation (Tajfel and Tuner 1979), but this perspective does not take into account social fluidity. This regional variation in diet may support Jones' (2005) assertion that the flexibility of Great Basin hunter-gatherer subsistence is unlikely to result in displacement of one hunter-gatherer group by another. However, inter-group territoriality and borders are potentially important for preserving natural resources for future use in a more populated region (Alvard and Kuznar 2001; Bayham et al. 2019; Whitaker et al. 2019).

The issue of territoriality is an important consideration for this mechanism of cultural change, because it is necessary to consider how one population supplanted or incorporated an in-situ population (Adams et al. 1978). The inference that there was an increase in territoriality as a competitive response to Numic invaders assumes unfoundedly that gathering rights did not exist before 1,000 cal BP. Despite hunter-gatherers often being categorized as having little private property ownership, studies have demonstrated that hunter-gatherers may more accurately be understood as having a spectrum of property rights ranging from common to private ownership of resources (Eerkens 2010; Jackson 1991; Smith 1988; Tushingham and Bettinger 2019). There is variability in hunter-gatherer emphasis on property rights of naturally-occurring resources as a result of group size, residential mobility, increased sedentism, climatic stressors, and/or increased and reliable stored foods in central and northern California, the Pacific Northwest, and the Great Basin (Codding and Jones 2013; Codding et al. 2019; Jackson 1991; Madsen 1975; Tushingham and Bettinger 2019; Whitaker et al. 2019). Additionally, ownership of plant resources for perishable artifacts has been observed among California basket makers who tended wild resources and enforced gathering rights (Anderson 2005; Dick-Bissonnette 2003), and among Owens Valley Paiute people, who gathered plant fibers for rabbit nets from Shoshone territories (Steward 1933). Bettinger (2015) suggests there may have been some informal ownership of pinyon pine stands, which may have factored into increased territoriality, privatization, and competition (Bettinger and Baumhoff 1982; Eerkens 2004, 2010; Madsen and Simms 1998; Magargal et al. 2017). Because basketry and cordage manufacture require gathering from known locations on the landscape, as I have demonstrated throughout this dissertation, it is unlikely that there was a large-scale ethnic population replacement 1,000 cal BP, as stated in this model.

Genetic relatedness is not part of my definition for ethnicity, but biological evidence is used politically and legally to make determinations about affiliation. The evidence for a genetic change in prehistory may provide support for a Numic migration (Cavalli-Sforza 1997; Greenberg et al. 1986). One genetic study suggests a possible discontinuity between the genetic makeup of people living in the Stillwater Marsh area and modern populations that may not simply be the result of genetic drift (Cabana et al. 2008; Kaestle and Smith 2001). The genetic variability exhibited in the Stillwater Marsh population may also be the result of admixture between populations, which would also be expected in a migration model that allows for intermixing and not population replacement, unlike the common Great Basin Numic model (Kaestle et al. 1999). Genetic studies in the Southwest also interpret a migration of at least male populations from Mexico, potentially alongside the spread of agriculture and the spread of Uto-Aztecan language (Kemp et al. 2010). DNA extractions from an assemblage of quids from Mule Spring Rockshelter in southern Nevada potentially also show the movement of people carrying mitochondrial haplogroup C into the Great Basin after ~1,000 cal BP, although the sample size is considered too low to unequivocally differentiate between migration, long-term residence, or different groups incorporating the site in their seasonal rounds (Hamilton-Brehm et al. 2018). While there is some genetic evidence to support a massive cultural demographic replacement of in-situ Great Basin people by Uto-Aztecan speakers (Hamilton-Brehm et al. 2018; Johnson and Lorenz 2006; Kaestle and Smith 2001), this genetic evidence for a Numic population migration is problematic because until recently there has been a general underrepresentation of comparative modern Native North American genetic data in the United States (Bolnick et al. 2016), unlike in Canada (Lindo et al. 2017). This is a result of distrust in the motivations of geneticists and applications of genetic research (TallBear 2013), especially in the early era of NAGPRA, when genetic and skeletal data (e.g. Spirit Cave remains, Ancient One/Kennewick Man) were often used to determine cultural affiliation of archaeological remains and explain perceived discontinuities in the archaeological record, which can have dramatic legal, political, national, and social ramifications (Barker et al. 2000; Chatters 2000; Coulam and Simms 2002; Dansie 1997; Edgar et al. 2007; Hockett and Palus 2008; Horting 2000; Jones 2005; Mihesuah 2000; Nelson 2016; Rasmussen et al. 2015; Shaul 2014; Thomas 2000). These problems reinforce the reasons why genetic relatedness should not be used in exclusion to determine ethnic affiliation, and may best be used to characterize the dynamic social environment that cross-cuts cultural boundaries.

Criticism of the Large-Scale Numic-Migration/Population Replacement Hypothesis. Criticisms of the applications of historical linguistics, interpretation of oral tradition, the small sample size of genetic data, potential biases of optimal-foraging theory, and potential equifinality of archaeological evidence indicate that the migration model as it relates to a potential Numic expansion is still far from settled, but cannot necessarily be disregarded. In her recent review of lines of evidence for Numic spread/expansion, Fowler (2011) suggests that research should emphasize the micro-scale of hunter-gatherer populations to characterize more complex forms of small-scale migration rather than a massive population replacement (more in-line with Model 2 discussed below), which may be supported by obsidian sourcing studies (Reckin and Todd 2020). The impetus for expansion of population(s) into the Great Basin may not simply be economic necessity, or a "wave-of-advance" (Anthony 1990) model with people colonizing a landscape, as has been suggested in the traditional narrative (Fowler 2011). Bonneville Basin data in my study reinforces Fowler's suggestion that gradual, small-scale migration (Model 2) is more likely than a massive population replacement.

Model 2: Technological Change is the Result of the Adoption of a New Technology through Diffusion or Small-Scale Migration

Adoption of new technology or elements of a new technology by a culture is a possible consideration for the appearance of a change in technological traits. Technological change through a diffusion and small-scale migration can have a similar archaeological signature of "hybridizing" traits, so these processes are combined in this model to differentiate them from the population replacement (large-scale ethnic migration) model frequently applied to the potential Numic spread. These processes are also often related, in that small-scale migration can introduce new technologies which are then adopted by local residents resulting in diffusion. In early studies, (large-scale) migration was inferred only if 1) a sudden new technology with a new constellation of traits appeared in a local population as an "intrusion" of an immigrant population, and that once established, 2) this immigrant group borrowed elements from the new group while maintaining elements of the immigrant technology (Haury 1958; Rouse 1958, 1986). Diffusion was seen as an alternative to migration (Adams 1978; Adams et al. 1978). In the case of Model 2, a new technology or technique (technological traits) may appear in an assemblage without other evidence of large-scale change required in the Model 1 population replacement process. New technology or techniques may appear alongside a directional movement of technology to a new geographic location, or on an assemblage-scale change, which is understood as diffusion (Jones 2005). In Great Basin research, diffusion is less often defined but is implicitly understood to be an alternative to migration, rather than acting together.

However, small-scale migration through movement of individuals or family units (rather than ethnic-scale) due to intermarriage or population mixing (Bernardini 2011; Clark 2011; Mills 2018; Ortman 2012), may yield a hybridization of traits as newcomers and local people adopt aspects of the other's technology, but the motivation for this blending of traits may differ from diffusion. To reconcile diffusion versus migration, diffusion may be understood as a more conscious adoption of a new technology potentially viewed as an improvement on an old technology or a new idea. Conversely, the blending of traits that may occur alongside small-scale migration may be more unconscious if the trait is embedded in conservative technological style, but this blending of traits may also be conscious if conformity is encouraged in a society

(Herbich and Dietler 2008). Mills (2018) discusses the idea of "boundary objects" in pottery as an alternative to the idea of hybridization or blending of traits, in which the form or function of a technology shared across separate groups serves as a gateway for a diffusion and diversity of stylistic traits. In this way, small-scale migration and diffusion may be overlapping, occurring alongside each other, and their influence may be manifested in a similar way in material culture, so I have chosen to not separate the two processes in this model.

Expectations. The introduction of new technology is expected to be either gradual or rapid. For example, we should expect it to be rapid if the technology is introduced through trade or replicated outside of an established craft tradition (diffusion), but we should expect it to be gradual or slow when acquired over time through small-scale migration. It is expected that there will be limited changes to the full material record, and most changes initially will coalesce around the new technology or technique. For example, if there is contemporaneous change in multiple functionally-unrelated technologies like basketry, cordage, and stone tools which were made in separate craft traditions, this is less likely technological diffusion and instead, evidence for large-scale migration. It is also expected that there is a homogeneity across assemblages in the case of diffusion through trade, because the technology was created in an outside established and separate craft tradition, with similar technological-stylistic attributes. If the technology was adopted from outside the community and then replicated inside the community (also a form of diffusion), then there will be a hybridization of technological-stylistic attributes reflective of overlaying the new technology over pre-existing craft traditions. If the new technology or traits were created outside the community and entered through newcomers through small-scale migration, there will also be a hybridization of traits. The new technology is also expected to be similar to the technology of its origin.

In basketry, adoption through trade would be interpreted if there is the appearance of a new basket-type made with a standardized set of technological-stylistic traits produced in a separate craft tradition; for example, if all new three-rod basketry was made with the same work direction. Technological adoption may also be interpreted in basketry if a new element (e.g. a new bowl type, or a different decorative or rim finishing method) is adopted from another region, but it is replicated in the local community, potentially resulting in hybridization. Replication as a method of diffusion is difficult to delineate from small-scale migration, because hybridization of basketry stylistic traits is also expected to occur as a result of incorporating a newcomer who hails from a separate craft tradition with a shared functional tradition of basketry.

Defining Diffusion in the Great Basin. Historically, diffusionist explanations for technological change were common in archaeological interpretations in the Great Basin. For example, past studies of the replacement of dart points by arrow points proposed a series of testable predictions for the manner in which this technology was spread, including diffusion (Bettinger and Eerkens 1999). Other relevant studies have focused on the regional distribution of ceramic artifacts and technological attributes in the Great Basin as a means of characterizing motives of conveyance, trade, and population movement (Eerkens 2002, 2012). Diffusion was briefly considered to explain the spread of brownware ceramic artifacts in the western Great Basin, though this interpretation was deemphasized after the 1920s (Eerkens 2000b). Jones (2005) in his criticism of the Numic-migration hypothesis, points out that the flexibility of Great Basin hunter-gatherers' subsistence strategy would likely mimic newer, more successful adaptive strategies (diffusion) (Jones 2005).

A model supporting the adoption of a new technology has sometimes been proposed for the middle and late Holocene spread of coiled basket technology out of the eastern Great Basin and into the Snake River Plain to the north and the Southwest to the south (Adovasio 1971), as well as from Mexico into the Southwest. Diffusion may explain the continuous production of Catlow Twine basketry (Baumhoff 1958) over coiled basketry in the western Great Basin from 9,200 to 1,040 cal BP and in the northern Great Basin from around 7,400-138 cal BP (Camp 2018). When coiling does occur in the northern and western Great Basin, it is not until very late (~3,000 cal BP), whereas it occurs around 9,000 cal BP in the eastern Great Basin (Connolly 2013). This delayed appearance of coiled basketry may be interpreted as evidence of a cultural division and isolation between northern and eastern Great Basin peoples (Adovasio 1970). Adovasio (1970) considers the eventual appearance of coiled basketry in the northern Great Basin to be evidence of population change through migration; however, others consider this the diffusion of technology from the eastern Great Basin gradually over time (Connolly 2013). In another study, trade as a mechanism of diffusion is also suggested as an explanation for basketry change in California (called Outland Coiling) and the spread of Catlow Twine from the western Great Basin, rather than through the migration of people (Fowler and Hattori 2012). Geib's (2000) study of Archaic-aged sandals shows a spread of plain-weave style from the southern Colorado Plateau (dating to ~9,100 cal BP) to the northern Colorado Plateau (dating after ~7,650 cal BP). He states that this is not indicative of population replacement, because some of the traditional elements of sandal manufacture remain the same, and instead suggests they were "melding the new style with the old" as a result of diffusion (Geib 2000).

Defining Fremont Diffusion. Adovasio observes that Fremont-type basketry disappeared after the decline in Fremont village occupations, to be replaced by Numic basketry as a result of the migration of Numic people into the region (Adovasio 2008). In the case of Southwestern "Desha Complex" basketry dating to ~7,500-3,500 cal BP (Adovasio 1970), Adovasio (1970, 1971, 1980) suggests that diffusion was a potential mechanism between the Southwest and Great Basin during this period, arguing that Great Basin and Mexican basketry techniques diffused into the Southwest and California, and were then altered in situ. This is a contradiction of his later theories about Fremont ethnogenesis (Adovasio 1976), and instead this interpretation of basketry typology suggests that there was contact between these cultural regions that may have been maintained into later periods. Some studies discuss a diffusion model for Fremont adoption of farming and functionally-related farming technologies like villages and granaries, ceramics, and art (Talbot 2000). Simms (1994) suggests that because he sees no clear constellation of Fremont technological traits or the cultural complex, diffusion is the best explanation for the appearance of Fremont cultural elements.

In light of new studies of Fremont social organization, Adovasio (2008) has recently re-addressed why Fremont basketry appears stylistically constant while other material classes change. One explanation is that male Ancestral Puebloan farmers moved separately into the Great Basin, marrying hunter-gatherer women who retained their traditional basketry manufacturing techniques (Adovasio 2008). However, throughout North American Native American populations, farming was largely a feminine task (Krech 1999). In other late Holocene interactions between Puebloans and hunter-gatherers in the Great Plains, it was women who married into hunter-gatherer groups, bringing with them farming skills (Leonard 2006). These changes in marriage practices resulted in technological change in Southern Plains society (Leonard 2006), so possibly if a similar change in marriage tradition occurred in the Great Basin, this may explain some of the observed technological patterns.

Defining Numic Diffusion. The appearance of “Numic” technological traits may be a marker of the adoption of new technology rather than through population replacement by a migrant ethnic population (Jones 2005). Simms (1994) supports a similar diffusion model in regard to the Numic problem, stating that there was a slow conscious adoption of technologies that is not dependent on population replacement. As discussed previously in Model 1, some argue that there is little evidence of either massive change in the subsistence strategies or wider material culture assemblage of pre-Numic and Numic people, or a major change in population based on biological evidence (Jones 2005; Kelly 1997; O'Connell et al. 1982). Instead, these studies suggest that the appearance of some new traits like western Great Basin Lovelock Wickerware basketry and its "disappearance" after the Numic expansion is the result of or a conscious adoption of a new technology or local innovation (either Model 3 or 4 discussed below). This interpretation is because it is a local type that has no origin or spread, and other parts of the Lovelock assemblage appear continuous before and after the Numic spread (Jones 2005).

Model 3: Technological Change Resulting from Local Development / In-situ Change

In-situ development, or drift, is occasionally offered as an explanation for technological variability over time. This model is in contrast to the idea of an adoption of a new technology from outside of the region because drift accounts for unconscious internal changes to a technology that are unrelated to conscious adaptation (Model 4). This model is grounded in cultural-transmission theory, in which evolutionary processes are used as an analogy for cultural manufacture of technology (as discussed in Chapter 1). In-situ or localized change to a technology is therefore considered analogous to a random genetic mutation. Technological drift has been found to be pronounced and far-reaching in some circumstances, especially in small populations or isolated groups (Henrich 2004; Neiman 1995). Shennan and Wilkinson (2001) suggested that restricted innovation, such as in a conservative craft tradition, can play a strong role in the presence of variation in a technology: in a population in which innovation is absent, the random selection of traits leads to the loss of variation over time, because the number of possibilities gets smaller as some are chosen over others. As a result, Shennan and Wilkinson (2001) suggest that in the absence of innovation, periods in which there are a greater number of variants are earlier than those with fewer variants (Shennan and Wilkinson 2001). Random copying errors and motor habits may also result in deviations from standardized technological templates and result in variation (Bentley 2007; Eerkens 2000a; Hamilton and Buchanan 2009; Neiman 1995). Additionally, population size and interaction may result in limiting choices (Henrich 2004) or increased innovation (Shennan and Wilkinson 2001).

Expectations. If drift occurs, it is expected that this is a gradual process that is accompanied by random and localized variation, because there will be deviations from an established craft tradition. It is also assumed that if there is flexibility within the craft tradition to allow for some change (a pro-innovation system), this may occur in other craft traditions as well, though it is not a requirement that other changes occur, because it is recognized that some traditions may be more flexible than others. Homogeneity is not required or expected, although homogeneity may appear differently depending on population size, and whether transmission is conformist, pro-novelty, or focused on random-copying (Aoki et al. 2011; Neiman 1995). It is expected that there may be some changes in nonfunctional variables, and that there is little "reason" for change in an attribute (i.e. it is not an adaptive response to external events). Rather, change is more random (or stochastic), individualistic, and results from individuals tweaking the recipe periodically, consciously or unconsciously for personal, localized, or accidental reasons. Change is not expected to coincide with demographic, environmental, or functional events, but may be related to changes in population size and social interaction. In basketry and cordage, drift would be interpreted if there was extensive stylistic variability within an assemblage which appears to be unrelated to conscious adaptation.

In-Situ Technological Change and the Fremont. Adovasio has long maintained that Fremont textiles show continuity between Archaic hunter-gatherers and Fremont groups, which is most like a cultural drift model (Adovasio 1970, 1976; Adovasio et al. 2002). He cites the relative impermeability of boundaries between Fremont and Southwestern groups, at least in relation to basketry (Adovasio 2008); however, he also suggests there may have been some diffusion of specific basketry elements like forms or bundles from the eastern Great Basin into the Southwest during pre-Fremont times, rather than the transferal of a “constellation of traits” (Adovasio 1971; Adovasio and Pedler 1994).

Other studies of basketry in the eastern Great Basin analyzed nonfunctional attributes to characterize change during the Fremont period (Adovasio 1976; Adovasio et al. 2002). By establishing that there was a maintenance of basketry craft traditions before and during the Fremont period, this was used to argue against population replacement in the eastern Great Basin during the Fremont period, as mentioned under Model 1. Because basketry- and cordage-making are considered conservative craft traditions, and therefore conformist in teaching style, Adovasio and others have argued that there was little change over time. Therefore, temporal changes that do occur, such as the development of three-rod bunched foundations, are evidence of localized innovation in technological attributes rather than an introduction of a new manufacturing method through large- or small-scale migration or diffusion.

Other Examples of In-Situ Change. In an ethnographic study of California basketry, stylistic attributes like decoration and starting methods were nearly identical within family groups over time in which mothers instructed daughters (Pryor and Carr 1995). Pryor and Carr (1995) observe stages in the basket *chaîne opératoire* which are also maintained over generations because they are considered passive stages. Attributes considered passive are material-collection methods, processing familiar plant types, form, and specific weave types, like coiling or twining. Even in this highly specialized and restrictive craft tradition, however, Pryor and Carr's study (1995) also identified specific instances where a woman sought instruction from more distant relatives and incorporated these new methods (in one case, three-rod foundation) into her own basketry. Other instances where alterations occurred in this conservative craft include misremembering a method of creating a design (Pryor and Carr 1975). This case study illustrates that although conformity was encouraged and perpetuated within a local community of basket-weavers through enculturation, some stylistic changes appeared in this craft tradition based on individual whims, preference, innovation, or copying errors which may then have been passed down to other direct relatives.

Model 4: Cultural Change is a Result of Conscious Adaptation to Environmental Conditions

Changes in the environment may be prime variables for changes in subsistence and technology. The concept of the Desert Culture emphasized the consistency of the Great Basin peoples' cultural adaptations over millennia (Davis 1963; Jennings 1957). This concept has since been generally reworked in light of new archaeological research, but some basic aspects of it—increased reliance on gathering and processing harder-to-access foods like pinyon pine nuts, pickleweed, and acorns during droughts and other climatic pressures—are still considered important characteristics of Great Basin and California subsistence. This model has been discussed throughout this dissertation as embedded in a cultural-ecological framework which emphasizes the position of hunter-gatherers as dependent on climatic variability. This model is similar to Model 3 in that it may include in-situ technological change, but it can be contrasted because it is a conscious technological adaptation made out of necessity. It is also similar to Model 2 in that a new technology may be adopted, but the adaptive model narrowly defines this technological change as an adaptive reaction to environmental stressors.

Expectations. If the observed changes in technology are the result of cultural adaptation to changes in the environment, it is expected that changes are heavily dependent on the nature of environmental changes, and there should be paleoecological documentation of these changes. These changes should coincide chronologically with major climatic shifts in paleoecology, as discussed in Chapter 2. Adoption of the new technology may be gradual or abrupt, depending on the nature of environmental change. Changes are expected to occur only in technology associated with food procurement. Homogeneity between assemblages is expected, because environmental adaptations are made on the regional scale. In basketry and cordage, an environmental adaptation model may be supported if the variability observed is associated with the function of the artifact. For instance, an increased frequency of parching trays may indicate an expansion of seed subsistence. Stylistic traits like work direction and spin direction are unrelated to subsistence, so they are not expected to change in response to ecology.

Fremont and Numic Environmental Adaptation. One documented type of change in technology is change in the function of the artifact itself, or the adoption of a new technology because of necessity (Schiffer and Skibo 1987). Changes in technology as a response to changes in climate have been cited often when referring to the development of coiled basketry in the eastern Great Basin (Adovasio 1970; Adovasio and Fry 1972). The eastern Great Basin was considered a more marginal environment than other parts of the Great Basin by archaeologists, who suggested that environmental pressure was alleviated by the increased dependence on coiled basketry in the middle Holocene for processing lower-ranked foods (Adovasio and Fry 1972). Adovasio and Fry (1972) suggest, though, that the first appearance of this basketry form may be the result of diffusion by way of demographic pressure from the Colorado Plateau and Southwest. Additionally, the development of new strategies in the procurement of plant food like the use of twined winnowing trays and seed beaters, or the intensification of small-game hunting with snares, has been attributed in some part to adaptation to increased aridity and a decrease in large game in the late Holocene (Hockett 2015; Janetski 1979; Kelly 1997). Aikens, although originally supporting a large-scale migration model for the appearance of Numic-attributed cultural identifiers, more recently has amended this position in favor of cultural variation as a result of environmental adaptation (cited in Jones 2005). Bettinger (2015; Bettinger and Baumhoff 1982) frequently points to increased seed processing as a marker of Numic people, but seed processing using basketry is observed throughout the Holocene in the Great Basin, and this same case has been made for behavioral and functional change in subsistence for various events throughout the early, middle, and late Holocene (Adovasio 1986; Aikens 1982; Grayson 2011; Herzog and Lawlor 2016; Jennings 1957; Madsen and Rhode 1990; Rhode and Louderback 2007; Simms 1983).

Skeletal data have been a significant indicator of paleoecological adaptation. Studies of Fremont-aged sites often emphasize the subsistence strategy of Fremont people as mixed economies, incorporating wild and cultivated foods. Stable-isotope analysis appears to support this interpretation of a mixed economy, suggesting variability in diet in village sites and non-village hunter-gatherer sites, and between men and women (Coltrain and Stafford 1999). Diet of Great Salt Lake people appears to have changed over time as well, coinciding with change from summer to winter rainfall patterns at the end of the Medieval Climatic Anomaly. Specifically, after 800 cal BP, there was a decrease in the consumption of cultivated foods (Coltrain and Stafford 1999). This interpretation is similar to studies of mixed forager/farming communities in the Southwest (Vierra 2008).

Criticisms of Environmental Adaptation. Jones (2005) argues against an adaptive model of technological change because of what is termed "panglossism", which is the tendency to see every adaptation (in this case, artifact change) as optimal, even though this may not be the case (Bahar 2017; Gould and Lewontin 1979). Simms (2008) argues that it is biased to assume that observed artifact change is evidence of the spread of people with more optimal technology, because people may adopt and use a new technology for a multitude of reasons that are not simply functional. This argument against a strict ecological model is relevant to arguments against migration as well. Additional criticism of this adaptive model, like the population replacement model, is that this perceived difference in subsistence strategy may be overstated—both pre-Numic and Numic mobile hunter-gatherers shared a very similar subsistence strategy (O'Connell et al. 1982).

Summary of Major Findings

Before assessing the results of the analyses presented earlier in the dissertation in light of the four models of late Holocene culture change in the eastern Great Basin, I first summarize my principle observations of coiled basketry and cordage from Chapters 3 and 4. I highlight patterns of change observed and measured, and how these patterns were specifically interpreted.

Variability in Basketry and Cordage at Bonneville Estates Rockshelter

In Chapter 3, the diachronic study of coiled basketry and cordage from Bonneville Estates, I concluded that patterns observed in the site's record was strongly linked to the subsistence pursuits of its human inhabitants. Seed processing in terms of parching and/or stone boiling was noted throughout the assemblage based on burning on the interior of baskets, and this interpretation was independently supported by macrofloral evidence (Rhode and Louderback 2007). The presence of bundles in most baskets throughout the variously-aged component assemblage also supported the interpretation that baskets were multi-functional (i.e. bundles are associated with water-handling, but water-handling is not necessary for seed parching). Cordage indicates that a diverse set of activities like trapping and net-hunting was also associated with the rockshelter, alongside other general domestic activities. Humans likely also manufactured cordage at Bonneville Estates in some periods of the middle Holocene, and they also repaired basketry. Changes in site function may have shifted in the late Holocene (after 4,100 cal BP, in Component 3), as this study documented an increase in the relative proportion of baskets associated with water-handling and burning. There was also a gradual shift away from general-function cordage made from coarse bark to an increase in fine cordage possibly associated with specialized activities, although there was also a relative increase in faunal cordage associated with generalized activities. Importantly, this study did not identify a wholesale shift in these materials, and even though there are shifts in the relative percentages of these functional materials, there is not an exclusivity in traits from one time period to another.

Not only are there changes in possible site function at Bonneville Estates between the middle and late Holocene, there are also shifts in technological-stylistic attributes of those materials. For basketry, both work directions are found throughout the variably-aged components, but in the late Holocene there is a shift toward right-to-left becoming the dominant work direction. A new basketry foundation also appears in the late Holocene, the introduction of three-rod foundation basketry. Similarly, in cordage, although both spin directions are present diachronically, fine cordage associated with specialized hunting and trapping activities is consistently z-spin throughout the Holocene. Both directions, however, are found throughout the Bonneville Estates record diachronically, so that a shift in dominance should not be considered the same as exclusivity. The production of generalized cordage does not show any trend through time as it was associated with both spin directions.

Both of these major changes documented in the Bonneville Estates textile record appear to represent gradual shifts in site function after ~4,100 cal BP. Together they indicate that at the beginning of the late Holocene there may have been a reorganization of how basketry and cordage were used and who made them. In terms of cordage production, the consistent trend of z-spin direction associated with netting, suggests that the demographic who is associated with net manufacture did not change. Based on ethnographic literature, I interpreted this as representing a consistent craft tradition of masculine net-manufacturing, which was maintained diachronically at Bonneville Estates. In terms of basketry, there was a general consistency in the kinds of containers that were used at the site, but there was a shift in how baskets were made, with an increase in right-to-left work direction and the appearance of three-rod foundation. I interpreted this shift as representing changes in a feminine craft tradition, potentially reflecting an introduction of new manufacturing styles or a potential change in demographic identity.

Characterization of Variability throughout the Late Holocene Bonneville Basin

The Bonneville Estates assemblage expresses some major shifts in perishable artifact technology over time (Chapter 3), with some of the greatest shifts occurring in the late Holocene components (after 4,100 cal BP). In the synchronic study of nine additional regional Bonneville Basin sites which included only late Holocene (~4,400-400 cal BP) assemblages, I observed some of the same patterns regionally that are reflected in the Bonneville Estates assemblage. Most basketry and cordage were interpreted as primarily utilitarian with little decoration, and the assemblages were associated with diverse subsistence strategies including seed processing and water-handling. Like at Bonneville Estates, I interpreted basketry and cordage to be multi-functional, providing evidence for diverse activities at the various sites. I also noted that although traits could be assigned generally to functional or technologically-stylistic categories, there was an interplay between these traits. For example, although work face could be used to predict form, work direction cross-cut form. By reconstructing the *chaîne opératoire* of basketry and cordage, I illustrated the interconnectedness of functional and stylistic traits.

Cordage during the late Holocene in the Bonneville Basin shows a consistency in technological organization, in which strong, fine cordage with sheet-bend knots, nooses, girth-hitches, and slip-knots were used frequently for traps and nets. Like at Bonneville Estates, this specific fine cordage was also most frequently associated with one initial spin direction: z-spin. Also, as in the Bonneville Estates assemblage, both spin-directions are associated with cordage made with coarse, minimally processed, weaker plant fibers, and less-specialized, overhand knots were more frequently found on coarse material. Similar to Bonneville Estates, s-spin direction was also found on fine cordage, but not generally on cordage I designated as netting. I interpreted these stylistic patterns as supporting the diachronic consistency of the masculine netting tradition, and I interpreted this as a widespread, regional tradition.

In the feminine basketry tradition, stylistic traits like dominant work direction, stitch type, and some foundation types varied regionally, whereas assemblages contained a similar toolkit including parching trays and small bowls, with some regional trends likely associated with site function or seasonality. I interpreted this stylistic variability as a potential indication of the presence of women identifying with diverse craft traditions, as opposed to a more standardized masculine net-making tradition.

Application to Models

I next consider the cordage and basketry data from Chapters 3 and 4 to test the four established models that potentially provide a greater context for observed patterns in the Bonneville Basin. Again, Table 5.1 summarizes these mechanisms and expectations.

Model 1: Population Replacement

If a new ethnic population migrated into the region and replaced an in-situ population, it is expected that both cordage and basketry would show a major shift, especially in stylistic traits, that appeared in the region all at once. This traditional population replacement model as an explanation for artifact variability in the late Holocene is inconsistent with the perishables data. Cordage and basketry show separate trends diachronically and regionally, which is inconsistent with an expected model of massive migration. At Bonneville Estates, variability in work direction, presence of bundles, and use wear indicative of seed parching are present throughout the middle (components 5 and 4, dating to ~8,300-4,100 cal BP) and late Holocene (components

3-1, dating to ~4,100-400 cal BP). Half-rod-and-bundle basketry is consistently the dominant type of basket at the rockshelter through time as well as across the Bonneville Basin. Changes in work direction favoring right-to-left work direction and changes in functions of basketry occur gradually over time, not simultaneously or rapidly, as is expected in a migration model.

Three-rod basketry appears at Bonneville Estates early in the late Holocene, in Component 3 (~4,100-1,500 cal BP), and this foundation type also appears across the Bonneville Basin assemblages during the late Holocene. Despite this appearance of a new basketry type, there is little consistency in how three-rod basketry was made, because work direction is not correlated with foundation and varies across the region. Three-rod basketry is not clearly tied to a specific function, so it may represent a new basketry form. However, because there is no other obvious change in technological-stylistic traits associated with manufacture alongside the introduction of this new technology, as would be expected if a new population migrated into the region, this isolated change in basketry foundation is inconsistent with expected trends in the population replacement model.

At Bonneville Estates, fine cordage used for specialized activities like net-hunting and trapping is consistently z-spin over time, and there is no change coincident with the timing of the basketry-foundation change. There is a regional association of z-spin with specialized cordage in the Bonneville Basin in the late Holocene, although some sites are differentiated by their greater proportion of s-spin fine cordage. When the diameters of z-spin and s-spin fine cordage are compared, however, z-spin may represent a more consistent specialized trapping tool (with a standard deviation of ~0.6 mm), whereas s-spin shows a wider range in diameters (standard deviation ~1.1 mm), and may have been used for a variety of tasks outside of netting. Cordage used for generalized tasks shows little consistency through time at Bonneville Estates or regionally during the late Holocene. Because there is no widespread, sudden change in cordage manufacturing, the cordage data do not indicate a population replacement occurred in the Bonneville Basin during the late Holocene. Additionally, because only one material class presents evidence of significant change, and because other changes are gradual and inconsistent, population replacement as an explanation for observed regional and diachronic artifact variability should be ruled out. These patterns, however, do not discount all kinds of migration, however, as discussed below with Model 2.

Model 2: Adoption of New Technology Through Diffusion or Small-Scale Migration

If technological changes were the result of the introduction of a new technology or technique from outside the region through diffusion or small-scale migration, it is expected that cordage or basketry would show a major shift in multiple traits, but not both artifact types. As discussed above, there is only minor variability in the creation of z-spin fine cordage for specialized activities, but there is more variability in initial s-spin cordage and coarse cordage used for general purposes through time and across the region. When basketry is compared, the appearance of three-rod foundations may be evidence of a newly introduced technology, and variability in work direction (a technological-stylistic trait) is consistent with hybridization, a potential effect of diffusion if the functional technology adopted from elsewhere and was then replicated in a local community. The additional inconsistency of other technological-stylistic traits in other baskets (i.e. no exclusive work direction, foundation type, or stitch type) reflects small-scale patterns potentially more consistent with diffusion by way of small-scale migration or replacement model of ethnogenesis. The greater variability in basketry than cordage provides further support for this model, because it is expected that there should not be a full shift in technology, as expected in Model 1. As presented, a classic a diffusion model does not explain all variability observed in the assemblages, but a small-scale migration model which takes into account the social environment in which technological diffusion may have occurred is supported by these observations.

Model 3: Random Drift, or In-Situ Development

If local random shifts explain variability in these assemblages, it is expected that cordage or basketry would show a gradual shift in how they are made or used in a manner than reflects random variability, but not conscious adaptation. To some degree, the data presented here could support this explanation. Although there was a consistency in the application of z-spin fine cordage to specialized activities, the presence of other spin directions may show random localized innovation or local approaches to manufacturing methods. There are trends in the most common types of basketry foundation (half-rod-and-bundle), but the variability seen in technological-stylistic traits like work direction or stitch type may be seen as local development. These fluctuations through time and variation across space appear to be of degree, not presence/absence, in both the case of cordage and basketry. Thus, drift as an explanation for technological change cannot be ruled out especially in relation to technological-stylistic, non-functional traits. However, three-rod basketry makes its first appearance in Component 3 at Bonneville Estates, and it appears at nearly all sites in the region during the late Holocene. The widespread appearance of this technology is not parsimonious with a drift model of technological change; however, this model may explain some patterns observed in these assemblages.

Model 4: Environmental Adaptation

If technological change was the result of cultural adaptation to ecological shifts, then cordage or basketry should show a gradual shift in functional (subsistence-related), but not stylistic traits. This model may explain some technological change in the Bonneville Basin assemblages. Cordage used for trapping is continually emphasized throughout the Holocene, and the method by which it was produced by using fine fibers spun in a z-direction is consistent through time, spanning the middle and late Holocene at Bonneville Estates and repeatedly present in the late-Holocene assemblages of the region. This would imply that small-game communal hunting continued to be a major factor in the repeated occupation of Bonneville Estates and other sites in the Bonneville Basin. Component 5 (~8,300-4,800 cal BP) has the largest amount of cordage inferred to have functioned in small-game hunting, and this support interpretations of a decline in large game during episodes of drought in the middle Holocene versus a period of increased moisture supporting larger human populations between 7,500-6,500 cal BP (Louderback and Rhode 2009). During the time of Component 3 (~4,100-1,500 cal BP), cordage manufactured for small-game netting outnumbers other cordage, and this coincides with fluctuations in precipitation which may have indirectly led to a decline in the production of coarse cordage; however, an increase in juniper pollen during this period indicating increased availability of this plant material is contradictory to the decline in cordage made from this material. The other potential uses of fine fiber and general-use coarse cordage is not immediately visible in these assemblages, so there are likely complex subsistence activities practiced using cordage that are currently unknown.

Basketry form does not drastically change over time, because half-rod basketry and parching trays are the most common types of baskets at Bonneville Estates throughout the

Holocene, and regionally in the late Holocene, although at Bonneville Estates there was an increased frequency of half-rod-and-bundle basketry and more frequent burning after 4,100 cal BP. This supports the interpretation that seed-parching is associated with increased diet breadth consistent with a potential expansion of xeric conditions between 2,800-1,850 cal BP, as discussed in Chapter 2 (Louderback and Rhode 2009). This model as I have presented it states that the most significant variability should be in functional traits occurring alongside paleoenvironmental shifts. However, the most significant variation in technology occurs in technological-stylistic traits, which is inconsistent with an environmental adaptation model of technological change, so this model does not explain all patterns of variability in the Bonneville Basin. Environmental adaptation, though, does likely explain some of the variability observed in the assemblages.

Discussion: The Role of Gender

Based on the above consideration, Model 2 accounts best for the appearance of multiple craft traditions in basketry and the single craft tradition in specialized cordage, because there is not a wholescale change consistent with an ethnic replacement. This small-scale migration/diffusion model appears to be the most parsimonious explanation for the sudden appearance of three-rod basketry, and the hybridization of technological-stylistic variables consistent with replicating a new technology outside of its craft tradition of origin. It is likely that other elements of these models may have played a part in observed technological variability, because trends in functional characteristics are likely associated with subsistence practices, as stated in Model 4, and there may have been some unconscious changes in technological-stylistic traits. In Chapters 3 and 4, many of this study’s findings were contextualized in gender roles, broadly suggesting that changes in basketry traits potentially reflect a recombination of feminine technologies, manufacturing practices, and subsistence strategies. Conversely, based on ethnographic accounts, I also suggested that net-making was a masculine technology, represented by fine cordage, sometimes with complex knots, and a consistent average diameter. Below I further consider how gender played a role in the development of basketry and cordage variability in the Bonneville Basin.

Gendered Tasks and Patterns

Cordage. To reiterate, at Bonneville Estates (see Chapter 3) fine cordage used for netting was consistently z-spin through time, suggesting that there was long-term stability in this masculine craft tradition. According to the Bonneville Estates assemblage, although both spin directions are present in coarse cordage and in some fine cordage, when men were taught how to make netting, they learned to spin in a z-direction. In other words, men rolled fine fibers up the thigh when consolidating loose fibers into plies, then likely reversed this direction to join multiple plies for netting cordage. They then joined cordage using sheet-bend knots and potentially loops, occasionally repairing this tool. This appears to be the method used by men to make specialized cordage for millennia at Bonneville Estates. Other cordage, like fine cordage used for other functions that are non-diagnostic in these assemblages, and coarse cordage used for generalized tasks, which I assume to have been made by women, do not appear to be consistently associated with a single spin direction. When women made cordage at Bonneville Estates, they either rolled unconsolidated fibers up or down their legs, and reversed the direction when plying together cordage. The presence of both spin directions may indicate a more flexible, less-restrictive technology for female tasks, or an activity that is indicative of a family-level method of cultural transmission of manufacturing method.

Regionally during the late Holocene (see Chapter 4), the association of z-spin with specialized cordage is also seen at Swallow Shelter and Thermal Point, but s-spin is the dominant spin direction associated with fine cordage at Four Siblings, Tube Cave, Remnant Cave, and Juke Box Cave. As illustrated in Figure 4.18, even at sites with a greater proportion of s-spin specialized cordage, the diameters of z-spin cordage (which is still present, but in lower percentages) have a smaller standard deviation than s-spin cordage, which I interpret as indicating that there is a greater consistency in how z-spin cordage is manufactured than s-spin cordage. I suggest that men still made nets at all sites, but that the other fine, non-diagnostic cordage may have functioned as traps, snares, and fishing line, potentially made by women, as discussed in Chapter 2 (see also Janetski 1991; Kelly 1997; Malouf 1940; Wheat 1967). Cordage for rabbit-skin blankets was also made from fine fibers, and in the Southwest, by women (Leach 2018). Therefore, the difference between these sites in terms of spin direction may reflect a diversity of gendered tasks, where men made nets, but the activities of women with a separate craft tradition were especially emphasized at Four Siblings, Tube Cave, Remnant Cave, and Juke Box Cave.

These separate trends in gender-assigned tasks lend some support for my assertion that there was a stable masculine craft tradition in the Bonneville Basin that spanned from the middle Holocene through the late Holocene. It does not reflect a major demographic shift during the Fremont (traditionally ~1,300-500 cal BP, but potentially 2,000 cal BP to 700 cal BP [Janetski and Talbot 2014; Madsen and Simms 1998; Talbot 2018]) or Numic (beginning after ~1,000 cal BP) cultural periods. Instead, there is more variability in feminine crafts potentially reflective of a small-scale migration and subsequent diffusion of craft traditions from outside the Bonneville Basin. The heterogeneity in feminine cordage production may reflect a greater diversity of feminine craft traditions, potentially driven by factors including: 1) marriage traditions favoring women from outside of the community; 2) potentially a lower logistical mobility of women than men, leading to increased drift in technological traits, and a greater logistical mobility of men; or 3) women hostages taken through raiding leading to increased drift locally in technological traits. These factors are discussed further below.

Basketry. As a feminine technology, basketry does not inform directly on the activities of men, although the entire community is affected by the actions of weavers. Women were largely making baskets which were utilitarian and functionally flexible. At Bonneville Estates, women made watertight baskets that were also used for parching seeds, a trend seen throughout the Holocene and regionally in the Bonneville Basin during the late Holocene. When making a basket a woman inserted an awl into the foundation, either from the interior or the exterior of the basket, depending on whether she was making a large tray or bowl, or a narrow basket. Most commonly, the basket weaver then inserted stitches to the left of the previous stitch, whether working from the interior or exterior of the basket. Some women, however, worked in the opposite direction, particularly when they were working from the interior of large baskets and parching trays. At Bonneville Estates, women usually worked from the left to the right of previous stitches (although not exclusively) during the middle Holocene, but over time, there was a shift with women more frequently working from the right to the left in the late Holocene. After 1,500 cal BP (components 2 and 3; Figure 3.8), women at Bonneville Estates worked exclusively from the right-to-left direction. This trend may represent a gradual influx of women who were raised in a tradition favoring working to the left. However, the tradition of working from the opposite direction did not disappear when right-to-left work direction was favored, especially among women when they were making large baskets and trays from the interior of the basket. With the appearance of a new foundation type (three-rod), the chosen work direction reflects similar trends as in half-rod foundation (Table 4.18), as it is incorporated into regional assemblages.

The appearance of three-rod basketry in Component 3 (catalog no. 18061, dating to 4,100-2,850 cal BP) at Bonneville Estates is significant, in that this later became a widespread basket foundation type regionally, and its function is unknown. Three-rod basketry was not necessarily watertight (there are no bundles), so these baskets likely were not used for carrying water. Three-rod basketry was infrequently used for parching seeds and instead was used in ways which resulted in abrasion and polish. Work face is frequently associated with the intended final form of the basket; however, three-rod basketry was made either on the concave or convex work surface, providing little indication of final form. Three-rod foundation may have been an introduced technology that served a new, widespread function in hunter-gatherer communities, although in these assemblages three-rod basketry was likely manufactured locally, because initial stages of construction reflects craft traditions of Bonneville Basin women. A functional role of this foundation type is supported by the inconsistent way it was made when looking at technological-stylistic traits: both right-to-left and left-to-right work directions are present, but as in half-rod basketry, right-to-left is most common, reflecting local craft traditions. Other stylistic traits have similar inconsistences, because interlocking and non-interlocking stitches are also present on this foundation. This inconsistency lends further support to a possible diffusion of a new functional technology into groups of women, which was then replicated using common manufacturing styles, and regional variation reflected similar trends observed in rod-and-bundle basketry.

The basketry data appear to support my previous assertion about the cordage data: there are shifts in feminine crafts potentially reflective of a diffusion of traditions, and/or local innovation in traits. Like cordage, these basketry patterns may be driven by factors including: 1) marriage traditions favoring women from outside of the small-scale multi-family community, who brought with them three-rod basketry and an increased preference for right-to-left work direction; or 2) potentially a lower logistical mobility of women over men, leading to increased drift and experimentation in technological traits. The basketry stylistic groups discussed in Chapter 4 (Table 4.26) may represent sites with higher proportions of women with new traditions, unrelated to their site function. These factors are discussed in the following section.

Gender Influences on Hunter-Gatherer Lifeways

Gender Influencing Mobility. Studies in the American Southwest have explored how gender-restricted mobility may have influenced relationships between neighboring groups in the Southwest, which may lend support to my explanation of the trend in the Bonneville Basin record. Coltrain and Janetski (2019) have suggested that in the late Holocene, Basketmaker II groups had a fluid socio-economic relationship with Great Basin hunter-gatherer groups. This study indicated greater male-centric logistical-mobility in semi-agricultural communities when compared to women, and this mobility promoted hunting forays and trade for exotic materials from neighbors (Coltrain and Janetski 2019). Conversely, the authors suggested that women maintained more stable residences, although there may have been potential integration by marriage of female hunter-gatherers into Basketmaker II groups (Coltrain and Janetski 2019). A recent comparison of forager-farmer male and female crania from the Sonoran Desert also supports this assertion that males were more logistically mobile than females, leading to a greater likelihood of matrilocal residence patterns, and potential polygyny (Byrd 2014). Similar studies of mitochondrial DNA and Y-chromosome data from burials in the Southwest also support different genetic histories of males and females in that region, potentially as a result of a greater logistical-mobility of men and more insular and more residentially-mobile communities of women (Kemp et al. 2010). In the Great Basin, skeletal studies of Great Salt Lake people also suggest that men had a higher logistical-mobility than women, who were residentially-mobile (Brunson 2000; Coltrain and Stafford 1999; Ruff 1999). Simms (1999) also suggests that pottery, another feminine craft, indicates there was variation in the mobility and organization of women when comparing interactions between Great Basin and Colorado Plateau Fremont farmers and other hunter-gatherers (see also Simms et al. 1997). Other studies of Fremont-attributed projectile points also suggested that there may have been patterns of gender-based logistical-mobility that could result in regionally variable technology and trade patterns (Holmer and Weder 1980).

Gender Influencing Craft Traditions and Borders. Gendered patterns of mobility likely influenced gendered material culture, which potentially is illustrated in this study. Throughout this dissertation, I have suggested that perishables in the Bonneville Basin show that the consistency of spin direction in the masculine net-making tradition represents a stable population with little evidence of demographic shifts indicative of migration, and that there was a less homogeneous population of women. Likewise, Coltrain and Janetski (2019) also suggest, based on basketry traditions, that the populations in the Southwest and Great Basin had fluid boundaries. Specifically, for example, Adovasio and colleagues (2002) suggest that the spread of false-braid rims in Fremont coiled basketry is potentially the result of acquiring wives from Ancestral Puebloan people. The three-rod basket from Component 3 at Bonneville Estates dating to 4,100-2,850 cal BP, however, also has a false-braid rim and it predates the accepted time period for Fremont and is contemporaneous with Basketmaker II in the Southwest (3,500-1,450 cal BP) (albeit three-rod basketry is not noted in the Southwest until the Basketmaker III period (1,450-1,200 cal BP) (Morris and Burgh 1941).

To address this problem further, here I review the record of coiled basketry across the Desert West, focusing on the late Holocene's culture areas in the eastern Great Basin, Snake River Plain, Colorado Plateau, and Southwest (Table 5.2). This includes the eastern Great Basin's hunter-gatherers, Fremont, Basketmaker/Ancestral Puebloan, and Numic cultures. Most foundation types I observed in the Bonneville Basin's hunter-gatherer assemblages are found in the eastern Great Basin and Southwest (Table 5.2; Figure 5.2). Half-rod-and-bundle-foundation basketry is found across the entire region (Figure 5.2) but is not as common in Numic basketry (Table 5.2). Three-rod basketry is not present in the middle Holocene, but becomes widely dispersed in the late Holocene across all regions and time periods, but not among Ancestral Dene basketry. Right-to-left work direction is most common across the entire region, although baskets with left-to-right direction are also present in most culture areas after the Basketmaker III period (after around 1,200 cal BP), but not in Ancestral Dene basketry (Figure 5.3). Left-to-right work direction is equal in proportion to right-to-left work direction in the eastern Great Basin from the middle Holocene until the late Holocene, when right-to-left dominates (Adovasio 1970). In most regions, stitches engage with the foundation with interlocking and non-interlocking stitches, with no regional trend, and examples of split and unsplit stitches are found in basketry assemblages across all cultural areas. The traits with the strongest regional trends include three-rod-bunched basketry, which is widely dispersed but temporally limited to the late Holocene; half-rod-and-bundle basketry, which is widely dispersed but rare in later periods except in Ancestral Dene assemblages; and a work direction shift in the eastern Great Basin that is majority right-to-left in the late Holocene, counter to increased incidences of left-to-right basketry in the Southwest (Table 5.2).

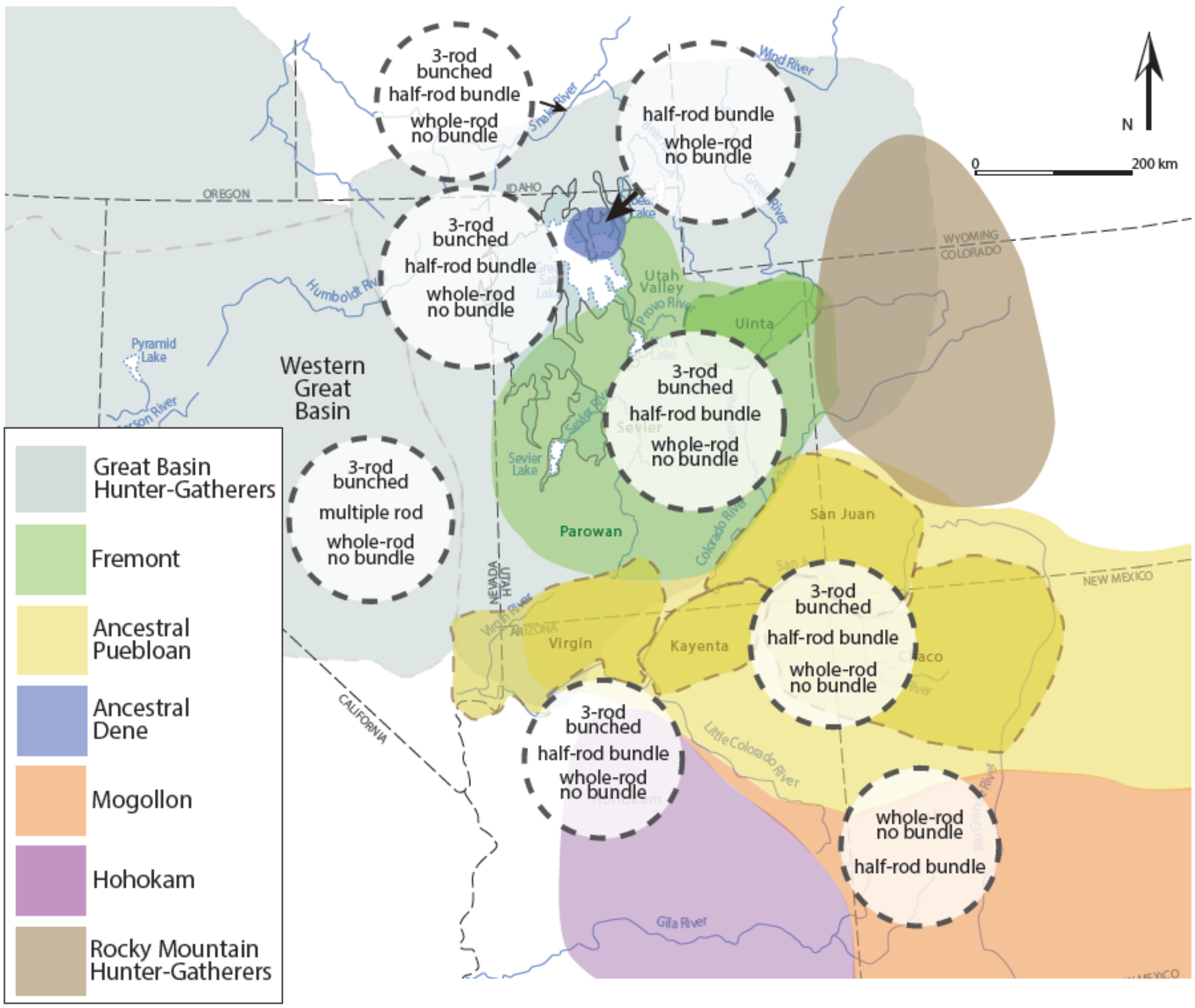

Figure 5.2. Common foundation types in the late Holocene Desert West. Three-rod foundation is found in all cultural groups except in Ancestral Dene and Mogollon areas. Half-rod-and-bundle foundation is the most widespread foundation type and is found in all areas except for the western Great Basin. There is no published survey of Rocky Mountain hunter-gatherer basketry. See Table 5.2 for more details and sources.

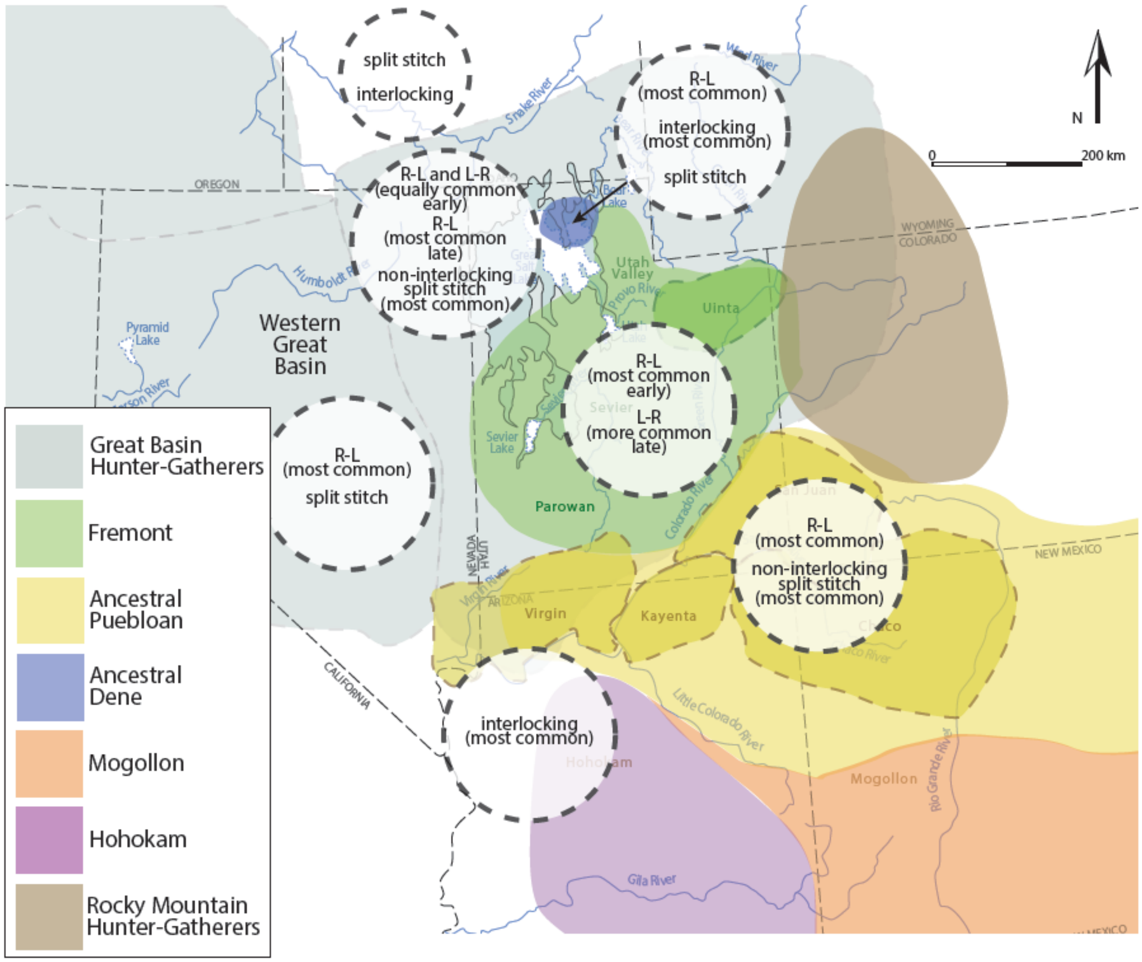

Figure 5.3. Stitch types in the late Holocene Desert West. Right-to-left work direction is the most common work direction geographically, a reverse from middle Holocene basketry in the Bonneville Basin. Right-to-left is the exclusive work direction for Ancestral Puebloan basketry until the late Holocene, when left-to-right is documented. Sources do not indicate work direction in the Snake River Plain, Hohokam, and Mogollon culture areas. All regions include split stitches, and some interlocking and non-interlocking stitches, with some regional variability in dominance of these traits. There is no published survey of Rocky Mountain hunter-gatherer basketry. See Table 5.2 for more details and sources.

This survey suggests that there was a spread of three-rod basketry across the entire region starting in the late Holocene (after at least 4,100 cal BP). This implies a cross-cultural functional requirement for basketry with bundles, a requirement that appears to have declined in popularity during the Numic period (after ~1,000 cal BP) (however, see discussion of problems in assigning dates to a proposed Numic migration in Chapter 2 and earlier in this chapter). The presence of both work directions in basketry in the eastern Great Basin and Southwest may be evidence of an increased permeability of the cultural border between these regions after 4,400 cal BP. While both work directions were present in Bonneville Basin basketry in the middle Holocene in the Bonneville Estates assemblage, the Southwestern basketry assemblage was homogeneously made in a right-to-left work direction until 1,200 cal BP, after which three-rod basketry was made with either work direction (Morris and Burgh 1941). This appearance of left-to-right work direction in the Southwest may be evidence of an influence of Great Basin hunter-gatherer women on Ancestral Puebloan women. Conversely, the increased dominance of right-to-left work direction in the Bonneville Basin during the late Holocene, as seen in this study, suggests an increased influence of Southwestern women on Great Basin hunter-gatherer weaving traditions. If women were more residentially-mobile, this fluidity of boundaries may have been driven by marriage.

I have assumed that netting was considered a masculine craft based on ethnographic literature, and reports from other culture areas have similarly discussed specialized cordage in terms of gendered tasks. Leach's (2018) survey of *Apocynum* sp. rabbit-skin blanket cordage (similarly classified as fine and specialized) from the Intermountain West (Southwest, Colorado Plateau, and Great Basin) indicates that historically, women most commonly made fine s-spin Z-twist cordage for specialized rabbit-skin blankets, whereas in parts of the Great Basin, men made the cordage for these blankets. In the late Holocene, although forager and horticultural communities in the Southwest and Great Basin likely had some border fluidity, the regional maintenance of opposite cordage spin direction on fine cordage was maintained, indicating at least one socio-technological border that was not fluid in the past, unlike basketry (Leach 2018).

As was noted for Bonneville Estates, Leach (2018) also found that these discrete traditions were maintained over millennia.

Expanding on Leach's (2018) study, here I present a brief review of the published literature to compare the dominant spin direction of fine, specialized cordage in the Bonneville Basin with similarly-attributed materials in the Intermountain West dating to the late Holocene (Table 5.3, Figure 5.4). This survey was hindered by inconsistent terminologies and analytical techniques, so it is limited to specialized cordage labeled as fine plant (including *Apocynum* sp.), bast, or diagnostic net or trap. Although final twist is most commonly published, I have recategorized these according to initial spin, which is usually the opposite direction from final twist to compare the material. Specialized cordage is consistently predominantly z-spin in the eastern Great Basin including sites attributed to hunter-gatherers, Fremont sites in the Great Basin and Colorado Plateau, and sites attributed to Ancestral Dene. Conversely, the dominant initial spin direction in the Southwest is usually s-spin. This comparison supports Haas' (2006) observations that at sites shared by Fremont people and Ancestral Puebloans, z-spin is associated with Fremont and s-spin is associated with Ancestral Puebloans, illustrating this potential strict boundary in specialized cordage craft traditions. The only sites with a dominant z-spin in the Southwest are Vandal Cave in the Four Corners region (Leach 2018) and Fresnal Shelter (McBrinn 2002) to the south in the Tularosa Basin. An analysis of northern and western Great Basin netting also indicates a general trend of z-spin cordage as netting (Connolly et al. 2017). To reiterate, however, cordage used in rabbit-skin blankets in the Southwest may be considered a feminine craft tradition, potentially influencing the boundaries reinforced in this survey. A more complete study would compare only diagnostic cordage.

Table 5.3. Regional Comparison of Specialized Cordage in the Late Holocene.

Region	Cultural Area	Site	Abbre-viation	Category	Initial Spin Direction
Great Basin	Bonneville Basin	Bonneville Estates [a]	BER	fine	z
		Four Siblings [a]	FS	fine	z
		Remnant Cave [a]	RC	fine	z
		Tube Cave [a]	TC	fine	z
		Swallow Shelter [a]	SS	fine	z
		Juke Box Cave [a]	JB	fine	z
		Thermal Point [a]	TP	fine	z
	Eastern Great Basin / Colorado Plateau	Cowboy Cave [b]	CWC	bast	z
		Old Man Cave [b]	OM	bast	z
	Ancestral Dene	Promontory Caves 1 and 2 [c, d]	PC	net, fine	z
	Fremont	Mantle's Cave [e]	MC	*Apocynum* sp.	z
		Lakeside Cave [f]	LC	bast, *Apocynum* sp.	z
Southwest	Ancestral Puebloan / Basketmaker I & II	Boomerang Shelter [b, g]	BS	fine, robe	s
		Old Man Cave [b]	OM	fine	s
		Sand Dune Cave [b]	SD	fine	s
		Durango Shelter [b]	DS	fine	s
		Three Fir Shelter [b]	TF	fine	s
		Vandal Cave [g]	VC	bast	z
		Kiet Siel [g]	KS	robes	s
		Turkey Cave [g]	TCS	robes	s
		Cottonwood Cave [h]	CTC	*Apocynum*	s
	Mogollon	Tularosa Cave [i]	TuC	bast, snares	s
		Cordova Cave [i]	CoC	bast, snares	s
		Last Chance Burial Cave [g]	LCB	robes	s
	Tularosa Basin	Fresnal Shelter [j]	FRS	*Apocynum*	z
	Hohokam	Chevlon Creek [k]	ChC	net	s
	Sinagua	Wupatki Pueblo [g]	WP	robes	s

[a] This report; [b] Haas 2006; [c] Goldberg 2018; [d] Steward 1937; [e] Goff 2010; [f] Goldberg 2018; [g] Leach 2018; [h] Gunnerson 1969; [i] Bluhm and Grange 1952; [j] McBrinn 2002; [k] Kaemlein 1971.

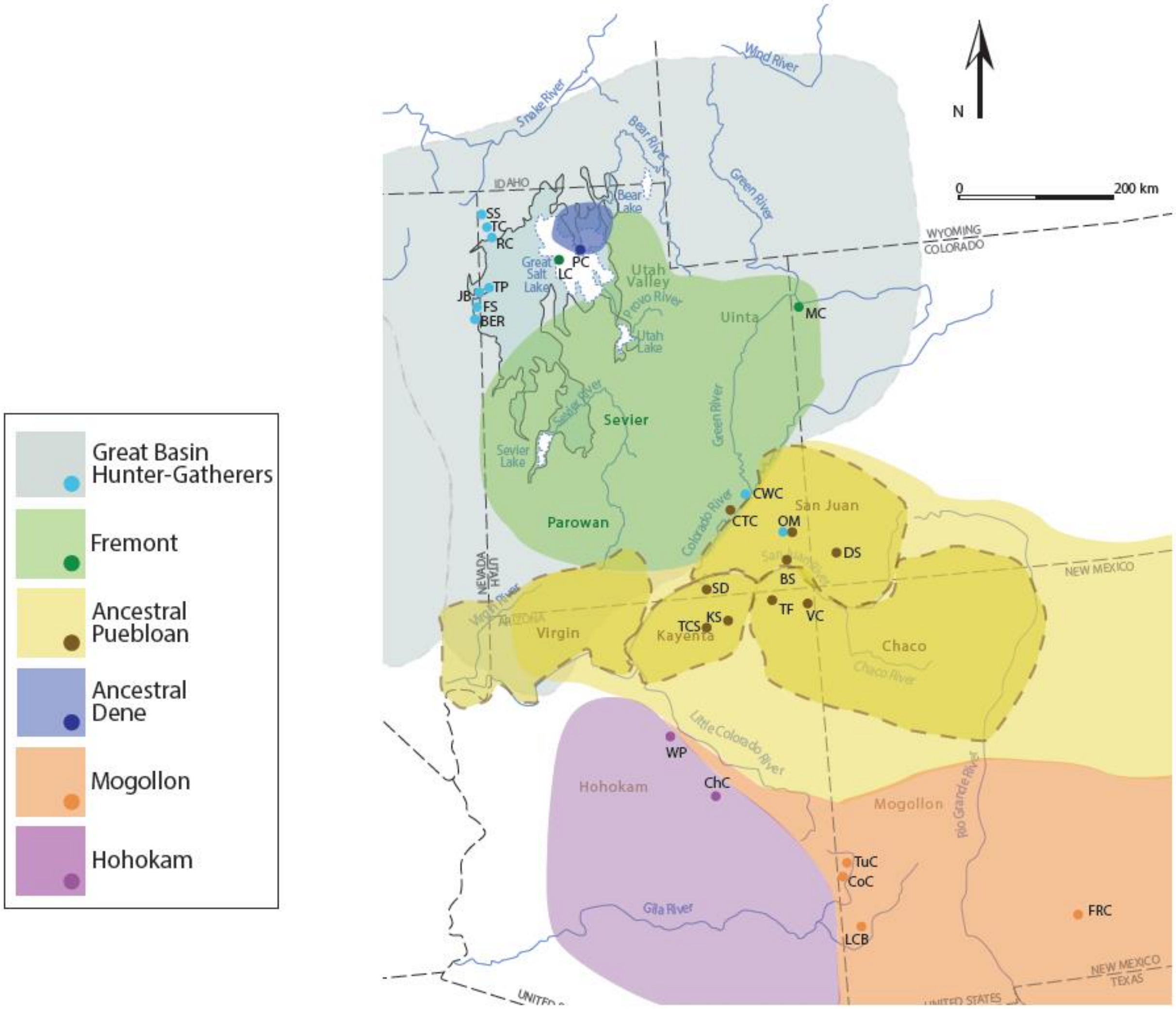

Figure 5.4. Locations of late Holocene sites with specialized cordage considered in Table 5.3.

This survey of specialized cordage in the Desert West emphasizes the potential for this technological-stylistic trait to reflect cultural boundaries, and lends support to the interpretation that people responsible for the manufacture of specialized cordage maintained a social border between the Southwest and eastern Great Basin despite the diffusion of other stylistic traits in basketry. My study provides data for the Bonneville Basin, but there are few studies of eastern Utah cordage. Although there was an emphasis on reduced mobility of women in these cultural groups in the eastern Great Basin and Southwest, the greater mobility of men may have provided the opportunity to maintain contact with neighboring groups, and through marriage or trade may have distributed feminine crafts to each region.

Function of Flexible Boundaries. Foraging women of the Great Basin may have married into Great Basin farming communities (Coltrain and Janetski 2019), supporting observations from outside the Southwest that forager women also married into farming communities. Recent work by Yanicki (2019) suggests that Uinta and Salt Lake Fremont women married into bison hunting-focused Ancestral Dene society as the Fremont period ended (after ~600 cal BP), because additional labor was in demand and alliance building was sought after. Additionally, studies note increased marrying out of Puebloan women into proto-historic Plains hunting groups after ~500 cal BP because of increased skin-processing labor demands and shared economic stability, potentially to gain social status, and as a reflection of climatic stressors affecting agriculture (Habicht-Mauche 2008). Villages in the southern Plains blended Puebloan agriculture and Plains bison-hunting traditions in ways that were potentially gendered: end scrapers and beveled knives used for hide processing by women were often associated with valuable nonlocal resources, potentially indicating higher status for these women in Plains society (Spielmann 1983; Vehik 2002). Mutual benefits to intermarriage between bison hunting and agricultural groups may reflect an increase in labor needed for spring and fall bison hunting as well as increased labor needed during spring and fall planting and harvesting seasons; however, these seasons frequently overlap (Spielmann 1986).

Great Basin foraging groups, however, likely did not have such an essential requirement for a long-term labor increase, even though communal hunts were relatively common, so the impetus for change in marriage structure is likely different from bison-focused cultures. Nonspecialist Great Basin hunter-gatherers, unlike Ancestral Dene and Plains bison hunters, may have been more available during harvest times, and may have provided essential labor for neighboring agricultural societies, as has been observed in other regions of the world (Pedersen and Woehle 1991; Spielmann 1986). In exchange for seasonal labor, hunter-gatherers may have provided wild-game resources frequently missing from agriculturalist diets (Spielmann 1986), and marriage is a traditional way of increasing alliances between groups (Yanicki 2019). The potential for alliances between mobile and sedentary people may also include increased trade of nonfood resources (Spielmann 1983, 1986; Vehik 2002). Additional mechanisms for contact between groups may have to do with a shift in power dynamics, for example shifts in yarn production from feminine, personal household contexts to masculine, performative religious contexts in Puebloan groups after ~850 cal BP, which may indicate a change in status of women (Jolie 2014a). This may have encouraged women to marry outside of their community into regions with flexible boundaries.

Trade across Boundaries. Despite a common treatment of cultural regions in the Great Basin as provincial and isolated, a great deal of trade and exchange was present in the Desert West. A survey of literature illustrates the extent of exchange and contact between proposed culture areas in the late Holocene, before the proposed expansion of Numic people (Figure 5.5). Obsidian-sourcing studies show the distance materials traveled from the Snake River Plain, western Wyoming, and central Utah into the Great Basin's hunter-gatherer, Fremont, Ancestral Dene, and Rocky Mountain hunter-gatherer sites, either through the movement of people or trade (Hughes 2014; Janetski 2002; Jardine 2007; Keene 2016; Metcalf and McDonald 2012; Yanicki 2019). Kayenta, Virgin, San Juan, and Chacoan ceramic artifacts are dispersed throughout the Fremont culture hubs, and Fremont ceramics appear in Rocky Mountain, Ancestral Dene, and

Bonneville Basin hunter-gatherer sites, which illustrate contact and trade between culture areas, not necessarily migrations of people (Janetski et al. 2012; Metcalf and McDonald 2012; Searcy and Talbot 2016). The spread of the shield-bearing warrior motif throughout the Great Basin, Colorado Plateau, and Rocky Mountains also illustrates an exchange of cultural ideas that crosscut geographical and cultural boundaries (Janetski et al. 2002; Metcalf and McDonald 2012).

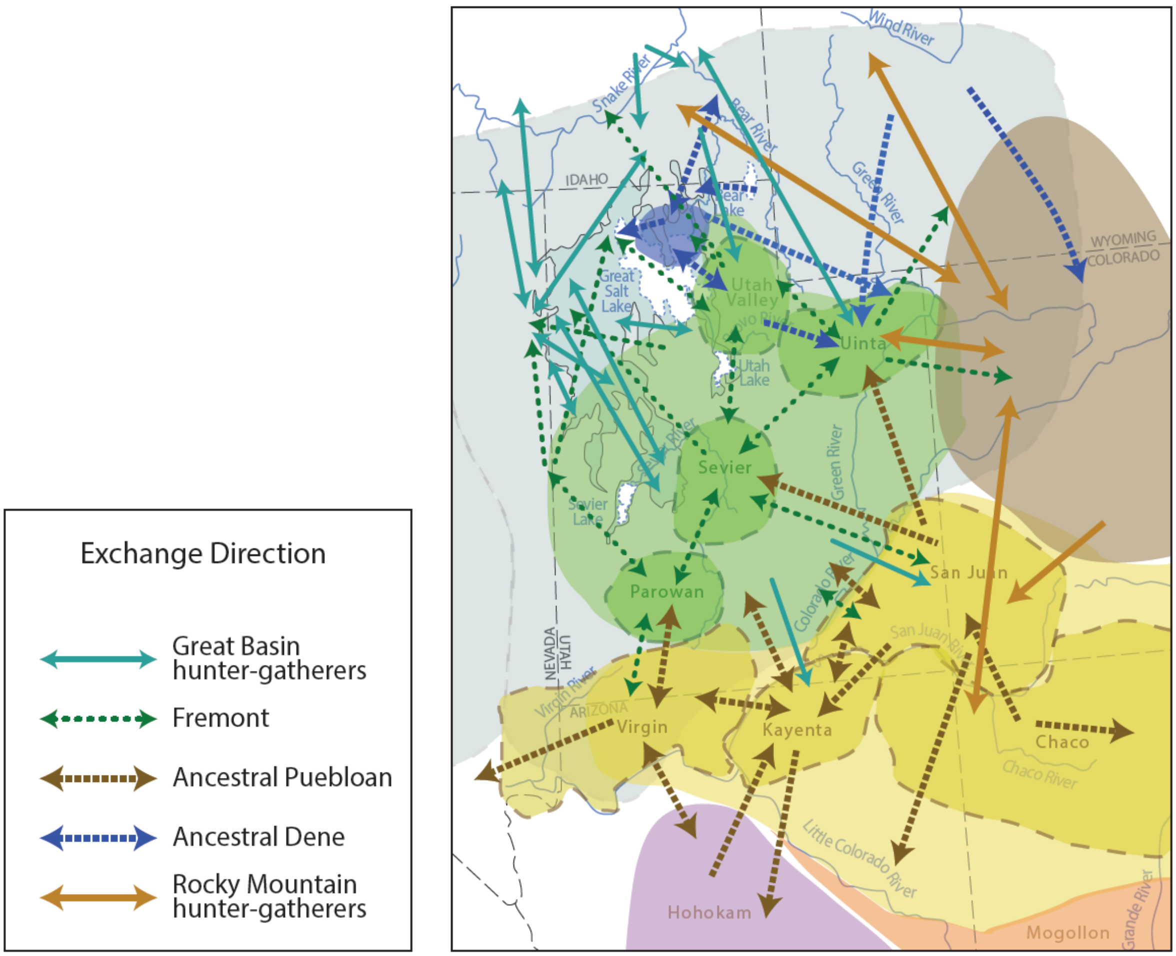

Figure 5.5. Exchange of goods and potential seasonal movements in the late Holocene Desert West and surrounding areas, based on published literature. These exchange directions are based on the presence of ceramics, rock art, footwear, domesticated plants, and sourced obsidian tools in culture areas (inferred from Hughes 2014; Janetski 2002; Janetski et al. 2012; Jardine 2007; Keene 2016; Metcalf and McDonald 2012; Searcy and Talbot 2016; Yanicki 2019).

The presence of exotic artifacts like turquoise and marine shell throughout this part of the Desert West also reveals the large-scale connection of cultural communities in the Southwest, Colorado, and Great Basin. The exchange of these exotic materials is illustrated in Figure 5.6, showing the exchange routes from the California coast to Ancestral Puebloan, Fremont, Ancestral Dene, and Great Basin hunter-gatherer sites, through which *Olivella* sp. and abalone shell moved to sites including Bonneville Estates and Hogup Cave (Janetski 2002; Janetski et al. 2012; Jardine 2007; Metcalf and McDonald 2012; Roberts and Ahlstrom 2012; Searcy and Talbot 2016). Additionally, the spread of turquoise from central Nevada into central Arizona, and turquoise from southern Arizona and eastern New Mexico into Hohokam, Ancestral Puebloan, and Fremont cultural sites, shows the interconnectedness of cultural areas on a broader scale than is initially visible when studying individual sites. The presence of these exotic materials is also evidence of the diffusion of materials from far-flung places, rather than a massive migration of people, which may be a point of comparison for the proposed diffusion of lower-visibility basketry traits into Bonneville Basin hunter-gatherer sites.

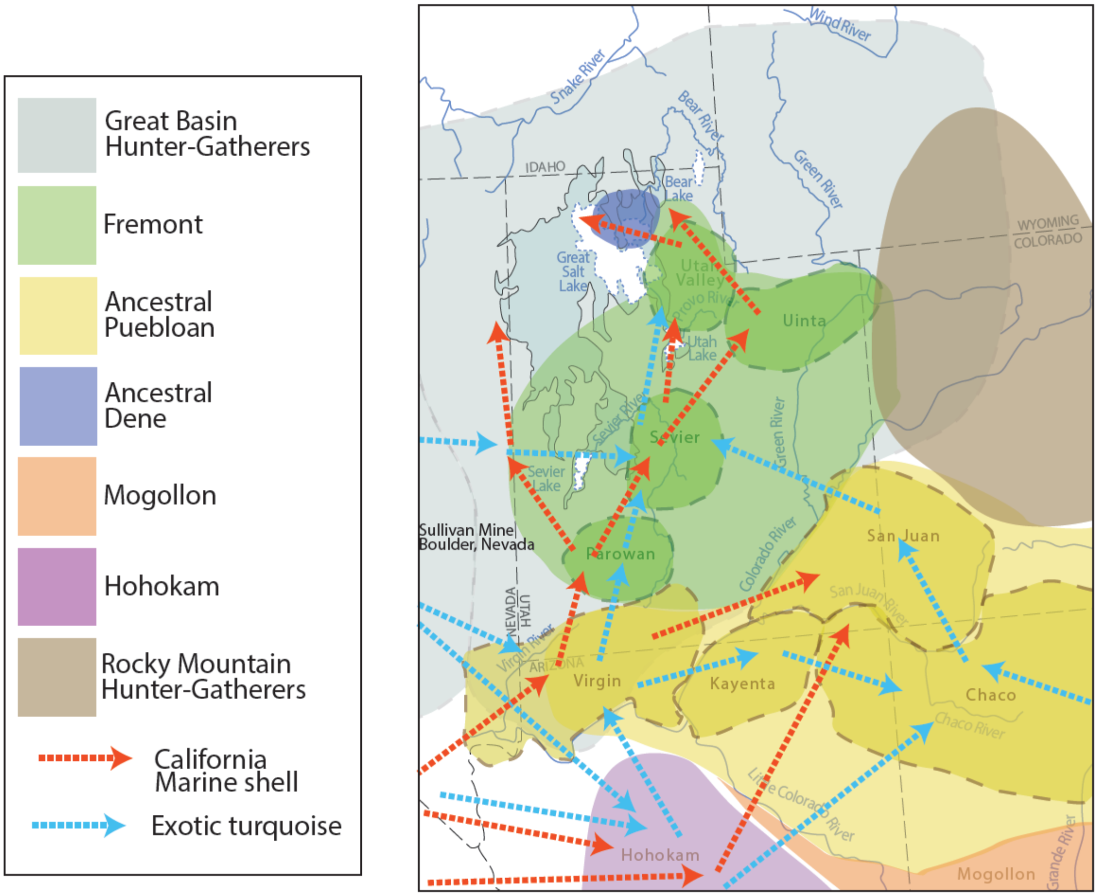

Figure 5.6. Routes in the trade of exotic goods. California marine shell like *Olivella* sp. and abalone, as well as turquoise sourced to central Nevada, the Sonoran Desert, and New Mexico are found throughout the Southwest and Great Basin. This further illustrates that Bonneville Basin hunter-gatherers were part of a wider exotic material exchange system.

Kinship

Defining the kinship structure of Bonneville Basin people is a way of describing the patterns of ethnogenesis observed in this study. Leach (2018) suggested that the maintained manufacturing styles of cordage in combination with other types of innovation (loom textiles and agriculture) may indicate that Southwestern groups had an exogamous marriage structure, a behavior that is also reiterated by Haas' (2006) comparison of Ancestral Puebloan and Fremont cordage. Focusing on artifacts made in variable craft traditions (cordage, sandals, and projectile points), McBrinn (2005, 2008) suggests that Southwest hunter-gatherer groups in the late Archaic (after 2,000 cal BP) had an endogamous marriage structure that maintained the boundaries between some craft traditions and not others. This in turn may be reflected in other material culture, with a gendered interpretation of masculine material culture (projectile points) as more stylistically-variable than feminine material culture (basketry) (Coltrain and Janetski 2019). This study and others suggest that during the late Holocene societies were fluid, and that there was likely movement of individuals into and out of foraging and farming groups, providing the opportunity for intermarriage (Coltrain and Janetski 2019). Based on the similarities between basketry in the wider region, and the division between cordage used for netting, I assume that the marriage structure in the region was exogamous for women, with hunter-gatherer families emphasizing marriage outside bands, occasionally incorporating women from outside Great Basin hunter-gatherer groups.

My interpretation of the Bonneville Basin's consistency of netting cordage as initially z-spin and associated with men may suggest that women from other communities and culture areas were marrying into communities of their husbands' families (patrilocality), rather than the reverse (matrilocality). This may be a simplistic interpretation of these data, because perishable craft traditions are grounded in tradition and slow to change. Social pressure and the complexity of kinship potentially influenced change in technological-stylistic traits, too. For instance, a family group of women may have strictly adhered to a work direction preference, because although this is a low-visibility technological-stylistic trait, it is not invisible. A new member of the community may have been encouraged or pressured to mimic the work direction of her new community, a learning method which has been observed in some pottery traditions, potentially as a result of a patrilocal kinship structure (Crown 2014; Herbich and Dietler 2008; Roe 1995).

Recent ethnological studies suggest that it is common for a woman to remain a part of her natal family group, even when she has relocated to a new community (Ensor 2015), so women in the Bonneville Basin who married exogamously likely were not completely isolated from their natal families.

In ethnographic accounts, although families were defined bilaterally, some groups in the Great Basin practiced matrilocal post-marriage residence until the birth of a child, after which the family could choose their residence (Eggan 1980). Specifically, in the Bonneville Basin, although marriage was bilateral and generally favored cross-cousin spouses, the focus was on patrilateral cousins (Eggan 1980). Adovasio and Illingsworth (2014) observed similarities between Fremont-attributed basketry and contemporaneous basketry made by Ancestral Dene people at Promontory Caves, suggesting that Fremont women were marrying into Ancestral Dene groups, and this may be supported by genetic evidence (Malhi 2012), ceramic artifacts, and gambling paraphernalia associated with women (Yanicki 2019). Patterns in stylistic traits may also reflect marriage practices like plural marriage. For example, a greater proportion of right-to-left work direction at one site may represent multiple women trained in the same manufacturing method, joining a community through a sororal-polygyny marriage structure. Polygamy may have been practiced by Great Basin hunter-gatherers, as it potentially was in acorn-processing communities of California (Bettinger 2015). Bettinger (2015) suggests that patrilineal bands may have been common in the Great Basin, but that the movement of Numic speakers with refined seed-processing technologies into the region who favored small family groups with bilateral kinship patterns may have upset this pattern. Based on linguistic evidence of kinship terminology, some scholars suggest that before the Numic spread (~1,000 cal BP), hunter-gatherers in the Great Basin practiced bilateral cross-cousin marriage, which was replaced by sister exchange after the Numic spread (Hage et al. 2004), although historically, cross-cousin marriage was reported among the Gosiute in the Deep Creek region (Hage et al. 2004; Malouf 1940; Steward 1938), and fraternal polyandry was also reported (Eggan 1980).

While the assemblages I studied show some technological change and variability over time, I do not see evidence for a major shift in kinship strategies as part of a proposed Numic expansion; however, with the exception of Bonneville Estates and Four Siblings, there is little fine-grained chronological control of the assemblages. Increased marriage between farming groups or groups outside of the Bonneville Basin as part of a preexisting exogamous marriage structure may explain some of the flexibility I observed in basketry. The logistical-mobility of men may have facilitated the trade of goods and reinforced contact between groups leading to intermarriage. The focus of this study has been Bonneville Basin hunter-gatherer cave and rockshelter sites, but a more detailed study of Fremont and Ancestral Puebloan feminine crafts may indicate whether hunter-gatherer women were marrying into these small-scale farming communities, and may better track how lineages were traced.

Conclusion

This chapter demonstrates the applicability of coiled basketry and cordage to address traditional eastern Great Basin models of basketry and cordage change, and I have expanded this approach to address regional questions about social interaction in prehistory. This diachronic and synchronic analysis of basketry and cordage from the Bonneville Basin, in combination with a survey of basketry and cordage from other culture areas in the Desert West, has contributed to a more thorough understanding of technological and social borders between Bonneville Basin hunter-gatherers and the larger Intermountain West geographic region. Based on these data, small-scale migration resulting in a diffusion of basketry traits is most likely the mechanism that contributes to the appearance of new basketry technological-stylistic traits in the Bonneville Basin, potentially being driven by exogamous kinship practices which incorporated women from immediately outside of the Bonneville Basin’s local craft traditions. Conversely, the logistical-mobility of men facilitated cross-regional communication, but they maintained an inflexibility of net-making traditions. Intermarriage between neighbors resulted in an ethnogenesis in the late Holocene spanning a fluid social landscape.

CHAPTER 6

CONCLUSION AND FUTURE RESEARCH

Introduction

This dissertation has sought to address major explanations for observed patterns in perishable technology. Here, I return to the broad questions posed in Chapters 3 and 4 to reiterate the ways coiled basketry and cordage can inform on the ecology of hunter-gatherer lifeways, and how this material class reflects multiple scales of social identity. This project is significant for four reasons: First, it is the first diachronic study of all perishable artifacts from Bonneville Estates Rockshelter, a valuable contribution to the ongoing interdisciplinary analysis of materials from this well-preserved, multi-component site with a record spanning 13,000 years of human prehistory. Second, it also relies on data from museum collections, often disregarded because of contextual issues, poor chronologies, and small sample sizes. Third, this dissertation applies a method of studying technological organization and paleoecology by incorporating ethnography, ethnohistory, and traditional knowledge to interpret the operational sequence of perishable-artifact manufacture, a perspective underutilized in studies of this material-culture class in North America. Fourth, this research demonstrates that, despite small sample sizes which have long hindered perishable artifact analysis, simple statistics (largely missing from earlier studies in the Great Basin) can be used to test models about the nature of these craft traditions.

How does Technological Variability Reflect Ecology and Subsistence Strategies?

The minimally-processed plant resources regularly employed in the manufacture of cordage and basketry are a proxy record for paleoecology, because the assignment of fibers to broad categories of coarse or fine may be a broad-stroke way to trace plants that are sensitive to climate and environmental change according to elevation (Laity 2008). The Bonneville Estates assemblage studied in Chapter 3 illustrates that the relative proportion of coarse to fine cordage may be a marker of these materials' differential availability for artifact manufacture. An increase in coarse plant materials, which grow in wetter conditions, in Component 5 potentially shows a period of expansion of subsistence practices in the middle Holocene. The reduction of juniper and sagebrush artifacts in the late Holocene (after 4,400 cal BP) may support local proxy records showing a return of drought conditions in the late Holocene between 2,800-1,850 cal BP (Louderback and Rhode 2009), but more likely, this a reflection of increased specialization in subsistence strategies focused on small-game hunting, or change in site function.

As previously discussed, the Bonneville Estates Rockshelter diachronic assemblage shows evidence of technological change over time, some of which may reflect ecological variability. Like at Danger Cave and Hogup Cave, human occupation of Bonneville Estates became more regular during the early-middle Holocene (after 7,500 cal BP), after more than a millennium of sparse occupation, presumably as drought conditions of the early Holocene ameliorated. There was an increase in baskets with burning on interior surfaces in the late Holocene, potentially reflective of an expansion of diet to include more seeds that required roasting; however, parching trays were part of the assemblage in earlier periods as well, alongside the migration of pinyon pine into the region (Louderback and Rhode 2009). There was also an increase in bundle foundations at the beginning of the late Holocene, potentially an indication of an emphasis on baskets which could hold water at Bonneville Estates, perhaps an indication of longer, more sustained occupations than during the middle Holocene.

Hindered by a paucity of reliable dates and small sample sizes from elsewhere in the regional Bonneville Basin (Chapter 4), the late Holocene has been treated here as a single synchronic assemblage, which limits a detailed characterization of ecological shifts and human responses. Sites in this research project are considered on a regional scale, rather than as isolated, independent communities, because past peoples were likely mobile, with flexible subsistence strategies based on the differential accessibility of natural resources. There was potentially an expansion of diet in the late Holocene reflecting variable and unpredictable environmental conditions (Grayson 2011; Hildebrandt and McGuire 2002, 2005; Hockett 2005; Kelly 1997). Although basketry served many purposes at sites including food collection, storage, and even serving, most Bonneville Basin sites I studied show evidence of seed processing through parching and possibly stone boiling, lending credence to the supposition that seeds were an important dietary component. This emphasis on seed production is not seen at all sites, which may reflect variation in resource availability or seasonal usage of the sites. The greater proportion of basketry with bundled foundations, work faces on the concave surface, and burning at Bonneville Estates, Tube Cave, and Hogup Cave indicates seasonal seed processing through parching or wide bowls for stone boiling. Other sites including Danger Cave, Juke Box Cave, Swallow Shelter, Thermal Point, Crab Cave, and potentially Remnant Cave emphasized baskets with exterior work faces more indicative of small jars and bowls with narrow openings for potentially hauling and storing water in the frequently harsh desert conditions, although seed processing was also important.

Baskets may also have been flexible in use, and not dedicated to a single function, because, for example, burned trays used for seed parching frequently have bundles for holding water. Sites were likely multi-functional, as indicated by the presence of other artifact classes, and it should also be reiterated that baskets are mobile objects that may have been transported to, cached at, or repaired at a site, not simply used there. Inter-site functional variation in cordage and coiled basketry also may be seen as indicators of variation in the functions of the sites themselves. The caves and rockshelters which are characterized as having a greater proportion of fine cordage potentially used for specialized communal net hunting and trapping rabbits or sage-grouse in the spring or fall (Kelly 1932; Powell 1875; Simpson 1869; Smith 1974; Steward 1938), may indicate that these sites were used to gear up for these activities. While small-game hunting was an important seasonal subsistence activity carried out from all of these caves and rockshelters included in this study, made evident by the predominance of cordage used for small-game hunting and trapping, people also may have carried out diverse activities that were less specialized, perhaps at other times of the year. This analysis illustrates the flexibility of site usage, because sites associated with small-game hunting (cordage) are also associated with plant cooking (roasting trays). Site functional variation may also indicate human mobility, as some site occupations may have been more seasonally ephemeral.

How do Perishable Artifacts Reflect Social Organization in the Late Holocene?

Late Holocene perishable artifacts from the Bonneville Basin cave and rockshelter sites are primarily utilitarian and subsistence-related, and artifacts were likely made, used, and deposited by culturally-related mobile people, seasonally relocating to caves or rockshelters. Patterns in cordage and coiled basketry likely resulted from a combination of social factors, including ethnicity, gendered division of labor, the association of manufacturing methods of baskets or cords with specific completed forms, variation and maintenance of craft traditions that may have diversified with intermarriage between families and bands, flexible population sizes, local and regional trade, and even perhaps the repair of valuable materials over time (i.e. heirlooms). I review some of these social factors below, focusing on gender, kinship, and ethnicity.

Gender. Although a third gender was recognized in Indigenous populations, this was generally expressed as men performing feminine tasks (Kehoe 2013). Thus, throughout this study I have referred to a binary structure of masculine and feminine tasks, but I acknowledge that those who performed these tasks may not have identified as men and/or women. Based on historical accounts and ethnographic studies worldwide (Murdock and Provost 1973), the manufacture and use of basketry is overwhelmingly considered the domain of women, and characterizing trends in this material class illustrates variation in feminine craft traditions. A general regional similarity was observed in the initial stages of the *chaîne opératoire* basketry manufacture: the selection of plants, preparation of the plant materials, and the initial stage of construction in basketry. This was because work face appears to be associated with specific basketry forms, indicating a shared gendered feminine craft tradition. There is also a general trend of work direction as predominantly right-to-left in the late Holocene, a gradual reversal from earlier periods at Bonneville Estates; however, variation in early-stage basketry manufacture is exhibited regionally, particularly in baskets from Thermal Point and Juke Box Cave. I interpret this diachronic and synchronic increase in right-to-left work direction as an incorporation of diverse feminine craft traditions in the late Holocene from outside of the localized Bonneville Basin. Sites with a greater proportion of left-to-right work direction are communities whose women practiced within an older, more localized Bonneville Basin tradition, which also included more interlocking and fewer split stitches. The manner in which three-rod basketry was made either right-to-left or the reverse reflects the general trend at respective sites: sites with higher proportions of left-to-right basketry consistently show this across all of the basketry foundation types. This suggests that all basketry types were made in the tradition as each other, and three-rod foundation was not representative of a separate ethnic group.

Although perishables as a broad material class are frequently considered women-centered, net-making is considered a masculine activity (Murdock and Provost 1973), and therefore archaeological patterns in netting manufacture may illustrate the activities of men. Net-hunting also historically is associated with large and diverse family groups, so this artifact may indicate not only use by the man who manufactured it, but also use by the larger community. There are notable inter-site differences between the proportion of z- and s-spin cordage, such as s-spin being the dominant type at Remnant Cave, Juke Box Cave, and Danger Cave, and the opposite being true at Swallow Shelter, Tube Cave, Thermal Point, Crab Cave, Bonneville Estates, Four Siblings, and Hogup Cave. A traditional interpretation is that the s-spin-dominant sites may represent a different ethnic group; however, I demonstrate that z-spin is most often on fine cordage with sheet-bend knots associated with netting and small animal traps. Because z-spin cordage with sheet-bend knots and a consistency in average diameter is likely diagnostic of netting, spin direction is a nuanced indicator of culturally-transmitted craft knowledge among men in the late Holocene. This long-term stability of net manufacture suggests a stability of the craft tradition among men, on a regional scale.

Historically, women also made some cordage out of coarse plant fibers, which was typically used for more general purposes, and they also made some specialized cordage from fine, bast fibers for traps, snares, and rabbit-skin blankets, although with less consistency. I suggest that women are more broadly associated with both spin directions, because both spin directions are more equally present on coarse cordage associated with generalized tasks and on undiagnostic fine cordage. Inter-site variability in spin direction among fine cordage may indicate manufacturing differences in masculine tasks, or differences in the designated gender associated with manufacture of this material type, if there is flexibility or exclusivity in who was assigned to the manufacture of other specialized cordage. The diversity of spin direction on other generalized cordage may indicate a greater diversity of this particular craft tradition in the population of women. It should also be noted that the initial selection stage and the use stage of the cordage-manufacturing process may have been a community or gendered activity.

Kinship. Much of the engendering of basketry and cordage assemblages in the study area is tied to kinship organization. The potential stability of masculine technology through time in the Bonneville Basin suggests that there was a closely maintained tradition of netting manufacture among men. When compared to other regions across the Intermountain West where netting was common, there appears to be a technological boundary in spin direction, because s-spin in the dominant spin direction outside of the eastern Great Basin (Leach 2018). Even with the proposed greater logistical-mobility of men, community-shared net-hunting events, and other mechanisms for contact outside of the Bonneville Basin, masculine technology was inflexible in manufacturing tradition. Alternatively, while there are certainly similarities between Bonneville Basin sites in basketry traits, I observed patterns of technological-stylistic variation that are indicative of multiple craft traditions operating contemporaneously. This is evidence of a kinship structure that is exogamous and favors women marrying outside of family groups. This marriage tradition is less noticeable in the middle Holocene, where there is a general homogeneity of technological-stylistic traits, although there is some variability in work direction, foundation, and stitch types. In the late Holocene, however, as a result of potential cultural reorganization in the Colorado Plateau and Southwest, the flexibility of this kinship structure potentially created an environment for women from outside of the Bonneville Basin to marry into the Bonneville Basin's hunter-gatherer groups through small-scale migration.

Future studies may focus on other ways women may have entered Bonneville Basin family groups. For instance, in other regions of the Intermountain West, acquiring women through raiding and hostage taking was recorded (Habicht-Mauche 2008). Steward (1938) noted occasional reports of raids and stealing children in the Great Basin and Snake River Plain among people with access to horses and influenced by Great Plains societies, but this was rarely practiced in small independent family groups of hunter-gatherers in the Bonneville Basin (1938). Crop raiding among Fremont groups has been inferred based on granaries and refuge structures (Barlow 2016), and capturing women may have been part of this system (McCool and Yawosky 2019). Ancestral Dene bison hunters may also have captured women (Mahli et al. 2012; Yanicki 2019). Currently, in the absence of other mechanisms for small-scale migration of women into family groups in the Bonneville Basin, I continue to refer to marriage as the driver of this process, although future studies may provide nuance to this interpretation.

Ethnicity: Fremont. As discussed above, the perishable material culture in the Bonneville Basin during the late Holocene potentially was influenced by Fremont mixed-horticultural groups. Similar basketry functions and technological styles throughout the Intermountain West, which also represent the major stylistic variations that occur at Bonneville Estates through time (dominance of right-to-left work direction, three-rod foundation), suggests a shared craft tradition between Ancestral Puebloan, Fremont, and eastern Great Basin basket-weavers, and potentially porous boundaries. The basketry "types" which traditionally are used to differentiate Fremont basketry from other cultural areas do not to hold up as statistically different from each other in this study, probably because most cultural areas in the region share these types.

Typologies created for basketry in the region show that there is a frequent recombination of these traits (rod type or number, splitting stitches, etc.), which may mean that we are overstating their purpose as clear markers of ethnic groups. In other words, the perceived differences in basketry styles may be less important observations than the similarities in basketry styles across a wide geographic region. While Fremont people may have occupied some rockshelters in the Great Basin, as has been inferred for Hogup Cave and Swallow Shelter (based on the presence of moccasins, exotic materials, and domesticates), it is also likely that much of the evidence for Fremont people in the Bonneville Basin appears as a result of trade—such as the abalone bead from Component 1 at Bonneville Estates (~800 cal BP)—or as a result of an introduction of technology or manufacturing styles via small-scale migration. Likely much of this diffusion occurred as a result of an acceptance of exogamous marriage structure, and the introduction of Fremont women into hunter-gatherer communities. Fremont people as a culture appear to have been very similar to Ancestral Puebloans in the Southwest, and the perceived incongruities in subsistence strategies of Fremont to incorporate more wild foods than Southwestern groups may be further evidence of porous boundaries between Fremont and Great Basin hunter-gatherers. An exogamous marriage structure among hunter-gatherers and Fremont would likely drive transactions between these cultural areas, where some Fremont women would marry into hunter-gatherer groups, hunter-gatherer women may have married into Fremont groups, and some men would provide harvest-time labor, wild foods, and trade-vectors for Fremont people.

Ethnicity: Numic Spread in the Bonneville Basin. While many of the perishable artifacts I analyzed likely date to the inferred time period for the proposed expansion of Numic language speakers (after ~1,000 cal BP), a lack of radiometric dating at these sites limits the identification of the "Numic-period" in a meaningful way. Potentially as a result of my treating sites as palimpsests of the late Holocene, significant changes in cordage or basketry that would indicate a significant migration of a new ethnic group into the Bonneville Basin have been diluted. Change does occur over time at Bonneville Estates, and there is variability in cordage and basketry traits at individual sites, but these patterns show up as changes in dominance of some traits over other, not the wholescale technological change expected if a large-scale migration occurred. The sites I analyzed are associated primarily with hunter-gatherers whose basketry and cordage were largely utilitarian in nature, emphasizing small-game hunting, seed parching, and carrying water, among other diverse tasks. I identified no sudden shifts in subsistence strategies, as is suggested as a part of the Numic model of population expansion, and none of my data could be used to determine the language spoken by hunter-gatherer people in the region. Bonneville Basin hunter-gatherers instead appear to have been open to outside influences in the case of basketry, which led to some subtle changes in low-visibility technological-stylistic traits. The population of men appears to have maintained a stronger border between the Great Basin and the Southwest, at least according to the masculine technology of netting, and this was maintained throughout the Holocene at Bonneville Estates, even across the period of the proposed Numic expansion ~1,000 cal BP. The lack of a technological shift in this trait runs counter to a large-scale migration/population replacement model for the Numic spread. Therefore, my study lends support for a continual population of hunter-gatherer people in the eastern Great Basin since at least ~4,400 cal BP and possibly even earlier, who likely incorporated technologies and innovations as part of an exogamous marriage system, and who were likely multi-lingual because they encouraged trade and intermarriage, rather than a replacement of in-situ hunter-gatherers by Numic speaking migrants.

Future Work

I have demonstrated that despite small samples sizes and imprecisely-dated artifacts, complex human interactions can begin to be characterized for archaeological societies. In the following final assessment, I discuss how this research may be applied to future projects, and ways in which this project may be improved upon with an expanded sample size and better dating.

Dating

Most importantly, future work should focus on refining the chronology of the late Holocene sites analyzed here through extensive radiocarbon dating. I was forced to conflate ~4,400 years in this analysis, which is an improvement on previous studies conflating even greater time spans; however, with better chronological control, especially the direct dating of baskets and cordage, a more thorough characterization of regional variability through time can be achieved. Potentially, the variability between site assemblages in terms of basketry technological-stylistic traits may reflect an accumulation of small changes over time. Perishable artifacts are directly-datable with minimally-destructive techniques, and obtaining more dates will be useful not only for future perishable analyses, but also for any future analyses of these sites in general. This is especially important for Thermal Cave, Juke Box Cave, and Tube Cave, which have no dates for any of the excavations. Similarly, while the oldest components at Danger Cave are dated extensively, there are only two bulk-sample dates from Component V which date to 5,300-3,700 cal BP and 2400-1,300 cal BP (Table 4.1, Appendix F). Redating Stratum 8 at Hogup Cave may also clarify the late Holocene period at this site, because Stratum 6 and Stratum 8 were potentially misidentified during excavation (Martin et al. 2017). Bonneville Estates is the most diachronically well-dated site in this study as well as in the entire eastern Great Basin, and it will be a useful benchmark for other diachronic studies focusing on the late Holocene. Finally, extensively dating three-rod foundation basketry throughout the region may address the timing and potential spread of this basketry foundation-type throughout the Intermountain West.

Field Excavation

Many of the sites examined in this analysis have not been extensively excavated. With improved dating and renewed excavations using state-of-the-art techniques, these sites would provide important evidence of chronology, context, and variability in material culture, even if the excavations are small in scale, just reaching several square meters in area. Perishable artifact analysis is often conducted on artifacts which were discovered incidentally and collected without a standardized procedure, but with sites included in this analysis, we have the potential to re-investigate them with targeted methods of investigating perishable artifact-producing sites. Sites which might be best suited for such field studies are Swallow Shelter, Thermal Point, and Tube Cave.

Additional Analyses

Danger Cave and Hogup Cave. The analysis presented here should be expanded to include a detailed look at the cordage assemblages from Danger Cave and Hogup Cave, which were unavailable to me because of an ongoing analysis by other researchers. The large cordage collections from both of these sites would greatly increase the sample size, and by targeting the specific variables I found to best show statistical significance—material type, spin direction, diameter, and knots—my observations about potential gender divisions could be further tested.

Diagnostic Cordage and Basketry Forms. Future analyses should focus on determining the function of fragmentary basketry and cordage, and compare functional and technological-stylistic traits. For instance, it would be useful to be able to assign fine, specialized cordage to additional categories of netting for rabbit-hunting, nets for fishing, snares, and traps to answer questions about gendered activities, and also to compare spin direction alongside these diagnostic types. It would also be useful for us to identify diagnostic cordage made from coarse materials, because determining this functional variation may contribute to the inconsistency in spin direction observed in this study. In basketry, it also will be significant for future analyses to determine specific basketry forms and compare, for example, container type alongside technological-stylistic traits. Determining the function of three-rod foundation basketry, and how it differs in function from other foundation types may be an important direction to explore, especially through use wear and residue analysis to define whether three-rod foundation basketry served solely as containers rather than cook-ware or for food-processing. Further, investigating use wear and residues in other basketry forms will also permit functional interpretations of specific basketry forms, flexibility of function, and how many baskets made up a contemporaneous and discrete tool kit.

Expanding the Regional Study. Additional sites in the proximity of the Bonneville Basin should be included in future investigations, for example other regions of the eastern Great Basin, central Great Basin, Colorado Plateau, Southwest, and Snake River Plain. Such an expanded, regional survey could facilitate a better characterization of the Fremont frontier, Numic spread, and dispersal of Ancestral Dene across the region. This expanded focus on cordage and basketry could directly address whether the small-scale migration and intermarriage patterns hypothesized here hold true, and from where outside the Bonneville Basin such influences came. Such an expansion of this study could also address Mills' (2018) idea of "boundary objects", given that baskets like parching trays and water jars are widely distributed throughout the Intermountain West, and may represent potential vectors of exchange and the subsequent blending of technological-stylistic traits.

Additional Artifact Classes. This study has focused exclusively on coiled basketry and cordage, but many of the sites included also have other complex perishable artifacts including twined basketry, although in lesser frequencies. Comparing similar processes of basketry manufacture in both coiled and twined basketry would provide a more nuanced illustration of craft traditions. Obviously, the interpretations gleaned from the present analysis would have been stronger with a more holistic characterization of a perishable technology tool kit. The inclusion of other potentially gendered artifact classes like projectile points and pottery in later periods may provide multiple lines of evidence for gender and kinship in the Bonneville Basin. Additional analysis of faunal remains is also a way of addressing the function of cordage in small-game hunting and basketry in stone boiling.

Larger Implications

This research has emphasized curated assemblages. Recent research highlights the disproportionate rates of publications and large grant applications made by women, men, and gender non-conforming people in archaeology (Fulkerson and Tushingham 2019; Goldstein et al. 2018; Heath-Stout 2020), which this dissertation hopes to assist in equalizing. Also, much has been written about the need to place collections research on equal footing with field research (Knoll 2011; Nielsen-Grimm and Haynie 2019; Saul and Jolie 2018; Sonderman 2018), emphasizing that collections research is a fruitful avenue of learning about the past, thereby encouraging the contributions of underrepresented women, minorities, and descendant communities in anthropological academic research. This dissertation research, which addresses questions of social groupings in the past and the role of the environment in organizing human social activities illustrates the diversity of the human experience, and the applicability of anthropology to current considerations of how humans react to climate change, environmental stewardship, issues of race and ethnicity, migration and population movement, and our current cultural conversations of gender and identity. The nature of perishable artifacts as an oftentimes low-visibility artifact class with great potential to address under-studied activities of women, children, and family collaboration unquestionably encourages a holistic approach to the study of human culture.

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APPENDIX A

Bonneville Estates Cordage Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	Type	Method of Ply Engagement	Decoration	Completed-ness	Plies	Length (mm)	Initial Spin Direction	Twist Angle	Tightness	Twists per CM (TPC) Average	Cordage Average Diameter (mm)	Strand Average Diameter (mm)	Splice Method	Use-Related Wear	Material Texture	Knot type	End Treatment		Additional Details
																				End 1	End 2	
6562	A2	1	Eagle Rock	unknotted	twisted	undecorated	fragment	2	17.7	z	52°	tight	4	3	1.4	twisted	none	fine	—	torn	torn	
454	A1a	1	Eagle Rock	unknotted	twisted	undecorated	fragment	1	159	z	—	—	—	—	0.73	twisted	none	fine	—	torn	torn	
522	A1a	1	Eagle Rock	unknotted	crepe-twisted	undecorated	fragment	2	18.8	z	—	—	—	—	1.73	twisted	burned	fine	—	torn	torn	charred
5133	A1a	1	Eagle Rock	unknotted	twisted	undecorated	fragment	2	27.2	s	42°	tight	3	5.03	2.37	twisted	none	fine	—	torn	torn	
8922	A2/3A	1/2 contact	Eagle Rock	other	twisted	undecorated	fragment	2	145.1	s	60°	tight	2	17.8	7.87	twisted	burned on one end	coarse	—	torn	torn	match/fire bundle
5248	6,2	2	Maggie Creek	unknotted	twisted	undecorated	fragment	2	NA	z	—	—	—	—	—	—	none	fine	—	torn	torn	
7909	A1	2	Maggie Creek	unknotted	twisted	undecorated	fragment	2	36.2	s	48°	tight	2	4.1	3.6	twisted	none	fauna	—	cut	torn	rabbit-skin cord
5813a	6,4	2	Maggie Creek	knotted	twisted	undecorated	fragment	2	64	s	40°	tight	4.67	2.07	1.17	twisted	none	fine	—	knotted	torn	
5813b	6,4	2	Maggie Creek	unknotted	twisted	undecorated	fragment	2	35.7	s	17°	medium	4	1.67	0.97	twisted	none	fine	—	torn	torn	
5585	6,4	2	Maggie Creek	unknotted	twisted	undecorated	fragment	2	47.8	z	48°	tight	5	1.93	1.47	twisted	none	fine	—	torn	cut	
5587	6,4	2	Maggie Creek	unknotted	twisted	undecorated	fragment	2	151.8	z	35°	tight	4	2.17	1.53	twisted	none	fine	—	torn	torn	
5643	6,9	2	Maggie Creek	unknotted	twisted	undecorated	fragment	2	193.4	s	40°	tight	2	4.89	2.87	laid-in	none	fine	—	torn	torn	
5565	6,2	2	Maggie Creek	unknotted	twisted	undecorated	fragment	2	319.3	s	52°	tight	3	5.67	4.83	twisted	none	fauna	—	torn	torn	
8777	A3b	3	James Creek	unknotted	twisted	undecorated	fragment	1	55.5	z	—	—	—	—	2.53	twisted	burned on one end	coarse	overhand	torn	torn	
9133	A3b	3	James Creek	knotted	twisted	undecorated	fragment	2	30.5	z	48°	tight	4	1.97	1.8	twisted	none	fine	sheet-bend	cut	torn	
9178	A3b	3	James Creek	unknotted	twisted	undecorated	fragment	1	23	z	—	—	—	—	4.77	twisted	none	fine	—	torn	torn	
16043	A3	3	James Creek	unknotted	twisted	undecorated	fragment	2	47.2	z	38°	tight	4	2.17	1.5	twisted	none	fine	—	torn	torn	
8341	A3b/7	3	James Creek	unknotted	twisted	undecorated	fragment	1	185.9	z	—	—	—	—	1.6	twisted	none	fauna	—	torn	cut	
9017	A3b/7, B17	3	James Creek	unknotted	twisted	undecorated	fragment	1	13.1	z	—	—	—	—	—	twisted	none	fauna	—	torn	torn	
31493	3(5)	3	James Creek	unknotted	twisted	undecorated	fragment	2	31.9	z	38°	medium	7	0.97	0.57	twisted	none	fine	—	torn	torn	
17789	7	3	James Creek	unknotted	twisted	undecorated	fragment	2	24.4	z	40°	tight	5	2.37	1.33	laid-in	none	fine	—	torn	torn	
17394	5	3	James Creek	unknotted	twisted	undecorated	fragment	2	47.6	z	40°	tight	4	2.57	1.5	twisted	none	fine	—	cut	torn	
25665	5	3	James Creek	knotted	twisted	undecorated	fragment	2	18.4	z	40°	tight	4	2.07	1.03	twisted	burned on one end	fine	girth-hitch	torn	knotted	Snare fragment with peg
25536	5	3	James Creek	unknotted	twisted	undecorated	fragment	2	52.8	s	33°	tight	4	2.55	1.33	twisted	none	fine	—	torn	torn	
25536	5	3	James Creek	unknotted	twisted	undecorated	fragment	1	162.9	s	—	—	—	—	1.93	twisted	none	fauna	—	torn	torn	sinew cord
25534	5	3	James Creek	unknotted	twisted	undecorated	fragment	2	84.7	z	48°	tight	2	5.8	4.2	twisted	none	coarse	—	cut	cut	
25666	5	3	James Creek	unknotted	twisted	undecorated	fragment	2	24.2	z	63°	tight	5	2.8	1.83	twisted	none	fauna	—	torn	cut	
25653	5	3	James Creek	unknotted	crepe-twisted	undecorated	fragment	1	15.7	z	—	—	—	—	0.8	twisted	none	fine	—	torn	crepe-twisted	
25680	5	3	James Creek	unknotted	twisted	undecorated	fragment	1	9.1	z	—	—	—	—	—	twisted	none	NA	—	torn	torn	
111	5	3	James Creek	unknotted	twisted	undecorated	fragment	2	64.8	z	33°	medium	5	2.4	1.67	twisted	none	fine	—	torn	torn	
25531.04	5	3	James Creek	unknotted	twisted	undecorated	fragment	1	35.4	s	—	—	—	—	2.43	twisted	none	fine	—	crepe-twisted	torn	
7952	A3	3	James Creek	unknotted	rat-tailed	undecorated	fragment	2	110.1	z	40°	tight	3	2.07	1.93	twisted	none	fauna	—	torn	knotted	Rabbit hair, twisted
7975	A3	3	James Creek	knotted	twisted	undecorated	fragment	2	44.5	z	42°	tight	4	2.57	1.6	twisted	none	fine	overhand	torn	knotted	
crnv-11-4893-7769	3	3	James Creek	unknotted	crepe-twisted	undecorated	fragment	2	109.6	z	37°	tight	2.33	4.57	2.1	twisted	none	coarse	—	crepe-twisted	torn	
17190	7	3	James Creek	unknotted	twisted	undecorated	fragment	2	19	z	43°	tight	6	1.97	1.2	twisted	none	fauna	—	knotted	torn	
5830	6, 5	3	James Creek	unknotted	twisted	undecorated	fragment	2	100.9	s	35°	tight	4	2.47	1.33	twisted	none	fine	—	torn	torn	

APPENDIX A continued

Bonneville Estates Cordage Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	Type	Method of Ply Engagement	Decoration	Completed-ness	Plies	Length (mm)	Initial Spin Direction	Twist Angle	Tightness	Twists per CM (TPC) Average	Cordage Average Diameter	Strand Average Diameter	Splice Method	Use-Related Wear	Material Texture	Knot type	End Treatment		Additional Details
																				End 1	End 2	
8914	A7	3	James Creek	unknotted	twisted	undecorated	fragment	2	21.6	z	40°	tight	6.33	1.73	1	twisted	burned on both ends	fauna	—	torn	torn	
8964	A7	3	James Creek	other	twisted	undecorated	fragment	2	77.8	s	40°	tight	2	5.23	3.8	twisted	none	fauna	—	torn	torn	
16044	A7	3	James Creek	unknotted	twisted	undecorated	fragment	2	70.4	z	43°	tight	4	1.6	1.37	twisted	none	fine	—	cut	torn	
16122	A9	3	James Creek	unknotted	twisted	undecorated	fragment	2	71.9	z	40°	tight	6	1.57	1	laid-in	none	fine	—	cut	torn	
17711	7	3	James Creek	unknotted	twisted	undecorated	fragment	2	59.7	z	43°	tight	7	2.27	1.53	twisted	none	fine	—	rat-tailed	torn	
17912	7	3	James Creek	unknotted	twisted	undecorated	fragment	2	44	z	45°	tight	5	2.13	1.57	twisted	none	fine	—	torn	torn	
4274	A7	3	James Creek	knotted	twisted	undecorated	fragment	2	204.1	s	28°	tight	6.33	1	0.6	laid-in	none	fine		knotted	torn	Cord with fur tassel end. Reverses twist direction close to tassel end
757	A7-9	3	James Creek	unknotted	twisted	undecorated	fragment	2	13.4	z	57°	tight	6	2.13	1.07	twisted	none	fine	—	torn	torn	
3204	A7	3	James Creek	knotted	twisted	undecorated	fragment	2	43.7	z	47°	tight	4.33	2.57	1.53	twisted	none	fine	—	torn	torn	
5130	A9	3	James Creek	unknotted	twisted	undecorated	fragment	2	34.4	z	55°	tight	2	7.17	4.47	twisted	none	fine	—	torn	torn	
255	A7	3	James Creek	unknotted	twisted	undecorated	fragment	2	49.3	z	48°	tight	5	1.73	1.23	twisted	none	fine	—	torn	torn	
209	A7	3	James Creek	unknotted	twisted	undecorated	fragment	2	42.4	z	40°	tight	5	1.73	1.27	twisted	none	fine	—	torn	torn	
15808	A8/9	3	James Creek	unknotted	twisted	undecorated	fragment	2	58.5	s	18°	medium	2	3.43	2.27	twisted	none	NA	—	torn	torn	
12045	A9	3	James Creek	unknotted	twisted	undecorated	fragment	2	57.2	z	52°	tight	4	2.4	1.6	twisted	none	NA	—	cut	torn	
12370	A9	3	James Creek	unknotted	twisted	undecorated	fragment	2	28.7	s	45°	tight	3	4.83	2.83	twisted	none	fine	—	torn	torn	
3409	A7	3	James Creek	knotted	twisted	undecorated	fragment	2	140.2	z	38°	tight	4.33	1.87	1.1	twisted	none	fine	sheet-bend	rat-tailed	torn	possibly netting
18146	7	3	James Creek	knotted	twisted	undecorated	fragment	2	34.2	z	40°	medium	3	2.9	1.73	twisted	none	fine	square-knot	torn	torn	
27298	7	3	James Creek	unknotted	twisted	undecorated	fragment	1	229.5	z	—	—	—	—	6.7	twisted	none	coarse	—	torn	torn	
17942	7	3	James Creek	knotted	twisted	undecorated	fragment	2	46	z	47°	tight	3.33	2.6	1.53	twisted	none	fauna	—	torn	knotted	leather moccasin or bag fragment
5131	A9	3	James Creek	knotted	twisted	undecorated	fragment	2	8.1	s	65°	tight	3	2.1	1	twisted	none	fauna	overhand	torn	knotted	stitched moccasin or bag
31515	7	3	James Creek	knotted	twisted	undecorated	fragment	2	86.8	z	47°	tight	4	2.23	1.5	twisted	none	fine	overhand	knotted	torn	
32268	7a	3	James Creek	unknotted	twisted	undecorated	fragment	2	13	z	35°	tight	5.67	1.43	0.9	twisted	none	fine	—	burned	cut	
4011.02	A8/9	3	James Creek	unknotted	twisted	undecorated	fragment	1	41.7	z	—	—	—	—	7.47	twisted	none	fauna	—	torn	torn	twisted rabbitskin
7099	T5	3	James Creek	unknotted	twisted	undecorated	fragment	1	53.4	z	—	—	—	—	2.47	twisted	none	coarse	—	torn	torn	
11067	6,7	3	James Creek	knotted	twisted	undecorated	fragment	2	17.2	z	30°	tight	2	7.63	4.87	twisted	none	coarse	overhand	knotted	torn	
12089	A0	3/4 contact	James Creek	unknotted	rat-tailed	undecorated	fragment	2	33.9	z	48°	tight	6	1.37	1.07	twisted	burned on one end	fine	—	rat-tailed	torn	lightly burned
9610	11	4	South Fork	knotted	twisted	decorated	fragment	2	141.1	s	30°	tight	1.33	4.4	2.67	twisted	none	coarse	overhand	knotted	torn	Dyed red??
11121	8,1	4	South Fork	knotted	twisted	undecorated	fragment	2	303.1	s	27°	tight	2.33	4.73	2.67	laid-in	none	coarse	overhand	knotted	torn	
6013a	8	4	South Fork	unknotted	twisted	undecorated	fragment	2	241.1	s	25°	medium	2	5.23	2.77	twisted	none	coarse	—	torn	torn	
6013b	8	4	South Fork	unknotted	twisted	undecorated	fragment	2	150.9	s	23°	medium	2	5.3	2.67	twisted	none	coarse	—	cut	torn	
6013c	8	4	South Fork	unknotted	twisted	undecorated	fragment	2	115.6	s	35°	tight	2	8.6	3.6	twisted	none	coarse	—	torn	torn	
12133	A1	4	South Fork	netting	twisted	undecorated	fragment	2	41	z	50°	tight	—	1.33	0.8	twisted	none	fine	sheet-bend, overhand	torn	knotted	possible net
25570	11	4	South Fork	unknotted	twisted	undecorated	fragment	2	178.2	z	28°	tight	2.67	4.3	2.63	laid-in	none	coarse	—	torn	torn	
5129	A11	4	South Fork	unknotted	twisted	undecorated	fragment	2	152	z	47°	tight	5	1.47	1.37	laid-in	none	fine	—	torn	torn	
25462	11	4	South Fork	unknotted	twisted	undecorated	fragment	2	95.6	s	23°	medium	4.33	2	1.2	laid-in	none	coarse	—	torn	torn	
5128	A11	4	South Fork	unknotted	twisted	undecorated	fragment	2	67.2	z	40°	tight	4.67	1.53	1.67	twisted	none	fine	—	torn	torn	

APPENDIX A continued

Bonneville Estates Cordage Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	Type	Method of Ply Engagement	Decoration	Completed-ness	Plies	Length (mm)	Initial Spin Direction	Twist Angle	Tightness	Twists per CM (TPC) Average	Cordage Average Diameter (mm)	Strand Average Diameter (mm)	Splice Method	Use-Related Wear	Material Texture	Knot type	End Treatment		Additional Details
																				End 1	End 2	
2889	A12d	5	Pie Creek	knotted	twisted	undecorated	fragment	2	56.2	s	28°	tight	4.67	3.3	1.4	twisted	none	coarse	overhand	torn	torn	
12864	A13	5	Pie Creek	knotted	twisted	undecorated	fragment	2	105.1	z	40°	tight	5	2.63	1.67	twisted	none	fine	overhand	knotted	torn	
12842	A13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	96.7	z	50°	tight	3.67	2.83	1.9	twisted	burned or stained	fauna	—	knotted	torn	
3493	A13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	69.1	s	47°	tight	5.33	5.97	2.87	twisted	none	fine	—	torn	crepe-twisted	
3442	A13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	81.2	z	40°	medium	7.67	1.53	0.73	twisted	none	fine	—	torn	torn	
3454	A13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	23.6	z	32°	medium	7.33	1.6	0.8	twisted	none	fine	—	torn	torn	
31566	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	21.3	z	35°	medium	3	3.2	2.03	twisted	none	fine	—	torn	torn	
31574.1	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	19.5	z	40°	medium	11.33	0.87	0.43	twisted	none	fine	—	torn	torn	possibly dyed red
31574.2	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	52.1	s	—	—	—	—	1.1	twisted	none	fine	—	torn	torn	
28478	12	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	46.3	z	33°	medium	4	3.27	2.23	twisted	none	fine	—	torn	torn	
28306	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	21.3	s	42°	medium	4	2.73	1.93	twisted	none	fine	—	torn	torn	
31670	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	95.9	s	63°	tight	2	4.4	2.03	twisted	none	coarse	—	rat-tailed	torn	
12411	A12	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	91.1	z	42°	medium	4	3.7	1.93	laid-in	none	fine	—	torn	torn	
2891	A13	5	Pie Creek	knotted	twisted	undecorated	fragment	2	61.5		42°	medium	4.67	1.63	1.3	twisted	stained	fine	noose-knot	knotted	torn	
32761	12	5	Pie Creek	knotted	twisted	undecorated	fragment	2	19.5	s	57°	tight	3.67	2.83	1.33	twisted	none	fine	overhand	torn	torn	
32852.02	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	107.8	s	20°	medium	2	3.93	2.47	twisted	none	coarse	overhand	torn	torn	
32852.01	13	5	Pie Creek	knotted	twisted	undecorated	fragment	10	46.5	s	35°	tight	3.67	2.47	0.63	laid-in	none	fine	overhand	knotted	torn	elaborate cordage fiber
3542	A13/14	5	Pie Creek	knotted	twisted	undecorated	fragment	2	17.4	z	35°	medium	5	3.17	1.93	twisted	none	fine	overhand	knotted	knotted	
4524	A12/A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	223.7	s	—	—	—	—	6.93	twisted	none	coarse	overhand	torn	torn	
908	A13-16	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	123.4	s	68°	tight	2	4.57	3.13	twisted	none	coarse	—	torn	torn	
856	A13-16	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	346.1	z	—	—	—	—	8.97	twisted	none	coarse	—	torn	torn	
3552	A13/14	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	26.8	s	55°	tight	3	4.4	2.6	twisted	none	fine	—	torn	torn	
26910	A14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	154.6	s	30°	tight	2	3.53	2.17	twisted	none	coarse	—	torn	torn	
26907	A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	36.8	s	25°	medium	1	4.93	2.77	twisted	none	fine	overhand	knotted	torn	
26703	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	81.1	z	53°	tight	6	1.83	1.37	twisted	stained reddish color	fine	—	cut	torn	
26753	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	79	z	52°	tight	4	2.27	1.47	twisted	none	fine	—	torn	torn	
26761	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	30.4	z	—	—	—	—	0.87	twisted	none	fine	—	torn	torn	
23533	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	73.5	s	—	—	—	—	2.63	twisted	none	fine	—	torn	torn	
18361	12	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	25.3	s	35°	tight	4.67	1.3	1.1	twisted	none	fine	—	torn	torn	
18435	13	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	270.7	s	38°	tight	3	1.83	1.5	laid-in	none	fine	—	cut	torn	
18372	13	5	Pie Creek	knotted	twisted	undecorated	fragment	2	204.8	s	32°	tight	2.33	1.87	1.17	twisted	none	coarse	overhand	cut	cut	
9627.1	12	5	Pie Creek	knotted	twisted	undecorated	fragment	2	31	s	38°	tight	2.67	2.77	1.4	twisted	none	coarse	overhand	knotted	torn	
9627.2	12	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	23.2	s	38°	tight	1	3.27	3.07	twisted	none	fine	—	torn	torn	
26921	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	112.5	s	43°	tight	1	10.27	6.53	twisted	none	coarse	overhand	knotted	torn	
5136	A14	5	Pie Creek	knotted	crepe-twisted	undecorated	fragment	2	35	z	45°	tight	2	3.33	2.16	twisted	stained	fine	overhand	knotted	cut	
5135	A14	5	Pie Creek	unknotted	crepe-twisted	undecorated	fragment	2	29.9	s	38°	tight	2	2.9	1.77	twisted	none	fine	—	torn	torn	
811	A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	111.2	s	23°	loose	3	2.23	1.43	twisted	none	fine	sheet-bend	torn	knotted	

APPENDIX A continued

Bonneville Estates Cordage Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	Type	Method of Ply Engagement	Decoration	Completed-ness	Plies	Length (mm)	Initial Spin Direction	Twist Angle	Tightness	Twists per CM (TPC) Average	Cordage Average Diameter (mm)	Strand Average Diameter (mm)	Splice Method	Use-Related Wear	Material Texture	Knot type	End Treatment		Additional Details
																				End 1	End 2	
804	A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	102	s	23°	medium	1	5.3	2.93	twisted	none	coarse	sheet-bend	torn	torn	
4882	A14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	35.2	s	—	—	—	—	2.3	twisted	none	fauna	—	cut	torn	dew claw rattle with hide cord
18762	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	1	37.9	—	—	—	—	—	4.63	twisted	none	coarse	overhand	knotted	torn	
26932	14A	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	461	s	33°	tight	1.67	5.6	4	laid-in	none	coarse	—	torn	torn	
5127	A14	5	Pie Creek	unknotted	twisted	undecorated	fragment	4	221.6	s	25°	medium	2	6.7	1.57	laid-in	none	coarse	—	—	—	
3862	14b/c	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	80.8	S	50°	tight	1.33	9.73	4.87	twisted	none	coarse	—	burned	torn	
3585	A14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	448.4	s	62°	tight	2	5.63	3.93	laid-in	none	coarse	—	torn	burned	
5139	A14	5	Pie Creek	unknotted	twisted	decorated	fragment	2	25.4	s	72°	tight	3	2.9	1.67	twisted	stained red	fine	—	torn	torn	pinkish thread through a seed bead
5141	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	59.5	s	63°	tight	3.33	2.53	1.53	laid-in	none	coarse	—	cut	torn	
5843	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	63.2	s	40°	medium	5	2.93	1.53	twisted	none	coarse	—	torn	torn	
3807	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	77.3	s	52°	tight	2	4.13	1.3	twisted	none	coarse	—	torn	torn	
3883	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	126.3	s	58°	tight	4	3.37	2.1	twisted	none	coarse	—	crepe-twisted	torn	
3794	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	40.7	s	52°	tight	3	3.97	2.2	twisted	none	fine	—	torn	torn	
3757	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	57.5	z	30°	medium	6.67	1.3	0.9	twisted	none	fine	—	torn	torn	
3772	A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	149.4	z	42°	medium	6.67	1.17	1.03	laid-in	none	fine	noose-knot	knotted	torn	
3766	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	46	s	77°	tight	2	2.67	2.13	twisted	none	fine	—	torn	torn	
3729	A14b	5	Pie Creek	knotted	twisted	undecorated	fragment	2	110.3	s	—	—	—	—	2.63	twisted	none	fine	overhand	torn	torn	
3760	A14b	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	45	z	42°	medium	8	1.03	0.67	laid-in	none	fine	—	torn	torn	
3620	A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	116	z	38°	medium	5	1.87	1.2	twisted	none	fine	overhand, sheet-bend	knotted	torn	
3699	A14a	5	Pie Creek	unknotted	rat-tailed	undecorated	fragment	2	77.3	s	63°	tight	5	1.63	1.13	laid-in	none	fine	—	rat-tailed	torn	
3583	A14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	97.2	s	55°	tight	3.33	2.67	1.23	twisted	none	coarse	—	torn	torn	
3621	A14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	24.1	s	70°	tight	1	3.33	1.43	twisted	none	fine	—	torn	torn	
3690	A14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	84.7	z	35°	medium	2	3.4	1.87	twisted	none	fine	—	torn	torn	
3599	A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	85.9	s	62°	tight	1	—	—	twisted	none	coarse	—	knotted	torn	coprolite with two cordage pieces
4484	A14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	4	67.5	s	65°	tight	4	2.1	1.37	laid-in	none	fine	—	torn	torn	
5147	A14	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	53.61	s	60°	tight	3.67	2.7	1.57	twisted	none	fine	—	torn	cut	
2898	A14	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	75.3	s	50°	tight	4	2.93	1.93	twisted	none	fine	—	torn	torn	
18510	14a/b	5	Pie Creek	knotted	twisted	undecorated	fragment	2	36.7	z	37°	medium	4	2.5	1.43	twisted	none	fine	sheet-bend	torn	torn	
18596	14c	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	70.7	z	—	—	—	—	1.37	twisted	none	fine	—	torn	torn	
18650	14c	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	13.4	s	60°	tight	4	1.83	1.3	twisted	none	fine	—	torn	torn	
18620	14c	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	94.5	s	62°	tight	1.33	2.67	1.17	laid-in	none	fine	—	torn	torn	
18445	14a	5	Pie Creek	knotted	twisted	undecorated	complete	2	119.5	s	72°	tight	4	1.1	1	twisted	none	fine	slip-knot	knotted	knotted	snare, end slip-knotted around peg
18678	14c	5	Pie Creek	knotted	twisted	undecorated	fragment	2	40.9	—	30°	medium	3	4.7	2.4	twisted	none	fine	overhand	knotted	torn	
876	A16	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	123	s	65°	tight	2	4.67	2.8	laid-in	none	coarse	—	torn	torn	
4485	A14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	652.2	s	63°	tight	1.67	5.6	3.33	laid-in	none	coarse	overhand	torn	torn	
24492	C4	5	Pie Creek	knotted	twisted	undecorated	fragment	2	30.1	z	55°	tight	2	3.6	2.37	laid-in	none	coarse	overhand	cut	torn	

APPENDIX A continued

Bonneville Estates Cordage Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	Type	Method of Ply Engagement	Decoration	Completed-ness	Plies	Length (mm)	Initial Spin Direction	Twist Angle	Tightness	Twists per CM (TPC) Average	Cordage Average Diameter (mm)	Strand Average Diameter (mm)	Splice Method	Use-Related Wear	Material Texture	Knot type	End Treatment		Additional Details
																				End 1	End 2	
31853	14	5	Pie Creek	knotted	twisted	undecorated	fragment	2	116.1	s	53°	tight	2	6.87	3.83	laid-in	none	coarse	overhand	crepe-twisted	knotted	
31852	14	5	Pie Creek	knotted	twisted	undecorated	fragment	2	12.5	s	43°	medium	3	3.8	2.67	twisted	none	coarse	overhand	torn	knotted	
29377	14c	5	Pie Creek	knotted	twisted	undecorated	fragment	2	19.8	s	55°	tight	2	7	4.1	twisted	burned	coarse	overhand	burned	torn	
29306	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	1	50.4	s	—	—	—	—	11.87	twisted	none	coarse	overhand	torn	torn	
28497	14c	5	Pie Creek	knotted	twisted	undecorated	fragment	2	109	s	55°	tight	2.33	3.87	2.13	twisted	none	fine	sheet-bend	torn	torn	
25981	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	14.4	z	—	—	—	2.67	2.07	twisted	none	fine	overhand	knotted	torn	
31691	14	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	382	s	70°	tight	2	5.47	2.83	laid-in	none	coarse	—	torn	torn	
31700	14	5	Pie Creek	knotted	twisted	undecorated	fragment	2	50.2	s	75°	tight	2	5.3	3.03	twisted	none	coarse	overhand	knotted	torn	
31702	14	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	82.8	s	65°	tight	2	2.9	1.47	twisted	none	coarse	—	torn	torn	
31707	14	5	Pie Creek	unknotted	crepe-twisted	undecorated	fragment	2	147.1	s	53°	tight	2	8.17	4.77	twisted	none	coarse	—	crepe-twisted	crepe-twisted	
31683	14	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	128.2	s	58°	tight	2	4.63	2.7	laid-in	none	coarse	—	cut	torn	
29521	14c	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	214.2	s	63°	tight	2	5.43	2.97	laid-in	none	coarse	—	torn	torn	
29573	14	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	111.3	s	55°	tight	3.33	1.57	0.67	twisted	none	fine	—	torn	torn	
9856	A16	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	270.9	s	67°	tight	3.33	2.3	1.47	twisted	none	fine	—	torn	torn	
32762.01	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	11.1	z	35°	tight	4	1.87	1	twisted	none	fine	—	torn	torn	
32762.02	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	12.8	z	33°	tight	4	1.37	0.93	twisted	none	fine	—	torn	torn	
32762.03	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	32.6	z	32°	tight	5	2.1	1.23	twisted	none	fine	—	torn	torn	
32762.04	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	34.4	z	38°	tight	4	2.3	1.53	twisted	none	fine	—	torn	torn	
32762.05	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	45.1	s	37°	tight	7.33	0.63	0.43	twisted	none	fine	—	torn	torn	
32762.06	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	55	z	38°	tight	7.33	0.9	0.77	twisted	none	fine	—	torn	torn	
32762.07	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	56	z	35°	tight	3.33	1.13	0.83	laid-in	none	fine	—	torn	torn	
32762.08	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	30.3	z	42°	tight	7.67	1.2	0.97	twisted	none	fine	—	torn	torn	
32762.09	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	16.7	s	53°	tight	2	2.57	1.5	twisted	none	fine	overhand	torn	knotted	
32762.10	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	17.3	z	35°	tight	4	2.67	1.43	twisted	none	fine	—	torn	torn	
32762.11	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	12.8	z	30°	tight	2	3.2	1.8	twisted	none	fine	—	torn	torn	
32762.12	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	15.8	z	27°	tight	2	2.8	1.77	twisted	none	fine	—	torn	torn	
29714	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	23.9	s	35°	tight	3	2.1	1.37	twisted	none	fine	—	torn	torn	
32763-13	14a	5	Pie Creek	knotted	crepe-twisted	undecorated	fragment	2	12.1	s	30°	tight	2	2.47	1.47	twisted	none	coarse	—	crepe-twisted	torn	
32763-12	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	68.4	z	42°	tight	4	1.67	0.73	twisted	none	coarse	overhand	torn	rat-tailed	
32763-11	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	45.7	z	35°	tight	3.67	2.67	1.7	twisted	none	fine	—	torn	torn	
32763-10	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	32.2	z	42°	tight	7	1.6	1	twisted	none	fine	—	torn	torn	
32763-9	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	41.8	s	45°	tight	3.33	3.16	1.67	twisted	none	fine	—	torn	torn	
32763-8	14a	5	Pie Creek	unknotted	crepe-twisted	undecorated	fragment	2	36	s	45°	tight	3.33	3.43	1.9	twisted	none	fine	—	crepe-twisted	torn	
32763-7	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	1	12.8	z	—	—	—	—	2.03	twisted	none	fine	overhand	knotted	torn	
32763-6	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	46.5	z	27°	tight	4.67	1.77	0.83	twisted	none	fine	—	torn	torn	

APPENDIX A continued

Bonneville Estates Cordage Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	Type	Method of Ply Engagement	Decoration	Completed-ness	Plies	Length (mm)	Initial Spin Direction	Twist Angle	Tightness	Twists per CM (TPC) Average	Cordage Average Diameter (mm)	Strand Average Diameter (mm)	Splice Method	Use-Related Wear	Material Texture	Knot type	End Treatment		Additional Details
																				End 1	End 2	
32763-5	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	57.5	s	43°	tight	2	3.27	2.03	twisted	none	fine	—	torn	torn	
32763-3	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	38.1	s	37°	tight	3.67	2.03	1.3	twisted	none	fine	—	torn	torn	
32763-4	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	105.3	s	37°	tight	5	1.33	1.1	twisted	none	fine	—	torn	torn	
32763-2	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	113.1	z	37°	tight	3	2.63	1.53	laid-in	none	fine	overhand	torn	knotted	cord running through leather
32763-1	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	18.7	z	43°	tight	3	2.83	1.9	twisted	none	fine	overhand	torn	knotted	
32853-2	15/16	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	46.6	z	—	—	—	—	1.3	twisted	none	fine	—	rat-tailed	torn	
32853-3	15/16	5	Pie Creek	knotted	twisted	undecorated	fragment	2	40.2	z	—	—	—	—	3.97	twisted	none	coarse	overhand	knotted	torn	
32853-4	15/16	5	Pie Creek	knotted	twisted	undecorated	fragment	1	110.3	z	—	—	—	—	3.16	twisted	none	coarse	overhand	torn	torn	
21493	14	5	Pie Creek	knotted	twisted	undecorated	fragment	1	36.1	z	—	—	—	—	3.4	twisted	none	coarse	overhand	torn	torn	
32764-1	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	110.5	s	37°	tight	1.67	7.8	4.17	twisted	none	coarse	—	torn	torn	
32764-2	14a	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	192.4	s	30°	tight	2	4.43	2.03	twisted	none	coarse	—	torn	torn	
32766-1	14b upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	15.5	s	23°	medium	2	3.4	2.4	twisted	none	fine	—	torn	torn	
32766-2	14b upper	5	Pie Creek	knotted	twisted	undecorated	fragment	2	182.6	z	40°	tight	6	1.67	1.1	twisted	none	fine	slip-knot	torn	torn	
32766-3	14a upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	8.6	s	—	—	—	—	1.87	twisted	none	fine	—	torn	torn	
32766-4	14b upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	128.6	z	40°	tight	5.33	1.93	1.13	twisted	none	fine	—	torn	torn	
32766-5	14b upper	5	Pie Creek	knotted	twisted	undecorated	fragment	2	15.9	s	50°	tight	4	2.2	2.13	twisted	none	fine	overhand	torn	knotted	
32766-6	14b upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	25.4	s	38°	tight	4	3.3	1.87	twisted	none	fine	—	torn	torn	
32766-7	14b upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	10.3	s	35°	tight	4	2.17	1.5	twisted	none	fine	—	torn	torn	
32766-8	14b upper	5	Pie Creek	unknotted	crepe-twisted	undecorated	fragment	2	14.9	z	45°	tight	5	2.57	1.57	twisted	none	fine	—	crepe-twisted	cut	
32766-9	14b upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	9	z	50°	tight	3	3.4	2.5	twisted	burned	fine	—	torn	burned	
32766-10	14b upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	83.9	z	35°	tight	5	1.4	0.97	twisted	none	fine	—	torn	torn	
32766-11	14b upper	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	34.3	z	42°	tight	5	1.7	1.23	twisted	none	fine	—	torn	torn	
32766-12	14b upper	5	Pie Creek	knotted	twisted	undecorated	fragment	1	15.9	s	—	—	—	—	1.33	twisted	none	coarse	double overhand	knotted	knotted	
22651	14	5	Pie Creek	unknotted	twisted	undecorated	fragment	1	21.4	s	—	—	—	—	0.97	twisted	none	fine	—	torn	torn	
19863	14	5	Pie Creek	netting	twisted	undecorated	fragment	2	15.9	z	45°	tight	5	1.7	1.03	twisted	none	fine	sheet-bend	knotted	torn	
29713	15/16	5	Pie Creek	unknotted	twisted	undecorated	fragment	3	72.8	s	38°	tight	5.67	1.9	0.83	twisted	none	fine	—	torn	torn	
29712a	C3	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	158.4	z	58°	tight	9	1.13	0.93	laid-in	none	fine	—	torn	torn	
29712b	C3	5	Pie Creek	knotted	twisted	undecorated	fragment	2	34.7	z	42°	medium	6	1.9	1.27	twisted	none	fine	overhand	knotted	torn	
19478	14a	5	Pie Creek	knotted	twisted	undecorated	fragment	2	92.5	s	68°	tight	2	5.57	3.4	twisted	none	coarse	overhand	crepe-twisted	knotted	
20734	C1-C2	5	Pie Creek	unknotted	twisted	undecorated	fragment	2	NA	z	40°	tight	5.67	2.4	1.6	twisted	none	fine	overhand		knotted	
20778	C1-C2	5	Pie Creek	knotted	twisted	undecorated	fragment	2	70.2	s	48°	tight	4	2.5	1.57	twisted	none	fine	overhand	knotted	torn	

APPENDIX A continued

Bonneville Estates Cordage Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	Type	Method of Ply Engagement	Decoration	Completed-ness	Plies	Length (mm)	Initial Spin Direction	Twist Angle	Tightness	Twists per CM (TPC) Average	Cordage Average Diameter	Strand Average Diameter	Splice Method	Use-Related Wear	Material Texture	Knot type	End Treatment		Additional Details
																				End 1	End 2	
20815	C1-C2	5	Pie Creek	knotted	twisted	undecorated	fragment	2	67.6	z	55°	tight	4	2.93	2.03	laid-in	none	fine	overhand	knotted	torn	
24716	PM2	5	Pie Creek	unknotted	twisted	decorated	fragment	2	41.9	z	57°	tight	6	1.5	1.03	twisted	stained	fine	—	torn	torn	red residue
24725	PM2	5	Pie Creek	knotted	twisted	decorated	fragment	2	35.8	s	55°	tight	4	3.33	2.27	twisted	none	fine	—	knotted	torn	red residue
20762	C1-C2	5	Pie Creek	knotted	twisted	undecorated	fragment	2	21	z	35°	tight	4	2.63	1.23	twisted	none	fine		knotted	torn	
24122	C5	5	Pie Creek	knotted	twisted	undecorated	fragment	2	19.9	s	—	—	—	—	4.16	twisted	burned	coarse	overhand	torn	burned	
32763	17b	6/7 contact	Dry Gulch	unknotted	twisted	undecorated	fragment	2	44.4	s	40°	tight	5.67	1.57	1	twisted	none	fine	—	torn	torn	
32686	17b	6/7 contact	Dry Gulch	unknotted	twisted	undecorated	fragment	1	6.1	s	—	—	—	—	0.97	twisted	none	coarse	—	torn	torn	
21264	17b'	7	Dry Gulch	unknotted	twisted	undecorated	fragment	2	16	s	42°	tight	5	2.33	1.63	twisted	none	fine	—	torn	torn	
21030	18a	7	Dry Gulch	unknotted	twisted	undecorated	fragment	2	27.7	z	47°	tight	3	2.23	1.87	twisted	none	fine	—	torn	torn	
20239	17b'	7	Dry Gulch	unknotted	twisted	undecorated	fragment	1	48.9	z	—	—	—	—	2.4	twisted	none	fine	—	torn	torn	
20519	17b'/18a contact	7	Dry Gulch	unknotted	rat-tailed	undecorated	fragment	2	79.1	s	48°	tight	6.33	1.63	0.8	twisted	none	fine	—	rat-tailed	rat-tailed	
20544	18	7	Dry Gulch	knotted	twisted	undecorated	fragment	2	12.1		—	—	—	2.6	1.5	twisted	none	fine	overhand	knotted	torn	
20274	18a	7	Dry Gulch	knotted	twisted	undecorated	fragment	2	49.7	s	42°	medium	8	1.73	1.17	twisted	none	fine	overhand	torn	knotted	
15265	18a	7	Dry Gulch	knotted	twisted	undecorated	fragment	1	123.3		—	—	—	—	1	twisted	none	coarse		knotted	knotted	possible snare, bent stick with knotted fiber wrapped around stick
14676	18a	7	Dry Gulch	unknotted	twisted	undecorated	fragment	2	28.2	z	22°	loose	6	2.07	1.7	twisted	none	fine	—	torn	torn	
15283	18a	7	Dry Gulch	knotted	twisted	undecorated	fragment	1	62		—	—	—	—	2.36	twisted	none	coarse	slip-knot	knotted	torn	
14737	18a	7	Dry Gulch	knotted	twisted	undecorated	fragment	2	44.7	z	23°	loose	4	3.27	2.03	twisted	none	fine	overhand	knotted	torn	
15124	18a	7	Dry Gulch	unknotted	braided	undecorated	fragment	3	197.9	s	57°	tight	5.67	3.17	1.37	twisted	none	fine	—	knotted	torn	
15272	18a	7	Dry Gulch	knotted	twisted	undecorated	fragment	1	81.3	s	—	—	—	—	1.93	twisted	none	fauna	overhand	knotted	torn	knotted feathers
14443	17b'	7	Dry Gulch	unknotted	twisted	undecorated	fragment	1	74.1	s	—	—	—	—	1.47	twisted	none	fine	—	torn	torn	
14471	17b'	7	Dry Gulch	knotted	twisted	undecorated	fragment	2	49.5	s	55°	tight	5	2	1.5	twisted	none	fine	slip-knot	knotted	knotted	
14777	18b	7	Dry Gulch	knotted	twisted	undecorated	fragment	1	49.3	s	—	—	—	—	4.4	twisted	none	fauna	overhand	torn	torn	knotted feathers
32674	17b'	7	Dry Gulch	unknotted	twisted	undecorated	fragment	2	6.8	z	30°	tight	6	1.73	1.2	twisted	none	fine	—	torn	torn	
32505	18b	7	Dry Gulch	unknotted	crepe-twisted	undecorated	fragment	2	8.1	z	30°	tight	6	1.23	0.77	twisted	none	fine	—	crepe-twisted	torn	

APPENDIX A.1

Cordage Tightness.

Catalog Number	Component	Initial Spin Direction	Twist Angle	Material Texture	Additional Details
5133	1	s	42°	fine	
6562	1	z	52°	fine	
5813a	2	s	40°	fine	
5813b	2	s	17°	fine	
5643	2	s	40°	fine	
5585	2	z	48°	fine	
5587	2	z	35°	fine	
25536	3	s	33°	fine	
5830	3	s	35°	fine	
4274	3	s	28°	fine	Cord with fur tassel end. Reverses twist direction close to tassel end
12370	3	s	45°	fine	
9133	3	z	48°	fine	
16043	3	z	38°	fine	
31493	3	z	38°	fine	
17789	3	z	40°	fine	
17394	3	z	40°	fine	
25665	3	z	40°	fine	Snare fragment with peg
111	3	z	33°	fine	
7975	3	z	42°	fine	
16044	3	z	43°	fine	
16122	3	z	40°	fine	
17711	3	z	43°	fine	
17912	3	z	45°	fine	
757	3	z	57°	fine	
3204	3	z	47°	fine	
5130	3	z	55°	fine	
255	3	z	48°	fine	
209	3	z	40°	fine	
3409	3	z	38°	fine	possibly netting
18146	3	z	40°	fine	
31515	3	z	47°	fine	
32268	3	z	35°	fine	
12089	3	z	48°	fine	lightly burned
5128	4	z	40°	fine	
12133	4	z	50°	fine	possible net
5129	4	z	47°	fine	
3493	5	s	47°	fine	
28306	5	s	42°	fine	
32761	5	s	57°	fine	

APPENDIX A.1 continued

Cordage Tightness.

Catalog Number	Component	Initial Spin Direction	Twist Angle	Material Texture	Additional Details
32852.01	5	s	35°	fine	elaborate cordage fiber
3552	5	s	55°	fine	
18361	5	s	35°	fine	
18435	5	s	38°	fine	
9627.2	5	s	38°	fine	
20778	5	s	48°	fine	
24725	5	s	55°	fine	red residue
26907	5	s	25°	fine	
5135	5	s	38°	fine	
811	5	s	23°	fine	
5139	5	s	72°	fine	pinkish thread through a seed bead
3794	5	s	52°	fine	
3766	5	s	77°	fine	
3699	5	s	63°	fine	
3621	5	s	70°	fine	
4484	5	s	65°	fine	
5147	5	s	60°	fine	
2898	5	s	50°	fine	
18650	5	s	60°	fine	
18620	5	s	62°	fine	
18445	5	s	72°	fine	snare, end slip-knotted around peg
28497	5	s	55°	fine	
29573	5	s	55°	fine	
9856	5	s	67°	fine	
32762.05	5	s	37°	fine	
32762.09	5	s	53°	fine	
29714	5	s	35°	fine	
32763-9	5	s	45°	fine	
32763-8	5	s	45°	fine	
32763-5	5	s	43°	fine	
32763-3	5	s	37°	fine	
32763-4	5	s	37°	fine	
32766-1	5	s	23°	fine	
32766-5	5	s	50°	fine	
32766-6	5	s	38°	fine	
32766-7	5	s	35°	fine	
29713	5	s	38°	fine	
12864	5	z	40°	fine	
3442	5	z	40°	fine	

APPENDIX A.1 continued

Cordage Tightness.

Catalog Number	Component	Initial Spin Direction	Twist Angle	Material Texture	Additional Details
3454	5	z	32°	fine	
31566	5	z	35°	fine	
31574.1	5	z	40°	fine	possibly dyed red
28478	5	z	33°	fine	
12411	5	z	42°	fine	
3542	5	z	35°	fine	
26703	5	z	53°	fine	
26753	5	z	52°	fine	
20734	5	z	40°	fine	
20815	5	z	55°	fine	
24716	5	z	57°	fine	red residue
20762	5	z	35°	fine	
5136	5	z	45°	fine	
3757	5	z	30°	fine	
3772	5	z	42°	fine	
3760	5	z	42°	fine	
3620	5	z	38°	fine	
3690	5	z	35°	fine	
18510	5	z	37°	fine	
32762.01	5	z	35°	fine	
32762.02	5	z	33°	fine	
32762.03	5	z	32°	fine	
32762.04	5	z	38°	fine	
32762.06	5	z	38°	fine	
32762.07	5	z	35°	fine	
32762.08	5	z	42°	fine	
32762.10	5	z	35°	fine	
32762.11	5	z	30°	fine	
32762.12	5	z	27°	fine	
32763-11	5	z	35°	fine	
32763-10	5	z	42°	fine	
32763-6	5	z	27°	fine	
32763-2	5	z	37°	fine	cord running through leather
32763-1	5	z	43°	fine	
32766-2	5	z	40°	fine	
32766-4	5	z	40°	fine	
32766-8	5	z	45°	fine	
32766-9	5	z	50°	fine	
32766-10	5	z	35°	fine	

APPENDIX A.1 continued

Cordage Tightness.

Catalog Number	Component	Initial Spin Direction	Twist Angle	Material Texture	Additional Details
32766-11	5	z	42°	fine	
19863	5	z	45°	fine	
29712a	5	z	58°	fine	
29712b	5	z	42°	fine	
21264	7	s	42°	fine	
20519	7	s	48°	fine	
20274	7	s	42°	fine	
15124	7	s	57°	fine	
14471	7	s	55°	fine	
32763	7	s	40°	fine	
21030	7	z	47°	fine	
14676	7	z	22°	fine	
14737	7	z	23°	fine	
32674	7	z	30°	fine	
32505	7	z	30°	fine	

APPENDIX A.2

Cordage Twists Per CM

Catalog Number	Component	Initial Spin Direction	Twists per CM (TPC) Average
5133	1	s	3
6562	1	z	4
5813a	2	s	4.67
5813b	2	s	4
5643	2	s	2
5585	2	z	5
5587	2	z	4
25536	3	s	4
5830	3	s	4
4274	3	s	6.33
12370	3	s	3
9133	3	z	4
16043	3	z	4
31493	3	z	7
17789	3	z	5
17394	3	z	4
25665	3	z	4
111	3	z	5
7975	3	z	4
16044	3	z	4
16122	3	z	6
17711	3	z	7
17912	3	z	5
757	3	z	6
3204	3	z	4.33
5130	3	z	2
255	3	z	5
209	3	z	5
3409	3	z	4.33
18146	3	z	3
31515	3	z	4
32268	3	z	5.67
12089	3	z	6
5128	4	z	4.67
5129	4	z	5
3493	5	s	5.33
28306	5	s	4
32761	5	s	3.67
32852.01	5	s	3.67

APPENDIX A.2 continued

Cordage Twists Per CM

Catalog Number	Component	Initial Spin Direction	Twists per CM (TPC) Average
3552	5	s	3
18361	5	s	4.67
18435	5	s	3
9627.2	5	s	1
20778	5	s	4
24725	5	s	4
26907	5	s	1
5135	5	s	2
811	5	s	3
5139	5	s	3
3794	5	s	3
3766	5	s	2
3699	5	s	5
3621	5	s	1
4484	5	s	4
5147	5	s	3.67
2898	5	s	4
18650	5	s	4
18620	5	s	1.33
18445	5	s	4
28497	5	s	2.33
29573	5	s	3.33
9856	5	s	3.33
32762.05	5	s	7.33
32762.09	5	s	2
29714	5	s	3
32763-9	5	s	3.33
32763-8	5	s	3.33
32763-5	5	s	2
32763-3	5	s	3.67
32763-4	5	s	5
32766-1	5	s	2
32766-5	5	s	4
32766-6	5	s	4
32766-7	5	s	4
29713	5	s	5.67
12864	5	z	5
3442	5	z	7.67
3454	5	z	7.33

APPENDIX A.2 continued

Cordage Twists Per CM

Catalog Number	Component	Initial Spin Direction	Twists per CM (TPC) Average
31566	5	z	3
31574.1	5	z	11.33
28478	5	z	4
12411	5	z	4
3542	5	z	5
26703	5	z	6
26753	5	z	4
20734	5	z	5.67
20815	5	z	4
24716	5	z	6
20762	5	z	4
5136	5	z	2
3757	5	z	6.67
3772	5	z	6.67
3760	5	z	8
3620	5	z	5
3690	5	z	2
18510	5	z	4
32762.01	5	z	4
32762.02	5	z	4
32762.03	5	z	5
32762.04	5	z	4
32762.06	5	z	7.33
32762.07	5	z	3.33
32762.08	5	z	7.67
32762.10	5	z	4
32762.11	5	z	2
32762.12	5	z	2
32763-11	5	z	3.67
32763-10	5	z	7
32763-6	5	z	4.67
32763-2	5	z	3
32763-1	5	z	3
32766-2	5	z	6
32766-4	5	z	5.33
32766-8	5	z	5
32766-9	5	z	3
32766-10	5	z	5
32766-11	5	z	5

APPENDIX A.2 continued

Cordage Twists Per CM

Catalog Number	Component	Initial Spin Direction	Twists per CM (TPC) Average
19863	5	z	5
29712a	5	z	9
29712b	5	z	6
21264	7	s	5
20519	7	s	6.33
20274	7	s	8
15124	7	s	5.67
14471	7	s	5
32763	7	s	5.67
21030	7	z	3
14676	7	z	6
14737	7	z	4
32674	7	z	6
32505	7	z	6

APPENDIX A.3

Cordage Diameter.

Catalog Number	Component	Plies	Initial Spin Direction	Cordage Average Diameter (mm)	Material Texture
5133	1	2	s	5.03	fine
6562	1	2	z	3	fine
5813a	2	2	s	2.07	fine
5813b	2	2	s	1.67	fine
5643	2	2	s	4.89	fine
5585	2	2	z	1.93	fine
5587	2	2	z	2.17	fine
25536	3	2	s	2.55	fine
9133	3	2	z	1.97	fine
16043	3	2	z	2.17	fine
31493	3	2	z	0.97	fine
17789	3	2	z	2.37	fine
17394	3	2	z	2.57	fine
25665	3	2	z	2.07	fine
111	3	2	z	2.4	fine
7975	3	2	z	2.57	fine
12089	3	2	z	1.37	fine
5830	3	2	s	2.47	fine
4274	3	2	s	1	fine
12370	3	2	s	4.83	fine
16044	3	2	z	1.6	fine
16122	3	2	z	1.57	fine
17711	3	2	z	2.27	fine
17912	3	2	z	2.13	fine
757	3	2	z	2.13	fine
3204	3	2	z	2.57	fine
5130	3	2	z	7.17	fine
255	3	2	z	1.73	fine
209	3	2	z	1.73	fine
3409	3	2	z	1.87	fine
18146	3	2	z	2.9	fine
31515	3	2	z	2.23	fine
32268	3	2	z	1.43	fine
5128	4	2	z	1.53	fine
12133	4	2	z	1.33	fine
5129	4	2	z	1.47	fine
3493	5	2	s	5.97	fine
28306	5	2	s	2.73	fine
32761	5	2	s	2.83	fine

APPENDIX A.3 continued

Cordage Diameter.

Catalog Number	Component	Plies	Initial Spin Direction	Cordage Average Diameter (mm)	Material Texture
32852.01	5	10	s	2.47	fine
3552	5	2	s	4.4	fine
18361	5	2	s	1.3	fine
18435	5	2	s	1.83	fine
9627.2	5	2	s	3.27	fine
20778	5	2	s	2.5	fine
24725	5	2	s	3.33	fine
12864	5	2	z	2.63	fine
3442	5	2	z	1.53	fine
3454	5	2	z	1.6	fine
31566	5	2	z	3.2	fine
31574.1	5	2	z	0.87	fine
28478	5	2	z	3.27	fine
12411	5	2	z	3.7	fine
3542	5	2	z	3.17	fine
26703	5	2	z	1.83	fine
26753	5	2	z	2.27	fine
20734	5	2	z	2.4	fine
20815	5	2	z	2.93	fine
24716	5	2	z	1.5	fine
20762	5	2	z	2.63	fine
26907	5	2	s	4.93	fine
5135	5	2	s	2.9	fine
811	5	2	s	2.23	fine
5139	5	2	s	2.9	fine
3794	5	2	s	3.97	fine
3766	5	2	s	2.67	fine
3699	5	2	s	1.63	fine
3621	5	2	s	3.33	fine
4484	5	4	s	2.1	fine
5147	5	2	s	2.7	fine
2898	5	2	s	2.93	fine
18650	5	2	s	1.83	fine
18620	5	2	s	2.67	fine
18445	5	2	s	1.1	fine
28497	5	2	s	3.87	fine
29573	5	2	s	1.57	fine
9856	5	2	s	2.3	fine
32762.05	5	2	s	0.63	fine

APPENDIX A.3 continued

Cordage Diameter.

Catalog Number	Component	Plies	Initial Spin Direction	Cordage Average Diameter (mm)	Material Texture
32762.09	5	2	s	2.57	fine
29714	5	2	s	2.1	fine
32763-9	5	2	s	3.16	fine
32763-8	5	2	s	3.43	fine
32763-5	5	2	s	3.27	fine
32763-3	5	2	s	2.03	fine
32763-4	5	2	s	1.33	fine
32766-1	5	2	s	3.4	fine
32766-5	5	2	s	2.2	fine
32766-6	5	2	s	3.3	fine
32766-7	5	2	s	2.17	fine
29713	5	3	s	1.9	fine
5136	5	2	z	3.33	fine
3757	5	2	z	1.3	fine
3772	5	2	z	1.17	fine
3760	5	2	z	1.03	fine
3620	5	2	z	1.87	fine
3690	5	2	z	3.4	fine
18510	5	2	z	2.5	fine
25981	5	2	z	2.67	fine
32762.01	5	2	z	1.87	fine
32762.02	5	2	z	1.37	fine
32762.03	5	2	z	2.1	fine
32762.04	5	2	z	2.3	fine
32762.06	5	2	z	0.9	fine
32762.07	5	2	z	1.13	fine
32762.08	5	2	z	1.2	fine
32762.10	5	2	z	2.67	fine
32762.11	5	2	z	3.2	fine
32762.12	5	2	z	2.8	fine
32763-11	5	2	z	2.67	fine
32763-10	5	2	z	1.6	fine
32763-6	5	2	z	1.77	fine
32763-2	5	2	z	2.63	fine
32763-1	5	2	z	2.83	fine
32766-2	5	2	z	1.67	fine
32766-4	5	2	z	1.93	fine
32766-8	5	2	z	2.57	fine
32766-9	5	2	z	3.4	fine

APPENDIX A.3 continued

Cordage Diameter.

Catalog Number	Component	Plies	Initial Spin Direction	Cordage Average Diameter (mm)	Material Texture
32766-10	5	2	z	1.4	fine
32766-11	5	2	z	1.7	fine
19863	5	2	z	1.7	fine
29712a	5	2	z	1.13	fine
29712b	5	2	z	1.9	fine
32763	7	2	s	1.57	fine
21264	7	2	s	2.33	fine
20519	7	2	s	1.63	fine
20274	7	2	s	1.73	fine
15124	7	3	s	3.17	fine
14471	7	2	s	2	fine
21030	7	2	z	2.23	fine
14676	7	2	z	2.07	fine
14737	7	2	z	3.27	fine
32674	7	2	z	1.73	fine
32505	7	2	z	1.23	fine

APPENDIX A.4

Cordage Knots.

Catalog Number	Component	Plies	Initial Spin Direction	Material Texture	Knot type
8777	3	1	z	coarse	overhand
11067	3	2	z	coarse	overhand
9133	3	2	z	fine	sheet-bend
25665	3	2	z	fine	girth-hitch
7975	3	2	z	fine	overhand
3409	3	2	z	fine	sheet-bend
18146	3	2	z	fine	square-knot
31515	3	2	z	fine	overhand
9610	4	2	s	coarse	overhand
11121	4	2	s	coarse	overhand
12133	4	2	z	fine	sheet-bend, overhand
2889	5	2	s	coarse	overhand
32852.02	5	2	s	coarse	overhand
4524	5	2	s	coarse	overhand
18372	5	2	s	coarse	overhand
9627.1	5	2	s	coarse	overhand
24122	5	2	s	coarse	overhand
32761	5	2	s	fine	overhand
32852.01	5	10	s	fine	overhand
20778	5	2	s	fine	overhand
12864	5	2	z	fine	overhand
3542	5	2	z	fine	overhand
20734	5	2	z	fine	overhand
20815	5	2	z	fine	overhand
26921	5	2	s	coarse	overhand
804	5	2	s	coarse	sheet-bend
4485	5	2	s	coarse	overhand
31853	5	2	s	coarse	overhand
31852	5	2	s	coarse	overhand
29377	5	2	s	coarse	overhand
29306	5	1	s	coarse	overhand
31700	5	2	s	coarse	overhand
32766-12	5	1	s	coarse	double overhand
19478	5	2	s	coarse	overhand
26907	5	2	s	fine	overhand
811	5	2	s	fine	sheet-bend
3729	5	2	s	fine	overhand
18445	5	2	s	fine	slip-knot
28497	5	2	s	fine	sheet-bend

APPENDIX A.4 continued

Cordage Knots.

Catalog Number	Component	Plies	Initial Spin Direction	Material Texture	Knot type
32762.09	5	2	s	fine	overhand
32766-5	5	2	s	fine	overhand
24492	5	2	z	coarse	overhand
32763-12	5	2	z	coarse	overhand
32853-3	5	2	z	coarse	overhand
32853-4	5	1	z	coarse	overhand
21493	5	1	z	coarse	overhand
5136	5	2	z	fine	overhand
3772	5	2	z	fine	noose-knot
3620	5	2	z	fine	overhand, sheet-bend
18510	5	2	z	fine	sheet-bend
25981	5	2	z	fine	overhand
32763-7	5	1	z	fine	overhand
32763-2	5	2	z	fine	overhand
32763-1	5	2	z	fine	overhand
32766-2	5	2	z	fine	slip-knot
19863	5	2	z	fine	sheet-bend
29712b	5	2	z	fine	overhand
20274	7	2	s	fine	overhand
14471	7	2	s	fine	slip-knot
14737	7	2	z	fine	overhand

APPENDIX B

Bonneville Estates Rockshelter Basketry Assemblage and Analysis.

Catalog #	Provenience			Completedness	Flexibility	Decoration	Mending Presence	Form	Rim Presence	Center Presence	Spacing	Work Direction	Work Surface	Foundation						Stitches						Use Wear		Rim Type	Center Type	Mending Details	Additional Details
	Strat	Component	Phase											Foundation Units per CM	Distance between Foundation Units Avg (mm)	Presence of Bundle	Rod Type	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Stitch Engagement of Foundation	Stitch Width Avg (mm)	Stitch Gap Avg (mm)	Stitches per CM	Work Surface	Non-Work				
29729	5a or A9-13	3, 4, 5	—	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	indeterminate	2	1.2	bundle	half rod	4.53	—	non-interlocking	some split on both faces	pierces	2.23	0.73	4	—	—	—	—	—	
5138	A2	1	Eagle Rock	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	right-to-left	indeterminate	2	13.6	bundle	half rod	4.3	3.1	non-interlocking	not split	encircles	3.2	0.88	3	burned	—	—	—	—	
5137	A3	2	Maggie Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	right-to-left	concave	2	1.28	bundle	half rod	5.35	—	non-interlocking	not split	encircles	3.83	0.98	2	burned	—	—	—	—	
5198	3	2	Maggie Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	right-to-left	concave	3	0.9	no bundle	whole rod	3.43	3.42	interlocking	not split	encircles	2.83	0.33	5	stained	—	—	—	—	
5304	6, 2 (3a)	2	Maggie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	convex	2	0.98	bundle	half rod	3.8	2.7	non-interlocking	split on non-work surface	encircles	2.7	0.93	3	—	—	—	—	—	
10518	6,1 (3a)	2	Maggie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	indeterminate	2	—	bundle	half rod	—	—	non-interlocking	not split	encircles	2.93	0.68	3	—	—	—	—	—	
5615	6,5 (3a)	2	Maggie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	convex	2	1.6	bundle	half rod	3.85	2.6	non-interlocking	not split	encircles	3.7	1.08	2	—	worn	—	—	—	
18791	3a	2	Maggie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	center	close	right-to-left	convex	2	1.7	no bundle	half rod	3.8	3.8	non-interlocking	not split	encircles	2.08	0.48	5	burned	—	—	normal, clockwise	—	
18790	3a	2	Maggie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	concave	2	—	no bundle	3-rod bunched	5.13	3.4	non-interlocking	non-worksurface is split	—	2.3	0.35	3	—	—	—	—	—	
10682	6,3 (3a)	2	Maggie Creek	incomplete	rigid	undecorated	mended	wide mouth bowl	rim	no center	close	right-to-left	concave	2	1.9	bundle	half rod	3.3	—	non-interlocking	some split on both faces	pierces	3.6	1.05	3	—	burned	self-rim, wrapped	—	Mended with fine cordage, 2 ply z spin S-twist. Knotted on non-work surface	
18061	9	3	James Creek	incomplete	rigid	undecorated	unmended	unknown	rim	no center	close	right-to-left	concave	2	—	no bundle	3-rod bunched	2.65	2.65	non-interlocking	not split	pierces	2.65	0.38	4	—	—	false-braid, tapered 2:2	—	—	
718.2	8	3	James Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	right-to-left	concave	2	—	bundle	half rod	3.95	3.1	non-interlocking	not split	pierces	2.28	0.38	4	burned	—	—	—	—	
5142	A9/10	3	James Creek	incomplete	rigid	undecorated	mended	parching tray	no rim	no center	close	right-to-left	concave	3	1.6	bundle	whole rod	4.83	4.82	non-interlocking	split on non-work face	encircles	2.93	0.45	4	burned	—	—	—	—	
718	8	3	James Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	right-to-left	concave	2	—	bundle	half rod	3.15	3.15	non-interlocking	split on non-work face	pierces	2.93	0.25	4	burned	—	—	—	—	
25567	5	3	James Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	indeterminate	—	—	bundle	missing	5.3	—	non-interlocking	not split	pierces	3.15	0.23	3	burned	stained	—	—	—	
5145	A0	3	James Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	right-to-left	convex	3	2.83	bundle	half rod	4.28	2.8	non-interlocking	split on both faces	encircles	2.1	0.65	4	burned	—	—	—	—	

APPENDIX B continued

Bonneville Estates Rockshelter Basketry Assemblage and Analysis.

Catalog #	Provenience			Completedness	Flexibility	Decoration	Mending Presence	Form	Rim Presence	Center Presence	Spacing	Work Direction	Work Surface	Foundation						Stitches						Use Wear		Rim Type	Center Type	Mending Details	Additional Details
	Strat	Component	Phase											Foundation Units per CM	Distance between Foundation Units Avg (mm)	Presence of Bundle	Rod Type	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Stitch Engagement of Foundation	Stitch Width Avg (mm)	Stitch Gap Avg (mm)	Stitches per CM	Work Surface	Non-Work				
12060	A7	3	James Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	indeterminate	2	0.9	bundle	half rod	2.93	2.7	non-interlocking	not split	encircles	1.85	0.73	4	—	—	—	—	—	
10039	A0	3	James Creek	complete	rigid	undecorated	unmended	unknown	no rim	center	close	left-to-right	convex	3	0.43	bundle	none	3.73	—	non-interlocking	some split on work face	encircles	2.3	0.35	4	—	—	self-rim, wrapped	reinforced normal	—	small complete basket, potential "learner basket" (Jolie personal communication)
2321	A0	3	James Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	left-to-right	convex	3	0.43	no bundle	half rod	4.05	—	interlocking	not split	encircles	2.78	0.53	4	burned	—	—	—	—	
972		3	James Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	left-to-right	concave	2	0.68	bundle	none	2.9	—	non-interlocking	split on non-work face	encircles	3.05	0.65	3	unknown	unknown	—	—	—	
16920	5	3	James Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	indeterminate	—	—	bundle	missing	2.95	—	non-interlocking	not split	encircles	1.93	0.53	5	burned	—	—	—	—	
8762	A3b	3	James Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	concave	—	1	bundle	half rod	3.15	3.3	non-interlocking	one split on non-work face	encircles	2.78	0.95	4	stained	burned	—	—	—	
5144	A9/10	3	James Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	right-to-left	convex	2	3.88	bundle	half rod	3.65	2.4	non-interlocking	split on non-work face	encircles	2.58	0.4	4	—	—	—	—	—	
5143	A9-10	3	James Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	convex	3	1	bundle	half rod	3.9	1.5	non-interlocking	split on non-work face	encircles	2.23	0.55	5	inorganic residue	inorganic residue	—	—	—	
10923	8, (9-10)	4	South Fork	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	right-to-left	indeterminate	—	—	bundle	whole rod	4.8	—	non-interlocking	not split	encircles	2.03	1.2	4	stained	—	—	—	—	
26982	14a	5	Pie Creek	incomplete	rigid	decorated	unmended	unknown	no rim	no center	close	left-to-right	convex	3	2.1	no bundle	2-rod welt	3.4	3.4	non-interlocking	some split on non-work face	encircles	2.4	0.63	4	stained	stained	—	—	—	stitches dyed red
808	A14a	5	Pie Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	left-to-right	convex	3	1.13	no bundle	whole rod	4.45	2.1	non-interlocking	some split on both faces	pierces	2.1	0.33	5	burned	stained	—	—	—	
3537	A13/14	5	Pie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	left-to-right	concave	3	1.05	unknown	half rod	1.93	1.92	non-interlocking	some split on work face	encircles	2.63	0.45	3	burned	—	—	—	—	
3536	A13/14	5	Pie Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	left-to-right	concave	2	—	no bundle	half rod	2.13	2.12	non-interlocking	split on non-work face	pierces	2.93	0.73	3	burned	—	—	—	—	
3535	A13/14	5	Pie Creek	incomplete	rigid	undecorated	unmended	parching tray	no rim	no center	close	left-to-right	concave	2	1.7	no bundle	whole rod	2.7	2.7	non-interlocking	split on non-work face	encircles	2.75	1.18	3	burned	—	—	—	—	
19533	14	5	Pie Creek	incomplete	rigid	undecorated	mended	shallow bowl	no rim	no center	close	right-to-left	concave	2	1.85	bundle	none	2.6	2.6	non-interlocking	split on non-work face	encircles	3.08	0.93	3	stained	—	—	—	roughly repaired with 3 large stitches spanning	

APPENDIX B continued

Bonneville Estates Rockshelter Basketry Assemblage and Analysis.

Catalog #	Provenience			Completedness	Flexibility	Decoration	Mending Presence	Form	Rim Presence	Center Presence	Spacing	Work Direction	Work Surface	Foundation						Stitches						Use Wear		Rim Type	Center Type	Mending Details	Additional Details
	Strat	Component	Phase											Foundation Units per CM	Distance between Foundation Units Avg (mm)	Presence of Bundle	Rod Type	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Stitch Engagement of Foundation	Stitch Width Avg (mm)	Stitch Gap Avg (mm)	Stitches per CM	Work Surface	Non-Work				
32766-14	14b upper	5	Pie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	—	indeterminate	—	—	—	none	—	—	—	not split	—	3.88	—	—	—	—	—	—	—	single prepared stitch, flattened
32766-13	14b upper	5	Pie Creek	incomplete	rigid	undecorated	unmended	unknown	no rim	no center	close	left-to-right	indeterminate	—	—	no bundle	unknown	1.2	—	—	not split	—	2.25	—	4	—	—	—	—	—	small stitches wrapped around flattened rod, maybe basket start

APPENDIX C

Bonneville Estates Rockshelter Manufacturing Debris Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	# of Specimens	Size Class	Weight (grams)	How Processed	Additional Manipulation	Material Class (Broad)	Material Type (Specific)	Description
22466.02	0	0	unassigned	2	3	<0.00	rhetted	shredded	fiber	*Asclepias* sp.	loose fibers lightly twisted together
22466.03	0	0	unassigned	1	5	0.07	contex intact	cut	stem	*Phragmites* sp.	roughly cut cane
25031.02	0	0	unassigned	1	5	0.49	contex intact	cut	stem	*Scirpus* sp.	cut on one end, torn opposite
25018.02	0	0	unassigned	1	5	0.86	contex intact	cut	stem	*Scirpus* sp.	s-twisted sedge
5124.02	0	0	unassigned	1	6	1.99	contex intact	cut	stem	*Scirpus* sp.	sedge, surface find, tapered on both ends
25663	1	1	Eagle Rock	1	4	0.39	contex intact	cut	stem	*Scirpus* sp.	cut sedge
31458.02	1	1	Eagle Rock	2	3	0.05	decorticated	snapped	stem	*Asclepias* sp.	two pieces of probably milkweed, snapped and fiber removed
31458.03	1	1	Eagle Rock	3	4	0.1	contex intact	snapped	stem	*Scirpus* sp.	barely modified, 3 pieces very thin cane
25639.02	1	1	Eagle Rock	2	4	0.1	rhetted	torn	fiber	*Scirpus* sp.	2 pieces, one is twisted other is rhetted root end of sedge, FS 17
32068	3	2	Maggie Creek	1	3	<0.00	decorticated	shredded	fiber	*Asclepias* sp.	very fine fiber
501	3	2	Maggie Creek	1	3	0.04	contex intact	cut	stem	*Phragmites* sp.	cane, broken into 3 pieces
5292	3/4	3	James Creek	2	5	1.28	contex intact	cut	stem	*Phragmites* sp.	raggedly cut, cane smashed
32085	3	3	James Creek	1	2	<0.00	decorticated	shredded	fiber	*Asclepias* sp.	very fine fiber
25531.02	5	3	James Creek	1	4	0.88	decorticated	cut	twig	unidentified	wood, rounded and cut on one side, slightly burned
25531.03	5	3	James Creek	1	4	0.36	contex intact	cut	stem	*Scirpus* sp.	small sedge, cut on one end
25649.02	5	3	James Creek	1	3	0.34	decorticated	burned	twig	unidentified	wood, possibly cut end, smoothed, straightened
25515.02	5	3	James Creek	1	4	0.17	decorticated	cut	stem	*Scirpus* sp.	sedge piece
25660.03	5	3	James Creek	3	4	0.5	contex intact	cut	stem	*Scirpus* sp.	sedge pieces
25717.02	5	3	James Creek	1	3	0.25	decorticated	shredded	bark	*Juniperus* sp.	FS 15, bundle of juniper
25681.02	5	3	James Creek	1	3	0.02	rhetted	torn	fiber	*Asclepias* sp.	very soft fiber wrapped around very fine twisted sticks (z-twisted sticks), composite piece
31612	7	3	James Creek	2	5	1.79	contex intact	cut	stem	*Scirpus* sp.	fibers separating
31513.02	7	3	James Creek	2	3	0.44	rhetted	cut	stem	*Scirpus* sp.	smashed and slightly rhetted sedge, FS 32
559	7	3	James Creek	3	3	0.03	rhetted	torn	fiber	unidentified	some cortex attached but fibers largely separated

APPENDIX C continued

Bonneville Estates Rockshelter Manufacturing Debris Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	# of Specimens	Size Class	Weight (grams)	How Processed	Additional Manipulation	Material Class (Broad)	Material Type (Specific)	Description
32097	9	3	James Creek	1	2	<0.00	decorticated	shredded	fiber	*Asclepias* sp.	very fine fiber
31636.02	7-11	3, 4	South Fork / James Creek contact	2	4	1.35	contex intact	cut	stem	*Scirpus* sp.	sedge cut on one end
28839.02	10-12	5	Pie Creek	1	1	<0.00	rhetted	cut	fiber	*Asclepias* sp.	small piece of consolidated milkweed fiber, possibly cut
28755.02	11/12	5	Pie Creek	1	4	0.11	contex intact	cut	stem	*Typha* sp.	flattened sedge, cut both ends
28773.02	11	5	Pie Creek	1	4	0.13	contex intact	torn	stem	*Phragmites* sp.	barely modified, splitting apart
28294	13	5	Pie Creek	1	5	0.17	contex intact	cut	bark	*Juniperus* sp.	coarse fiber, cut both ends, twisted lightly
28292.02	13	5	Pie Creek	1	2	<0.00	rhetted	cut	fiber	*Asclepias* sp.	consolidated plant fiber, cut both ends
28299	13	5	Pie Creek	18	3	0.13	rhetted	cut	fiber	*Asclepias* sp.	many lengths of cut fibers, slightly consolidated
28299.02	13	5	Pie Creek	22	2	0.05	rhetted	cut	fiber	*Asclepias* sp.	many lengths of cut fibers, slightly consolidated
32363	14	5	Pie Creek	1	3	<0.00	decorticated	shredded	fiber	*Asclepias* sp.	very fine fibers
22730.02	14	5	Pie Creek	1	6	0.66	contex intact	cut	stem	*Phragmites* sp.	cut cane
22591.02	14	5	Pie Creek	1	3	0.13	contex intact	cut	stem	*Scirpus* sp.	sedge, cut diagonally both ends
22607.02	14	5	Pie Creek	3	4	0.46	decorticated	snapped	stem	*Asclepias* sp.	asclepias bark with removed fiber, larger piece might be cut
22493.02	14	5	Pie Creek	1	3	0.1	contex intact	cut	stem	*Scirpus* sp.	cut sedge
22788.02	14	5	Pie Creek	3	4	0.41	contex intact	cut	stem	*Scirpus* sp.	two pieces flattened cane, one piece intact but cut on bottom
22474.02	14	5	Pie Creek	1	3	0.17	decorticated	cut	twig	unidentified	flattened piece of wood, both ends cut
22514.02	14	5	Pie Creek	1	4	0.15	contex intact	cut	stem	*Scirpus* sp.	sedge, straight cut on one end torn opposite
31693.02	14	5	Pie Creek	2	4	0.2	contex intact	cut	stem	*Phragmites* sp.	cut cane pieces
22623.02	14	5	Pie Creek	2	4	0.33	contex intact	snapped	stem	*Phragmites* sp.	cane pieces
25445	14	5	Pie Creek	1	6	1.28	contex intact	cut	stem	*Phragmites* sp.	reed/cane
25493	14	5	Pie Creek	1	5	0.25	contex intact	cut	stem	*Phragmites* sp.	reed/cane
31046	14	5	Pie Creek	1	4	0.04	decorticated	snapped	stem	*Asclepias* sp.	fine tip of milkweed plant with some fibers fraying off

APPENDIX C continued

Bonneville Estates Rockshelter Manufacturing Debris Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	# of Specimens	Size Class	Weight (grams)	How Processed	Additional Manipulation	Material Class (Broad)	Material Type (Specific)	Description
22826	14	5	Pie Creek	1	5	0.28	decorticated	split	stem	unidentified	split tapering flat piece of wood, maybe splice for basket
22658.02	14	5	Pie Creek	1	5	0.19	contex intact	cut	stem	*Phragmites* sp.	thin piece of cane, cut on one end
22940	14	5	Pie Creek	1	4	<0.00	rhetted	cut	fiber	*Lewisii* sp.	consolidated fiber , straightened
22922	14	5	Pie Creek	1	3	<0.00	rhetted	burned	fiber	unidentified	very fine plant fibers, one end lighty burned to consolidate, tapered torn opposite end
25460	14	5	Pie Creek	2	4	0.24	contex intact	cut	stem	*Phragmites* sp.	cut cane, both ends roughly cut
25464	14	5	Pie Creek	1	5	0.43	contex intact	cut	stem	*Phragmites* sp.	cut reed
31705.02	14	5	Pie Creek	1	4	0.1	contex intact	cut	stem	*Phragmites* sp.	cut cane
5134	14	5	Pie Creek	1	4	0.22	contex intact	cut	twig	*Phragmites* sp.	cut cane
32383	14a	5	Pie Creek	1	4	<0.00	decorticated	shredded	fiber	*Asclepias* sp.	very fine fiber
29319.02	14a	5	Pie Creek	4	2	0.06	contex intact	snapped	stem	*Phragmites* sp.	cane fragments
29319.03	14a	5	Pie Creek	5	3	0.28	contex intact	snapped	stem	*Phragmites* sp.	cane pieces
26127	14a	5	Pie Creek	1	3	0.26	decorticated	cut	twig	unidentified	wood cut on both ends, may be basket rod fragment
25816.02	14a	5	Pie Creek	1	3	0.06	decorticated	cut	stem	unidentified	thin piece of wood cut on one end
28531	14a	5	Pie Creek	1	2	<0.00	rhetted	cut	fiber	*Lewisii* sp.	consolidated very fine fiber, both ends straight cut
32236	14b	5	Pie Creek	1	1	<0.00	decorticated	shredded	fiber	*Asclepias* sp.	very fine fiber
25795.02	14b	5	Pie Creek	1	3	0.08	contex intact	cut	bark	*Juniperus* sp.	flat piece of juniper bark, cut on one end, shredded opposite
29333.02	14b	5	Pie Creek	4	3	0.07	contex intact	cut	stem	*Phragmites* sp.	
29333.02	14b	5	Pie Creek	4	3	0.07	contex intact	cut	stem	*Phragmites* sp.	
29409.02	14c	5	Pie Creek	2	3	0.15	decorticated	cut	stem	unidentified	unidentified wood, flattened, cut on each both ends

APPENDIX C continued

Bonneville Estates Rockshelter Manufacturing Debris Assemblage and Analysis.

Catalog Number	Strat	Component	Phase	# of Specimens	Size Class	Weight (grams)	How Processed	Additional Manipulation	Material Class (Broad)	Material Type (Specific)	Description
29348.03	14c	5	Pie Creek	2	2	0.02	decorticated	cut	stem	unidentified	short pieces cortex removed and inner removed
29348.02	14c	5	Pie Creek	2	3	0.11	decorticated	cut	stem	unidentified	cut on both ends on longer piece, one end on shorter piece
32853-5	15/16	5	Pie Creek	1	3	0.23	decorticated	shredded	bark	unidentified	stiff thick fibers folded
32853-1	15/16	5	Pie Creek	1	2	0.03	contex intact	cut	stem	*Phragmites* sp.	small phragmites or type, cut on both ends, piece folded over
32182	17a	5	Pie Creek	5	4	<0.00	decorticated	shredded	fiber	*Asclepias* sp.	very fine fibers
29463	17b'	7	Dry Gulch	3	2	<0.00	rhetted	cut	fiber	unidentified	evenly cut
26511.02	18b	7	Dry Gulch	1	3	0.03	contex intact	cut	stem	*Scirpus* sp.	sedge piece
25391.02	18b	7	Dry Gulch	1	3	0.08	contex intact	cut	stem	*Phragmites* sp.	smashed piece of cane, cut one end

Appendix D

Rhonda L. Andrews Center for Perishables Analysis Cordage Form.

RLA_____________

Initials: ___________

Date: _____________

CORDAGE ANALYSIS FORM (20120831)

(present all metric data in millimeters unless otherwise stated)

GENERAL DATA

1. *Site Number*: _______________________
2. *Site Name*: _________________________
3. *Cultural Affiliation*: __________________
4. *Specimen I.D. Number*: _______________
5. *Provenience*: ________________________

____

____

( ) Un-Knotted

( ) Knotted

( ) Netting

( ) Other: _______________

ANALYTICAL DATA

6. *Method of Ply Engagement*: ( ) Twisted ( ) Braided

( ) Crepe-twisted

( ) Rat-tailed

7. *General Appearance*: ( ) Undecorated ( ) Fragmentary

( ) Decorated ( ) Complete

8. *Ply Formula*:

Type Name: _______________________________________

Appendix D continued

Rhonda L. Andrews Center for Perishables Analysis Cordage Form.

9. *Angle of Twist*: _______ ; _______ ; _______ ; _______   10. *Twist per Centimeter*: _______ ; _______ ; _______

11. *Length of Construction*: _________

12. *Cord Diameter*: _______ ; _______ ; _______ ; _______ ; _______ ; _______ ; _______

Range: _______ to _______

Mean: _______

13. *Strand Diameter*: _______ ; _______ ; _______ ; _______ ; _______ ; _______ ; _______

Range: _______ to _______

Mean: _______

14. *Splices*: ( ) Present   ( ) Not Present

Type:			
	( ) ply	( ) strand	( ) cord
	( ) laid-in	( ) laid-in	( ) eye
	( ) twisted	( ) twisted	( ) end
	( ) looped	( ) looped	( ) joining
	( ) other: ________________	( ) other: ________________	( ) other: ________________

15. *Use Related Wear*: ( ) Carbonized: ___________ ( ) Organic Residue: _______ ( ) Inorganic Residue: ______

( ) Sheen ( ) Pitched ( ) Stain ( ) Other: ______________________________

16. *Raw Material*: ( ) Flora: ____

( ) Fauna: ____

Method of Identification: ______________________________

<u>GENERAL COMMENTS</u>

Appendix E

Rhonda L. Andrews Center for Perishables Analysis Coiled Basketry Form.

Initials: ___________

RLA_____________

Date: _____________

COILED BASKETRY ANALYSIS FORM

(present all metric data in millimeters unless otherwise stated)

GENERAL DATA

1. *Site Number*: _______________________ Type Name: __________________________________
2. *Site Name*: _________________________
3. *Cultural Affiliation*: __________________
4. *Specimen I.D. Number*: _______________
5. *Provenience*: ________________________

____

____

ANALYTICAL DATA (BODY)

6. *General Appearance*:

( ) Complete
( ) Incomplete

( ) Flexible
( ) Semi-flexible
( ) Rigid

( ) Decorated
( ) Undecorated
( ) Mended
( ) Unmended

7. *Form*:

( ) Constricted mouth bowl
( ) Wide mouth bowl
( ) Parching Tray
( ) Other: _________________

( ) With rim
( ) Without rim
( ) With center
( ) Without center

8. *Dimensions and Sketch*:

Appendix E continued

Rhonda L. Andrews Center for Perishables Analysis Coiled Basketry Form.

9. *Foundation Spacing*: ( ) Close Foundation Units per Centimeter: _________________

( ) Open

( ) Close and Open Frequency of Close and Open Sections: ____________

10. *Distance Between Foundation Units*: ______ ; ______ ; ______ ; ______ ; _______

Range: _______ to _______

Mean: _______

11. *Foundation Type*:

( ) _____ Rod ( ) Single

( ) _____ Bundle ( ) Horizontal

( ) _____ Rod in Bundle ( ) Stacked

( ) _____ Welt ( ) Bunched

( ) _____ Other: __________________ ( ) Other: ________________________

Foundation Name: ____

12. *Foundation Unit Diameter*: _______ ; _______ ; _______ ; _______ ; _______ ; _______ ; _______

Range: _______ to _______

Mean: _______

13. *Foundation Element Diameter* (mean):

( ) Rod: _______

( ) Bundle: _______

( ) Rod in Bundle: _______

( ) Welt: _______

( ) Other: _______

14. *Foundation Element Material and Preparation*:

( ) Rod: _____________________________________

( ) Bundle: __________________________________

( ) Welt: ____________________________________

( ) Other: ___________________________________

15. *Foundation Splicing Technique and Comments*:

Appendix E continued

Rhonda L. Andrews Center for Perishables Analysis Coiled Basketry Form.

16. *Work Direction*: ( ) Right to Left //// ( ) Left to Right \\\\

17. *Work Surface*: ( ) Concave ( ) Convex ( ) Indetermenent

17. *Stitch Type and Alinement*:

( ) Non-interlocking
( ) Interlocking
( ) Un-split
( ) Split: ____________________
frequency: ____________
( ) Other: ____
____

( ) Random
( ) Vertical
( ) Pinwheel
( ) Other: ____________

18. *Stitch Engagement of Foundation*: ( ) Encircles ( ) Pierces

19. *Stitch Width*: _______ ; _______ ; _______ ; _______ ; _______ ; _______

Range: _______ to _______

Mean: _______

20. *Stitch Gap*: _______ ; _______ ; _______ ; _______ ; _______ ; _______

Range: _______ to _______

Mean: _______

21. *Stitches per Centimeter*: _______

22. *Permeability*: __________________

23. *Stitch Material and Preparation*: ____

24. *Stitch Splices*: Fag End: ____

Length: _______ ; _______ ; _______

Range: _______ ; _______

Mean: _______

Angle: _______ ; _______ ; _______

Range: _______ ; _______

Mean: _______

Appendix E continued
Rhonda L. Andrews Center for Perishables Analysis Coiled Basketry Form.

24. *Stitch Splices* (con't.): Moving End: ____

Length: _______ ; _______ ; _______

Range: _______ ; _______

Mean: _______

Angle: _______ ; _______ ; _______

Range: _______ ; _______

Mean: _______

25. *Use Related Wear*: Work Surface: ( ) Sheen ( ) Stained ( ) Organic Residue

( ) Pitched ( ) Inorganic Residue

( ) Other: ____________________________________

Non-Work Surface: ( ) Sheen ( ) Stained ( ) Organic Residue

( ) Pitched ( ) Inorganic Residue

( ) Other: ____________________________________

<u>ANALYTICAL DATA (RIM)</u>

26. *Rim Type*: ( ) Self Rim

( ) Wrapped ( ) Same direction of work as body

( ) Unwrapped ( ) Different direction of work

( ) False Braid

Direction: ____________ Number of elements: ___________

Braid interval: ________

( ) Combination

Explain: ____

____

27. *General Rim Comments*:

Appendix E
Rhonda L. Andrews Center for Perishables Analysis Coiled Basketry Form.

ANALYTICAL DATA (CENTER)

28. *Type of Center*:

( ) Normal
- ( ) Reinforced
- ( ) Un-reinforced

( ) Oval
- ( ) Reinforced
- ( ) Un-reinforced

( ) Knotted: __________
- ( ) Reinforced
- ( ) Un-reinforced

( ) Plaited: ___________
- ( ) Reinforced
- ( ) Un-reinforced

29. *General Center Comments*:

ANALYTICAL DATA (MENDING AND DECORATION)

30. *Comments on Mending Technique*:

31. *Comments on Decoration Technique*:

COMMENTS

APPENDIX F

Assemblages used in this Study.

Site	Alternative Site Names	Elevation (m asl)	Strata	Occupation	Additional Provenience	Cultural Association	Radiocarbon Dates	Calibrated Age (Calib Rev 7.0.4)	Material Dated	Artifact Sample Sizes		Major Sources
										Cordage	Basketry	
Bonneville Estates Rockshelter (CRNV-11-4893)		1580	0-9	Component 1		Late Archaic - Late Prehistoric	(0) 400 ± 40	424-518	coprolite	61	23	Goebel 2007; Goebel et al. 2007; Goebel et al. 2018; Graf 2007; Hockett 2007, 2015; Hockett et al. 2017; Rhode and Louderback 2007; Schmidt and Loupo 2012; Schroedl and Coulam 1989
							(1b) 160 ± 30	161-231	hearth charcoal			
							(2) 440 ± 40	431-540	hearth charcoal			
				Component 2		Late Archaic, possibly Fremont	(2/3) 1370 ± 60	1180-1385	hearth charcoal			
							(3a) 1380 ± 60	1221-1394	hearth charcoal			
							(3a) 1415 ± 35	1286-1374	hearth charcoal			
				Component 3		Middle and Late Archaic	(3b) 1690 ± 60	1474-1731	hearth charcoal			
							(3b) 1710 ± 35	1549-1703	ricegrass seeds			
							(3b) 1760 ± 40	1566-1741	hearth charcoal			
							(4) 1900 ± 40	1728-1926	basket			
							(5) 1910 ± 40	1733-1935	cordage			
							(5) 1960 ± 40	1825-1991	cordage			
							(7) 2090 ± 40	1949-2152	coprolite			
							(7) 2250 ± 80 (Schroedl and Coulam 1989)	2038-2439	bulk charcoal			
							(9) 2830 ± 40	2847-3064	hearth charcoal			
							(9) 2960 ± 60	2953-3260	hearth charcoal			
							(9) 3260 ± 50	3379-3591	hearth charcoal			
							(9) 3420 ± 40	3574-3732	hearth charcoal			
							(9) 3670 ± 40	3889-4094	hearth charcoal			
Four Siblings Rockshelters (CRNV-11-7736)		1463	1, 2, 3a, 3b, 4 (LSER); 1a, 1b, 2 (BBWR)			Late Archaic - Late Prehistoric	LSER (3a, 2, 1) 190 ± 40 (feature 1)	305-70	hearth charcoal	20	0	Coe 2012; Graf et al. 2006
							LSER (3b) 2160 ± 40	2310-2010	cordage			
							BBWR (2) 190 ± 40	305-70	hearth charcoal			
							BBWR (3b) 1710 ± 60 (feature 3 in 3b)	1810-1420	hearth charcoal			
							BBWR (5) 2090 ± 40	2285-1950	hearth charcoal			

APPENDIX F continued

Assemblages used in this Study.

Site	Alternative Site Names	Elevation (m asl)	Strata	Occupation	Additional Provenience	Cultural Association	Radiocarbon Dates	Calibrated Age (Calib Rev 7.0.4)	Material Dated	Artifact Sample Sizes		Major Sources
										Cordage	Basketry	
Swallow Shelter (42BO268)		1768	3--9			Fremont	(9) 1120 ± 110	898-1279	charcoal	27	16	Dalley and Berry 1977
						Late Archaic	(5) 2630 ± 110	2377-2956	charcoal			
						Late Archaic	(4) 2850 ± 100	2760-3228	charcoal from hearth			
						Archaic	(3) 3500 ± 120 (not cultural)	3476-4089	dispersed charcoal			
						Archaic	(1) 5410 ± 170 (not cultural)	5873-6560	dispersed charcoal			
Remnant Cave (42BO365)		1450	6, 4			Pauite Shoshone	(6, firepit) 405 ± 60	416-527	charcoal from base of hearth 1	25	4	Coulam 1988; Dalley and Berry 1977
						Fremont	(6) 950 ± 125 BP	668-1090	charcoal from base of Strat 6			
						Fremont	(6) 3485 ± 370 (rejected by authors)	2878-4710	*Phragmites* sp. arrow shaft associated with Fremont pottery			
						Late Archaic	(4) 2435 ± 65	2352-2711	charcoal			
Juke Box Cave (42TO20)	Site #5, U-149	1341	II			Middle and Late Archaic	none	N/A	none	53	8	Jennings 1957; Murchison 1989; Rudy 1953; Smith 1942
Tube Cave (42BO184)		1615	2,4			Middle / Late Archaic	(2) Diagnostic points	N/A	Elko eared, Large side-notch, Black Rock concave	7	1	Dalley and Berry 1977
						Middle / Late Archaic	(4) Diagnostic points		Eastgate, Elko-eared			
Crab Cave (42JB8)		1360	2, 3			Late Archaic / Fremont	(3) Diagnostic points and ceramics		Rose Springs Corner-notched point, Elko Corner-notched, Great Salt Lake pottery	5	1	Madsen 1979
						Late Archaic / Fremont	(3) 2010 ± 135	1694-2324	*Atriplex* sp. twig			
						Middle Archaic	(2) 4445 ± 160	4789-5479	hearth charcoal			

APPENDIX F continued

Assemblages used in this Study.

Site	Alternative Site Names	Elevation (m asl)	Strata	Occupation	Additional Provenience	Cultural Association	Radiocarbon Dates	Calibrated Age (Calib Rev 7.0.4)	Material Dated	Artifact Sample Sizes: Cordage	Artifact Sample Sizes: Basketry	Major Sources
Thermal Point (42TO32)		1338	IV, III, II			Fremont and Shoshone	(IV) Diagnostic point	N/A	Rosegate point	13	8	Price 1952; Rudy 1953
						Middle and Late Archaic	(III) Diagnostic point		Elko series			
						Middle and Late Archaic	(II) Diagnostic point		Elko series, possible Humboldt			
Hogup Cave (42BO36)		1432	16, 14, 12, 10, 9, 8	IV (16, 15)	IV (11-16) (Martin et al. 2017) (2610-360 cal B.P.)	Numic / Promontory	(16) 480 ± 80 (Aikens 1970)	422-572	grass/sticks	145	59	Adovasio 1970; Aikens 1970; Berry 1976; Byers and Hill 2009; Fry 1970; Hockett 1994; Martin et al. 2017; Mullen 1997
				III (14, 13, 12)		Numic / Promontory	(14) 620 ± 100 (Aikens 1970)	480-743	sticks/bark			
						Fremont / Numic	(14) 1210 ± 100 (Aikens 1970)	951-1296	sticks/bark			
						Fremont / late Archaic	(14) 1951 ± 70 (Mullen 1997)	1718-2061	*Lepus sp.* bone collagen			
						Fremont / late Archaic	(14) 1710 ± 20 (Martin et al. 2017)	1558-1632	*Ovis sp.* bone collagen			
						Fremont / late Archaic	(14) 2330 ± 20 (Martin et al. 2017)	2341-2352	*Antilocapra* sp. bone collagen			
						Fremont / late Archaic	(12) 1530 ± 80 (Aikens 1970)	1293-1569	grass/reeds			
						Fremont / late Archaic	(12) 2920 ± 80, 2550 ± 70 (Aikens 1970 rejected)	2858-3256	grass/sticks/bark			
				II (11, 10, 9, some of 8)	III (9-10) (Martin et al. 2017) (2870-2760 cal B.P.)	Late Archaic	(10) 2430 ± 245 (Berry 1976)	2297-2762	*Phragmites sp.* arrow shaft			
						Middle Archaic	(10) 4490 ± 100 (rejected by Aikens 1970)	4857-5326	feces			
						Middle Archaic	(10) 2600 ± 100 (Aikens 1970)	2361-2879	grass/sticks/bark			
						Late Archaic	(10) 2770 ± 20 (Martin et al. 2017)	2843-2885	*Antilocapra* sp. bone collagen			
						Late Archaic	(10) 2750 ± 20 (Martin et al. 2017)	2782-2880	*Antilocapra* sp. bone collagen			
						Late Archaic	(10) 2700 ± 20 (Martin et al. 2017)	2760-2846	*Antilocapra* sp. bone collagen			

APPENDIX F continued

Assemblages used in this Study.

Site	Alternative Site Names	Elevation (m asl)	Strata	Occupation	Additional Provenience	Cultural Association	Radiocarbon Dates	Calibrated Age (Calib Rev 7.0.4)	Material Dated	Artifact Sample Sizes		Major Sources
										Cordage	Basketry	
Hogup Cave (42BO36) continued		1432	16, 14, 12, 10, 9, 8	II (11, 10, 9, some of 8)	II (8) (Martin et al. 2017) (5840-3330 cal B.P)	Late Archaic	(10) 2690 ± 20 (Martin et al. 2017)	2756-2809	*Antilocapra* sp. bone collagen	145	59	Adovasio 1970; Aikens 1970; Berry 1976; Byers and Hill 2009; Fry 1970; Hockett 1994; Martin et al. 2017; Mullen 1997
							(9) 1260 ± 120 (Madsen and Berry 1975)	934-1371	*Phragmites* sp. arrow shaft			
							(8) 2160 ± 20 (Martin et al. 2017)	2107-2181	*Antilocapra* sp. bone collagen			
							(8) 3730 ± 30 (Martin et al. 2017)	3981-4154	*Antilocapra* sp. bone collagen			
							(8) 4430 ± 20 (Martin et al. 2017)	4956-5058	*Antilocapra* sp. bone collagen			
						Middle Archaic	(8) 4610 ± 100 (potential mixing Aikens 1970)	5035-5492	grass/sticks/bark from full layer			
						Middle Archaic	(8) 3200 ± 140 (potential mixing Aikens 1970)	3058-3729	reeds, sticks from bottom of layer			
							(8) 4586 ± 94 (Mullen 1997)	4971-5484	*Lepus* sp. bone collagen			
							(8) 6370 ± 111 (Mullen 1997) (rejected, likely Strat 6)	7137-7483	*Lepus* sp. bone collagen			
						Middle Archaic	(8) 6484 ± 117 (Mullen 1997) (rejected, likely Strat 6)	7172-7578	*Lepus* sp. bone collagen			

APPENDIX F continued

Assemblages used in this Study.

Site	Alternative Site Names	Elevation (m asl)	Strata	Occupation	Additional Provenience	Cultural Association	Radiocarbon Dates	Calibrated Age (Calib Rev 7.0.4)	Material Dated	Artifact Sample Sizes		Major Sources
										Cordage	Basketry	
Danger Cave (42TO13)	U-145, U-144, Site #4, Lamus Cave, Hands and Knees Cave, On Your Knees Cave	1318		DV		Archaic	(V) 1930 ± 240 (Jennings 1953)	1327-2434	twigs	183	36	Aikens 1970; Coulam 1988; Fry 1976; Goebel et al. 2007; Harper and Alder 1972; Jennings 1957; Madsen and Rhode 1990, 1998; Mullen 1997; Rhode et al. 2006; Rudy 1953, 1981; Tamers et al. 1964; Taylor 1939
							(V, middle) 4000 ± 300 14C (Jennings 1953)	3693-5302	twigs			

APPENDIX G

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
CRNV-11-4893	BER	6562	1	unknotted	twisted	undecorated	fragment	2	z	52	tight	4	17.7	1.40	3.00	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	454	1	unknotted	twisted	undecorated	fragment	1	z	—	—	—	159	0.73	—	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	522	1	unknotted	crepe-twisted	undecorated	fragment	2	z	—	—	—	18.8	1.73	—	absent	none	none	none	burned	fine	none	torn	torn	
CRNV-11-4893	BER	8922	1	other	twisted	undecorated	fragment	2	s	60	tight	2	145.1	7.87	17.80	absent	none	none	none	burned	coarse	none	torn	torn	match/fire bundle
CRNV-11-4893	BER	5133	1	unknotted	twisted	undecorated	fragment	2	s	42	tight	3	27.2	2.37	5.03	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4983	BER	5248	2	unknotted	twisted	undecorated	fragment	2	z	—	—	—	—	—	—	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	7909	2	unknotted	twisted	undecorated	fragment	2	s	48	tight	2	36.2	3.60	4.10	absent	none	none	none	none	fauna	none	cut	torn	Rabbit skin cord twisted
CRNV-11-4893	BER	5585	2	unknotted	twisted	undecorated	fragment	2	z	48	tight	5	47.8	1.47	1.93	absent	none	none	none	none	fine	none	torn	cut	
CRNV-11-4893	BER	5587	2	unknotted	twisted	undecorated	fragment	2	z	35	tight	4	151.8	1.53	2.17	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	5643	2	unknotted	twisted	undecorated	fragment	2	s	40	tight	2	193.4	2.87	4.87	present	twisted	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	5813a	2	knotted	twisted	undecorated	fragment	2	s	40	tight	5	64	1.17	2.07	absent	none	none	none	none	fine	unknown	knotted	torn	
CRNV-11-4893	BER	5813b	2	unknotted	twisted	undecorated	fragment	2	s	17	medium	4	35.7	0.97	1.67	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	5565	2	unknotted	twisted	undecorated	fragment	2	s	52	tight	3	319.3	4.83	5.67	absent	none	none	none	none	fauna	none	torn	torn	
CRNV-11-4893	BER	17394	3	unknotted	twisted	undecorated	fragment	2	z	40	tight	4	47.6	1.50	2.57	absent	none	none	none	none	fine	none	cut	torn	
CRNV-11-4893	BER	25665	3	knotted	twisted	undecorated	fragment	2	z	40	tight	4	18.4	1.03	2.07	absent	none	none	none	burned	fine	girth-hitch	torn	knotted	Snare fragment with peg
CRNV-11-4893	BER	25536	3	unknotted	twisted	undecorated	fragment	1	s	—	—	—	162.9	1.93	—	absent	none	none	none	none	fauna	none	torn	torn	curled sinew strip
CRNV-11-4893	BER	25534	3	unknotted	twisted	undecorated	fragment	2	z	48	tight	2	84.7	4.20	5.80	absent	none	none	none	none	coarse	none	cut	cut	
CRNV-11-4893	BER	25666	3	unknotted	twisted	undecorated	fragment	2	z	63	tight	5	24.2	1.83	2.80	absent	none	none	none	none	fauna	none	torn	cut	sinew
CRNV-11-4893	BER	25653	3	unknotted	crepe-twisted	undecorated	fragment	1	z	—	—	—	15.7	0.80	—	absent	none	none	none	none	fine	none	torn	crepe-twisted	
CRNV-11-4893	BER	25680	3	unknotted	twisted	undecorated	fragment	1	z	—	—	—	9.1	—	—	absent	none	none	none	none	unknown	none	torn	torn	
CRNV-11-4893	BER	111	3	unknotted	twisted	undecorated	fragment	2	z	33	medium	5	64.8	1.67	2.40	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	25531.04	3	unknotted	twisted	undecorated	fragment	1	s	—	—	—	35.4	2.43	—	absent	none	none	none	none	fine	none	crepe-twisted	torn	
CRNV-11-4893	BER	7769	3	unknotted	crepe-twisted	undecorated	fragment	2	z	37	tight	2	109.6	2.10	4.57	absent	none	none	none	none	coarse	none	crepe-twisted	torn	
CRNV-11-4893	BER	7952	3	unknotted	rat-tailed	undecorated	fragment	1	z	40	tight	3	110.1	1.93	2.07	absent	none	none	none	none	fauna	none	torn	knotted	
CRNV-11-4893	BER	7975	3	knotted	twisted	undecorated	fragment	2	z	42	tight	4	44.5	1.60	2.57	absent	none	none	none	none	fine	overhand	torn	knotted	
CRNV-11-4893	BER	8777	3	knotted	twisted	undecorated	fragment	1	z	—	—	—	55.5	2.53	—	absent	none	none	none	burned	coarse	overhand	torn	torn	
CRNV-11-4893	BER	9133	3	knotted	twisted	undecorated	fragment	2	z	48	tight	4	30.5	1.80	1.97	absent	none	none	none	none	fine	sheet-bend	cut	torn	
CRNV-11-4893	BER	9178	3	unknotted	twisted	undecorated	fragment	1	z	—	—	—	23	4.77	—	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	16043	3	unknotted	twisted	undecorated	fragment	2	z	38	tight	4	47.2	1.50	2.17	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	8341	3	unknotted	twisted	undecorated	fragment	1	z	23	medium	—	185.9	1.60	—	absent	none	none	none	none	fauna	none	torn	cut	
CRNV-11-4893	BER	9017	3	unknotted	twisted	undecorated	fragment	1	z	—	—	—	13.1	—	—	absent	none	none	none	none	fauna	none	torn	torn	
CRNV-11-4893	BER	31493	3	unknotted	twisted	undecorated	fragment	2	z	38	medium	7	31.9	0.57	0.97	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	17190	3	unknotted	twisted	undecorated	fragment	2	z	43	tight	6	19	1.20	1.97	absent	none	none	none	none	fauna	none	knotted	torn	sinew
CRNV-11-4893	BER	5830	3	unknotted	twisted	undecorated	fragment	2	s	35	tight	4	100.9	1.33	2.47	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	4274	3	knotted	twisted	undecorated	fragment	2	s	40	tight	10	185.8	0.10	0.80	present	twisted	none	none	none	fine	unknown type	knotted	torn	Very fine string small fur tassel
CRNV-11-4893	BER	8914	3	unknotted	twisted	undecorated	fragment	2	z	40	tight	6	21.6	1.00	1.73	absent	none	none	none	burned	fauna	none	torn	torn	

APPENDIX G continued

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
CRNV-11-4893	BER	8964	3	other	twisted	undecorated	fragment	2	s	40	tight	2	77.8	3.80	5.23	absent	none	none	none	none	fauna	none	torn	torn	hide
CRNV-11-4893	BER	16044	3	unknotted	twisted	undecorated	fragment	2	z	43	tight	4	70.4	1.37	1.60	absent	none	none	none	none	fine	none	cut	torn	
CRNV-11-4893	BER	16122	3	unknotted	twisted	undecorated	fragment	2	z	40	tight	6	71.9	1.00	1.57	present	twisted	none	none	none	fine	none	cut	torn	
CRNV-11-4893	BER	17711	3	unknotted	twisted	undecorated	fragment	2	z	43	tight	7	59.7	1.53	2.27	absent	none	none	none	none	fine	none	rat-tailed	torn	
CRNV-11-4893	BER	17912	3	unknotted	twisted	undecorated	fragment	2	z	45	tight	5	44	1.57	2.13	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	17789	3	unknotted	twisted	undecorated	fragment	2	z	40	tight	5	24.4	1.33	2.37	present	twisted	none	none	none	coarse	none	torn	torn	
CRNV-11-4893	BER	757	3	unknotted	twisted	undecorated	fragment	2	z	57	tight	6	13.4	1.07	2.13	absent	—	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	3204	3	knotted	twisted	undecorated	fragment	2	z	47	tight	4	43.7	1.53	2.57	absent	—	none	none	none	fine	unknown type	torn	torn	
CRNV-11-4893	BER	5130	3	unknotted	twisted	undecorated	fragment	2	z	55	tight	2	34.4	4.47	7.17	absent	—	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	255	3	unknotted	twisted	undecorated	fragment	2	z	48	tight	5	49.3	1.23	1.73	absent	—	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	209	3	unknotted	twisted	undecorated	fragment	2	z	40	tight	5	42.4	1.27	1.73	absent	—	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	15808	3	unknotted	twisted	undecorated	fragment	2	s	18	medium	2	58.5	2.27	3.43	absent	—	none	none	none	unknown	none	torn	torn	
CRNV-11-4893	BER	12045	3	unknotted	twisted	undecorated	fragment	2	z	52	tight	4	57.2	1.60	2.40	absent	—	none	none	none	unknown	none	cut	torn	
CRNV-11-4893	BER	12370	3	unknotted	twisted	undecorated	fragment	2	s	45	tight	3	28.7	2.83	4.83	absent	—	none	none	none	fine	none	torn	torn	
CRNV-11-4893	BER	3409	3	knotted	twisted	undecorated	fragment	2	z	38	tight	4	140.2	1.10	1.87	absent	none	none	none	none	fine	sheet-bend	rat-tailed	torn	
CRNV-11-4893	BER	18146	3	knotted	twisted	undecorated	fragment	2	z	40	medium	3	34.2	1.73	2.90	absent	none	none	none	none	fauna	square	torn	torn	
CRNV-11-4893	BER	27298	3	unknotted	twisted	undecorated	fragment	1	z	—	—	—	229.5	6.70	—	absent	none	none	none	none	coarse	none	torn	torn	
CRNV-11-4893	BER	17942	3	knotted	twisted	undecorated	fragment	2	z	47	tight	3	46	1.53	2.60	absent	none	none	none	none	fauna	unknown type	torn	knotted	leather moccasin or bag
CRNV-11-4893	BER	5131	3	knotted	twisted	undecorated	fragment	2	s	65	tight	3	8.1	1.00	2.10	absent	none	none	none	none	fauna	overhand	torn	knotted	moccasin or bag
CRNV-11-4893	BER	31515	3	knotted	twisted	undecorated	fragment	2	z	47	tight	4	86.8	1.50	2.23	absent	none	none	none	none	fauna	overhand	knotted	torn	
CRNV-11-4893	BER	32268	3	unknotted	twisted	undecorated	fragment	2	z	35	tight	6	13	0.90	1.43	absent	none	none	none	none	fine	none	burned	cut	
CRNV-11-4893	BER	12089	3	unknotted	rat-tailed	undecorated	fragment	2	z	48	tight	6	33.9	1.07	1.37	absent	—	none	none	burned	fine	none	rat-tailed	torn	
CRNV-11-4893	BER	7099	3	unknotted	twisted	undecorated	fragment	1	z	—	—	—	53.4	2.47	—	absent	—	none	none	none	coarse	none	torn	torn	
CRNV-11-4893	BER	11067	3	knotted	twisted	undecorated	fragment	2	z	30	tight	2	17.2	4.87	7.63	absent	—	none	none	none	coarse	overhand	knotted	torn	
CRNV-11-4893	BER	4011.02	3	unknotted	twisted	undecorated	fragment	1	z	—	—	—	41.7	7.47	—	absent	—	none	none	none	fauna	none	torn	torn	twisted rabbitskin
42BO268	Swallow Shelter	FS80.54	7	unknotted	twisted	undecorated	fragment	2	z	28	tight	3	127.8	1.30	2.50	present	none	none	looped	none	fine	none	torn	torn	
42BO268	Swallow Shelter	79.9		unknotted	twisted	undecorated	fragment	2	z	32	tight	3	101.7	2.13	3.27	absent	none	none	none	none	fine	none	torn	torn	
42BO268	Swallow Shelter	75.2	9	unknotted	twisted	undecorated	fragment	2	z	30	tight	4	61.3	1.23	1.83	absent	none	none	none	stained	fine	none	burned	torn	
42BO268	Swallow Shelter	13.301	9	unknotted	crepe-twisted	undecorated	fragment	1	z	—	—	—	150.8	1.50	—	absent	none	none	none	none	fauna	none	rat-tailed	torn	
42BO268	Swallow Shelter	224.55		knotted	twisted	undecorated	fragment	2	z	33	tight	6	153.7	1.00	1.43	present	none	twisted	none	none	fine	overhand	knotted	torn	
42BO268	Swallow Shelter	109.57	9	unknotted	twisted	undecorated	fragment	2	z	33	tight	5	134.2	1.23	2.40	absent	none	none	none	none	fine	none	torn	torn	
42BO268	Swallow Shelter	79.7		unknotted	twisted	undecorated	fragment	1	z	—	—	—	75.8	2.10	—	absent	none	none	none	none	coarse	none	torn	torn	
42BO268	Swallow Shelter	13.36	9	knotted	twisted	undecorated	fragment	2	s	32	tight	1	61.8	5.77	9.50	absent	none	none	none	stained	coarse	overhand	knotted	torn	

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
42BO268	Swallow Shelter	175.116		knotted	twisted	undecorated	fragment	1	z	—	—	—	—	1.90	—	absent	none	none	none	none	fauna	overhand	knotted	knotted	knotted leather
42BO268	Swallow Shelter	107.4		unknotted	crepe-twisted	undecorated	fragment	2	s	23	medium	2	30.2	1.77	3.10	absent	none	none	none	none	coarse	none	crepe-twisted	crepe-twisted	
42BO268	Swallow Shelter	177.43	9	unknotted	twisted	undecorated	fragment	3	z	40	tight	3	71	2.17	4.50	present	none	twisted	none	none	fine	none	cut	torn	
42BO268	Swallow Shelter	2.38		unknotted	twisted	undecorated	fragment	2	z	27	tight	2	175.1	3.17	4.37	present	none	twisted	none	none	coarse	none	burned	torn	
42BO268	Swallow Shelter	195.5		unknotted	twisted	undecorated	fragment	2	z	28	tight	4	76.1	1.47	2.03	absent	none	none	none	none	fine	none	torn	torn	
42BO268	Swallow Shelter	2173.3	9	unknotted	twisted	undecorated	fragment	1	z	—	—	—	318	7.50	—	absent	none	none	none	none	coarse	none	burned	torn	
42BO268	Swallow Shelter	217.2	9	netting	twisted	undecorated	fragment	2	z	40	tight	7	318	0.87	1.53	present	none	twisted	none	none	fine	sheet-bend	torn	burned	net fragment
42BO268	Swallow Shelter	217.20.2	9	unknotted	twisted	undecorated	fragment	2	z	35	tight	5	22	1.10	1.90	absent	none	none	none	none	fine	none	torn	torn	
42BO268	Swallow Shelter	217.15	9	unknotted	twisted	undecorated	fragment	1	z	—	—	—	318	5.53	—	absent	none	none	none	none	coarse	none	torn	torn	
42BO268	Swallow Shelter	268.13	7	unknotted	twisted	undecorated	fragment	2	z	32	tight	5	97.7	1.33	2.17	absent	none	none	none	none	fine	none	torn	torn	
42BO268	Swallow Shelter	267.8	9	unknotted	twisted	undecorated	fragment	2	z	32	tight	6	327.4	1.07	1.63	present	none	twisted	none	none	fine	none	cut	burned	
42BO268	Swallow Shelter	224.59		knotted	twisted	undecorated	fragment	2	z	37	tight	6	135.2	1.13	2.17	absent	none	none	none	none	fine	overhand	torn	torn	
42BO268	Swallow Shelter	203.9-1	9	knotted	twisted	undecorated	fragment	2	z	25	medium	4	12.7	1.17	1.57	absent	none	none	none	none	fine	overhand	knotted	knotted	rabbitskin wrapped over cord
42BO268	Swallow Shelter	203.9-2	9	unknotted	twisted	undecorated	fragment	2	z	37	tight	3	133.9	1.33	9.97	absent	none	none	none	none	fauna	none	rat-tailed	torn	rabbitskin wrapped over cord
42BO268	Swallow Shelter	29.4	9	unknotted	twisted	undecorated	fragment	1	z	—	—	—	159.1	4.03	—	absent	none	none	none	none	fauna	none	torn	torn	rabbitskin strip wrapped
42BO268	Swallow Shelter	217.14-1	9	knotted	twisted	undecorated	fragment	2	z	32	tight	3	42	2.07	3.20	absent	none	none	none	none	fine	overhand, half-hitch	knotted	torn	cord looped around rabbitskin strip
42BO268	Swallow Shelter	217.14-2	9	knotted	twisted	undecorated	fragment	2	z	25	medium	10	21.11	0.67	1.50	absent	none	none	none	none	fine	overhand	torn	torn	rabbitskin wrapped around cord
42BO268	Swallow Shelter	217.14-3	9	unknotted	twisted	undecorated	fragment	2	s	32	tight	2	158.2	4.93	7.30	absent	none	none	none	none	fauna	none	torn	torn	rabbitskin
42BO268	Swallow Shelter	279.2-2	7	knotted	twisted	undecorated	fragment	2	z	52	tight	3	121	2.40	3.53	absent	none	none	none	none	fine	overhand	knotted	knotted	basket mend
42BO365	Remnant Cave	6.2-2		knotted	twisted	undecorated	complete	2	s	22	medium	2	335.1	3.03	4.77	present	none	laid-in	none	none	coarse	overhand	knotted	knotted	
42BO365	Remnant Cave	61.1		unknotted	twisted	undecorated	fragment	2	z	35	tight	4	53.3	1.43	2.83	absent	none	none	none	none	fine	none	torn	torn	
42BO365	Remnant Cave	19.295		knotted	twisted	undecorated	fragment	2	s	40	tight	6	86.1	1.33	1.60	absent	none	none	none	stained	fine	square	torn	cut	
42BO365	Remnant Cave	51.78-1		knotted	twisted	undecorated	fragment	2	s	30	tight	2	183	2.90	5.57	present	none	twisted	none	burned	coarse	overhand	knotted	torn	
42BO365	Remnant Cave	51.78-2		unknotted	crepe-twisted	undecorated	fragment	2	s	37	tight	3	40.9	1.60	3.23	absent	none	none	none	none	coarse	none	crepe-twisted	torn	
42BO365	Remnant Cave	60.11		unknotted	twisted	undecorated	fragment	2	z	47	tight	5	86.2	1.53	2.60	present	none	laid-in	none	none	fine	none	torn	torn	
42BO365	Remnant Cave	8.112		unknotted	twisted	undecorated	fragment	2	s	40	tight	2	202.1	3.13	5.10	present	none	twisted	none	other	fine	none	crepe-twisted	torn	
42BO365	Remnant Cave	78.78		unknotted	twisted	undecorated	fragment	2	s	28	medium	3	133	2.43	3.20	absent	none	none	none	none	fine	none	torn	torn	

APPENDIX G continued

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
42BO365	Remnant Cave	48.1		knotted	twisted	undecorated	complete	2	z	37	tight	2	599.3	4.60	7.90	present	none	laid-in	none	none	coarse	overhand	knotted	knotted	
42BO365	Remnant Cave	72.46		unknotted	twisted	undecorated	fragment	2	s	28	medium	4	337.3	1.83	2.50	present	none	twisted	none	stained	fine	none	torn	torn	
42BO365	Remnant Cave	10.21		knotted	twisted	undecorated	fragment	2	s	32	tight	4	148	1.93	3.50	present	none	twisted	none	none	fine	overhand, sheet-bend	torn	torn	
42BO365	Remnant Cave	36.13-1		unknotted	twisted	decorated	fragment	2	z	32	tight	5	341.9	1.00	1.60	present	none	laid-in	none	none	fine	none	torn	knotted	may be stained red
42BO365	Remnant Cave	36.13-2		unknotted	crepe-twisted	undecorated	fragment	2	z	25	medium	2	125.6	2.17	3.37	present	none	twisted	none	none	fine	none	crepe-twisted	torn	
42BO365	Remnant Cave	19.28		netting	twisted	undecorated	fragment	2	s	35	tight	5	238.3	1.00	1.80	present	none	twisted	none	stained	fine	sheet-bend	torn	torn	netting fragment
42BO365	Remnant Cave	36.18		knotted	twisted	undecorated	fragment	2	z	37	tight	5	62.8	1.30	1.83	absent	none	none	none	none	fine	slip-knot	knotted	torn	
42BO365	Remnant Cave	48.2		knotted	twisted	undecorated	fragment	3	z	25	medium	2	250.7	1.83	3.97	present	laid-in	none	none	inorganic residue	coarse	overhand	knotted	torn	
42BO365	Remnant Cave	79.27		knotted	rat-tailed	undecorated	fragment	2	s	38	tight	6	119.5	0.77	1.43	absent	none	none	none	none	coarse	overhand	knotted	rat-tailed	
42BO365	Remnant Cave	33.1		knotted	twisted	undecorated	fragment	3	z	37	tight	2	483.3	2.97	5.97	present	none	twisted	none	inorganic residue	fine	overhand, square	torn	knotted	
42BO365	Remnant Cave	8.11		knotted	twisted	undecorated	fragment	2	s	27	medium	3	515.9	2.07	2.83	present	none	twisted	none	inorganic residue	fine	overhand, sheet-bend	knotted	torn	
42BO365	Remnant Cave	45.5		knotted	twisted	undecorated	fragment	2	z	33	tight	2	193.1	3.50	5.73	present	none	twisted	none	none	coarse	overhand	torn	torn	
42BO365	Remnant Cave	7.3		knotted	twisted	undecorated	fragment	2	s	25	medium	4	284.9	1.73	2.83	present	none	twisted	none	inorganic residue	fine	sheet-bend, square	torn	torn	
42BO365	Remnant Cave	40.6		knotted	twisted	undecorated	fragment	2	s	23	medium	1	520.4	3.27	6.23	present	none	twisted	none	none	coarse	overhand	knotted	torn	
42BO365	Remnant Cave	9.103		knotted	twisted	undecorated	fragment	2	z	42	tight	5	308.4	1.70	2.27	absent	none	none	none	inorganic residue	fine	overhand	knotted	torn	
42BO365	Remnant Cave	40.61		knotted	twisted	undecorated	fragment	2	z	25	medium	5	65.3	1.60	2.17	present	none	twisted	none	inorganic residue	fine	overhand, slipknot	knotted	knotted	
42BO365	Remnant Cave	81.46		netting	twisted	undecorated	fragment	2	z	38	tight	5	154.9	1.03	1.00	absent	none	none	none	stained	fine	sheet-bend	torn	torn	netting fragment
42BO184	Tube Cave	3.43		unknotted	twisted	undecorated	fragment	2	s	45	tight	3	71.9	2.23	3.33	absent	none	none	none	stained	fine	none	torn	torn	
42BO184	Tube Cave	4.119		knotted	twisted	undecorated	fragment	2	z	28	tight	3	47.8	1.47	3.67	absent	none	none	none	none	fine	square	torn	cut	
42BO184	Tube Cave	15.46		knotted	crepe-twisted	undecorated	fragment	2	z	25	medium	2	128.3	3.50	5.60	absent	none	none	none	none	coarse	overhand	crepe-twisted	torn	
42BO184	Tube Cave	15.43-1		unknotted	twisted	undecorated	fragment	2	z	37	tight	3	505.9	1.83	2.40	present	none	twisted	none	none	fine	none	torn	torn	
42BO184	Tube Cave	15.43-2		knotted	twisted	undecorated	fragment	2	z	35	tight	4	546.9	1.50	2.10	present	none	twisted	none	none	fine	overhand	torn	torn	

APPENDIX G continued

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
42BO184	Tube Cave	15.43-3		unknotted	twisted	undecorated	fragment	2	s	40	tight	4	141	1.80	2.90	absent	none	none	none	none	fine	none			
42BO184	Tube Cave	15.43-4		unknotted	crepe-twisted	undecorated	fragment	2	s	30	tight	3	43.9	1.43	2.63	absent	none	none	none	none	fine	none	crepe-twisted	torn	
42TO20	Jukebox Cave	23738	III	unknotted	twisted	undecorated	fragment	2	s	30	tight	2	166	2.90	5.00	present	none	twisted	none	none	coarse	none	torn	torn	
42TO20	Jukebox Cave	22258.4	II	unknotted	twisted	undecorated	fragment	2	s	30	tight	3	248.8	0.80	1.57	absent	none	none	none	none	fauna	none	torn	torn	animal skin
42TO20	Jukebox Cave	22181.7	II	knotted	twisted	undecorated	fragment	2	s	32	tight	2	348.9	1.93	3.80	present	none	twisted	none	none	coarse	overhand	knotted	torn	
42TO20	Jukebox Cave	21999.14	II	knotted	twisted	undecorated	fragment	2	s	30	tight	6	141.3	1.03	1.37	absent	none	none	none	stained	fine	overhand, sheet-bend, slip-knot	rat-tailed	knotted	
42TO20	Jukebox Cave	22259.26	II	unknotted	twisted	undecorated	fragment	1	s	_	—	_	176.5	2.10	—	absent	none	none	none	none	fauna	none	torn	torn	sinew
42TO20	Jukebox Cave	21935.1	II	knotted	twisted	undecorated	fragment	2	s	28	tight	2	239.9	3.80	7.27	present	none	laid-in	twisted	none	coarse	overhand	torn	torn	
42TO20	Jukebox Cave	21999.10'	II	unknotted	twisted	undecorated	fragment	2	s	30	tight	2	337.8	2.57	5.37	present	none	twisted	none	none	coarse	none	torn	burned	
42TO20	Jukebox Cave	21999.11	II	unknotted	twisted	undecorated	fragment	2	s	35	tight	4	75	1.37	1.93	present	none	twisted	none	none	fine	none	cut	cut	
42TO20	Jukebox Cave	22181.9	II	unknotted	twisted	undecorated	fragment	2	s	40	tight	1	166.7	2.77	5.87	present	none	laid-in	none	burned	coarse	overhand	burned	knotted	
42TO20	Jukebox Cave	21904.3	II	knotted	twisted	undecorated	fragment	2	s	37	tight	4	171.2	1.83	3.27	present	twisted	none	none	none	fine	overhand	cut	torn	
42TO20	Jukebox Cave	22270.4	II	unknotted	twisted	decorated	fragment	2	s	28	medium	3	148	1.30	2.43	absent	none	none	none	none	fine	none	cut	torn	
42TO20	Jukebox Cave	22181.8	II	unknotted	twisted	undecorated	fragment	2	z	28	tight	4	105.6	1.43	1.97	absent	none	none	none	none	fine	none	torn	torn	
42TO20	Jukebox Cave	22292.2	II	knotted	twisted	undecorated	fragment	2	z	37	tight	4	180.4	1.70	1.83	present	none	twisted	none	none	fine	overhand, noose	torn	knotted	
42TO20	Jukebox Cave	22105.1	II	unknotted	twisted	undecorated	fragment	2	s	25	medium	2	354	2.53	3.80	present	none	twisted	none	none	coarse	none	torn	torn	
42TO20	Jukebox Cave	21999.12	II	knotted	twisted	undecorated	fragment	2	s	35	tight	2	32.8	2.40	6.17	absent	none	none	none	none	coarse	overhand	torn	torn	
42TO20	Jukebox Cave	22188.3	II	knotted	twisted	undecorated	fragment	1	s	_	—	_	99.7	3.37	—	absent	none	none	none	none	coarse	overhand	torn	torn	
42TO20	Jukebox Cave	21977.3	II	knotted	twisted	undecorated	fragment	2	s	32	tight	1	218.4	2.00	4.23	absent	none	none	none	none	coarse	slip-knot	knotted	torn	
42TO20	Jukebox Cave	21899.2	II	knotted	twisted	undecorated	fragment	1	z	_	—	_	122.2	10.67	—	absent	none	none	none	none	coarse	overhand	torn	torn	
42TO20	Jukebox Cave	22132.8	II	knotted	twisted	decorated	fragment	2	z	38	tight	4	372.2	1.73	1.93	absent	none	none	none	inorganic residue	fauna	half-hitch, sheet-bend	torn	cut	composite leather
42TO20	Jukebox Cave	21999.9-1	II	knotted	twisted	undecorated	fragment	2	s	30	tight	2	415.6	1.70	3.93	present	none	twisted	none	none	coarse	overhand	knotted	knotted	
42TO20	Jukebox Cave	21999.9-2	II	knotted	twisted	undecorated	fragment	2	s	28	tight	2	223.2	1.90	3.07	absent	none	none	none	none	fine	overhand, half-hitch	knotted	knotted	
42TO20	Jukebox Cave	21999.13	II	unknotted	twisted	undecorated	fragment	2	z	28	tight	3	128.2	1.60	2.17	present	none	laid-in	none	none	fine	none	torn	torn	
42TO20	Jukebox Cave	22187.1-1	II	unknotted	twisted	undecorated	fragment	2	s	23	medium	4	109.3	1.13	1.43	absent	none	none	none	none	fine	none	torn	torn	

APPENDIX G continued

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
42TO20	Jukebox Cave	22187.1	II	knotted	twisted	undecorated	fragment	2	s	23	medium	4	103.4	0.63	1.10	absent	none	none	none	none	fine	overhand, sheet-bend	knotted	torn	
42TO20	Jukebox Cave	22258.3	II	unknotted	twisted	undecorated	fragment	1	z	_	—	_	67.5	2.03	—	absent	none	none	none	none	fine	none	crepe-twisted	torn	
42TO20	Jukebox Cave	22212.16	II	unknotted	twisted	undecorated	fragment	2	s	47	tight	2	17.2	2.60	5.33	absent	none	none	none	none	coarse	none	torn	torn	
42TO20	Jukebox Cave	22132.9	II	knotted	twisted	undecorated	fragment	1	z	_	—	_	24	6.93	—	absent	none	none	none	none	coarse	overhand	burned	torn	
42TO20	Jukebox Cave	22258.7	II	knotted	twisted	undecorated	fragment	2	z	28	tight	5	74.6	1.03	1.70	absent	none	none	none	none	fine	overhand	torn	torn	
42TO20	Jukebox Cave	22238.2	II	unknotted	twisted	undecorated	fragment	1	z	_	—	_	82.5	3.80	—	absent	none	none	none	none	fauna	none	torn	torn	rabbitskin
42TO20	Jukebox Cave	22292.3	II	unknotted	twisted	undecorated	fragment	2	z	33	tight	6	117.1	0.97	1.73	absent	none	none	none	none	fine	none	torn	torn	
42TO20	Jukebox Cave	21999.16	II	unknotted	twisted	undecorated	fragment	2	s	38	tight	2	40.4	2.20	2.87	absent	none	none	none	none	fine	none	torn	torn	
42TO20	Jukebox Cave	22234.1	II	unknotted	twisted	undecorated	fragment	2	z	35	tight	6	130.8	1.13	1.70	absent	none	none	none	stained	fine	none	torn	torn	
42TO20	Jukebox Cave	22146.16	II	knotted	twisted	undecorated	fragment	1	s	_	—	_	218.9	3.63	—	absent	none	none	none	none	coarse	none	torn	torn	
42TO20	Jukebox Cave	22181.6	II	unknotted	twisted	undecorated	fragment	2	s	33	tight	1	271.5	2.87	5.33	present	none	laid-in	none	none	coarse	none	burned	torn	
42TO20	Jukebox Cave	21935.2	II	unknotted	twisted	undecorated	fragment	2	s	45	tight	2	237.9	2.97	5.77	absent	none	none	none	inorganic residue	fine	none	torn	torn	
42TO20	Jukebox Cave	21655.4	II	netting	twisted	undecorated	fragment	2	z	45	tight	6	70.1	1.20	1.63	absent	none	none	none	none	fine	sheet-bend, square , overhand	cut	knotted	net
42TO20	Jukebox Cave	22188.2-1	II	knotted	twisted	undecorated	fragment	2	s	23	medium	2	518.7	2.37	4.13	present	none	twisted	none	none	coarse	overhand	knotted	torn	
42TO20	Jukebox Cave	22188.2-2	II	knotted	twisted	undecorated	fragment	2	z	25	medium	2	125.7	1.67	3.37	present	none	twisted	none	none	coarse	half-hitch	torn	torn	
42TO20	Jukebox Cave	22188.2-3	II	knotted	twisted	undecorated	fragment	2	z	27	medium	2	98.7	1.93	3.73	absent	none	none	none	none	coarse	overhand	torn	torn	
42TO20	Jukebox Cave	22258.6	II	unknotted	crepe-twisted	undecorated	fragment	2	z	30	tight	1	80.4	1.83	4.07	absent	none	none	none	none	coarse	none	crepe-twisted	torn	
42TO20	Jukebox Cave	21853	II	knotted	crepe-twisted	undecorated	fragment	2	z	27	tight	1	296.5	1.90	3.73	absent	none	none	none	none	coarse	overhand	knotted	crepe-twisted	
42TO20	Jukebox Cave	2297.2-1	II	knotted	twisted	undecorated	fragment	2	s	28	tight	1	318.82	3.93	7.73	absent	none	laid-in	none	none	coarse	slip-knot	knotted	torn	
42TO20	Jukebox Cave	2297.2-2	II	knotted	twisted	undecorated	fragment	2	z	28	tight	5	38	1.10	1.57	absent	none	none	none	none	fine	overhand, sheet-bend	knotted	knotted	
42TO20	Jukebox Cave	22258.1	II	knotted	twisted	undecorated	fragment	2	z	35	tight	3	159.1	1.83	2.87	present	none	twisted	none	none	fine	overhand	knotted	torn	
42TO20	Jukebox Cave	22222.4	II	unknotted	twisted	undecorated	fragment	2	s	37	tight	2	232.7	3.17	5.27	absent	none	none	none	none	coarse	none	torn	torn	
42TO20	Jukebox Cave	21998.2	II	unknotted	twisted	undecorated	fragment	2	s	32	tight	2	529.8	2.73	3.93	present	none	twisted	none	burned	coarse	none	torn	torn	
42TO20	Jukebox Cave	22275.1	II	unknotted	twisted	undecorated	fragment	2	z	37	tight	2	327.2	3.73	5.77	present	none	twisted	none	other	coarse	none	torn	torn	
42TO20	Jukebox Cave	21901.43	II	unknotted	twisted	undecorated	fragment	2	z	35	tight	2	182.1	2.00	4.93	present	none	twisted	none	none	fine	none	torn	torn	

APPENDIX G continued

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
42TO20	Jukebox Cave	21999.8	II	unknotted	twisted	undecorated	fragment	2	s	25	medium	6	281.6	0.30	0.53	absent	none	none	none	none	fine	slip-knot	torn	knotted	wrapped around a stick
42TO20	Jukebox Cave	22150.11	II	unknotted	twisted	undecorated	fragment	2	z	43	tight	6	61.4	1.03	1.53	absent	none	none	none	none	fine	none	torn	torn	
42TO20	Jukebox Cave	22238.1	II	unknotted	twisted	undecorated	fragment	2	z	38	tight	6	177	0.73	1.53	absent	none	none	none	burned or pitched	fine	none	burned	torn	
42TO20	Jukebox Cave	22181.10'	II	netting	twisted	undecorated	fragment	2	z	40	tight	6	—	0.90	23.57	absent	none	none	none	none	fine	sheet-bend	torn	knotted	netting fragment
42TO20	Jukebox Cave	22181.3	II	knotted	twisted	undecorated	fragment	2	s	43	tight	2	89.4	2.47	3.80	present	none	twisted	none	none	fine	overhand	torn	knotted	
42TO32	Thermal Point	22762.1		knotted	twisted	undecorated	fragment	2	s	52	tight	3	148.3	2.70	4.07	absent	none	none	none	none	fine	overhand	torn	torn	
42TO32	Thermal Point	22700.14		unknotted	twisted	undecorated	fragment	2	s	40	tight	2	100.6	3.57	5.60	absent	none	none	none	none	coarse	none	torn	torn	
42TO32	Thermal Point	22752.7		knotted	twisted	undecorated	fragment	2	z	33	tight	4	57.1	1.50	3.00	absent	none	none	none	none	fine	overhand	knotted	knotted	
42TO32	Thermal Point	22761.1		unknotted	twisted	undecorated	fragment	2	z	25	medium	5	91.6	0.93	1.47	absent	none	none	none	none	fine	none	rat-tailed	torn	
42TO32	Thermal Point	22729.4		unknotted	twisted	undecorated	fragment	2	z	40	tight	4	75.2	1.37	1.97	absent	none	none	none	none	fine	none	torn	torn	
42TO32	Thermal Point	22736.2		knotted	twisted	undecorated	complete	2	z	35	tight	2	80.9	3.03	4.47	absent	none	none	none	none	coarse	half-hitch	torn	knotted	
42TO32	Thermal Point	22729.1		knotted	twisted	undecorated	fragment	2	z	32	tight	4	126	1.47	1.97	absent	none	none	none	none	fine	none	torn	torn	
42TO32	Thermal Point	22759.2-1		unknotted	twisted	undecorated	fragment	2	z	43	tight	6	59.6	1.00	1.50	absent	none	none	none	none	fine	none	torn	torn	
42TO32	Thermal Point	22759.2-2		unknotted	twisted	undecorated	fragment	2	z	45	tight	6	43.9	0.90	1.63	absent	none	none	none	none	fine	none	torn	torn	
42TO32	Thermal Point	22756.2		knotted	twisted	undecorated	fragment	2	s	35	tight	4	130.6	1.67	2.13	present	none	laid-in	none	none	fine	overhand	knotted	torn	
42TO32	Thermal Point	22761.14		knotted	twisted	undecorated	fragment	2	s	25	medium	2	158.8	1.53	2.77	absent	none	none	none	none	coarse	overhand	knotted	torn	
42TO32	Thermal Point	22729.3		knotted	twisted	undecorated	fragment	2	z	35	tight	4	100.1	1.63	2.57	absent	none	none	none	none	fine	noose	torn	knotted	
42TO32	Thermal Point	22705.2		knotted	twisted	undecorated	fragment	2	z	38	tight	6	223	0.97	1.33	present	none	twisted	none	none	fine	unknown type	torn		
42JB8	Crab Cave	78.27.15.18		unknotted	twisted	undecorated	fragment	1	s	—	—	—	191.3	6.03	—	absent	none	none	none	none	coarse	none	cut	cut	
42JB8	Crab Cave	78.27.15.25		unknotted	twisted	undecorated	fragment	1	z	—	—	—	103.3	3.33	—	absent	none	none	none	none	fauna	none	rat-tailed	torn	rabbitskin
42JB8	Crab Cave	78.27.2.7		unknotted	twisted	undecorated	fragment	1	z	—	—	—	97.5	5.83	—	absent	none	none	none	none	fauna	none	torn	torn	rabbitskin
42JB8	Crab Cave	78.27.6.13		unknotted	twisted	undecorated	fragment	1	z	—	—	—	78.9	4.70	—	absent	none	none	none	none	fauna	none	rat-tailed	torn	rabbitskin
42JB8	Crab Cave	78.27.9.2		unknotted	twisted	undecorated	fragment	1	z	—	—	—	64.9	10.47	—	absent	none	none	none	none	fauna	none	torn	torn	rabbitskin
CRNV-11-7736E	Little Sister East	67	2	unknotted	twisted	undecorated	fragment	2	s	50	tight	5	19.3	2.30	2.60	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-7736E	Little Sister East	70	2	knotted	twisted	undecorated	fragment	1	z	—	—	—	50.9	2.40	3.53	absent	none	none	none	none	coarse	none	cut	torn	
CRNV-11-7736E	Little Sister East	95	3	unknotted	twisted	undecorated	fragment	2	s	55	tight	5	37.1	—	1.97	absent	none	none	none	none	fine	none	torn	torn	

APPENDIX G continued

Complete Cordage Assemblage for Chapter 4.

Site Number	Site Name	Catalog Number	Occupation / Component	Type	Method of Ply Engagement	Decoration	Completedness	Plies	Initial Spin	Twist Angle	Tightness	Twists Per CM	Length (mm)	Strand Diameter (mm)	Cord Diameter (mm)	Splice Presence	Splice Ply	Splice Strand	Splice Cord	Use-Wear	Material Type	Knots	End 1	End 2	General Comments
CRNV-11-7736E	Little Sister East	96.1	3	unknotted	twisted	undecorated	fragment	1	s	—	—	—	52.9	1.20	—	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-7736E	Little Sister East	96.2	3	unknotted	crepe-twisted	undecorated	fragment	1	z	—	—	—	62.2	0.50	—	absent	none	none	none	none	fine	none	crepe-twisted	torn	
CRNV-11-7736E	Little Sister East	96.3	3	unknotted	none	undecorated	fragment	2	z	54	tight	5	84.3	0.50	2.80	absent	none	none	none	none	fine	none	crepe-twisted	torn	
CRNV-11-7736E	Little Sister East	96.4	3	unknotted	twisted	decorated	fragment	1	s	—	—	—	33.9	1.93	—	absent	none	none	none	none	fine	none	torn	torn	blue wool
CRNV-11-7736E	Little Sister East	127	3	unknotted	twisted	undecorated	fragment	2	z	40	medium	6	124.3	—	1.67	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-7736E	Little Sister East	143	3	unknotted	twisted	undecorated	fragment	2	s	35	medium	2	52.8	—	2.77	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-7736E	Little Sister East	178	3	unknotted	twisted	undecorated	fragment	2	z	35	medium	4	61.3	—	2.63	absent	none	none	none	none	fine	none	cut	cut	
CRNV-11-7736E	Little Sister East	223	3	unknotted	twisted	undecorated	fragment	2	z	48	tight	1	109.6	—	7.47	absent	none	none	none	none	coarse	none	torn	torn	
CRNV-11-7736E	Little Sister East	277	5	unknotted	twisted	undecorated	fragment	2	z	47	tight	—	19.3	—	2.07	absent	none	none	none	none	fine	none	cut	torn	
CRNV-11-7736E	Little Sister East	425	3	unknotted	twisted	undecorated	fragment	4	z	25	medium	—	10.4	—	1.47	absent	none	none	none	none	fine	none	cut	torn	
CRNV-11-7736E	Little Sister East	513.02	4	unknotted	twisted	undecorated	fragment	1	s	—	—	—	33.3	1.50	—	absent	none	none	none	none	fine	none	torn	torn	
CRNV-11-7736E	Little Sister East	518	3	unknotted	twisted	undecorated	fragment	1	z	—	—	—	123.7	5.07	—	absent	none	none	none	none	coarse	none	torn	torn	
CRNV-11-7736E	Little Sister East	137	3	knotted	twisted	undecorated	fragment	1	z	—	—	—	235.2	14.83	—	absent	none	none	none	none	fine	none	torn	knotted	bundle of sedge stems
CRNV-11-7736W	Big Brother West	10	1	unknotted	twisted	undecorated	fragment	2	s	42	medium	—	54.4	—	2.40	absent	none	none	none	none	fine	none	cut	cut	
CRNV-11-7736W	Big Brother West	32.1	2	knotted	twisted	undecorated	fragment	2	s	18	medium	—	229.9		0.77	absent	none	none	none	none	fauna	unknown	knotted	torn	horse hair
CRNV-11-7736W	Big Brother West	113		unknotted	none	undecorated	fragment	1	z	—	—	—	142	1.27	—	absent	none	none	none	none	fauna	none	cut	cut	sinew
CRNV-11-7736W	Big Brother West	151	2	unknotted	twisted	undecorated	fragment	1	z	—	—	—	42.8	0.70	—	absent	none	none	none	none	fine	none	torn	torn	

APPENDIX H

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completedness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation on Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
CRNV-11-4893	Bonneville Estates Rockshelter	5138	A2		1	incomplete	rigid	parching tray	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	13.60	bundle	half rod	stacked	4.30	3.1	non-interlocking	not split	—	—	encircles	3.20	3	burned	inorganic residue	
CRNV-11-4893	Bonneville Estates Rockshelter	5137	A3		2	incomplete	rigid	parching tray	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.28	bundle	half rod	stacked	5.35	—	non-interlocking	not split	—	—	encircles	3.83	2	burned	inorganic residue	
CRNV-11-4893	Bonneville Estates Rockshelter	5198	3		2	incomplete	rigid	parching tray	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.90	no bundle	whole rod	stacked	3.43	3.42	interlocking	not split	—	—	encircles	2.83	5	stained	none	
CRNV-11-4893	Bonneville Estates Rockshelter	5304	6, 2 (3a)		2	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.98	bundle	half rod	stacked	3.80	2.7	non-interlocking	split on non-work surface	intentional	—	encircles	2.70	3	none	none	
CRNV-11-4893	Bonneville Estates Rockshelter	10518	6, 1 (3a)		2	incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	bundle	half rod	stacked	—	—	non-interlocking	not split	—	—	encircles	2.93	3	none	none	
CRNV-11-4893	Bonneville Estates Rockshelter	5615	6, 5 (3a)		2	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.60	bundle	half rod	stacked	3.85	2.6	non-interlocking	not split	—	—	encircles	3.70	2	none	stained	
CRNV-11-4893	Bonneville Estates Rockshelter	10682	6, 3 (3a)		2	incomplete	rigid	wide mouth bowl	right-to left	convex	undecorated	—	mended	Mended with 2-ply fine z-spin cordage	present	self	absent	—	close	2	1.90	bundle	half rod	stacked	3.30	—	non-interlocking	split on both faces	accidental	—	pierces	3.60	3	stained	inorganic residue	
CRNV-11-4893	Bonneville Estates Rockshelter	18791	3a		2	incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	present	normal, spiraling clockwise	close	2	1.70	no bundle	half rod	single	3.80	3.8	non-interlocking	not split	—	—	encircles	2.08	5	burned	none	
CRNV-11-4893	Bonneville Estates Rockshelter	18790	3a		2	incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	no bundle	3-rod	bunched	5.13	3.4	non-interlocking	split on non-work	intentional	—	—	2.30	3	none	none	
CRNV-11-4893	Bonneville Estates Rockshelter	718	8		2	incomplete	rigid	parching tray	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	bundle	half rod	stacked	3.15	3.15	non-interlocking	split on non-work	intentional	—	pierces	2.93	4	burned	stained	
CRNV-11-4893	Bonneville Estates Rockshelter	16920	5		3	incomplete	flexible	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	none	single	2.95	—	non-interlocking	not split	—	—	encircles	1.93	5	none	none	
CRNV-11-4893	Bonneville Estates Rockshelter	18061	9		3	incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	present	false braid	absent	—	close	2	—	no bundle	3-rod	bunched	2.65	2.65	non-interlocking	not split	—	—	pierces	2.65	4	none	none	
CRNV-11-4893	Bonneville Estates Rockshelter	5145	A0		3	incomplete	rigid	parching tray	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	2.83	bundle	half rod	stacked	4.28	2.8	non-interlocking	split on non-work face	intentional	—	encircles	2.10	4	burned	inorganic residue	
CRNV-11-4893	Bonneville Estates Rockshelter	12060	A7		3	incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.90	bundle	half rod	stacked	2.93	2.7	non-interlocking	not split	—	—	encircles	1.85	4	none	none	

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
CRNV-11-4893	Bonneville Estates Rockshelter	25567	5		3	incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	none	stacked	5.30	—	non-interlocking	not split	—	—	pierces	3.15	3	burned	organic residue	
CRNV-11-4893	Bonneville Estates Rockshelter	5142	A9/10		3	incomplete	rigid	parching tray	right-to left	concave	undecorated	—	mended	Mended with cordage	absent	—	absent	—	close	3	1.60	bundle	whole rod	stacked	4.83	4.82	non-interlocking	split on non-work face	intentional	—	encircles	2.93	4	burned	none	
CRNV-11-4893	Bonneville Estates Rockshelter	10039	A0		3	incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	present	normal, reinforced	close	3	0.43	bundle	none	stacked	3.73	—	non-interlocking	split on work face	intentional	—	encircles	2.30	4	none	none	"learner basket"
CRNV-11-4893	Bonneville Estates Rockshelter	972	—		3	incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.68	rod in bundle	half rod	stacked	2.90	—	non-interlocking	split on non-work face	intentional	—	encircles	3.05	3	stained	stained	
CRNV-11-4893	Bonneville Estates Rockshelter	8762	A3b		3	incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	—	1	bundle	half rod	stacked	3.15	3.3	non-interlocking	not split	—	—	encircles	2.78	4	stained	burned	
CRNV-11-4893	Bonneville Estates Rockshelter	2321	A0		3	incomplete	rigid	other / unknown	left-to-right	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.43	no bundle	half rod	stacked	4.05	—	interlocking	not split	—	—	encircles	2.78	4	charred	none	
CRNV-11-4893	Bonneville Estates Rockshelter	5144	A9/10		3	incomplete	rigid	parching tray	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	3.88	bundle	half rod	stacked	3.65	2.4	non-interlocking	split on non-work face	intentional	—	encircles	2.58	4	none	none	
CRNV-11-4893	Bonneville Estates Rockshelter	5143	A9/10		3	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1	bundle	half rod	stacked	3.90	1.5	non-interlocking	split on non-work face	intentional	—	encircles	2.23	5	inorganic residue	inorganic residue	
CRNV-11-4893	Bonneville Estates Rockshelter	718.2	8		3	incomplete	rigid	parching tray	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	bundle	half rod	stacked	3.95	3.1	non-interlocking	not split	—	—	pierces	2.28	4	burned	stained	
42BO268	Swallow Shelter	109.55	F10 in F74	9		incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.75	bundle	half rod	stacked	2.73	2.1	non-interlocking	not split	—	—	encircles	2.40	4	organic residue	organic residue	
42BO268	Swallow Shelter	177.11	F10 in F84	9		incomplete	rigid	wide mouth bowl	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.23	no bundle	3-rod	bunched	2.13	—	interlocking	split on both faces	intentional	—	pierces	2.18	4	none	stained, abraded	
42BO268	Swallow Shelter	13.21	F10 in F18	9		incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.10	bundle	rod missing	unknown	4.00	—	—	split on both faces	intentional	—	encircles	3.33	3	none	none	

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience: Strat	Provenience: Level	Provenience: Occupation	Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration: Presence	Decoration: Decoration Description	Mending: Presence	Mending: Description	Rim: Presence	Rim: Rim Type	Center: Presence	Center: Center Type	Foundation: Foundation Spacing	Foundation: Foundation Units per CM	Foundation: Distance Between Foundation Units Avg (mm)	Foundation: Foundation on Bundle	Foundation: Rod Type	Foundation: Foundation Configuration	Foundation: Foundation Unit Diameter Avg (mm)	Foundation: Rod Diameter (mm)	Stitch Type: Stitch Type	Stitch Type: Split: Presence	Stitch Type: Split: Intention	Stitch Type: Additional Stitch Type	Stitch Type: Stitch Engagement with Foundation	Stitch Type: Stitch Width Avg (mm)	Stitch Type: Stitches Per CM	Use-Wear: Work Surface	Use-Wear: Nonwork Surface	General Comments
42BO268	Swallow Shelter	36.9	F9 in F46			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.60	no bundle	3-rod	bunched	4.90	—	interlocking	split on both faces	intentional	—	pierces	3.35	3	burned	none	
42BO268	Swallow Shelter	75.1	F10 in F65	9		incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	no bundle	3-rod	bunched	4.75	—	—	split on both faces	intentional	—	encircles	3.03	3	none	stained	
42BO268	Swallow Shelter	183.1	F88 in f97			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.33	no bundle	3-rod	bunched	3.33	—	non-interlocking	split on non-work face	intentional	—	encircles	1.88	5	none	none	
42BO268	Swallow Shelter	124.5	F10 in F78	9		incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.00	bundle	half rod	stacked	4.98	1.9	non-interlocking	not split	—	—	encircles	2.03	4	abraded	none	
42BO268	Swallow Shelter	167.1	F10			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.20	no bundle	3-rod	bunched	3.40	—	—	split on work face	intentional	—	encircles	2.95	3	abraded	abraded	
42BO268	Swallow Shelter	267.7	F10 in F115	9		incomplete	rigid	wide mouth bowl	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.30	no bundle	3-rod	bunched	4.20	—	non-interlocking	not split	—	—	encircles	2.08	4	abraded	stained, abraded	
42BO268	Swallow Shelter	209.4	F72 in F103	5		incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	bundle	half rod	stacked	4.25	—	non-interlocking	not split	—	—	encircles	2.63	3	abraded	none	
42BO268	Swallow Shelter	AR60227	—			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close and open	3	0.60	no bundle	3-rod	bunched	3.03	—	interlocking	not split	—	—	encircles	2.43	3	burned	abraded	
42BO268	Swallow Shelter	217.24	F10 in F106	9		incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.43	maybe bundle	3-rod	bunched	3.68	—	interlocking	not split	—	—	encircles	2.43	4	abraded	none	
42BO268	Swallow Shelter	250.8	F10 in F106	9		incomplete	rigid	wide mouth bowl	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.20	no bundle	3-rod	bunched	4.30	—	interlocking	split on work face	intentional	—	encircles	2.60	3	abraded	abraded	
42BO268	Swallow Shelter	203.7	F10 in F103	9		incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	1	—	bundle	half rod	bunched	6.63	—	non-interlocking	not split	—	—	encircles	2.90	3	none	none	
42BO268	Swallow Shelter	79.6	F67 in F65			incomplete	semi-flexible	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	bundle	half rod	bunched	3.50	—	—	not split	—	—	encircles	1.85	4	abraded	none	
42BO268	Swallow Shelter	279.2-1	f114 in f115	7		incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	mended	Mended with fine s-spin cordage and stitches	absent	—	absent	—	close	2	0.73	bundle	half rod	stacked	—	—	interlocking and non-interlocking	split on both faces	accidental	—	encircles	2.63	4	stained	stained	

APPENDIX H continued

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42BO365	Remnant Cave	24.11	6			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.33	no bundle	3-rod	bunched	4.48	—	non-interlocking	split on non-work	—	—	pierces	3.43	3	burned	burned	
42BO365	Remnant Cave	40.76	4			incomplete	rigid	wide mouth bowl	right-to left	concave	undecorated	—	unmended	—	absent	—	present	normal, reinforced	close	3	0.93	no bundle	3-rod	bunched	3.63	—	non-interlocking	not split	—	—	pierces	2.55	4	stained, abraded	none	
42BO365	Remnant Cave	18.32	5?			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.80	bundle	half rod	stacked	3.68	2	interlocking	not split	—	—	encircles	2.63	3	stained	none	
42BO365	Remnant Cave	61.8	6			incomplete	rigid	other / unknown	both	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.60	no bundle	rod and welt	stacked	3.30	2.8	interlocking	not split	—	—	pierces	2.95	3	stained	stained	
42BO184	Tube Cave	2.42	—			incomplete	rigid	parching tray?	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.40	bundle	half rod	bunched	4.23	—	non-interlocking	not split	accidental	—	pierces	2.83	3	burned	none	
42TO20	Juke Box Cave	22181	F31	II		incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.13	bundle	half rod	stacked	4.25	2.7	non-interlocking	not split	—	—	encircles	3.50	3	burned	stained, abraded	
42TO20	Juke Box Cave	21981	F34	II (maybe)		incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.70	bundle	half rod	stacked	2.45	—	non-interlocking	split on work face	intentional	—	pierces	2.00	4	none	none	
42TO20	Juke Box Cave	22335	F37 T13			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.10	bundle	half rod	stacked	3.78	2.3	non-interlocking	split on both faces	intentional work, accidental non-work	—	pierces	2.55	4	stained	organic residue, abraded	
42TO20	Juke Box Cave	22102	F34	II (maybe)		incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	2.48	bundle	half rod	stacked	3.38	—	non-interlocking	split on work face	intentional	—	pierces	2.33	4	none	none	
42TO20	Juke Box Cave	22102	F34	II (maybe)		incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.73	bundle	half rod	stacked	3.75	—	non-interlocking	split on work face	intentional work, accidental non-work	—	pierces	2.43	4	none	none	
42TO20	Juke Box Cave	22000	F34	II		incomplete	rigid	other / unknown	left-to-right	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	1	—	no bundle	3-rod	bunched	4.70	—	interlocking	not split	—	—	pierces	2.40	3	stained	stained	
42TO20	Juke Box Cave	21899	F10	II		incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	4	1.15	no bundle	1-rod	single	2.95	—	interlocking	split on both faces	intentional non-work, accidental work	—	encircles	2.05	3	sheen	burned, stained	

APPENDIX H continued

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type	Split						Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Presence	Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42TO20	Juke Box Cave	22280	F43	II (maybe)		incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	present	normal, reinforced, unfinished	close	2	—	no bundle	3-rod	stacked	5.05	—	—	not split	—	—	encircles	2.98	0	none	burned on concave	
42TO32	Thermal Point	22756	F5	F29 R51-58 17.7-		incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	no bundle	3-rod welt	bunched	6.55	2	non-interlocking	split on work face	intentional	—	pierces	2.63	3	stained	stained	
42TO32	Thermal Point	22754	F5			incomplete	rigid	other / unknown	left-to-right	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.05	no bundle	1-rod	single	2.33	—	interlocking	split on work face	intentional	intricate	encircles	3.43	3	abraded	none	
42TO32	Thermal Point	22728	—			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.00	no bundle	half rod	single	1.80	1.8	interlocking	not split	—	intricate	encircles	2.48	4	stained	none	
42TO32	Thermal Point	22699	F4	clean up		incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	4	1.03	no bundle	1-rod	single	1.95	1.95	interlocking	not split	—	intricate	encircles	2.25	3	stained	none	
42TO32	Thermal Point	22735	F4	F21		incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	4	0.95	no bundle	unknown	single	2.60	2.6	interlocking	not split	—	intricate	encircles	2.05	3	organic residue	none	
42TO32	Thermal Point	AR59005				incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	5	1.03	no bundle	1-rod	single	1.53	1.52	interlocking	not split	—	intricate	encircles	2.25	3	organic residue	none	
42TO32	Thermal Point	22763	F4	F21		incomplete	rigid	other / unknown	left-to-right	convex	undecorated	—	unmended	—	present	self	absent	—	close	3	1.03	no bundle	half rod	single	1.98	1.9	interlocking	not split	—	intricate	encircles	2.93	4	abraded	none	
42TO32	Thermal Point	22726	F4	packrat midden		incomplete	rigid	other / unknown	left-to-right		undecorated	—	unmended	—	absent	—	absent	—	close and open	5	0.65	no bundle	whole rod	single	1.73	1.7	interlocking	not split	—	intricate	encircles	2.45	4	organic residue	organic residue, stained	
42JB8	Crab Cave	AS 78.27.7.2	—			incomplete	rigid	other / unknown	left-to-right	indeterminate	undecorated	—	unmended	—	present	false braid	absent	—	close and open	3	1.15	no bundle	whole rod	single	3.80	3.8	interlocking	not split	—	intricate	encircles	4.28	2	none	none	leather strap wrapped around rim 14 times
42BO36	Hogup Cave	245.112b 24302	8			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.03	no bundle	2-rod and welt	bunched	3.43	1.8	interlocking	not split	—	—	pierces	2.00	3	stained	organic residue	
42BO36	Hogup Cave	FS172.24 24302	8			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	no bundle	2-rod and welt	bunched	4.83	3.4	interlocking	split on work face	intentional	—	pierces	3.30	3	burned	none	
42BO36	Hogup Cave	FS239.4	8			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	half rod	stacked	4.08	2.2	interlocking	split on one face	accidental	—	pierces	2.18	3	burned	none	

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completedness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42BO36	Hogup Cave	FS245.112a 24302	8			incomplete	rigid	other / unknown	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.95	no bundle	2-rod and welt	bunched	4.73	2.7	non-interlocking	split on both faces	accidental	—	pierces	2.20	4	stained	organic residue, sheen	
42BO36	Hogup Cave	FS669.193 24309	8			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.65	no bundle	half rod	single	1.90	1.9	interlocking	not split	—	—	encircles	2.18	3	burned	none	
42BO36	Hogup Cave	FS233.214 24302	8			incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	half rod	bunched	2.93	2.9	interlocking	split on both faces	accidental	—	pierces	2.25	3	burned	none	FS233 lot dated by Martin et al 2017 4220-3980 cal BP
42BO36	Hogup Cave	FS245.112d 24302	8			incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.48	bundle	half rod	stacked	5.10	3.4	non-interlocking	not split	—	—	pierces	2.63	3	none	none	
42BO36	Hogup Cave	FS451.3 24309	8			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.03	bundle	half rod	bunched	4.60	3.1	non-interlocking	split on both faces	accidental	—	pierces	2.43	4	burned	burned, abraded	
42BO36	Hogup Cave	FS701.271 24309	8			incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	4	0.93	no bundle	half rod	single	2.30	2.3	interlocking	not split	—	—	encircles	2.23	3	burned	burned	
42BO36	Hogup Cave	FS241.126	8			incomplete	rigid	parching tray	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	2.15	bundle	half rod	stacked	3.13	1.8	non-interlocking	split on both faces	accidental	—	pierces	2.38	4	burned	none	
42BO36	Hogup Cave	FS13.176 24302	14			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.25	bundle	half rod	stacked	3.15	3.15	non-interlocking	split on work face	accidental	—	pierces	2.68	4	none	stained, abraded	
42BO36	Hogup Cave	124.94	12			incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	half rod	stacked	4.55	4.5	non-interlocking	split on both faces	accidental	—	pierces	2.10	4	burned	abraded	
42BO36	Hogup Cave	FS126.79 24302	9			incomplete	rigid	other / unknown	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.23	bundle	half rod	stacked	4.63	4.6	non-interlocking	split on work face	intentional	—	pierces	2.88	3	sheen	sheen	
42BO36	Hogup Cave	FS277.109	9			incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	half rod	stacked	4.53	4.5	interlocking	split on both faces	accidental	—	pierces	3.35	3	sheen	burned	
42BO36	Hogup Cave	FS116.24 24302	12			incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	present	self rim, wrapped	absent	—	close	—	—	bundle	half rod	stacked	4.18	4.1	non-interlocking	not split	—	—	pierces	2.88	3	abraded	sheen	
42BO36	Hogup Cave	FS48.619	12			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.33	bundle	half rod	stacked	4.23	4.2	non-interlocking	split on work face	accidental	—	pierces	1.83	4	stained, abraded	stained, abraded	

Basketry from All Bonneville Basin Assemblages for Chapter 4.

			Provenience								Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		
Site #	Site Name	Catalog #	Strat	Level	Occupation	Completeness	Flexibility	Form	Work Direction	Work Surface	Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	General Comments
42BO36	Hogup Cave	FS62.6	13			incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	4	0.78	no bundle	half rod	single	2.08	2.1	interlocking	split on work face	accidental	—	encircles	2.90	2	organic residue	stained	
42BO36	Hogup Cave	FS435.409a	9			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	no bundle	3-rod	bunched	6.93	6.9	non-interlocking	split on one face	accidental	—	pierces	2.73	4	stained	stained, abraded	
42BO36	Hogup Cave	435.409b	9			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	—	no bundle	3-rod	bunched	4.45	4.4	interlocking	split on work face	intentional	—	encircles	2.03	3	sheen	stained, abraded	
42BO36	Hogup Cave	FS71.163	13			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	no bundle	3-rod	bunched	5.23	5.2	non-interlocking	split on non-work	intentional	—	pierces	2.38	3	abraded	abraded	
42BO36	Hogup Cave	FS272.45	12			incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.43	bundle	half rod	stacked	—	2.5	non-interlocking	split on both faces	accidental	—	pierces	2.88	3	abraded	abraded	
42BO36	Hogup Cave	FS495.46 or 705.86	6 or 8			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	4	0.88	bundle	half rod	stacked	3.00	3	non-interlocking	split on non-work face	accidental	—	pierces	1.65	5	burned	organic residue	
42BO36	Hogup Cave	FS12681	9			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.18	bundle	half rod	stacked	3.48	3.4	non-interlocking	split on both faces	accidental	—	pierces	2.80	3	sheen	abraded	
42BO36	Hogup Cave	F24.10	12			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	half rod	stacked	5.03	5	non-interlocking	not split	—	—	pierces	2.35	3	abraded	abraded	
42BO36	Hogup Cave	FS420.2	8			incomplete	rigid	wide mouth bowl?	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.60	bundle	half rod	stacked	4.65	3.6	non-interlocking	split on both faces	accidental	—	pierces	2.38	4	sheen	organic residue, sheen	
42BO36	Hogup Cave	FS646.58	8			incomplete	rigid	parching tray	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.28	bundle	half rod	stacked	3.20	1.9	non-interlocking	not split	—	—	pierces	3.25	3	sheen	inorganic residue, burned	
42BO36	Hogup Cave	FS649.42	8			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	present	normal, reinforced	close	2	1.63	bundle	half rod	stacked	3.73	2.4	non-interlocking	split on both faces	accidental	—	pierces	3.28	3	stained	inorganic residue, burned	FS649 lot dated by Martin et al 2017 5260-4880 cal BP, from line 110L identified as problematic
42BO36	Hogup Cave	FS466.96	8			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.30	bundle	half rod	stacked	3.53	2.3	non-interlocking	not split	—	—	pierces	1.90	5	sheen	abraded	

APPENDIX H continued

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42BO36	Hogup Cave	FS245.112c	8			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.68	no bundle	3-rod	bunched	2.68	2	non-interlocking	split on non-work face	intentional	—	pierces	2.85	4	burned	stained, abraded	
42BO36	Hogup Cave	FS669.350	8			incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.75	no bundle	half rod	stacked	1.60	1.6	interlocking	not split	—	—	encircles	1.93	3	stained	organic residue	
42BO36	Hogup Cave	FS649.42	8			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	present	normal, unreinforced, spiral	close	2	0.70	bundle	half rod	stacked	4.43	3.3	non-interlocking	split on both faces	accidental	—	pierces	2.48	4	burned	none	FS649 lot dated by Martin et al 2017 5260-4880 cal BP, from line 110L identified as problematic
42BO36	Hogup Cave	FS646.58b	—			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	present	normal, unreinforced, spiraling clockwise	close	3	0.75	bundle	half rod	stacked	3.15	2.4	non-interlocking	not split	—	—	pierces	1.73	4	pitched	inorganic residue, burned	
42BO36	Hogup Cave	420.1	8			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	present	normal, reinforced	close	2	0.90	bundle	half rod	stacked	4.10	3.8	non-interlocking	split on work face	intentional	—	pierces	2.55	5	sheen, stained	stained, abraded	
42BO36	Hogup Cave	FS669.198	8			incomplete	rigid	constricted mouth bowl?	right-to left	concave	decorated	feather chevron	unmended	—	absent	—	absent	—	close	3	0.95	bundle	half rod	stacked	2.60	1.7	non-interlocking	split on non-work face	accidental	—	pierces	2.08	4	organic residue	stained, abraded	
42BO36	Hogup Cave	640.2	9			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	no bundle	3-rod	bunched	5.00	—	interlocking	not split	—	—	pierces	1.85	3	abraded	abraded	
42BO36	Hogup Cave	FS226.34	8			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.75	bundle	half rod	stacked	3.48	2.3	non-interlocking	split on both faces	intentional	—	pierces	1.98	4	burned	stained, abraded	
42BO36	Hogup Cave	233.22	8			incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	4	1.33	bundle	half rod	stacked	2.33	—	non-interlocking	not split	—	—	pierces	1.75	5	burned	burned, abraded	FS233 lot dated by Martin et al 2017 4220-3980 cal BP

APPENDIX H continued

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42BO36	Hogup Cave	47.54	12			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	present	normal, unreinforced, wrapped	close	3	1.75	bundle	half rod	stacked	3.63	1.5	non-interlocking	not split	—	—	pierces	2.40	4	burned	none	
42BO36	Hogup Cave	131.75	9			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.25	no bundle	2-rod welt	bunched	3.18	1.9	interlocking	not split	—	—	pierces	2.10	3	burned	abraded	
42BO36	Hogup Cave	60.1	—			incomplete	rigid	wide mouth bowl	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.00	bundle	half rod	stacked	3.43	2.2	non-interlocking	split on non-work face	intentional	—	pierces	2.93	3	sheen	stained, abraded	
42BO36	Hogup Cave	688.36	—			incomplete	rigid	other / unknown		indeterminate	undecorated	—	unmended	—	present	self	absent	—	unknown	—	—	no bundle	half rod	unknown	4.25	2.6		not split	—	—	—	3.78	0	none	none	
42BO36	Hogup Cave	116.27	—			incomplete	rigid	parching tray	right-to-left	convex	undecorated	—	unmended	—	absent	—	present	normal, unreinforced	close	2	1.53	bundle	half rod	stacked	4.03	1.6	non-interlocking	split on non-work face	intentional	—	pierces	2.73	3	abraded	abraded	
42BO36	Hogup Cave	104.47	13			incomplete	rigid	parching tray?	right-to-left	convex	undecorated	—	unmended	—	absent	—	present	normal, unreinforced, wrapped	close	3	1.38	bundle	half rod	stacked	4.00	2.5	non-interlocking	split on both faces	accidental	—	pierces	2.25	5	sheen, burned	stained, abraded	
42BO36	Hogup Cave	413.2	12			incomplete	rigid	other / unknown	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.03	no bundle	3-rod	bunched	2.85	—	non-interlocking	split on non-work face	intentional	—	pierces	2.13	3	inorganic residue	none	
42BO36	Hogup Cave	413.14	12			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	4	—	no bundle	3-rod	bunched	5.25	—	non-interlocking	split on non-work face	intentional	—	pierces	2.08	4	burned	burned, abraded	
42BO36	Hogup Cave	413.13	12			incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	bundle	half rod	stacked	3.28	2.2	non-interlocking	not split	—	—	pierces	2.35	3	burned	burned	
42BO36	Hogup Cave	47.1	12			incomplete	rigid	tray	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.98	no bundle	3-rod	bunched	5.05	—	non-interlocking	split on work face	intentional	—	pierces	2.30	4	none	stained, abraded	
42BO36	Hogup Cave	47.134a	12			incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.03	bundle	2-rod	unknown	—	—	non-interlocking	split on work face	intentional	—	pierces	2.50	3	none	burned	
42BO36	Hogup Cave	47.134	12			incomplete	rigid	other / unknown	left-to-right	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	no bundle	3-rod	bunched	5.73	—	non-interlocking	not split	—	—	pierces	2.88	3	burned	none	
42BO36	Hogup Cave	435.41	9			incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.25	no bundle	3-rod welt	bunched	4.63	—	interlocking	split on work face	intentional	—	pierces	2.35	3	abraded	stained, abraded	

APPENDIX H continued

Basketry from All Bonneville Basin Assemblages for Chapter 4.

			Provenience								Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		
Site #	Site Name	Catalog #	Strat	Level	Occupation	Completedness	Flexibility	Form	Work Direction	Work Surface	Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	General Comments
42BO36	Hogup Cave		9			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	present	self	absent	—	close	2	1.10	bundle	half rod	stacked	5.65	3.6	non-interlocking	split on work face	accidental	—	pierces	3.40	3	none	none	
42BO36	Hogup Cave	416.21	9			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.50	bundle	half rod	stacked	5.38	3	non-interlocking	split on non-work face	accidental	—	pierces	2.48	3	stained	abraded	
42BO36	Hogup Cave	705.86	9			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.45	bundle	half rod	stacked	5.03	3.2	non-interlocking	split on work face	accidental	—	pierces	2.75	4	abraded	abraded	
42BO36	Hogup Cave	554.94	9			incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.55	bundle	half rod	bunched	5.48	2.7	non-interlocking	not split	—	—	pierces	2.90	3	abraded	sheen	
42BO36	Hogup Cave	639.73	9			incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.78	no bundle	3-rod	bunched	3.95	—	non-interlocking	split on non-work face	intentional	—	pierces	2.48	4	sheen	organic residue, abraded	
42BO36	Hogup Cave	416.22	9			incomplete	rigid	parching tray	right-to left	concave	undecorated	—	mended	Repaired with stitches	absent	—	absent	—	close	2	1.08	bundle	half rod	stacked	5.13	—	non-interlocking	split on both faces	accidental	—	pierces	2.73	4	stained	stained, abraded	
42BO36	Hogup Cave	121.53	11			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.40	bundle	half rod	stacked	4.75	2.2	non-interlocking	not split	—	—	pierces	2.90	3	stained, charred	none	
42BO36	Hogup Cave	435.41	9			incomplete	rigid	other / unknown	left-to-right	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.15	no bundle	3-rod	bunched	4.93	—	interlocking	split on one face	intentional	—	pierces	2.18	3	sheen	abraded	
42BO36	Hogup Cave	269.6	10			incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	no bundle	unknown	unknown	—	3.3	non-interlocking	not split	—	—	encircles	3.13	3	burned	inorganic residue, burned	
42TO13	Danger Cave	22996	—		V	incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.08	no bundle	2-rod welt	stacked	4.35	—	non-interlocking	split on non-work face	intentional	—	pierces	2.15	4	inorganic residue	organic residue	
42TO13	Danger Cave	22996	—		V	incomplete	rigid	constricted mouth bowl?		convex	undecorated	—	unmended	—	present	self	absent	—	close	3	0.90	bundle	half rod	stacked	3.83	2.1	non-interlocking	split on non-work face	intentional	—	encircles	2.53	4	sheen	sheen	
42TO13	Danger Cave	22988	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.98	bundle	half rod	stacked	3.63	2.3	non-interlocking	split on work face	intentional	—	pierces	2.83	3	none	burned	
42TO13	Danger Cave	AR59044	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	4.13	no bundle	2-rod welt	stacked	4.38	—	non-interlocking	split on work face	intentional	—	encircles	2.53	3	burned	burned	
42TO13	Danger Cave	AR59043	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.03	no bundle	half rod	single	3.10	—	non-interlocking	split on work face	intentional	—	pierces	2.63	3	abraded	abraded	

APPENDIX H continued

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42TO13	Danger Cave	23011	—		V	incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.40	no bundle	half rod welt	stacked	4.05	2.3	non-interlocking	split on work face	intentional	—	encircles	2.90	3	sheen	organic residue	
42TO13	Danger Cave	22811	—		V	incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.00	no bundle	2-rod	horizontal	2.08	—	interlocking	not split	—	—	pierces	2.33	3	sheen	sheen, burned	
42TO13	Danger Cave	22995	—		V	incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.80	no bundle	half rod and welt	stacked	3.00	3	non-interlocking	split on both faces	accidental	—	pierces	2.35	3	organic residue	sheen, pitched	
42TO13	Danger Cave	22995	—		V	incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.98	no bundle	3-rod	bunched	4.80	—	non-interlocking	split on both faces	intentional	—	pierces	2.30	4	none	none	
42TO13	Danger Cave	23285	—		V	incomplete	rigid	other / unknown	right-to left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.40	bundle	half rod	stacked	4.03	—	non-interlocking	split on non-work face	accidental	—	pierces	2.85	4	sheen, burned	burned	
42TO13	Danger Cave	23355	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.48	no bundle	2-rod and welt	stacked	3.25	—	non-interlocking	split on both faces	accidental	—	pierces	2.80	3	burned	inorganic residue, burned	
42TO13	Danger Cave	23334	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.18	no bundle	half rod and welt	stacked	3.05	1.5	non-interlocking	split on work face	intentional	—	pierces	2.88	3	burned	sheen, stained	
42TO13	Danger Cave	22943	—		V	incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	3.08	bundle	1-rod bundle	stacked	5.55	—		split on one face	—	—	pierces	3.65	2	none	none	
42TO13	Danger Cave	22949	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	0.83	no bundle	half rod welt	unknown	4.33	1.8	interlocking	split on both faces	accidental	—	pierces	2.25	3	burned	pitched, burned	
42TO13	Danger Cave	23108	—		V	incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.35	no bundle	whole rod	single	3.03	—	interlocking	not split	—	—	encircles	2.85	2	sheen	organic residue, pitched	
42TO13	Danger Cave	22545	—		V	incomplete	rigid	other / unknown	right-to left	indeterminate	undecorated	—	mended	Mended with fine s-spin cordage	absent	—	absent	—	close	2	1.05	no bundle	1-rod and welt	stacked	4.83	—	non-interlocking	not split	—	—	pierces	2.95	3	burned	none	
42TO13	Danger Cave	AR59037	—		V	incomplete	rigid	wide mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.23	bundle	half rod	stacked	3.75	2.6	non-interlocking	not split	—	—	pierces	2.63	4	stained, abraded	inorganic residue, burned	
42TO13	Danger Cave	AR974	—		V	incomplete	rigid	parching tray?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.75	no bundle	1-rod and welt	stacked	3.58	2.3	non-interlocking	split on both faces	accidental	—	pierces	2.28	4	sheen	sheen, pitched	
42TO13	Danger Cave	22802	—		V	incomplete	rigid	constricted mouth bowl?	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.05	no bundle	1-rod	single	2.55	—	non-interlocking	not split	—	—	pierces	2.53	3	burned, sheen	sheen	

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completeness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg (mm)	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split: Presence	Split: Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42TO13	Danger Cave	AR59048	—		V	incomplete	rigid	other/unknown	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.38	welt	2-rod welt	stacked	4.35	—	non-interlocking	split on non-work face	accidental	—	pierces	3.13	3	sheen, burned	sheen	
42TO13	Danger Cave	22545	—		V	incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.50	no bundle	1-rod	single	4.48	—	non-interlocking	split on both faces	intentional	—	pierces	3.23	3	none	inorganic residue, burned	
42TO13	Danger Cave	23334	—		V	incomplete	rigid	other / unknown	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.45	no bundle	1-rod and welt	stacked	4.00	—	non-interlocking	split on work face	intentional	—	pierces	2.93	3	sheen	inorganic residue, burned	
42TO13	Danger Cave	22943.1F73	—		V	incomplete	rigid	other / unknown	left-to-right	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.10	no bundle	3-rod	bunched	3.48	—	non-interlocking	not split	—	—	pierces	2.35	4	organic residue	inorganic residue	
42TO13	Danger Cave	23333	—		V	incomplete	rigid	other / unknown	left-to-right	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	2.10	bundle	half rod	stacked	3.95	1.9	non-interlocking	split on work face	accidental	—	pierces	2.68	3	stained, abraded	inorganic residue, burned	
42TO13	Danger Cave	22813	—		V	incomplete	rigid	other / unknown	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.85	no bundle	3-rod	bunched	4.38	—	non-interlocking	split on work face	intentional	—	pierces	2.48	3	organic residue	none	
42TO13	Danger Cave	23334	—		V	incomplete	rigid	other / unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.63	no bundle	1- rod welt	stacked	3.98	2.7	interlocking	split on non-work face	accidental	—	pierces	3.08	3	sheen, pitched	sheen, pitched	
42TO13	Danger Cave	23257	—		V	incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	2	0.93	bundle	half rod	stacked	2.78	2.1	interlocking	not split	—	—	pierces	2.23	4	stained	none	
42TO13	Danger Cave	23271	—		V	incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	no bundle	1-rod and welt	stacked	3.05	1.4	non-interlocking	not split	—	—	pierces	2.15	3	burned	sheen, burned	
42TO13	Danger Cave	22997	—		V	incomplete	rigid	constricted mouth bowl?	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.38	no bundle	1-rod and welt	stacked	4.85	2.2	non-interlocking	split on non-work face	intentional	—	pierces	2.35	3	stained, abraded	organic residue, stained	
42TO13	Danger Cave	23334	—		V	incomplete	rigid	other / unknown	right-to-left	indeterminate	undecorated	—	unmended	—	absent	—	absent	—	close	—	—	no bundle	one rod	stacked	3.13	—	non-interlocking	not split	—	—	pierces	2.10	5	none	none	
42TO13	Danger Cave	AR59050	—		V	incomplete	rigid	other / unknown	right-to-left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.28	no bundle	1-rod and welt	stacked	3.43	1.3	interlocking	split on work face	intentional	—	pierces	2.45	4	burned	burned	
42TO13	Danger Cave	22912	—		V	incomplete	rigid	other/unknown	right-to-left	concave	undecorated	—	unmended	—	absent	—	absent	—	close	2	1.18	bundle	half rod	stacked	4.08	1.8	non-interlocking	split on work face	accidental	—	pierces	3.20	3	organic residue	none	
42TO13	Danger Cave	22980.1, 53.27	—		V	incomplete	rigid	parching tray	right-to-left	concave	undecorated	—	unmended	—	absent	—	present	normal, reinforced	close	2	1.13	no bundle	1-rod and welt	stacked	4.23	2.1	non-interlocking	split on work face	accidental	—	pierces	2.33	4	none	stained, abraded	

APPENDIX H continued

Basketry from All Bonneville Basin Assemblages for Chapter 4.

Site #	Site Name	Catalog #	Provenience			Completedness	Flexibility	Form	Work Direction	Work Surface	Decoration		Mending		Rim		Center		Foundation								Stitch Type							Use-Wear		General Comments
			Strat	Level	Occupation						Presence	Decoration Description	Presence	Description	Presence	Rim Type	Presence	Center Type	Foundation Spacing	Foundation Units per CM	Distance Between Foundation Units Avg	Foundation Bundle	Rod Type	Foundation Configuration	Foundation Unit Diameter Avg (mm)	Rod Diameter (mm)	Stitch Type	Split Presence	Split Intention	Additional Stitch Type	Stitch Engagement with Foundation	Stitch Width Avg (mm)	Stitches Per CM	Work Surface	Nonwork Surface	
42TO13	Danger Cave	23358	—		V	incomplete	rigid	other/unknown	right-to left	concave	undecorated	—	unmended	—	present	self	present	normal, reinforced	close	2	1.25	no bundle	3-rod	bunched	4.33	—	non-interlocking	split on both faces	intentional non-work, accidental work	—	pierces	3.05	3	none	none	
42TO13	Danger Cave	22985	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	unmended	—	absent	—	absent	—	close	3	1.28	no bundle	1-rod and welt	stacked	4.68	1.8	non-interlocking	split on work face	intentional	—	pierces	2.53	4	burned	sheen, stained	
42TO13	Danger Cave	19657	—		V	incomplete	rigid	other / unknown	right-to left	convex	undecorated	—	mended	Mended large hole with stitches	absent	—	absent	—	close	3	1.23	no bundle	one rod	single	3.13	—	interlocking	split on both faces	accidental	—	encircles	2.80	2	none	organic residue	