THESIS

THE PREHISTORIC UTILIZATION OF MOLLUSC SHELL IN THE ARKANSAS AND SOUTH PLATTE RIVER BASINS OF EASTERN COLORADO

Submitted By

Emily Calhoun

Department of Anthropology

In partial fulfillment of the requirements

For the Degree of Master of Arts

Colorado State University

Fort Collins, Colorado

Spring 2011

Masters Committee:

Advisor: Jason M. LaBelle

Lawrence C. Todd
Ellen E. Wohl

ABSTRACT

THE PREHISTORIC UTILIZATION OF MOLLUSC SHELL IN THE ARKANSAS AND SOUTH PLATTE RIVER BASINS OF EASTERN COLORADO

This comprehensive examination of prehistoric mollusc artifacts from the Arkansas and South Platte River basins of Eastern Colorado explores how material cultural is inherently linked to environmental conditions and cultural influences. These connections are explored via an in-depth investigation of form, function, and use through time of mollusc artifacts, the results of which are used to formulate the basis of two subsequent environmental and cultural investigations. The first uses the biological parameters required to support freshwater mollusc populations, based on the freshwater artifacts within the study assemblage, to argue that environmental conditions in the Eastern Colorado study area were most favorable for molluscs during the Late Holocene. The second examines the origins and mechanisms by which marine artifacts from the study assemblage entered the Arkansas and South Platte Basins and concludes that artifacts were primarily acquired via trade and exchange with peoples of the Southwest. This examination also argues that increasing cultural connectivity and interaction culminating during the Late Prehistoric would have allowed for various exotic marine artifacts to enter Eastern Colorado. The overarching conclusion of this study is that mollusc artifacts are used as items of personal adornment and are predominantly recovered from archaeological sites dating to the Late Prehistoric in Eastern Colorado. Additionally, this temporal affiliation is directly dependent on a variety of environmental

and cultural influences. The results and arguments formulated within this study provide a baseline for future in-depth examinations of mollusc artifacts in Eastern Colorado.

ACKNOWLEDGMENTS

I would like to express profound appreciation and gratitude to all those who made my graduate career meaningful and my thesis research possible. First and foremost, I would like to thank my advisor Jason LaBelle. It was mere weeks into my first semester when Jason handed me two *Central Plains Archaeology* volumes focused on the molluscs of the Central Plains. These volumes and various discussions with Jason on the subject were the inspiration for this thesis. Jason's door was always open for consultation regarding my research and for larger discussions of archaeology and life. He was always there to listen, but never pushed my research. He allowed me to triumph in my successes and learn from my mistakes, for which I am most grateful. Larry Todd and Ellen Wohl, who graciously served as my committee members, both challenged me to examine cultural inquiries in light of their environmental and geologic contexts. They both pushed me to think beyond my comfort zone and I hope the results of this reflection are evident in this thesis.

I would also like to acknowledge the support and guidance from my friends and colleagues including Becky Latanich, Heather Horobik, Krystal Langholz, Rachel Brown, Jennifer Richbourg, Maggie Scott, Dana Coleman, Sarah Knizewski, Lance Rom, Lisa Kelley, Kelly Brennan, Kerri Barile, and Michael Carmody. But most notably Jillian Flesh and Brett Dorrance with whom I spent many South Dakota days pondering plains archaeology from the seemingly endless prairie grasslands.

My thesis was rooted in the study of archaeological collections, archival records, and zoological collections at several institutions across Eastern Colorado. Without the outstanding staff at these repositories my research would not have been possible. I would like to thank Mary Sullivan at the Colorado Office of Historic Preservation (Denver); Bridget Ambler at the Colorado State Historical Society (Denver); Jason LaBelle at Colorado State University's Laboratory of Public Archaeology (Fort Collins); Isabel Tovar with the Denver Museum of Nature and Science (Denver); Mark Owens, Tom Baurley, and Terry Moody at the Fort Carson Cultural Resources Program (Colorado Springs); Linda Moore with the Fort Collins Museum (Fort Collins); Loretta Martin at the Louden-Henritze Archaeology Museum (Trinidad); Stephen Lekson and Mariko Kageyama with the University of Colorado Museum of Natural History (Boulder); and Brooke Rohde with the University of Denver Museum of Anthropology (Denver). Additionally, my thesis research was generously supported by the Colorado Archaeological Society's Alice Hamilton Scholarship Fund.

Most importantly I want to thank my husband Dustin Calhoun and my family, in particular my parents, for their unwavering support during my graduate career. Dustin has been a constant during this process and has been my biggest cheerleader, always encouraging me to follow my dreams regardless of the sacrifices. For that reason I would like to dedicate this work to him and to our future. My parents, Fred and Pam Bank, have provided endless emotional and financial support, for which I am eternally grateful.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

"Mussels hold the key to a true understanding of Plains prehistory."

Kerry Lippincott (1995)

Material remains can provide key insights into various facets of prehistoric life. Prehistoric material culture is often studied within a site-specific context, but overarching examinations of artifact classes across large geographic areas can offer meaningful insights into greater understandings of prehistoric life. Such fruitful studies of material cultural have been completed for a range of artifact classes in a variety of geographic regions, but prolific studies of this nature are absent within Colorado. Many, if not all, of these studies are rooted in the American Southwest Colorado (e.g., Haury 1936; Jernigan 1978).

The research presented within this thesis aims to fill a knowledge gap in the understanding of prehistoric material culture in Colorado, in particular in the Arkansas and South Platte River Basins of Eastern Colorado. The study area was defined by physical geographic boundaries, prehistoric patterns, established cultural chronologies, and convenience. Mollusc artifacts will be examined from across this geographic region in an effort to understand how a subset of the material record from Eastern Colorado can provide insight into the environmental and cultural factors that influenced prehistoric peoples. Studies from adjacent regions, namely the Southwest, Central Plains, and Great Basin, have shown the research potential of mollusc studies (Bennyhoff and Hughes 1987; Blakeslee 1997 and 2000; Carlson 1997; Claassen 1986; Dorsey 2000; Haury 1976; Jernigan 1978; Kozuch 2002; Nelson 1991; Warren 2000). The results of these

studies coupled with the lack of previous examinations in Eastern Colorado were the basis for the study and subsequent analysis present in this thesis.

Mollusc artifacts can be used to infer a variety of prehistoric behaviors including use/function of shell artifacts, foraging behaviors, environmental conditions, and trade and exchange networks. Blakeslee (2000) compares studies of freshwater mussel shells to bison kills, arguing that a wealth of information pertaining to seasonality, population structure, utilization strategies, and subsistence patterns can be gleaned from freshwater mussel assemblages. The form and archaeological context of mollusc artifacts can provide clues to the prehistoric use of shell. Gladwin et al. (1937), Haury (1976), Nelson (1991), and Bennyhoff and Hughes (1987) all present classification schemes of molluscs artifacts that range from subsistence to items of personal adornment. Yet the overwhelming majority of artifacts studied using these classification methods are jewelry items.

Molluscs can be a vital to prehistoric subsistence and metric studies of mollusc assemblages can lead to a better understanding of prehistoric diet. By examining growth layers within shells, the season of procurement and age of death at collection can be discerned (Claassen 1986; Dorsey 2000; Meyers and Perkins 2000; Warren 2000). These determinations can then be used to understand frequencies of foraging activities and the role of molluscs in prehistoric diets. These methods have even been used to show cyclical patterns in freshwater mussel collection associated with feasting activities (Warren 2000) and to demonstrate that molluscs were a vital component of prehistoric diets (Meyers and Perkins 2000).

Growing interest in understanding the ecological framework of archaeological sites has spawned a variety of paleoenvironmental reconstruction methods using mollusc artifacts and ecofacts. It has been shown that molluscs are sensitive to a variety of environmental parameters and record a wide range of environmental conditions within their shells. Haury (1936) was one of the first to use knowledge of mollusc biology to infer hydrologic patterns of Hohokam drainage canals. Since this early application in North American archaeology, the potential for molluscs to yield information on paleoenvironmental conditions and past river system structure has been recognized and utilized by archaeologists to aid in both cultural and environmental interpretations. Reconstructions are accomplished using chemical signatures recorded in mollusc shells, including isotopic studies (Balakrishnan et al. 2004; Balakrishnan et al. 2005; Goodfriend and Magaritz 1987) and trace element analyses (Peacock and Seltzer 2008).

The ecological characteristics of species habitats combined with metric measurements of shells can be used to gain a general understanding of mussel habitat/ river characteristics. Theler (1991) used freshwater mussel assemblages from a variety of archaeological sites to discern environmental conditions along the Crawfish River in Wisconsin. He ultimately concluded based on these assemblages that river characteristic have changed dramatically throughout prehistory and that these changes shaped prehistoric subsistence and exploitation of mollusc populations. Various other studies have been completed using freshwater mollusc assemblages from archaeological sites to infer river and environmental characteristics (Peacock and Seltzer 2008; Warren 1991 and 2000).

Gastropods have long been recognized as important indicators of paleoenvironmental conditions. Jaehnig (1971) demonstrated that sampling naturally occurring gastropods at archaeological sites can provide insights into micro-environmental site conditions, which in turn can be used to further understand prehistoric behaviors. Bobrowsky (1984) and others (Allen and Cheatum 1961; Baerreis 1980; Matteson 1959; Palacios-Fest 2010) have further argued that studies of gastropods can further our understandings of paleoenvironmental conditions, in particular micro or site specific environments.

The presence of marine mollusc artifacts at archaeological sites, especially at inland locations, provides another avenue to study prehistoric behavior, namely the role of trade and exchange networks. Routes and mechanisms of trade have been widely studied using exotic materials such as marine shell and long distance trade has been traced via marine shell speciation (Bennyhoff and Hughes 1987; Blakeslee 1997; Carlson 1997; Haury 1976; Hoard and Chaney 2010; Jernigan 1978; Kozuch 2002; Nelson 1991; Tower 1945). These studies highlight marine shell as an important commodity moving among prehistoric populations. They have also highlighted the presence of marine shell processing and distribution centers on both the Atlantic and Pacific coasts of North America.

As evident by the summaries presented above, studies of molluscs in an archaeological context take on a number of forms, but require a rudimentary understanding of form/function. This most basic knowledge is lacking in Eastern Colorado. There is no baseline synthesis of the type and form of molluscs seen in an archaeological context. Until this precedent is established in depth studies cannot take

place. The comprehensive study presented within this thesis aims to fill this void so that future endeavors can fully realize the research potential of mollusc assemblages in the region.

The methods one uses to study molluscs in an archaeological context are linked to the research questions at hand, yet all of the methods outlined above inherently examine links between environmental and cultural phenomena. The study of molluscs presented in this thesis embraces this connection in an effort to explain the prehistoric use of mollusc in Eastern Colorado in terms of both changing environmental and cultural landscapes. It also recognizes that the link between culture and the environmental is central to a comprehensive understanding of prehistory. I argue that examinations of material culture cannot be examined in a vacuum.

The impetus for this thesis was first and foremost to highlight the research potential of archaeological mollusc collections. This study is the first synthesis of mollusc artifacts in Eastern Colorado and thus it will serve as a regional baseline for future and more in depth examinations. The analysis presented in this thesis barely scrapes the surface of the overall research potential of the Eastern Colorado study assemblage. Yet it is not intended to be the final verdict on the prehistoric use on molluscs in the area, rather I hope it will inspire further discussions.

The goal of this thesis is to highlight patterns in the prehistoric use of molluscs in Eastern Colorado and to examine how environmental and cultural factors influence observed trends in use. Given the scope of the study, a large scale approach is used in an attempt to illuminate generalized patterns in the prehistoric use of molluscs in the study area. Despite this scale, it is important to note that future examinations in this region will

need to refine the conclusions of this thesis through small scale (possibly site specific) inquiries.

In an effort to close the mollusc shell research gap, the chapters of this thesis will address the following:

1. **Research definitions and study methodology (Chapter 2).** The discussions presented in this chapter outline the research strategy and methodology of this study. These discussions will include definitions of research interests, the project area, research methodology, descriptions of native molluscs within the study area, a discussion of marine shell found within the study area, summaries of species classification and artifact classification methods. The discussions presented in this chapter frame the analysis and discussions presented throughout the remainder of the thesis.
2. **The analysis of use classifications and trends in mollusc use through time (Chapter 3).** Figures showing various artifact classes will be presented in an effort to form a standardized artifact classification method for future characterization of mollusc shell artifacts within the study area. Distributions of artifact classes and comparisons of artifacts within the entire study area and in each drainage basin will be discussed in order to determine the primary prehistoric use of mollusc shell. Following an examination of mollusc artifact form, a study of use through time will be presented for both the entire Eastern Colorado study area and then within each respective river basin. Conclusions will be made about how mollusc artifacts were used through time and possible explanations for this change will be explored.

3. **Freshwater artifacts and their implications for fluvial reconstruction and cultural comparison studies (Chapter 4).** Environmental parameters needed to sustain freshwater mussel growth will be discussed in order to understand baseline environmental characteristics needed to support mollusc populations. These environmental parameters will then be examined in terms of the Arkansas and South Platte River Basins, in an effort to explore if these river systems were capable of supporting local mussel populations throughout prehistory. Changes in prehistoric climatic conditions and their impacts on freshwater mollusc populations will be examined to hypothesize how changes in human use of molluscs may be correlated to changing environmental conditions. Comparisons will be made between the Eastern Colorado study area and adjacent geographic regions to further explore how environmental factors can influence resource availability.
4. **Mollusc shell and its implications for understanding prehistoric trade and exchange networks (Chapter 5).** This chapter will include a discussion of the marine mollusc shell found in the study area, including a speciation study and site descriptions. A general discussion of the proposed and possible mechanisms for the movement of marine mollusc artifacts into the Eastern Colorado region will be presented. This will include general summaries of the use and movement of marine shell into regions geographically adjacent to the study area, including the American Southwest, the Great Basin, and Central Plains areas. Hypotheses will be presented as to the likely routes by which marine mollusc shells entered the study area based on temporal similarities, the speciation study, artifact forms, and

stylistic comparisons with adjacent geographic areas. A brief examination of possible freshwater mussel trade and exchange mechanisms will be addressed. Finally, hypotheses will be presented as to the role of trade and exchange in Eastern Colorado, as manifested through presence of marine shell found archaeologically.

5. **Thesis Conclusions (Chapter 6).** The research, discussions, and conclusions presented in the previous chapters will be synthesized in this final chapter and the overarching results of this analysis will discussed. Final conclusions of the observed trends in prehistoric mollusc utilization will be summarized with discussions focusing how these results provide insights into environmental conditions and cultural interactions. Lastly, future research avenues will be proposed to refine the methods and conclusions presented within this analysis.

CHAPTER 2: RESEARCH AND METHODS

Molluscs are vital to our understanding of prehistory in the Arkansas and Platte River basins of Eastern Colorado because their archaeological context can provide insight into cultural traditions, paleoenvironmental conditions, and prehistoric economies. Thus the study of molluscs, both extant and in archaeological collections can facilitate a more complete understanding of the prehistory of Eastern Colorado. The discussions presented within this chapter outline the research strategy and methods of this study. These discussions will include definitions of research interests, the project area, research methodology, descriptions of native molluscs within the study area, a discussion of marine shell found within the study area, summaries of species classification and artifact classification methods. The concepts and definitions in this chapter will frame the analysis and discussions presented throughout the rest of my thesis.

Research Strategy

As discussed above, molluscs can be used to answer a variety of biological and archaeological research questions. Within the framework of this study, mollusc shell found in an archaeological context in Eastern Colorado will be used to answer questions pertaining to use and function through time, the ecological framework of shell harvested, and prehistoric trade and exchange associations. Analysis in this study focuses on two river basin systems in Colorado; the Arkansas and South Platte.

Definition of the Study Area

The study area boundaries were defined by hydrologic and archaeological criteria as outlined by Gilmore et al. (1999) and Zier and Kalasz (1999) and are shown in Figure 1. The Platte River Basin consists of the northeastern portion of Colorado drained by the South Platte River. As such, the northern and eastern boundaries are formed by arbitrary political boundaries with Wyoming, Nebraska, and Kansas. Both the western and southern boundaries are formed by drainage divides; the Continental Divide to the west and the Palmer divide to the south. The drainage encompasses approximately 62,937 square kilometer (24,300 square miles) and is characterized by the Southern Rocky Mountains and Great Plains physiographic regions (USGS 2002). Also important in the geography of the region is the foothills transition zone that marks the separation of the Southern Rockies to the west and the Great Plains to the east. The basin encompasses all of Adams, Arapahoe, Boulder, Clear Creek, Denver, Douglas, Gilpin, Jackson, Jefferson, Larimer, Logan, Morgan, Phillips, Sedgwick, Washington, Weld, and Yuma Counties and portions of Cheyenne, Elbert, El Paso, Kit Carson, Lincoln, Park and Teller Counties.

The Arkansas River Basin consists of the southeastern portion of Colorado and encompasses an area of approximately 73,037 square kilometers (28,200 square miles) (Zier and Kalasz 1999). The eastern and southern boundaries are political state boundaries formed by New Mexico, Oklahoma, and Kansas. The Continental Divide to the west and the Palmer divide to the north constitute the remaining boundaries. The region is characterized by two distinct physiographic provinces; the Southern Rocky Mountains in the western portion of the basin, the Great Plains to the east, and the Raton Volcanic section to the south. The basin encompasses all of Baca, Bent, Chaffee, Crowley, Custer, Fremont, Huerfano, Kiowa, Lake, Las Animas, Otero, Prowers, and

Pueblo Counties and portions of Cheyenne, Costilla, Douglas, Elbert, El Paso, Kit Carson, Lincoln, Park, Saguache, and Teller Counties.

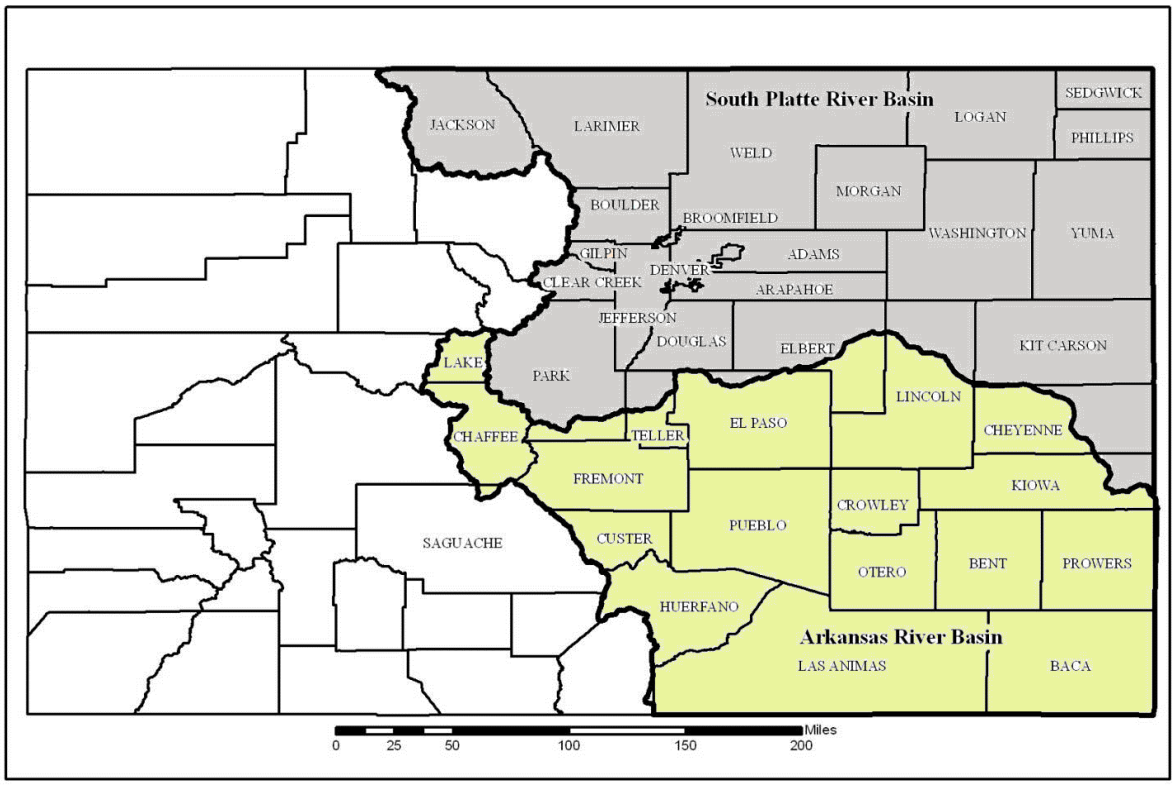

Figure 1: Map Depicting River Basin Boundary Delineations within Colorado. The Platte and Arkansas Basins define the limits of this study.

A variety of cultural chronologies have been proposed for the Arkansas and South Platte River Basins (Breternitz 1969; Butler 1989; Eddy and Windmiller 1977; Gilmore et al. 1999; Haug 1968; Mulloy 1958; Renaud 1950; Wood 1967; Zier and Kalasz 1999). The schemes from Zier and Kalasz (1999) for the Arkansas Basin and from Gilmore et al. (1999) for the South Platte Basin were used for the purposes of this study and are shown in Table 1 and Table 2 below.

Table 1: Arkansas River Basin Cultural Chronology, from Zier and Kalasz (1999).

Stage	Period	Date Range
Paleoindian	Pre-Clovis	>11,500 RCYBP
	Clovis	11,500–10,950 RCYBP
	Folsom	10,950 –10,250 RCYBP
	Plano	10,250–7800 RCYBP
Archaic	Early Archaic	7800–5000 RCYBP
	Middle Archaic	5000–3000 RCYBP
	Late Archaic	3000–1850 RCYBP
Late Prehistoric	Developmental	1850–900 RCYBP
	Diversification	900–500 RCYBP
	Apishapa	900–500 RCYBP
	Sopris	900–750 RCYBP
	Protohistoric	500–225 RCYBP

Table 2: South Platte River Basin Cultural Chronology, from Gilmore et al. (1999).

Stage	Period	Date Range
Paleoindian	Clovis	13,990–11,700 RCYBP
	Folsom	13,290–10,670 RCYBP
	Plano	12,800–7450 RCYBP
Archaic	Early Archaic	7450–4950 RCYBP
	Middle Archaic	4950–2950 RCYBP
	Late Archaic	2950–1800 RCYBP
Late Prehistoric	Early Ceramic	1800–800 RCYBP
	Middle Ceramic	800–410 RCYBP
Protohistoric		410–90 RCYBP

Research Methods

Research was conducted via the examination of previously excavated archaeological collections from within the defined study area. Sites known to contain mollusc artifacts were compiled through file and record searches with the Colorado Office of Historic Preservation (OAHP), the Colorado State Historical Society (CHS), Colorado State University's Laboratory of Public Archaeology **(**LOPA), the Denver Museum of Nature and Science (DMNS), Fort Carson Cultural Resources Program, the

Fort Collins Museum, the Louden-Henritze Archaeology Museum, the University of Colorado Museum of Natural History, and the University of Denver Museum of Anthropology. Additional sites were identified via literature research. In total, 189 sites within the study area were identified as containing mollusc shell artifacts.

After sites known to contain shell were compiled, locations of archaeological collections were identified. Collections were then visited at CHS, LOPA, DMNS, the Fort Carson Cultural Resources Repository, the Fort Collins Museum, the Louden-Henritze Archaeology Museum, University of Colorado Museum of Natural History, and University of Denver Museum of Anthropology. Of the 189 sites identified as containing mollusc artifacts, collections from only 79 of these sites could be located and studied. While visiting collections, a variety of measurements and observations were taken for each artifact. General metric measurements such as length, width, thickness, and diameter were recorded using digital calipers. Species classifications and artifact class identifications were determined for each artifact following the methods outlined in the sections below. Each artifact was photographed and information pertaining to archaeological context was gathered. All artifacts were given catalog numbers and a complete list by catalog number of measurements and observations can be found in Appendix A.

Following the examination of all known artifacts, every effort was made to locate publications associated with each site within the scope of the study. Records for each site, including site form documents and project reports, filed with the OAHP office in Denver, were thoroughly examined. Site files and reports were also examined within the scope of research conducted at the above mentioned artifact repositories. Additionally,

queries with various research engines and journals were completed to document publications associated with sites within the study. The results of this extensive bibliographic research are presented in Appendix B.

Native Molluscs within the Study Area

In an effort to more thoroughly understand the context of mollusc artifacts examined in this study, a natural history overview of the phylum along with discussions of native species are summarized. The phylum mollusca is defined by the presence of a muscular foot and a soft body enclosed within a mantle and the phylum includes six classes of animals (Harrold and Guralnick 2008). The freshwater molluscs of Eastern Colorado are represented by two classes: Gastropoda (gastropods) and Bivalvia (bivalves). Gastropods (snails and slugs) have one spiral coiled shell (snails) or one reduced or absent shell (slugs). Gastropods are primarily marine animals, but are represented in small numbers in the freshwater and terrestrial assemblages of Eastern Colorado. As indicated by the name, bivalves have two valves or shells.

Inventories of the freshwater molluscs of Colorado have long been an interest of local and regional naturalists. The first comprehensive catalogues were published by Cockrell (1889) and Henderson (1907) and various subsequent inventories have been completed (Brandauer and Wu 1978; Henderson 1912; Henderson 1924; Wu 1989; Harrold and Guralnick 2008). These studies have produced comprehensive lists of both native gastropods and bivalves of Eastern Colorado (Table 3 and Table 4). Although there are currently a number of invasive gastropod and bivalve species within the river systems of Eastern Colorado, these species have been omitted from this study due to their obvious inaccessibility to prehistoric peoples.

Table 3: Native Gastropods of Eastern Colorado, Compiled from Wu (1989) and Harrold and Guralnick (2008)

Species Name	Common Name	Distribution	Average Size	Habitat Description
Acroloxus coloradensis (Henderson 1930)	Rocky Mountain Capshell	South Platte	4-7 mm length 2-3.5 mm width	High mountain lakes of the Rockies
Ferrissia fragilis (Pilsbry and Ferriss 1907)	Fragile Ancylid	Unknown	5mm length	Unknown
Ferrissia rivularis (Say 1817)	Creeping Ancylid	Arkansas and South Platte	7 mm length 4mm width	Clings to rocks in rapidly moving water
Fossaria bulimoides (I. Lea 1841)	Prairie Fossaria	Arkansas and South Platte	6-10 mm length	Shallow water in muddy substrate, in lower elevations
Fossaria obrussa (Say 1825)	Golden Fossaria	Arkansas and South Platte	17 mm length	Shallow water within muddy substrates
Lymnaea (Radix) auricularia (Linnaeus 1758)	Big-eared Radix	Arkansas and South Platte	14-24 mm length	Lakes, ponds, slow moving waters with dense vegetation.
Lymnaea (Stagnicola) caperata (Say 1829)	Wrinkled Marsh Snail	Arkansas and South Platte	30-55 mm length	Common in a variety of aquatic habitats, rarely found in the mountains
Lymnaea (Stagnicola) elodes (Say 1821)	Marsh Pond Snail	South Platte	32 mm length	Common in both slow and fast water habitats
Lymnaea parva (Lea 1841)	Pygmy Fossaria	Arkansas and South Platte	3-6 mm length	Common in a variety of habitats
Lymnaea (Stagnicola) stagnalis (Burch 1979)	Swampy Lymnaea	Arkansas	40 mm length	Mountainous shallow ponds, lakes and marshes
Physa (Physella) acuta (Draparnaud 1805)	Tadpole Physa	Arkansas and South Platte	19 mm length 14 mm width	Variety of aquatic habitats below 10,500ft
Physa (Physella) gyrina (Say 1821)	Pouch Snail	Arkansas and South Platte	20 mm length	Mountainous aquatic habitats
Gyraulus parvus (Tryon 1866)	Ash Gyro	Arkansas and South Platte	7 mm diameter	Shallow ponds with dense vegetation
Helisoma anceps (Menke 1830)	Two-ridge Ramshorn	Arkansas and South Platte	22 mm diameter 12mm height	Lakes, rivers, and streams of lower elevations in a variety of substrates
Helisoma trivolvis (Say 1817)	Marsh Ramshorn	Arkansas and South Platte	8-10 mm diameter 5 mm height	Shallow and quiet rivers, lakes, and ponds
Promenetus exacuous (Say 1821)	Sharp Sprite	South Platte	4-5 mm diameter 1.5 mm height	Protected lakes, ponds, and marshes
Promenetus umbilicatellus (Cockerell 1887)	Umbilicate Sprite	South Platte	4-5 mm diameter 1-1.5 mm height	High altitude lakes and creeks
Amnicola limosa (Say 1817)	Pond Snail	Arkansas and South Platte	4-5 mm length	Slow-moving shallow creeks with silty substrate
Aplexa elongata (Say 1821)	Lance Aplexa	Arkansas and South Platte	23 mm length	Commonly found in ephemeral ponds

Table 4: Native Bivalves of Eastern Colorado. Compiled from Henderson (1924), Brandauer and Wu (1978), Wu (1989), and Harrold and Guralnick (2008).

Species Name	Common Name	Drainage Basin	Average Size	Habitat Description
Anodonta grandis grandis (Say 1829)	Giant Floater	South Platte and Arkansas Rivers	190 mm length	Slow moving waters of lower elevations
Lampsilis siliquoidea (Barnes 1823)	Fatmucket	South Platte River	127 mm length	Lakes and small to medium-sized streams in mud, sand, or gravel
Anodontoides ferussacianus (Lea 1834)	Cylindrical Papershell	South Platte and Arkansas Rivers	106 mm length 47 mm width 52 mm height	Mud or sand substrate of lakes and streams
Uniomerus tetralasmus (Say 1831)	Pond Horn	South Platte River	110 mm length 60 mm height 40 mm width	Lakes or streams with muddy substrate
Musculium lacustre (Muller 1774)	Lake Fingernail Clam	South Platte and Arkansas Rivers	8 mm length	Lakes, streams, rivers of lower elevations
Sphaerium striatinum (Lamark 1818)	Striated Fingernail Clam	South Platte and Arkansas Rivers	14 mm length 7mm width	Mud/clay substrate of creeks and rivers
Pisidium casertanum (Poli 1791)	Ubiquitous Pea Clam	South Platte and Arkansas Rivers	3 mm length 2 mm width	Variety of habitats
Pisidium compressum (Prime 1852)	Ridged-Back Pea Clam	South Platte and Arkansas Rivers	3 mm length 3 mm width	Found in aquatic environments below 6000ft
Pisidium ferrugineum (Prime 1852)	Rusty Pea Clam	South Platte and Arkansas Rivers	3 mm length 2 mm width	High elevation lakes
Pisidium hallae (Kuiper 1983)	None	South Platte and Arkansas Rivers	3 mm length 2 mm width	Variety of habitats
Pisidium liljeborgi	Lilljeborg Pea Clam	South Platte and Arkansas Rivers	3 mm length 2 mm width	High elevation lakes
Pisidium milium (Held 1836)	Quadrangular Pea Clam	South Platte and Arkansas Rivers	3 mm length 2 mm width	High elevation lakes, above 8000ft
Pisidium nitidum (Jenyns 1832)	Shiny Pea Clam	South Platte and Arkansas Rivers	3 mm length 2 mm width	Variety of habitats
Pisidium sanguinichristi (Taylor 1987)	Sangre de Cristo Pea Clam	South Platte and Arkansas Rivers	3 mm length 2 mm width	Potentially endemic species to Sangre de Cristo Mountains
Pisidium variabile (Prime 1852)	Triangular Pea Clam	South Platte and Arkansas Rivers	3 mm length 2 mm width	High elevation lakes and ponds
Pisidium ventricosum (Prime 1851)	Globular Pea Clam	South Platte and Arkansas Rivers	2 mm length 1.5 mm width	Variety of habitats

The species listed in Table 3 and Table 4 were compiled from freshwater mussel surveys in Eastern Colorado from Henderson (1924), Brandauer and Wu (1978), Wu (1989), and Harrold and Guralnick (2008). Older studies were used despite their

incompleteness in species listings to capture a more complete picture of species native to Colorado. These surveys were recorded prior to or concurrently with profound watershed impacts by the introduction of invasive species and/or the modification of river systems by modern humans. For example, *Lampsilis siliquoidea* is only reported from the early Henderson (1907, 1912, and 1924) reports and is absent from all later surveys of freshwater molluscs of Colorado. This species is important to the archaeological data examined in this study, therefore it was included within the species listings for Eastern Colorado. More recently completed surveys and reports offered complete listing of species as well as modern naming conventions.

As evident by the length, width, and height measurements presented in the tables above, the majority of these gastropod and bivalve species are extremely small. Only four of the 35 species listed are longer than 15 mm. In an effort to visualize the small size of native molluscs within the study area, species with known length and width measurements are displayed in Figure 2.

One area of ambiguity among freshwater mussel classification used by archaeologists is the identification of artifacts as freshwater *Unio* shell. This is a common identification in the older site form and reports; however, as Black (1995) highlights, the genus *Unio* is no longer recognized within North American classification systems of freshwater bivalves. The broad use of the classification of artifacts as freshwater *Unio* shell creates suspicion that this nomenclature may have been used as an overarching term for artifacts in the older literature, rather than as a definitive genus identification. A. Cvancara described the term as being a catchall for freshwater mussels in the western U.S., used in the past by both archaeologists and paleontologists (personal

communication 2009). The *Unio* classification is particularly troublesome when it is used to describe heavily modified artifacts that lack key shell landmarks necessary for identification. Although *Unio* is an outdated genus classification in the study area, designations of artifacts identified as such on site forms and reports have been maintained because the exact meaning of the term is unknown.

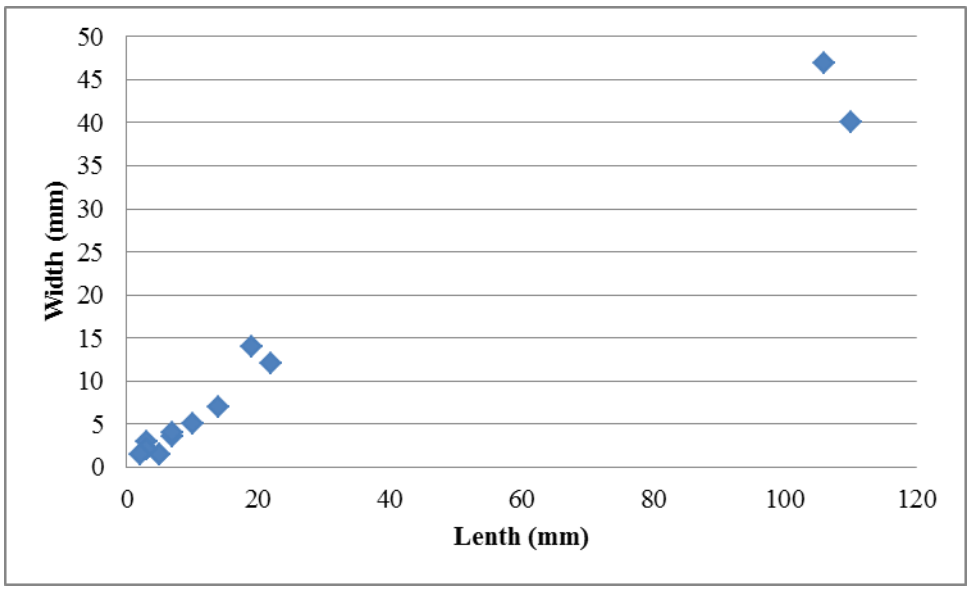

Figure 2: Scatter Plot Showing the Average Length and Width of Native Molluscs of Eastern Colorado.

The species listed in the above tables were identified from archaeological collections using field guide descriptions and diagrams listed above. Additionally, specimens housed within the University of Colorado Invertebrate Zoological Collections were used to form a photographic study collection of the freshwater bivalves of Eastern Colorado. In order to positively identify species, specimens must be relatively complete or at minimum possess diagnostic portions of the shell. For example, gastropods are often characterized by the shape of the aperture (opening), while bivalves are often distinguished via the hinge portion of the shell. Due to the often incomplete or modified

state of mollusc shells in archaeological collections, diagnostic landmarks were frequently absent, therefore positive identification was often impossible. Whenever possible, species or genus designations were noted; however, when species could not be identified, general designations such as gastropod versus bivalve or freshwater versus marine were assigned.

Marine Shell found Archaeologically within the Study Area

In addition to freshwater molluscs, prehistoric peoples of Eastern Colorado used a variety of marine mollusc shells. Field guide descriptions and diagrams were used to identify the marine mollusc shell examined within the archaeological collections of this study (Keen 1963; Rehder 1996; Wye 2000). Additionally, species identifications of some specimens were completed by Dr. Laura Kozuch, curator at the Illinois Transportation Archaeological Research Program, using photographs taken by the author. As with the freshwater artifacts, marine artifacts are often heavily modified, making species identification difficult and often impossible. However, genus or family identifications were made when species determinations were not definitive.

Artifact Classification Definitions

Following species identification using the methods described above, artifact use classifications were determined for each artifact within the study. Artifact classification methods used were largely adopted from established artifact definitions used in the Southwestern and Great Basin areas of the United States. The archaeological record from these regions contains a rich history of jewelry manufacture from bone, stone, and shell. Therefore, classification methods have already been developed and were easily applicable to the objects examined within this study. In their report of the excavations at

Snaketown, Gladwin et al. (1937) classify shell broadly into four categories: unworked shell, worked shell (including beads, pendants, bracelets, rings, perforated shells, mosaic work and miscellaneous), painted shell, and etched shell. Haury (1976) and Nelson (1991) use this general framework while expanding definitions assigned to individual artifact classes. Bennyhoff and Hughes (1987) present similar classification schemes from the Great Basin but elaborate on and define various forms of marine beads and shell disc beads classes.

Due to the variety and abundance of shell artifacts from the Southwest and the Great Basin areas, the previous work highlighted above as well as the prevalence of artifact types examined from Eastern Colorado were used to develop the artifact classification method used in this study, defined as follows:

I. Unworked Shell: shell within this category may represent debitage or debris from manufacture (but shows no clear definitive modification) or shell that exists in its natural state.
    a. Complete
    b. Fragmentary
II. Worked Shell
    a. Utility
        i. Tool Use: The shell shows signs of use wear, including polishing and fragmentation along the use edge.
    b. Ornament
        i. Beads
            1. Whole Shell: Exclusively small marine gastropods, *Olivella* sp. The apex was removed by grinding or perforating with a small tool to create a hole for suspension, creating spire lopped beads.
            2. Disc: Small round disk, flattened on both sides by grinding, with a perforation at the center of the disk.
        ii. Pendants
            1. Whole Shell: Complete or nearly complete shells with one or more perforations. Perforations typically occur through the umbo, but can also occur along the outer margins of the shell. Within this study, these are exclusively freshwater bivalve shells. Can be incised and/or carved along edge margins.

2. Cut Shell: Pendants constructed from flat portions of shell, often taking on geometric forms. Possess one or more perforations that are not centrally located within the artifact, but can also lack suspension holes. Can be incised and/or carved along edge margins.

c. Unknown Function: Includes all shell culturally modified shell that cannot be conclusively classified utilitarian or ornamental.
    i. Partially-perforated: incomplete/partial drill holes of unknown function
    ii. Non-perforated culturally modified shell
        1. Cut/ground artifacts.
        2. Incised or notched artifacts.
        3. Cut/ground and incised artifacts.

Conclusions

The research goals and methods presented within this chapter serve as the basis for research presented in the following chapters. The concepts presented here will be used to analyze to the mollusc collections found in the Arkansas and South Platte River Basins of Eastern Colorado. Research within the following chapters will focus on the analysis of use classifications and trends in use through time, freshwater artifacts and their implications for environmental reconstruction studies, and mollusc shell in terms of trade and exchange networks. Research within these areas of interest will help to better understand the cultural, environmental, and economic prehistoric landscape of the Arkansas and South Platte River Basins.

CHAPTER 3: THE STUDY ASSEMBLAGE

Chapter 3 will examine the mollusc artifact assemblage from the Eastern Colorado study area. This assessment will begin with an in depth discussion of the artifact forms represented within the collection. Descriptions will highlight diagnostic features of the artifacts, their use or function, brief comments on their distribution in Eastern Colorado, predominant shell type and photographic examples of artifact classes. After the artifact classes have been defined, examinations of artifact modification, ecosystem origins, and artifact forms will be presented. This examination will include comparisons of these parameters in Arkansas and South Platte River Basins in an effort to compare mollusc shell use between these two regions. Following an examination of mollusc artifact form, a study of use through time will be presented for both the entire Eastern Colorado study area and then within each respective river basin. Conclusions will be made about how mollusc artifacts were used through time and possible explanations for this change will be explored.

Mollusc Artifacts

All artifacts examined were cataloged by the author using the classification methods outlined in Chapter 2. This scheme was adapted from various sources and geographic regions (Gladwin et al. 1938; Haury 1976; Nelson 1991; Bennyhoff and Hughes 1987). A total of 691 artifacts were examined within this study and each was classified into predefined cataloging categories; these groups, along with the counts and

percentages within the Eastern Colorado assemblage, are identified in Table 5. Many of the collections examined, in particular those at the Louden-Henritze Archaeology Museum, contained an abundant amount of small terrestrial gastropods. These terrestrial gastropods were examined and were determined to be naturally occurring, rather than the result of prehistoric cultural activities, and therefore were not included within the scope of this study.

Table 5: Artifact Catalog Categories

Artifact Catalog Category	Count	Percentage
Unworked-fragment	473	68.45
Unworked-complete	12	1.74
Worked-utility-tool use	4	0.58
Worked-ornament-bead-whole shell	47	6.80
Worked-ornament-bead-disc	31	4.49
Worked-ornament-pendant-whole shell	6	0.86
Worked-ornament-pendant-cut	27	3.91
Worked-unknown function-incised	4	0.58
Worked-unknown function-ground	47	6.80
Worked-unknown function-ground-incised	12	1.74
Worked-unknown function-partial drill	28	4.05
Total	691	100%

The distribution of mollusc artifacts and sites site containing these artifacts in Eastern Colorado are shown in Table 6 and 7. Counties not listed in these tables did not have artifacts examined within the parameters of this study. In comparison to adjacent geographic regions (e.g., the Southwest, Great Basin, and Central Plains), the assemblage from Eastern Colorado is extremely small. Single sites in these neighboring areas have been reported to contain mollusc shell collections larger than those observed from Eastern Colorado (Myers and Perkins 2000; Warren 2000).

Table 6: Artifacts Examined and Site Distributions Across the Study Area.

County	Number of Artifacts	Number of Sites
Adams	2	1
Baca	4	2
Douglas	49	2
El Paso	3	3
Fremont	22	3
Huerfano	14	1
Jefferson	1	1
Larimer	36	10
Las Animas	508	40
Morgan	1	1
Otero	1	1
Pueblo	30	11
Weld	4	1
Yuma	2	2
Unknown	14	Unknown
Total	**691**	**79**

Table 7: Percentage of Prehistoric Sites Containing Molluscs within the Total County Assemblage.

County	Total Prehistoric Sites	Prehistoric Sites with Molluscs	Percentage
Adams	405	1	0.2%
Baca	514	2	0.4%
Douglas	1321	2	0.2%
El Paso	1879	3	0.2%
Fremont	979	3	0.3%
Huerfano	1133	1	0.1%
Jefferson	483	1	0.2%
Larimer	1527	10	0.7%
Las Animas	7195	40	0.6%
Morgan	474	1	0.2%
Otero	363	1	0.3%
Pueblo	1488	11	0.7%
Weld	2200	1	<0.1%
Yuma	116	2	1.7%
Total	**20,077**	**79**	0.4%

Table 6 indicates that the majority of artifacts within the study assemblage come from Las Animas County in the Arkansas River Basin. At first glance this seems to indicate a concentration of molluscs in this county, but as Table 7 demonstrates the percentage of sites containing molluscs artifacts within all recorded sites from Las Animas County is comparable to percentages in other counties within the study area. Further, Table 7 shows that the portion of sites containing mollusc artifacts are comparable across Eastern Colorado. This indicates consistency in the use of molluscs across both the Arkansas and South Platte Basins.

Artifact Classes and Examples

The assemblage was dominated by unworked or non-culturally modified fragmented mollusc shell artifacts (68.45 percent; n=473). These artifacts showed no evidence of cultural modification and their fragmented nature likely resulted from taphonomic processes (Figure 3). It is possible that these artifacts could possibly represent bi-products of mollusc shell artifact manufacture; to borrow terminology from lithic analysis, they may be a form of shell debitage. However, there are limited hypotheses and/or methods for shell manufacturing procedures in the surrounding geographic region, let alone standards for diagnosis of shell manufacturing by-products (Bennyhoff and Hughes 1987; Jernigan 1978). Research conducted on mollusc species from the Caribbean suggests that the breakage of adult shells produces predictable fragments, but these by-products appear to be somewhat dependent on the species of shell and developmental stage in the lifecycle of the specimen (O'Day and Keegan 2001). Although these artifacts do not show recognizable signs of human modification, there are

believed to be directly associated with prehistoric peoples, rather than coincidentally found. These artifacts were transported and deposited at archaeological site locations via cultural activities. These artifacts could be representative of prehistoric subsistence, but given their limited environmental availability their presence seems to be indicative of non-subsistence uses.

Figure 3: Example of Artifact Category Unworked-Fragmented (Catalog Number 5DA0272.DU.14).

The artifact categories with the second highest percentages within the Eastern Colorado assemblage are culturally modified whole shell beads and culturally modified mollusc artifacts that have been ground or cut (both n=47; 6.80 percent). Whole shell beads within the assemblage are exclusively marine mollusc species including unknown gastropods, *Cypraea* spp., *Olivella* spp. and *Dentalia* spp. (Figure 4 and Figure 5). Artifacts within this category are used for personal adornment purposes, based on the presence and locations of drilled holes. This artifact class is almost exclusively represented by *Olivella* spp. artifacts, which comprise 97.8 percent of the category.

Figure 4: Example of *Olivella* spp. Whole Shell Bead (Catalog Number 5BA0118.LOPA.1).

Figure 5: Example of *Dentalium,* spp. Whole Shell Bead (Catalog Number 5LR0263.LOPA.1).

Culturally modified mollusc artifacts that have been ground or cut, classified as worked-unknown function-ground, are predominantly manufactured from freshwater molluscs and were exclusively documented from sites in the Arkansas River Basin (Figure 6). The exact function of these artifacts is unknown, but their cultural modification is represented by the grinding/cutting of the shell edges to form predominantly geometric forms. Many of the artifacts within this category resemble in form, shape, and thickness geometric pendants identified within the collection. It is therefore possible that these ground/cut artifacts could represent pendant preforms or incomplete pendants, in that they all lack drilled holes for hanging. This could be

indicative of a shell processing industry, such as the ones documented in the Southwest and Great Basin (Bayman 1996; Gladwin et al. 1938; Haury 1976).

Figure 6: Example of Worked-Unknown Function-Ground Artifacts (Catalog Numbers 5LA5234.FC.11 and 5LA5262.FC.7).

The next category represented in the assemblage are shell disc beads (cataloged as worked-ornament-bead-disc) (Figure 7). Artifacts within this catalog class are highly modified and thus species identification, let alone the distinction between freshwater or marine habitats, is often impossible. These artifacts were almost exclusively recovered from the Arkansas River Basin (n=24; 77.4 percent).

Partially drilled artifacts comprise 4.05 percent (n=28) of the Eastern Colorado assemblage. These artifacts are characterized by incomplete drill holes (Figure 8). The incomplete nature of the drill holes on these artifacts precludes a definitive identification of use, thus they are characterized with an unknown function. These artifacts may be indicative of the fragile nature of mollusc shell as a raw material and they were likely fragmented during the drilling process, or broken during use or port-abandonment. All

were recovered from the Arkansas River Basin and all were identified as freshwater species.

Cut pendants comprise 3.91 percent (n=27) of the study assemblage and were also recovered entirely from the Arkansas River Basin. These artifacts were identified predominantly as freshwater species (n=26; 96.3 percent), with the remaining classified as unknown due to their highly modified state. These artifacts are objects of personal adornment; cut or ground into predominantly geometric shapes, they have one or more drilled holes used for stringing (see Figure 8).

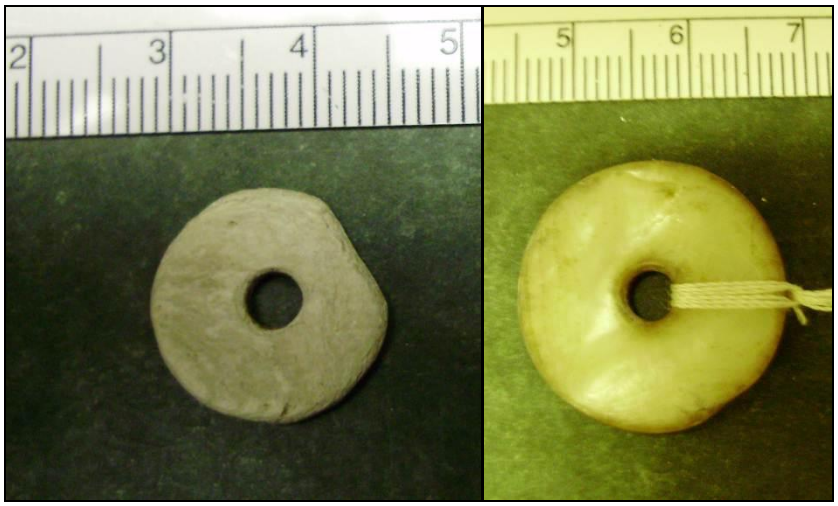

Figure 7: Example of Worked-Ornament-Bead-Disc (Catalog Numbers 5LA1413.TD.1 and 5LA1416.TD.4).

Non-culturally modified complete mollusc shell and modified cut/ground and incised artifacts each comprise 1.74 percent (n=12) of the study assemblage. Unmodified complete shells were recovered from both the Arkansas and South Platte River Basins. This category consists primarily of oyster shell recovered from 5PE0081, but also contains un-modified gastropod specimens (Figure 9). Culturally modified cut/ground and incised artifacts have an unknown function, but are clearly worked as evidenced by

their ground/cut edges and incised markings, typically found along the edges of the artifacts (Figure 10). As with the unknown cut/ground artifacts discussed above, these artifacts may be representative of a stage in the production of geometric pendants, but their exact function is unknown. These artifacts were recovered exclusively from the Arkansas Basin and were classified primarily as being manufactured from freshwater species.

Figure 8: Example of Catalog Categories Worked-Unknown Function-Partial Drill and Worked-Ornament-Pendant-Cut (Catalog Numbers 5HF0188.DU.1 [left], 5LA5385.FC.1 [middle], and 5LA5385.FC.2 [right]).

Figure 9: Examples of the Unworked-Complete Catalog Type (Catalog Numbers 5PE0081.DU.9 [left] and 5MR0390.CHS.1 [right]).

The remaining three artifact categories all comprise less than 1 percent of the Eastern Colorado study collection. Whole shell pendants represent 0.86 (n=6) of the assemblage (Figure 11). These artifacts were all classified as freshwater bivalve species *Lampsilis siliquoidea* (Barnes 1823). Four were recovered from Las Animas County in the Arkansas River Basin, while the remaining two were found in Larimer County in the South Platte River Basin. Two additional artifacts of this nature were recovered from the Robert's Ranch Burials in Larimer County, but these artifacts are not included here because they were not physically examined and therefore not included with the study assemblage. These artifacts may be affiliated with internment practices, as three of the six recovered were from burial contexts.

Figure 10:Example of a Worked-Unknown Function-Ground-Incised Artifact (Catalog Number 5PE0349.DU.2).

Four artifacts (0.58 percent) of the artifact assemblage examined from the study area consisted of incised or notched mollusc artifacts (Figure 12). All of these were recovered from the Arkansas River Basin and they are characterized by the presence of one or more incised or notched marks along the edge of a mollusc shell fragment. All were characterized as freshwater mollusc species. Again, these may be related to the

production of cut pendants because of their often geometric shape and similarity in form to complete cut pendants within the collection.

Figure 11: Example of a *Lampsilis siliquoidea* Whole Shell Pendant (Catalog Number 5LR0284.LOPA.1).

Figure 12: Example of the Worked-Unknown Function-Incised Artifact Category (Catalog Number 5LA1057.TD.48).

Utilitarian artifacts, classified as tools manufactured from mollusc shell, make up 0.43 percent (n=4) of the assemblage. These artifacts were identified by the presence of a sharp working edge and evidence for repeated use such as polishing and localized breakage or use-wear (Figure 13). These artifacts were recovered both from the Arkansas and Platte River Basins, and were identified as both freshwater and unknown shell types. These artifacts would have provided a sharp working edge; however, due to the structural composition of mollusc shell, would have been brittle and would likely break often. This pre-disposition for breakage likely resulted in the fractures and use-wear observed along the working edge of these artifacts. Based on the artifacts examined in the study, all appear to have been cutting tools, given their sharp working edges. It is unclear if these tools were expedient or curated in nature, but given the brittle nature of shell it is likely that these tools would not withstand extended and repeated use. These characteristics would seem to indicate that these would have served as expedient tools.

Figure 13: Example of the Worked-Utility-Tool Use Artifact Category (Catalog Number 5DA0272.DU.25).

Trends in Artifact Classes in Eastern Colorado

Overall trends in the assemblage will be examined in terms of cultural modification, freshwater, marine, or terrestrial origin, and trends in artifact classes. The total number of artifacts examined as part of this study totaled 691, with 587 (84.9 percent) being from the Arkansas River Basin and 104 (15.1 percent) recovered from archaeological sites within the South Platte Basin. The majority of artifacts examined in the study were not culturally modified (n=480; 69.5 percent). Percentages for non-culturally modified artifacts and artifacts showing evidence of cultural modification are presented in Table 8. These percentages are relatively consistent between the Arkansas and South Platte River Basins; indicating a similarity in assemblage composition between the basins, which is likely reflective of similarities in artifact production methods and mollusc acquisition.

Table 8: Non-Culturally and Culturally Modified Artifact Distributions in the Study Assemblage.

	Arkansas	South Platte	Total
Unworked Count	403	78	481
Unworked Percentage in the Total Basin Assemblage	68.7%	75%	
Worked Count	184	26	210
Worked Percentage in the Total Basin Assemblage	31.3%	25%	

The assemblage is composed of 579 freshwater, 61 marine, 11 terrestrial, and 40 unknown mollusc artifacts (Table 9). Of particular interest within the scope of this examination are the freshwater, marine, and terrestrial specimens. The artifacts of unknown environmental origin or species offer little to this discussion. The percentage of the total basin assemblage of freshwater, marine, and terrestrial shell artifacts in the Arkansas and South Platte River Basins are relatively similar, further suggesting

continuity in mollusc shell use throughout Eastern Colorado. Freshwater artifacts constitute a slightly higher percentage of the assemblage in the Arkansas Basin, suggesting that prehistoric peoples in this region had greater access to freshwater species. This increased availability could have resulted from a variety of factors including differing environmental availability or differing exchange with peoples who had access to desirable freshwater species. The percentages of marine and terrestrial artifacts in the river basins differ only slightly, further suggesting similarities in the cultural use and value of molluscs in these two geographic regions.

Table 9: Freshwater, Marine, Terrestrial, and Unknown Artifact Distributions with the Eastern Colorado Assemblage.

	Arkansas	**South Platte**	**Total**
Freshwater Count	506	73	579
Freshwater Percentage in the Total Basin Assemblage	86.2%	70.2%	
Marine Count	49	12	61
Marine Percentage in the Total Basin Assemblage	8.3%	11.5%	
Terrestrial Count	9	2	11
Terrestrial Percentage in the Total Basin Assemblage	1.6%	2%	
Unknown Count	23	17	40
Unknown Percentage in the Total Basin Assemblage	3.9%	16.3%	

As with worked, unworked, marine, freshwater, and terrestrial artifacts, the artifact classes presented Table 10 are similar in percentage of assemblage composition between the Arkansas and South Platte Basins. The exception to this generalization is a group of similar artifacts that were recovered exclusively from the Arkansas River Basin. This group includes cut pendants and unknown function artifacts that have been cut, ground, and incised.

Table 10: Percentages of Artifact Classes in the Study Basins.

Artifact Catalog Category	Arkansas	South Platte
Unworked-fragment Count	394	79
Unworked-Fragment Percentage in the Total Basin Assemblage	67.6%	73.1%
Unworked-complete	10	2
Unworked-complete Percentage in the Total Basin Assemblage	1.7%	1.9%
Worked-utility-tool use	2	2
Worked-utility-tool use Percentage in the Total Basin Assemblage	0.3%	1.9%
Worked-ornament-bead-whole shell	39	8
Worked-ornament-bead-whole shell Percentage in the Total Basin Assemblage	6.6%	7.7%
Worked-ornament-bead-disc	24	7
Worked-ornament-bead-disc Percentage in the Total Basin Assemblage	4.1%	6.7%
Worked-ornament-pendant-whole shell	4	2
Worked-ornament-pendant-whole shell Percentage in the Total Basin Assemblage	0.7%	1.9%
Worked-ornament-pendant-cut	27	0
Worked-ornament-pendant-cut Percentage in the Total Basin Assemblage	4.6%	0.0%
Worked-unknown function-incised	4	0
Worked-unknown function-incised Percentage in the Total Basin Assemblage	0.7%	0.0%
Worked-unknown function-ground	47	0
Worked-unknown function-ground Percentage in the Total Basin Assemblage	8.0%	0.0%
Worked-unknown function-ground-incised	12	0
Worked-unknown function-ground-incised Percentage in the Total Basin Assemblage	2.0%	0.0%
Worked-unknown function-partial drill	25	3
Worked-unknown function-partial drill Percentage in the Total Basin Assemblage	4.3%	2.9%

As described in the artifact class description sections above, many of these cut, ground and incised unknown artifacts closely resemble cut pendants; however, they lack drilled holes. Again, they may represent an intermediary stage in cut pendant production (see further discussion in the next section). The absence of this group of artifacts in South Platte Basin assemblage suggests that cut pendants were not a common artifact type of material culture in this region. Despite this one difference, the mollusc artifact assemblages from the Arkansas and South Platte Basins show a great deal of consistency, in that all other artifact categories have comparable distributions with their respective assemblages.

Discussion of Trends in Mollusc Artifacts

Based on the composition of the Eastern Colorado study assemblage, it appears that the primary prehistoric use for mollusc shell is for personal adornment. The combined artifact classes of beads, pendants, and artifacts representative of these forms (such as partial perforations, cut/ground, and incised) dominate the culturally modified assemblage. Artifact forms indicative of tool or subsistence practices are represented in low numbers or not observed at all. Thus the prehistoric use of mollusc shell in the Arkansas and South Platte Basins is inherently linked to items of personal adornment.

The comparisons between the mollusc assemblages of the Arkansas and South Platte River Basins indicate a similarity in composition of worked, unworked, marine, freshwater, and terrestrial artifacts, as well as similarities in the majority of artifact classes as categorized by the author. The comparable assemblage composition of worked and unworked artifacts indicates that there may be analogous methods of manufacture and/or procurement. If the materials classified as unworked are in fact representative of

manufacturing by-products, this would indicate that manufacturing techniques and likely artifact forms were consistent across the study area. If the unworked artifacts are not indicative of a reduction sequence, they may be reflective of the procurement strategies or cultural value of molluscs. In that these artifacts were not aggregated at site locations by natural factors, they were gathered and deposited at these locations in an unmodified state because of some currently unknown cultural significance.

The comparable number of freshwater and marine mollusc species between the Arkansas and South Platte Basins has implications for a similarity in environmental and cultural factors between these basins. Like percentages of freshwater artifacts within each basin suggests one of two things; that these regions had similar freshwater environments capable of sustaining mollusc populations or that prehistoric peoples in these areas had similar trade or exchange access to acquire freshwater molluscs. The freshwater species identifiable within the collection included *Lampsilis siliquidae* (Barnes 1823) and *Anodontoides ferussacianus* (Lea 1834). Each were found in collections from both river basins, further suggesting that environmental conditions capable of supporting the same mollusc species existed in both the Arkansas and South Platte River Basins. The parallels in marine artifact percentages within each assemblage indicate that prehistoric peoples in Eastern Colorado had similar access to trade and exchange goods. The mechanisms and routes of exchange may have varied, but access to exotic goods appears to be analogous, and the cultural significance of exotic marine goods would also have to be similar.

Consistent frequencies of the various artifact classes in each basin assemblage indicate a similarity in material culture and cultural value of mollusc shell artifacts. The

only significant difference in this comparison is presence of cut pendants, cut/ground, and incised artifacts, which are found exclusively in the Arkansas Basin. As noted above, the artifacts within this group are all likely connected and are possibly representative of a production sequence. Cut pendants are a common artifact form seen in the Southwest (Jernigan 1978) and the close geographic location of the Arkansas to this region may account for this difference in material culture. Despite this difference, the remaining artifact classes represent similar percentages of their respective basin assemblages, strongly indicating a consistency in material culture and possibly similar cultural significance of mollusc artifacts. All of these similarities indicate that the prehistoric groups of Eastern Colorado used, acquired, and valued mollusc artifacts in comparable fashions. These parallels show that the geographic boundaries that distinguish the Arkansas River Basin from the South Platte had little bearing on the prehistoric use of mollusc shell.

Reduction Sequence of Mollusc Artifacts and Raw Material Size Classes

Mollusc artifact production is inherently a reductive technology, as opposed to additive such as pottery manufacture. Reductive sequences of lithic artifact production have been shown to be predictable and repetitive (Ahler 1989; Collins 1975), and important factors for classifying, studying, and inferring uses of lithic artifacts (Callahan 1979; Crabtree 1972). Additionally, non-reduction sequence type artifacts such as shatter and angular debris have also been used to infer lithic utilization (Andrefsky 1998; Whittaker 1994). These techniques of classification and categorization may have implications for the examination of mollusc shell artifacts, in that both are reductive technologies. Similar patterns of inferred stages or steps in reduction/ manufacture of

mollusc artifacts can likely be assigned. This type of reduction sequence examination may have application to certain classes of mollusc artifacts, in particular the personal adornment artifacts such as beads and pendants. These artifacts have regular and somewhat standard forms that were likely manufactured using uniform and predictable methods. Further experimental research beyond the scope of this study would need to be completed to verify these assumptions.

In addition to reduction sequences, some artifact categories examined within this study have minimum size requirements for production, for example disc beads (cataloged as worked-ornament-bead-disc). Disc beads examined within this study have an average thickness of 1.74 mm (standard deviation of 0.51), whereas unworked whole shell and fragments have an average thickness of 1.02 mm (standard deviation of 0.78). Clearly the average thickness of the available raw material for this artifact class (regardless of marine or freshwater origin) would have to be substantially above that of the average thickness of the final product (keeping in mind that to produce a disc shell bead the starting raw material is reduced by grinding down the surface, which further reduces the final product thickness). Thus, the general characteristics of the end product could be inferred by knowing the metric characteristics of a given site's raw material assemblage. Studies of this nature would be useful in determining the possible origins of artifact raw materials, without using traditional speciation landmarks, that are often absent on highly modified artifacts.

Mollusc Use Through Time

An examination of the use of mollusc shell by prehistoric peoples of Eastern Colorado through time has the ability to reveal insights into changing environmental and

cultural conditions. As frequently encountered when examining existing collections, contextual, age, and/or cultural affiliation information for sites was not always available. Additionally, many of the artifacts examined were recovered as a result of pedestrian cultural resource management surface inventories, therefore contextual information is limited given the surface context of recovered artifacts. Of the total 691 artifacts within the study, only 38.8 percent (n=268) were recovered from sites of known age or cultural affiliation. Despite this lack of information for all sites with mollusc artifacts, conclusions can be drawn about the sites with definitive age or cultural affiliations.

Cultural Chronologies

There are a number of cultural chronologies that have been developed and widely used in both the Arkansas and South Platte Basins. Historically, the Arkansas and South Platte Basins have been viewed as culturally distinct and thus have differing cultural chronologies (Gilmore et al. 1999; Zier and Kalasz 1999). This lack of standardization is reflected in the site literature and state records examined within the scope of this study. Also dominant in the site documentation are date associations based on material culture remains, rather than absolute dating techniques. In an effort to provide consistency within this study, cultural chronologies were adopted for the Arkansas River Basin from Zier and Kalasz (1999) and for the South Platte Basin from Gilmore et al. (1999). When chronometric ages were provided in site documentation, these dates were correlated to periods presented within the referenced chronologies. When only cultural period was listed, the author converted the artifact to the corresponding period in the Zier and Kalasz (1999) and Gilmore et al. (1999) chronologies.

Trends in Use Through Time

An examination of the entire Arkansas and South Platte Basin assemblage indicates that the collection is dominated by artifacts (75 percent; n=201) recovered from archaeological sites dating to the Late Prehistoric period (A.D. 150–A.D. 1800) (Figure 14). Artifacts dating to the Late Archaic to Late Prehistoric transition (3000–1850 B.P.) comprise 24.6 percent (n=66) of the assemblage, while artifacts dating to the Early and Middle Archaic periods (7800–3000 B.P.) constitute less than 1 percent of the collection (0.4 percent; n=1). No artifacts were found to be associated with sites dating to before the Middle Archaic, including the Paleoindian period. It is important to note that artifacts with known site age or cultural affiliation comprise 38.8 percent (n=268) of the total collection, while artifacts recovered from sites of unknown age dominate the assemblage at 61.2 percent (n=423). Despite the lack of comprehensive data on site age association, meaningful trends in the data can be studied in an effort to understand changing use of mollusc artifacts in the study area.

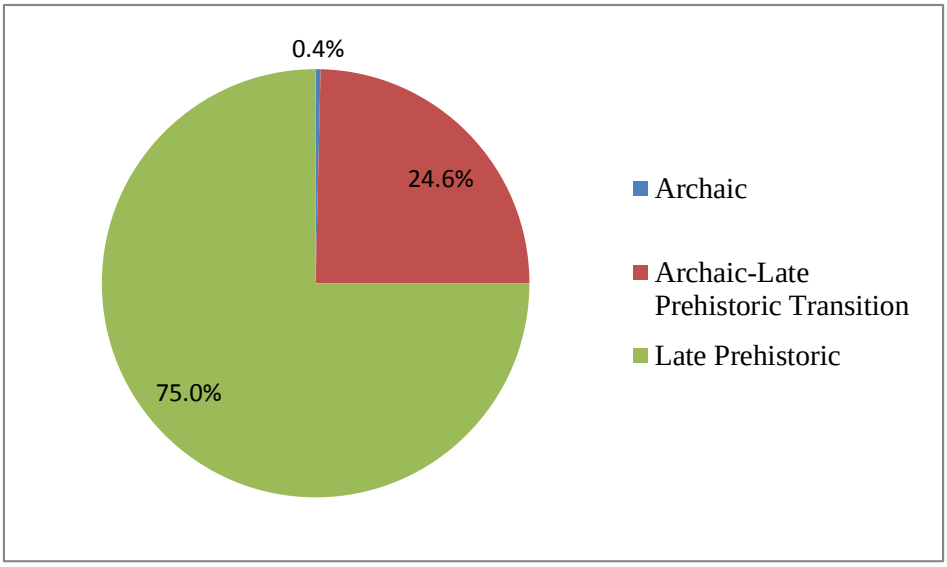

Figure 14: Age Association of Artifacts Recovered from the Eastern Colorado Study Collection.

These trends are mimicked in the basin assemblages as well. In the Arkansas Basin, mollusc artifacts gradually increase from the Archaic to a peak in the Late Prehistoric, while in the South Platte Basin these artifacts are only present in site assemblages dating to the Late Prehistoric (Figure 15). Again, the majority of artifacts within the smaller basin assemblages are dominated by artifacts of unknown age, especially in the South Platte Basin, in which the unknown portion account for 94.2 percent (n=98) of the total collection.

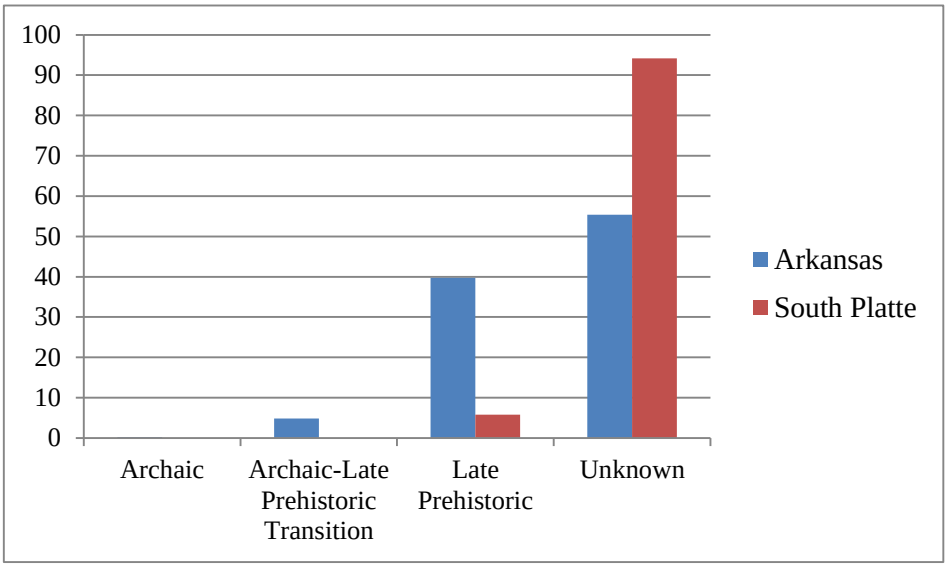

Figure 15: Percent Mollusc Artifact Use Through Time for the Arkansas and South Platte Basins.

There were numerous limitations in the age data set that precluded in depth examinations of artifact class trends through time. Despite these limitations, broad conclusions can be made about some artifacts classes; specifically, it appears that marine artifacts, in particular whole shell beads such as *Cypraea* spp., *Olivella* spp. and *Dentalia* spp., are artifacts found predominantly in the Late Prehistoric and into the Protohistoric. These artifacts were likely more common later in the prehistoric record due to increasing

cultural connectivity throughout prehistory, which afforded greater reaches of cultural exchange of goods.

Discussion of Changing Uses of Mollusc Shell

Based on an examination of the data, it appears that mollusc artifacts were most prevalent in the Eastern Colorado study area in the Late Prehistoric. Mollusc artifacts first appear in the archaeological record of the Arkansas River Basin in the Middle Archaic and increase in prevalence through the Late Prehistoric. In the South Platte Basin they are only present during the Late Prehistoric. The lack of the mollusc artifacts in the South Platte Basin during the Archaic and Archaic to Late Prehistoric transition may -be reflective of the lack of complete site age data; however, it may represent clues to the origin of mollusc artifacts in Eastern Colorado. Perhaps mollusc artifacts were first introduced to the study area in the Arkansas Basin and then spread northward into the South Platte. Alternatively, this observed trend could be indicative of Southwestern cultural influences and possibly speak to the timing of said influences. As noted above, the data within this study to support this inference are limited due to a lack of complete site age or cultural association.

The observed temporal trends in mollusc artifacts are inherently linked with the prehistoric utilization of artifact classes. The analysis of artifact classes presented in this first part of this chapter concluded that culturally modified mollusc artifacts primarily function as items of personal adornment. If the temporal trends in this artifact class are in fact representative of actual changes in the prehistoric use of molluscs, then they may also be indicative of changing methods, types, or fads of personal adornment. The

catalyst for this change is to this point unknown, but it is likely rooted in both environmental and cultural influences.

The changing use of molluscs through prehistory in Eastern Colorado has various implications for cultural and environmental interpretations. On the one hand, changing environmental conditions could account for the observed trends in use through time. Varying environmental conditions through prehistory have an effect on the availability of freshwater mollusc raw materials. On the other hand, increasing cultural complexity and interaction could account for an influx in trade goods, in particular marine and non-local freshwater molluscs. These scenarios will be further explored in Chapters 4 and 5, but changes in use are undoubtedly linked to both changing environmental and cultural conditions.

Discussions of Trends Observed in the Study Assemblage

The Arkansas and South Platte River Basins are divided by geographic barriers and have historically been examined by archaeologists as supporting different cultural groups. Historically speaking, the cultural groups of Eastern Colorado have rarely been examined as continuous and are frequently divided on grounds of geographic and cultural distinction. Cultural groups within the Arkansas Basin of southeastern Colorado have often been compared to their close geographic neighbors in the Southwest, often equating trends in organization and material cultural to influences from these neighboring groups (Irwin-Williams and Irwin 1966). On the other hand, prehistoric peoples in the South Platte Basin in northeastern Colorado have often been examined in terms of their High Plains neighbors to the north and Central Plains groups to the east. Rarely are prehistoric people from the Arkansas Basin compared to those in the South Platte. Yet the

examination presented in this chapter indicates that there are a number of similarities in their use of mollusc artifacts both in the classes of artifacts represented in their collective assemblages and the temporal use of artifact. This indicates at least some similarities in material culture, environmental conditions and/or exploitation of local resources, and trade/exchange pathways. Given the known dates of artifacts within the study, there were likely cultural similarities from the Late Archaic through the Late Prehistoric periods. The lack of mollusc artifacts recovered from sites of known age beyond these periods precludes assigning cultural parallels.

Given the small subset of material cultural examined within this study and the results, that indicate a great deal of similarity, it is likely that further examinations may result in the identification of additional cultural parallels between the prehistoric people of the Arkansas and South Platte River Basins. Of course, research would need to verify this assumption, but it is likely that the prehistoric peoples of Eastern Colorado share more in common than previously thought.

Another point of comparison within the study collection is the context from which artifacts were collected and possible trends in this context. Specifically, were artifacts in the study collection found predominately in burials, surface scatters, stratified sites, rock shelters, or other site type? As with the temporal data, site context was not found for the majority of artifacts. Despite this shortcoming, some generalization can be made about context. Mollusc artifacts in Eastern Colorado appear to be from surface and buried sites, typically characterized as habitation locations. Examples are also found from burial and rock shelter sites, but in much smaller numbers.

Conclusions

An examination of the Eastern Colorado mollusc artifact dataset revealed similarities in the use of the artifacts between the Arkansas and South Platte River Basins. Comparisons of worked, unworked, freshwater, marine, terrestrial and various artifact classes indicate similarities in most categories. Mollusc artifact use through time in the overall Eastern Colorado study area, as well as within each individual river basin, indicates that the majority of artifacts were recovered from sites dating to the Late Prehistoric period. In the Arkansas River Basin use through time increases sharply from the Archaic through the Archaic to Late Prehistoric transition and culminating during the Late Prehistoric. Possible mechanisms driving changing uses likely include a combination of environmental and cultural factors.

CHAPTER 4: PALEOENVIRONMENTAL ANALYSIS

A variety of environmental parameters must be satisfied in order to sustain freshwater mollusc populations. Of particular interest to this study are the optimum environmental conditions to support the freshwater mussel species used by prehistoric peoples of Eastern Colorado. An understanding of freshwater mussel biology and environments within the Arkansas and South Platte River Basins in Colorado can provide a baseline for understanding prehistoric mollusc availability and general river characteristics. River characteristics can also be inferred via paleoclimatic reconstructions pertaining directly to river systems as well as paleoenvironmental studies centered on more general climatic conditions. Changes in prehistoric climatic conditions and their impacts on freshwater mollusc populations will be examined in an effort to understand how changes in human use of molluscs may be correlated to changing environmental conditions. Mechanisms for changes in the prehistoric use of freshwater molluscs will be examined in terms of cultural and environmental variations. Comparisons to freshwater mussel industries of the Central Plains will be made in an effort to further explore the role of culture and environment in the prehistoric use of mollusc shell and more generally to understand how environmental factors can affect resource availably and thus impact the material record studied by archaeologists.

Freshwater Molluscs Examined within the Current Study

Research conducted at the various artifact repositories indicated that prehistoric mollusc artifact assemblages of Eastern Colorado are dominated by freshwater species

(n=579) (Figure 16). Although many specimens were difficult to identify, the identifiable assemblage was dominated by freshwater bivalve species as evidenced by hinge fragments, muscle scars, and other shell characteristics indicative of freshwater bivalve species. Therefore, freshwater bivalves will be the main focus of analysis and discussion within this chapter.

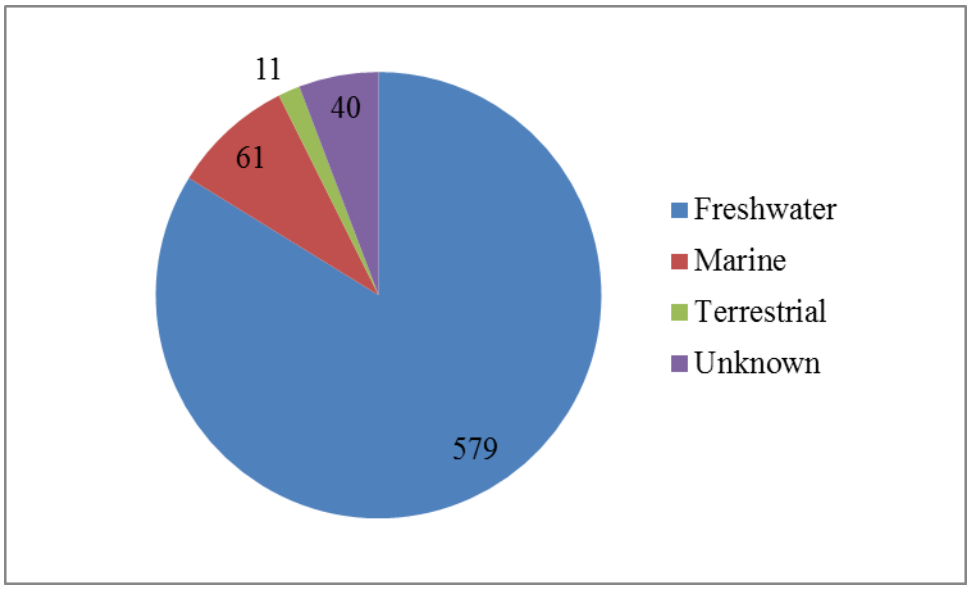

Figure 16: Mollusc Artifact Assemblage Characterized by Freshwater, Marine, Terrestrial, and Unknown Species.

Ecology and Biology of Freshwater Bivalves

There are two classes of native freshwater bivalves in North America; Unionoida (Freshwater Mussels) and Non-Unionoida (Fingernail, Pea, and Pill Clams). Both of these types of freshwater bivalves are ubiquitous in freshwater environments, but are often inconspicuous because they spend most of their lifecycle partially or fully buried. Freshwater mussels are sensitive to a variety of environmental/water factors including water temperature, turbidity, and nutrient availability. They are most often found in permanent stream environments, but certain species do inhabit pond and lake environments (Cummings and Bogan 2006). They can be found in almost any type of

substrate, but are usually absent from shifting sands and deep silts. Stream environments are preferred due to the abundance of food, which is filtered from the water column and consists of organic matter/ detritus and microscopic plants and animals (such as algae, protozoa, rotifers, diatoms, and desmids) (Korniushin 2006).

As outlined in Table 4 (Chapter 2), there are 16 species of freshwater bivalves found within the Eastern Colorado study area. The majority of these species are found within both the South Platte and Arkansas River Basins, with two species being found exclusively in the South Platte Basin. These species have a myriad of specific ecological and biological parameters. Through the course of artifact examination and research, certain specimens were identified to a species level, but the number was low due to the fragmented and highly modified nature of the assemblage. The only freshwater bivalve species conclusively identified within the assemblage were *Lampsilis siliquidae* (Barnes 1823) and *Anodontoides ferussacianus* (Lea 1834). These species were identified from artifacts recovered from sites within both the South Platte and Arkansas River Basin study areas.

Lampsilis siliquidae (Barnes 1823) was identified in the South Platte River Basin of Eastern Colorado by Henderson (1907; 1924) and Wu (1989), but more recent surveys of molluscs have revealed that the species is no longer found within Colorado (Harrold and Guralnick 2008). The absence of the species within Colorado is likely due to habitat modification and loss. This species is typically found in quiet waters of sandy-mud substrate (Watters 1995). This species was positively identified at multiple site locations in the South Platte and Arkansas River Basins.

Anodontoides ferussacianus (Lea 1834) is found in the mud or sandy substrate of lakes and small quiet streams (Harrold and Guralnick 2008). This species thrives in low energy aquatic environments. When this species was originally identified in Colorado, it was ubiquitous and widespread (Henderson 1907). Modern modifications of the river systems of Colorado, especially in the South Platte, have greatly reduced suitable habitat and thus have reduced populations (Harrold and Guralnick 2008). This species was identified from site locations in the South Platte River Basin, but it is known to occur naturally in both basins. The general and species specific ecological and biological characteristics of freshwater bivalves outlined will be used in conjunction with river and environmental reconstruction in effort to understand freshwater bivalve abundance within the prehistoric landscape.

Arkansas and Platte River Basins: Paleoenvironmental Reconstructions

Due to their geographic proximity, it is reasonable to assume that paleoenvironmental conditions within the Arkansas and South Platte Basins were similar. Because of these parallels, the two river basins will be discussed and analyzed together. A substantial literature base exists for paleoclimatic studies of both the South Platte River in Colorado and more general paleoclimatic conditions within the basin through prehistory, whereas studies centered on the Arkansas Basin are woefully small in number. Therefore, the following discussion of the paleoenvironmental conditions will be centered on the Platte River Basin and augmented by the limited literature from the Arkansas Basin.

The available literature focuses primarily on the Pleistocene to Holocene transition and Holocene aeolian studies. Both of these research foci are important to the

discussion of climatic variability within the Colorado study area. Not all of this literature pertains directly to river characteristics, but findings regarding climatic conditions can be used to infer general river characteristics. A review of the literature is presented below and will be used in combination with the biological parameters discussed above to draw conclusions about prehistoric mollusc availability in the Arkansas and Platte River Basins.

Late Pleistocene-Early Holocene Transition

The Arkansas and Platte River Basins were occupied by prehistoric peoples from the Paleoindian period (approximately 12,000 RCYBP) through European contact, at approximately AD 1700 (Gilmore et al. 1999; Zier and Kalasz 1999). A variety of geoarchaeology and geomorphology studies have been completed and are vital to an understanding of river morphology, terrace systems, and general climatic conditions during the Late Pleistocene (ending at 10,000 RCYBP) and Early Holocene (10,000-7,500 RCYBP).

Terrace systems along the South Platte River have long been recognized as important landscape features often associated with prehistoric habitation and indicate landscape stability along the river course (Holliday 1987; McFaul et al. 1994; Wohl 2001; Zier et al. 1993). The first terrace along the South Platte to have been used by prehistoric peoples was the Kersey Terrace, which began forming along the river system during the last major glaciation (Haynes et al. 1998). Deposition of the terrace occurred as a result of a glacial influx of sand and gravels from the Rocky Mountain glaciers (Haynes et al. 1998). This influx of clastic sediments is attributed to the Pinedale glaciation of the Rocky Mountains and is directly correlated to the Kersey Terrace

aggradation, which ended between 11,500-10,000 RCYBP (Holliday 1987). These data indicate that the Kersey Terrace would have been a stable land surface during the latter portion of the Paleoindian time period, post 10,000 RCYBP.

The modern Arkansas and South Platte Rivers supply Eastern Colorado with sufficient water; however, the water contributions of these rivers during the Paleoindian Period were much greater. Holliday (1987) argues that during 11,500-10,000 RCYBP the South Platte River channel was wide and had braided channel morphology. Zier and co-authors (1993) note the Kersey Terrace is characterized by ridge-swale topography. Ridge-swale topography is typically formed via sediment deposition common in glacial fluvial systems with wide rapidly migrating channels, high bedload transport, and easily erodible banks (Fahnestock 1963). A regional geoarchaeological study along the Kersey Terrace completed by McFaul et al. (1994) revealed the presence of braided channel deposition in the Platte study area and found evidence for the use of channel bars and banks by prehistoric peoples.

Holocene along the Arkansas and South Platte Rivers

The Holocene within the study area and the larger Great Plains Region was a time of significant environmental change and is characterized by shifts between glacial advances and warmer/dryer climatic periods. The Early Holocene is marked by the end of widespread glaciation in the study area (Muhs 1985). The Middle Holocene (7,500-4,000 RCYBP) is characterized by the drastically warmer Altithermal period (Benedict and Olson 1978). The Late Holocene sees cycles of glacial advance and warmer

interstade periods, as evidenced by large eolian dune fields, but the period generally trends toward a more stable warmer climate (Muhs 1985).

The Altithermal was first proposed by Antevs (1948, 1955) and suggests that the Early/Middle Holocene climate was warmer and dryer than the present climate in much of western North America, including the Great Plains and the current Arkansas and South Platte River Basins. Subsequent research by Benedict and Olson (1978) demonstrated both geomorphological and archaeological evidence for the Altithermal period in the Holocene. Archaeological site densities during this time period indicate that prehistoric populations were increasing in the Colorado Front Range and higher altitude Rocky Mountain locations while declining in the lower elevation Great Plains and Colorado Plateau. These data indicate that prehistoric peoples were abandoning the warmer/dryer lower elevations in favor of more hospitable higher elevation locations. Radiocarbon dating studies of eolian dunes corroborate this archaeological evidence indicating two distinct periods of sand movement, suggesting two distinct warm and dry periods during the Altithermal (Gaylord 1982; Grigal, Severson, and Goltz 1976; Holliday et al. 1985).

During the Altithermal period the down-cutting of the abandoned Kersey Terrace floodplain formed the Kuner Terrace along the South Platte River (Holliday 1987). The formation of the Kuner Terrace suggests a period of stability, but the warm and dry climatic conditions likely meant decreased volume in the South Platte River. Despite decreased water volume, the river channel was likely more stable than during the preceding Pleistocene. The Kuner terrace was abandoned approximately 6000 RCYBP (McFaul et. al 1994). Cultural deposits from this period are almost exclusively found

within eolian deposits on the terrace, further indicating the warm and dry climatic conditions during this time period (McFaul et al. 1994).

During the Late Holocene there is another period of markedly warm and dry climatic conditions. Benedict (1973, 1975) terms this period the interstade and is supported by extensive eolian dune activity, most notably in the Nebraska Sand Hills. The interstade period occurs between the Triple Lakes and Audobon glacial advances in the Colorado Front Range. Via radiocarbon dating, extensive dune fields in extreme Eastern Colorado and Nebraska have been directly correlated to the interstade period, from 3000-1500 RCYBP (Ahlbrandt and Fryberger 1980). Archaeological evidence also corroborates the stabilization of the dunes by 1500 RCYBP, as evidenced by the habitation of the Hardin Terrace along the South Platte River (Ahlbrandt and Fryberger 1980).

As described, the Holocene is characterized by drastically changing environmental conditions, which oscillated between neo-glacial advances and periods of extreme warming. Despite climatic oscillations, the Holocene is generally characterized as warmer as and dryer than the Pleistocene. Additionally, the Late Holocene sees the stabilization of climatic shifts and a trend of characteristically warm and dry climates. Changing environmental conditions during the Holocene undoubtedly resulted in changing river conditions in the Arkansas and South Platte Basins. During warm/dry periods these rivers were no longer fed by extensive glacial melt waters and although still perennial, would have been more stable and less variable than during the Pleistocene. This stability and decreased flow rate would have resulted in lower energy within the river system and would in turn provide more permanent aquatic habitats (Gilmore 1989).

River System Characteristics and Implications for Mollusc Populations

The freshwater mussel species used by prehistoric peoples in the Arkansas and South Platte River Basins require specific environmental conditions to grow and thrive. The conditions most conducive to successful mussel growth include low energy river environments, which allow for quiet waters and pooling, and stable year-round river/stream systems that provide suitable habitat. Additionally, mussel populations depend on an abundance of detritus and microorganisms suspended within the water column. These factors, the physical environmental conditions required by mussel population and food/resource availability, will be examined in order to assess whether paleoenvironmental conditions would have been capable of supporting freshwater mussel populations and thus providing a raw material for prehistoric exploitation.

The river systems present during the Late Pleistocene through the Early Holocene was likely an inhospitable environment for bivalve species commonly used by the prehistoric peoples of Eastern Colorado. These systems were fed primarily by glacial discharge which would have varied seasonally and variations in discharge would have allowed for rapidly migrating channels and likely high energy depositional environments (Gilmore 1989). The end of the Pinedale glaciation in the study area, between 15,000 and 12,000 RCYBP, caused an increase in river discharge (Madole 1986; Muhs et al. 1999). Migrating channels and high energy depositional environments would have made it difficult for mussel populations to establish and thrive. High flow rates and the lack of a stable channel would have prevented the establishment of large mussel populations during the Pleistocene and Early Holocene. Additionally, the extremely cold environmental conditions during these time periods would have prevented the extensive

growth of microorganisms and the limited the amount of detritus within the water column. This is not to say that mussel populations were incapable of living under these conditions, but populations were likely minimal, thus severely limiting their availability to prehistoric peoples.

The Middle Holocene and Late Holocene periods of stable warmer and dryer climates were likely the most conducive to supporting extensive freshwater mussel populations. During these periods the rivers of Eastern Colorado would have more adequately satisfied the low energy and stable channel parameters required by freshwater mussels. Warmer conditions during these periods of the Holocene were also more conducive to producing an abundance of detritus and microorganisms necessary for freshwater mussel subsistence. The dramatic climatic oscillations of the Holocene undoubtedly affected the viability of freshwater mussel populations, but the periods of warmer and dryer stable climatic conditions would have better supported freshwater mussel populations than those present during the Pleistocene.

River System Characteristics and Changes in Artifact Frequencies

As presented in Chapter 3, the frequency of archaeological sites containing mollusc shell artifacts, as well as the sheer volume of shell artifacts, increases dramatically from the Pleistocene through the Holocene, with the highest volume attributed to the Late Holocene or the Late Prehistoric. An increase in the use of mollusc shell through time, including freshwater mussels, has most commonly been attributed to exchanges and changes in prehistoric cultural practices rather than environmental changes (Breternitz and Wood 1965; Cassells 1983; Gilmore 1989; Wood 1967).

The prehistoric use of mollusc shell within Eastern Colorado is commonly linked to the Colorado Plains Woodland mortuary practices during the transition period from the Archaic (6400 B.C. –A.D. 150) to the Late Prehistoric (AD 150–1540). In the Platte River Basin this time period corresponds to the Late Archaic (1200 B.C.–A.D. 150) to Early Ceramic Period (A.D. 150–1150) transition, while in the Arkansas basin it is marked by the Developmental Period (A.D. 100–1050) (Gilmore 2008; Zier and Kalasz 1999). Burials attributed to this mortuary complex are found both within the Platte and Arkansas Basins (Table 11), but based on the literature and artifact research are more prevalent in Northeastern Colorado (Johnson and Johnson 1998). Shells characteristic of the Colorado Plains Woodland burials include freshwater clam shell pendants, shell disk beads (of probable marine origins), and marine gastropod beads (*Olivella* spp.) (Black 1995).

It has been proposed that the characteristic burial practices of the Early Ceramic and Developmental periods in Colorado are the result of cultural influences from the Central Plains (Breternitz and Wood 1965; Johnson and Johnson 1998). This implies that people occupying Eastern Colorado at this time were on the periphery of the Plains Woodland peoples to the east. However, more recently, similarities in burial practices between Eastern Colorado and the Central Plains of Kansas and Nebraska have been attributed to the parallel development of cultural institutions (Gilmore 2008). Regardless of the mechanism for development, burials attributed to this mortuary complex have been one of the primary (and somewhat limited) forums for the discussion of the prehistoric use of shell in Eastern Colorado.

Table 11: Burials in Eastern Colorado Linked to the Colorado Plains Woodland and Containing Mollusc Artifacts.

Number	Site Name	Basin	Burials	Mollusc Shell Artifacts	Reference
5AM0003	Hazeltine Heights	Platte	Seven Burials, Three Containing Shell	Burial 2= *Olivella* Beads Burial Burial 6=*Olivella* Beads and *Unio* Pendant Burial 7=*Olivella* Beads and *Unio* Pendant	Buckles et al. 1963; Breternitz 1972; Scott and Brikedal 1972
5BL0062	Sadar Site	Platte	Two Burials	380+ *Unio* Beads	Biggs 1966
5EP1177	East Fork Burial	Arkansas	One Burial	One Pendant	Chomko and Hoffman 1993
5CH0003	Chubbuck-Oman	Platte	One Burial	42 *Olivella* Beads One *Unio* Pendant	Tipton 1966
5JF0223	Magic Mountain	Platte	Four Burials, One Containing Shell	Six *Olivella* Beads	Irwin-Williams and Irwin 1966
5JF1780	Lena Gulch	Platte	Two Burials, One Containing Shell	Burial 1= One Pendant	Jepson and Hand 1999
5LR0284	Lightening Hill	Platte	One Burial	Two *Lampsilis siliquoidea* Pendants	LOPA Records
5LR1683	Roberts Ranch Burial	Platte	One Burial	One Large *Lampsilis siliquoidea*, One Small Pendant, Over 100 Disk-Shaped Beads, Several *Olivella* Beads	Black 1995
Morgan County	Wildcat Creek Burial	Platte	Three Burials	*Unio* Pendants	Breternitz and Wood 1965
5MR0378	Gahagan-Lipe Site	Platte	Six Burials, Two Containing Shell	Burial 2= Pendant Burial 5= 6 *Unio* Pendants	Scott and Birkedal 1972
5MR389	Clark Site	Platte	Eight Burials	One Bead	Gilmore et al. 1999
5MR0617	Howard Rollins Burial	Platte	Three Burials	One Associated *Unio* Pendant	Breternitz and Wood 1965
5PE0009	Beacon Hill	Arkansas	One Burial	249 Beads (*Olivella* and *Unio* disc)	Black et al. 1991
Denver County	Whitman Burial	Platte	Unknown	Beads and Bracelets	Irwin-Williams and Irwin 1966
5WL1986	Garcia Site	Platte	Twenty-seven Burials	Beads and *Unio* Pendants	Greenway 1961, Gilmore et al. 1999

Although cultural exchange and developments were likely important factors in the observed changes in use of freshwater molluscs in Eastern Colorado, the environmental conditions and biological parameters required to support populations have been omitted from the discussion. Changing environmental conditions along the Arkansas and South Platte River systems, as outlined in the above sections, played an important role in the resource or raw material availability. If freshwater mussel populations could not successfully grow and thrive in the river systems, then they were unavailable for use by prehistoric peoples. The low quantities of freshwater mollusc artifacts observed during the Pleistocene and Early Holocene Periods can be attributed in part to the inhospitable environmental conditions that existed. Additionally, the dramatic increases in the use of freshwater molluscs during the Late Holocene in both the Arkansas and South Platte River Basins can be attributed in part to the favorable environmental conditions. Cultural influences definitely were a component of changing uses, but environmental conditions played a role in availability. Environmental parameters are often over looked in lieu of cultural explanations. However, in terms of freshwater molluscs satisfactory environmental conditions undoubtedly played a factor in their availability to prehistoric peoples and thus environmental conditions had an effect on the use of freshwater mussels by prehistoric people of Eastern Colorado.

Discussion

Changing climatic conditions throughout prehistory in Eastern Colorado have impacted paleoenvironments along the Arkansas and South Platte Rivers. Glacial advances and characteristically cooler climates during the Pleistocene and Early Holocene created conditions that were not favorable for freshwater mussel populations.

The Middle and Late Holocene were characterized by extreme climatic oscillations, with periods of minor glacial advance followed by periods of warm and dry conditions. Despite oscillations, the Middle and Late Holocene in general were markedly warmer than the Pleistocene and are characterized by a general warming trend. Periods of stability during warm and dry periods, especially during the Late Holocene, were the most hospitable for freshwater mussel populations. During warm and dry periods the river morphology was ideal and there was an abundance of food available in the water column.

Comparison of Eastern Colorado and Eastern Plains Freshwater Mollusc Artifacts

Prehistoric peoples beyond Eastern Colorado were using freshwater mollusc shell. For the purposes of this discussion, the use of mollusc shell in the adjacent Central Plains is examined and compared to that of Eastern Colorado. The Central Plains geographic region is of interest because this region had an extensive prehistoric freshwater shell industry centered on the Plains Woodland cultural practices, for which comparisons have been made to Colorado Plains Woodland cultural practices. A significant literature base for the use of mollusc shells exists in the Central Plains region and this literature will be examined in an effort to understand cultural and environmental factors affecting freshwater mollusc use.

Within this discussion, the Central Plains are defined by the geographic boundaries of Kansas and Nebraska (Gilmore et al. 1999). The Missouri River is the dominant drainage in this area, and along with its tributaries is the source of freshwater molluscs within the region (Warren 2000). The frequency of freshwater molluscs in the archaeological record is much higher in the Central Plains than in Eastern Colorado. The

prevalence of shell artifacts within Central Plains' assemblages is greater than in Eastern Colorado and these larger sample sizes have afforded more widespread study (Blakeslee 2000; Dorsey 2000; Myers and Perkins 2000; Warren 1991 and 2000). Similar to Eastern Colorado, mollusc shell has been examined in terms of the Plains Woodland mortuary complex. Beyond these studies, archaeologists in the Central Plains have begun to examine freshwater mussel in terms of the environmental parameters that control their growth and the implications of this for archaeological interpretations (Blakeslee 2000; Dorsey 2000; Warren 1991). Blakeslee (2000) compares studies of freshwater mussel shells in the Central Plains to bison kills, arguing that a wealth of information pertaining to seasonality, population structure, and utilization strategies can be gleaned from freshwater mussel assemblages. Specifically, by examining the chemistry and physical structure of a large mollusc assemblage, he was able to ascertain that the collection represented molluscs exploited and deposited by prehistoric peoples in the late summer/fall time period. Additionally, due to sheer volume of freshwater molluscs found archaeologically, the exploitation of molluscs in terms of subsistence has been examined (Myers and Perkins 2000). These authors found that prehistoric peoples of the central plains were able to supplement their dietary needs with locally available mollusc species. They even went so far as to speculate that prehistoric peoples maintained/exploited mollusc population dynamics to maximize subsistence yields.

Presently, the Missouri River in the Central Plains is capable of supporting much larger and more diverse freshwater mussel populations than either Arkansas or South Platte Rivers of Colorado (Gordon 1982; Hoke 2000). Population sizes and species diversity within the Missouri River are significantly greater due to more favorable environmental conditions. The primary factor that accounts for these differences is the

presence of more suitable and extensive habitats. One of the main dissimilarities between the habitats provided in Eastern Colorado and those of the Central Plains region is change in river gradient. Changes in elevations along the Missouri River in the Central Plains are much less and therefore allow for more suitable calm water freshwater mussel habitats (Gordon 1982; Hoke 2000).

Differing use of shell in Eastern Colorado, when compared to that of the Central Plains, especially during the Late Prehistoric, has often been attributed to cultural influences and cultural exchange (Breternitz and Wood 1965; Johnson and Johnson 1998). However, more recently, similarities have been explained via parallel development of cultural institutions (Gilmore 2008). However, environmental factors may play a role in these perceived cultural differences; the differences in the amount of freshwater mussel shell recovered from archaeological sites is likely a factor of local environmental availability. Freshwater mussel habitats varied dramatically between these two geographic locations and thus undoubtedly affected availability to prehistoric peoples. Therefore, it is unreasonable to assume that differences in the use of shell between Eastern Colorado and the Central Plains can be attributed solely to cultural differences. As outlined above, there is a significant amount of continuity between mortuary practices and the material record from these two locations, therefore environmental factors affecting resource availability cannot be omitted from the discussion. Perhaps perceived cultural differences are based on environmental differences that impact the material record observed at archaeological sites.

Conclusion

Paleoenvironmental reconstructions can lead to a better understanding of freshwater mussel availability. Pleistocene and Early Holocene environmental conditions along both the Arkansas River and South Platte were inhospitable and therefore severely limited freshwater mussel populations. Low or non-existent freshwater mussel populations meant that prehistoric peoples had limited access to local raw materials. Warm and dry periods during the Middle and Late Holocene provided more favorable habitat conditions for freshwater mussel populations within the study area. Higher local raw material availability allowed for increased utilization of freshwater molluscs by prehistoric peoples. Previous examinations of mollusc shell artifacts in Eastern Colorado have attributed variations in use solely to cultural developments and cultural influences. The examination of paleoenvironment presented within this chapter argues that environmental conditions affecting resource availability coupled with cultural changes account for the observed patterns of mollusc shell through time in Eastern Colorado. Additionally, cultural and environmental similarities and differences in terms of prehistoric freshwater mussel utilization in Eastern Colorado and the Central Plains were examined in an effort to further understand how environmental factors can play an important role in the material record left by prehistoric peoples. Too often, environmental factors that affect resource availability are overlooked in favor of culturally based explanations of similarities and differences between geographic regions.

CHAPTER 5: MOLLUSC TRADE AND EXCHANGE

This chapter will examine the marine mollusc shell found within Eastern Colorado in terms of a speciation study, discussions of site types from which marine shell was recovered and a general discussion of trends in marine shell use through time. The marine artifacts examined from the Arkansas and Platte River Basins will then used to formulate possible mechanisms and routes of movement of marine molluscs into the Eastern Colorado study area. Included within this discussion will be general summaries of currently proposed trade and exchange systems in Eastern Colorado and more broadly the mechanisms by which marine shell moves into, within, and out of regions geographically adjacent to the study area. Adjacent areas to be discussed include the Southwest, the Great Basin, and Central Plains areas. Hypotheses and mechanisms by which marine molluscs entered Eastern Colorado will be developed using these data, speciation studies, artifact forms, and stylistic similarities with adjacent geographic areas. A brief examination of possible freshwater mussel trade and exchange mechanisms will also be addressed. The role of Contact period exchange will also be briefly discussed. Finally, hypotheses will be presented as to the role of trade and exchange in Eastern Colorado, as manifested through presence of marine shell found archaeologically.

Marine Molluscs in Eastern Colorado

A total of 61 conclusively marine artifacts from 11 known archaeological sites and two private collections were examined in the current study (Table 12). Marine artifacts were identified using field guides, comparisons to the University of Colorado

Invertebrate Study collection, and by Dr. Laura Kozuch, curator at the Illinois Transportation Archaeological Research Program. When possible, artifacts were identified to the species level, but due to cultural and taphonomic modifications many could not be identified to this level.

Table 12: Marine Artifacts Studied From Eastern Colorado.

Site Number	Artifact Count	Marine Artifacts	Marine Source Waters
5JA0000a	1	Unknown Gastropod	Unknown
5LR0013	2	*Olivella*, spp. unknown. Unknown Gastropod	Pacific or Atlantic
5DA0095	1	Family Ostreidae	Pacific or Atlantic
5PE0081	10	Family Ostreidae	Pacific or Atlantic
Roy Coffin Collection	3	*Olivella*, spp. unknown	Pacific or Atlantic
5LA5420	1	*Cypraea*, spp. unknown	Not Coastal Waters of North America
5BA0118	1	*Olivella* either *baetica* or *biplicata*	Pacific
5LR0263	1	*Dentalium*, spp. unknown	Pacific; Northwest Coast
5LA1057	2	*Olivella baetica; Jaspidella jaspidea*	Pacific; Atlantic
5LA1211	4	*Olivella*, spp. unknown	Pacific or Atlantic
5LA1415	30	*Olivella* spp. either *dama*, *gracilis*, or *nivea*	Pacific or Atlantic
5LA1485	1	Family Ostreidae	Pacific or Atlantic
Gary Weinmeister Private Collection (WD-1)	4	*Olivella* spp. either *dama*, *gracilis*, or *nivea*	Pacific or Atlantic

Marine shells represent 8.8 percent (n=61) of the total Eastern Colorado mollusc collection, that includes 691 artifacts. Using the artifact classification system outlined in Chapter 2, the majority of these artifacts (80.3 percent; n=49) fall into the worked/ornamentation/ bead classification. Artifacts that fall within this category include

three positively identified species, including *Cypraea,* spp., *Dentalium,* spp., and *Olivella,* spp. The only artifacts that are not classified as beads are non-modified oyster shell, which comprise 19.6 percent (n=12) of the total marine assemblage. The unknown marine gastropods identified within in the collection are discussed briefly, but they lack contextual information, which renders them somewhat unusable within this discussion.

One *Cypraea,* spp. mollusc shell was examined within the collections of the Fort Carson Cultural Resources Program, from archaeological site 5LA5420 in the Arkansas River Basin (Figure 17). Examinations of site form and report records examined at both Fort Carson and the OAHP yielded little information about this site age/cultural affiliation or the artifact itself, other than to indicate that it was collected from a surface context. This genus of marine mollusc is native to Indo-Pacific and Mediterranean waters; they are not found along the coastal waters of North or South America. The source location of this marine shell is of particular interest because it is highly unlikely that this artifact entered Eastern Colorado solely via North American prehistoric trade networks. This artifact likely entered the Arkansas River Basin through European or Contact Period exchange mechanisms.

The examination of artifacts at LOPA yielded one *Dentalium* spp. marine mollusc recovered from site 5LR0263 in the South Platte River Basin (Figure 5). This site was thoroughly examined by Newton (2008) and through various analyses it was found to date to the Protohistoric/Contact Period, from 1800–1840. This marine mollusc artifact was briefly examined and reported to have entered the site via contact period/European influenced trade and exchange mechanisms (Newton 2008).

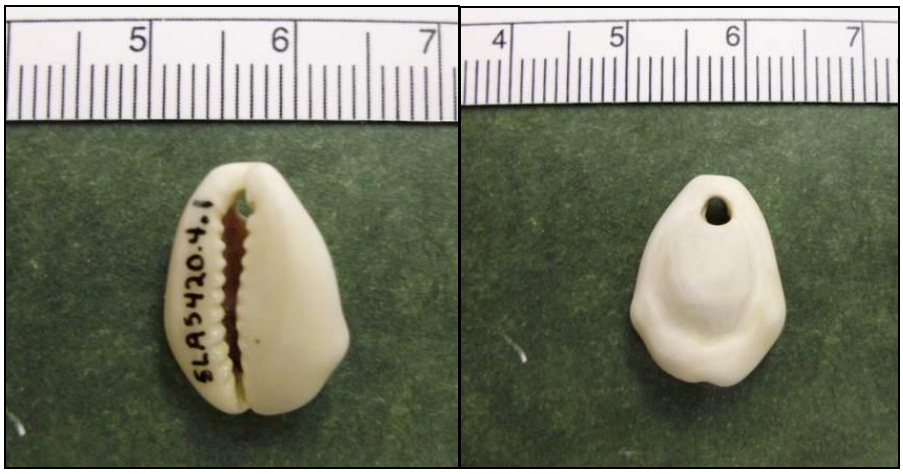

Figure 17: *Cypraea,* spp. Artifact Examined From 5LA5420 (Catalog Number 5LA5420.FC.1)

The majority (73.7 percent; n=45) of marine artifacts studied from Eastern Colorado are *Olivella,* spp (Figure 18). Many of these artifacts have been culturally modified, making them somewhat difficult to speciate, but possible species include *Olivella baetica, Olivella biplicata, Jaspidella jaspidea, Olivella dama*, *Olivella gracilis*, and *Olivella nivea* (Kozuch 2002; Rehder 1996; Woodring 1966). These artifacts came from five sites and two private collections. All have been modified to allow for use as a decorative bead. This modification includes the removal of the apex and grinding along the aperture.

Figure 18: Sample of *Olivella,* spp. Artifacts from 5LA1415.

An unknown *Olivella* spp. was studied from the DMNS site collections reportedly associated with the Lindenmeier Site (5LR0013) in the South Platte River Basin. This is a stratified site with documented Paleoindian through Late Prehistoric occupations. The provenience/accession card accompanying the collection indicates that this artifact, as well as a small engraved piece of steatite, were attributed to 5LR0013 and were donated to DMNS from a private collector. Therefore, their actual provenience is somewhat suspect. Personal communications with Isabel Tovar, Collections Manager at DMNS, and Cody Newton, a CU graduate student studying the collection, indicate that the two marine artifacts reportedly from the site are likely not from Lindenmeier based on thorough re-examinations of excavation records and notes.

Also studied from private collections were seven *Olivella* spp. artifacts from the Roy Coffin Collection at the Fort Collins Museum and the Garry Weinmeister collection at LOPA. Contextual information about the Roy Coffin Collection artifacts are unknown, except to that they were recovered from northeastern Colorado, assumed by the author to be found from within the South Platte River Basin. The four *Olivella* spp. artifacts from the Garry Weinmeister collection were recovered from a single site in Weld County and are either *Olivella dama* or *Olivella nivea.* The site is dual component, with both McKean Complex and Plains Woodland occupations, but Garry Weinmeister believes the artifacts to be associated with the Woodland component. He suspects there may have been a Woodland burial at the site, but never found direct evidence.

The remaining 37 *Olivella* spp. artifacts within the scope of this study are from site collections from the Arkansas River Basin; sites 5BA0118, 5LA1057, 5LA1211, and 5LA1415. All have species that can be sourced to either Pacific or Atlantic waters,

except for 5BA0118, which has species strictly from the Pacific coast. Examinations of site forms and reports do not provide occupation/site age for 5BA0118 and 5LA1415. 5LA1057/Trinchera Cave had the largest collection (n=30) of *Olivella* spp. artifacts. Species include *Olivella baetica* and *Jaspidella jaspidea* from Pacific and Atlantic waters, respectively. Excavations at Trinchera Cave occurred in the 1960s and 1970s under various archaeological directors (Wood 1974 and 1976). As such, many of these artifacts lack provenience other than site documentation. The final site to contain *Olivella* spp. is 5LA1211 and dates to the Sopris Phase (900–750 RCYBP) in the Arkansas River Basin. Other sites within Eastern Colorado have been reported to contain *Olivella* spp. artifacts, such as Hazeltine Heights and Chubbuck-Oman (see Table 11), but the physical collections could not be relocated by the author and were thus not included within the study assemblage.

Oyster shells and fragments were recovered from two archaeological sites, 5LA1485 and 5PE0081, both of which are located in the Arkansas River Basin. The site forms and associated reports were examined for these sites at the OAHP. 5LA1485 was identified via investigations conducted by Trinidad State Junior College in 1965. The site form and associated report mention no temporal affiliation for the site and oyster shell is not included within the site descriptions or artifact catalogs (Baker 1965). As with 5LA1485, the site form and associated reports associated with 5PE0081 neglect to mention the oyster shell artifacts (Olson 1968). Due to the lack of contextual and descriptive information about these artifacts, it is extremely difficult to speculate on their use or purpose. The presence of oyster shell within the study collection is puzzling in that shell is all unmodified, but is of obvious marine origin. In a coastal environment the

presence of these shells would be interpreted in terms of prehistoric subsistence, but given the geographic location of these oyster shells, the use of these shells for subsistence purposes has to be ruled out. It is also possible that these artifacts are not associated with the prehistoric occupation of the site, but may be related to historic or modern discard.

General Trade and Exchange Networks

Goods, cultural practices, technologies, ideas, and a myriad of other commodities moved among prehistoric peoples within the Eastern Colorado study area and adjacent localities. Movement and exchange between Eastern Colorado prehistoric populations and adjacent groups is often examined in terms of trade with Southwestern populations (Cassells 1983; Breternitz and Wood 1965; Johnson and Johnson 1998; Zier and Kalasz 1999). A more limited context exchange has been proposed with Eastern Plains' populations to the east (Cassells 1983; Gilmore 1989; Wood 1967) and even more limited with Great Basin groups to the west. A variety of goods, such as cultural traditions, lithic materials, and ideas, likely moved between these cultural groups, but for the purposes of this study the primary focus will be the trade and exchange of mollusc shell artifacts.

Marine Species and Identification

The majority of mollusc species are found within marine ecosystems, where there are nearly 100,000 marine species, many more than freshwater species (Wye 2000). Due to the large array of species, only the species found in the prehistoric archaeological record of Eastern Colorado will be discussed here in detail. Marine molluscs are represented by 6 classes; Gastropoda, Bivalvia, Cephalopoda, Scaphopoda, Polyplacaphora, and Monoplacophora. The classes represented in the artifacts of Eastern Colorado are Gastropoda, Bivalvia and Scaphopoda. Table 5 describes the marine

molluscs within the Eastern Colorado assemblage in terms of naming conventions and distribution. Although this species list pertains to Eastern Colorado artifacts, complete lists of marine artifacts used by adjacent prehistoric peoples of the American Southwest, Central Plains, and Great Basin exist and show a larger variety of species (Bennyhoff and Hughes 1987; Blakeslee 1997; Carlson 1997; Haury 1976; Jernigan 1978; Nelson 1991).

Table 13: Descriptions of Marine Shells Studied in Eastern Colorado. Compiled from Rehder (1981), Kozuch (2002), Keen (1963), Keen (1971).

Scientific Name	Common Name	Distribution
Cypraea spp.	Cowery	Non North American Coastal Waters. Probable Indo-Pacific in Origin
Dentalium spp.	Tusk Shells	Pacific, North-West Coast of the United States
Ostreidae	Oyster	Pacific and Atlantic
Olivella biplicata (Sowerby 1825)	Purple Dwarf Olive	Pacific, British Columbia to Baja California
Olivella baetica (Carpenter 1864)	Baetic Dwarf Olive	Pacific, Alaska to Baja California
Olivella dama (Wood 1828)	Dama Dwarf/Lady Olive	Pacific, Gulf of California
Olivella gracilis (Broderip & Sowerby 1829)	Graceful Dwarf Olive	Pacific, Gulf of California
Olivella nivea (Gmelin 1791)	West Indian Dwarf Olive	Atlantic, Southeastern Florida to Texas and the West Indies
Jaspidella jaspidea (Gmelin 1791)	Jasper Dwarf Olive	Atlantic, Southeastern Florida to Curacao

Field guide descriptions and diagrams were used to identify the marine mollusc shell examined within the archaeological collections of this study (Keen 1963; Rehder 1996; Wye 2000). Additionally, species identifications were completed by Dr. Laura Kozuch, curator at the Illinois Transportation Archaeological Research Program, using photographs taken by the author. The list provided above probably does not represent the totality of marine species found in prehistoric archaeological collections of Eastern Colorado. Instead, this listing summarizes marine shells that have been positively

identified among the artifacts within the scope of this study. Shell artifacts of marine origin are frequently heavily modified, making species identification difficult and often impossible. Included within this category are robust shell disk beads, which are sometimes thought to be manufactured from marine clam species such as *Tivela* spp., *Glycymeris* spp. or *Laevicardium* spp. (Black 1995; Jernigan 1978); however, because of intense modification, no conclusive species identifications can be made.

The assemblage from Eastern Colorado contained 31 shell disk beads, both complete and fragmented. For the most part, these artifacts were cataloged as unknown shell type, due to their highly modified state. However, a portion of the artifacts were classified as freshwater based on comparisons with other conclusively known freshwater species from the same specific site assemblage (for example artifacts from 5LA1211). As a function of the freshwater mollusc raw material, these conclusively freshwater disk beads were thin and brittle (Figure 19). The others classified as unknown shell type were more robust and thick, likely manufactured from marine shell, but diagnostic features required to identify species are no longer present (Figure 20). Shell disk beads of probable marine origin are common in the Southwest shell economy (Jernigan 1978). Freshwater counterparts noted within the Eastern Colorado study collection may represent copying of the Southwestern style shell disk beads. The lack (or economic cost) of marine raw material may have necessitated the use of freshwater shell to manufacture this artifact category, suggesting that environmental availability of shell raw material may be a driving force in the artifact classes/types observed within Eastern Colorado.

Figure 19: Example of Freshwater Shell Disk Beads from 5LA1211 (Catalog Numbers 5LA1211.TD.7– 5LA1211.TD.11).

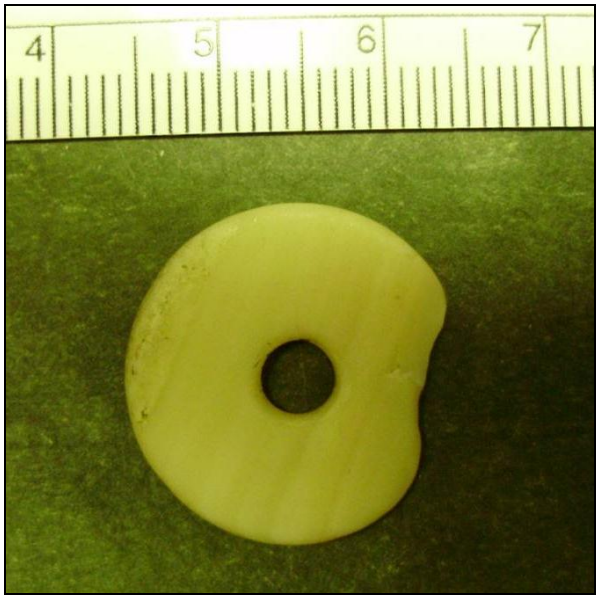

Figure 20: Example of Robust and Likely Marine Shell Disk Bead from 5LA1413 (Catalog Number 5LA1413.TD.5).

Exchange with the Southwest

The archaeology of the Southwest of particular relevance to this discussion of shell use centers around the Ancestral Puebloan, Mogollon, and Hohokam cultures (when the term Southwest is used in the following discussion it is meant to refer to these groups). These cultural groups arise during the equivalent of the Late Archaic period in Eastern Colorado (Jernigan 1978). Ancestral Puebloan sites stretch from southwestern

Colorado south into present day Arizona and New Mexico. Mogollon sites span the southern half of New Mexico and southeastern Arizona, while Hohokam sites are located in southern Arizona. The cultural chronologies used in this discussion were derived from Lipe (1999) and Jeringan (1978:29). The Ancestral Puebloans were the closest geographically to the prehistoric peoples of the Platte and Arkansas River Basins, but it is likely that all three groups played an influential role in the trade and exchange of shell artifacts due to their close cultural and geographic proximity.

Marine shell within the Southwest context is almost exclusively used to produce artifacts of personal adornment, thus artifacts are limited to these objects and waste/debitage material associated with their manufacture. The use of exotic marine shell began as early as the Basketmaker II period, when the Ancestral Puebloans manufactured shell disc beads (Lindsey 2005). Shortly thereafter, disc beads appear in the archaeological record of both the Mogollon and Hohokam peoples (Jernigan 1978:34-35). Both *Olivella* spp. beads and complete shell pendants emerged within these cultural groups shortly after the disc beads. Over time, both forms and species utilized elaborated and anthropomorphic and zoomorphic pendants, bracelets, rings and acid etched shells were being produced during the height of utilization (Haury 1936; Haury 1974; Jernigan 1978).

The Hohokam are often regarded as the shell merchants of the Southwest (Haury 1976; Jernigan 1978), suggesting an appreciation for shell in terms of personal adornment and for its commercial value. As such, the Hohokam were the main suppliers of shell raw materials and predominantly acquired shell from the Gulf of California. A small fraction of marine shell in the Southwest was obtained from coastal California outside the

gulf and an even smaller portion was obtained from Atlantic waters (Jernigan 1978). Ornaments produced by these groups were almost entirely manufactured from marine mollusc shell. This bias for marine shell was most likely the result of raw material characteristics; freshwater molluscs available locally are more brittle and fragile than their marine counterparts.

An understanding of the changes in the manufacture of shell ornaments through time within the Southwest is of great important in terms of understanding relationships between Southwestern and Eastern Colorado shell artifacts. The chronology of change observed in the Southwest can then be applied to changes observed in Eastern Colorado. Because the Hohokam were the most likely producers and distributors of these artifacts, their manufacturing history will be examined in detail.

As mentioned above, manufacture of shell artifacts began during the Pioneer period and production was somewhat limited compared to later periods. The Sedentary period was characterized by a wide variety of techniques and shell species being used to produce the greatest variety of ornament types, but the peak in quantity of shell artifacts occurred later during the Classic (Neitzel 1991). Classic period artifacts are more standardized, less elaborate, and more abstract/geometric than those from the Sedentary period. These shifts in production and distribution have been shown to be correlated to changes in political organization, craft specialization, and ritual behavior in the Southwest (McGuire and Howard 1987; Neitzel 1991). The Classic period marks the beginning of the end for the Hohokam, thus it is assumed that the end of the procurement and manufacturing of shell artifacts by the Hohokam coincides with the terminal date for this period, A.D. 1450.

The origins of marine shell in Eastern Colorado have been seldom been addressed in past research. Irwin-Williams and Irwin (1966) note an influx of Southwestern artifacts and attribute these changes in the archaeological record to the movement of Southwestern peoples into Eastern Colorado. More recent studies have begun to examine marine shell trade networks as the source of artifact similarities between Eastern Colorado and the Southwest (Black et al. 1991; Gilmore 2008; Kozuch 2002). When examined, prehistoric marine mollusc shell found archaeologically in the study area is often attributed to trade and exchange activities occurring with Southwestern peoples. This is a logical assumption because marine shell is prevalent within archaeological collections from the Southwest, in particular within Hohokam affiliated sites (Gladwin et al. 1938; Haury 1976; Jernigan 1978; Nelson 1991). Of importance to Eastern Colorado studies is literature addressing the movement of *Olivella* spp. shell beads into the Southwestern region (Brand 1938; Ford 1983; Nelson 1991).

Various published discussions and maps show possible marine shell trade routes into the Southwestern region, predominantly originating at the Pacific coast (Brand 1938; Ford 1983; Heizer 1941, 1978; Jernigan 1978). These proposed routes originate at the Gulf of California, then head east toward present day Arizona following any number of drainages. The Hohokam are the shown to be the primary shell traders, thus goods arrive first in southern Arizona and then radiate to the north, to adjacent Southwestern cultural groups. It is important to note that despite being more or less centrally located between two marine sources (the Pacific Coast including the Gulf of California and the Gulf of Mexico's Atlantic waters), artifacts from Southwestern sites are predominantly of Pacific origin (Jernigan 1978; Nelson 1991). Thus, exchange models suggest a strong

procurement and manufacturing industry along the Pacific Coast, centered at the Gulf of California. The Hohokam seem to have supplied both themselves and the rest of the Southwest with shell, often directly procuring shell raw materials and manufactured shell items from California (Bradley 1999; Jernigan 1978). It is assumed that shell then moved northeastward through various routes into the Arkansas and South Platte River Basins of Colorado, but specific routes into Eastern Colorado and models for exchange are absent within the literature.

The diversity of marine species used and forms represented in Southwestern shell artifacts are much more elaborate than those forms observed in Eastern Colorado (complete summaries Jernigan 1978; Nelson 1991). However, there is continuity between some artifact types, including disc beads and spire lopped *Olivella* spp. beads. These shell artifact types are prevalent in Early Ceramic/ Developmental Period burials in Eastern Colorado (as shown in Table 11) but are also found at sites with non-burial contexts in both the Arkansas and South Platte Basins. Because of this continuity, artifacts of a marine origin in Eastern Colorado are rarely attributed to trade networks beyond the scope of direct exchange with the Southwest.

Exchange with the Great Basin

The Great Basin was defined by the explorer John C. Fremont as the region between the Rocky Mountains and the Sierra Nevada ranges (Fowler and Fowler 2008). This region is hydrologically defined and encompasses portions of Idaho, Oregon, Utah, Nevada, and California. Although the Great Basin is removed geographically from the Eastern Colorado, the use of shell within this region may lend clues to patterns of marine mollusc use observed in the Arkansas and Platte River Basins. This comparison may be

particularly useful in understanding the origins of shell species not seen in Southwest or Central Plains sites. Additionally, more recent studies of Great Basin archaeology argue that Archaic and Fremont period sites of the western Colorado Plateau are inherently linked to sites in the Great Basin (Fowler and Fowler 2008). Therefore, the Great Basin may not be as geographically removed as previously thought. For the purposes of this discussion, the chronology of the Great Basin was adapted from schematics presented in Bennyhoff and Hughes (1987).

Similar to the Hohokam of the Southwest, prehistoric peoples of the Great Basin were involved in the trade and exchange of marine mollusc shell from coastal California. Due to the prevalence of Pacific coast marine species, studies of Great Basin shell use are inherently linked to trade and exchange with cultural groups in California. Unlike the Hohokam, who predominantly acquired shell raw materials from the Gulf of California, Great Basin populations were acquiring shell along the entire coast of California as well as the Gulf. Bennyhoff and Hughes (1987) propose four major trade network centers through which Great Basin peoples acquired shell beads and ornaments: northern California (King 1978), central California (Davis 1961), southern California (Davis 1961), and the Gulf of California (Jernigan 1978). Mollusc shell artifacts including disc beads, spire-lopped *Olivella* spp. beads and *Dentalium* spp. beads are the most common forms found among shell artifacts of the Great Basin (Bennyhoff and Hughes 1987).

The presence of shell artifacts and evidence for the trade/exchange of shell in the Great Basin seems to predate that of the Southwest. The Western Great Basin has been a major shell redistribution center since 6000 B.C., while the eastern portions of the region show involvement in this trade and exchange by 2000 B.C. (Bennyhoff and Hughes

1987; Hester 1973). Bennyhoff and Hughes (1987:116, 157-161) developed chronologies based on marine shell types and form for the Western Great Basin. Marine shell trade in the Western Great Basin appears to have two peaks, one from 2000-200 B.C. and then another during the Late Prehistoric period, A.D. 700-1500. Specific artifacts applicable to Eastern Colorado studies include *Dentalia* spp., which appear in the record from the Middle Prehistoric through the Protohistric period (200 B.C.–A.D. 1880). *Olivella* spp. beads and marine clam species thought to have been used to create shell disc beads observed in the study area are present in the Great Basin from the Early Prehistoric onward (2000 B.C–AD.1880). The important difference between the shell of the Great Basin and the Southwest is the presence of *Dentalia* spp. This is important within the scope of this study because *Dentalia* spp. is found in the archaeological record of the South Platte Basin.

Exchange with the Eastern Plains

As outlined in Chapter 4, the Central Plains are defined by the geographic boundaries of Kansas and Nebraska (Gilmore et al. 1999). Marine shell in this region is associated with the Plains Woodland cultural complex and more specifically with the burial practices affiliated with this period (Hoard and Cheney 2010). Characteristics of the Plains Woodland mortuary complex were defined by Breternitz and Wood (1965) and Wood (1967) and are the same as defined previously for the Colorado Plains Woodland Complex in Eastern Colorado; they differ only by geographic location. The most notable Early Ceramic burials from the Eastern Plains containing marine molluscs in the Central Plains are Woodruff Ossuary, Kansas (Kivett 1953), the Bladen Ossuary, Nebraska (Carlson 1997) the Massacre Canyon Site, Nebraska (Kivett 1952; Wedel 1986), the

Young Site, Kansas (Wedel 1959), and the Bisterfeldt Potato Shelter Site, Nebraska (Breternitz and Wood 1965). These burials contain the characteristic *Olivella* spp. shell beads, disc shell beads, and freshwater mussel shell pendants.

As mentioned, marine artifacts are prevalent in Early Ceramic Burials of the Central Plains. However, unlike Eastern Colorado, marine artifacts have been documented more consistently outside this narrow burial context in the Central Plains. Blakeslee (1997) and Carlson (1997) have shown through comprehensive surveys of marine shell that shell of this nature first appears in the Central Plains in the Late Archaic in low frequencies. Early Ceramic Periods are dominated by the presence of shell within burial contexts, but later cultural periods show an increase in marine shell within habitation sites. Despite the uniform presence of marine shell, material sources vary. Sites from Kansas show shell of Southwestern affiliation presumed to be of Pacific origin, while sites from Nebraska contain marine artifacts of predominantly Atlantic origins (Blakeslee 1997; Carlson 1997; Hoard and Chaney 2010). These comprehensive studies also exhibit a greater diversity of shell species than documented within Eastern Colorado, including a variety of conch and welk shells. Dragoo (1963) outlines possible trade routes for marine shell into the Central Plains, proposing that shell from the Gulf of Mexico and the Atlantic Seaboard entered via routes along the Mississippi River. While items from the Pacific Coast entered through trade and exchange with Southwestern peoples.

Proposed Routes of Mollusc Movement into Eastern Colorado

Marine mollusc artifacts likely moved into the Arkansas and South Platte River Basins from a combination of sources including the Southwest, the Eastern Plains, and

the Great Basin. The majority of the marine artifacts examined within the parameters of this study are from the Arkansas River Basin (80.3 percent; n=49), but the percentage of marine artifacts within both basins were relatively similar. The dominant marine species present within the collections is *Olivella* spp. (Figure 21). Speciation studies conducted by the author and marine shell experts indicate that species with both Atlantic and Pacific origins are present within the Eastern Colorado assemblage. Despite some difficulty in identifying exact types, species with Pacific origins are more prevalent within the study collection.

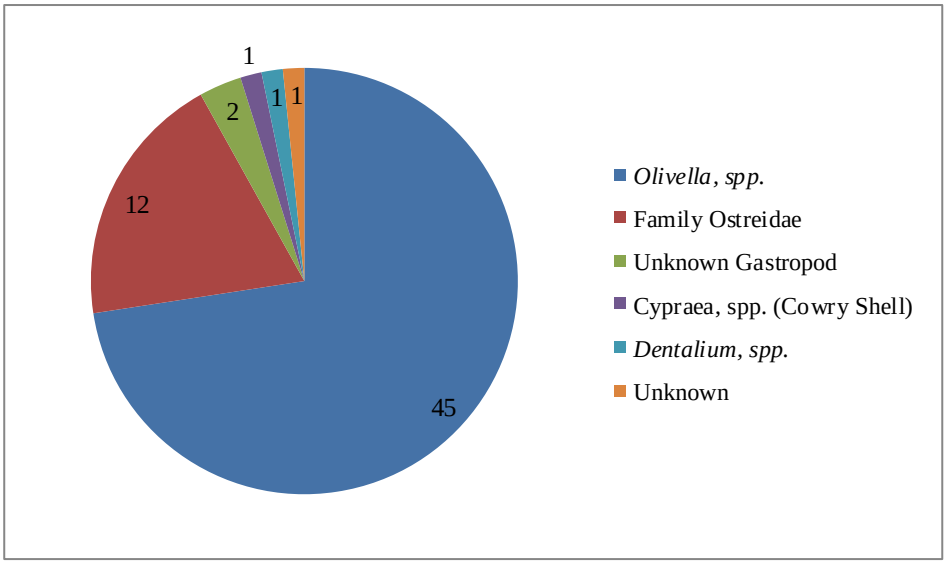

Figure 21: Breakdown of Marine Artifacts within the Eastern Colorado Study Assemblage.

The higher prevalence of Pacific marine species indicates that most marine shell in the study area likely entered Eastern Colorado from the Southwest exchange. Additionally, geographic proximity and comparable artifact forms between the Southwest and the cut pendants (and associated forms) in the Arkansas Basin indicate that exchange networks were strongest between these two regions. But, certain artifacts and species

indicate that the Southwest was not the sole source of marine mollusc for prehistoric peoples in the Arkansas and South Platte Basins.

As discussed above, the Southwest, in particular the marine shell trade and exchange networks established by the Hohokam, have long been the thought to be the source of marine shell artifacts in Eastern Colorado. The collections studied within the parameters of this study seem to confirm that the Southwest was likely the source of the majority of marine shell. Species used to create artifacts, and artifact forms and types, show consistency from the Southwest to the study area. The higher percentage of marine mollusc artifacts in the Arkansas Basin is likely indicative of the geographic proximity of this region to the Southwest, but artifacts from the Southwest entered the South Platte Basin as well. The high prevalence of Pacific species also indicates a Southwestern affiliation, since the majority of Southwestern marine artifacts are of Pacific origin. For these reasons, the author proposes that trade and exchange with the Southwest was the primary means by which prehistoric peoples in the study area acquired marine mollusc artifacts.

Although the Southwest was likely the primary source for marine molluscs, other secondary sources were undoubtedly important. The Great Basin was also likely a source for Pacific Ocean species and Northwest Coast species, such as *Dentalium* spp. Species from Atlantic/Gulf of Mexico waters likely entered the through the Southwest in low quantities and possibly through exchange with eastern populations from the Eastern or Southern Plains. As mentioned in Chapter 4, freshwater molluscs were likely entering Eastern Colorado from the Eastern Plains, so it is feasible that marine molluscs originating from Atlantic waters also entered the study area via exchange with Eastern

Plains cultural groups. Many have proposed that Woodland traditions observed in Eastern Colorado, including the use of mollusc artifacts, are representative of an influx of cultural ideas, rather than physical migrations (Cassells 1983; Gilmore 1989; Wood 1967). The higher prevalence of mollusc artifacts during this period in Eastern Colorado is likely reflective of this arrival of not only ideas, but also physical goods (such as mollusc artifacts) from the Central Plains.

In summary, marine molluscs entered Eastern Colorado primarily via trade and exchange with the Southwest. However, exchange with Great Basin, Eastern and Southern Plains, and European cultural groups probably account for a portion of the marine molluscs studied from Eastern Colorado. Figure 22 below shows the proposed movement of mollusc into the study area. As reflected by the size of arrows on the map, this study concludes that the Southwest was the major avenue by which molluscs were entering Eastern Colorado. In particular the influence of the Southwest appears to be most prominent in the Arkansas River Basin based on consistency in artifact form and species. Marine molluscs are also entering the study area from the Central Plains, as manifested through the presence of Atlantic species within the study assemblage. Marine shell was entering via trade with the Great Basin as evidenced by coastal California species within the collection. Although contextual information is somewhat lacking, the presence of marine artifacts appears to increase in later cultural periods. Perhaps these marine artifacts are linked to cultural and mortuary practices, as discussed in detail in Chapter 4. Additionally, direct and indirect contact with Europeans played a part in the introduction of marine artifacts into Eastern Colorado. The increase in marine artifacts through time may be indicative of greater cultural connectivity and exchange.

Figure 22: Proposed Routes of Mollusc Movement into Eastern Colorado.
The size of the arrow indicates proposed amount/influence.

It is reasonable to assume that other goods, not strictly marine shell, were moving along similar trade and exchange routes. Thus, it is likely that other material and cultural goods were moving in and out of Eastern Colorado. Analysis from the Southwest and Central Plains regions show that commodities such as obsidian, pottery, and turquoise are also important trade items (Hoard et al. 2008; Hughes 1984; Nelson 1984). These items are observed as exports of the Southwest, similar as proposed for marine shell within this analysis; however it is unclear at this point what items are entering the Southwest in return for these goods. Further research is needed to explore what commodities were leaving the Eastern Colorado study area in exchange for marine shell and other trade items.

As proposed, the primary source of marine shell into the study area was from the Southwest, but further research would be needed to determine whether the Southwest was

a primary source of other goods and cultural practices. As with the exchange with Southwest, other items were likely entering Eastern Colorado from the Great Basin and Eastern Plains. These geographic regions have often been ignored as sources of exchange with Eastern Colorado, but this research and other recent research has begun to demonstrate the vast complexity of prehistoric exchange between these groups.

Conclusion

Thorough examinations of the marine mollusc artifacts within the Eastern Colorado study collection have led to a more complete understanding of trade and exchange between the Arkansas and South Platte River Basins and more distant locales. Prehistoric peoples of these basins had access to marine mollusc goods via exchange with surrounding cultural groups, including the Southwest, Great Basin and Eastern Plains. The majority of studied marine artifacts were from Pacific Ocean species, but portions were identified from Atlantic, Northwest Coast, and Indo-Pacific waters. Although complete contextual data were not available, generally the presence of marine molluscs increased in the archaeological record through time, corresponding to the trends observed in Chapter 3 of this thesis. Based on species identification, artifact densities, and comparisons with adjacent cultural groups, it was determined that the majority of Eastern Colorado marine molluscs entered the region via exchange with Southwest. However, it is likely that goods entered the study area via exchange with Great Basin, Eastern Plains, and European peoples as well. Other good besides marine molluscs undoubtedly moved via these exchange routes as well.

CHAPTER 6: CONCLUSIONS

This thesis examined an aspect of material culture in order to explore how larger environmental and cultural factors influenced prehistoric peoples of Eastern Colorado. The main research foci are revisited here in an effort to synthesize the conclusions of three separate, yet inherently linked, examinations of mollusc artifacts.

The analysis presented in Chapter 3 indicated that the primary use of this artifact class was for items of personal adornment, as represented by high percentages of beads, pendants, and artifacts likely associated with their manufacture. Comparisons between the artifacts of the Arkansas and South Platte Basins show similarities in the assemblage composition of worked, unworked, freshwater, marine, terrestrial, and other various artifact classes. These similarities indicate parallels in the procurement of freshwater mollusc, the manufacturing of artifacts, the acquisition of exotic marine specimens, and an overall similarity in the perceived or cultural value of mollusc artifacts. Despite limited temporal association data, a study of mollusc use through time was conducted for the entire Eastern Colorado study area and each basin. The results of these studies showed that mollusc utilization was widespread in the Late Prehistoric. A limited number of artifacts were found to be affiliation Archaic and Archaic to Late Prehistoric transition sites and these were only found in the Arkansas Basin. These data possibly indicate that mollusc artifacts appeared first in this region and then spread northward into the South Platte, and this radiation was probably a result of both environmental and cultural phenomenon.

Chapters 4 and 5 further explored the role of environmental and cultural factors as influencing agents on the utilization of mollusc artifacts in Eastern Colorado. A thorough examination of the geological and paleoenvironmental conditions in the Arkansas and South Platte Basins during human prehistory revealed that the most favorable environmental conditions for freshwater mussels existed during the Late Holocene, which is the same general time period in which mollusc artifacts appear in large numbers in the archaeological record of Eastern Colorado. Increased environmental availability undoubtedly played a role in the surge in mollusc utilization by prehistoric peoples.

The cultural aspects driving changing uses of molluscs were explored in Chapter 5 via an examination of prehistoric trade and exchange. This chapter centered on the marine artifacts within the study area and revealed that these artifacts have Pacific, Atlantic, and Indo-Pacific marine origins. Through examinations of neighboring shell industries of the Southwest, Great Basin, and Central Plains, I concluded that marine artifacts were predominantly entering the study area via the Southwest, but the Great Basin and Central Plains regions likely contributed as well. It was also found that the timing of established shell trade industries in these adjacent geographic areas corresponds with the Late Prehistoric of Eastern Colorado, previously established as the period from which the majority of mollusc artifacts are attributed.

There were some key limitations to this study that are worth highlighting in an effort to understand the reaches of the interpretations/conclusions presented here. First, one will notice that the mollusc data presented in Chapter 3 and analyzed throughout my thesis is dominated by artifacts from a single county, Las Animas County in the Arkansas River Basin. The assemblage is skewed by the presence of the Pinon Canyon military

training facility associated with the Fort Carson military installation. Training activities on this large 235,000 acre tract has necessitated a great deal of cultural resource compliance. Thus this anomaly in the sample distribution can be attributed, at least in part, to an abundance of archaeological investigations. The abundance of mollusc artifacts from Las Animas County is not a reflection of an anomaly in the prehistoric use of molluscs, as seen in the Table 7 in Chapter 3. This assumption is supported by the consistency in artifact form within the entire Eastern Colorado study collection and comparable distributions of artifact forms in each river basin. Another caveat to this study is the role that taphonomy has played in shaping the nature of the study assemblage. As noted previously, by nature molluscs are structurally brittle and prone to fracture. Based on this characteristic it is possible that a variety of environmental processes could have modified artifacts post abandonment. This concept is particularly relevant when examining the unworked fragmented artifacts in assemblage. These artifacts dominate the study assemblage, but given their predisposition for fracture taphonomic processes may be skewing the data set. Regardless further investigations of mollusc artifact manufacturing processes will need to be conducted so that cultural by products can be distinguished from ecofacts fragmented by taphonomic processes.

My thesis highlights that a total of 691 mollusc artifacts from across Eastern Colorado were examined. Even though this number is impressive given the scarcity of mollusc artifacts in the study area, it does not compare to the large quantities from adjacent geographic regions, especially assemblages known from the Central Plains (Dorsey 2000; Myers and Perkins 2000). This extreme difference is likely due to a combination of both environmental and cultural factors such as environmental

availability, cultural value, cultural practices (such as burial traditions), and cultural exchange. The goal of this thesis is not to definitively discern the root of this difference, but to motivate further discussions on the role of both environmental and cultural influences on material culture.

In this thesis, three distinct research efforts focused on the entire collection of mollusc artifacts, freshwater artifacts in relation to environmental conditions, and the examination of marine artifacts in regard to their implications on prehistoric exchange. My research has demonstrated that the utilization of molluscs in Eastern Colorado is inherently linked to both environmental and cultural factors. Further, changes and variations in use are directly linked to these factors. Therefore, the understanding of the prehistoric utilization of mollusc artifacts, and likely many other artifact classes, is intrinsically tied to an understanding of a variety of contextual factors converging to form distinct signatures in material culture.

The data and discussions presented in this thesis are meant to serve as a starting point for future examinations of shell in Eastern Colorado and to supplement the existing knowledge base for the prehistoric use of molluscs. In comparison to adjacent regions, studies of the freshwater and marine molluscs found archaeologically in Eastern Colorado are lacking. The analysis and synthesis within this thesis greatly highlighted the need for future research. Future research needs include studies on the techniques used to manufacture artifact classes, which might lead to a better understanding of the reduction sequences and the 'debitage' characteristic of artifact production. Studies of this nature may also shed light on raw material size class requirements, which may streamline speciation of artifacts. Experimental artifact production as well as

ethnographic examples will likely prove to be the most fruitful in understanding manufacturing methods. Other avenues of future research should aim to further understand the environmental parameters required to support freshwater mollusc populations in Eastern Colorado. Further knowledge on this subject will help to clarify the local versus exotic nature of mollusc artifacts, which will in turn advance studies of cultural exchange and interaction. The prehistoric economy of marine shell needs to be further explored, namely understanding what other commodities were moving along with marine shell. Lithic source studies, in particular a better understanding of obsidian sources and movement in Colorado, will likely lead to a more thorough understanding of the movement of prehistoric trade goods (Ferguson and Skinner 2003). As with many aspects of prehistory, there are many more questions than answers, but this research aims to open the discussion for further examinations.

In line with future research avenues, the study of molluscs needs to be integrated into the Native American Graves Protection and Repatriation Act (NAGPRA) process. Many of the rare/exemplary specimens within this study were found in a burial context and will be repatriated. Every effort should be made to document and record these specimens in a culturally sensitive manner prior to repatriation so they can be used in further analysis.

Despite the obvious need for further research, the overarching goal of my research has been to examine how prehistoric peoples of Eastern Colorado used mollusc artifacts and to understand how this utilization has been shaped by a variety of environmental and cultural factors. However, there were various other underlying goals that motivated this research, which include providing a baseline understanding of mollusc artifacts in the

study area and establishing a framework within which to examine future mollusc artifacts found in Eastern Colorado. Comprehensive examinations of mollusc artifacts have been undertaken in a variety of surrounding geographic areas, but these artifacts for the most part have not been seen in Eastern Colorado. Thus research within this thesis aims to fill a gap in the prehistoric literature of the study area. I hope the effort will help establish a baseline example of how a single artifact class, coupled with thoughtful examinations of environmental and cultural context, can reveal key insights into prehistoric cultures. As with any study, there are limitations and shortcomings, which have been acknowledged and discussed throughout this analysis, but I hope these are far outweighed by the results of the examination.

REFERENCES CITED

Ahlbrandt, T.S. and S.G. Fryberger

1980 Eolian deposits in the Nebraska Sand Hills. *Geologic and Palentologic Studies of the Nebraska Sand Hills*. United States Geological Survey Professional Paper 1120: 1–24.

Allen, D., and G. P. Cheatum

1961 Ecological Implications of Freshwater and Land Gastropods in Texas Archaeological Sites. *Texas Archaeological Society Bulletin* 31:291–316.

Andrefsky, William, Jr.

1998 *Lithics: Macroscopic Approaches to Analysis.* Cambridge University Press, Cambridge.

Antevs, E.

1948 Climatic Changes and Pre-White Man. *University of Utah Bulletin* 38:91–168.

1955 Geologic-climatic dating in the West. *American Antiquity* 20: 35–317.

Baerreis, D.A.

1980 Habitat and Climatic Interpretation from Terrestrial Gastropods at the Cherokee Site. In *The Cherokee Excavations: Mid-Holocene Ecology and Human Adaptation in Northwestern Iowa*, edited by D. C. Anderson and H. A. Semken, pp. 101-122. Academic Press, New York.

Balakrishnan, M., C.J. Yapp, D.J. Meltzer, J.L. Theler

2004 Paleoenvironment of the Folsom archaeological site, New Mexico, USA, approximately 10,500 ^{14}C yr B.P. as inferred from the stable isotope composition of fossil land snail shells. *Quaternary Research* 63(1):31–44.

Balakrishnan, M., C.J. Yapp, J.L. Theler, B. J. Carter, D.G. Wyckoff

2005 Environmental significance of $^{13}C/^{12}C$ and $^{18}O/^{16}O$ ratios of modern land-snail shells from the southern great plains of North America. *Quaternary Research* 63:15–30.

Bayman, James M.

1996 Shell Ornament Consumption in a Classic Hohokam Platform Mound Community. *Journal of Field Archaeology* 23(4): 403–420.

Benedict, J.B.
1973 Origin of Rock Glaciers. *Journal of Glaciology* 12(66): 520–522.
1975 Chronology of cirque glaciation, Colorado Front Range. *Quaternary Research* 3: 584–599.

Benedict, J.B., and B. L. Olson
1978 *The Albion Complex: A Study of prehistoric man and the Altithermal*. Research Report No. 1, Center for Mountain Archaeology, Ward.

Bennyhoff, James A. and Richard E. Hughes
1987 Shell Bead and Ornament Exchange between California and the Western great Basin. *American Museum of Natural History Anthropological Papers* 62(2):80–175.

Biggs, Robert
1966 The Sadar Site, Colorado Cultural Resource Survey. Ms. On file, Office of Archaeology and Historic Preservation, Colorado Historical Society, Denver.

Black, Kevin D.
1995 *Excavations at the Roberts Ranch Burial, Site 5LR1683, Larimer County, Colorado*. Colorado Historical Society, Denver.
1997 OSAC Field Investigations in Colorado, 1991–1995. *Southwestern Lore* 63(3) 1–36.

Black, Kevin D., Kimberly Spurr, and Diane L. France
1991 Two Ceramic Burials From Southeastern Colorado. *Southwestern Lore* 57(3)1–27.

Blakeslee, Donald J.
1997 The Marine Shell Artifacts of Kansas. *Central Plains Archaeology* 5(1): 3–10.
2000 Mussels, Bison Kills, and Pots: Clarity in the Archaeological Record. *Central Plains Archaeology* 8(1): 5–12.

Bobrowsky, Peter T.
1984 The History and Science of Gastropods in Archaeology. *American Antiquity* 49(1): 77–93.

Bradley, Ronna J.
1999 Shell Exchange within the Southwest, The Casas Grandes Interaction Sphere. In *The Casas Grandes World*, edited by Curtis F. Schaafsma and Carroll L. Riley, pp. 213–228. University of Utah Press, Salt Lake City.

Brand, D.D.
1938 The Historical Geography of Northwestern Chiluahua. Unpublished Ph.D. dissertation, Department of Geography, University of California, Berkley,

Brandauer, Nancy and Shi-Kuei Wu
1978 The freshwater mussels (Family Unionidae). *Natural Historic Inventory of Colorado 2. The Bivalvia of Colorado*. University of Colorado Museum, Boulder.

Breternitz, David A.
1972 A Further Note on Burial 7, Hazeltine Heights Site. *Southwestern Lore* 38(3):18–39.

Breternitz, David A. and John J. Wood
1965 Comments on the Bisterfeldt Potato Cellar Site and Flexed Burials in the Western Plains. *Southwestern Lore* 31(3): 62–66.

Buckles, W. G., G.H. Ewing, N. Buckles, G.J. Armelagos, J.J. Wood, J.D. Haug, and J.H. McCullough
1963 The Excavations of the Hazeltine Heights Site. *Southwestern Lore* 29(1):1–36.

Butler, William B.
1989 The Woodland Period In Northeastern Colorado. *Plains Anthropologist* 33(122): 449–469.

Breternitz, David A.
1969 Radiocarbon Dates: Eastern Colorado. *Plains Anthropologist* 14(44): 113–144.

Callahan, Errett
1979 The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts. In *Archaeology of Eastern North America* 7(1):1–180. Reprinted in 1990 by the Eastern States Archeological Federation.

Carlson, Gayle F.
1997 A Preliminary Survey of Marine Shell Artifacts from Prehistoric Archaeological Sites in Nebraska. *Central Plains Archaeology* 5(1): 11–48.

Cassells, E. Steve
1983 *The Archaeology of Colorado*. Johnson Books, Boulder

Chomko, Stephen A., and J. Michael Hoffman
1993 The East Fork Burial, El Paso County, Colorado. Manuscript in preparation (No copy available at the Fort Carson Curation Facility).

Claassen, Cheryl
1986 Shellfishing Seasons in the Prehistoric Southeastern United States. *American Antiquity* 51(1): 21–37.

Cockrell, T. D. A.
1889 Preliminary remarks on the molluscan fauna of Colorado. *Journal of Conchology* 6: 60–65.

Crabtree, Donald
1972 An Introduction to Flintworking. *Occasional Papers of the Idaho State University Museum, No. 28.* Idaho State University, Pocatello, Idaho.

Cummings, Kevin S. and Arthur E. Bogan
2006 Unionoida: Freshwater Mussels. In *The Mollusks: A Guide to Their Study, Collection, and Preservation*, edited by C.F. Sturm, T.A. Pearce and A. Valdes, pp. 313–325. American Malacological Society, Los Angeles.

Dorsey, Ron
2000 Archaeological Interpretation of Freshwater Mussel Assemblages near the Solomon River, Kansas. *Central Plains Archaeology* 8(1): 13–24.

Dragoo, Don
1963 *Mounds for the Dead: An Analysis of the Adena Culture*. Annals of Carnegie Museum 37. Pittsburgh.

Eddy, Frank W. and Ric Windmiller
1977 An Application of the Wyoming Projectile Point Chronology to the Dating of an Eastern Colorado Foothills Site Survey. Paper Presented at the 42nd Annual Meeting of the Society for American Archaeology.

Fahnestock, R. K.
1963 Morphology and hydrology of a glacial stream–White River, Mount Rainier, Washington. United States Geological Survey Professional Paper 422–A: A1–A70.

Ferguson, Jeffery R. and Craig E. Skinner
2003 Colorado Obsidian? Preliminary Results of a Statewide Database of Trace Element Analysis. *Southwestern Lore* 69(4):35–50.

Ford, R.I.
1983 Inter-Indian Exchange in the Southwest. In *Southwest*, edited by A. Ortiz, pp. 711-722. *Handbook of North American Indians*, vol. 10. W.C . Sturtevant general editor, Smithsonian Institution Press, Washington, D.C.

Fowler, Catherine S., and Don D. Fowler
2008 *The Great Basin, People and Places in Ancient Times*. School for Advanced Research Press, Santa Fe.

Gaylord, D.R.
1982 Holocene paleoclimatic fluctuations revealed from dune and interdune strata in Wyoming. *Journal of Arid Environments* 18: 123–138.

Gilmore, Kevin P.
1989 Archaeology and Holocene Stratigraphy at the Foot of the Front Range. *Southwestern Lore* 55(3):12-28.
2008 Ritual Landscapes, Population and Changing Sense of Place During the Late Prehistoric Transition in Eastern Colorado. In *Archaeological Landscapes on the High Plains,* edited by Laura L. Scheiber and Bonnie Clark, pp. 71–114. The University Press of Colorado, Boulder.

Gilmore, Kevin P., Marcia Tate, Mark Chenault, Bonnie Clark, Terry McBride, and Margaret Wood
1999 *Colorado Prehistory: A Context for the Platte River Basin*. Colorado Council of Professional Archaeologists, Denver.

Gladwin, H.S., E.W. Haury, E.B. Sayles, and N. Gladwin
1938 *Excavations at Snaketown, Material Culture*. Medallion Papers No. 25. Gila Pueblo.

Goodfriend, Glenna A and Mordeckai Magaritz
1987 Carbon and oxygen isotope composition of shell carbonate of desert land snails. *Earth and Planetary Science Letters* 86:377–388.

Gordon, Mark E.
1982 Mollusca of the White River, Arkansas and Missouri. *The Southwestern Naturalist* 27(3): 347–352.

Greenway, John
1961 The Garcia Site. *Southwestern Lore* 27(3):42.

Grigal, D.F., R.C. Severson, and G.E. Goltz
1976 Evidence of eolian activity in north-central Minnesota 8000 to 5000yr ago. *Geological Society of America Bulletin* 87: 1251–1254.

Harrold, Mardy Nelson and Robert P. Guralnick
2008 *A Field Guide to the Freshwater Mollusks of Colorado*. Colorado Division of Wildlife, Denver.

Haug, James D.
1968 Prehistoric Eastern Colorado 10,000 B.C. to 1 A.D *Southwestern Lore* 34(1):1-10.

Haury, Emil W.
1936 The Snaketown Canal. The University of New Mexico Bulletin No. 296 1(5): 48–50.
1976 *The Hohokam, Desert Farmers & Craftsmen. Excavations at Snaketown, 1954–65*. University of Arizona Press, Tuscon.

Haynes Jr., C. Vance, Michael McFaul, Robert H. Brunswig, Kenneth D. Hopkins
1998 Kersey-Kuner terrace investigations at the Dent and Bernhardt sites, Colorado. *Geoarchaeology*, 13(2): 201–218.

Heizer, Robert F.
1941 Aboriginal trade between the Southwest and California. Southwest Museum Masterkey 15(5): 185–188.
1978 Trade and Trails. *Handbook of North American Indians*, Vol. 8, California edited by R.F. Heizer, pp. 690–693. Smithsonian Institute, Washington.

Henderson, Junius
1907 The Mollusca of Colorado, Parts I and II. *The University of Colorado Studies* 4 (2): 77–96 and 167–185
1912 The Mollusca of Colorado, Part III. *The University of Colorado Studies* 9(2-3): 53–63.
1924 Mollusca of Colorado, Utah, Montana, Idaho and Wyoming. *The University of Colorado Studies* 13(2): 65–223.

Hester, Thomas R.
1973 *Chronological Ordering of Great Basin Prehistory*. University of California Press, Berkeley.

Hoard, Robert J., C.T. Bevitt, and J. McLean
2008 Source Determinations of Obsidian from Kansas Archaeological Site Using Compositional Analysis. *Transactions of the Kansas Academy of Sciences* 111:219–229.

Hoard, Robert J. and Henry W. Chaney
2010 Olivella Shells from Kansas Archaeological Sites. *Plains Anthropologist* 55(216):293–298.

Hoke, E.
2000 A Critical Review of the unionid mollusks reported for Nebraska by Samuel Aughey (1877). *Central Plains Archaeology* 8:35–47.

Holliday, Vance T., Eileen Johnson, Herbert Haas, and Robert
1985 Radiocarbon Ages from the Lubbock Lake site, 1950–1980, Framework for Cultural and Ecological Change on the Southern High Plains. *Plains Anthropologist* 28(102): 277–291.

Holliday , Vance T.
1987 Geoarchaeology and late quaternary geomorphology of the middle South Platte River, Northeastern Colorado. *Geoarchaeology*, 2(4): 317–329.

Hughes, Richard E.
1984 Obsidian Sourcing in the Great Basin: Prospects and Problems. In *Obsidian Studies in the Great Basin*, edited by Richard E. Hughes, pp- 1–20. Archaeological Research Facility Report No. 45, University of California, Berkley.

Irwin-Williams, Cynthia and Henry J. Irwin
1966 Excavation at Magic Mountain: A Diachronic Study of Plains-Southwest Relations. Proceedings of the Denver Museum of Natural History, No. 12, Denver.

Jaehnig, Manfred E.
1971 The Study of Gastropods: Methodology. *Plains Anthropologist* 16:289-297.

Jepson, Daniel A. and O.D. Hand
1999 The Salvage Excavation of Two Human Burials at the Lena Gulch Site (5JF1780), Jefferson County, Colorado. Colorado Department of Transportation Archaeological Research Series No. 6, Denver.

Jernigan, Wesley E.
1978 *Jewelry of the Prehistoric Southwest*. University of New Mexico Press, Albuquerque.

Johnson and Johnson
1998 The Plains Woodland. In *Archaeology on the Great Plains*, edited by W. Raymond Wood pp. 201–233. University Press of Kansas, Lawrence.

Keen, A.M.
1963 Marine molluscan genera of Western North America. Stanford University Press, Stanford.
1971 Sea shells of tropical west America, second edition. Stanford University Press, Stanford.

Kelly, E.F., S.W. Blecker, C.M. Yonker, C.G Olsen, E.E. Wohl, L.C. Todd
1998 Stable isotope composition of soil organic matter and phytoliths as paleoenvironmental indicators. *Geoderma* 8(1):59–81.

King, Chester
1978 Protohistoric and historic archaeology. *In California Handbook of North American Indians*, edited by R.F. Heizer. Smithsonian Institute, Washington, D.C.

Kivett, M.F.
1952 Woodland Sites in Nebraska. Nebraska State Historical Society, Publications in Anthropology, No. 1, Lincoln.
1953 The Woodruff Ossuary, a Prehistoric Burial Site in Phillips County, Kansas. *River Basin Survey Papers*, No. 3. Bureau of American Ethnology Bulletin 154, Washington, D.C.

Korniushin, Alexei V.
2006 Non-Unionoida Freshwater Bivalves. In *The Mollusks: A Guide to Their Study, Collection, and Preservation*, edited by C.F. Sturm, T.A. Pearce and A. Valdes, pp. 326–337. American Malacological Society, Los Angeles.

Kozuch, Laura
2002 Olivella Beads from Spiro and the Plains. *American Antiquity* 67(4): 697–709.

Lindsey, Rocche M.
2005 Analysis of Feature 5 at the Late Prehistoric Barnes Site on the Southeastern High Plains of Colorado. Unpublished Master's Thesis, Department of Anthropology, University of Kansas, Lawrence.

Lippincott, Kerry
1995 Identification and Analysis of Mussel from 24CA287, Great Falls, Montana, *Archaeology in Montana* 36(2):1–10.

Madole, Richard F.
1986 Lake Devlin and Pinedale Glacial History, Front Range, Colorado. *Quaternary Research* 25: 43-54.

Matteson, M. R.
1959 Snails in Archaeological Sites. *American Anthropologist* 61:1094–1096.

McFaul, Michael, Karen Lynn Traugh, Grant D. Smith, William Doering, Christian J. Zier
1994 Geoarchaeologic analysis of South Platte River terraces: Kersey, Colorado**.** *Geoarchaeology*, 9(5):345–374

McGuire, R.H, and A.V. Howard
1987 The structure and organization of Hohokam shell exchange. *The Kiva* 52: 113–146.

Myers, Thomas P. and Keith Perkins III
2000 Mussels and Marginal Utility. *Central Plains Archaeology* 8(1): 49–68.

Muhs, Daniel R.
1985 Age and Paleoclimatic Significance of Holocene Sand Dunes in Northeastern Colorado. *Annals of the Association of American Geographers* 75(4):566–582.

Muhs, Daniel R., John N. Aleinikoff, Thomas W. Stafford, Jr, Rolf Kihl, Josh Been, Shannon A. Mahan and Scott Cowherd
1999 Late Quaternary loess in northeastern Colorado: Part I—Age and paleoclimatic significance. *Geological Society of America Bulletin* 111(12): 1861-1875.

Mulloy, William T.
1958 A Preliminary Historical Outline for the Northeastern Plains. *University of Wyoming Publications in Science* 22(122).

Neitzel, Jill
1991 Hohokam material culture and behavior: The dimensions of organizational change. In *Exploring the Hohokam: Prehistoric Desert Peoples of the American Southwes*t, edited by G.J. Gumerman, pp. 177–230. University of Arizona Press, Tucson.

Nelson, Fred W., Jr.
1984 X-ray Fluorescene Analysis of Some Western North American Obsidians. . In *Obsidian Studies in the Great Basin*, edited by Richard E. Hughes, pp. 27–62. Archaeological Research Facility Report No. 45, University of California, Berkley.

Nelson, Richard S.
1991 *Hohokam Marine Shell and Exchange and Artifacts*. Arizona State Museum Archaeological Series, No. 179, The University of Arizona, Tucson, Arizona.

O'Day, Sharyn Jones, and William F. Keegan
2001 Expedient Shell Tools from the Northern West Indies. *Latin American Antiquity* 12(3): 274–290.

Peacock, Evan and Jennifer L. Seltzer
2008 A comparison of multiple proxy data sets for paleoenvironmental conditions as derived from freshwater bivalve (Unionid) shell. *Journal of Archaeological Science* 35: 2557–2565.

Palacios-Fest, Manuel R.
2010 Late Holocene Paleoenvironmental History of the Upper West Amarillo Creek Valley at Archaeological Site 41PT185/C, Texas, USA. *Boletín de la Sociedad Geológica Mexicana* 62(3): 399–436.

Rehder, Harald A.
1996 National Audubon Society Field Guide to North American Seashells. Alfred A. Knopf, New York.

Renaud, E.B.
1950 Cultural Overlaps and Archaeological Chronology *Southwestern Lore* 15(4):41–46.

Scott, Douglas D. and Terje G. Brikedal
1972 The Archaeology and Physical Anthropology of the Gahagan-Lipe Site with Comments on Colorado Woodland Mortuary Practices. *Southwestern Lore* 38(3): 1–18.

Theler, James L.
1991 Aboriginal Utilization of Freshwater Mussels at the Aztalan Site, Wisconsin. In *Beamers, Bobwhites, and Blue-Points: Tributes to the Career of Paul W. Parmalee*, edited by James R. Purdue, Walter E. Klippel, and Bonnie W. Styles, pp. 315–323. Illinois State Museum Scientific Papers XXIII, Springfield.

Tipton, Richard B.
1966 A Burial From the Chubbuck-Oman Site. *Southwestern Lore* 33(1):14–21.

Tower, Donald B.
1945 The Use of Marine Mollusca and Their Value in Reconstruction Prehistoric Trade Routes in the American Southwest. *Papers of the Excavators Club* 2(3): 1–54.

United States Geological Survey (USGS)
2002 *National Water-Quality Assessment Program, South Platte River Basin*. Accessed 11/28/2008: http://co.water.usgs.gov/nawqa/splt/html/spbasin info.html

Warren, Robert E.
1991 Freshwater Mussels as Paleoenvrionmental Indicators: A Quantitative Approach to Assemblage Analysis. In *Beamers, Bobwhites, and Blue-Points: Tributes to the Career of Paul W. Parmalee*, edited by James R. Purdue, Walter E. Klippel, and Bonnie W. Styles, pp. 23–66. Illinois State Museum Scientific Papers XXIII, Springfield.

Warren, Robert E.
2000 Prehistoric Procurement and Use of Freshwater Mussels Along the Missouri River in the Northern Great Plains. *Central Plains Archaeology* 8(1): 79–98.

Wohl, Ellen E.
2001 *Virtual Rivers: lessons from the mountain rivers of the Colorado Front Range*. Yale University Press, New Haven.

Watters, G.
1995 *A guide to the freshwater mussels of Ohio*. Ohio Department of Natural Resources, Columbus.

Wedel, Waldo R.
1959 *An Introduction to Kansas Archaeology*. Bulletin No. 174. Bureau of American Ethnology, Smithsonian Institute, Washington.
1986 *Central Plains Prehistory: Holocene Environments and Cultural Change in the Republican River Basin*. University of Nebraska Press, Lincoln.

Whittaker, John C.
1994 *Flintknapping: Making and Understanding Stone Tools*. University of Texas Press, Austin, Texas.

Wood, J. J.
1967 Archaeological Investigations in Northeastern Colorado. Unpublished Ph.D. dissertation, Department of Anthropology, University of Colorado, Boulder.

Wood, Caryl
1974 Excavations at Trinchera Cave, 1974. Southwestern Lore (40) 3 and 4:53-56.
1976 Trinchera Cave: a rock shelter in southeastern Colorado. Unpublished Master's Thesis, Department of Anthropology, University of Wyoming, Laramie.

Woodring, W. P.
1966 The Panama Land Bridge as a Sea Barrier. *Proceedings of the American Philosophical Society* 110 (6): 425-433.

Wu, Shi-Kuei,
1989 *Natural History Inventory of Colorado, No. 11*. University of Colorado Museum, Boudler.

Wye, Kenneth R.
2000 *The Encyclopedia of Shells*. Chartwell Books, Edison, New Jersey.

Zier, Christian J. and Stephen M. Kalasz
1999 *Colorado Prehistory: A Context for the Arkansas River Basin*. Colorado Council of Professional Archaeologists, Denver.

Zier, Christian J., Daniel A. Jepson, Michael McFaul, and William Doering
1993 Archaeology and geomorphology of the Clovis-age Klein site near Kersey, Colorado. *Plains Anthropologist*, 38:203–210.

APPENDIX A: ARTIFACT CATALOG

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5AM0648.CU.1	5AM0648	11.7	10.0	2.0	0.8	worked-ornament-bead	freshwater; unknown	Small fragment of freshwater shell. 1 drill hole.
5AM0648.CU.2	5AM0648	9.0	4.5	1.1	N/A	unworked-fragment	freshwater; unknown	
5BA0007.DU.1	5BA0007	14.7	7.7	1.6	N/A	unworked-fragment	unknown	
5BA0007.DU.2	5BA0008	16.1	8.1	1.6	N/A	unworked-fragment	unknown	
5BA0007.DU.3	5BA0009	10.7	6.9	1.5	N/A	unworked-fragment	unknown	
5BA0118.LOPA.1	5BA0118	17.7	7.9	0.6	1.8	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	Drilled apex.
5DA0088.CU.1	5DA0088	21.8	18.0	3.3	N/A	unworked-fragment	unknown	
5DA0095.DU.1	5DA0095	60.0	45.9	8.7	N/A	unworked-fragment	marine; Ostreidae (oyster)	
5DA0272.DU.1	5DA0272	30.2	22.0	1.2	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.10	5DA0272	17.8	16.2	0.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.11	5DA0272	22.7	9.6	1.2	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.12	5DA0272	19.2	13.3	0.6	2.9	worked-unknown function-partial drill	freshwater; bivalve	1 drill hole.
5DA0272.DU.13	5DA0272	24.3	13.3	0.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.14	5DA0272	24.7	11.1	0.4	N/A	unworked-fragment	freshwater; bivalve	Has beak and hinge retained.
5DA0272.DU.15	5DA0272	20.3	17.7	0.5	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.16	5DA0272	19.5	17.0	1.0	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.17	5DA0272	13.6	11.1	0.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.18	5DA0272	24.4	16.8	1.1	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.19	5DA0272	19.4	17.9	0.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.2	5DA0272	18.1	17.3	1.0	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.20	5DA0272	16.2	6.1	1.1	N/A	unworked-fragment	unknown	
5DA0272.DU.21	5DA0272	17.9	14.0	0.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.22	5DA0272	19.4	8.6	0.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.23	5DA0272	19.6	14.0	0.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.24	5DA0272	24.4	20.1	0.6	N/A	unworked-fragment	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5DA0272.DU.25	5DA0272	35.3	9.3	3.5	N/A	worked-utility-tool use	unknown	Utilitarian, based on worked edge possibly cutting.
5DA0272.DU.26	5DA0272	23.9	12.6	1.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.27	5DA0272	15.9	10.4	0.7	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.28	5DA0272	21.4	15.9	0.9	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.29	5DA0272	17.7	14.1	1.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.3	5DA0272	43.0	20.7	1.1	N/A	unworked-fragment	freshwater; unknown	
5DA0272.DU.30	5DA0272	11.9	9.4	0.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.31	5DA0272	12.1	10.7	1.2	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.32	5DA0272	10.5	9.7	1.2	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.33	5DA0272	9.0	7.6	1.0	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.34	5DA0272	20.4	9.0	0.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.35	5DA0272	13.7	12.2	0.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.36	5DA0272	15.9	10.5	0.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.37	5DA0272	31.4	20.5	0.9	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.38	5DA0272	23.9	23	1.0	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.39	5DA0272	17.4	11.7	0.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.4	5DA0272	20.2	17.2	0.9	N/A	unworked-fragment	freshwater; unknown	
5DA0272.DU.40	5DA0272	13.9	12.3	0.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.41	5DA0272	31.4	18.3	1.2	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.42	5DA0272	20.6	15.7	0.9	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.43	5DA0272	33.6	24.8	0.7	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.44	5DA0272	20.1	14.6	0.7	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.45	5DA0272	13.5	8.9	0.8	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.46	5DA0272	10.6	9.8	0.9	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.47	5DA0272	17.0	16.9	1.1	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.48	5DA0272	24.0	14.7	1.6	N/A	unworked-fragment	freshwater; bivalve	
5DA0272.DU.5	5DA0272	17.2	14.0	1.3	N/A	unworked-fragment	freshwater; unknown	
5DA0272.DU.6	5DA0272	72.9	17.1	1.0	N/A	unworked-complete	gastropod; freshwater	
5DA0272.DU.7	5DA0272	28.9	10.7	0.7	N/A	unworked-fragment	freshwater; bivalve	Retains beak and hinge.
5DA0272.DU.8	5DA0272	30.8	18.2	1.0	N/A	unworked-fragment	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5DA0272.DU.9	5DA0272	19.8	14.4	1.0	5.3	worked-unknown function-partial drill	freshwater; bivalve	1 drill hole.
5EP0750.CU.1	5EP0750	37.9	35.1	3.8	N/A	unworked-fragment	freshwater; unknown	
5EP1208.FC.1	5EP01208	12.3	11.9	1.1	N/A	unworked-fragment	freshwater; unknown	
5EP1696.FC.1	5EP01696	15.7	13.4	1.1	N/A	unworked-fragment	freshwater; unknown	
5FN0127.DU.1	5FN0127	7.9	4.8	0.2	1.6	worked-unknown function-partial drill	freshwater; bivalve	1 drill hole.
5FN0181.FC.1	5FN 0181	13.4	12.2	1.7	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.10	5FN 0181	13.0	6.7	1.2	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.11	5FN 0181	17.8	8.9	1.8	N/A	worked-ornament-bead-disc	freshwater; unknown	Perforated shell disk. Disk diameter is 4.2 mm.
5FN0181.FC.12	5FN 0181	11.7	10.3	2.2	3.2	worked-ornament-pendant-cut	freshwater; unknown	1 dill hole.
5FN0181.FC.13	5FN 0181	17.8	8.9	2.1	3.4	worked-ornament-bead-disc	freshwater; unknown	1 dill hole.
5FN0181.FC.14	5FN 0181	11.3	8.8	2.1	N/A	worked-ornament-pendant-cut	freshwater; unknown	1 dill hole.
5FN0181.FC.15	5FN 0181	9.2	6.3	0.9	N/A	worked-ornament-pendant-cut	freshwater; unknown	1 dill hole.
5FN0181.FC.16	5FN 0181	11.2	8.1	1.3	4.4	worked-ornament-pendant-cut	freshwater; unknown	1 dill hole.
5FN0181.FC.17	5FN 0181	9.5	6.7	0.8	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.18	5FN 0181	9.3	6.0	1.4	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.2	5FN 0181	10.2	5.7	0.7	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.3	5FN 0181	6.3	5.6	0.5	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.4	5FN 0181	9.6	6.6	1.1	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.5	5FN 0181	7.5	6.0	1.1	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.6	5FN 0181	15.3	9.9	1.7	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.7	5FN 0181	13.4	7.4	1.1	N/A	unworked-fragment	freshwater; unknown	
5FN0181.FC.8	5FN 0181	14.7	12.0	3.2	N/A	worked-ornament-bead-disc	freshwater; unknown	Perforated shell disk fragment.

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5FN0181.FC.9	5FN 0181	14.0	11.0	1.8	N/A	worked-ornament-bead-disc	freshwater; unknown	Perforated shell disk fragment.
5FN0184.FC.1	5FN0184	14.7	14.1	0.8	N/A	unworked-fragment	freshwater; unknown	
5FN0184.FC.2	5FN0184	22.3	7.0	4.1	N/A	unworked-fragment	freshwater; unknown	
5FN0184.FC.3	5FN0184	9.2	8.9	1.8	N/A	unworked-complete	gastropod; unknown	
5HF0188.DU.1	5HF0188	16.6	13.3	0.9	3.5	worked-unknown function-partial drill	freshwater; unknown	Nearly complete drill hole.
5HF0188.DU.10	5HF0188	13.2	9.4	0.7	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.11	5HF0188	10.7	5.5	0.4	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.12	5HF0188	9.5	6.3	0.4	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.13	5HF0188	16.2	9.5	0.8	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.14	5HF0188	10.7	7.3	0.5	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.2	5HF0188	9.2	7.7	0.7	2	worked-unknown function-partial drill	freshwater; unknown	
5HF0188.DU.3	5HF0188	21.9	13.4	1.3	N/A	worked-unknown function-ground	freshwater; unknown	
5HF0188.DU.4	5HF0188	14.5	9.5	0.1	N/A	worked-unknown function-partial drill	freshwater; unknown	
5HF0188.DU.5	5HF0188	14.1	10.8	0.6	2.6	worked-unknown function-partial drill	freshwater; unknown	
5HF0188.DU.6	5HF0188	21.4	10.1	2.1	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.7	5HF0188	8.7	4.6	0.4	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.8	5HF0188	7.7	6.5	0.4	N/A	unworked-fragment	freshwater; unknown	
5HF0188.DU.9	5HF0188	6.9	5.5	0.3	N/A	unworked-fragment	freshwater; unknown	
5JF0136.DU.1	5JF0136	13.2	10.9	6.9	N/A	unworked-fragment	gastropod; terrestrial	
5LA1057.TD.1	5LA1057	18.2	10.8	1.0	2.8	worked-ornament-bead-disc	freshwater; bivalve	Trinchera Shelter. Chase artifact. Perforated shell disk.
5LA1057.TD.10	5LA1057	12.9	10.7	1.2	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA1057.TD.11	5LA1057	10.1	5.4	0.2	N/A	unworked-fragment	gastropod; terrestrial	
5LA1057.TD.12	5LA1057	16.2	5.4	1.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.13	5LA1057	11.2	8.7	0.2	N/A	unworked-fragment	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1057.TD.14	5LA1057	11.0	8.5	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.15	5LA1057	12.5	9.4	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.16	5LA1057	10.6	9.1	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.17	5LA1057	18.3	12.2	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.18	5LA1057	9.6	9.4	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.19	5LA1057	22.6	9.6	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.2	5LA1057	29.0	11.0	2.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.20	5LA1057	22.7	13.9	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.21	5LA1057	19.0	16.6	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.22	5LA1057	13.2	10.0	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.23	5LA1057	13.7	10.7	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.24	5LA1057	10.6	8.7	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.25	5LA1057	9.2	7.1	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA1057.TD.26	5LA1057	11.7	9.3	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA1057.TD.27	5LA1057	7.9	6.1	0.1	N/A	unworked-fragment	freshwater; unknown	
5LA1057.TD.28	5LA1057	31.2	16.9	0.8	N/A	unworked-fragment	freshwater; unknown	
5LA1057.TD.29	5LA1057	13	6.1	0.6	2	worked-ornament-bead-whole shell	marine; *Olivella biplicata*	
5LA1057.TD.3	5LA1057	10.6	10.4	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.30	5LA1057	9.4	7.4	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.31	5LA1057	92.0	43.7	2.6	1.9, 1.4, 1.6, 1.7, and 2.2	worked-ornament-pendant-whole shell	freshwater bivalve; *Anodontoides ferussacianus*	Shell pendant. 5 drilled holes, all drilled from the interior. Along bottom edge are a series of notch marks. 14 indentations over a 39.5mm length.
5LA1057.TD.32	5LA1057	13.4	10.9	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.33	5LA1057	16.0	11.2	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.34	5LA1057	20.5	12.0	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.35	5LA1057	13.0	7.7	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.36	5LA1057	14.8	10.8	0.8	3.0	worked-ornament-pendant-cut	freshwater; bivalve	Edges of artifact are ground and smoothed.

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1057.TD.37	5LA1057	25.1	15.5	1.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.38	5LA1057	16.1	12.4	3.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.39	5LA1057	17.2	11.7	1.5	2.3	worked-unknown function-partial drill	freshwater; bivalve	Artifact has a drill hole along one edge. Drilled from the exterior.
5LA1057.TD.4	5LA1057	7.8	7.1	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.40	5LA1057	22.6	15.1	0.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.41	5LA1057	30.4	8.7	2	N/A	worked-unknown function-ground-incised	freshwater; bivalve	Artifact is ground along all edges. There are incised markings on the interior of the artifact.
5LA1057.TD.42	5LA1057	19.3	19.1	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.43	5LA1057	32.5	12.9	1.3	1.2	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.44	5LA1057	23.5	12.4	1.4	1.5	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.45	5LA1057	5.9	3.4	0.6	1.9	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.46	5LA1057	13.4	9.6	1.6	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA1057.TD.47	5LA1057	21.4	18	2.1	1.4 and 1.4	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.48	5LA1057	12.8	11.9	1.5	N/A	worked-unknown function-incised	freshwater; bivalve	Artifact has 3 indentations along one side.
5LA1057.TD.49	5LA1057	12.0	7.9	1.1	N/A	worked-unknown function-ground	freshwater; bivalve	Small pendant preform. Rounded triangular shape.
5LA1057.TD.5	5LA1057	17.4	11.7	0.8	N/A	worked-unknown function-ground	freshwater; bivalve	Small pendant preform. Rounded triangular shape.

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1057.TD.50	5LA1057	20.7	12.2	0.8	1.3	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.51	5LA1057	20.1	13.1	1.1	N/A	worked-unknown function-ground	freshwater bivalve; *Anodontoides ferussacianus*	
5LA1057.TD.52	5LA1057	21.7	10.9	1.1	N/A	worked-unknown function-ground	freshwater bivalve; *Anodontoides ferussacianus*	
5LA1057.TD.53	5LA1057	16.1	15.2	1.1	2.0	worked-unknown function-partial drill	freshwater bivalve; *Anodontoides ferussacianus*	
5LA1057.TD.54	5LA1057	23.6	14.9	1.1	1.4	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.55	5LA1057	27.5	14.6	0.8	3.6	worked-unknown function-partial drill	freshwater; bivalve	
5LA1057.TD.56	5LA1057	15.6	11.2	1.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.57	5LA1057	19.8	13.1	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.58	5LA1057	21.5	13	1.2	N/A	worked-unknown function-incised	freshwater; bivalve	
5LA1057.TD.59	5LA1057	22.3	8.5	0.6	0.7	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.6	5LA1057	29.4	9.8	3.2	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.60	5LA1057	10.2	8.1	1.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.61	5LA1057	11.2	8.4	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.62	5LA1057	17.6	7.7	1.2	3.2	worked-ornament-bead-disc	freshwater; bivalve	
5LA1057.TD.63	5LA1057	15.6	13.9	1.7	N/A	unworked-fragment	unknown	
5LA1057.TD.64	5LA1057	12.9	8.5	0.3	N/A	unworked-fragment	unknown	
5LA1057.TD.65	5LA1057	20.5	17.8	1.2	N/A	unworked-fragment	unknown	
5LA1057.TD.66	5LA1057	13.5	10.8	0.9	1.9	worked-unknown function-partial drill	freshwater; bivalve	
5LA1057.TD.67	5LA1057	12.0	11.4	0.7	N/A	worked-unknown function-ground-incised	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1057.TD.68	5LA1057	12.9	10.5	0.9	2.6	worked-unknown function-partial drill	freshwater; bivalve	
5LA1057.TD.69	5LA1057	20.8	10.9	0.8	1.4	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1057.TD.7	5LA1057	10.5	5.6	0.9	N/A	worked-ornament-bead-whole shell	marine; *Olivella baetica* or *Jaspidella jaspidea*	
5LA1057.TD.70	5LA1057	20.8	13.1	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.71	5LA1057	21.8	11.8	0.8	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA1057.TD.72	5LA1057	15.5	14.0	1.5	2.3	worked-unknown function-partial drill	freshwater; bivalve	
5LA1057.TD.73	5LA1057	19.8	16.7	0.9	N/A	unworked-fragment	gastropod; terrestrial	
5LA1057.TD.74	5LA1057	29.9	19.3	1.9	N/A	worked-unknown function-ground	unknown	
5LA1057.TD.75	5LA1057	29.4	11.2	1.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.76	5LA1057	24.1	8.1	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.77	5LA1057	13.3	7.0	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.78	5LA1057	23.1	8.5	0.9	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA1057.TD.79	5LA1057	21.0	19.9	2.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.8	5LA1057	16.3	9.9	1.7	5.0	worked-ornament-bead-disc	freshwater; bivalve	Perforated shell disk.
5LA1057.TD.80	5LA1057	10.9	8.8	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.81	5LA1057	10.2	8.7	1.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.82	5LA1057	12.8	8.0	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.83	5LA1057	12.3	11.1	0.9	N/A	unworked-fragment	gastropod; terrestrial	
5LA1057.TD.84	5LA1057	16.9	10.1	1.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1057.TD.85	5LA1057	12.0	7.4	1.1	N/A	unworked-fragment	unknown	
5LA1057.TD.9	5LA1057	15.3	15	1.2	1.4	worked-unknown function-partial drill	freshwater; bivalve	
5LA1211.TD.1	5LA1211	8.3	5.0	0.5	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1211.TD.10	5LA1211	7.1	2.3	1.1	4.3	worked-ornament-bead-disc	freshwater; bivalve	Perforated disc bead.
5LA1211.TD.11	5LA1211	6.2	1.7	0.9	4.1	worked-ornament-bead-disc	freshwater; bivalve	Perforated disc bead.
5LA1211.TD.12	5LA1211	11.7	11.1	0.9	6.1	worked-unknown function-partial drill	freshwater; bivalve	Perforated disc bead.
5LA1211.TD.13	5LA1211	14.2	10.7	0.4	3.5	worked-ornament-bead-disc	freshwater; bivalve	Perforated disc bead.
5LA1211.TD.14	5LA1211	14.1	12.3	0.3	3.6	worked-ornament-bead-disc	freshwater; bivalve	Perforated disc bead.
5LA1211.TD.15	5LA1211	12.3	9.3	0.7	N/A	worked-ornament-bead-whole shell	gastropod; unknown	
5LA1211.TD.2	5LA1211	7.4	5.8	0.7	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	Burned.
5LA1211.TD.3	5LA1211	7.2	5.6	1.0	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	Burned.
5LA1211.TD.4	5LA1211	5.5	4.1	3.5	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	Burned.
5LA1211.TD.5	5LA1211	12.9	9.5	1.7	N/A	worked-ornament-bead-disc	freshwater; bivalve	Perforated disc bead.
5LA1211.TD.6	5LA1211	21.1	18.1	1.1	N/A	worked-unknown function-incised	freshwater; bivalve	Artifact has 5 notches along all edges.
5LA1211.TD.7	5LA1211	8.9	2.4	2.2	4.5	worked-ornament-bead-disc	freshwater; bivalve	
5LA1211.TD.8	5LA1211	5.5	1.7	0.2	3.9	worked-ornament-bead-disc	freshwater; bivalve	
5LA1211.TD.9	5LA1211	8.8	1.7	0.5	4.2	worked-ornament-bead-disc	freshwater; bivalve	
5LA1247.DU.1	5LA1247	13.2	10.5	1.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1247.DU.10	5LA1247	18.8	16.6	1.3	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.11	5LA1247	11.0	10.4	1.2	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1247.DU.12	5LA1247	12.6	6.3	0.4	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.13	5LA1247	9.9	9.5	0.8	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.14	5LA1247	13.3	12.0	0.7	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.15	5LA1247	10.5	7.5	0.1	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.16	5LA1247	9.9	9.1	0.6	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.17	5LA1247	11.0	5.6	0.1	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.18	5LA1247	7.9	6.5	0.9	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.19	5LA1247	7.0	6.2	0.3	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.2	5LA1247	32.9	23.2	13.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1247.DU.20	5LA1247	23.4	22.7	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA1247.DU.21	5LA1247	59.4	23.9	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1247.DU.22	5LA1247	26.5	20.4	1.3	N/A	worked-unknown function-ground	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.23	5LA1247	24.8	14.4	2.2	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.24	5LA1247	26.5	14.7	0.6	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.25	5LA1247	15.5	12.4	1.1	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.26	5LA1247	14.6	12.8	0.6	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.27	5LA1247	12.0	11.9	0.5	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.28	5LA1247	11.8	7.0	0.7	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1247.DU.29	5LA1247	17.6	8.3	1.1	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.3	5LA1247	18.7	12.5	1.8	N/A	unworked-fragment	freshwater; bivalve	
5LA1247.DU.30	5LA1247	16.1	6.3	0.5	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.31	5LA1247	13.6	7.9	0.3	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.32	5LA1247	11.8	6.7	1.5	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.33	5LA1247	9.8	8.5	1.0	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.4	5LA1247	14.8	9.7	1.2	N/A	unworked-fragment	freshwater; bivalve	
5LA1247.DU.5	5LA1247	77.9	50.3	7.3	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.6	5LA1247	38.2	19.5	1.9	N/A	worked-unknown function-ground	freshwater bivalve; *Lampsilis siliquoidea*	Shape is oval with one pointed end, pendant preform.
5LA1247.DU.7	5LA1247	29.8	24.8	1.7	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.8	5LA1247	23.6	12.5	0.6	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1247.DU.9	5LA1247	16.1	9.9	1.4	N/A	unworked-fragment	freshwater bivalve; *Lampsilis siliquoidea*	
5LA1413.TD.1	5LA1413	15.6	14.7	2.2	2.9	worked-ornament-bead-disc	freshwater; bivalve	
5LA1413.TD.2	5LA1413	21.9	11.4	1.5	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA1413.TD.3	5LA1413	31.2	28.4	2	1.5 and 1.7	Worked-ornament-pendant-whole shell	freshwater bivalve; *Lampsilis* (unk)	
5LA1413.TD.4	5LA1413	39.7	22.2	2.3	1.4	worked-ornament-pendant-cut	freshwater bivalve; *Lampsilis* (unk)	Hole is drilled from the interior.
5LA1413.TD.5	5LA1413	20.6	18.0	2.6	4.1	worked-ornament-bead-disc	unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1413.TD.6	5LA1413	7.2	7.1	1.4	2.3	worked-ornament-bead-disc	unknown	
5LA1413.TD.7	5LA1413	10.8	6.2	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1413.TD.8	5LA1413	10.4	5.0	1.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.1	5LA1415	24.1	23.9	3.0	N/A	worked-unknown function-ground-incised	freshwater; bivalve	
5LA1415.TD.10	5LA1415	14.1	6.1	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.11	5LA1415	10.9	7.6	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.12	5LA1415	21.0	13.1	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.13	5LA1415	12.5	10.5	2.0	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.14	5LA1415	16.4	12.9	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.15	5LA1415	14.8	7.2	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.16	5LA1415	16.1	9.8	1.5	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.17	5LA1415	18.6	6.3	1.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.18	5LA1415	15.1	7.1	2.7	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.19	5LA1415	13.9	6.9	0.9	3.1	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.2	5LA1415	68.9	49.2	7.4	N/A	Worked-utility-tool use	freshwater; bivalve	
5LA1415.TD.20	5LA1415	17.1	7.7	0.9	1.8	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.21	5LA1415	14.6	7.1	0.7	1.2	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.22	5LA1415	9.3	5	0.8	N/A	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.23	5LA1415	11.7	5.6	0.7	N/A	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.24	5LA1415	15.6	6.9	0.8	1.2	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.25	5LA1415	15.1	7.7	1.1	2.2	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.26	5LA1415	13.3	6.6	0.6	N/A	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1415.TD.27	5LA1415	14.0	7.7	0.8	N/A	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.28	5LA1415	15.4	6.9	0.9	1.4	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.29	5LA1415	12.7	6.2	0.8	2.1	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.3	5LA1415	14.9	12.8	0.9	N/A	worked-unknown function-ground-incised	freshwater; bivalve	
5LA1415.TD.30	5LA1415	9.5	7.2	1	N/A	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.31	5LA1415	13.0	6.6	0.7	1.3	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.32	5LA1415	11.9	6.9	0.7	N/A	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.33	5LA1415	14.4	7.1	0.8	2.1	worked-ornament-bead-whole shell	marine; *Olivella* either *dama, gracilis, or nivea*	
5LA1415.TD.34	5LA1415	11.3	9.4	1.1	N/A	unworked-fragment	freshwater; unknown	
5LA1415.TD.35	5LA1415	20.1	17.4	0.9	N/A	worked-unknown function-ground-incised	freshwater; unknown	
5LA1415.TD.36	5LA1415	10.7	8.9	1.0	N/A	unworked-fragment	freshwater; unknown	
5LA1415.TD.37	5LA1415	23.0	16.7	1.1	N/A	worked-unknown function-ground	freshwater; unknown	
5LA1415.TD.38	5LA1415	24.2	21.4	1.3	N/A	worked-unknown function-ground	freshwater; unknown	
5LA1415.TD.39	5LA1415	17.7	10.2	1.6	N/A	unworked-fragment	freshwater; unknown	
5LA1415.TD.4	5LA1415	20.0	15.2	2.7	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.40	5LA1415	14.7	8.0	1.8	N/A	unworked-fragment	freshwater; unknown	
5LA1415.TD.41	5LA1415	22.9	14.8	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA1415.TD.42	5LA1415	31.4	12.7	1.1	4.2	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.43	5LA1415	32.7	13.9	1.8	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1415.TD.44	5LA1415	15.6	6.7	0.7	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.45	5LA1415	13.2	6.0	0.6	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.46	5LA1415	13.4	6.1	0.8	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.47	5LA1415	10.6	5.9	0.7	1.1	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.48	5LA1415	14.5	6.4	0.8	1.8	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.49	5LA1415	12.7	6.9	0.6	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.5	5LA1415	33.1	21.9	2.1	N/A	unworked-fragment	unknown	
5LA1415.TD.50	5LA1415	11.7	6.7	0.8	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.51	5LA1415	14.8	6.8	0.5	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.52	5LA1415	15.2	7.6	0.6	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.53	5LA1415	14.3	6.4	1	2.2	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.54	5LA1415	15.7	6.9	1.1	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.55	5LA1415	13.9	6.2	0.7	1.6	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.56	5LA1415	13.8	6.3	0.6	N/A	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
5LA1415.TD.6	5LA1415	30.5	10.4	2.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.7	5LA1415	21.6	13.5	1.7	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.8	5LA1415	12.4	6.0	1.5	N/A	unworked-fragment	freshwater; bivalve	
5LA1415.TD.9	5LA1415	6.9	6.9	0.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1416.TD.1	5LA1416	10.8	10.6	4.9	3.6	worked-ornament-bead-disc	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1416.TD.10	5LA1416	8.8	7.2	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1416.TD.11	5LA1416	14.0	7.2	1.0	N/A	worked-unknown function-ground	freshwater; bivalve	Pendant preform.
5LA1416.TD.12	5LA1416	12.9	7.6	0.4	N/A	worked-unknown function-ground	freshwater; bivalve	Pendant preform.
5LA1416.TD.13	5LA1416	11.9	8.2	0.4	N/A	worked-unknown function-ground	freshwater; bivalve	Pendant preform.
5LA1416.TD.14	5LA1416	9.9	7.1	1.0	N/A	worked-unknown function-ground	freshwater; bivalve	Pendant preform.
5LA1416.TD.15	5LA1416	11.1	5.7	0.5	N/A	worked-unknown function-ground	freshwater; bivalve	Pendant preform.
5LA1416.TD.2	5LA1416	19.6	16.7	2.6	N/A	unworked-fragment	freshwater; bivalve	
5LA1416.TD.3	5LA1416	7.0	6.1	1.7	N/A	worked-unknown function-ground-incised	freshwater; bivalve	Triangular shaped with one notch along edge.
5LA1416.TD.4	5LA1416	22	21.6	3.2	3.6	worked-ornament-bead-disc	unknown	Large perforated shell disk. Very thick and robust.
5LA1416.TD.5	5LA1416	15.5	10.9	1.4	N/A	unworked-fragment	freshwater; bivalve	
5LA1416.TD.6	5LA1416	20.1	18.8	3.8	N/A	unworked-fragment	freshwater; bivalve	Beak fragment freshwater mussel, very thick
5LA1416.TD.7	5LA1416	7.7	2.5	1.2	3.9	worked-ornament-bead-disc	unknown	
5LA1416.TD.8	5LA1416	10.3	6.7	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1416.TD.9		12.5	10.5	1.5	2.2	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1417.TD.1	5LA1417	7.1	7	1.0	2.3	Worked-unknown function-partial drill	freshwater; bivalve	
5LA1419.TD.1	5LA1419	16.1	15.4	0.8	N/A	worked-unknown function-ground	freshwater; bivalve	Pendant preform.
5LA1426.TD.1	5LA1426	18.0	9.4	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA1456.TD.1	5LA1456	32.6	11.5	2.3	2.9	worked-unknown function-partial drill	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA1456.TD.2	5LA1456	15.4	10.0	1.1	N/A	worked-unknown function-ground-incised	freshwater; bivalve	
5LA1456.TD.3	5LA1456	15.0	6.7	0.2	1.9	worked-unknown function-partial drill	freshwater; bivalve	
5LA1456.TD.4	5LA1456	12.2	6.4	1	N/A	unworked-fragment	freshwater; bivalve	
5LA1456.TD.5	5LA1456	17.1	9.7	0.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1456.TD.6	5LA1456	7.7	5.8	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA1456.TD.7	5LA1456	7.8	4.3	0.1	N/A	unworked-fragment	freshwater; bivalve	
5LA1456.TD.8	5LA1456	7.4	5.2	0.9	N/A	unworked-fragment	freshwater; bivalve	
5LA1478.TD.1	5LA1478	24.9	15.7	1.5	1.0	worked-ornament-pendant-cut	freshwater; bivalve	
5LA1485.TD.1	5LA1485	40.8	29.4	3.3	N/A	unworked-fragment	marine; Ostreidae (oyster)	
5LA1485.TD.2	5LA1485	15.1	12.3	1.3	N/A	unworked-fragment	freshwater; bivalve	
5LA1485.TD.3	5LA1485	12.1	10.3	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA1485.TD.4	5LA1485	9.8	8.1	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA2316.FC.1	5LA2316	11.8	7.2	4.0	N/A	unworked-fragment	freshwater; unknown	
5LA2316.FC.2	5LA2316	15.0	8.4	2.3	N/A	unworked-fragment	freshwater; unknown	
5LA2316.FC.3	5LA2316	8.9	7.6	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA2316.FC.4	5LA2316	14.4	7.7	2.5	N/A	unworked-fragment	freshwater; unknown	
5LA2351.FC.1	5LA2351	33.8	13.1	2.0	N/A	unworked-fragment	freshwater; unknown	
5LA2618.FC.1	5LA2618	12.1	9.1	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA2618.FC.2	5LA2618	7.7	3.5	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA2619.FC.1	5LA2619	18.4	8.1	1.5	N/A	unworked-fragment	freshwater; unknown	
5LA3189.FC.1	5LA3189	13.6	10.8	1.4	N/A	unworked-fragment	freshwater; unknown	
5LA3189.FC.2	5LA3189	21.2	15.3	1.3	N/A	unworked-fragment	freshwater; unknown	
5LA3221.FC.1	5LA3221	15.5	14.7	2.4	N/A	unworked-fragment	freshwater; unknown	
5LA3369.FC.1	5LA3369	13.5	9.5	0.4	N/A	unworked-fragment	freshwater; unknown	
5LA3369.FC.2	5LA3369	19.2	8.7	1.5	N/A	unworked-fragment	freshwater; unknown	
5LA3420.FC.1	5LA3420	40.3	25.5	2.4	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA3421.FC.1	5LA3421	5.9	3.3	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA3421.FC.2	5LA3421	5.2	5.1	0.4	N/A	unworked-fragment	freshwater; unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA3421.FC.3	5LA3421	8.7	8.8	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA3421.FC.4	5LA3421	11.8	3.6	1.3	N/A	unworked-fragment	freshwater; unknown	
5LA3421.FC.5	5LA3421	5.6	4.2	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA3421.FC.6	5LA3421	8.7	6.3	0.4	N/A	unworked-fragment	freshwater; unknown	
5LA3421.FC.7	5LA3421	17.1	9.4	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA3421.FC.8	5LA3421	21.5	17.3	1.3	N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.1	5LA3491	16.6	17.7	0.8	N/A	worked-ornament-pendant-cut	freshwater; unknown	
5LA3491.FC.10	5LA3491	13.9	6.9	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.11	5LA3491	41.3	12.1	2.8	N/A	worked-unknown function-ground	freshwater; unknown	
5LA3491.FC.12	5LA3491	31.7	14.1	2.0	2.1	worked-ornament-pendant-cut	freshwater; unknown	Rectangular in shape.
5LA3491.FC.13	5LA3491	12.9	9.7	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA3491.FC.2	5LA3491				N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.3	5LA3491	22.1	14.7	1.9	N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.4	5LA3491	15	12.3	1.4	N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.5	5LA3491	12.2	8.1	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.7	5LA3491	13.2	14.1	1.4	N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.8	5LA3491	13.9	9.8	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA3491.FC.9	5LA3491	8.6	6.1	0.1	N/A	unworked-fragment	freshwater; unknown	
5LA3570.FC.1	5LA3570	14.6	9.4	2.2	N/A	unworked-fragment	freshwater; bivalve	
5LA3570.FC.2	5LA3570	8.9	4.9	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA4414.FC.1	5LA4414	20.7	13.9	2.1	N/A	unworked-fragment	freshwater; bivalve	
5LA4414.FC.2	5LA4414	13.3	10.5	1.7	N/A	unworked-fragment	freshwater; bivalve	
5LA4414.FC.3	5LA4414	9.2	6.6	1.7	N/A	unworked-fragment	freshwater; bivalve	
5LA4451.FC.1	5LA4451	11.9	3.6		N/A	worked-ornament-bead-disc	freshwater; unknown	Perforated disk. Hole in center is much larger than other perforated disks.
5LA5234.FC.1	5LA5234	17.5	8.8	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.10	5LA5234	10.2	8.1	0.3	N/A	unworked-fragment	freshwater; unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5234.FC.11	5LA5234	19.3	10.9	0.6	N/A	worked-unknown function-ground	freshwater; unknown	Geometric/triangular shape.
5LA5234.FC.12	5LA5234	32.6	15.1	1.9	N/A	worked-unknown function-ground	freshwater; unknown	Ground into a geometric/rectangular shape. Ground on all side
5LA5234.FC.13	5LA5234	19.9	14.6	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.14	5LA5234	9.1	5.3	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.2	5LA5234	10.4	8.4	0.8	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.3	5LA5234	19.9	15.3	0.5	N/A	worked-unknown function-ground-incised	freshwater; unknown	Rectangular with 3 notches along one edge.
5LA5234.FC.4	5LA5234	14.7	8.8	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.5	5LA5234	9.1	4.6	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.6	5LA5234	10.1	5.6	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.7	5LA5234	14.4	13.5	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.8	5LA5234	16.3	11.8	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5234.FC.9	5LA5234	9.9	7.4	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA5235.FC.1	5LA5235	9.7	6.3	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA5235.FC.2	5LA5235	19.9	17.2	1.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5235.FC.3	5LA5235	10.2	7.5	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA5235.FC.4	5LA5235	16.2	14.4	2.5	1.6	worked-unknown function-partial drill	freshwater; bivalve	
5LA5243.FC.1	5LA5243	14.8	8.4	0.9	N/A	unworked-fragment	freshwater; bivalve	
5LA5244.FC.1	5LA5244	11.5	7.3	0.6	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA5244.FC.2	5LA5244	10.9	7.7	0.3	1.7	worked-unknown function-partial drill	freshwater; bivalve	
5LA5244.FC.3	5LA5244	16.4	12.4	1.4	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA5244.FC.4	5LA5244	15.1	8.6	1.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5244.FC.5	5LA5244	11.3	9.8	2.2	N/A	unworked-fragment	unknown	
5LA5244.FC.6	5LA5244	18.8	7.4	1.4	N/A	unworked-fragment	freshwater; bivalve	Beak fragment.

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5244.FC.7	5LA5244	13.2	9.3	1.1	N/A	worked-unknown function-ground-incised	freshwater; bivalve	
5LA5253.FC.1	5LA5253	19.4	14.7	0.4	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA5255.FC.1	5LA5255	16.8	10.3	2.1	N/A	unworked-fragment	gastropod; unknown	
5LA5255.FC.10	5LA5255	16.1	15.5	1.1	N/A	unworked-fragment	freshwater; unknown	
5LA5255.FC.2	5LA5255	7.6	6.0	0.8	N/A	unworked-fragment	freshwater; unknown	
5LA5255.FC.3	5LA5255	7.2	5.7	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5255.FC.4	5LA5255	83.7	52.0	2.6	N/A	worked-unknown function-partial drill	freshwater bivalve; *Anodontoides ferussacianus*	
5LA5255.FC.5	5LA5255	9.2	8.6	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5255.FC.6	5LA5255				N/A	unworked-fragment	freshwater; unknown	
5LA5255.FC.7	5LA5255	12.1	10.6	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5255.FC.8	5LA5255	17.3	13.5	2.1	N/A	unworked-fragment	freshwater; unknown	
5LA5255.FC.9	5LA5255	10.0	6.3	0.2	N/A	unworked-fragment	gastropod; unknown	
5LA5257.FC.1	5LA5257	28.6	16.7	2.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.1	5LA5258	24.8	15.4	1.4	N/A	Worked-utility-tool use	freshwater; unknown	
5LA5258.FC.10	5LA5258	15.4	13.8	1.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.11	5LA5258	16.0	10.1	1.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.12	5LA5258	8.9	7.3	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.2	5LA5258	9.4	5.0	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.3	5LA5258	20.0	10.5	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.4	5LA5258	10.0	8.4	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.5	5LA5258	12.8	10.3	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.6	5LA5258	17.8	5.6	2.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.7	5LA5258	7.9	6.6	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.8	5LA5258	21.7	11.8	2.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5258.FC.9	5LA5258	18.4	17.1	1.4	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA5262.FC.1	5LA5262	25.0	16.5	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.10	5LA5262	11.9	10.4	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.11	5LA5262	10.4	7.4	0.3	N/A	unworked-fragment	freshwater; unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5262.FC.12	5LA5262	14.3	10.5	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.13	5LA5262	13.0	8.2	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.14	5LA5262	10.4	8.3	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.15	5LA5262	9.0	8.1	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.16	5LA5262	9.4	7.6	0.9	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.17	5LA5262	8.0	4.6	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.2	5LA5262	14.8	13.4	0.9	N/A	worked-unknown function-ground	freshwater; unknown	
5LA5262.FC.3	5LA5262	9.2	7.7	1.0	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.4	5LA5262	15.9	12.3	0.4	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.5	5LA5262	10.9	6.0	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.6	5LA5262	42.3	18.6	1.7	N/A	worked-unknown function-ground	freshwater; unknown	
5LA5262.FC.7	5LA5262	26.4	11.9	0.7	N/A	worked-unknown function-ground	freshwater; unknown	
5LA5262.FC.8	5LA5262	13.9	11.5	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5262.FC.9	5LA5262	18.2	15.0	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5264.FC.1	5LA5264	18.1	12.5	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.10	5LA5264	11.2	8.6	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.11	5LA5264	15.4	11.3	2.0	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.2	5LA5264	16.6	16.1	2.7	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.3	5LA5264	23.4	12.5	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.4	5LA5264	17.9	10.5	1.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.5	5LA5264	29.4	10.4	1.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.6	5LA5264	13.5	9.9	1.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.7	5LA5264	15.4	8.7	1	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.8	5LA5264	16.3	8.1	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5264.FC.9	5LA5264	10.8	8.6	0.9	N/A	unworked-fragment	freshwater; bivalve	
5LA5270.FC.1	5LA5270	18.2	9.0	1.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5270.FC.10	5LA5270	22.3	10.3	1.8	N/A	unworked-fragment	freshwater; unknown	
5LA5270.FC.11	5LA5270	27.5	14.1	2.6	N/A	unworked-fragment	freshwater; unknown	
5LA5270.FC.2	5LA5270				N/A	unworked-complete	gastropod; unknown	
5LA5270.FC.3	5LA5270	21.9	12.6	1.6	N/A	unworked-fragment	freshwater; unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5270.FC.4	5LA5270	11.2	11.1	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5270.FC.5	5LA5270	8.9	7.4	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA5270.FC.6	5LA5270	10.1	7.5	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5270.FC.7	5LA5270	7.1	5.9	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA5270.FC.8	5LA5270	10.0	5.8	0.4	N/A	unworked-fragment	freshwater; unknown	
5LA5270.FC.9	5LA5270	10.0	7.8	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA5298.FC.1	5LA5298	20.7	11.2	2.0	N/A	unworked-fragment	freshwater; bivalve	
5LA5300.FC.1	5LA5300	9.8	9.7	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA5300.FC.2	5LA5300	8.8	4.6	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA5300.FC.3	5LA5300	3.0	2.0	0.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5300.FC.4	5LA5300	7.6	5.0	0.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5300.FC.5	5LA5300	7.0	6.0	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5300.FC.6	5LA5305	12.0	7.7	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA5320.FC.1	5LA5320	18.1	12.3	1.3	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.10	5LA5320	15.0	6.4	1.0	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.11	5LA5320	17.7	13.7	1.0	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.12	5LA5320	22.6	12.8	1.1	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.13	5LA5320	13.9	12.1	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.14	5LA5320	9.9	8.7	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.15	5LA5320	15.6	10.3	0.4	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.16	5LA5320	28.6	27.5	1.3	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.17	5LA5320	25.6	17.3	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.18	5LA5320	19.2	17.1	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.19	5LA5320	21.0	13.8	1.3	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.2	5LA5320				N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.20	5LA5320	39.2	17.6	1.5	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.21	5LA5320	33.1	16.8	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.22	5LA5320	16.0	8.4	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.23	5LA5320	14.4	10.4	1.1	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.24	5LA5320	20.3	8.7	0.9	N/A	worked-unknown function-ground	freshwater; unknown	Ground on two edges
5LA5320.FC.25	5LA5320	31.6	19.3	1.9	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.26	5LA5320	17.5	9.8	1.2	N/A	unworked-fragment	freshwater; unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5320.FC.27	5LA5320	15.4	11.5	0.8	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.28	5LA5320	14.3	8.9	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.29	5LA5320	13.7	13.5	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.3	5LA5320	12.7	10.1	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.30	5LA5320	15.1	10.0	0.9	N/A	worked-unknown function-incised	freshwater; unknown	3 notches along one edge.
5LA5320.FC.31	5LA5320	10.2	8.2	1.5	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.32	5LA5320	10.2	9.8	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.33	5LA5320	9.8	8.6	0.6	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.34	5LA5320	10.0	7.7	0.8	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.35	5LA5320	21.0	18.0	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.36	5LA5320	17.0	7.9	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.4	5LA5320	22.1	13.1	0.9	N/A	unworked	freshwater; unknown	
5LA5320.FC.5	5LA5320	16.3	12.9	1.0	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.6	5LA5320	18.7	16.1	1.3	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.7	5LA5320	20.5	12.5	1.0	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.8	5LA5320	14.5	7.6	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5320.FC.9	5LA5320	16.6	13.5	0.8	N/A	unworked-fragment	freshwater; unknown	
5LA5326.FC.1	5LA5326	15.0	8.8	0.6	N/A	worked-ornament-pendant-whole shell	freshwater bivalve; *Lampsilis* (unk)	
5LA5379.FC.1	5LA5379	25.9	12.9	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5383.FC.1	5LA5383	13.4	6.3	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5383.FC.2	5LA5383	10.3	6.4	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5383.FC.3	5LA5383	4.9	2.3	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5383.FC.4	5LA5383	10.1	7.3	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5383.FC.5	5LA5383	17.7	13.5	1.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5383.FC.6	5LA5383	18.4	15.2	1.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5383.FC.7	5LA5383	21.2	9.7	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5385.FC.1	5LA5385	9.9	9.8	0.2	N/A	worked-ornament-pendant-cut	freshwater; unknown	
5LA5385.FC.10	5LA5385	14.3	8.0	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5385.FC.11	5LA5385	13.0	7.0	1.0	N/A	unworked-fragment	freshwater; unknown	
5LA5385.FC.12	5LA5385	11.9	5.1	0.2	N/A	unworked-fragment	freshwater; unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5385.FC.13	5LA5385	14.1	9.0	0.2	N/A	unworked-fragment	freshwater; unknown	
5LA5385.FC.14	5LA5385	10.9	8.1	0.5	N/A	worked-unknown function-ground	freshwater; unknown	
5LA5385.FC.2	5LA5385	10.2	9.5	0.4	N/A	worked-ornament-pendant-cut	freshwater; unknown	
5LA5385.FC.3	5LA5385	20.7	16.4	3.5	N/A	worked-unknown function-ground	freshwater bivalve; *Lampsilis* (unk)	Pendant preform.
5LA5385.FC.4	5LA5385	15.8	11.2	0.7	N/A	worked-unknown function-ground	freshwater; unknown	Pendant preform.
5LA5385.FC.5	5LA5385	12.6	9.0	0.5	0.6	worked-ornament-pendant-cut	freshwater; unknown	Triangular pendant.
5LA5385.FC.6	5LA5385	20.7	16.1	3.2	N/A	worked-unknown function-ground	freshwater; unknown	Square shape with rounded corners.
5LA5385.FC.7	5LA5385	14.1	13.0	1.6	N/A	unworked-fragment	freshwater; unknown	
5LA5385.FC.8	5LA5385	12.1	6.5	2	N/A	unworked-fragment	freshwater; unknown	
5LA5385.FC.9	5LA5385	12.9	7.6	1	N/A	unworked-fragment	freshwater; unknown	
5LA5402.FC.1	5LA5402	40.2	19.2	2.5	N/A	worked-ornament-pendant-cut	freshwater; unknown	
5LA5402.FC.10	5LA5402	8.4	5.9	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.11	5LA5402	17.8	7.6	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.12	5LA5402	7.3	6.7	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.13	5LA5402	11.9	11.0	1.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.14	5LA5402	14.3	6.8	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.2	5LA5402	13.0	6.8	2.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.3	5LA5402	9.7	8.1	1.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.4	5LA5402	19.6	17.2	0.6	N/A	worked-unknown function-ground-incised	freshwater; bivalve	
5LA5402.FC.5	5LA5402	10.1	10	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.6	5LA5402	8.8	8.2	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.7	5LA5402	19.0	11.1	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.8	5LA5402	17.0	9.2	0.9	N/A	unworked-fragment	freshwater; bivalve	
5LA5402.FC.9	5LA5402	7.4	4.2	0.2	N/A	unworked-fragment	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5403.FC.1	5LA5403	28.7	12.9	1.2	N/A	worked-ornament-pendant-cut	unknown	
5LA5403.FC.10	5LA5403	13.9	10.3	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.2	5LA5403	21.0	9.8	2.1	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.3	5LA5403	13.4	8.7	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.4	5LA5403	20.3	13.5	0.7	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.5	5LA5403	20.2	11.7	1.2	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.6	5LA5403	8.5	8.3	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.7	5LA5403	13.1	6.9	0.4	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.8	5LA5403	13.3	7.2	0.3	N/A	unworked-fragment	freshwater; unknown	
5LA5403.FC.9	5LA5403	13.9	12.9	0.5	N/A	unworked-fragment	freshwater; unknown	
5LA5420.FC.1	5LA5420	16.2	12.1	7.9	N/A	worked-ornament-bead-whole shell	marine; *Cypraea* (cowery)	
5LA5423.FC.1	5LA5423	12.9	10.9	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5423.FC.2	5LA5423	27.4	15.6	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA5465.FC.1	5LA5465	22.3	11.6	2.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5465.FC.2	5LA5465	12.5	10.4	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5471.FC.1	5LA5471	15.9	7.4	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA5471.FC.2	5LA5471	10.3	9.4	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5471.FC.3	5LA5471	6.8	5.9	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5471.FC.4	5LA5471	9.0	8.5	0.2	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.1	5LA5503	11.0	11.0	0.9	N/A	worked-ornament-pendant-cut	freshwater; bivalve	
5LA5503.FC.10	5LA5503	7.0	7.0	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.11	5LA5503	9.6	7.1	0.9	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.12	5LA5503	17.6	13.1	2.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.13	5LA5503	14.3	12.5	1.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.14	5LA5503	14.0	8.6	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.2	5LA5503	17.3	7.8	0.4	N/A	worked-unknown function-ground	freshwater; bivalve	
5LA5503.FC.3	5LA5503	16.7	7.9	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.4	5LA5503	6.8	6.8	0.4	N/A	worked-ornament-pendant-cut	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5503.FC.5	5LA5503	18.7	6.7	0.9	N/A	worked-unknown function-ground	unknown	Pendant preform.
5LA5503.FC.6	5LA5503	13.5	11.2	0.7	3.2	worked-ornament-bead-disc	freshwater; bivalve	
5LA5503.FC.7	5LA5503	12.2	7.3	0.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.8	5LA5503	9.8	5.8	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5503.FC.9	5LA5503	8.5	5.8	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5554.FC.1	5LA5554	9.1	7.5	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5554.FC.2	5LA5554	9.8	8.3	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.1	5LA5568	16.4	11.7	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.10	5LA5568	11.5	10.4	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.2	5LA5568	21.3	15.1	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.3	5LA5568	11.9	9.1	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.4	5LA5568	11.3	7.9	0.6	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.5	5LA5568	18.7	14.6	1.4	N/A	unworked-fragment	freshwater; bivalve	Beak fragment.
5LA5568.FC.6	5LA5568	16.1	11.8	1.2	N/A	unworked-fragment	freshwater; bivalve	Beak fragment.
5LA5568.FC.7	5LA5568	15.5	12.3	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.8	5LA5568	13.6	9.8	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA5568.FC.9	5LA5568	8.7	7.2	0.4	N/A	unworked-fragment	freshwater; bivalve	
5LA5571.FC.1	5LA5571	28.1	16.2	2.4	N/A	unworked-fragment	freshwater; bivalve	Beak fragment.
5LA5571.FC.2	5LA5571	12.7	9.8	1	N/A	unworked-fragment	freshwater; bivalve	
5LA5571.FC.3	5LA5571	14.0	8.8	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5571.FC.4	5LA5571	17.5	4.1	0.3	N/A	unworked-fragment	freshwater; bivalve	
5LA5571.FC.5	5LA5571	32.8	5.6	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA5598.FC.1	5LA5598	8.4	6.6	0.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5598.FC.2	5LA5598	8.9	5.9	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA5598.FC.3	5LA5598	19.1	8.0	0.8	N/A	unworked-fragment	freshwater; bivalve	
5LA5602.FC.1	5LA5602	45.4	23.0	3.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5602.FC.2	5LA5602	7.6	7.6	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA5602.FC.3	5LA5602	15.7	8.7	1.5	N/A	unworked-fragment	freshwater; bivalve	
5LA5602.FC.4	5LA5602	11.3	8.7	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA5703.FC.1	5LA5703	8.5	7.4	1.0	N/A	unworked-fragment	freshwater; bivalve	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LA5955.CU.1	5LA5955	23.9	13.6	1.5	N/A	worked-unknown function-ground	freshwater; unknown	
5LA5955.CU.2	5LA5955	21.1	12.6	2.1	2.5	worked-ornament-pendant-whole shell	freshwater; unknown	
5LA5955.CU.3	5LA5955	15.4	14.2	1.8	N/A	worked-unknown function-ground	freshwater; unknown	
5LA6104.FC.1	5LA6104	30.7	15.5	2.0	N/A	worked-unknown function-ground	freshwater bivalve; *Lampsilis* (unk)	
5LA6104.FC.2	5LA6104	16.0	8.8	1.7	N/A	unworked-fragment	freshwater bivalve; *Lampsilis* (unk)	
5LA6105.FC.1	5LA6105	16.9	16.8	1.5	N/A	worked-ornament-bead-disc	freshwater bivalve; *Lampsilis* (unk)	
5LA6568.FC.1	5LA6568	9.5	7.6	1.1	N/A	unworked-fragment	freshwater; bivalve	
5LA6568.FC.2	5LA6568	15.1	7.9	1.0	N/A	unworked-fragment	freshwater; bivalve	
5LA6568.FC.3	5LA6568	9.1	7.2	0.7	N/A	unworked-fragment	freshwater; bivalve	
5LA6592.FC.1	5LA6592	11.3	9.0	0.8	2.1	worked-ornament-pendant-cut	unknown	
5LA8108.FC.1	5LA8108	16.1	10.8	1.7	N/A	unworked-fragment	freshwater bivalve; *Lampsilis* (unk)	
5LR0013.CU.1	5LR0013	23.4	14.8	2.6	N/A	unworked-fragment	unknown	
5LR0013.CU.2	5LR0013	18.9	8.9	2.7	N/A	unworked-fragment	unknown	
5LR0013.DMNS.1	5LR0013	14.4	7.1	0.7	1.8	worked-ornament-bead	marine; *Olivella* (unk)	
5LR0144c.LOPA.1	5LR0144	23.3	14.4	6.0	N/A	unworked-fragment	unknown	Kinny Springs
5LR0144c.LOPA.2	5LR0144	12.3	9.3	2.4	4.5	worked-ornament-bead-disc	unknown	Kinny Springs
5LR0205.LOPA.1	5LR0205	14.6	8.3	3.8	N/A	unworked-fragment	freshwater; unknown	
5LR0205.LOPA.2	5LR0205	8.7	7.1	3.5	N/A	unworked-fragment	unknown	
5LR0205.LOPA.3	5LR0205	9.8	8.6	1.6	1.6	worked-unknown function-partial drill	unknown	
5LR0205.LOPA.4	5LR0205	13.2	7.1	1.4	N/A	unworked-fragment	unknown	
5LR0205.LOPA.5	5LR0205	12.5	9.2	3.1	N/A	unworked-fragment	unknown	
5LR0205.LOPA.6	5LR0205	12.6	8.4	1.8	N/A	unworked-fragment	unknown	
5LR0205.LOPA.7	5LR0205	12.7	6.5	1.7	N/A	unworked-fragment	unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LR0205.LOPA.8	5LR0205	12.4	6.6	1.1	N/A	unworked-fragment	unknown	
5LR0251.LOPA.1	5LR0251	23	20.1	2.8	4.7	worked-ornament-bead-disc	unknown	
5LR0263.LOPA.1	5LR0263	10.1	2.9	0.6	1.4 and 0.5	worked-ornament-bead-whole shell	marine; *Dentalium*	Tubular shell bead.
5LR0284.LOPA.1	5LR0284	121.8	68.8	7.5	8.0 and 1.2	worked-ornament-pendant-whole shell	freshwater; unknown	Lightening Hill
5LR0284.LOPA.2	5LR0284	115.3	68.7	4.9	6.5, 12.2, and 2.6	worked-ornament-pendant-whole shell	freshwater; unknown	Incised on the underside. 3 drill holes. Lightening Hill
5LR0284.LOPA.3	5LR0284	16.9	9.2	0.9	N/A	unworked-fragment	freshwater; unknown	
5LR0296.LOPA.1	5LR0296	10.7	7.3		3.6	worked-ornament-bead-disc	unknown	
5LR0296.LOPA.2	5LR0296	9.4	7.7		2.4	worked-ornament-bead-disc	unknown	
5LR11697.LOPA.1	5LR11697	30	19.2	5.9	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.10	5LR11697	12.6	8.8	1.0	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.11	5LR11697	16.7	7.9	1.5	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.12	5LR11697	10.6	7.4	0.9	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.13	5LR11697	12.8	7.4	0.3	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.14	5LR11697	12.9	9.7	0.3	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.15	5LR11697	10.2	7.1	0.4	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.2	5LR11697	26.9	12.9	1.5	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.3	5LR11697	36.9	15.9	3.4	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.4	5LR11697	17.4	9.6	0.7	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.5	5LR11697	16.4	12.1	2.4	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.6	5LR11697	25.3	14.5	4.3	N/A	unworked-fragment	freshwater; unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5LR11697.LOPA.7	5LR11697	16.6	11.1	3.8	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.8	5LR11697	12.9	11.9	1.4	N/A	unworked-fragment	freshwater; unknown	
5LR11697.LOPA.9	5LR11697	12.3	9.7	0.5	N/A	unworked-fragment	freshwater; unknown	
5MR0390.CHS.1	5MR0390	4.9	3.6	0.4	N/A	unworked-complete	gastropod; terrestrial	
5OT0219.CU.1	5OT0219	18.4	7.3	2.0	N/A	unworked-fragment	freshwater; unknown	
5PE0081.DU.1	5PE0081	26.8	18.1	4.3	N/A	unworked-fragment	marine; Ostreidae (oyster)	
5PE0081.DU.10	5PE0081	62.4	29.2	11.4	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0081.DU.2	5PE0081	76	58.2	9.1	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0081.DU.3	5PE0081	71.5	51.9	9.4	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0081.DU.4	5PE0081	80.9	58.5	12.7	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0081.DU.5	5PE0081	104.6	59.3	5.9	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0081.DU.6	5PE0081	90.2	68.1	11.8	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0081.DU.7	5PE0081	100.1	53.3	12.0	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0081.DU.8	5PE0081	35.4	25.9	10.9	N/A	unworked-fragment	marine; Ostreidae (oyster)	
5PE0081.DU.9	5PE0081	109.7	56.6	14.5	N/A	unworked-complete	marine; Ostreidae (oyster)	
5PE0082.DU.1	5PE0082	14.4	9.7	0.8	N/A	unworked-fragment	unknown	
5PE0133.DU.1	5PE0133	16.4	7.6	0.3	N/A	unworked-fragment	gastropod; terrestrial	
5PE0133.DU.2	5PE0133	15.9	6.2	0.3	N/A	unworked-fragment	gastropod; terrestrial	
5PE0272.DU.1	5PE0272	14.1	7.5	0.7	N/A	worked-unknown function-ground	unknown	Diamond shaped.
5PE0272.DU.2	5PE0272	20.5	8.0	0.5	N/A	unworked-fragment	gastropod; terrestrial	
5PE0273.DU.1	5PE0273	20.4	17.9	0.6	N/A	unworked-fragment	gastropod; terrestrial	
5PE0273.DU.2	5PE0273	18.8	15.6	1.6	N/A	unworked-fragment	unknown	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
5PE0321.FC.1	5PE0321	29.3	11.3	2.3	N/A	unworked-fragment	unknown	
5PE0349.DU.1	5PE0349	10.9	5.6	0.5	1.7 and 1.3	worked-unknown function-partial drill	freshwater; unknown	Two drill holes.
5PE0349.DU.2	5PE0349	11.9	9.2	1.3	1.6	Worked-unknown function-ground-incised	freshwater; unknown	
5PE0349.DU.3	5PE0349	9.3	5.6	0.3	1.5	worked-unknown function-partial drill	freshwater; unknown	
5PE0349.DU.4	5PE0349	5.1	4.2	0.4	1.2	worked-unknown function-partial drill	freshwater; unknown	
5PE0349.DU.5	5PE0349	9.6	7.4	1.1	1.4	worked-unknown function-partial drill	freshwater; unknown	
5PE0349.DU.6	5PE0349	12.2	8.3	0.9	1.6 and 1.6	worked-unknown function-partial drill	freshwater; unknown	
5PE0349.DU.7	5PE0349	6.0	6.1	0.3	N/A	worked-unknown function-partial drill	freshwater; unknown	
5PE0648.FC.1	5PE0648	16.2	9.6	1.2	N/A	worked-unknown function-ground	unknown	
5PE0868.FC.1	5PE0868	9.8	5.6	1.3	N/A	unworked-fragment	unknown	
5PE1192.FC.1	5EP1192	8.7	6.9	1	N/A	worked-ornament-pendant-cut	freshwater; unknown	
5YM0002.DU.1	5YM0002	11.9	10.5	1.3	N/A	unworked-fragment	freshwater; unknown	
5YM0005.DU.1	5YM0005	12.6	11	1.9	N/A	unworked-fragment	freshwater; unknown	
UKN.CU.1	5JA0000a	12.7	9.3	5.5	1.2	worked-ornament-bead	marine; unknown	
LR.LOPA.GW-2.1	Monroe Ranch	5.4	5.3	1.2	2.4	worked-ornament-bead-disc	freshwater; bivalve	
UNK.DMNS.2	Unknown	12.5	11.5	2.4	3	worked-ornament-bead	gastropod; marine	
UNK.FCM.1	R. Coffin Collection	21.9	21.7	unknown	5.1	worked-ornament-bead-disc	freshwater; bivalve	
UNK.FCM.2	R. Coffin Collection	7.3	7	2.8	2.2	worked-ornament-bead-disc	freshwater; bivalve	
UNK.FCM.3	R. Coffin Collection	14.2	7	1	1.3	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	

Catalog Number	Site Number	Length (mm)	Width (mm)	Thickness (mm)	Hole Diameter (mm)	Type Category	Shell Type	Notes/Description
UNK.FCM.4	R. Coffin Collection	14.3	5.6	0.8	1.1	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
UNK.FCM.5	R. Coffin Collection	14.9	7.1	1.2	2.9	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
UNK.FCM.6	R. Coffin Collection	63.2	26.4	unknown	N/A	worked-utility-tool use	freshwater; bivalve	
WL.LOPA.GW-1.1	WD-1	14.5	6	1.2	2.3	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
WL.LOPA.GW-1.2	WD-1	15.2	6.8	0.8	1.2	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
WL.LOPA.GW-1.3	WD-1	13.6	6.4	0.9	2.2	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
WL.LOPA.GW-1.4	WD-1	12.5	4.9	0.8	1.7	worked-ornament-bead-whole shell	marine; *Olivella* (unk)	
UNK.TD.1	Apishapa 1-2	14.9	11.4	0.9	N/A	unworked-fragment	freshwater; bivalve	
UNK.TD.2	Apishapa 1-2	18.0	10.4	1.4	N/A	unworked-fragment	freshwater; bivalve	
UNK.TD.3	Apishapa 1-2	17.2	14.2	0.6	N/A	worked-unknown function-ground	freshwater; bivalve	
UNK.TD.4	Red Rock Island Site	20.1	12.9	1.1	N/A	worked-unknown function-ground	freshwater; bivalve	
UNK.TD.5	Red Rock Island Site	36.6	19.5	2.1	N/A	unworked-fragment	freshwater; bivalve	
UNK.TD.6	Red Rock Island Site	18.8	13.4	1.3	N/A	worked-unknown function-ground	freshwater; bivalve	
UNK.TD.7	Red Rock Island Site	17.6	14.2	1.2	N/A	unworked-fragment	freshwater; bivalve	
UNK.TD.8	Red Rock Island Site	23.1	17.2	2.1	N/A	unworked-fragment	freshwater; bivalve	
UNK.TD.9	Red Rock Island Site	19.4	11.5	1.5	N/A	unworked-fragment	freshwater; bivalve	

APPENDIX B: SITE BIBLIOGRAPHY

Appendix B presents a compilation of all prehistoric sites in the Arkansas and South Platte River Basins known to contain mollusc artifacts with their corresponding bibliographic information. Also included in this list are the contents/notes from the corresponding OAHP site forms. This site list was compiled via various database and literature queries. Not every site listed in this complication has artifacts in Appendix A, because not all specimens could be located for study. This list is meant to be comprehensive and serve as a baseline for mollusc bibliographic references in Eastern Colorado, but the author acknowledges that the list may lack some sites and reference information.

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5AM0003	There is no site form for this site	The Archaeology and Physical Anthropology of the Gahagan-Lipe Site with Comments on Colorado Woodland Mortuary Practices	Douglas D. Scott and Terje G. Birkedal	1972	*Southwestern Lore* 38(3): 1- 18
	See above	A Further Note on Burial 7, Hazeltine Heights Site	David D. Breternitz	1972	*Southwestern Lore* 38(3): 18
	See above	The Excavation of the Hazeltine Heights Site	William G. Buckles, George H. Ewing, Nancy Buckles, George J. Armelagos, John J. Wood, James D. Haug, and John H. McCullough	1963	*Southwestern Lore* 29(1)1-36
5AM0005	Site form lists artifacts as "1 woodland sherd."	Cultural Resource Inventory of the Arapahoe Motorized State Recreation Area	Keith Abernathy	1982	Denver Chapter, Colorado Archaeological Society
	See above	Archaeological Appraisal of the Proposed West Bijou, East Bijou and Big Muddy Resevoirs, Arapahoe and Adams Counties, Colorado	David A. Breternitz	1969	Department of Anthropology, CU
5AM0648	Site form lists shell	An Archaeological and Historical Survey of the Interstate 76-120th Avenue Interchange, Adams County, Colorad	Christian J. Zier, Daniel A Jepson, Marcus Grant	1993	Centennial Archaeology, Inc., Fort Collins Colorado.
5BA0007	Site form does not mention shell	Information on the site card was extracted from the journal of Hal Chase on July 2, 1949.	N/A	N/A	N/A
5BA0118	Site form lists "1 univalve shell"	The Cultural Resources of the Flank Field Storage Area, Baca County, Colorado	Caryl E. Wood, Penny Price-McPherson, Cheryl A Harrison, and Howard M. Davidson	1981	Reports of the Laboratory of Public Archaeology No. 36 June, 1981. Laboratory of Public Archaeology, Colorado State University, Fort Collins, CO
5BL0004	Site form states "old shell"	The archaeology of Rabbit Mountain, the 1993 Inventory	P. Gleichman and K. Halford		Native Cultural Services, Boulder Colorado

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
	See above	An Archaelogical Inventory of Rabbit Mountain East of Lyons, Boulder County, Colorado	Sharon Pay, Tom Meiers, Larry Riggs, and Ann Pipkins	1989	Prepared by Colorado Archaeological Society, Lyons Chapter
5BL0020	Site form does not mention shell	N/A	N/A	N/A	N/A
5BL0062	Site form states 380+ Unio shell beads	The Sadar Site. Colorado Cultural Resource Survey	Robert Biggs	N/A	Ms. On file, Office of Archaeology and Historic Preservation, Colorado Historical Society, Denver, Colorado
5BL0239	Site form states "1 clam shell"	Carter and Burgess, Inc, 96th Street Connection Intensive Inventory for Cultural Resources Boulder County, Colorado	Dulaney Barclay and Steve Mehls	2000	Metcalf Archaeological Consultants, Inc. Eagle Colorado and Western Historical Studies, Inc. Lafayette Colorado
5CF0048	Site form states "1 discoidal shell fragment"	Archaeological Investigations in 1973 in the Proposed Alignment of the Mt. Elbert-Poncha Transmission Line, Fryingpan-Arkansas Project, Bureau of Reclamation in Lake and Chaffee Counties, Colorado	William G. Buckles	1975	Laboratory of Anthropology Southern Colorado State College, Pueblo, Colorado
5CH0003	Site form lists "pendants"	The Discovery and Exploration of the Olsen-Chubbuck Site (5CH3)	Jerry Chubbuck	1959	*Southwestern Lore* 25(1):6-10
5CH0003	See above	A Burial from the Chubbuck-Oman Site	Richard B. Tipton	1967	*Southwestern Lore* 33(1):14-21
5DA0088	Site form does not mention shell	N/A	N/A	N/A	N/A
5DA0095	Site form indicates "fresh-water mussel shell"	Archaeological Survey of the Chatfield Reservoir, Colorado, 1968	Arnold Withers	1972	Department of Anthropology, University of Denver for the National Park Service
	See above	Archaeological Investigations in the Chatfield Reservoir, Colorado	Sarah M Nelson	1979	Department of Anthropology, University of Denver for Heritage Conservation and Recreation Service, US Department of the Interior

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5DA0099	Site form does not mention shell	N/A	N/A	N/A	N/A
5DA0272	Site form describes 45 pieces of unmodified shell	Subsistence and Stone Tools at Franktown Cave, Colorado	Anthony King	2006	Unpublished Masters Thesis, Anthropolgoy Department, University of Colorado
5DA1687	Site form state "freshwater shell fragments"	N/A	N/A	N/A	N/A
5EP0750	Site form states "one piece of non-local shell was collected"	Report format Letter: Summary of Preliminary Reconnaissance and Site Assessment Data for the widening of State Highway 83 from Academy Boulevard to Shoup Road in Colorado Springs, Colorado	Gooding, John	1985	N/A
5EP1177	Site form does not mention shell	The East Fork Burial, El Paso County, Colorado (Manuscript in preparation)	Stephen A. Chomko and J. Michael Hoffman	1993	N/A
5EP1192	Site form does not mention shell	Test Excavations of Seven Prehistoric Sites on the Fort Carson Military Reservation, El Paso and Pueblo Counties, Colorado	Stephen M. Kalasz, Daniel A. Jepson, Christian J. Zier, Margaret A. Van Ness	1993	Centennial Archaeology, Inc., Fort Collins Colorado.
	See above	Archaeological Survey of High Priority Parcels and Other Miscellaneous Areas on the Fort Carson Military Reservation, El Paso, Pueblo, and Fremont Counties, Colorado	Daniel A. Jepson, Christian Zier, Stephen M. Kalasz, Andres M. Barnes	1992	Centennial Archaeology, Inc., Fort Collins Colorado.
5EP1208	Site form does not mention shell	Archaeological Survey of High Priority Parcels and Other Miscellaneous Areas on the Fort Carson Military Reservation, El Paso, Pueblo, and Fremont Counties, Colorado	Daniel A. Jepson, Christian Zier, Stephen M. Kalasz, Andres M. Barnes	1992	Centennial Archaeology, Inc., Fort Collins Colorado.
5EP1696	Site form does not mention shell	N/A	N/A	N/A	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5FN0005	1973 site form says "1 frag of shell"	Cultural Resource Inventory, G&V Gravel Pit Fremont County, Colorado	William R. Arbogast,	1992	Submitted to Valley Surveying, Florence Colorado
5FN0127	Site form states "possible shell pendant"	N/A	N/A	N/A	N/A
5FN0181	Site form does not mention shell	A Settlement Survey of the Fort Carson Military Reservation	Alexander, R., J. Hartley, and T. Babcock	1982	Grand River Consultants, Grand Junction, Colorado
5FN0184	Site form does not mention shell	N/A	N/A	N/A	N/A
5FN1592	Site form does not mention shell	Excavations at the Gilligan's Island Shelters (5FN1592), Fort Carson Military Reservation (FCMR), Fremont County, Colorado, Volumes I and II	Cody Anderson	2008	Unpublished Masters Thesis, Anthropology Department, Colorado State University
5HF0188	Site form does not mention shell	N/A	N/A	N/A	N/A
5HF1171	Site form states “16 disk shell beads”	Excavation and Analysis of a Prehistoric Native American Burial (5HF1171) Near Walsenburg, in Huerfano County, Colorado.	Margaret A. Van Ness	1994	N/A
	See above	OSAC Field Investigation in Colorado 1991-1995	Kevin Black	1997	*Southwestern Lore* 63(3):1-35
5JF0012	Site form does not mention shell	Salvage Archaeology at Golden Site 5JF12	Junann J. Stighorst and Betty Bennett	1973	*Southwestern Lore* 39(1):12-17
5JF0051	Site form does not mention shell	Archaeological Investigations at the Ken-Caryl Ranch, Colorado	Ann M. Johnson (Editor Richard F. Somer)	1997	Memoir Number 6 of the Colorado Archaeological Society No. 6
5JF0136	Site form does not mention shell	N/A	N/A	N/A	N/A
5JF0223	Site form does not mention shell	Excavation At Magic Mountain: A Diachronic Study of Plains-Southwest Relations	Cynthia Irwin-Williams and Henry J. Irwin	1966	Proceeding of the Denver Museum of Natural History No. 12
	See above	Olivella Beads from Spiro and the Plains	Laura Kozuch	2002	*American Antiquity* 67 (4): 697-709

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
	See above	Report of the 1994/1996 Grid Block Archaeological Excavations at the Magic Mountain Site (5JF223) in Jefferson County, Colorado	Stephen Kalasz and Sheilds	1997	Centennial Archaeology, Inc., Fort Collins Colorado.
	See above	Excavations At Magic Mountain, A study of Plains-Southwest Relations in the Central Rocky Mountian Foothills	Cynthia Irwin-Williams	1963	Unpublished Doctoral Dissertation, Harvard University, Cambridge, Massachusetts
5JF1780	Site form states "Shell pendant"	The Salvage Excavation of Two Human Burials at the Lena Gulch Site (5JF1780), Jefferson County, Colorado	Daniel A. Jepson and O D Hand	1999	Colorado Department of Transportation Archaeological Research Series No.6
5JF2464	Site form does not mention shell	Archaeological Survey in the Ken-Caryl Valley, Jefferson County, Colorado	N/A	N/A	N/A
5LA1057	Site form does not mention shell	Excavations at Trinchera Cave, 1974	Caryl Wood	1974	*Southwestern Lore* 40(3):53- 62
	See above	Trinchera Cave: A Rock Shelter in Southeastern Colorado	Caryl Wood	1976	Unpublished Masters Thesis, University of Wyoming, Laramie, Wyoming
5LA1211	Site form states "shell beads"	Trinidad Lake Cultural Resource Study Part II, The Prehistoric Occupation of the Upper Purgatoire River Valley	Caryl Wood and Gerald A. Bair	1980	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
	See above	Trinidad Lake Preliminary Evaluative Archaeological Inspection	Caryl Wood	1981	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1247	Site form does not mention shell. States "small collection at the University of Nebraska State Museum"	Apishipa Canyon Archaeology: Excavations at the Cramer, Snake Blakeslee and Nearby Sites	James H. Gunnerson	1989	Reprints in Anthropology, Vol. 41
	See above	N/A	Hal Chase	1949	N/A
5LA1310	Site form does not mention shell	Archaeological Investigations of Torres Cave (5LA1310), Las Animas County, Colorado, 1977	Steven D. Hoyt	1977	*Southwestern Lore* 45(1&2): 1-21

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA1413	Site form does not mention shell	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1415	Site form does not mention shell	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1416	Site form states " Shell beads"	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
	See above	Trinidad Lake Cultural Resource Study Part II, The Prehistoric Occupation of the Upper Purgatoire River Valley	Caryl Wood and Gerald A. Bair	1980	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1417	Site form does not mention shell	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1419	Site form does not mention shell	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA1426	Site form does not mention shell	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1456	Site form does not mention shell	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1478	Site form states "20 shell beads and 1 single shell pendant"	Trinidad Lake Cultural Resource Study Part I, An Evaluative Survey of Historic and Archaeological Sites Within the Corps of Engineers Trinidad Lake Flood Control Project, Las Animas County, Colorado	O D Hand, Carla Latuda, and Gerald A. Bair	1977	Laboratory of Contract Archaeology, Trinidad State Junior College, Trinidad Colorado
5LA1485	Site form does not mention shell	Final Report Trinidad State Junior College Raton Pass Highway Salvage Archaeology Project	Galen R. Baker	1965	Trinidad State Junior College, Trinidad Colorado
5LA2240	Continuation form says "small shell in feature 10" no other mention of shell	Archaeological Sites Inventory of the Training Area 10 and 12 Portions of the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Mark Owens and Lawrence L. Loendorf	2004	Midwest Archaeological Center, National Park Service, Lincoln Nebraska
	See above	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA2316	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA2351	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA2618	Site form does not mention shell	1983 University of Denver Phase I Survey of PCMS	N/A	1983	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA2619	Site form does not mention shell	1983 University of Denver Phase I Survey of PCMS	N/A	1983	N/A
5LA3186	Site form does not mention shell	Archaeological Investigations at Sites 5LA3186, 5LA3188, and 5LA3189 along Burke Arroyo in the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Stephen M. Kalasz, Christopher Kinneer, Cody M. Anderson, Lawrence L. Loendorf, Bonnie K. Gibson, Cortney A. Wands, John D. Kennedy	2007	Centennial Archaeology, Inc. Fort Collins Colorado
5LA3188	Site form does not mention shell	Archaeological Investigations at Sites 5LA3186, 5LA3188, and 5LA3189 along Burke Arroyo in the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Stephen M. Kalasz, Christopher Kinneer, Cody M. Anderson, Lawrence L. Loendorf, Bonnie K. Gibson, Cortney A. Wands, John D. Kennedy	2007	Centennial Archaeology, Inc. Fort Collins Colorado
5LA3189	Shell listed in the artifact inventory attached to site form	Archaeological Investigations at Sites 5LA3186, 5LA3188, and 5LA3189 along Burke Arroyo in the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Stephen M. Kalasz, Christopher Kinneer, Cody M. Anderson, Lawrence L. Loendorf, Bonnie K. Gibson, Cortney A. Wands, John D. Kennedy	2007	Centennial Archaeology, Inc. Fort Collins Colorado
5LA3199	Site form does not mention shell	1984 University of Denver Phase I Survey of PCMS	Larry Loendorf	1984	New Mexico State University
5LA3221	Site form does not mention shell	1984 University of Denver Phase I Survey of PCMS	Larry Loendorf	1984	New Mexico State University
5LA3369	Site form does not mention shell	1984 University of Denver Phase I Survey of PCMS	Larry Loendorf	1984	New Mexico State University
5LA3406	Site form does not mention shell	Archeological Investigations at Ceramic Stage Sites in the Pinon Canyon Maneuver Site, Colorado	Loendorf, Lawrence L., Jeani L. Borchert, and Duane G. Klinner	1996	Department of Anthropology, University of North Dakota, Contribution No. 308
5LA3420	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA3421	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA3491	Site form does not mention shell	N/A	N/A	N/A	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA3570	Site form stares "Shell fragments located in the midden area"	Evaluative Testing of Eight Archaeological Sites in the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Mona Charles, Randy Nathan, and Philip Duke	1996	Department of Anthropology, Fort Lewis College, Durango, Colorado
5LA4414	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA4431	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA4451	Site form states "one shell bead"	N/A	N/A	N/A	N/A
5LA4795	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5234	Site form states "1 shell fragment" and "shell: possible abalone shell fragments"	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5235	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5243	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5244	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5253	Site form does not mention shell	1983 University of Denver Phase I Survey of PCMS	N/A	1983	N/A
5LA5255	Site form states multiple shell artifacts	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5255	Site form does not mention shell	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5257	Site form does not mention shell	1983 University of Denver Phase I Survey of PCMS	N/A	1983	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA5258	Site form does not mention shell	1983 University of Denver Phase I Survey of PCMS	N/A	1983	N/A
5LA5262	Site form states "10 shell artifacts"	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
	See above	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5264	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5265	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5270	Site form states "multiple shell artifacts"	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
	See above	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5275	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5298	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 2	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1991	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5300	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA5305	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5320	Site form states "multiple shell artifacts"	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5320	Site form does not mention shell	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5326	Site form states "Shell pendant"	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume 1	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5326	See above	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5355	Site form does not mention shell	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1985	University of Denver
5LA5379	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5383	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5385	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5389	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA5402	Site form states "multiple shell artifacts, including shell pendant"	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5402	Site form does not mention shell	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5403	Site form lists shell multiple artifacts on excavation inventory sheets	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5403	Site form does not mention shell	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5420	Site form states "shell"	N/A	N/A	N/A	N/A
5LA5423	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5465	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5471	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5503	Site form states “multiple shell artifacts"	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5503	Site form does not mention shell	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA5554	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5568	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	William Andrefsky Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Ross G. Hilman	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5571	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5598	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	Andrefsky, William Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Daniel A. Jepson	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
5LA5602	Site form does not mention shell	Test Excavations in the Pinon Canyon Maneuver Site, Southeastern Colorado, Volume II	Andrefsky, William Jr., Marilyn J. Bender, John D. Benko, Judy K. Michaelsen, Daniel A. Jepson	1990	Larson-Tibesar Associates, Inc. Laramie Wyoming
	See above	A Descriptive Report on Sites Tested during Phase I of the Fort Carson-Pinon Canyon Archaeological Project	Shelia Pozorski and Thomas Pozorski	1984	University of Denver
5LA5703	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA5955	Site form states "2 halves of lenticular shell pendant. Also one other shell fragment not modified"	Cultural Resource Investigation on a Proposed Colorado interstate Gas Company Pipeline near Trinidad, Las Animas, Colorado	Ronald J. Rood and Minette C. Church	1989	Metcalf Archaeological Consultants, Inc., Eagle Colorado
5LA6104	Site form does not mention shell	Archaeological Sites Inventory of the Training Area 10 and 12 Portions of the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Mark Owens and Lawrence L. Loendorf	2004	Midwest Archaeological Center, National Park Service, Lincoln Nebraska
5LA6105	Site form does not mention shell	Archaeological Sites Inventory of the Training Area 10 and 12 Portions of the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Mark Owens and Lawrence L. Loendorf	2004	Midwest Archaeological Center, National Park Service, Lincoln Nebraska

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA6197	Site form does not mention shell	Archaeological Investigation at Wolf Spider Shelter (5LA6197) Las Animas County, Colorado	O D Hand and Daniel Jepson	1996	Colorado Department of Transportation Archaeological Research Series No. 5
5LA6321	Site form states "fragments of shell, possible pendant"	Cultural Resource Inventory of a Portion of the Picket Wire Canyonlands Comanche National Grassland, Las Animas and Otero Counties, Colorado	Alan D. Reedvand Jonathon C. Horn	1995	Alpine Archaeological Consultants, Inc. Montrose Colorado
5LA6331	Site form states "small iridescent piece of shell"	Cultural Resource Inventory of a Portion of the Picket Wire Canyonlands Comanche National Grassland, Las Animas and Otero Counties, Colorado	Alan D. Reedvand Jonathon C. Horn	1995	Alpine Archaeological Consultants, Inc. Montrose Colorado
5LA6568	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA6592	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA6767	Site form does not mention shell	Archaeological Sites in Welsh Canyon, Las Animas County, Colorado	Lawrence L. Loendorf and Christopher R. Loendorf	1999	Midwest Archaeological Center, National Park Service, Lincoln Nebraska
5LA6952	Site form states "A small shell fragment that appears to be freshwater bivavle shell was noted but not collected"	Archaeological Sites in Welsh Canyon, Las Animas County, Colorado	Lawrence L. Loendorf and Christopher R. Loendorf	1999	Midwest Archaeological Center, National Park Service, Lincoln Nebraska
5LA7438	Site form states "2 pieces of shell"	Archaeological Sites Inventory in the Black Hills of the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Mark Owens, Lawrence L. Loendorf, Vincent Schiavitti, Christopher R. Loendorf	2000	Midwest Archaeological Center, National Park Service, Lincoln Nebraska
5LA7673	Site form does not mention shell	N/A	N/A	N/A	N/A
5LA8058	Site form does not mention shell	N/A	N/A	N/A	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LA8108	Site form states "Shell fragments, no cortex or hinge element. Unidentified shell"	Archaeological Sites Inventory of the Training Area 7 Portion of the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Mark Owens and Lawrence L. Loendorf	2002	Prepared for the Directorate of Environmental Compliance and Management, Department of the Army, Fort Carson by the Department of Sociology and Anthropology, New Mexico State University, Las Cruces, New Mexico.
5LA9333	Site form states "1 piece of unidentified shell"	Archaeological Sites Inventory of the Training Area 10 and 12 Portions of the Pinon Canyon Maneuver Site, Las Animas County, Colorado	Mark Owens and Lawrence L. Loendorf	2004	Midwest Archaeological Center, National Park Service, Lincoln Nebraska
5LK0178	Site form states "1 shell bead"	Anthropology Investigations Near The Crest of the Continent 1975-1978	William Buckles	1978	Laboratory of Anthropology Southern Colorado State College, Pueblo, Colorado
5LK0246	Site form does not mention shell	N/A	N/A	N/A	N/A
5LK0926	Site form does not mention shell	Cultural Resource Inventory of two High Priority Survey Areas California Gulch Superfund Site Operable Unit 6 Lake County, Colorado	Kevin W. Thompson		Alpine Archaeological Consultants, Inc. Montrose Colorado
5LN0291	Site form " mussel shell (1)"	Colorado Interstate Gas Company: Cultural Resources Inventory of the Tri-State/Limon Pipeline, Lincoln County, Colorado	O'Brien, Patrick K.	2001	Metcalf Archaeological Consultants, Inc.
5LO0001	No mention of shell artifacts in site form. Very brief old site card	Archeological Investigations in Northeastern Colorado	John Jackson Wood	1967	Unpublished Doctoral Dissertation, University of Colorado, Boulder, Colorado
5LR0013	Site form does not mention shell	N/A	N/A	N/A	N/A
5LR0118	OAHP has no site form	N/A	N/A	N/A	N/A
5LR0144c	Site form does not mention shell	N/A	N/A	N/A	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LR0153	Site form states "1 shell fragment"	N/A	N/A	N/A	N/A
5LR0161	Site was combined with 5LR0251	Phoebe Rockshelter: A multi-component site in North-Central Colorado	Kevin W. Thompson	1986	Unpublished Masters Thesis, CSU
5LR0198	Site form does not mention shell	N/A	N/A	N/A	N/A
5LR0201	Site form states "1 shell fragment"	N/A	N/A	N/A	N/A
5LR0205	Site form does not mention shell	N/A	N/A	N/A	N/A
5LR0251	Site was combined with 5LR0161. Site form states "1 large disc shell bead"	Phoebe Rockshelter: A multi-component site in North-Central Colorado	Kevin W. Thompson	1986	Unpublished Masters Thesis, CSU
5LR0252	Site form does not mention shell	A Brief Descriptive Summary of the Spring Gulch Site, Larimer County, Colorado	Ronald E. Kainer	1974	*Southwestern Lore* 40(3):37-41
5LR0253	Site form does not mention shell	N/A	N/A	N/A	N/A
5LR0263	Site form does not mention shell	The Protohistoric Periods in Northcentral Colorado: Analysis of the Lykins Valley Site (5LR0263)	Cody C. Newton	2008	Unpublished Masters Thesis, CSU
	See above	The Archaeology of the Boxelder Project: A Water Control Project in Larimer County, North Central Colorado, 1972-1979	Elizabeth Ann Morris	1979	Laboratory of Public Archaeology, Fort Collins, Colorado
	See above	The Lykins Valley Site (5LR263): A Stratified Locality on Boxelder Creek, Larimer, County, Colorado	N. Ted Ohr, Kenneth L. Kvamme, and Elizabeth Ann Morris	1979	Laboratory of Public Archaeology, Fort Collins, Colorado
5LR0284	Site form does not mention shell	N/A	N/A	N/A	N/A
5LR0296	Site form states "1 shell fragment"	N/A	N/A	N/A	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5LR11697	Site form does not mention shell	N/A	N/A	N/A	N/A
5LR1683	Site form does not mention shell	Excavations at the Roberts Ranch Burial, Site 5LR1683, Larimer County, Colorado	Kevin Black	1995	Colorado Historical Society, Office of Archaeology and Historic Preservation, Office of the State Archaeologist of Colorado
	See above	OAHP Investigations at Unmarked Human Graves in 1992-1993	Kevin Black	1994	Paper presented at the 1994 annual meeting of the Colorado Council of Professional Archaeologists, Montrose, Colorado
5MR0003	Site form states "unworked clam shells"	The Archaeology and Physical Anthropology of the Gahagan-Lipe Site with Comments on Colorado Woodland Mortuary Practices	Douglas D. Scott and Terje G. Birkedal	1972	*Southwestern Lore* 38(3): 1- 18
5MR0244	Site form states "collected 1 piece of shell"	Archaeological Survey of the Narrows Unit Project Morgan and Weld Counties, Northeastern Colorado	Elizabeth Ann Morris, Bruce J. Lutz, Timothy J. Kloberdanz, Kenneth L. Kvamme, and Clark Pool	1975	Laboratory of Public Archaeology, Fort Collins, Colorado
5MR0265	Site form states "1 piece of shell found with flakes"	Archaeological Survey of the Narrows Unit Project Morgan and Weld Counties, Northeastern Colorado	Morris, Elizabeth Ann, Bruce J. Lutz, Timothy J. Kloberdanz, Kenneth L. Kvamme, and Clark Pool	1975	Laboratory of Public Archaeology, Fort Collins, Colorado
5MR0378	See above-same as 5MR0003	The Archaeology and Physical Anthropology of the Gahagan-Lipe Site with Comments on Colorado Woodland Mortuary Practices	Douglas D. Scott and Terje G. Birkedal	1972	*Southwestern Lore* 38(3): 1- 18
5MR0389		Colorado Prehistory: A Context for the Platte River Basin.	Kevin P. Gilmore, Marcia Tate, Mark Chenault, Bonnie Clark, Terry McBride, and Margaret Wood	1999	Colorado Council of Professional Archaeologists, Denver
5MR0390	Site form does not mention shell	Koehler Site Excavation CETA Archaeological Program	Stephanie Klausner		

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5MR0523	Site form does not mention shell	Colorado Interstate Gas Company's Proposed Young Storage Field: Class III Cultural Resource Inventory in Morgan County, Colorado	Patrick M. Lubinski and Patrick K. O'Brien	1992	Metcalf Archaeological Consultants, Inc. Eagle Colorado
5MR0617	Site form does not mention shell	Comments on the Bisterfeldt Potato Cellar Site and Flexed burials in the Western Plains	David A.Breternitz and John J. Wood	1965	*Southwestern Lore* 31(3):62-66
5OT0141	Site form states "3 fragments of unmodified mollusk shell recovered from shovel hole #1"	Archaeological testing of Prehistoric and Historic Sites at Bent's Old fort National Historic Site, Otero County, Colorado	Rand A. Greubel	1996	Alpine Archaeological Consultants, Inc. Montrose Colorado
5OT0219	Site form states "1 piece of shell"	Test Excavations at the Apishipa River Bridge Site	Marcia K. Kelly	1984	Colorado Department of Highways, Highway Salvage Report #54
5PE0009	Site form states "249+ shell beads (Olivella and Unindent disc)	Two Ceramic Period Burials From Southeastern Colorado	Kevin D. Black, Kimberly Spurr, and Diane L. France	1991	*Southwestern Lore* 57(3):1–27
	See above	Olivella Beads from Spiro and the Plains	Laura Kozuch	2002	*American Antiquity* 67 (4):697-709
5PE0081	Site form does not mention shell	Archaeological Survey of the Sugarloaf, Twin Lakes and Pueblo Reservoirs, Colorado, 1964	Arnold Withers	1965	Department of Anthropology, University of Denver
	See above	Archaeological Salvage for the Fryingpan-Arkansas Project, 1966	Alan P. Olson	1968	Department of Anthropology, University of Denver
5PE0082	Site form does not mention shell	N/A	N/A	N/A	N/A
5PE0133	Site form does not mention shell	N/A	N/A	N/A	N/A
5PE0272	Site form states "shell charcoal"	N/A	N/A	N/A	N/A
5PE0273	Site form does not mention shell	N/A	N/A	N/A	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5PE0321	Site form does not mention shell	A Settlement Survey of the Fort Carson Military Reservation (pg 81)	R. Alexander, J. Hartley, and T. Babcock	1982	Grand River Consultants, Grand Junction, Colorado
5PE0349	Site form does not mention shell	Archaeological Survey of the Sugarloaf, Twin Lakes and Pueblo Reservoirs, Colorado, 1964	Arnold Withers	1965	Department of Anthropology, University of Denver
	See above	Archaeological Salvage for the Fryingpan-Arkansas Project, 1966	Alan P. Olson	1968	Department of Anthropology, University of Denver
5PE0484	Site form does not mention shell	Apishipa Canyon Archaeology: Excavations at the Cramer, Snake Blakeslee and Nearby Sites	James H. Gunnerson	1989	Reprints in Anthropology Vol. 41
5PE0648	Site form does not mention shell	Archaeological Excavation of Recon John Shelter (5PE648) on the Fort Carson Military Reservation, Pueblo County, Colorado	Christian J. Zier	1989	Centennial Archaeology, Inc., Fort Collins Colorado
5PE0745	Site form states "one deeply concave shell-like fragment with ground interior"	An Archaeological Inventory of Selected Sample Transects on the Fort Carson Military Reservation, El Paso, Fremont, and Pueblo Counties, Colorado	Marcus P. Grant and Christian J. Zier	1987	Centennial Archaeology, Inc., Fort Collins Colorado
5PE0815	Site form does not mention shell	Paleo Climate in the Raton Mesas Area in Northeast New Mexico and Southeast Colorado and a Comparison of Site Elevations	Gregory D. Everhart	1996	Class report for Dr. David E Stuart (manuscript on file at OAHP)
5PE0866	Site form does not mention shell	N/A	N/A	N/A	N/A
5PE0868	Site form states "1 shell fragment"	Test Excavations of Seven Prehistoric Sites on the Fort Carson Military Reservation, El Paso and Pueblo Counties, Colorado	Stephen M. Kalasz, Daniel A. Jepson, Christian J. Zier, Margaret A. Van Ness	1993	Centennial Archaeology, Inc., Fort Collins Colorado.

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5PE1033	Site form does not mention shell	Archaeological Survey of High Priority Parcels and Other Miscellaneous Areas on the Fort Carson Military Reservation, El Paso, Pueblo, and Fremont Counties, Colorado	Daniel A. Jepson, Christian Zier, Stephen M. Kalasz, Andres M. Barnes	1992	Centennial Archaeology, Inc., Fort Collins Colorado.
5PE1192	Site form does not mention shell	N/A	N/A	N/A	N/A
5PE1413	Site form states "two shell fragments"	A Settlement Survey of the Fort Carson Military Reservation	Alexander, R., J. Hartley, and T. Babcock	1982	Grand River Consultants, Grand Junction, Colorado
5SH3393	Site form does not mention shell	Final Report on the 2007 Archaeological Inventory and Site Condition Assessment at Great Sand Dunes National Park and Preserve, Saguache and Alamosa Counties, Colorado.	Chris Bevilacqua, Steve Dominguez, and Dulaney Barclay	2008	RMC Consultants, Inc. Lakewood, Colorado
5SH3603	Site form does not mention shell	Final Report on the 2007 Archaeological Inventory and Site Condition Assessment at Great Sand Dunes National Park and Preserve, Saguache and Alamosa Counties, Colorado.	Chris Bevilacqua, Steve Dominguez, and Dulaney Barclay	2008	RMC Consultants, Inc. Lakewood, Colorado
5WL0031	Site form does not mention shell	Archeological Investigations in Northeastern Colorado	John Jackson Wood	1967	Unpublished Doctoral Dissertation, University of Colorado, Boulder, Colorado
5WL0032	Site form does not mention shell	Archeological Investigations in Northeastern Colorado	John Jackson Wood	1967	Unpublished Doctoral Dissertation, University of Colorado, Boulder, Colorado
5WL0101	Site form does not mention shell	Happy Hollow Rock Shelter	L.C. Steege	1967	*Wyoming Archaeologist* 10(3): 11-23
5WL0177	Site form does not mention shell	N/A	N/A	N/A	N/A
5WL0568	Site form does not mention shell	N/A	N/A	N/A	N/A
5WL0701	Site form states "shell fragment"	N/A	N/A	N/A	N/A

Site Number	OAHP Site Form Information	Report/Article	Authors	Year	Publication
5WL1273	Site form states "shell (mother of pearl) pendant fragment"	Archaeological Inventory of 574 Acres in the Pawnee National Grasslands, Weld County, Colorado	Peter J. Gleichman	1988	Native Cultural Services, Boulder Colorado
5WL1478	Site form states "worked clam shell"	The Archaeology of the Agate Bluff Area, Colorado	Cynthia Irwin and Henry Irwin	1957	*Plains Anthropologist* 4(8): 15-38
5WL1481	Site form states "1 worked shell fragment"	The Archaeology of the Agate Bluff Area, Colorado	Cynthia Irwin and Henry Irwin	1957	*Plains Anthropologist* 4(8): 15-38
5WL1872	Site form states "burnt fragment of freshwater shellfish'	N/A	N/A	N/A	N/A
5WL1986	Site form does not mention shell	The Garcia Site	John Greenway	1961	*Southwestern Lore 27(3):42*
5WL2382	Site form states "shell (6)"	Archaeological and Geological Investigation at the Willow Bunker Archaeological Area, Pawnee National Grassland, Colorado	Eric J. Feiler	2001	PaleoCultural Research Group, Flagstaff Arizona
5YM0002	Site form lists shell fragment in surface artifact inventory	Preliminary Appraisal of the Archaeological and Paleontological Resources of Wray Reservoir	N/A	1947	Missouri Valley Project, River Basin Surveys, Smithsonian Institution
5YM0005	Site form does not mention shell	Preliminary Appraisal of the Archaeological and Paleontological Resources of Wray Reservoir	Missouri Valley Project, River Basin Surveys, Smithsonian Institution	1947	