Organization of lithic technology at the Bowman Site (26Ny809), Pahrump Valley, Nye County, Nevada

Annette Joye Smith

University of Nevada, Las Vegas

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ORGANIZATION OF LITHIC TECHNOLOGY AT THE BOWMAN SITE
(26NY809), PAHRUMP VALLEY, NYE COUNTY, NEVADA

by

Annette Joye Smith

Bachelor of Arts
Arizona State University
1999

Bachelor of Arts
Arizona State University
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Associate in Applied Science
Thomas Nelson Community College
1989

A thesis submitted in partial fulfillment
of the requirements for the

Master of Arts Degree in Anthropology
Department of Anthropology
College of Liberal Arts

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Thesis Approval
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University of Nevada, Las Vegas

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The Thesis prepared by
Annette Joye Smith

Entitled
"Organization of Lithic Technology at the Bowman Site (26NY809), Pahrump Valley, Nye County, Nevada"

is approved in partial fulfillment of the requirements for the degree of

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[Signatures]
Examination Committee Chair
Dean of the Graduate College

Examination Committee Member
Examination Committee Member
Graduate College Faculty Representative
ABSTRACT

Organization of Lithic Technology at the Bowman Site (26NY809), Pahrump Valley, Nye County, Nevada

by

Annette Joye Smith

Dr. Barbara Roth, Examination Committee Chair
Associate Professor of Anthropology
University of Nevada, Las Vegas

The organization of lithic technology and its relationship to mobility and resource procurement contributes to the understanding of hunter-gatherer lifeways. In this study, lithic or stone tool requirements, raw material availability, and procurement strategies are all considered. The study area is located in Pahrump Valley, which lies within the southern Nevada portion of the Mojave Desert. Potential pathways from the Bowman Site to Eureka Quartzite sources are studied to determine their use by prehistoric hunter-gatherers while procuring Eureka Quartzite. A determination was made regarding the organization of lithic technology and direct or embedded procurement, establishing a mobility strategy used by the hunter-gatherers inhabiting the Bowman Site.
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CHAPTER 1

INTRODUCTION

Study Introduction

Lithic resources can help us understand how the prehistoric people of Pahrump Valley used their environment. This study specifically addresses lithic resources. Lithic technology at the Bowman Site (26NY809) and the use of surrounding resources indicate the mobility strategies used by the people inhabiting the site. By studying the organization of lithic technology, we can address research questions regarding the mobility strategies of the hunter-gatherers inhabiting the Pahrump Valley and, more broadly, the eastern Mojave Desert.

The Bowman Site, located west of the Spring Mountain Range in Pahrump Valley, Nevada, was a residential base for people living in Pahrump Valley due to its continual water supply, a critical resource in the arid region. The site was occupied for at least five thousand years because of its beneficial location. Utilizing the resources in the
valley and also within the mountain ranges surrounding them, prehistoric hunter-gatherers would have adopted mobility strategies useful within their environment. Resources available by the middle Holocene in the nearby Spring Mountains include large game (i.e. deer, desert big horn sheep), small game (i.e. rabbit, rodents), edible flora (i.e. pine nuts, juniper berries, yucca), and lithic material (Grayson 1993). Pathways into the mountains would have been used in order to move into the area where the resources could be procured.

The primary focus of this study is the use of Eureka Quartzite from the Spring Mountains (Figure 1). The procurement and use of Eureka Quartzite provides information on mobility and land use on the part of the Bowman Site occupants. The bulk of lithic material exposed in the Spring Mountains and Pahrump Valley is limestone and dolomite. There are many other lithic resources within the Spring Mountains, but most fine-grained quality lithic material is bedded and difficult to extract. Nonetheless, in the few locations where this fine-grained material can be extracted, it was quarried by prehistoric people.
Figure 1. Vicinity of the Bowman Site and Eureka Quartzite.
Research Goals

Lithic organization studies have pushed lithic analysis to stand more strongly on methodological and theoretical grounds. Specific traditions in which lithic tools were manufactured, used, and discarded can be used to infer mobility and procurement strategies (Andrefsky 1991; Bamforth 1986, 1990, 1991; Kelly 1988; Nelson 1981).

The specific research questions formulated for this study are discussed below:

1. Can the mobility strategies of the people inhabiting the Bowman Site be identified by their lithic technological organization?

By analyzing lithics from the Bowman Site, a pattern will emerge indicating whether the people curated specific lithic material or used it in an expedient fashion. Typically, curation is used when there is time stress and/or a lack a raw material where tools need to be used. Collectors have been more solidly linked to a curation strategy tied to logistical mobility, whereas foragers are often strongly connected to an expedient strategy. Availability of raw material is also strongly associated with expedient or curation strategies (Andrefsky 1991; Bamforth 1986; Bamforth and Bleed 1997; Binford 1979,
A few of the lithic characteristics that are examined in this study include size, cortex percentage, flake scars, the ratio of flakes to cores, and retouch. All of these characteristics bear upon the question of whether a particular lithic material has been curated.

2. Is there evidence to support the use of the potential pathways to Eureka Quartzite from the Bowman Site identified by the GIS study?

A Geographic Information System (GIS) program was used to identify the most logical routes from the Bowman Site to the Eureka Quartzite locations within the Spring Mountains. These pathways were then studied in the field to determine if there is any evidence of their use by prehistoric people. The evidence would include a higher percentage of archaeological sites and isolated occurrences located in the vicinity of the pathways compared to the surrounding landscape.

3. Did the people inhabiting the Bowman Site combine their procurement of Eureka Quartzite with other procurement activities?

Evidence of procurement activities at archaeological sites near the pathways, at the Eureka Quartzite
locations, and at the Bowman Site was used to answer this question. Evidence suggesting embedded procurement includes sites and isolated occurrences typically associated with the procurement of food resources (i.e. basket rests, cleared areas, rock rings, hunting camps, etc.), while direct procurement has an absence of evidence relating to other types of procurement activities.

**Study Organization and Summary.** This study determines if non-local lithic material was treated in a different manner than local material by focusing on the organization of lithic technology at the Bowman Site, known lithic resources (Eureka Quartzite), and predicted pathways from the site to the Eureka Quartzite. Studying the predicted pathways will determine if forays into the Spring Mountains were done solely to obtain Eureka Quartzite or if other resources were procured concurrently (direct procurement versus embedded procurement).

The level of curation indicates value of the resource. Curation of Eureka Quartzite, due to its high quality, suggests that the people did not have ample opportunities to gather the resource, likely due to its non-local nature (Bamforth 1986; Newman 1994).
Chapter 2 will address the local environment, geology, physiography, lifeways, and archaeology of the Pahrump Valley and the Spring Mountains. This background sets the conditions within the area. Chapter 3 introduces the study, explains its context and how spatial analysis can be used to assist the study. The research design (Chapter 4) addresses the research questions and explains the methods used. Chapter 5 explains the results of the study, while Chapter 6 ties the results to the research questions and addresses the advantages and disadvantages of the study, along with the potential for future studies.
CHAPTER 2

BACKGROUND TO THE STUDY

Geologic Background of Pahrump Valley

In the Pahrump Valley, water is life, for humans and non-humans alike. The Pahrump Valley contains several springs, and evidence exists that these water sources were present well into the past (Quade nd; Quade et al. 1995). Several small springs and seeps, in addition to the major water producers of Manse and Pahrump Springs, make Pahrump Valley one of the most productive water sources in Southern Nevada (Maxey and Jameson 1948). Leon Hughes, a long time resident of Pahrump Valley, states that there was no need for water pumps when his family arrived in 1936 (McCracken 1988a). The importance of water cannot be over-emphasized in arid settings. The Bowman Site is located at Manse Spring in Pahrump Valley.

Physiography. Pahrump Valley lies directly west of Las Vegas Valley, with the Spring Mountain Range separating the two valleys (Figure 2). Pahrump Valley spans four
counties, two in Nevada (Nye and Clark) and two in California (San Bernadino and Inyo), and the valley extends over 2,720 square kilometers (1,050 square miles). Pahrump Valley lies in a typical Basin and Range topographic setting with closed basins separated by mountains, mesas, and hills. The elevation of a large portion of the valley floor ranges from approximately 760 meters (2,490 feet) to 855 meters (2,805 feet). The surrounding mountain ranges have elevations spanning from 3,633 meters (11,918 feet) to the east (Charleston Peak), 2,505 meters (8,218 feet) to the north (Mount Stirling), 1,955 meters (6,414 feet) to the west (Resting Spring and the Nopah Range), and 2,231 meters (7,320 feet) to the south (Kingston Peak). The elevation difference from the valley floor to the highest peak, Charleston Peak, which lies to the east in the Spring Mountain Range, is approximately 2,873 meters (9,426 feet).
Figure 2. Areas Mentioned in the Study.
Alluvial fans lie on the western margins of the Spring Mountains leading high into the canyons of Charleston Peak and other peaks within the range. The valley floor consists of silt and clay alluvium. There is some debate on whether a Pleistocene Lake was in Pahrump Valley. Most drainages consist of underground flows that move through alluvium, cavities, and fractures (Cornwall 1972; Longwell et al. 1965; Maxey and Jameson 1948; McCracken 1990, 1992; Quade et al. 1995).

Pahrump Valley lies within the Mojave Desert within the Great Basin (see discussions in Grayson 1993; Wheeler 1989 [1971]). Figures 3 and 4 show the basic boundaries of the Great Basin and regional deserts. Pahrump Valley lies on the eastern edge of the Mojave Desert and the extreme southern end of the Great Basin. In addition, its animal and plant life is a mixture of Mojave Desert and Great Basin species, including animals such as the desert cottontail, black-tailed jackrabbit, fox, badger, mule deer, mountain sheep, desert tortoise, and plants such as yucca, juniper, pinyon, and prickly pear (Olsen 1968, 1964; Whitson et al. 1992).

**Hydrology.** The springs of Pahrump Valley are replenished from the precipitation falling on the western slope of the
Spring Mountain Range. No loss of water occurs from seepage outside this aquifer as impenetrable bedrock lies beneath it. Average rainfall ranges from 10 centimeters (four inches) within the lower parts of the valley to 50 centimeters (20 inches) in the higher elevations of the Spring Mountains (Cornwall 1972; McCracken 1992).

Figure 3. General Boundaries of Desert Ecosystems (After Grayson 1993).
Research supports Leon Hughes' statement (McCracken 1988a) that the valley was pumpless in 1936. Prior to 1937, nearly 9,600 acre-feet of water discharged per year into Pahrump Valley, most of it at Pahrump Spring and Manse Spring. From 1937 to 1946, numerous wells were drilled, most of them near Manse Spring, the location of the Bowman
Site. Manse Spring discharged approximately 2,600 acre-feet per year before 1937. By 1946 over 9,700 acre-feet discharged from the Manse Spring area due to the addition of numerous wells (Maxey and Jameson 1948; McCracken 1992).

Geology and Lithic Resources. The northern Spring Mountains consist mostly of Precambrian to Mississippian sedimentary rocks, and the area surrounding Pahrump Valley lies in a region of late Precambrian and Paleozoic rocks that have been tectonically deformed (Cornwall 1972).

The Spring Mountains contain several rock formations consisting primarily of dolomite and limestone. Shale, sandstone, and siltstone exist with regularity along with quartzite, minor marble, and a few thin layers of chert. Chert is present in the Nopah Range, west of Pahrump Valley. (Cornwall 1972; Longwell et al. 1965; Secor 1962).

Local Quartzite. Several quartzites are found in the vicinity of Pahrump Valley (Cornwall 1972: Plate 1; Longwell et al. 1965: Plate 1). They include occur in the following rock units: Johnnie Formation, Stirling Quartzite, Wood Canyon Formation, Zabriski Quartzite, and Eureka Quartzite. Table 1 summarizes the characteristics of these quartzites (Cornwall 1972; Longwell et al. 1965). Quartzite from the Eureka Quartzite is easily
distinguishable from other quartzites on the basis of color and grain size; however, it is often mistaken for chert because it is vitreous. Several Eureka Quartzite artifacts from the Bowman Site are misidentified as chert. Use of a simple 10x hand lens reveals the differences; quartzite from the Eureka Quartzite consists of well-rounded, fine grains. Longwell et al. (1965: 22) state that "much of the Eureka Quartzite is ... gleaming white and remarkably pure." Photograph 1 illustrates the gleaming white quality of Eureka Quartzite, which contrasts with the gray limestones and dolomites that dominate the Spring Mountains. The quartzite from the Johnnie Formation is also fine-grained, but not as fine-grained as Eureka Quartzite. Also, useful pieces of quartzite are difficult to obtain from the Johnnie Formation because the quartzite occurs in thin layers with abundant fractures. Quartzite from the Wood Canyon formation is grayish-red and yellowish-gray and its quality ranges from course to fine grained. Quartzite from Zabriskie Quartzite is pale-red, fine to course grained, and is less than 20 feet thick throughout the Spring Mountains (See Table 1).
<table>
<thead>
<tr>
<th>Formation</th>
<th>Attributes</th>
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| Johnnie Formation         | • Precambrian  
                           • Fine-grained greenish or grayish green  
                           • Many freshly broken surfaces  
                           • Bed thickness ranges from 15 cm to 31 cm |
| Stirling Quartzite        | • Precambrian.  
                           • Gray to pink with minor conglomerate, siltstone,  
                           and shale beds  
                           • Widespread in southern Nye County  
                           • Bed thickness in the Spring Mountains are from 975 m to 1,036 m |
| Wood Canyon Formation     | • Precambrian and Cambrian  
                           • Yellowish-gray and grayish-red  
                           • Beds contain siltstone, dolomite, and conglomerate |
| Zabriskie Quartzite       | • Cambrian  
                           • Zabriskie Quartzite is pale red, course to fine  
                           • Less than 6 m thick in the Spring Mountains |
| Eureka Quartzite          | • Ordovician  
                           • White to grayish orange, vitreous, fine-grained,  
                           well-rounded and sorted grains  
                           • Distinct whitish band contrasts to grays found  
                           around Eureka Quartzite  
                           • Bed thickness in the Spring Mountains is  
                           approximately 90 m |

Table 1. Attribute of Quartzite Located Around and Near Pahrump Valley.
Environmental Background of Pahrump Valley

Late Pleistocene Environment. Exploring the past environment of southern Nevada helps explain different strategies used by its past inhabitants. Adaptation to the environment is critical for people to subsist over time in an area.

Pahrump Valley's springs, ponds created by the springs, and possible Pluvial Lake would have provided habitat for cattails and water plants near the edge of these water sources. Pahrump Valley's environment during this time was...
a cooler and wetter woodland environment. By 13,000 years ago, sagebrush and juniper grew on the valley floor. The climate had dried and warmed by 1,000 years later (Grayson 1993; McCracken 1990).

Packrat middens give a glimpse into the late Pleistocene vegetation. Death Valley and Amargosa Valley lie directly west and north of Pahrump Valley. These valleys have packrat middens that have been studied that date to the Late Pleistocene. They were found at elevations between 700 meters [2,300 feet] and 900 meters [2,955 feet]. As summarized by Grayson (1993), analysis of these middens shows they were vegetated by shadscale, beavertail cactus, yucca, brittlebush, juniper, and Joshua tree. Higher elevation middens, between 900 meters [2,955 feet] and 1,300 meters [4,265 feet] were vegetated by mountain mahogany, juniper, yucca, and Joshua trees. Many common plants living today on the alluvial fans surrounding Pahrump Valley were not present until the Late Pleistocene or Early Holocene. Plants such as creosote, white bursage, and brittlebush appear later. Bursage and brittlebush appeared between 10,000 to 11,000 years ago, but creosote did not make an appearance until about 9,000 to 10,000 years ago (Grayson 1993).
Data from the plants in the surrounding valleys' packrat middens indicate that temperatures were probably warmer at night and cooler during the day, with cooler summers and warmer winters, making the environment less harsh than today. While the plants were similar, some differences existed; for example, brittlebush, creosote, and bursage were not present and junipers were located at lower elevations than they are found today (Grayson 1993).

**Holocene and Modern Environment.** Pahrump Valley is one valley (approximately 40 miles) west of the Las Vegas Valley. Because of this close proximity, the assumption can be made that the environment is close to that found in the Las Vegas Valley, where meaningful data exist.

The Early Holocene (10,000 to 7,500 years ago), a warm and moist time period called the Anathermal, was less arid than today. Evidence of standing water with cattails and cicadas exists in the southern Great Basin, suggesting a mild and damp climate. Sagebrush existed at lower elevations until about 7,000 years ago, as did juniper. Evidence indicates that some species of mammals, including mule deer, which dwell at relatively high elevations today, inhabited lower elevations until approximately 7,000 years ago (Grayson 1993).
By 7,000 years ago, the environment of the Pahrump Valley would have been warmer and dryer than today, resembling the current Mojave Desert lower elevation environment. This phenomenon is called the Altithermal. Marshes disappeared, timberline existed at higher elevations, and sagebrush increased on upper slopes. This climatic change had a dramatic influence on the hunter/gatherers living within the Great Basin and Mojave Desert. Evidence suggests human populations in some portions of these regions decreased significantly during this climatic period, except in areas with a continuous water source (Cornwall 1972; Grayson 1993; Longwell et al. 1965; Maxey and Jameson 1948; McCracken 1990, 1992).

The Late Holocene (4,500 years ago to modern times) was overall cooler and wetter than the Middle Holocene. A slow and gentle cooling trend began and continued until reaching the current environment; however, variation occurred during this period, with cooler times, wetter times, warmer times, and dryer times. This climatic period is called the Medithermal. Vegetation gradually became similar to today as the environment passed through these climatic periods. (Grayson 1993; Kelly 2001).
Today, vegetation in and around Pahrump Valley is representative of most southwestern deserts and ranges, being zonal and dependent on altitude. The lower valleys tend to have greasewood or creosote, rice grass, rabbitbrush, and mesquite if the water table remains close to the surface. The alluvial fans tend to support creosote, saltbrush, Mormon tea, barrel cactus, yucca, shadscale, and bursage. The Spring Mountains support several zones. Joshua trees grow between 1,160 meters (3,800 feet) and 1,525 meters (5,000 feet). Pinyon, juniper, and grasses are common above 1,525 meters (5,000 feet), and coniferous forests are widespread above 1,525 meters (5,000 feet) (Cornwall 1972; Longwell et al. 1965; Maxey and Jameson 1948).

Today in Pahrump Valley maximum temperatures are approximately the same as in the Las Vegas Valley but minimum temperatures are cooler. This results in a slightly earlier frost in the autumn and later frost in the spring (Maxey and Jameson 1948; Venstrom 1932).

Pahrump Valley is considered arid to semiarid. Extremely high temperatures, low rainfall, and low humidity characterize the summer months. Lathrop Wells, located approximately 30 miles north of Pahrump Valley (records not
available), had a 14-year average rainfall of 7.47 centimeters (2.94 inches) while Las Vegas has an annual average rainfall of 11.73 centimeters (4.62 inches). Temperature extremes at Beatty, located approximately 60 miles northwest of Pahrump Valley, range from 114 degrees to 1 degree Fahrenheit. These data are from a 39-year period. Southern Nye County’s average high temperature in June is 104 degrees Fahrenheit. The January low temperature average is 18 degrees Fahrenheit (Cornwall 1972; Longwell et al. 1965; Maxey and Jameson 1948).

Formation of the Bowman Site Area. The Bowman Site lies at Manse Spring, located on the tip of the Manse Alluvial Fan. The Manse Alluvial Fan extends from Charleston Peak, in the Spring Mountains, in a generally west/southwest direction (Cornwall 1972; Maxey and Jameson 1948; Maxey and Robinson 1947). The site lies in a low area between the Manse Alluvial Fan to the southeast and the Pahrump Alluvial Fan to the northwest (Miller 1948; Miller et al. 1989).

Deposits caused by the past presence of water tend to be alluvial or fluvial. Eolian, alluvial, fluvial, and chemical sedimentary processes occur in desert environments, the major difference being the presence or
absence of water and its affect on these processes (Miller 1948; Miller et al. 1989).

Photograph 2 is from the Manse Alluvial Fan facing west/southwest toward the Bowman Site. Photograph 3 is of the Pahrump Alluvial Fan from the Manse Alluvial Fan facing north. Maxey and Jameson (1948: 72) state that wells in the Manse area go deeper than 275 meters (900 feet) and are drilled into 100% sediments with no older consolidated rock. These sediments consist of clay and silt, with a few thin sand and gravel lenses. Well depth signifies deep valley fill extending beyond 275 meters (900 feet). The Manse Spring elevation is 840 meters (2,756 feet) with rises on the adjacent alluvial fans being approximately 15 to 20 meters directly to the north and south. Figure 5 demonstrates the location of Manse Spring in relation to the alluvial fans.
Photograph 2. Bowman Site (where subdivision is located) from Manse Fan Facing West/Southwest.

Photograph 3. Pahrump Fan from Manse Fan Facing North.
Figure 5. Manse Spring in Relation to Alluvial Fans.
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<tr>
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<td>Paleo-Indian</td>
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Table 2. Cultural Sequences in the Great Basin.

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Cultural Background, Past Archaeological Research in Pahrump Valley, and Lifeways

Archaeological investigations in Pahrump Valley are limited. Because of this lack of direct knowledge, Las Vegas Valley serves as the source for cultural background information.

Human occupation likely occurred as early as 10,000 to 13,000 years ago in the area and continues through the present. Several periods describe the cultural history of Southern Nevada. There are several different names for cultural classifications depending on the source (see for example Kolvet et al. 2000: Figure 3.2). Table 2 presents a brief description of the chronological sequences that appear in the Great Basin, with an emphasis on the southern Great Basin. It also includes the basic sequence used for this chapter. A brief background discussion of the Paleo-Indian, Archaic, Late Prehistoric, and Protohistoric periods provides a general background of Southern Nevada’s cultural history (see Fowler and Madsen 1986; Grayson 1993; Lyneis 1992a; Thomas 1981; Warren and Crabtree 1986).

Paleo-Indian Period 9,000 – 13,000 Years Ago. The earliest appearance of humans in Southern Nevada occurred during the Late Pleistocene or Early Holocene Period
(10,000 to 13,000 years ago). This early date is based on infrequent finds of fluted points in Southern Nevada. Large stemmed points, hafted as spears, dating to the Early Holocene also exist. Stemmed points are usually found as isolates but are sometimes found with crescents, knives, gravers, and scrapers. These early finds often occur near bodies of water or pluvial lakes. This early culture appears to have focused on megafauna hunting because many points lie in context with these large mammals at some archaeological sites in other areas. However, direct cultural context with large mammals (megafauna) has not been documented in southern Nevada (Grayson 1993; Kolvet et al. 2000).

**Archaic Period 1,500 - 9,000 Years Ago.** Changing environments commonly occurred throughout the Archaic period. Environmental changes drove changes in cultural lifeways, including abandonment of some areas and high mobility. The general lifeway focused on hunting and gathering. Different point types and grinding stones emerged during this period. Different projectile points were used to hunt animals that were smaller (i.e. deer, rabbit, etc.) than the megafauna that no longer existed. Grinding stones were used for processing plants and/or
skins. Humboldt points were common during the transition from Early to Middle Archaic Periods until approximately 1,500 years ago. Elko, Gatecliff, Gypsum, and Pinto points also date to the Archaic period (Busby 1979; Dincauze 2000; Grayson 1993; Kelly 2001; Kolvet et. al. 2000; Thomas 1981; Warren and Crabtree 1986).

Approximately 4,500 years ago, the Great Basin began to look similar to today’s Great Basin in climate and vegetation. The archaeological record indicates site types similar to those left by the indigenous people Europeans first encountered. Site type diversity became commonplace between 4,000 and 5,000 years ago. The site types appearing about 4,000 years ago included caves, rockshelters, open sites, and mountain sites. Intense use of every environmental setting became common in the Great Basin region. All vegetation zones were used as the people made seasonal rounds to areas where resources were obtainable either seasonally or year round. Movement would include moving from the mountains to the warmer valleys when the weather was cold and resources scarce. This type of resource/landscape use corresponds with what the first Europeans described when they encountered the Southern Paiute people populating southern Nevada (Grayson 1993).
Late Prehistoric Period 2,000 - 700 Years Ago. An increase in the number of sites and site types across the landscape continued into historic times. Lifeway evidence indicates a likelihood of human adaptation to the continually unpredictable environment along with an increase in human population, possibly from migration (see Bettenger 1994).

Grinding stones, which appeared during the Archaic Period, continued to become an ever increasing part of the material culture of the Great Basin’s prehistoric people. Seed processing became more popular as other resources became scarce in the warmer and dryer climate. Due to its energy expenditure requirements, grass seeds would only have been processed if necessary. The energy expense (calories) for seed processing is great compared to calories created (Grayson 1993; Kelly 1995).

All of this evidence may indicate a change from a single (or limited) resource diet to a more diverse diet, allowing for some insurance during inadequate times. The change likely caused the inhabitants to gather grass seeds as a resource until their mobility rounds brought them to the resources that were previously available year round in the valleys. This diversity allowed survival if a resource did
not present itself as expected. Subsistence insurance, including diversifying, is typical in less than predictable environments similar to the Great Basin. The diversity versus specialization choice can ensure successful subsistence.

The Basketmaker to Pueblo transition in the Southwest occurs during the late prehistoric period. Prehistoric Pueblo people settled as far west as the lower Muddy and Virgin Rivers just north of Las Vegas (Fowler and Madsen 1986; Warren and Crabtree 1986; Lyneis 1992a; 1995; 2000). Warren and Crabtree (1986: 191) state that similarities exist from this area to the Death Valley area, three valleys west of Las Vegas (Figure 6). The similarities imply interchange, trade, and travel into these areas. The presence of Prehistoric Pueblo artifacts, including pottery, does not automatically indicate that the Prehistoric Pueblo people lived in these areas, as some archaeologists often infer. It is conceivable that interaction and trade occurred between the Prehistoric Pueblo people located in the lower Muddy and Virgin River area and the decisively mobile people to the west on their periphery or margin (Upham 2000). Pahrump Valley would have been influenced by this contact. Bowman Site cultural
material includes Prehistoric Puebloan pottery, supporting this connection (Lyneis 2000; UNLV site notes, Bowman Site-26NY809).

**Protohistoric Times 700 Years Ago to European Contact.**

The Shoshonean people (Paiute and Shoshone) have been occupants of the Great Basin beginning approximately 1,000 years ago. In Las Vegas Valley, the Numic occupation presumably occurred after the area was abandoned by the Prehistoric Puebloans. No direct evidence has yet been discovered indicating a Prehistoric Pueblo occupation of Pahrump Valley. It is possible that the Southern Paiute migrated to the Las Vegas Valley after it was abandoned by the Prehistoric Pueblo people. Migration may have originated from peripheral areas, like Pahrump Valley. Southern Paiute people are a semi-nomadic, seasonal-round hunting and gathering population (d’Azevedo 1986; Kelly 1934; Steward 1997 [1938]; Sutton and Yohe II 1987).

The Southern Paiute people used distinctive pottery, making their presence easy to identify. The Paiute people survived the Great Basin’s environment in much the same way as their predecessors as far back as 5,000 years ago (Grayson 1993). Whether the Paiute people are the previous occupants’ descendants or newcomers to the Great Basin,

Figure 6. Locations in Southern Nevada Discussed.
Great Basin Lifeways

Grayson (1993) observed that from approximately 5,000 years ago to historic times indigenous lifeways would have been extremely similar. Grayson's argument is based upon archaeological sites after 5,000 years old compared to the lifeways of indigenous people as observed upon European contact. Lifeways changed dramatically after Euro-American settlers entered and established themselves in the area.

Prehistoric inhabitants of the Great Basin lived as mobile hunter-gatherers. Their subsistence involved seasonal rounds through different parts of their environment in order to take advantage of the resources (Binford 1980). Base camps or residential bases tended to be located near resources critical to survival, such as water. The Bowman Site was one of these base or residential base sites (Ebert 1992; Kelly 1995, 2001; Stephens and Krebs 1986; Steward 1997 [1938]; Varien 1999).

Kelly (2001: 53-59) proposed four models for subsistence in Great Basin Wetlands. They consist of,

- Marshland foraging from a residential base
- Mountain foraging after a residential move from the marshland
- Logistic mountain foraging from a marshland base camp
- Logistic valley foraging from a mountain base camp

Kelly (2001: 62) explains that these models do not address resources that are located at greater distances. These models can be mixed together, becoming more effective and realistic depending on the specific circumstances. For example, some of the population may remain foraging in the valley and others may go into the mountains to hunt large game and acquire other resources.

Seasonal cycles were critical to hunter-gatherer subsistence in the Great Basin. As seasons changed, the people traveled across the landscape to take advantage of resources located in different environments, usually associated with different elevations. Base camps exist at water sources and in mountain areas, but tend to be more common at valley water sources. Both types of base camps are used, depending on harvest success during the year. Foodstuffs close to water resources tend to be more predictable than other resources across the landscape (Binford 1980; Ebert 1992; Kelly 2001).

Fall harvests of pine nuts become an important resource because of the nut's ability to be stored for future use.
consumption. If the pine nut harvest was extremely good, it permitted sustained camping in the mountains. It is important to keep in mind that stored resources are extremely important during harsh winters, making stored pine nuts even more cost effective. Roots and seeds (i.e. grasses) that are found distant from water resources, become critical during the springtime, occasionally pulled the population further from a water resource and/or base camp. Hunting large game (i.e. deer and desert mountain sheep) also causes inhabitants to travel away from their base camp. Mountain foraging can range up to 30 kilometers and remain effective for food procurement (Kelly 2001). If lithic material was gathered, a trip could be made even more cost effective.

The inhabitants of the Great Basin were extremely mobile. Diversification was necessary for their survival in the arid environment. Seasonal rounds were fine-tuned to the environment in order to assure that people were present in an area when the relevant resource became available. Flexibility was normal, while long-term static behavior generally did not exist and could be detrimental to survival.
Pahrump Valley Excavations

Little archaeological study has occurred within the Pahrump Valley. Only two recorded archaeological excavations have occurred within the last 25 years. Excavations include the Bowman Site (Photograph 4), which is the focus of this study, and the Bolling Spring Mound Site (26NY10186).

Bolling Spring Mound. Four hundred and ten Rosemary Clarke Middle School students and approximately 50 adult volunteers excavated Bolling Spring Mound, under the direction of Kathy Moskowitz of the United States Forest Service, in the late 1990s. The excavation was conducted to raise public awareness of extensive looting at the site (Moskowitz 1998). The Bolling Spring Mound is located less than one kilometer from Pahrump Springs. The indigenous occupants of Pahrump Springs had been driven away in 1875 by Euro-American settlers.

The Bolling Spring Mound excavation generated public education, and in the process information gathering occurred with some scientific control versus the loss of information from looting. However, excavations took place to minimize loss rather than to address specific research questions. Muskowitz’s (1998) main goal was to determine
the age of the site, who occupied the site, and how it was used. Information gathered in the excavations furnished an understanding of the material culture present so that further research could occur. The potential complete loss of the site made it clear that information needed to be gathered quickly and with minimal funding (Muskowitz 1998).

Surface artifacts indicated a late prehistoric occupation associated with the Southern Paiute (Desert side-notched and triangular projectile points). Results argued for a long term occupation at the site, possibly as old as 7,000 years ago based upon the recovery of a Pinto Point. Other evidence includes marine shell from California and what Moskowitz (1998) interpreted as attempts to imitate Virgin Anasazi pottery, supporting the likelihood of contact with other cultures in the general region.

Bolling Springs' lifeways appeared to be seasonal rounds, associated with hunter/gatherers, based upon the floral material recovered. Muskowitz (1998) accepts that Bolling Spring Mound is a seasonal round base camp. Almost all of the floral material present consisted of native species (731 of 771 samples). Pine nut shells, catclaw, and juniper seeds were recovered, indicating movement into higher elevations to gather these resources. Over 700
grape seeds known to have grown at the site in historic times were also recovered. They were found in a cache between a depth of 40 and 50 centimeters, and many of the seeds were punched with a tiny hole suggesting that they had been made into beads. Squash, cucumber, and gourd were also recovered between 30 and 60 centimeters which suggests that cultigens were also being grown at some point; this is not uncommon during proto-historic and historic times within the Great Basin (Moskowitz 1998). Basic questions were answered during this study; however further details and specific studies did not occur.

Bowman Site Recording and Excavation Interpretations. The Bowman Site, which was named after the family who owned the land, was extensively farmed in the 1980s and is currently being developed as a housing subdivision. Dr. Margaret Lyneis conducted a field methods class at the site to address the owner's concerns about findings in his potential farm fields (i.e. human remains and artifacts). As with Bolling Spring Mound, it was an excavation to gather information before destruction, with no specific research questions being addressed.
Photograph 4. University of Nevada - Las Vegas Bowman Site Excavations from the 1980s.
Stanton Rolf (1977) originally recorded the Bowman Site in March of 1977. He described it as situated in “migrating blow sands in [a] low sand hummock situation” and the specific area recorded lies in the “blow out areas in migrating sand dunes.” Rolf’s (1977) description indicated dunes as the primary landform. The water expelled by Manse Spring created ponds in modern history. These ponds were likely fairly expansive in previous times because of a higher water table (Miller 1948; Miller et al. 1989). Spring-fed ponds, run-off, and potential pluvial lake in the Pahrump Valley, also played a part in the early sedimentary deposits within the vicinity of the Bowman Site.

Rapp and Hill (1998) state that ground water seepage can form desert lakes and ponds and interdunal ponds are often created within sand dunes. Ponds created from springs and ancient lake shorelines contain a high potential for archaeological sites in the desert, making continuous occupation of the Bowman Site probable (Miller 1948; Miller et al. 1989; Rapp and Hill 1998; Grayson 1993).

During 1982, 1983, and 1984, less than five percent of the known site area was excavated during the field school; however thousands of artifacts were recovered and several
features were found. At least 13 units had fire-cracked rock with associated charcoal, three rock features/concentrations and hearths were acknowledged, one pit was identified, areas of midden material were present, and seven burials were documented. Excavations began when the owner of the property leveled the dunes in order to cultivate his land. This process took away approximately 15 feet of dune material and in the process exposed human remains. Most of the excavation units extended to a depth of over a meter, with many approaching 1.5 meters. These units could have been extended further, however the field methods class ran out of time and could not take them deeper. Seven distinct burials were identified. All appear to date to late prehistoric times; one burial included a Puebloan Black Mesa black-on-white bowl (UNLV excavation notes, Bowman Site-26NY809).

Over 3,800 faunal bones or bone fragments were recovered and four flotation samples were taken. Due to the limited resources available for the field methods class, material recovered from the Bowman Site has not been analyzed and no reports have been generated. Because of this lack of information, the floral and faunal remains cannot be discussed.
Approximately 10 units exposed a large complex midden deposit. Late prehistoric artifacts were gathered in the upper levels and Archaic period artifacts extended into the deeper deposits.

Dr. Lyneis (1985) expressed excitement at the potential of the Bowman Site in a letter to the land owner, Merton Bowman. In this letter, she states that artifacts recovered suggested an occupation dating over 5,000 years ago. In addition to the nature of the deposits in which the artifacts were recovered, seed grinding implements diagnostic of the middle Holocene were recovered. Lyneis (1985) interpreted the Bowman Site to be a large, major site, older than “any known in southern Nevada or the adjacent area of California”. She expressed hope that the site would be further studied, but this never came to fruition.

Several artifacts were found at depths up to 1.4 meters in a dark sandy soil. Jay Quade from the Desert Research Institute visited the Bowman Site on June 4, 1983. He explored the geological age of the site and soil creation. Quade (UNLV excavation notes, Bowman Site-26NY809) identified the soil at the bottom of several units and backhoe trenches as being formed under wetter conditions,
and he identified mollusk fragments in the soil. Some soil formation occurred from spring flows, and Quade speculated that deeper strata would produce Pleistocene fauna. A consolidated sand layer that was a "discontinuity" from the silt lying above it was the result of the playa drying or a "shift or decline of spring runoff" (UNLV excavation notes, Bowman Site-26NY809). The geologic analysis emphasizes that humans likely used the Bowman Site for several thousand years, possibly back to the Early Holocene or Late Pleistocene. This determination, based upon Quade's analysis, is due to the obvious wet environment present in the past.

Projectile points from the Bowman Site include Gatecliff Contracting Stem, Humboldt, Elko, Rosegate, and Desert Side-notched. These points also argue for a long occupation at the site, beginning at least 5,000 years ago. The temporal range continues into Euro-American contact when Pahrump Paiute were living in the vicinity. Table 3 summarizes the projectile points recovered from the Bowman Site and their associated dates (Buck et al. 1994, 1998; Hester 1973; Hester and Heizer 1973; Jennings 1978, 1986; Kelly 2001; Kolvet et al. 2000; Thomas 1981; UNLV excavation notes, Bowman Site-26NY809).
Arid environments unfortunately cause serious disturbance to a site area. The presence of seasonal water from runoff, rainfall, and any other higher intensity, water-related activity may erode and disturb desert archaeological sites dramatically. Wind, another significant desert erosion action, causes deflation prompting diminutive particles to blow away, leaving larger items behind. This action both protects or destroys an archaeological site, depending on the circumstances (see discussion in Rapp and Hill 1998; Mehringer 1986). Because Manse Spring ponded, water erosion likely occurred (Miller 1948; Miller, et al. 1989).

<table>
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<tr>
<th>Projectile Point Type</th>
<th>Chronological Time Period</th>
<th>Number of Projectile Points</th>
<th>Percentage of Assemblage</th>
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<td>Large Side-Notched</td>
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<td>Elko Series</td>
<td>1,250-3,250 BP</td>
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<td>7.02</td>
</tr>
<tr>
<td>Gatecliff Series (Contracting Stem)</td>
<td>3,250-4,950 BP</td>
<td>4</td>
<td>7.02</td>
</tr>
<tr>
<td>Unknown (not enough data)</td>
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<td>10</td>
<td>17.54</td>
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<tr>
<td>Out of Key (did not fit Thomas 1981 projectile point flow chart key)</td>
<td>NA</td>
<td>9</td>
<td>15.79</td>
</tr>
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</table>

Table 3. Typology (based on Thomas 1981) of Bowman Site Projectile Points.
Pahrump Valley Cultural Studies Summary. Research and excavation in Pahrump Valley has been limited to only two excavations. Cultural resource surveys have occurred. However, areas around the springs are located on private property, making archaeological research almost impossible. The Pahrump Valley was heavily homesteaded and thus little of the lower lying land close to critical water sources remains within the public domain. Indeed, absent Merton Bowman’s personal interest and Dr. Lyneis’ willingness to allocate scarce time and resources to the Bowman Site, virtually nothing would be known. Even so, much of the cultural context still depends upon an assumption that parallels can be drawn to the occupation of the Las Vegas Valley. The information gathered from the Bowman Site and Bolling Springs excavations is extremely valuable due to the lack of information from the Pahrump Valley’s spring locations.
CHAPTER 3

STUDY INTRODUCTION, CONTEXT, AND SPATIAL ANALYSIS

Introduction

This study focuses on lithic procurement and how information from artifacts and spatial analysis can provide insight into the activities of the prehistoric occupants of the Bowman Site. Several research questions can potentially be answered about the procurement, manufacture, use, and discard of lithic material at this site. Binford (1979) demonstrates what can be learned in a specific culture by looking at the organization of technology. It is argued that different situations and lifeways dictate organizational differences in technology (Andrefsky 1994, 1991; Bamforth 1990, 1986; Bleed 1986; Kelly 1988; Nelson 1981; Newman 1994; Ricklis and Cox 1993).

Stone tool manufacture is a significant indicator of mobility. Costs and rewards are also linked to stone tools. For example, humans would have to consider the cost of obtaining the raw material and transporting the stone.
tool, versus its utility. It would be logical for extremely mobile people to spend more time and effort producing stone tools that are reliable and of high enough quality to deal with several different situations, and endure until replacement is possible. Research has supported arguments that bifacial tools were more common in mobile populations than sedentary populations (Bamforth 1986, 1990, 1991; Kelly 1988, 1995, 2000; Odell 1996, 2000, 2004). Sedentary populations, if located near a raw material source, can readily chip off a flake whenever they need one. Mobile groups will also use expedient tools if a lithic source is close to the area where they need the tool. In contrast, if people acquiring the raw material must travel a great distance, then they would work the raw material into well-formed blanks or cores with little waste material before leaving the quarry, keeping the cost of transportation minimal. Mobile people are also limited in the number of items they can carry (Andrefsky 1994; Bamforth 1990; Bleed 1986; Kelly 1995, 2001; Kuhn 1994; Metcalfe and Barlow 1992).

High quality lithic material would have been sought if none were available locally. This need requires a significant expenditure of energy and time in order to
travel to the location of the lithic material. The expenditure would not occur if the material did not produce adequate output. The utility of the material becomes apparent, so the material would be curated as much as possible to maximize its use-life (Shott 1996).

**Technological Organization**

The study of technological organization is still in its infancy. It was developed in the 1970s with most credit going to Binford (see Binford 1979). Recently, technological organization concepts have been applied to lithic studies and developed further for a greater understanding about the organization of technology and landscape use (see Amick 1996; Andrefsky 1994; Anshuetz et al. 2001; Bamforth 1986; Carr and Bradbury 2001; Kelly 1988; Moore 1989; Nelson 1981; Roth 1998; Tainter 1979). Technological organization encompasses the manufacture of stone tools in a temporal and spatial context. The concept includes how the tools were used, reused, discarded, and how the tool functioned in relation to raw material types and variables related to behavior. These behavioral variables determine how the activity, manufacturing, and
raw material locations take place spatially and temporally (Kelly 1988).

This approach can help us to understand variability in the archaeological record. Several studies regarding mobility and stone tool production have established a link between the two (see for example, Bamforth 1986). Andrefsky (1994), however, has brought into question the availability of raw lithic material and the way technology is organized. His study has shown that raw material availability could have a stronger influence on stone tool production than mobility. Humans are influenced by many factors and it is likely that there will be several aspects that influence stone tool technology within a culture (see Bamforth 1990, 1991).

Studies Associated with Technological Organization. Several factors must be considered when addressing the way stone tool technology is organized within a culture. Mobility requires that a tool kit be transported by the people using it. Binford’s forager-collector model (1980) assessed the mobility of people by the way they move across the landscape. Foragers typically travel each day to find resources and then return to their base camps or residential locations daily. Foragers’ residential
locations also move across the landscape as different resources become available. Collectors, however, do not move their residential bases around as readily as foragers do. Collectors move resources to the people by organizing task groups that go to the resources and bring them back to the residential site. Logistical mobility (collectors) is on one end of a continuum and high residential mobility (foragers) exists on the other end of this mobility scale. Mobility strategies for a given people will fall at any point along this continuum (Carr and Bradbury 2001).

By addressing lithic technological organization, it can be possible to define a specific site’s mobility strategies. Roth and Dibble (1998) point out that lithic variability includes how raw material and mobility affects the design, transport, and maintenance of stone tools. Lithic material used as groups travel must be obtained because the availability of raw lithic material does not necessarily exist where the stone tools must be used. Efficient technology is necessary to fulfill needs with minimal effort. Reliability, maintainability, versatility, flexibility, and transportability are the characteristics associated with efficient technology (Bamforth 1986; Bleed 1996; Nelson 1991; Shott 1996) (Table 4).
### Table 4. Characteristics Associated with Lithic Technological Organization (Nelson 1991).

<table>
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<tr>
<th>Design Attributes</th>
<th>Characteristic</th>
<th>Reasons for Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Overdesigned, carefully prepared, and sturdy. Also available when needed. Materials used are often stronger and more durable than other available materials.</td>
<td>Time constraints. Often used when time is much more important for procurement and processing of the resource due to unpredictability or the time the resource will be available. An example would be large hafting elements and material selected for its strength.</td>
</tr>
<tr>
<td>Maintainability, Versatility, and Flexibility</td>
<td>Works under numerous circumstances. Reshaped or changed easily for the immediate need or a universal form that meets many needs.</td>
<td>Useful when time is not as important because a tool that can do many tasks will not be designed for that specific task, thus the likelihood of using more time for that task. The advantage is the oversimplification of the toolkit, making it more transportable. An example would be a bifacial or disk core that can be changed through its reduction process.</td>
</tr>
<tr>
<td>Transportability</td>
<td>Lightweight and/or small toolkits and/or tools. Mobile toolkits can be lightweight because they are small or because they contain lightweight tools (usually made from organic material).</td>
<td>Adapted for mobility and anticipated needs. Tools that are multifunctional are an example because the need for carrying several tools declines. The importance is having a usable tool (not necessarily an optimized tool) when it is needed.</td>
</tr>
</tbody>
</table>

Procurement of raw lithic material would differ depending on several factors: the location of the raw lithic source, the size and nature of the source, the quality and composition of the material and how it is exposed, and how easily the material can be removed from its source. The
raw material must be transported so reduction would be expected to take place at the quarry site to minimize weight (Metcalfe and Barlow 1992; Newman 1994; Pedrick 1985).

Curation is defined as the extent of the utility of an artifact. Many stone tools are curated; the question is only to what extent they are curated. For the purpose of this study, the term "curate" will indicate effort expended in order to maximize tool utility (Shott 1996).

Highly curated lithic tools can be expected to indicate a mobility strategy which falls on one end of the spectrum, with minimally curated tools (expedient) on the other. Curated tools tend to be used and reworked/reused for many different tasks and in an anticipatory fashion as opposed to expedient tools that tend to be used in a situational fashion (see Binford 1979). Curated tools are maintained, transported, and then recycled for other purposes when their original form is exhausted. Expedient tools are manufactured and used for an immediate need in a specific situation and then discarded. It is reasonable to assume that if a group practices a collector's logistical mobility, then there should be an increase in curation and maintenance of stone tools. Production of curated lithic
material can also be related to time stress (Torrence 1989). Curated tools can be prepared during idle time, ensuring that tool production does not interfere with other subsistence-related activities (Bamforth 1986; Bamforth and Bleed 1997; Binford 1978, 1979; Bleed 1986; Odell 2000).

However, neither unanticipated needs nor time stress totally explains the concept of curated tools. Curation can occur in many different circumstances and one explanation is not likely a complete one. Changes in curation would also occur based upon how difficult it is to access raw material. If quality lithic raw material were scarce, then stone tools would be curated more out of a need to preserve tools until a new material source was found (Andrefsky 1994; Bamforth 1991, 1990, 1986; Newman 1994; Roth 2000).

Mobile Toolkit Characteristics. Lithic sources are not always associated with the location of food resources and this fact must be dealt with in order to meet the functional needs of a mobile group. Stone tool needs cannot always be anticipated and when a need arises, raw material must be available. Bifaces, by their nature, are multifunctional, long use-life tools (Kelly 1988). Because
of these characteristics, they are common in the tool kits of mobile people (Kelly 1988).

Kelly (1988:718-719) argues three reasons for the deliberate manufacture and use of bifaces.

1. Large bifaces can be used as cores and as tools. This characteristic becomes important in case raw material is not available when an unforeseen need arises.

2. The properties of a biface give the tool a long use life which is another important aspect for mobile groups. The biface can be recycled and therefore is available over an extended period of time. Replenishing the tool kit therefore becomes less critical when raw material is not available.

3. A biface becomes a biface because of special needs or stylistic preference. An example of a special need would be hafting. These tool types would be produced at the base camp where the materials would be available for hafting.

All these factors take into consideration the requirements of a mobile toolkit. It is intuitive that the tools used in a mobile toolkit will be most useful if they can be used for a variety of tasks, are durable, and/or fit
a specific need. In essence, having a suitable tool where and when it is needed.

Kuhn (1994) points out that bifaces, however, are not the chosen toolkit of mobile populations in Australia or Europe. He argues that many small tools are just as beneficial as the bifacial toolkit when addressing the needs of mobile populations. However, the small tools could have been a result of the raw material available to these mobile groups (i.e. small lithic nodules). Western United States data supports the idea that the biface is the tool of choice for mobile populations in this region (Kelly 1988).

It is important to also consider that curation is not only associated with mobility but also with the availability of the raw material. Bamforth (1986:40) argues that curation will only occur if the raw material is not available. However, this concept does not take into account other social decisions that could factor into the idea of curation. Nelson (1991:77) agrees that raw material availability is important, but also points out strategies exist to meet raw material needs within a group of people.
Raw Material Availability, Mobility, and Lithic Procurement

As discussed earlier, the procurement of lithic raw material can influence the procurement of other resources. Lithic procurement can either be embedded into other procurement activities or it may be the principal activity for a specific foray. As Roth (1998) points out, the distinction between availability and accessibility is required. Lithic material may be available but if it is not located in an area where other resources can be procured then it is not readily accessible. If, however, the lithic source is located in a place where other resources are available then accessibility constraints diminish.

Resource Procurement and the Bowman Site. Eureka Quartzite, as discussed earlier, possesses attributes that make it easy to identify. Eureka Quartzite is located in geological formations creating the mountains to the east of Pahrump Valley, and one location is located in an outcrop within the valley, northwest of the site, approximately 27 kilometers away. It is only found in seven locations ranging from 17 to 30 kilometers from the Bowman Site. Because of these characteristics, the procurement of Eureka Quartzite in the Spring Mountains by prehistoric occupants

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of the Pahrump Valley was chosen as the focus in this study.

Knowing the locations of possible pathways from the Bowman Site to the known Eureka Quartzite sources in the Spring Mountains can offer further understanding of landscape use. Also, it can demonstrate whether procurement of Eureka Quartzite existed in conjunction with other activities (embedded procurement versus direct procurement).

The Bowman Site was a residential base camp due to its year-round water supply. Movement of people from the Bowman Site into the mountains to obtain Eureka Quartzite could have involved obtaining food resources as well. Six of the seven locations are located in the Spring Mountains and these locations will be the focus of the study (Ebert 1992; Knecht 1997). Seasonal rounds have always been studied as part of a food gathering/hunting way of life. Ebert (1992: 113) points out that most studies published by Great Basin ethnographers do not cite nonfood resources as singular seasonal round determining factors. He suggests that these ethnographers were likely unaware of the connection between the procurement of food and nonfood resources.

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Foraging theory borrows from evolutionary or behavioral ecology. The basis for foraging ideas is the need for humans to live, reproduce, and ensure their progeny live long enough to propagate, a concept generally referred to as “fitness.” Behavioral ecology thrives because it is based upon measurable and falsifiable experimental components (Broughton and O’Connell 1999; Cronk 1991; Kelly 2000).

Kelly (1995, 2000, 2001) illustrates behavioral ecological components by measuring the amount of calories it takes to obtain a resource versus how many calories the resource supplies. However, direct correlation does not take into consideration resources not directly supplying calories. Lithic procurement is one of the resources that does not supply calories directly to the community or individual. Stone tools, however, supply calories indirectly because they provide the means to collect and process plant foods and hunt and process game more efficiently. Kelly (2000: 69) argues that using stone tools in behavioral ecology is imperative since most hunter-gatherer cultural remains are stone tools and lithics. Performance characteristics provide a measure similar to the food foraging “return-rate” (Kelly 2000: 59).
Some of these performance characteristics are knappability, sharpness, durability, and fracture mechanics.

The above mentioned performance characteristics, along with other lithic studies, must be combined to express the cost and benefit of the resource. "People weigh their options and opt for those that provide the highest benefit: cost ratio given opportunity costs" (Kelly 2000:69). The technology model predicts that the type of tool made with a specific material is related to the amount of time spent obtaining the material. More time will be spent obtaining material and creating a tool if its use-life will be long. Kelly (2000: 70-71) also points out that the model requires experimental data in order to become a useful predictive model.

Recognizing that the information and data supporting lithic procurement and use in a foraging theory model is only in its emergent stage, this study focuses on lithic procurement based upon the lithics present at the base camp (Bowman Site) and their technological organization. Surveying the potential pathways to the Eureka Quartzite procurement location could provide insight about many other activities that could have occurred during lithic procurement forays. Prediction of the pathways is based
upon the easiest and quickest route to the six locations where Eureka Quartzite is located in the Spring Mountains. If other procurement activities occurred during forays to retrieve Eureka Quartzite, then archaeological sites associated with food gathering or hunting activities should be present along these pathways. However, other people that did not reside at the Bowman Site also could have used portions of these pathways during their travels in the area.

Pathway Predictions from the Bowman Site to Eureka Quartzite Quarry Locations

Deserts are ideal for locating archaeological sites due to artifact visibility in areas with a dearth of ground cover. Cultural disturbances, including pathways, remain visible for many hundreds or even thousands of years due to the deflationary nature of the landscape (Barker and Gilbertson 2000).

Geographical Information Systems (GIS), are analytical tools that store, retrieve, analyze, and display spatial data. Thematic maps can be layered together to produce information that can be used in analysis. For example, a base map is any map that can be georeferenced with the same
scale and projection thematic map(s). Thematic maps are the tools that allow researchers to select what is important to their specific research (Environmental Systems Research Institute, Inc. (ESRI) 1999; Ormsby and Alvi 1999).

Spatial analysis using Geographic Information Systems (GIS) can be used in archaeology to more clearly depict how sites fall on the landscape and to more readily predict and recognize sites using the visualizations available through GIS programs. Geographic Information Systems have been a part of archaeology since the 1980s and emphasizes specific measurable attributes (see Maschner 1996 for more archaeology and GIS explanation). For example, the distance from a water source, rock quarry, or any other place, feature, or attribute associated with a landscape can be shown using GIS.

However, the nuances of human thought are not brought into GIS analysis (Lock 2000; Lock and Harris 2000). Knowing this weakness allows consideration of the potential faults. Human thought processes are often not taken into consideration in many theories, mainly because it is often unpredictable. As an example, hunter-gatherers could possibly weave mythology into their landscape and these
beliefs will affect decisions (Boaz and Uleberg 2000; Tilley 1994).

Summary

By studying the organization of lithic technology, lithic procurement strategies, and spatial analysis, this study expects to answer questions regarding the mobility strategies of the inhabitants of the Bowman Site. Mobile people carry a transportable tool kit which limits the quantity of items carried. These constraints, in addition to the availability and/or accessibility of lithic sources, dictate behavior patterns when addressing lithic artifacts. The following chapter will discuss the research design and methods that will be used to address the research questions.
CHAPTER 4

RESEARCH DESIGN AND METHODS

Introduction

The people who lived at the Bowman Site were mobile, as is typical of prehistoric people living in the Great Basin. Information obtained through the lithics excavated at the site in conjunction with lithic procurement areas and the likely pathways used to move to and from these areas may give insights into mobility strategies of the prehistoric people inhabiting the Bowman Site. Specific research questions are addressed that are related to these topics.

Research Questions

Can the mobility strategies of the people inhabiting the Bowman Site be identified by their lithic technological organization? Several factors come into play when trying to address mobility strategies. We can address this research question by looking at technological organization, specifically the level of curation (Carr and Bradbury...
By analyzing the lithics at the Bowman Site, a pattern will emerge showing where the people who occupied the Bowman Site fall on the sliding scale of curation and expedient use of lithic materials. This scale will help determine the mobility strategy that the inhabitants of the Bowman Site practiced.

This study assumes that bifaces were curated tools. Bifaces can be used as tools and/or cores. Biface production results in more small, non-cortical flakes than expedient technology, because the biface will be used over a period of time for several different tasks, all the while being reworked and reduced until it is no longer useable.

Curated lithic material will typically contain more formal tools, bifaces, smaller lithics of all kinds, less cortex, and more flake scars than an expedient strategy. Platforms will more likely be prepared (i.e. abraded, faceted) and terminations will be feathered since care was taken when separating the flake from the core. Because cores will be reduced carefully and used until exhausted, there should be more flakes (and smaller ones) for each core of a specific material type that is being treated with a curation strategy.
Expediency is the manufacture, use, and discard of a tool as and where it is used. It is often wasteful and commonly produces larger flakes with a higher percentage of cortex, unstructured or amorphous cores (i.e. assayed, multidirectional), shatter or debris, and fewer formal tools.

Often a site will have mixed assemblages with both curation and expediency present. A high-quality raw material (especially if it is not readily available) will show curation qualities while the available raw material will be treated in a more expedient fashion (Bamforth 1991; Bleed 1986; Nelson 1991; Roth 1998).

Is there evidence to support the use of the potential pathways to the Eureka Quartzite from the Bowman Site identified by the GIS study? Over 2,000 Eureka Quartzite artifacts were recovered from the Bowman Site. Bowman Site inhabitants made forays into the Spring Mountains, and specifically to the areas where Eureka Quartzite is located. Eureka Quartzite was obtained from areas in the Spring Mountains and transported, either as raw material, unfinished tools, and/or finished tools. The specific Eureka Quartzite locations in the Spring Mountains were the focus of this study.
Eureka Quartzite is easily identifiable and has limited distribution within the Spring Mountains where different resources are also available to the Bowman Site inhabitants. Also, Eureka Quartzite is an extremely good quality lithic material that commonly is mistaken for chert, as Jay Quade (UNLV Excavation Notes - Bowman Site (26NY809) affirms. Therefore, Eureka Quartzite is ideal for a lithic study of this kind. Its quarry locations are known, it will not be mistaken for other lithic materials, and it is a high quality material that would have been valued for stone tools.

GIS (ArcView 3.2a) will be used to predict pathways that are the quickest and easiest to and from the Eureka Quartzite locations and the Bowman Site. Examining the potential pathways can reveal if cultural remains such as basket rests, cleared areas, hunting camps, rock rings, etc. are present, which would suggest that lithic procurement was embedded in other activities. In the same manner, areas distant from the pathways can be examined for similar (or contrary) evidence. We may be able to determine whether the same pathways were used more often than other areas across the landscape by comparing data using GIS.
Did the people inhabiting the Bowman Site combine their Eureka Quartzite procurement with other procurement activities? Evidence either at the procurement sites, along the potential pathways, and at the Bowman Site, can assist in making a determination of whether the procurement of Eureka Quartzite was embedded within other procurement activities or if direct procurement occurred.

Methods

Addressing the research questions involves examining the organization of lithic technology, raw material availability, and how the landscape was utilized while traveling to and from the Bowman Site and lithic procurement areas.

The main technological strategy assessed in this study is the level of curation of specific lithic material types. As discussed previously, curation solves problems in time stress and the lack of raw material in the area where the tools are to be used.

Lithic Analysis. Analysis of the lithics recovered from the Bowman Site involved identifying lithic types, material used, the level of curation, and the size of the lithic
artifacts. All of these factors come into play when interpreting the organization of technology (Nelson 1981).

The analysis of lithic material collected from the Bowman Site included the following attributes and measurements and lithics will focus on chipped stone for this study:

- **Description** - this category included the types of lithics and whether they are whole or fragmentary. Lithics were categorized into projectile point types, bifaces, unifacial tools, flakes, microflakes, cores, hammerstones, shatter, and fragments of the specific categories where appropriate.

- **Material** - the material type is the basic lithic material of the artifact. Material types found at the Bowman Site include quartzite, chert, basalt, obsidian, Eureka Quartzite, tuff, limestone, siltstone, and sandstone.

- **Length** - in millimeters at its longest point (whole specimens only).

- **Width** - in millimeters at its widest point (whole specimens only).

- **Thickness** - in millimeters at its thickest point (whole specimens only).

- **Weight** - in grams.
- Cortex percentage - a visual estimation of the percentage of cortex present (whole specimens only).

- Number of flake scars - a count of the flake scars present (whole specimens only).

- Platform type - the type of platform from which the percussion occurred to create the artifact (whole specimens only). Platform type categories included plain, crushed, faceted, cortical, and abraded.

- Termination - the type of termination present (whole specimens only). Termination types include feather, hinge, step, overshot, and unknown.

- Biface stage - the stage (1 through 5) of the biface (whole specimens only). Biface stages are defined by the amount of reduction that has occurred. These biface stages are:
  - Stage One - Flake Blank
  - Stage Two - Edged Biface
  - Stage Three - Thinning Biface
  - Stage Four - Preform
  - Stage Five - Finished Point (Andrefsky 1998:30-31).

- Volume (length x width x thickness) - (whole specimens only).

- Surface Area (length x width) - (whole specimens only).
• Additive Volume (length + width + thickness) - (whole specimens only).
• Section (length / thickness) - (whole specimens only)
• Additive Section (length + width / thickness) - (whole specimens only).
• Width to Thickness Index (width / thickness) - (whole specimens only).
• Additive Area (length + width).
• Surface Area Section (length x width / thickness) - (whole specimens only).

Several of these factors indicate the amount of reduction that has occurred for specific lithic materials. Heavy reduction would be characteristic of lithic material that is highly curated. Repeated reduction of the tool argues for curation, and thus the increased utility of the specific lithic material. Size is an important aspect of the level of curation.

Lack of cortex and a high number of flake scars are characteristic of heavy reduction. Nodule size will influence the percentage of cortex present so it is not always be an accurate measure of reduction. Cortex percentage may not always be a predictor of curated material.
Retouch on a tool or flake generally denotes curation. Time is spent to reshape, sharpen, etc. a tool for its continued use instead of discarding it. Expedient lithics may, at times, be minimally retouched or backed as needed for the specific task. However, retouch is most often a characteristic of a curation strategy.

Platform preparation is a characteristic that argues for either more or less care in the flaking of a specific lithic material, depending on the platform type. Often, a faceted or abraded platform indicates that more preparation went into the reducing process. The same is true of the termination type. A termination that is not flawed (i.e. feathered) indicates skill and care in the reduction process. Characteristics that this study considered are displayed in Table 5 (Nelson 1991; Newman 1994; Roth 1998).

Predicted or Potential Pathways to Eureka Quartzite Locations from the Bowman Site. Spatial analysis using GIS predicts the most likely pathways from the Bowman Site into the Spring Mountains and to the exposed Eureka Quartzite beds. Several of the stone tools and flakes from the Bowman Site were produced from Eureka Quartzite. Very few locations exist in the surrounding areas that contain Eureka Quartzite.
<table>
<thead>
<tr>
<th>Curation Strategy</th>
<th>Expedient Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td>Characteristics</td>
</tr>
<tr>
<td>Formal Cores</td>
<td>Informal (amorphous) Cores</td>
</tr>
<tr>
<td>High Number of Bifaces</td>
<td>Low Number of Bifaces</td>
</tr>
<tr>
<td>More Formal Tools</td>
<td>Fewer Formal Tools</td>
</tr>
<tr>
<td>Smaller Flakes</td>
<td>Larger Flakes</td>
</tr>
<tr>
<td>Smaller Cores</td>
<td>Larger Cores</td>
</tr>
<tr>
<td>Prepared Platforms</td>
<td>High Amount of Waste Flakes</td>
</tr>
<tr>
<td>Large Number of Flake Scars</td>
<td>Fewer Flake Scars</td>
</tr>
<tr>
<td>Lower Percentage of Cortex</td>
<td>Higher Percentage of Cortex</td>
</tr>
<tr>
<td>High Number of Flakes to Cores</td>
<td>Low Number of Flakes to Cores</td>
</tr>
</tbody>
</table>

Table 5. Characteristics of Curated and Expedient Assemblages Addressed in this Study.

Using a geologic map (Geological Society of America), the locations of the Eureka Quartzite were identified. Figure 7 displays general areas of Eureka Quartzite in the Spring Mountain range. Focusing on these locations, the Eureka Quartzite coordinates were recorded. The locations lie within four 7 ½ minute (1:24,000) USGS quadrangle maps; Horse Springs, Wheeler Well, Pahrump, and Pahrump NE. Eureka Quartzite identification was limited to 30 kilometers. It is argued that resources over 30 kilometers from the base camp become too expensive to actively pursue (Kelly 1996; 2000). Coordinates for the Eureka Quarry areas and the Bowman Site are located in Table 6. Eureka Quartzite is located primarily in the northwestern portion
of the Spring Mountains and disappears on east side of the Spring Mountains (Longwell et al. 1965).

Figure 7. General Locations of Eureka Quartzite within 30 Kilometers of the Bowman Site.

The United State Geological Survey (USGS) provided Digital Elevation Models (DEM) used as base maps for each
7½ minute topographic quadrangle map (Figure 8). These maps are georeferenced, permitting the location to be easily identified and plotted using coordinates from the maps. The four DEMs used were downloaded from the USGS website (United State Geological Survey Website).

<table>
<thead>
<tr>
<th>Location</th>
<th>Easting</th>
<th>Northing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowman Site 26NY809</td>
<td>0599590</td>
<td>4000620</td>
</tr>
<tr>
<td>Eureka Quartzite Bed 1 (E1)</td>
<td>0602445</td>
<td>4024098</td>
</tr>
<tr>
<td>Eureka Quartzite Bed 2 (E2)</td>
<td>0603638</td>
<td>4024098</td>
</tr>
<tr>
<td>Eureka Quartzite Bed 3 (E3)</td>
<td>0612035</td>
<td>4022627</td>
</tr>
<tr>
<td>Eureka Quartzite Bed 4 (E4)</td>
<td>0610256</td>
<td>4015172</td>
</tr>
<tr>
<td>Eureka Quartzite Bed 5 (E5)</td>
<td>0609786</td>
<td>4012576</td>
</tr>
<tr>
<td>Eureka Quartzite Bed 6 (E6)</td>
<td>0610232</td>
<td>4009796</td>
</tr>
</tbody>
</table>

Table 6. UTM Coordinates (NAD27) of the Bowman Site and Eureka Quartzite Locations in the Study.

In order for the four DEMs to function as one base map, they must be consolidated into one map (Figure 9). Project analysis utilizes a GIS (ArcView 3.2a) program designed by Environmental Systems Research Institute, Inc. (ESRI). Specific extensions for the program had to be engaged or added for the study. These extensions are Spatial Analyst, Network Analyst, and 3D Analyst. The DEM consolidation occurs using an ESRI extension called "Mosaic" that was obtained from the ESRI Website (Environmental Systems Research Institute Website).
An aerial photograph (Photograph 5) of the Bowman Site was obtained and UTM (NAD27) coordinates were identified using a computer program designed by DeLorme, entitled 3-D TopoQuads. The NAD27 datum is used so all information will correspond with the 7½ minute topographic quadrangle maps, DEMs, and the handheld Global Positioning System (GPS) unit used for the study. UTMs obtained for the Bowman Site were georeferenced to the DEM mosaic using the ArcView extension labeled "School Tools" obtained from the ESRICanada Website (Environmental Systems Resource Institute Canada Website). The georeferenced points were also used on two hand drawn Bowman Site maps and layered onto the base map DEM (Figure 10).

The Eureka Quartzite coordinates were placed into a point theme in ArcView 3.2a along with the Bowman Site. Maps that remain as vector data were converted to raster data or grid themes so spatial analysis could be performed. The thematic layers are shown in Figure 11.
Figure 8. Four Separate Digital Elevation Models (DEMs) Downloaded from USGS Website.
Figure 9. Four DEMs Consolidated Into One Mosaic.

Figure 10. Georeferenced Layers (Aerial and Two Hand Drawn Maps) Placed onto the DEM Mosaic.
Figure 11. Map Illustrating Thematic Layers.
Figure 11 includes the following layers:

- Base map—Mosaic of four 7½ minute digital elevation models of the topographic quadrangle maps in the study.
- Theme map—Aerial photograph of the Bowman Site.
- Theme map—Hand drawn map of the Bowman Site.
- Theme map—Hand drawn detail map of the Bowman Site.
- Theme map—Eureka Quartzite locations and the Bowman Site.

Humans tend to follow pathways that are the easiest to walk; specifically they do not voluntarily climb or descend extremely steep slopes when an easier path exists, as long as the path avoiding the steep terrain does not become too long. The slope of the terrain will be the center of the preferred pathway analysis. Another advantage to this type of pathway is that water tends to follow gradual slopes because it cannot flow uphill; consequently it curves around the steep slopes to find its way downhill.

"Derive Slope" was performed in ArcView 3.2a and a "Map Query" was performed to identify slopes in five percent increments. The resulting grid was reclassified so that each slope equates to a numeric value. The lower slope has a lower value and higher slopes have higher values. Any slope that did not fall into a value was given a value of zero. No data values were reclassified with an extremely
high value so that the paths do not follow "no data" areas. No data tends to exist on the edges of the DEMs. Ten slope value grids were created using the above criteria. "Map Calculator" was then performed to add these grids together for a grid value total or cost for specific slopes. Cost places a value on the slopes in one thematic map.

Slope values do not reflect the actual "cost" of climbing a slope in terms of energy. Cost is reflected in a linear fashion so that a pathway could be chosen that maintains the least slope with the shortest distance. The actual cost of traveling up a slope is non-linear as Bell and Lock (2000) point out in their GIS study. ArcView 3.2a does not take into account traveling downhill as being different from traveling uphill. Downhill travel is also difficult, however.

A script was written and performed in ArcView for cost distance/cost path from one point to another. Several combinations were performed from the Bowman Site and the Eureka Quartzite locations. The cost path script gives a value to each pixel measured within the grid. The cost distance script uses this value to create the path between two points that costs the least amount in distance. Cost path takes two points and finds the least cost path between
them based upon slope values. Used jointly, the pathway created chooses the least distance in conjunction with the least slope as the pathway of choice. The cost distance/cost path script is done for each pathway needed. Table 7 shows the basic scripting used for this analysis.

```
theView = av.GetActiveDoc
sGTheme = theView.FindTheme ("E1grd")
eGTheme = theView.FindTheme ("E2grde")
cGTheme = theView.FindTheme ("COST")
sGrid = sGTheme.GetGrid
eGrid = eGTheme.GetGrid
cGrid = cGTheme.GetGrid
dirFN = av.GetProject.GetWorkDir.MakeTmp ("dirfn",""")
cumGrid = sGrid.CostDistance (cGrid,dirFN,Nil,Nil)
ecGTheme = GTheme.Make (cumGrid)
theView.AddTheme (ecGTheme)
dirGrid = Grid.Make (Grid.MakeSrcName(dirFN.GetFullName))
pathGrid = eGrid.CostPath (cumGrid,dirGrid,TRUE)
pathGTheme = GTheme.Make (pathGrid)
theView.AddTheme (pathGTheme)
```

Table 7. Cost Distance/Cost Path Basic Script  
(This Script is Specifically the Path Between Eureka Quartzite Beds 1 to 2)

These pathways can be easily located on the landscape due to georeferencing available on the base map (DEM mosaic). By using the georeferencing, the coordinates can be taken directly from the base map and used for an archaeological pedestrian survey sample. Distances are also available, along with elevation at any point along the pathway.

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The predicted pathways to and from the six Eureka Quartzite locations and the Bowman Site are shown in Figure 12 and distances are shown in Table 8. ArcView 3.2a GIS prediction denotes pathways across the landscape that avoids steep slopes, yet takes into account the cost of adding distance to travel. These predictions must be tested in order to validate their usefulness. Archaeological survey sampling was done to test the predictions and any previous archaeological studies in the area were reviewed. Figure 13 is a three-dimensional view of the GIS predicted pathways.

<table>
<thead>
<tr>
<th>Two Location Points for Pathway</th>
<th>Distance in Kilometers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowman Site-Eureka Quartzite Bed 1 (E1)</td>
<td>29</td>
</tr>
<tr>
<td>Bowman Site-Eureka Quartzite Bed 2 (E2)</td>
<td>28</td>
</tr>
<tr>
<td>Bowman Site-Eureka Quartzite Bed 3 (E3)</td>
<td>28.5</td>
</tr>
<tr>
<td>Bowman Site-Eureka Quartzite Bed 4 (E4)</td>
<td>22</td>
</tr>
<tr>
<td>Bowman Site-Eureka Quartzite Bed 5 (E5)</td>
<td>19</td>
</tr>
<tr>
<td>Bowman Site-Eureka Quartzite Bed 6 (E6)</td>
<td>17</td>
</tr>
<tr>
<td>E1 - E2</td>
<td>1.5</td>
</tr>
<tr>
<td>E2 - E3</td>
<td>10</td>
</tr>
<tr>
<td>E2 - E4</td>
<td>13</td>
</tr>
<tr>
<td>E3 - E4</td>
<td>12</td>
</tr>
<tr>
<td>E4 - E5</td>
<td>4</td>
</tr>
<tr>
<td>E5 - E6</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Table 8. Distances Derived for Each Pathway Predicted.
Figure 12. GIS Map Illustrating All Locations and Predicted Pathways from the Bowman Site to Eureka Quartzite Beds Located in the Spring Mountains.
Since Eureka Quartzite is a known resource utilized by the people inhabiting the Bowman Site, the pathways to and from the resource source can provide insight into whether other resources were procured while acquiring Eureka Quartzite. Other resource procurement activities (i.e. food) would be indicated by the types of sites that are identified within the vicinity of the pathways and at the Eureka Quartzite sources. Sites characteristic of hunting camps or plant resource gathering areas provide evidence of other resource procurement along the pathways to the Eureka Quartzite. Evidence was gathered in the field and from
past research to determine if other resources were likely procured.

Availability versus accessibility becomes strategic because, as Bamforth (1986) discusses, if the material is not available when needed, then curation becomes crucial. Or, as Roth (1998) states, the material may be available, but it may not be accessible if other resources are not available near the lithic source.

Pedestrian Survey Methods. Areas within and outside the pathways' vicinity were surveyed and the portions surveyed were chosen using a judgmental sampling (Orton 2000). The sample areas were chosen in order to cover the beginning (Bowman Site), end (Eureka Quartzite location), and middle areas of at least one pathway. Time, accessibility, and man-power constraints were also deciding factors in surveying area locations.

Twenty kilometers were surveyed by three professional archaeologists and three volunteers. The survey included portions of the predicted pathway, in addition to a smaller area distant from the pathway to insure that the findings along the pathway were relevant to the study. Part of the survey was conducted from October 19th through November 2nd in 2001. The archaeologists included Annette J. Smith, W.
Bryan Cole, and Sara Ferland. Other portions were surveyed by Annette J. Smith, W. Bryan Cole, Scott K. Risley, Gordon W. Smith, Jr., and Cassandra Ginn intermittently from November 2001 through March 2002. The pedestrian survey occurring from October 29th through November 2nd permitted enhanced coverage compared to the later survey, which did not encompass as wide an area along the pathway. The first phase of the predicted pathway survey was approximately 500 meters. The distance between archaeologists varied from 10 to 25 meters during the survey and averaged 20 meters. The remaining survey covered a minimum of 100 meters in width and the distance between archaeologists averaged between 25 and 35 meters. Ideally, the 100-meter survey width pedestrian survey would have been completed with the same rigor as the 500-meter survey. The survey for this study is strictly limited to the ground surface with no subsurface testing.

Ground visibility can greatly influence the results of a pedestrian survey. If ground cover is thick with bushes, trees, grass, and debris the visibility of the cultural material becomes limited (Dancey 1981). Visibility in the predicted pathway areas was extremely good. Desert and high desert vegetation is typically sparse and contains
areas of desert pavement and alluvium. Alluvium, however, can make it difficult to locate cultural material, specifically lithics, because the lithics blend with the gravels, pebbles, and alluvial debris (Dancey 1981).

A random pedestrian survey was also conducted to determine if cultural material existing on the landscape randomly is comparable to sites along the predicted pathways. Doing this survey, apart from the predicted pathways, assures that findings on the pathways are meaningful. Both random surveys were chosen by random numbers choice. Areas of the mosaic map (four topographic quadrangle maps) were divided into 30 segments and given a number. The numbers were placed in a bowl and two numbers, 16 and 29, were blindly chosen. Sixteen carried into segment 17 (16/17) as the west side of 16 lies is private property. A linear portion, approximately 500 meters wide, of the area was surveyed. Approximately 6 kilometers was surveyed, with each segment being approximately 3 kilometers in length (Figure 18).

Random survey 16/17 and 29 was conducted by Annette J. Smith, W. Bryan Cole, Scott Risley, and Cassandra Ginn. Cassandra, a middle school student, used this project as part of her science studies as a home-schooled student.
Scott, an amateur archaeologist, has served as an Arizona State Historic Preservation Office Archaeological Site Steward and served on the Board of Directors of the Arizona Archaeological Society, Phoenix Chapter at Pueblo Grande Museum in Phoenix, Arizona. His experience was extremely helpful for this study.

Previous Archaeological Studies. Research at the Southern Nevada Archaeological Archive (Harry Reid Center for Environmental Studies, University of Nevada - Las Vegas) provided information about past research within the study area. Information obtained from the archival research was used to help determine the landscape use.

Previous archaeological investigations in the study area identified sites previously recorded and how they lay on the landscape in relation to the predicted pathways, the Bowman Site, and the Eureka Quartzite procurement areas. This information, in conjunction with the archaeological pedestrian survey sample of the predicted pathways, provides information on the use of the pathways. The kinds of archaeological sites along these pathways establishes the types of activities that likely occurred; providing additional support for either embedded or direct procurement of Eureka Quartzite.
CHAPTER 5

STUDY RESULTS

Introduction

This chapter presents the study results, including the lithic analysis, the predicted pathway results (previous archaeological studies within the area and the results from the pedestrian survey sample), and the results of the random survey. The goal of this study was determine the mobility strategies of the Bowman Site inhabitants using the organization of lithic technology and the spatial analysis established landscape use and procurement strategies.

Lithic Analysis

High levels of curation creates an assemblage with more evidence of reduction and recycled/reworked tools resulting in more flakes, smaller flakes, and heavily reduced cores; all with less cortex. Lithic material that is readily available or of a lesser quality is often manifested by
more wasteful technology resulting in fewer tools, larger flakes, more cortex, and larger cores with undefined shapes. Local material will tend to show expediency while higher quality, less available material will exhibit higher levels of formal retouched and reworked tools (Andrefsky 1994; Bamforth 1991, 1990, 1986; Nelson 1981; Newman 1994).

Eureka Quartzite is a high quality raw material often mistaken as chert due to its fine-grained nature. Available in exposed beds located in the Spring Mountains, it was utilized by the people inhabiting the Bowman Site. Chert, also a high quality material, is minimally available to the inhabitants of Pahrump Valley as alluvial cobbles (personal experience). Substantial exposed chert beds do not exist in the Spring Mountains (Longwell et al. 1965). Previous research would predict higher levels of curation of Eureka Quartzite, chert, and obsidian due to their high quality and non-local nature. Expediency should characterize the stone tool technology of local lower quality materials, such as limestone, sandstone, and siltstone.

The entire lithic collection from the Bowman Site was analyzed. Recovery of specific lithics by depth is considered by material type; however, specific analysis by
depth is beyond the scope of this study. Eureka Quartzite is found at all levels from the surface to a depth 140 centimeters. As a percentage of material type by depth, it ranges from 29 percent on the surface, 15 to 26 percent from 0 to 50 centimeters, 12 to 20 percent from 51 to 100 centimeters, and from 5 to 17 percent from 101 to 140 centimeters. Eureka Quartzite percentage of lithics cataloged with an unknown depth is 30 percent (Table 9). Eureka Quartzite was apparently used continuously over time at the Bowman Site because it was found at all levels of excavation.

The lithic collection from the Bowman Site consisted of 10,584 lithics including tools, bifaces, flakes, cores, microflakes (<10mm length), hammerstones, and debris (shatter). Formal bifacial tools (i.e. projectile points, drills, etc.) are separated from other bifaces because they are special purpose bifaces; making them Stage 5 bifaces. Bifaces can be classified into specific stages depending on the amount of reduction and shaping that has occurred (Andrefsky 1998; see methods discussion in Chapter 4).

No unifacial tools were identified within the Bowman Site lithic collection. Hammerstones are not factored into the analysis except to note their quantity, material type and
size (See Appendix II). Because of the nature of hammerstone use, they tend to be fashioned from hard lithic material. Seventeen quartzite hammerstones and one limestone hammerstone were identified in the collection.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Basalt</th>
<th>Chert</th>
<th>Eureka</th>
<th>Limestone</th>
<th>Obsidian</th>
<th>Quartzite</th>
<th>Sandstone</th>
<th>Siltstone</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
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<td>176</td>
<td>223</td>
<td>42</td>
<td>35</td>
<td>218</td>
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<td>757</td>
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<tr>
<td>0-10</td>
<td>13</td>
<td>339</td>
<td>187</td>
<td>34</td>
<td>17</td>
<td>206</td>
<td>4</td>
<td>19</td>
<td>819</td>
</tr>
<tr>
<td>11-20</td>
<td>21</td>
<td>440</td>
<td>189</td>
<td>66</td>
<td>8</td>
<td>250</td>
<td>1</td>
<td>39</td>
<td>1,014</td>
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<tr>
<td>21-30</td>
<td>6</td>
<td>326</td>
<td>235</td>
<td>17</td>
<td>9</td>
<td>290</td>
<td>5</td>
<td>9</td>
<td>897</td>
</tr>
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<td>31-40</td>
<td>10</td>
<td>453</td>
<td>313</td>
<td>113</td>
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<td>452</td>
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<td>502</td>
<td>211</td>
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<td>578</td>
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<td>370</td>
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<td>115</td>
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<td>131</td>
<td>0</td>
<td>20</td>
<td>568</td>
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<td>166</td>
<td>93</td>
<td>47</td>
<td>3</td>
<td>113</td>
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<td>74</td>
<td>11</td>
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<td>69</td>
<td>72</td>
<td>13</td>
<td>57</td>
<td>3</td>
<td>6</td>
<td>471</td>
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<td>101-110</td>
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<td>8</td>
<td>19</td>
<td>4</td>
<td>20</td>
<td>0</td>
<td>15</td>
<td>161</td>
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<tr>
<td>111-120</td>
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<td>60</td>
<td>10</td>
<td>25</td>
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<td>1</td>
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<td>282</td>
<td>59</td>
<td>51</td>
<td>18</td>
<td>20</td>
<td>1</td>
<td>5</td>
<td>494</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>6</td>
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<td>51</td>
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<td>30</td>
<td>168</td>
</tr>
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<td>10,390</td>
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<td></td>
<td></td>
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</tr>
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</table>

Table 9. Number and Percentage of Material Type by Depth of the Entire Bowman Site Lithic Collection (Material Types not Listed were Less than One Percent).
Material categories include chert, quartzite, Eureka Quartzite, limestone, basalt, siltstone, obsidian, sandstone, and tuff. Graph 1 shows the quantity and material types from the lithic assemblage. Table 10 displays the kinds of lithics, their material type, and quantity.

**Projectile Points and Drills.** Analysis of the tools recovered from the Bowman Site reveals 23 complete and 31 tool fragments. Most of the complete tools (56.52%, N=13) and tool fragments (58.06%, N=18) are chert. Projectile points include the Desert Side-notched, Rosegate Series, Large Side-notched, Elko Series, Humboldt Series, and Gatecliff Contracting Stem. Quartzite and Eureka Quartzite tools both had the same quantity with three (13.04%) complete and four (12.90%) tool fragments. Three basalt tools (13.04%), one obsidian (4.25%) tool and five (16.13%) tool fragments were found. Not surprisingly, all of the tools were made from high quality material not readily available locally.

Scattergrams showing the relationship between length (mm) and width (mm) by material type and volume (LxWxT) to surface area (LxW) are extremely informative and clearly
illustrate that Eureka Quartzite tools are the smallest in the collection.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Tools</th>
<th>Tool Fragments</th>
<th>Bifaces</th>
<th>Biface Fragments</th>
<th>Flakes</th>
<th>Flake Fragments</th>
<th>Cores</th>
<th>Core Fragments</th>
<th>Micro-Flakes</th>
<th>Micro-Flake Fragments</th>
<th>Debris</th>
</tr>
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<tbody>
<tr>
<td>Chert</td>
<td>13</td>
<td>18</td>
<td>11</td>
<td>34</td>
<td>693</td>
<td>826</td>
<td>3</td>
<td>1</td>
<td>1,255</td>
<td>1,178</td>
<td>237</td>
</tr>
<tr>
<td>Quartzite</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td>10</td>
<td>568</td>
<td>897</td>
<td>12</td>
<td>0</td>
<td>574</td>
<td>565</td>
<td>160</td>
</tr>
<tr>
<td>Eureka</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td>289</td>
<td>244</td>
<td>1</td>
<td>1</td>
<td>760</td>
<td>661</td>
<td>29</td>
</tr>
<tr>
<td>Limestone</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>189</td>
<td>189</td>
<td>20</td>
<td>0</td>
<td>136</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Basalt</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>109</td>
<td>59</td>
<td>2</td>
<td>1</td>
<td>56</td>
<td>59</td>
<td>56</td>
</tr>
<tr>
<td>Siltstone</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>57</td>
<td>64</td>
<td>2</td>
<td>0</td>
<td>41</td>
<td>54</td>
<td>9</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>33</td>
<td>7</td>
<td>0</td>
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<td>52</td>
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<tr>
<td>Sandstone</td>
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<td>0</td>
<td>0</td>
<td>25</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Tuff</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 10. Material Types and Kinds of Lithics Retrieved from the Bowman Site.

Graphs 2 and 3 demonstrate that high quality materials are smaller than lower quality materials. Length/width and volume/surface area indicate that Eureka Quartzite is the smallest, followed by obsidian, basalt, chert, and quartzite. Small tool size suggests that some material types may have been reworked and recycled, making them smaller than other material types. In this case, the smaller tools tend to be made from higher quality and less available lithic materials. This characteristic, however, is not a strong argument for curation, but it is interesting that this correlation exists in the tool assemblage from the Bowman Site. Visible evidence of
retouch only existed on one tool in the collection. This tool was manufactured of Eureka Quartzite.

Graph 1. Bowman Site Lithic Collection Illustrating Quantity and Lithic Material Type for All Lithics.
Graph 2. Scattergram Illustrating the Relationship Between Length (mm) and Width (mm) of Complete Tools.

Graph 3. Scattergram Illustrating the Relationship Between Volume (LxWxT) and Surface Area (LxW).
Other Bifaces. Thirty-one complete bifaces and 66 biface fragments were recovered from the Bowman Site. Chert accounted for 11 (35.48%) complete and 34 (51.52%) fragments; quartzite eight (25.81%) complete and 10 (15.15%) biface fragments; Eureka Quartzite had seven (22.58%) complete and 16 (24.24%) fragments; there was one (3.23%) complete and one fragment (1.52%) limestone biface; three (9.68%) complete basalt bifaces and one (1.52%) fragment; one (1.52%) siltstone biface fragment; three (4.55%) obsidian biface fragments; and one (3.23%) complete tuff biface. Table 11 summarizes the bifaces, both whole and fragments. The table includes biface stages as defined by Andrefsky (1998:30). Biface stages also argue for curation strategies of specific material types.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Number of Bifaces</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basalt</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
<td>0</td>
</tr>
<tr>
<td>Eureka</td>
<td>23</td>
<td>0</td>
<td>3 (13%)</td>
<td>6 (26%)</td>
<td>7 (30%)</td>
<td>7 (30%)</td>
</tr>
<tr>
<td>Limestone</td>
<td>2</td>
<td>0</td>
<td>1 (50%)</td>
<td>0</td>
<td>0</td>
<td>1 (50%)</td>
</tr>
<tr>
<td>Quartzite</td>
<td>18</td>
<td>0</td>
<td>2 (11%)</td>
<td>7 (39%)</td>
<td>8 (44%)</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>Tuff</td>
<td>1</td>
<td>0</td>
<td>1 (100%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Obsidian</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1 (33%)</td>
<td>2 (67%)</td>
<td></td>
</tr>
<tr>
<td>Siltstone</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (100%)</td>
<td></td>
</tr>
<tr>
<td>Chert</td>
<td>45</td>
<td>1 (2%)</td>
<td>5 (11%)</td>
<td>11 (24%)</td>
<td>15 (33%)</td>
<td>13 (29%)</td>
</tr>
</tbody>
</table>

Table 11. Bifaces (whole and fragments) from the Bowman Site Lithic Collection Including Biface Stage.
Scattergrams (Graphs 4 and 5) illustrating the complete biface relationships of length to width and volume to surface area shows limestone and tuff do not follow the overall trend of the other material types. However, only one specimen each of these two material types exists in the biface collection. Eureka Quartzite tends to be smaller than the other material types (excluding the one tuff biface) except for basalt, which is smaller in the volume/surface area ratio, but somewhat larger in the length/width ratio.

Graph 4. Scattergram Illustrating the Relationship Between Length (mm) and Width (mm) of Complete Bifaces.
Biface flake scar count should increase compared to a decrease in cortex percentage. Graph 6 illustrates this relationship. Limestone and tuff only have one specimen each in the biface category and therefore there is no average. Excluding limestone and tuff, Eureka Quartzite has the least amount of cortex, with chert being second. However, chert has more flake scars than Eureka Quartzite. Quartzite and basalt have the most cortex, with the least number of flake scars. Again, indications are present that
curation was likely being practiced more extensively on Eureka Quartzite and chert.

Graph 6. Scattergram Illustrating the Relationship Between Cortex Percentage and the Number of Flake Scars of Complete Bifaces.

Cores. Cores from the Bowman Site include 40 complete specimens and three core fragments (one each chert, Eureka Quartzite, and basalt). Of the complete cores, three (7.50%) are chert, 12 (30.00%) are quartzite, one (2.50%) is Eureka Quartzite, 20 (50.00%) are limestone, and there are two (5.00%) each of basalt and siltstone. Fifty
percent of the complete cores consist of limestone; the most easily accessible material type at the Bowman Site. Cores from non-local material should be smaller, have more flake scars, and exhibit formalized forms if more curation occurred (Bleed 1986; Nelson 1991, Roth 1998). Only one complete Eureka Quartzite core was recovered from the Bowman Site and it is smaller than the average core size of the other lithic materials and is a formal form (biface). The lack of Eureka Quartzite and low number of chert cores could also represent the idea that these materials were brought in as already reduced bifaces or blanks. Another possibility is that these cores were exhausted to the point of making some type of tool from the remaining material, arguing for curation to the point of using them to the maximum utility possible.

Scattergrams of core size (length to width and volume to surface area) show the relationship of material types and core size (Graphs 7 and 8). The relationship of core size and material type is clearly apparent, with Eureka Quartzite being the smallest, followed by basalt, quartzite, chert, limestone, and sandstone. However, there is only one Eureka Quartzite core, which may skew the results.
Complete Cores - Length/Width (Millimeters)

Graph 7. Scattergram Illustrating the Relationship Between Length (mm) and Width (mm) of Complete Cores.

Complete Cores - Volume/Surface Area (Millimeters)

Graph 8. Scattergram Illustrating the Relationship Between Volume (LxWxT) and Surface Area (LxW) of Complete Cores.
A scattergram of the relationship between core cortex percentage and the number of flake scars present on complete cores (Graph 9) illustrates that the one Eureka Quartzite core has more cortex than the other material types, even though it is smaller than the other lithic material types. This could be a product of the small sample size (only one) skewing the results or the fact that it was a small nodule when it was obtained.

Siltstone has the least amount of cortex, but also has the lowest number of flake scars. Chert has the least amount of cortex with the most flake scars. Eureka Quartzite has the most cortex, but also has the second most flake scars, indicating that the core was reduced to a greater extent than all other lithic material except chert. The cortex/flake scar relationship does not argue as strongly for more curation of Eureka Quartzite as the other categories; however, only one specimen was recovered.

Debitage. A total of 4,214 pieces of debitage was analyzed. Complete flakes (>10mm in length - remaining microflakes were under 10mm) totaled 1,909 and there were 2,305 flake fragments. Complete flake quantity by material type consisted of 693 chert, 568 quartzite, 289 Eureka Quartzite, 189 limestone, 109 basalt, 33 obsidian, 25
sandstone, and three tuff. Flake fragments by material type includes 826 chert, 897 quartzite, 244 Eureka, 189 limestone, 59 basalt, 64 siltstone, seven obsidian, 18 sandstone, and one tuff. Table 12 summarizes the debitage information.

Graph 9. Scattergram Illustrating the Relationship Between Cortex Percentage and the Number of Flake Scars Present on Complete Cores.

Of the complete flakes, Eureka Quartzite is clearly the smallest in length and width as well as in volume and surface area as illustrated in the scattergrams (Graphs 10 and 11). The order from smallest to largest flakes in both...
the length/width and volume/surface area relationships is Eureka Quartzite, chert, obsidian, tuff, basalt, quartzite, sandstone, and limestone. The small flake size of Eureka Quartzite is not a product of only being able to obtain small pieces of raw material, as Eureka Quartzite could be obtained easily in large nodules from the quarry sites.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Complete Flake</th>
<th>Flake Fragments</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>693</td>
<td>826</td>
<td>36%</td>
</tr>
<tr>
<td>Quartzite</td>
<td>568</td>
<td>897</td>
<td>35%</td>
</tr>
<tr>
<td>Eureka Quartzite</td>
<td>289</td>
<td>244</td>
<td>13%</td>
</tr>
<tr>
<td>Limestone</td>
<td>189</td>
<td>189</td>
<td>9%</td>
</tr>
<tr>
<td>Basalt</td>
<td>109</td>
<td>59</td>
<td>4%</td>
</tr>
<tr>
<td>Obsidian</td>
<td>33</td>
<td>7</td>
<td>&gt;1%</td>
</tr>
<tr>
<td>Sandstone</td>
<td>25</td>
<td>18</td>
<td>1%</td>
</tr>
<tr>
<td>Tuff</td>
<td>3</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Siltstone</td>
<td>0</td>
<td>64</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 12. Debitage in the Bowman Site Collection by Material Type.

The size ratios of the lithic material types show that more curation occurred with Eureka Quartzite than other material types due to the small size of complete flakes. Continuing reduction on lithic material creates a series of smaller flakes as the material is reduced over time.
Graph 10. Scattergram Illustrating the Relationship Between Length (mm) and Width (mm) of Complete Flakes.

Graph 12 exhibits the relationship between the percentage of cortex and the number of flake scars on complete flakes, displaying Eureka Quartzite as being one of the lithic materials with the least amount of cortex and the most flake scars. Obsidian and tuff also indicate this feature; however, there are only three tuff flakes in the collection. It is not surprising for the obsidian, a highly valued lithic material to show lower cortex percentage in conjunction with more flake scars.
Cortex/flake scare measurement argues for more reduction in the valuable high-quality, non-local lithic material.

Graph 11. Scattergram Illustrating the Relationship Between Volume (LxWxT) and Surface Area (LxW) of Complete Flakes.

Again, these characteristics associated with complete flakes argue for more curation of high quality lithic material, including Eureka Quartzite. Limestone appears to be the least curated material which is what is expected because limestone is readily available throughout the Pahrump Valley. Excluding the one tuff specimen, obsidian had the most flake scars compared to cortex percentage with
Eureka Quartzite being next. Chert, basalt, quartzite, and sandstone are next in order of most flake scars/least cortex.

Graph 12. Scattergram Illustrating the Relationship Between Cortex Percentage and the Number of Flake Scars Present on Complete Flakes.

The platform types present on complete flakes include plain, crushed, faceted, cortical, and abraded (Graph 13). Eureka Quartzite and obsidian display a higher percentage of crushed platforms than other material types. The crushed platforms in these two material types outnumber the plain platforms, which is the leading platform type in all
the other material types. However, crushed platforms occur with soft hammer percussion and pressure flaking; methods often used when working and reducing bifaces (Whittaker 1994). Limestone displays a high number of cortical platforms, arguing that it does not get reduced as completely as other material types. Abraded and faceted platforms argue for care in core preparation before a flake is removed. The same is true with feathered terminations, although skill level is also involved. No specific patterns emerged from the platforms or terminations, except with the crushed platforms (Graph 14).

Flake numbers compared to core numbers also help define curation tendencies. Cores that are heavily reduced produce more flakes than cores that are not heavily reduced. High numbers of flakes versus low numbers of cores argues that specific material types were used as much as possible before discarding. Complete microflakes (<10mm in length) and flakes were combined to total the number of flakes for each material type. Complete flake quantity compared to complete core quantity is shown in Graph 15.

Table 13 presents the number of complete flakes to complete cores. Graph 16 shows the ratio by material type of complete flakes to each complete core.
The ratio reveals that Eureka Quartzite has the most flakes for the one core present (1:1,049). This ratio, however, may be skewed due to the fact that only one core was present. Chert is second (1:649) in the number of flakes to cores. The remaining materials' ratios drop significantly (all under 1:100) for each core present. Obsidian, sandstone, and tuff had no cores, so a ratio could not be calculated. All three of these materials have a very small number of specimens (refer to Table 13).
Table 13. Number of Complete Flakes and Complete Cores by Material Type and the Ratio of Complete Flakes to Each Core.

<table>
<thead>
<tr>
<th>Lithic Material</th>
<th>Complete Flakes</th>
<th>Complete Cores</th>
<th>Ratio - Cores: Flakes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eureka Chert</td>
<td>1049</td>
<td>1</td>
<td>1:1049</td>
</tr>
<tr>
<td>Chert</td>
<td>1948</td>
<td>3</td>
<td>1:649</td>
</tr>
<tr>
<td>Quartzite</td>
<td>1142</td>
<td>12</td>
<td>1:95</td>
</tr>
<tr>
<td>Basalt</td>
<td>165</td>
<td>2</td>
<td>1:83</td>
</tr>
<tr>
<td>Siltstone</td>
<td>98</td>
<td>2</td>
<td>1:49</td>
</tr>
<tr>
<td>Limestone</td>
<td>265</td>
<td>20</td>
<td>1:13</td>
</tr>
<tr>
<td>Obsidian</td>
<td>85</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Sandstone</td>
<td>29</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Tuff</td>
<td>3</td>
<td>0</td>
<td>NA</td>
</tr>
</tbody>
</table>

Graph 16. Graph Showing the Ratio of Complete Flakes to Each Complete Core by Material Type.
Lithic Analysis Summary. The analysis of the lithic artifacts recovered from the Bowman Site argues for a high level of curation of high quality material. Quality lithic material is not available in the general proximity of the Bowman Site and must be procured from areas distant from the site. Eureka Quartzite is one of the lithic materials showing the strongest characteristics for maximum curation including: formal cores, a high number of bifaces, more formal tools, smaller flakes, smaller cores with a large number of flake scars, a lower percentage of cortex, and a high ratio of flakes to cores. Crushed platforms were the most common in both Eureka Quartzite and obsidian arguing that Eureka Quartzite may have some of the fragile characteristics, or is dealt with similarly (i.e. biface reduction) to obsidian.

Predicted Pathway Results and Archival Research of Study Area.

ArcView GIS was used to predict pathways from the Bowman Site to the six Eureka Quartzite locations. The predicted pathways go across the landscape, avoiding steep slopes, in the most direct fashion possible. The predicted pathways were tested in order to validate the usefulness of these
predictions coupled with a review of past research and an archaeological pedestrian sample survey.

**Previous Archaeological Studies.** Research conducted at the Southern Nevada Archaeological Archive, located on the campus of University of Nevada - Las Vegas at the Harry Reid Center for Environmental Studies, provided previous research and site recording within the four topographic quadrangle maps used in this study. Recorded sites on these quadrangles are outlined in Table 14.

Twenty-four previously recorded sites were documented. Seventeen are prehistoric, six are historic, and one has components that are both prehistoric and historic. Of the prehistoric sites, only two were assigned a possible date range. One was dated to AD 1,000 to AD 1,100 and the other AD 500 to 7,000 BC. However, the previously recorded prehistoric sites were identified as associated with hunter/gatherer activities.

The historic sites all dated from the late 1800s into the early 1900s. The site with both historic and prehistoric components was not identified with a specific date range. The prehistoric sites consist of several lithic scatters, some with associated ceramics, rock circles, rock shelters, middens, groundstone, and clearings. The historic sites
consist of charcoal kilns, foundations, a road, and trash scatters/dumps.

Of the 24 sites previously recorded, 10 (42%) are within 500 meters of the predicted pathways. Seven (29%) are within 500 to 1,000 meters, and seven (29%) are over 1,000 meters from the predicted pathways. Removing previously recorded historic sites, the numbers become promising in relation to the predicted pathways. Eighteen of the 24 previously recorded sites are prehistoric. Eight (45%) are within 500 meters of the predicted pathways, six (33%) lay within 500 to 1,000 meters, and four (22%) fall outside 1,000 meters. Fourteen (78%) of the eighteen prehistoric sites were situated within 1,000 meters of the predicted pathways. Of the pedestrian surveys previously conducted in the study area, approximately half of the area falls outside the predicted pathway area, suggesting a relationship between sites and the predicted pathways.

Previous research provided further evidence for the validity of the predicted pathways. Previous pedestrian surveys in the study area covered approximately 22 kilometers of the predicted pathways (Figure 14).
<table>
<thead>
<tr>
<th>7 ½ Min. Topo. Quad.</th>
<th>Site #</th>
<th>With -in 500m of Path -way</th>
<th>With -in 500-1000m of Path -way</th>
<th>Beyond 1000m of Path -way</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheeler Well 26CK950</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic scatter with some pottery sherds (corrugated grayware).</td>
</tr>
<tr>
<td>Wheeler Well 26CK962</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic scatter.</td>
</tr>
<tr>
<td>Wheeler Well 26CK956</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic scatter.</td>
</tr>
<tr>
<td>Wheeler Well 26CK4732</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Prehistoric rockshelter with midden.</td>
</tr>
<tr>
<td>Wheeler Well 26CK970</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic scatter with one sherd.</td>
</tr>
<tr>
<td>Wheeler Well 26CK951</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Circular units with concentration of lithics. H/G activity site.</td>
</tr>
<tr>
<td>Wheeler Well 26CK1070</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Two rockshelters with midden. Metate, flakes, sherds.</td>
</tr>
<tr>
<td>Wheeler Well 26CK952</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic scatter and mano.</td>
</tr>
<tr>
<td>Wheeler Well 26CK4733</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic isolate.</td>
</tr>
<tr>
<td>Pahrump NE 26CK4779</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic site.</td>
</tr>
<tr>
<td>Pahrump NE 26CK965</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic scatter.</td>
</tr>
<tr>
<td>Pahrump NE 26CK985</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Lithic scatter.</td>
</tr>
<tr>
<td>Pahrump 26NY8715</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Historic road running from the Pahrump and Manse Spring (Bennett and Bowman Ranch).</td>
</tr>
<tr>
<td>Pahrump 26CK5967</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Historic dump.</td>
</tr>
<tr>
<td>Pahrump 26NY2599</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Rock ring and rock pile.</td>
</tr>
<tr>
<td>Pahrump 26NY8711</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Historic trash scatter.</td>
</tr>
<tr>
<td>Pahrump 26NY8712</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Cleared feature.</td>
</tr>
<tr>
<td>Pahrump 26NY8713</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Historic trash scatter.</td>
</tr>
<tr>
<td>Pahrump 26NY8714</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td>Historic trash scatter.</td>
</tr>
</tbody>
</table>

Table 14. Previously Recorded Sites in the Study Area.
Predicted Pathways Survey Results. The sample survey included two phases. The first phase was a 500-meter width survey (Figure 15) that included an upper and lower survey. The second phase of the sample survey involved a 100-meter wide survey (Figure 16). Table 15 summarizes the survey sample and research of the pathways.

<table>
<thead>
<tr>
<th>Predicted Pathways</th>
<th>Distance (km)</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Pathways</td>
<td>81 km</td>
<td>100%</td>
</tr>
<tr>
<td>Previous Survey within 1 km of predicted pathway</td>
<td>22 km</td>
<td>27%</td>
</tr>
<tr>
<td>Study Survey 500 m wide</td>
<td>10 km</td>
<td>12%</td>
</tr>
<tr>
<td>Study Survey 100 m wide</td>
<td>4 km</td>
<td>5%</td>
</tr>
<tr>
<td>Total Surveyed</td>
<td>36 km</td>
<td>44%</td>
</tr>
<tr>
<td>Overlapped Survey (Previous and 500 m wide)</td>
<td>-3 km</td>
<td>-4%</td>
</tr>
<tr>
<td>GRAND TOTAL SURVEYED</td>
<td>33 km</td>
<td>40%</td>
</tr>
</tbody>
</table>

Table 15. Summary of Predicted Pathway Surveys and Research.

Lower 500 Meter Survey Results. A total of nine areas with cultural material were identified during the survey. Three sites consisted of rock rings; one had a rock ring and hearth; one contained a rock ring and a basket rest; another contained a cairn marker and a visible foot path; another contained several rock rings, basket rests, a stone marker intentionally placed, and a looter’s hole, one consisted of a rock ring, and one was a lithic core (Table 16).
The sites identified in the lower survey were located closer to the Bowman Site and were dense with rock rings, basket rests, etc. At approximately 900 meters (3,000 feet) elevation and two kilometers from the Bowman Site, sites were no longer present. It was obvious on the pedestrian survey that the sites stopped when the flora changed (becoming extremely sparse) in conjunction with a steeper incline and heavy alluvium (refer to Figure 7). Desert pavement disappears and the geology consisted of an abundance of loose, large gravel, cobbles, and stones. The last four kilometers of the lower survey provided no additional sites.

<table>
<thead>
<tr>
<th>Feature(s) and/or Artifact(s) Present</th>
<th>UTM Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearth (.75m)</td>
<td>11S 0599536 E</td>
</tr>
<tr>
<td></td>
<td>4001650 N</td>
</tr>
<tr>
<td>Rock Ring (1.5m)</td>
<td></td>
</tr>
<tr>
<td>Rock Ring (2m)</td>
<td>11S 0599583 E</td>
</tr>
<tr>
<td></td>
<td>4001597 N</td>
</tr>
<tr>
<td>Rock Ring (2.5m)</td>
<td></td>
</tr>
<tr>
<td>Rock Ring (3m)</td>
<td>11S 0600393 E</td>
</tr>
<tr>
<td>Basket Rest</td>
<td>4001829 N</td>
</tr>
<tr>
<td>Basket Rests, Pot Hunter Hole, Pointer facing NW, Rock Rings (1.5m, 2m, and 3-4m)</td>
<td>11S 0600798 E</td>
</tr>
<tr>
<td></td>
<td>4001941 N</td>
</tr>
<tr>
<td>Rock Ring (2m) and adjacent Rock Ring (1m)</td>
<td>11S 0600015 E</td>
</tr>
<tr>
<td></td>
<td>4001806 N</td>
</tr>
<tr>
<td>Cairn with visible foot path</td>
<td>11S 0599630 E</td>
</tr>
<tr>
<td></td>
<td>4001666 N</td>
</tr>
<tr>
<td>Rock Ring (1.5m) next to small drainage</td>
<td>11S 0599798 E</td>
</tr>
<tr>
<td></td>
<td>4001734 N</td>
</tr>
<tr>
<td>Core with patina on flake scar</td>
<td>11S 0600459 E</td>
</tr>
<tr>
<td></td>
<td>4001723 N</td>
</tr>
<tr>
<td>Rock Ring (.75m)</td>
<td>11S 0600505 E</td>
</tr>
<tr>
<td></td>
<td>4001695 N</td>
</tr>
</tbody>
</table>

Table 16. Lower Elevation 500 Meter Survey Results—Detail.
Figure 14. Portions of the Predicted Pathways Previously Surveyed.
Figure 15. First Phase Survey at 500 Meter Width.

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Figure 16. Second Phase Survey at 100 Meter Width.
Upper 500 Meter Survey Results. The upper survey yielded three areas where cultural material was identified (Table 17). One site contained rock rings, a remnant footpath, basket rests, a cleared area, a lithic blank, and a drilled stone; another was a slab metate fragment; and one was a rock ring. These finds were dispersed, with some clustering in less steep areas, indicating that camps, rest areas, and general use areas occurred in places where the lower slope facilitated activities.

Summary of First Phase Survey Results. A total of twelve sites or isolated occurrences were identified during this first phase of the survey. Nine were in the lower survey area and three were in the upper survey area. The site density was one every 0.67 kilometers in the lower survey and one every 1.33 kilometers in the upper survey. Combined, the site density for the 500-meter wide survey is one every 0.83 kilometers.

<table>
<thead>
<tr>
<th>Feature(s) and/or Artifact(s) Present</th>
<th>UTM Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock Ring (1.5m), Foot Path, Rock Ring (1m), Basket Rests, Cleared Area, Limestone Point Blank, and Drilled Stone</td>
<td>11S 0611050 E 4008521 N</td>
</tr>
<tr>
<td>Small Groundstone Fragment - Slab Metate</td>
<td>11S 0611095 E 4008462 N</td>
</tr>
<tr>
<td>Rock Ring (2-3m)</td>
<td>11S 0610670 E 4009278 N</td>
</tr>
</tbody>
</table>

Table 17. Higher Elevation 500 Meter Survey Results—Detail.
Rock rings appear to be the most common feature in the first phase 500 meter sample survey. The exact function of many rock rings is difficult to identify. Blair and Fuller-Murillo (1997) have developed a rock circle model with the expectations for determining rock ring functions. Possible uses for rock rings include: 1) cache, 2) water catchment, 3) food preparation area, 4) hearth, 5) hunting blind, 6) sleep circle, 7) esoteric uses, 8) habitation outline, 9) natural formation, 10) agricultural plots, 11) art form, and 12) child's play area.

Second Phase 100 Meter Survey Results. The 100-meter width survey identified one Eureka Quartzite projectile point and a lithic reduction site with abundant Eureka Quartzite (Table 18 and Figure 19). The site had thousands of flakes within a few hundred meter radius. The vast majority of the flakes were Eureka Quartzite. Time constraints did not allow further study of the lithic reduction site. Tool material included Eureka Quartzite, chert, and obsidian. The site density of the second phase 100 meter survey is one site every two kilometers.
Figure 17. Topographic Map Showing 500 Meter (Lower Elevation) Survey Results.
Figure 18. Topographic Map Showing 500 Meter (Upper Elevation) Survey Results.
Figure 19. Topographic Map Illustrating 100 Meter Survey Results.

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<table>
<thead>
<tr>
<th>Cluster or Feature(s) and/or Artifact(s)</th>
<th>Feature(s) and/or Artifact(s) Present</th>
<th>UTM Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eureka Projectile Point</td>
<td>Discovered in wash area after rain storm</td>
<td>0605191 E 4025216 N</td>
</tr>
<tr>
<td>Lithic Reduction Site</td>
<td>Thousands of early stage reduction flakes. Some tools, utilized flakes, unifacial tools, and bifacial tools. Material includes thousands of Eureka Quartzite and Limestone flakes. Some bifacial tools are obsidian, Eureka Quartzite, and chert.</td>
<td>0604862 E 4025853 N</td>
</tr>
</tbody>
</table>

Table 18. Survey Result from 100 Meter Survey - Detail.

Random Pedestrian Survey Results. The random sample survey was conducted to determine if cultural material existing randomly on the landscape is comparable to sites identified (previously and from this study) along the predicted pathways. This random survey, conducted a substantial distance away from the predicted pathways, verifies that the cultural resources identified along the pathways are meaningful (See Figure 20).

A total of six kilometers was surveyed for the random sample survey. One site was identified, making the site density one in six kilometers. Table 19 details the information from this sample survey. The identified site was located in survey 16/17, while survey 29 was negative for cultural resources. The site consisted of a unifacial tool, a rock pile, and a dance ring. The dance ring is a
circular well-worn pathway. This site, upon asking local Pahrump Paiutes, is known to them and has continued significance today.

<table>
<thead>
<tr>
<th>Identified Cultural Resources</th>
<th>Random Survey Number</th>
<th>Feature(s) and/or Artifact(s) Present</th>
<th>UTM Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site #1</td>
<td>16/17</td>
<td>Dance Ring Rock Pile Unifacial Tool</td>
<td>Not supplied due to nature of site to the Native Americans - member of tribe asked for location not be disclosed</td>
</tr>
</tbody>
</table>

Table 19. Survey Results of Random Survey – Detail.

Summary. Previous research and this study's testing of the pathways argue for more prehistoric use in the proximity of the predicted pathways. The site types exhibited characteristics of other procurement activities, such as food gathering. Food gathering characteristics include basket rests, cleared areas, rock rings, groundstone, etc. Lithic procurement was also evident at the Eureka Quartzite location.
Figure 20. Area Covered by Random Survey (Away from the Predicted Pathways).
CHAPTER 6

CONCLUSIONS

Introduction

This chapter discusses the results of this study in relation to the research questions. Advantages and disadvantages of the study are addressed, along with potential further research ideas prompted by the study.

Bowman Site Lithic Collection Analysis and Research Questions

Can the mobility strategies of the people inhabiting the Bowman Site be identified by their lithic technological organization? Lithics at the Bowman Site argue for high levels of curation of high quality, non-local lithic material, specifically Eureka Quartzite and chert. These two lithic material types dominate the stone tool and biface assemblage in the site collection; however these two materials are not obtainable within the Bowman Site proximity. Lithic material close to the Bowman Site is low
quality and consists predominantly of limestone, with some sandstone and siltstone. Because of the surrounding poor quality stone, high quality lithic material would be valued and thus curated to extend its utility. Expecting more curation of high quality lithic material, specific traits were considered when analyzing the Bowman Site lithic collection. Appendix II presents the lithic analysis summary for this study.

The Bowman Site lithic collection demonstrated that the inhabitants preferred to fashion their tools and bifaces from high quality, non-local lithic material, though they would use local materials when it fit their needs. High quality lithic materials like Eureka Quartzite, chert, and quartzite, were transported to the Bowman Site from the Spring Mountains, either as heavily reduced cobbles, bifaces, blanks, or already-fashioned tools. Evidence for curation of quality lithic material is present in the collection and can be seen by the size of the different material types, the amount of cortex present, the number of flake scars present, and more importantly, the ratio of flakes present for each core by lithic material. Expediency is evident in the use of local material, especially limestone. Limestone flakes are larger, there
are no formal tools, and more cortex is present on these specimens.

The organization of the stone tool assemblage at the Bowman Site argues for heavy curation of Eureka Quartzite and other high quality, non-local lithic material. The people inhabiting the site were mobile and moved into the mountains to obtain lithic resources. The materials were valued and treated to extend their life because of their high quality and distance from the residential base camp.

Because strong curation characteristics are displayed in the Eureka Quartzite material, it is likely that mobility patterns tended towards a logistical (collector) strategy. Collectors tend to keep their residential base in one place and send people out to procure and return with the resources required. Foragers are more inclined to move their residential camps.

Chert was also curated, but not to the extent of Eureka Quartzite. Chert nodules are available on the portions of the alluvial fans, located somewhat closer to the Bowman Site than Eureka Quartzite. This difference in curation would argue that forays into the foothills and lower elevations of the mountains were more common than movement.
into the higher elevations where the Eureka Quartzite is located, making chert more accessible and/or available.

Site Presence and Use Along the GIS Predicted Pathways

Is there evidence to support the use of the potential pathways to the Eureka Quartzite from the Bowman Site identified by the GIS study? Eureka Quartzite is exposed in very few locations in the Spring Mountains making beds easy to locate. Using geographical information and GIS, pathways were predicted, from the Bowman Site to the six Eureka Quartzite locations within a 30 kilometer range.

Previous research conducted in the area produced eight prehistoric sites within 500-meters of the predicted pathways over the sampling of 22 kilometers. Twelve sites were found in the 500-meter width survey of the predicted pathways and two sites were found in the 100-meter width survey, for a total of 14 sites.

Twenty-two prehistoric sites were discovered or previously recorded within 500-meters of the 33 kilometers of predicted pathways surveyed (previously or in this study). Site density averages one site every 1.5 kilometers. Site density outside the predicted pathway corridor is less, averaging one in six kilometers.
density along the predicted pathways demonstrates that the sites are directly related to landscape use occurring while people were procuring lithic resources. However, there is no definite method of knowing that these sites were actually used by the Bowman Site inhabitants. Other people using the landscape may have used these sites along with the Bowman Site people.

Did the people inhabiting the Bowman Site combine their Eureka Quartzite procurement into other procurement activities? The sites present along the pathways argue for procurement of other resources in addition to lithic procurement. Sites previously recorded within 500-meters of the predicted pathways include four lithic scatters, three lithic scatters with groundstone, and two rockshelters with one midden. Sites discovered during the study’s pedestrian survey include five rockring sites; one rockring with an associated hearth; two rock ring sites with associated basket rests; one isolated groundstone fragment; and one site with rockrings, basket rests, a cleared area with associated large rocks, a projectile point blank, and a drilled stone.

The presence of groundstone at sites and as an isolate indicates processing of seeds or other food resources,
basket rests argue for plant resource procurement, and the rockshelters were interpreted as camps used at least seasonally. Rock rings are used for many things including caches (see Blair and Fuller-Murillo 1997; previous discussion in Chapter 4), and the lithic scatters are areas where reduction occurred to prepare a tool for procuring resources (hunting, cutting/preparing plant resources, and/or lithic procurement). Cleared areas are often used as drying and preparation areas of plants and meat procured in the area (Blair and Fuller-Murillo 1997).

The types of sites that have been previously recorded or discovered during this study argue for an embedded procurement strategy versus direct procurement of the Eureka Quartzite. Sites lying close to the pathways show strong indications of more activity occurring than just an overnight camp on the way to the Eureka Quartzite locations. Basket rests, rock rings, and cleared areas all suggest plant procurement.

As with the use of the pathways, it is possible that other people besides the Bowman Site residents may have been using these sites. The use of these sites, especially as they approach the lithic sources, does indicate embedded procurement of resources. The inhabitants of the Bowman
Site definitely used and procured Eureka Quartzite which supports the argument that these site were used by them, even if not exclusively.

Advantages and Disadvantages of the Study

This study addresses several variables concerning procurement strategies by the inhabitants of the Bowman Site. The organization of lithic technology clearly argues for high levels of curation, specifically for the high quality non-local lithic material. Using Eureka Quartzite as a case study, the study was able to establish the geographic locations of the sources (six sources within 30 kilometers); the nature of the source (beds); and the quality of the material (fine); the fact that the beds are exposed; and that extraction could occur with little effort.

Knowing these variables permitted the prediction of pathways to and from the Bowman Site and the six locations of Eureka Quartzite. Testing these pathways clearly suggests that procurement of the lithic resource occurred along with other resource procurement, making it embedded. It is intuitive that the inhabitants of the Bowman Site would take advantage of the plentiful resources available.
in the Spring Mountains in conjunction with procuring the valued lithic resources, as would be true for other people who were not Bowman Site residents utilizing Eureka Quartzite.

One disadvantage of this study, due to time constraints, was the decision to focus on only complete specimens instead of including broken ones. Broken flakes and shatter could show a relationship with cores (Roth and Dibble 1998) and the width of flakes could show relationships between local and non-local lithic material, as Newman (1994) indicates.

Locations and depths of the lithic specimens collected at the Bowman Site were not addressed in detail in this study. By addressing these factors, changes in the organization of lithic technology over time could be identified. If variation occurs, then changes in mobility/procurement strategies (forager/collector/sedentary) over time may be explained (Andrefsky 1991; Kelly 1988; Roth 1999, 1998).

Resources not considered in the GIS pathway predictions that may have perfected the predicted pathways include water resources, plant resources, other lithic material locations, and known archaeological sites. This study identified sites that could be used for further spatial
analysis studies. Combining the information from this study, previous research, and environmental data could provide further refinements in spatial analysis (Anschuetz et al. 2001).

**Future Research Directions and Final Thoughts**

Future research in the Pahrump Valley could provide additional information regarding its prehistoric inhabitants. Addressing mobility over time in addition to comparisons with other sites within the valley could provide data showing changes in mobility and procurement strategies over time (Andrefsky 1991; Kelly 1988; Roth 1999, 1998; Young and Harry 1989).

Comparing the Bowman Site lithic assemblage with other assemblages in Pahrump Valley and the Spring Mountains could also provide data indicating differences throughout the valley in procurement strategies and the organization of lithic technology. This kind of comparison, with possible chronological indicators, could answer questions regarding the similarities and differences of Pahrump Valley sites (Anschuetz et al. 2001; Tainter 1979).

Unfortunately, little research has been completed in Pahrump Valley, primarily due to the fact that natural
water resources in the valley exist on private property. Residential camps are known to exist at these natural springs; however, several camps have either never been recorded or have only been recently recorded while most have been extremely damaged by development, looting, or farming. What little research that has been completed is due to the private owners showing interest, allowing the University of Nevada - Las Vegas and the United States Forest Service to conduct minimal studies. Looting has been commonplace in these locations and continues today. Any further research could provide critical information regarding Pahrump Valley’s past inhabitants before the sites are completely destroyed.

Summary

The study determined that the people inhabiting the Bowman Site traveled into the Spring Mountains to obtain different kinds of resources. Focusing on Eureka Quartzite, the organization of lithic technology, and procurement strategies the study determined that Eureka Quartzite was valuable and curated more than any other lithic material recovered from the Bowman Site. Curation argues that Eureka Quartzite was not easily accessible, yet
desired. It is likely that the people procured the Eureka Quartzite during their seasonal rounds. When these rounds brought them to the vicinity of the Eureka Quartzite, it was also procured. However, special trips just to obtain Eureka Quartzite did not occur unless necessary. Mobility was confirmed, the use of GIS in predicting pathways was successful, and embedded procurement of Eureka Quartzite was supported.
APPENDIX I

OBSIDIAN SOURCING
Obsidian Sourcing

Obsidian sourcing was performed by Richard E. Hughes of the Geochemical Research Laboratory in Portola Valley, California for Nellis Air Force Base, Las Vegas, Nevada (Nellis AFB). Using energy dispersive x-ray fluorescence spectrometry (EDXRF), the geochemical composition of the obsidian was obtained and matched with known sources.

Twenty samples were sent to Nellis AFB for obsidian sourcing information. Seven of these samples were projectile points; the remaining thirteen were flakes. Results produced six different locations for the sources. These sources were Tubb Spring, Shoshone Mountain, West Sugarloaf Coso Volcanic Field, Sugarloaf Mountain Coso Volcanic Field, Kane Springs, and Panaca Summit. Three samples returned with no known source. The approximate distance from the Bowman Site (26NY809) to the source locations ranges from 95 kilometers to 240 kilometers.

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Values in parts per million (ppm) except total iron (in weight percent) and Fe/Mn ratios; ± = estimate (in ppm and weight percent) of x-ray counting uncertainly and regression fitting error at 300 and 600 (*) seconds livetime; nm = not measured.
APPENDIXII

LITHIC ANALYSIS SUMMARY
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PHOTOGRAPHS FROM 500 METER WIDTH LOWER ELEVATION SURVEY
Photograph 6. Rock Ring from Cluster #1, Facing Southeast.

Photograph 7. Hearth from Cluster #1, Facing Northeast.
Photograph 8. Rock Ring from Single #9, Facing West/Northwest.


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Photograph 11. Rock Ring Area from Cluster #4, Facing Southeast.

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Wheat, M. M.


Whittaker, J. C.
Young, L. C. and K. R. Harry
VITA

Graduate College
University of Nevada, Las Vegas

Annette Joye Smith

Home Address:
9105 West Flamingo Road, Apartment 2062
Las Vegas, Nevada 89147

Degrees:
Bachelor of Arts, Anthropology, 1999
Bachelor of Arts, Art History, 1999
Arizona State University

Associate in Applied Science, Management, 1989
Thomas Nelson Community College

Special Honors and Awards:
Cynthia Lakin Award, Department of Anthropology, Arizona State University, 1998-1999

Jack Breckenridge Prize in Art History, College of Fine Arts, The School of Art, Arizona State University, 1999

The Myra Wrigley Scholarship, The Doñas of Arizona, for Meritorious Efforts in the Field of Anthropology, 1999

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Thesis Examination Committee:
Chairperson, Dr. Barbara Roth, Ph. D.
Committee Member, Dr. Margaret Lyneis, Ph. D.
Committee Member, Dr. Karen Harry, Ph. D.
Graduate Faculty Representative, Dr. Steven Rowland, Ph. D.

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