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A Synthesis of Archaeological Studies on the Utah Test and Training Range

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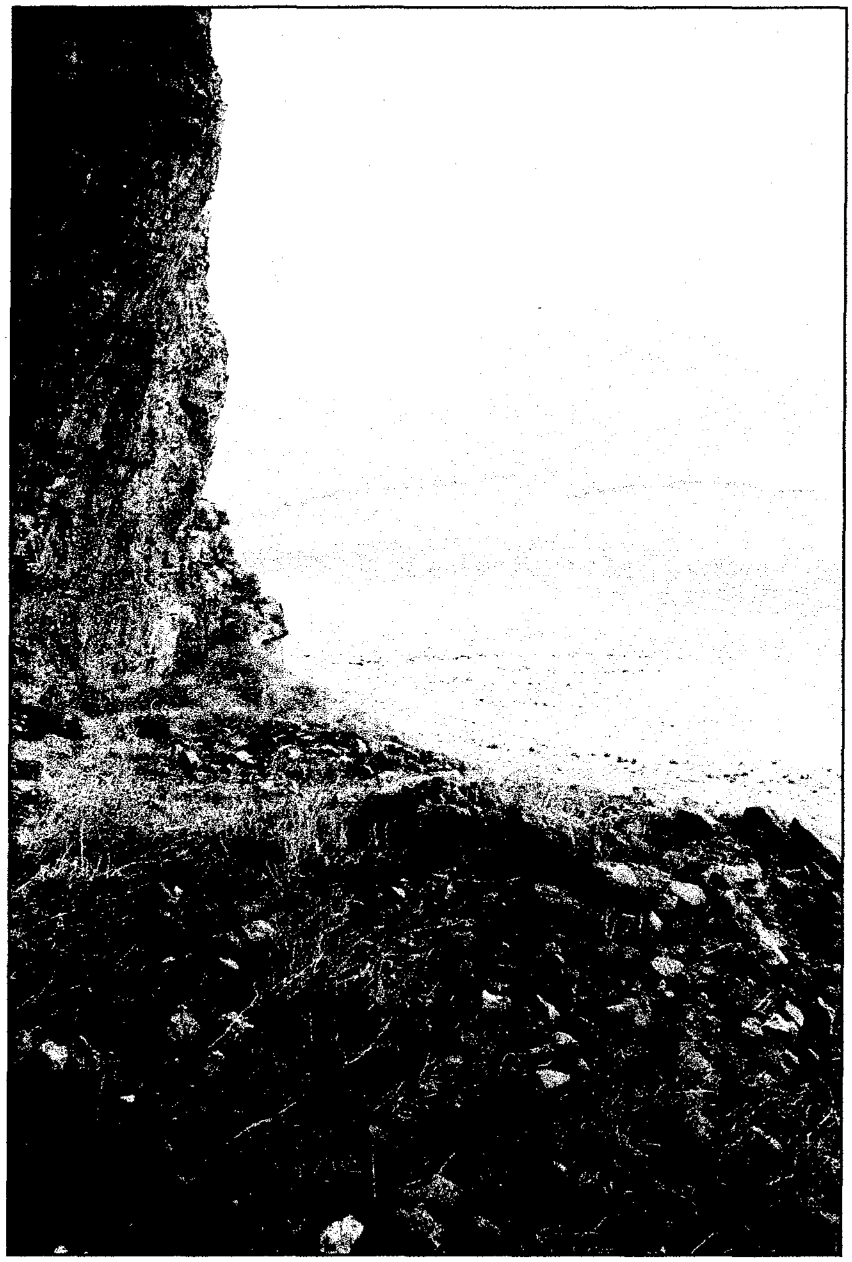

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13. ABSTRACT *(Maximum 200 words)*
This report, conducted by Statistical Research, Inc., under contract with the National Park Service, is a synthesis of research to date on the prehistoric and historical archaeology of the Utah Testing and Training Range, two U.S. Air Force training ranges under the jurisdiction of Hill Air Force Base. Results are presented in eight chapters. Topics include present and past environments, paleontological resources, a cultural-historical overview, previous research in the project area (including information on all archaeological resources known as of October 1998), and Native American concerns. This synthesis is used as the backdrop for a brief research design for both prehistoric and historical-period cultural resources. Salient prehistoric contexts include settlement and land use, cultural affiliation, lithic technology, and the evolution of Great Basin ceramic traditions. Historical themes include ranching, mining, transportation, Native American–Euroamerican interactions, government campaigns and exploration, Mormon settlement, and World War II–era use of the region. The report concludes with management recommendations. A glossary of key terms and an annotated references-cited section are also included. A popular version of this report is also available.

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A Synthesis of Archaeological Studies on the Utah Test and Training Range

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Prepared under the supervision of
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TECHNICAL ABSTRACT

Statistical Research, Inc. (SRI), undertook a synthetic study of the prehistory, history, and paleontology of the Utah Testing and Training Range (UTTR) under contract with the National Park Service (NPS), Interagency Archeological Services, Denver (Contract No. 1443-CX-1200-95-002). Funding was provided for the project by the Legacy Resource Management Program, DoD #9301016, Historical Research for Multiservice Weapons, to the U.S. Air Force, Air Force Materiel Command, Ogden Air Logistics Center, Hill Air Force Base (AFB), Utah. The results are presented in eight chapters. Overviews of the present and past environments, paleontological resources, prehistory, history, and Native American concerns, as well as a research design are presented.

The environmental section focuses on the characteristics of the UTTR, including climate, physiography, modern biotic communities, and paleoenvironments. The paleontology section is described by geological period, with a discussion of fossil types found in and around the UTTR for each period. The research design highlights salient issues in prehistory, such as settlement and land use, cultural affiliation, lithic technology, and the evolution of Great Basin ceramic traditions. Historical themes include ranching, mining, transportation, Native American–Euroamerican interactions, government campaigns and exploration, Mormon settlement, and World War II–era use of the region.

The prehistory section describes the culture history of the region as well as the 209 sites recorded on the UTTR as of December 1998. The history section presents a narrative of European exploration and settlement of the region as well as historical-period sites previously recorded within the UTTR. The chapter on Native American concerns discusses ethnography and contemporary issues such as the identification of traditional cultural properties (TCPs). The report concludes with management recommendations. A glossary of key terms and an annotated referenced-cited section are also included. An appendix lists the known cultural resources located on the UTTR as of October 1998.

POPULAR ABSTRACT

This volume provides a glimpse into the landscapes and the people of northwestern Utah, an area known as the Utah Testing and Training Range (UTTR), which is administered by Hill Air Force Base (AFB). The journey begins more than 500 million years ago, when the earliest life-forms—small, crablike creatures known as trilobites—swam in the warm, shallow seas that covered the region. The record of fossils is followed until about 10,000 years ago, when human beings made their initial entry into the region.

The drama is heightened as these bold new inhabitants—who lived by hunting and gathering wild foods—battled for survival and attempted to tame the unforgiving landscape they shared with massive bison, camels, horses, and mammoths. The many adjustments humans made to the challenging and changing landscape of the region are described: the extinction of the great mammals just mentioned, the disappearance of the huge rain-fed lakes in the region, the increasing desertlike conditions, movements of other peoples into the region, the adoption of corn and other crops and a more settled way of life, and, finally, the Native Americans' first encounters with European explorers and settlers. After this last event, changes become even more rapid, as wagon trails give way to railroads and then highways, as miners and speculators tapped into the natural resources of the region, and a country at war selected the region as a locality in which to train soldiers and test and store weapons.

Throughout the journey, the theme of the relationship of humans to the land—the rugged, desert landscape of the UTTR—lies at the heart of the narrative. This technical version of the story contains overviews of the present and past environments, paleontological resource, prehistory, history, Native American concerns, and a research design for studying the area. Included in the prehistory and history sections are summaries of the known archaeological sites for each period. Prehistoric site types reflect the intimate ties of the ancient inhabitants to their environment: rockshelters, artifact scatters, and quarries where stone sources were obtained. Sites relating to the historical-period occupation of the area include mining-related sites, camps, house foundations, trash dumps, railroad grades, a mustang corral, emigrant wagon camps associated with the infamous Donner-Reed party, and a salt-evaporation. These sites record the traces of European settlers and explorers who either passed through the desolate area or came to exploit what it had to offer in the way of resources.

The report also contains a glossary to aid the reader unfamiliar with archaeological terminology, and an annotated list of references cited in the report for anyone desiring more information on a particular topic. An appendix lists the known cultural resources located on the UTTR as of October 1998.

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PREFACE

In 1995, Statistical Research, Inc. (SRI), was awarded a contract (1443-CX-1200-95-002) by the National Park Service (NPS) to complete the "Archaeological Research Study Unit II" portion of Cultural Resource Archival Studies for Hill Air Force Base (AFB), Utah. The NPS (Interagency Archeological Services, Denver) received funding from the U.S. Air Force, Air Force Materiel Command, Ogden Air Logistics Center, Hill AFB. Their funding derived from the Legacy Resource Management Program, DoD #9301016, Historical Research for Multiservice Weapons.

The study area was defined as the Utah Testing and Training Range (UTTR), which comprises the UTTR North, or Hill Air Force Range (AFR), and the UTTR South, or Wendover AFR. This contract involved a series of interrelated tasks. Archival and minimal field studies were undertaken to gather information on the archaeology (prehistoric and historical period), paleontology, geomorphology, and paleoenvironment of the UTTR, as well as additional topics, such as Native American concerns. (It should be noted that SRI did not compile specific information on resources related to the pre-military and military history of the UTTR or conduct any oral historical research. "Research Study Unit I - History" was let as a separate contract to another consulting firm, and apparently no final report was produced.) Data on all prehistoric and historical-period archaeological sites recorded on the UTTR were also collected (current through October 1998). Three data-collection visits were made to the project area between 1995 and 1998. This preliminary work was conducted per an approved implementation plan that was submitted as a deliverable early in the life of the contract.

The information gathered by SRI formed the basis for preparation of two of the contract deliverables—a synthetic report on the project area (represented by the current document) and a popular report (Ezzo 1999) intended for a general audience. Annotated reference sections and glossaries are included in each deliverable. The reports were prepared following submission and approval of specific outlines. Site-location data and information on previously surveyed areas of the UTTR, which were primarily taken from Intermountain Antiquities Computer System (IMACS) forms on file at the State Historic Preser-]vation Office at the Utah Division of State History (UDSH), were plotted on U.S. Geological Survey Quadrangle Maps of the area. These maps are also project deliverables.

The IMACS site data and other information gleaned from research into previous work in the area were entered into a database that will provide easy access to resource managers concerned with archaeological sites on the UTTR. The original database deliverable was to be prepared using the NPS's Integrated Preservation Software (IPS) programs. However, the IPS program proved cumbersome and was essentially unsupported by the NPS. The client later approved creation of a database that features a Microsoft Access front end with dBaseIII+ components. A users' manual has been prepared as a deliverable to accompany the database (Knoblock and Rose 1999), which contains information on 209 sites known to be located on the UTTR through December 1998.

Without the collaboration of numerous individuals, the compilation of information for this project would have been impossible. SRI research staff included Dr. Robert B. Neily, who served as principal investigator during the early stages of the project (I replaced Dr. Neily as principal investigator); Dr. Steven D. Shelley, who helped to develop the database; Mr. Matt C. Bischoff, who provided historical sources; and Mr. Keith Knoblock, who contributed substantially to all aspects of the project's success, particularly in the areas of mapping, data collection and data entry, site-file and paleontology research, and database management. Mr. Martin Rose modified the database from IPS format to one employing Microsoft Access for Windows and dBase, and provided SRI with technical information on the operation of the system. Ms. Cindy Elsner, Ms. Lois Kain, Mr. Chester Schmidt, Ms. Lynne Yamaguchi, and Ms.

Karen Barber, of SRI's production and graphics staff, ably prepared the illustrations and formatted the report. Mr. S. Greg Johnson performed a technical edit on the project reports at various stages. Dr. Joseph A. Ezzo wrote the popular and the synthetic reports.

Dr. William Butler, then of the Interagency Archeological Services division of the NPS, Denver office, and now of Rocky Mountain National Park, served as SRI's contracting officer's technical representative until he was replaced by Mr. Steven De Vore (now at the NPS Midwest Archeological Center, Lincoln) toward the end of the contract; Mr. Thomas J. Forsyth served as the NPS Contracting Officer; and Ms. Debbie Hall was SRI's contact at Hill AFB. Mr. Martyn D. Tagg, HQ AFMC/CEVC cultural resources manager, reviewed the synthetic and popular reports and provided SRI with numerous thoughtful comments. Mr. Ralph Giles, of the NPS Western Archeological and Conservation Center, Tucson, kindly provided us with some data sources. Mr. Bryan Hockett, archaeologist with the Bureau of Land Management, Elko District, supplied additional site information, as did Mr. Melvin Brewster of the BLM Pony Express Resource Area. Mr. Brewster also provided insights into Native American concerns in the area. David Madsen and Evvy Selinger of the UDSH greatly facilitated our research and data-collection efforts at that office. Finally, we are grateful to Glenda Cotter of the University of Utah Press, who generously granted SRI permission to reproduce illustrations in this report.

Teresita Majewski, Ph.D.
Principal Investigator

CHAPTER 1

Introduction

This document constitutes a synthetic report prepared by Statistical Research, Inc. (SRI), for "Research Study Unit II - Archeology," Phase II, Task 1, of the Cultural Resource Archival Studies for Hill Air Force Base (AFB), Utah. The document is in partial fulfillment of Contract No. 1443-CX-1200-95-002, as awarded to SRI by the National Park Service (NPS). (The preface to this report includes a complete summary of the contract's history.) The study area includes the Utah Testing and Training Range (UTTR) North (Hill Air Force Range [AFR]) and the UTTR South (Wendover AFR) (Figure 1).

The report is one of several tasks specified by the solicitation to aid the U.S. Air Force "in meeting and transcending their responsibilities with the Federal cultural resource laws and mandates" (Solicitation, p. 4; see also SRI 1995, and the preface to this report). The solicitation (p. 5) states that the goal of this project "is to produce reports and documents on the history and prehistory of the area that may be used for public education and interpretation."

Chapter Synopsis

This report consists of eight chapters. Following this introduction, Chapter 2 begins with a description of the project area in terms of location, size, and federal components. This is followed by a general discussion of the hydrography, physiography, and biotic communities of the Great Basin. The remainder of the chapter is devoted to the environment of the project area, and includes information on climate, typography, geology, hydrology, geomorphology and soils, paleoenvironment, and modern biotic communities.

Chapter 3 provides a research design for the prehistoric and historical-period archaeology of the project area. Four historic contexts (research themes) are presented for the prehistoric period, including settlement and land use, cultural affiliation, lithic technology, and the evolution of Great Basin ceramic traditions. Eight historic contexts are presented for the historical period, including mining, transportation, Native American–Euroamerican interactions, military campaigns, exploration, ranching, homesteading, Mormon settlement, and World War II–era use of the project area. Each historic context is discussed in terms of its significance within the project area (and the Great Basin in general) and the types of data that are required to address each context.

Chapters 4–7 provide information on paleontological, prehistoric, historical-period, and ethnographic resources and concerns. Chapter 4 presents a review of known paleontological localities in the project area. Discussion of fossil types, fossil-bearing localities, and the ages of these areas is emphasized. The reader should be aware that paleontological resources are normally not treated in such detail in a cultural resources study. However, the Scope of Work for the original solicitation for this project required this level of treatment. As a point of clarification, it should be noted that the U.S. Air Force does not conduct paleontological inventories nor protect such sites (Martyn D. Tagg, personal communication 1998).

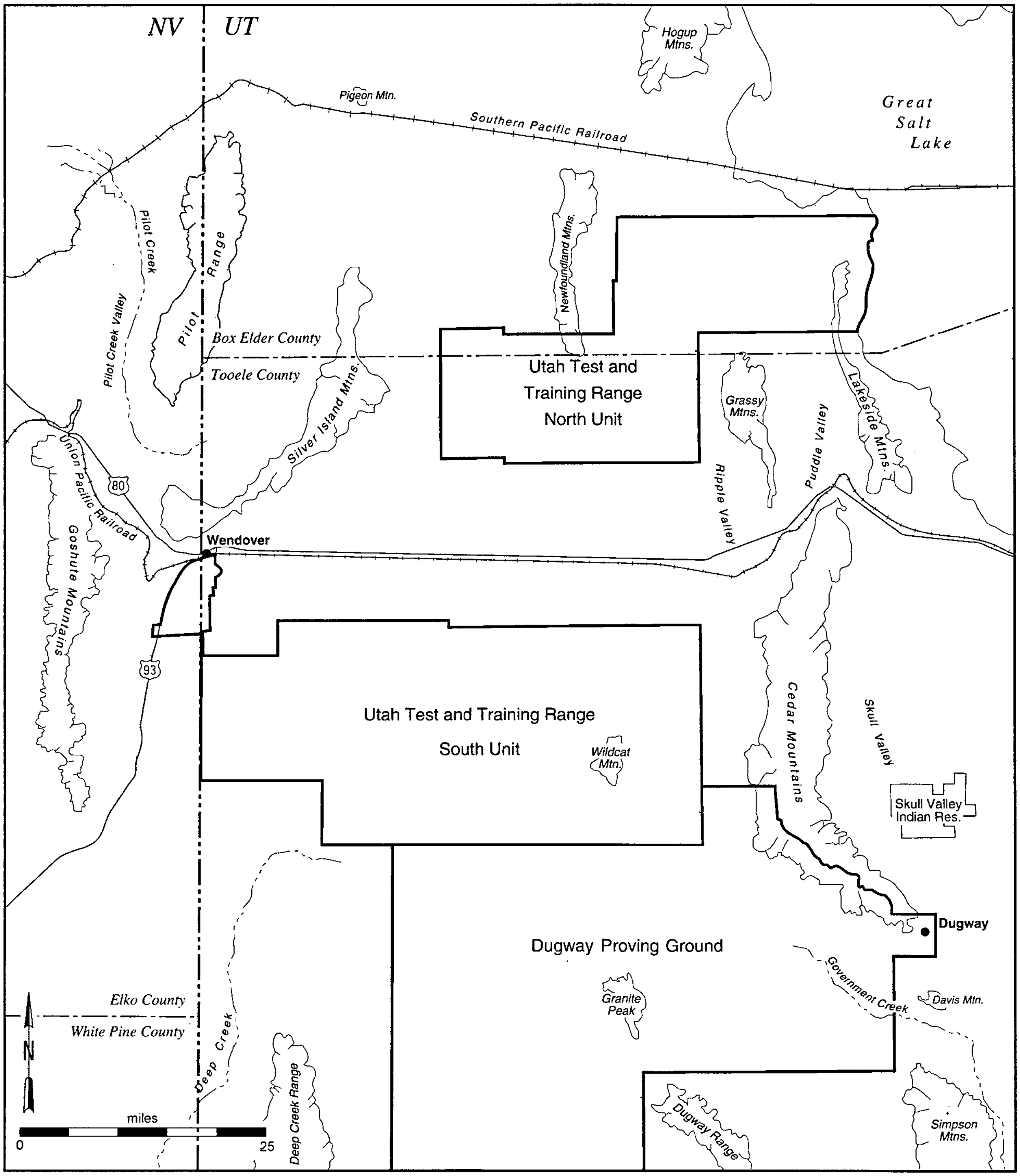

Figure 1. Map of northwestern Utah showing the two components of the UTTR.

Chapter 5 summarizes the prehistoric archaeology of the region and includes a discussion of known sites, history of research, and a culture history that employs the terminology commonly used for the eastern Great Basin. Chapter 6 presents a parallel overview of the history and historical archaeology of the project area and surrounding region. Chapter 7 deals with Native American studies and concerns, providing information on ethnography, ethnohistory, the current status of Native American groups in the area, and such topics as the American Indian Religious Freedom Act (AIRFA), the Native American Graves Protection and Repatriation Act (NAGPRA), traditional cultural properties (TCPs), and Native American involvement in activities relating to cultural resources. Chapter 8 concludes the document with a synthesis of material presented in Chapters 2–7, management summary and recommendations, and conclusions. An appendix lists known cultural resources on the UTTR as of October 1998.

The eight chapters and the appendix are followed by a glossary of technical terms and an annotated references-cited section for all sources cited in the body of the report.

As a point of reference, the reader should note that the terms "historic" and "historical" have distinct meanings in this report (after French 1987:100). A *historic* event is a important occurrence, one that stands out in history. A historic resource would be equivalent to a resource listed in the National Register of Historic Places (NRHP). *Any* occurrence in the past is a historical event. Years ago, when the Society for Historical Archaeology was established, considerable discussion surrounded the use of these two terms, and the consensus was that "historical" was the more correct usage (i.e., historical archaeology). An exception would be "historic context," which is a term defined very specifically within the NRHP significance-evaluation process.

CHAPTER 2

Environment

The Project Area

The project area consists of approximately 953,887 acres (1,490.4 square miles) on the west side of the Great Salt Lake in the Great Salt Lake Desert of northwestern Utah, and, as noted in Chapter 1, consists of two U.S. Air Force test and training ranges that are collectively referred to as the UTTR (see Figure 1). The North Range, also known as Hill AFR, is located in Tooele and Box Elder Counties north of Interstate 80. The South Range, also known as Wendover AFR, is located in Tooele County south of Interstate 80; it stretches south to the Tooele-Juab County border, and west to the Utah-Nevada Border.

An Overview of Great Basin Physiography

The project area lies within what geologists refer to as the Basin and Range Province of western North America. This province encompasses approximately 300,000 square miles, or about 8 percent of the continental United States. In general, it extends from the southwestern corner of Oregon and includes virtually the entire state of Nevada, western Utah, southeastern California, southern and northwestern Arizona, southwestern New Mexico, and the southwestern corner of Texas (Hunt 1967). Topography is generally characterized by parallel, narrow, north-south-trending mountain ranges separated by valleys, or basins, that tend to be structural rather than erosional in nature.

Although the Basin and Range Province is physiographically distinct, it can be divided into a number of units based primarily on climate and biota. These include the Mojave Desert, the Sonoran Desert, the Chihuahuan Desert, and the Great Basin (MacMahon 1988). Physiographically, the project area lies within the Great Basin; before focusing specifically on the climate, geology, topography, hydrology, and biota of the project area, a brief discussion of the Great Basin is appropriate.

The Great Basin encompasses almost half of the Basin and Range Province; according to Hunt (1967:309), it consists of "linear, north-south mountain ranges separated by valleys, many of which are closed basins." Four "Great Basins" have been defined (see Grayson [1993] and Trimble [1989] for reviews): the hydrographic Great Basin, the physiographic Great Basin, the floristic Great Basin, and the ethnographic Great Basin. The hydrographic Great Basin is that region of the arid West that drains internally (Smith and Street-Perrott 1983). According to Grayson (1993), this is perhaps the most common conception of the Great Basin, and it covers the entire area described above. The physiographic Great Basin is based on the spatial extent of the linear mountain ranges and adjacent valleys (Hunt 1967). This Great Basin is less extensive, as much of southeastern California lies outside of its boundaries. The floristic Great Basin is based on the spatial extent of a relatively distinct assemblage of flora (Cronquist et al. 1972). This Great Basin extends more prominently into southern Oregon and southern Idaho, and its southern boundary is farther north than those of either the hydrographic or physiographic Great

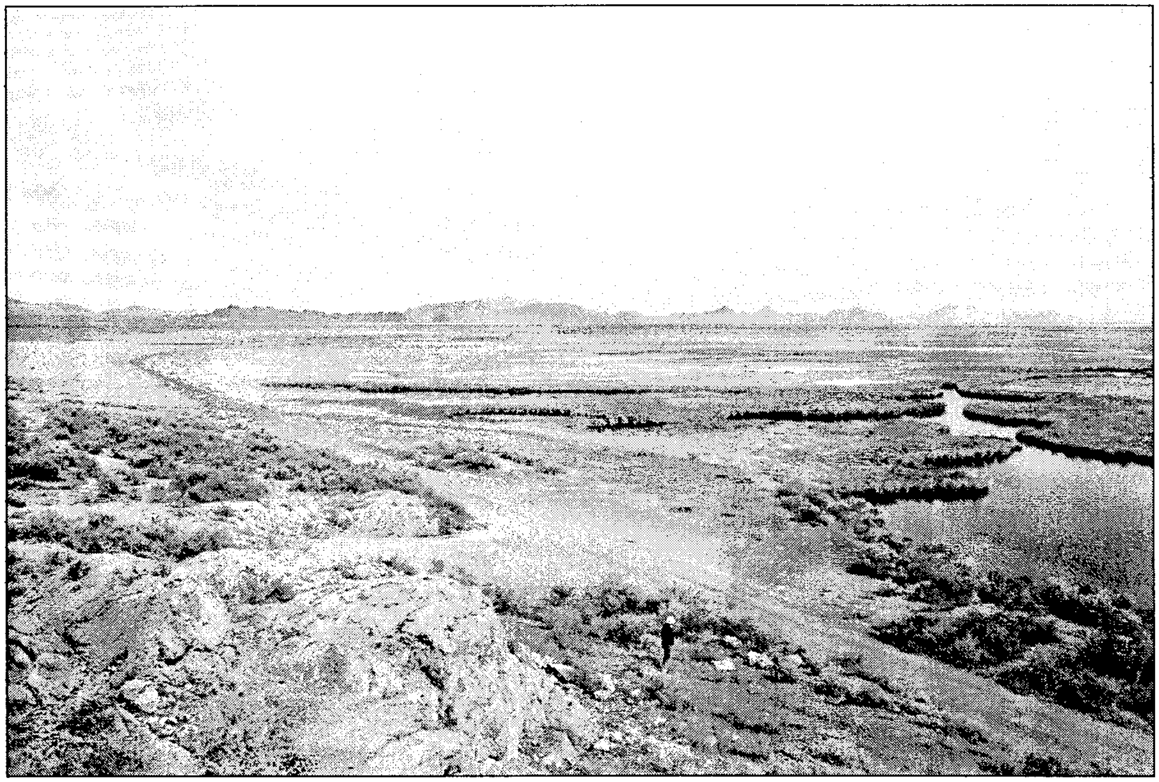

Figure 2. View of Blue Lake on the UTTR South, looking north.

Basins. Virtually all of southeastern California, as well as southern Nevada, falls outside the floristic Great Basin. This definition has been the most convenient for distinguishing the Great Basin from the deserts to the south, as the southern boundary tends to follow the 4,000-foot elevation, separating it from the creosote-dominated communities of the Mojave Desert (Cronquist et al. 1972; Grayson 1993; MacMahon 1988). Finally, the ethnographic Great Basin is based on the presence of Native Americans who occupied the region at the time of European contact (d'Azevedo 1986). This Great Basin approximates the hydrographic Great Basin; given the mobility of Native Americans throughout the Basin and Range Province, as well as the rapid displacement of native groups after contact with Europeans occurred, this is arguably the most arbitrary definition of the Great Basin (Ezzo 1996).

The project area falls within all of the four Great Basins described above. In each case it occurs at the eastern boundary. Typical physiographic features of the UTTR are illustrated in Figures 2–5.

Climate

The climate of the project area is characterized by hot, generally dry summers, cool, dry springs and autumns, and moderately cold winters. The average annual rainfall is 19.2 inches, and annual snowfall averages 71.8 inches. Summer thunderstorms contribute the majority of the annual rainfall. Winters are characterized by 2–3-week periods between storm systems, when stagnant high-pressure systems trap cold air in the area of lower elevation and create fog (Dames and Moore 1996; U.S. Air Force 1994).

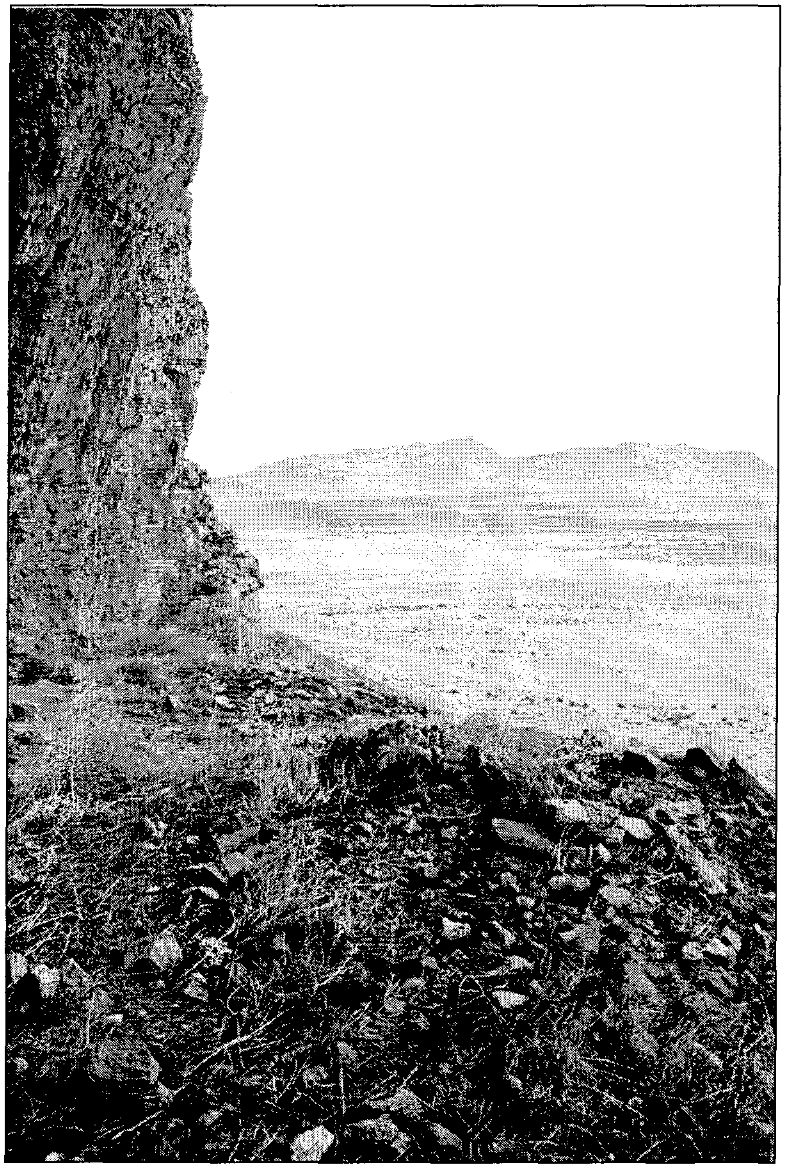

Figure 3. A typical rockshelter on the UTTR North.

Maximum temperatures tend to range from 30 to 50° F in January and 80 to 100° F in July; temperatures exceeding 110° F have been recorded in the Great Salt Lake Desert. Minimum temperatures tend to range from 10 to 20° F in January and 50 to 70° F in July; temperatures as low as -22° F have been recorded in the area. Based on weather records from the town of Wendover, the average annual temperature between 1941 and 1970 was 52.2° F. Between 1951 and 1964, the Wendover area averaged 151 frost-free days per year. The average wind speed at Hill AFB is 7 knots (Dames and Moore 1996; U.S. Air Force 1994).

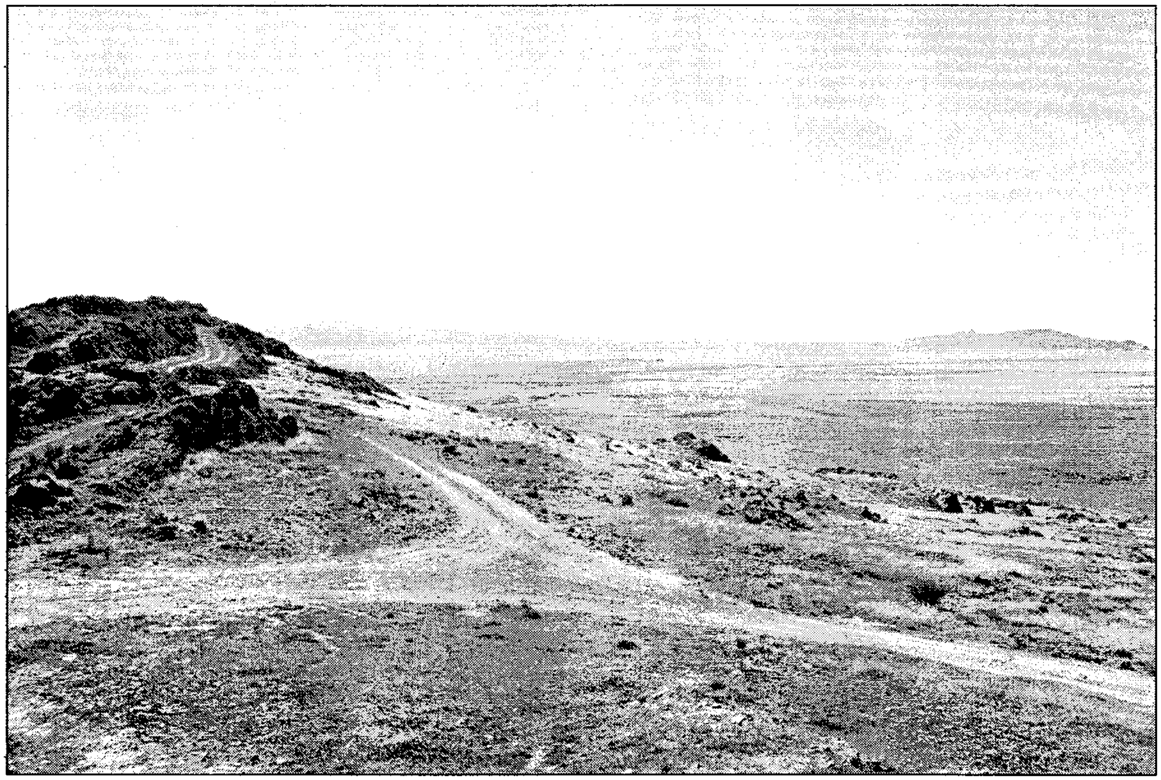

Figure 4. View of the Cedar Mountains on the UTTR South, looking east.

Figure 5. Mudflats on the UTTR South.

Physiography, Geology, and Hydrology

Physiography

Elevations within the UTTR range from 4,200 feet (1,273 m) to 5,850 feet (1,773 m) above mean sea level (AMSL). Physiographically, the UTTR is composed of the Great Salt Lake Desert, the shoreline of the Great Salt Lake, and several mountains ranges, including the Lakeside, Newfoundland, and Grassy Ranges in the UTTR North, and the Wildcat and Kittycat Mountains in the UTTR South. These ranges, typical of those found in the Great Basin, are generally narrow, relatively low in maximum elevation, and oriented north to south (Dames and Moore 1996).

Much of the UTTR consists of the Great Salt Desert, which is composed largely of Quaternary mud flats and aeolian deposits; upland areas are found along the northern tip of Grassy and Lakeside mountain ranges, the southern tip of the Newfoundland Mountains, and the Wildcat and Kittycat Mountains. One upland valley, the Sink Valley, occurs in the UTTR North between the Grassy and Lakeside Mountains. The landforms created by Lake Bonneville are present along the flanks of these ranges.

Geology

Intensive geological mapping of the mountain ranges in the UTTR North has been undertaken (see Hintze 1988:Charts 10 and 25). The Lakeside and Grassy Mountains contain formations that range from Cambrian to Quaternary in age. The mountain ranges are dominated by a variety of limestone, shales, and dolomites, with quartzites present in the oldest (Cambrian and Ordovician) strata and cherts in later (Late Permian) strata. Andesites are present in the Eocene strata. The Newfoundland Mountains similarly have strata ranging from Cambrian to Quaternary. Dolomites, shales, and limestones predominate, with quartz present in Jurassic strata and conglomerates in the Pennsylvanian strata. All of these ranges are overlain by Miocene–Pliocene valley fill and Quaternary deposits of colluvium and Lake Bonneville lacustrine deposits.

Areas near the UTTR South that have been mapped geologically, such as Fish Springs and Gold Hill (Hintze 1988:Charts 45 and 46), show similar prevalences of limestones, dolomites, shales, and quartzites, some of which are Precambrian, but contain inclusion of andesites, rhyolites, fluorites, barites, basalts, and granite stocks, which occur in the Jurassic and later strata. The Miocene–Pliocene valley fill is evident here, underlying the Quaternary Lake Bonneville deposits, and may be several thousand feet thick in areas, particularly near Fish Springs.

Hydrology

The Great Salt Lake borders the UTTR on the northeast, and, as discussed in the section below on the paleoenvironment, is the saline remnant of Pleistocene Lake Bonneville. The lake resides in a closed basin. Therefore, all water that drains into it becomes trapped and can only leave by evaporation. The lake's levels have fluctuated markedly in historical times, and flooding can occur along the east flank of the Lakeside Mountains on the UTTR North, as well as on the low-lying mud flats that occur between the north end of the Lakeside Mountains and the south end of the Hogup Ridge in the UTTR North (Dames and Moore 1996).

There are no perennial streams in the UTTR; streams intermittently flow from perennial springs. Precipitation runoff in the area is generally discharged quickly by evapotranspiration (Gates and Kruer 1981; Stephens 1974). The only known perennial springs on the UTTR occur at Mosquito Willy's, in the southwestern portion of the UTTR South.

Groundwater in the UTTR consists primarily of a reservoir of unconsolidated to partially consolidated basin fill. This reservoir consists of two or three major aquifers. A shallow brine aquifer underlies the mud flats of the UTTR, the basin-fill aquifer underlies the older alluvial sediments, and the alluvial fan aquifer, which may not occur on the UTTR, would underlie the flanks of the Newfoundland and Lakeside Mountains, if present (Gates and Kruer 1981; Stephens 1974).

Geomorphology and Soils

Geomorphology

Dames and Moore (1996) discuss the landforms within these physiographic features in terms of being either pre–Lake Bonneville, Lake Bonneville, or post–Lake Bonneville in age. According to Dames and Moore (1996:3-4):

> Pre–Lake Bonneville landforms include landforms that were created by thrust faulting, domal uplift, volcanism, and block faulting. The landforms created by Lake Bonneville include wave-cut terraces, shorelines, sea caves, spits, and barrier bars. . . . Post–Lake Bonneville landforms include the present drainage patterns, outwash materials from occasional flash flooding, deposits of windblown sand and silt, and minor amounts of outwash materials from ravines and canyons.

Much of the mountain building within the UTTR occurred during the Laramide orogeny near the end of the Mesozoic era, when rock formations in the region were compressed and formed folds that were oriented north to south. The Wildcat and Kittycat Ranges were folded during this time. The Lakeside Range forms the western flank of the Northern Utah Highland Dome, which resulted from Paleocene uplift. During this time, uplift in the Newfoundland Mountains compressed the area where the Grassy Mountains are today, causing overturning, thrusting, and tight folding of the strata.

Caves occur in the Paleozoic carbonate rock formations (limestones and dolomites) of the various mountain ranges within the UTTR. The caves were formed by the dissolution of these rocks by groundwater. These localities, along with the fossil Holocene shorelines of Lake Bonneville, are the most likely locations for prehistoric archaeological sites in the UTTR.

Soils

The primary soils found on the UTTR are referred to as Playa and Playa-Saltair Complex soils (Dames and Moore 1996:3-8); these occur in the low-lying, flat portions of the ranges. These soil complexes are related to a landscape feature known as a "playa," which is a barren, undrained basin subject to repeated flooding by salt water. "Salinization" occurs when accumulated water evaporates and covers the cracked ground surface with salt crystals. The Saltair soil is formed in alluvium and lake sediments that derive from mixed rock sources. Both soil complexes are highly saline, have low water capacities, and do not favor plant growth.

Most of the remaining soils cover the slopes and upland areas of the ranges and consist of loams, sand, and rock outcrops. For the most part, these soils are alkaline and support very little plant life. Less than 4 percent of the South Range is covered with dune sand.

In general, soils found on the UTTR are poorly suited to livestock grazing, rangeland seeding, recreational uses, or residential development, because of low forage quality, alkalinity, and frequent flooding (Dames and Moore 1996:3-8).

Paleoenvironment

During the Pleistocene, the entire UTTR was part of Pleistocene Lake Bonneville. According to Grayson (1993), approximately 27,800,000 acres of land in the Great Basin was covered by lakes during the late Pleistocene; this is more than 11 times the current coverage in the region (approximately 2.5 million acres). Grayson (1993) acknowledges that this figure is somewhat conservative, given the difficulties in determining the shorelines and extents of ancient lakes. During the late Quaternary, Pleistocene Lake Bonneville reached a maximum between ca. 16,000 and 14,500 B.P., when it covered some 19,970 square miles (12,780,800 acres; 11 times the size of the Great Salt Lake); at this time the lake accounted for nearly 46 percent of the total surface area of pluvial lakes in the Great Basin, and its shoreline reached the 5,335-foot contour. By 14,200 B.P., the lake had decreased in size to 14,470 square miles, with a shoreline at an elevation of 4,930 feet AMSL. By the end of the Pleistocene (ca. 10,000 B.P.), the lake covered 6,600 square miles; the modern Great Salt Lake covers 1,800 square miles, with its shoreline at 4,200 feet AMSL (Benson et al. 1992).

Modern Biotic Communities

The UTTR is characterized biotically by flora and fauna typical of the Great Basin desert scrub community (Cronquist et al. 1972). Tables 1–4 list the principal species of plants and animals found in the region. More than half of the plants listed in Table 1 were common food sources for traditional Great Basin Native Americans (C. Fowler 1986). Workman et al. (1992a) discuss seven basic vegetation zones in the eastern Great Basin that are present within the project area. The greasewood-shadscale zone occurs between approximately 4,300 and 4,500 feet AMSL, and is characterized by cheat grass, halogeton, and shadscale. The mixed grass-shrub zone occurs between about 4,300 and 4,600 feet AMSL, and is characterized by cheat grass, Russian thistle, and winter-fat. The desert scrub–saltbush zone occurs from approximately 4,400 to 4,600 feet AMSL, and is characterized by Salina wild rye, prickly lettuce, and shadscale. The grass–cheat grass zone also occurs between these elevations, and is characterized by cheat grass, Indian rice grass, halogeton, and spiny horsebrush. The sagebrush zone occurs between about 5,000 and 5,200 feet AMSL, and is characterized by cheat grass, Hood's phlox, greasewood, and big sagebrush. The tall shrubs–trees zone occurs between about 5,600 and 5,800 feet AMSL, and is characterized by Salina wild rye, Hood's phlox, black sagebrush, and Utah juniper. Finally, the riparian zone, which occurs at various elevations, is characterized by salt grass, gray molly, and pickleweed.

Table 1. Principal Plant Species of the UTTR and Surrounding Region

Common Name	Species Name
Alkali sacaton[a]	*Sporobolus airoides*
Aster	*Aster* sp.
Bassia	*Bassia hyssopifolia*
Beardtongue	*Penstemon* sp.
Bent grass	*Agrostis* sp.
Big rabbitbrush	*Chrysothamnus nauseosus*
Big sagebrush	*Artemisia tridentata*
Bitterbrush	*Purshia tridentata*
Black sagebrush	*Artemisia nova*
Blazing star[a]	*Mentzelia laevicaulis*
Blue wild rye[a]	*Elymus glaucus*
Bluebunch wheat grass[a]	*Agropyron spicatum*
Broom snakeweed	*Gutierrezia sarothrae*
Buckwheat[a]	*Eriogonum* sp.
Bud sage	*Artemisia spinescens*
Bull grass[a]	*Elymus ambiguus*
Bulrush[a]	*Scirpus* sp.
California bricklebush	*Brickellia californica*
Cheat grass[a]	*Bromus tectorum*
Cliff rose[a]	*Cowania mexicana*
Columbine[a]	*Aquilegia* sp.
Common reed	*Phragmites communis*
Common sunflower[a]	*Helianthus* sp.
Cottonwood	*Populus angustifolia*
Crested wheat grass[a]	*Agropyron cristatum*
Curl-leaf mountain mahogany	*Cercocarpus ledifolius*
Curlycup gumweed	*Grindelia squarrosa*
Cushion goldenweed	*Haplopappus acaulis*
Daisy fleabane	*Erigeron pumilis*
Desert thorn[a]	*Lycium andersonii*
Desert parsley[a]	*Lomatium* sp.
Dusty maiden	*Chaenactis* sp.
Dwarf catseye	*Cryptantha humilis*
Evening primrose[a]	*Oenothera caespitosa*
Filaree	*Erodium cicutarium*
Five-stemmed tamarisk	*Tamarix pentandra*
Flannel mullein	*Verbascum thapsis*
Flaxflower	*Leptodactylon pungens*
Four-wing saltbush	*Atriplex canescens*
Foxtail barley[a]	*Hordeum jubatum*

Common Name	Species Name
Galleta grass [a]	*Hilaria jamesii*
Geranium	*Geranium fremontii*
Goosefoot [a]	*Chenopodium* sp.
Gray molly	*Kochia americana*
Graylocks	*Hymenoxys acaulis*
Greasewood	*Sarcobatus vermiculatus*
Great Basin wild rye [a]	*Elymus cinereus*
Great Basin fishhook cactus [a]	*Sclerocactus pubispinus*
Halogeton	*Halogeton glomeratus*
Hedgehog cactus [a]	*Echinocactus* sp.
Hood's phlox	*Phlox hoodii*
Horsebrush	*Tetradymia glabrata*
Indian paintbrush	*Castilleja* sp.
Indian rice grass [a]	*Oryzopsis hymenoides*
Kentucky bluegrass	*Poa pratensis*
Larkspur	*Delphinium* sp.
Little-foot mustard	*Thelypodium sagittatum*
Little rabbitbrush	*Chrysothamnus viscidiflorus*
Longleaf phlox	*Phlox longifolia*
Milk vetch	*Astragalus purshii*
Milkweed	*Asclepias* sp.
Milkwort	*Polygala acanthoclada*
Mountain snowberry [a]	*Symphoricarpos oreophilus*
Needle-and-thread [a]	*Stipa comata*
Nevada ephedra [a]	*Ephedra nevadensis*
Nevada bluegrass	*Poa nevadensis*
Nuttall's saltbush	*Atriplex nuttallii*
Orange globe mallow [a]	*Sphaeralcea munroana*
Peppergrass [a]	*Lepidium perfoliatum*
Pickleweed [a]	*Allenrolfea occidentalis*
Pinyon pine [a]	*Pinus monophylla*
Prickly lettuce [a]	*Lactuca serriola*
Prickly pear [a]	*Opuntia polyacantha*
Pussytoes	*Antennaria* sp.
Red three-awn	*Aristida longiseta*
Rock goldenrod	*Petradoria pumila*
Rockcress [a]	*Arabis divaricarpa*
Rocky Mountain bee plant [a]	*Cleome serrulata*
Rush [a]	*Juncus* sp.
Russian thistle	*Salsola kali*

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Common Name	Species Name
Salina wild rye [a]	*Elymus salinus*
Salsify	*Tragopogon dubius*
Salt grass	*Distichlis stricta*
Sand dropseed [a]	*Sporobolus cryptandrus*
Sandberg bluegrass	*Poa sandbergii*
Scarlet globe mallow [a]	*Sphaeralcea coccinea*
Sedge [a]	*Carex* sp.
Seepweed [a]	*Suaeda torreyana*
Serviceberry	*Amelanchier alnifolia*
Shadscale	*Atriplex confertifolia*
Slender rushpink	*Lygodesmia juncea*
Spineless horsebrush	*Tetradymia canescens*
Spiny rushpink	*Lygodesmia spinosa*
Spiny horsebrush	*Tetradymia spinosa*
Spiny hop-sage	*Grayia spinosa*
Squaw current [a]	*Ribes cereum*
Squaw-bush [a]	*Rhus trilobata*
Squirrel-tail [a]	*Sitanion hystrix*
Tall wheat grass [a]	*Agropyron elongatum*
Tansy mustard [a]	*Descurainia pinnata*
Tassel flower	*Brickellia microphyla*
Thistle [a]	*Cirsium* sp.
Three-toothed saltbush	*Atriplex gardneri*
Toadflax [a]	*Comandra umbellata*
Tumbling mustard [a]	*Sisymbrium altissimum*
Tumbling pigweed [a]	*Amaranthus albus*
Utah juniper [a]	*Juniperus osteosperma*
Weedy milk vetch	*Astragalus miser*
Western wheat grass [a]	*Agropyron smithii*
Western wallflower	*Erysimum asperum*
White stoneseed	*Lithospermum arvense*
Winter-fat	*Ceratoides lanata*
Wire-lettuce [a]	*Stephanomeria exigua*
Woolly milk vetch	*Astragalus mollissimus*
Yarrow	*Achillea millefolium*
Yellow stoneseed	*Lithospermum ruderale*

Note: After Workman et al. (1992a) and C. Fowler (1986).
[a] Common food sources for traditional Great Basin Native Americans.

Table 2. Principal Mammal Species of the UTTR and Surrounding Region

Common Name	Species Name
Antelope ground squirrel	*Ammospermophilus leucurus*
Badger	*Taxidea taxus*
Big brown bat	*Eptesicus fuscus*
Big myotis	*Myotis lucifugus*
Black-tailed jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Botta's pocket gopher	*Thomomys bottae*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Bushy-tailed wood rat	*Neotoma cinerea*
Canyon mouse	*Peromyscus crinitus*
Chisel-toothed kangaroo rat	*Dipodomys microps*
Cliff chipmunk	*Eutamias dorsalis*
Coyote	*Canis latrans*
Dark kangaroo mouse	*Microdipodops megacephalus*
Deer mouse	*Peromyscus maniculatus*
Desert cottontail	*Sylvilagus audubonii*
Desert wood rat	*Neotoma lepida*
Ermine	*Mustela erminea*
Golden-mantled ground squirrel	*Spermophilus lateralis*
Great Basin pocket mouse	*Perognathus parvus*
Hairy-winged myotis	*Myotis volans*
Hoary bat	*Lasiurus cinereus*
Kit fox	*Vulpes macrotis*
Least chipmunk	*Eutamias minimus*
Long-eared myotis	*Myotis evotis*
Long-tailed pocket mouse	*Perognathus formosus*
Long-tailed vole	*Microtus longicaudus*
Long-tailed weasel	*Mustela frenata*
Meadow vole	*Microtus pennsylvanicus*
Montane vole	*Microtus montanus*
Mountain lion	*Felis concolor*
Mule deer	*Odocoileus hemionus*
Northern grasshopper mouse	*Onychomys leucogaster*
Northern pocket gopher	*Thomomys talpoides*
Ord's kangaroo rat	*Dipodomys ordii*
Pinyon mouse	*Peromyscus truei*
Porcupine	*Erethizon dorsatum*
Pronghorn	*Antelocapra americana*
Pygmy cottontail	*Sylvilagus idahoensis*

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Common Name	Species Name
Ring-tailed cat	*Bassariscus astutus*
Rock squirrel	*Spermophilus variegatus*
Sagebrush vole	*Lagurus curtatus*
Silver-haired bat	*Lasionycteris noctivagans*
Small-footed myotis	*Myotis subulatus*
Spotted skunk	*Spilogale putorius*
Striped skunk	*Mephitis mephitis*
Townsend's ground squirrel	*Spermophilus townsendii*
Uinta chipmunk	*Eutamias umbrinus*
Uinta ground squirrel	*Spermophilus armatus*
Vagrant shrew	*Sorex vagrans*
Water shrew	*Sorex palustris*
Western harvest mouse	*Reithrodontomys megalotis*
Western jumping mouse	*Zapus princeps*
Western pipistrelle	*Pipistrellus hesperus*
White-tailed jackrabbit	*Lepus townsendii*
Yellow-bellied marmot	*Marmota flaviventris*

Note: After Workman et al. (1992a).

Table 3. Principal Fish, Reptile, and Amphibian Species of the UTTR and Surrounding Region

Common Name	Species Name
Fish	
Bonytail chub	*Gila elegans*
Colorado squawfish	*Ptychocheilus lucius*
Humpback chub	*Gila cypha*
June sucker	*Chasmistes liorus mictus*
Lahontan cutthroat trout	*Salmo clarki henshawi*
Least chub	*Iotichthys phlegethonius*
Leatherside chub	*Gila copei*
Longnose dace	*Rhinichthys cataractae*
Razorback sucker	*Xyrauchen texanus*
Virgin River bonytail chub	*Gila robustus seminuda*
Virgin River spinedace	*Lepidomeda mollispinus*
Woundfin	*Plagopterus argentissimus*
Reptiles	
California kingsnake	*Lampropeltis getulus californiae*
Chuckwalla	*Sauromalus obesus*
Desert night lizard	*Xantusia vigilis*
Desert glossy snake	*Arizona elegans*
Desert tortoise	*Gopherus agassizi*

Common Name	Species Name
Desert iguana	*Dipsosaurus dorsalis*
Gila monster	*Heloderma suspectum*
Great Plains rat snake	*Elaphe guttata emoryi*
Many-lined skink	*Eumeces multivirgatus*
Mojave rattlesnake	*Crotalus scutulatus scutulatus*
Mojave patchnose snake	*Salvadora hexalepis mojavensis*
Plateau whiptail	*Cnemidophorus velox*
Sidewinder	*Crotalus cerastes cerastes*
Sonoran lyre snake	*Trimorphodon biscutatus lambda*
Southwestern speckled rattlesnake	*Crotalus mitchelli pyrrhus*
Utah banded gecko	*Coleonyx variegatus utahensis*
Utah blackhead snake	*Tantilla planiceps utahensis*
Utah blind snake	*Leptotyphlops humilis utahensis*
Utah mountain kingsnake	*Lampropeltis pyromelana infralabialis*
Utah milk snake	*Lampropeltis triangulum taylori*
Western smooth green snake	*Opheodrys vernalis blanchardi*
Zebratail lizard	*Callisaurus draconoides*
Amphibians	
Arizona toad	*Bufo microscaphous microscaphous*
Pacific tree frog	*Hyla regilla*
Relict leopard frog	*Rana onca*
Western spotted frog	*Rana pretiosa pretiosa*

Note: After Workman et al. (1992a).

Table 4. Principal Avian Species of the UTTR and Surrounding Region

Common Name	Species Name
American bittern	*Botaurus lentiginosus*
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*
American robin	*Turdus migratorius*
Ash-throated flycatcher	*Myiarchus cinerascens*
Bald eagle	*Haliaeetus leucocephalus*
Barn swallow	*Hirundo rustica*
Black tern	*Chlidonias niger*
Black-bellied plover	*Pluvialis squatarola*
Black-billed magpie	*Pica pica*
Black-capped chickadee	*Parus atricapillus*
Black-throated gray warbler	*Dendroica nigrescens*

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Common Name	Species Name
Black-throated sparrow	*Amphispiza bilineata*
Blue-gray gnatcatcher	*Polioptila caerulea*
Bobolink	*Dolichonyx oryzivorus*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewer's sparrow	*Spizella breweri*
Burrowing owl	*Athene cunicularia*
Bushtit	*Psaltriparus minimus*
California gull	*Larus californicus*
California quail	*Callipepla californica*
Canada goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Canyon wren	*Catherpes mexicanus*
Cassin's finch	*Carpodacus cassinii*
Chipping sparrow	*Spizella passerina*
Chukar	*Alectoris chukar*
Cinnamon teal	*Anas cyanoptera*
Clark's nutcracker	*Nucifraga columbiana*
Cliff swallow	*Hirundo pyrrhonota*
Common loon	*Gavia immer*
Common nighthawk	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Common raven	*Corvus corax*
Common snipe	*Gallinago gallinago*
Common yellowthroat	*Geothlypis trichas*
Cooper's hawk	*Accipiter cooperii*
Dusky flycatcher	*Empidonax oberholseri*
European starling	*Sturnus vulgaris*
Ferruginous hawk	*Buteo regalis*
Forster's tern	*Sterna forsteri*
Franklin's gull	*Larus pipixcan*
Gadwall	*Anas strepera*
Golden eagle	*Aquila chrysaetos*
Gray catbird	*Dumetella carolinensis*
Great blue heron	*Ardea herodias*
Great horned owl	*Bubo virginianus*
Great-tailed grackle	*Quiscalus mexicanus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
House wren	*Troglodytes aedon*
Killdeer	*Charadrius vociferus*

Common Name	Species Name
Lark bunting	*Calamospiza melanocorys*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passerina amoena*
Lewis's woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovicianus*
Long-eared owl	*Asio otus*
MacGillivray's warbler	*Oporornis tolmiei*
Mallard	*Anas platyrhynchos*
Marsh wren	*Cistothorus palustris*
Mountain bluebird	*Sialia currucoides*
Mourning dove	*Zenaida macroura*
Northern flicker	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Northern oriole	*Icterus galbula*
Northern pintail	*Anas acuta*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Northern shrike	*Lanius excubitor*
Northern waterthrush	*Seiurus noveboracensis*
Orange-crowned warbler	*Vermivora celata*
Peregrine falcon	*Falco peregrinus*
Pine siskin	*Carduelis pinus*
Pinyon jay	*Gymnorhinus cyanocephalus*
Plain titmouse	*Parus inornatus*
Prairie falcon	*Falco mexicanus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Ring-necked pheasant	*Phasianus colchicus*
Rock dove	*Columba livia*
Rock wren	*Salpinctes obsoletus*
Rough-legged hawk	*Buteo lagopus*
Sage grouse	*Centrocercus urophasianus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Sandhill crane	*Grus canadensis*
Savannah sparrow	*Passerculus sandwichensis*
Say's phoebe	*Sayornis saya*
Scrub jay	*Aphelocoma coerulescens*
Sharp-shinned hawk	*Accipiter striatus*
Short-eared owl	*Asio flammeus*

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Common Name	Species Name
Sora rail	*Porzana carolina*
Spotted sandpiper	*Actitis macularia*
Swainson's hawk	*Buteo swainsoni*
Townsend's solitaire	*Myadestes townsendi*
Townsend's warbler	*Dendroica townsendi*
Turkey vulture	*Cathartes aura*
Vesper sparrow	*Pooecetes gramineus*
Violet-green swallow	*Tachycineta thalassina*
Warbling vireo	*Vireo gilvus*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*
Western tanager	*Piranga ludoviciana*
Western wood-pewee	*Contopus sordidulus*
White-crowned sparrow	*Zonotrichia leucophrys*
White-faced ibis	*Plegadis chihi*
Willow flycatcher	*Empidonax traillii*
Wilson's phalarope	*Phalaropus tricolor*
Wilson's warbler	*Wilsonia pusilla*
Yellow-breasted chat	*Icteria virens*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow-rumped warbler	*Dendroica coronata*
Yellow warbler	*Dendroica petechia*

Note: After Workman et al. (1992a) and Dames and Moore (1996).

The Relationship of Archaeological Resources to Landforms

In northwestern Utah, archaeological resources tend to occur in relationship to landforms that provide relatively easy passage through difficult terrain, near springs or other permanent water sources, and in areas where critical food resources were readily available. Access to a variety of environmental zones, generally defined by differing elevations, also appears to be a significant criterion in site location. The lower slopes and bases of the various mountain ranges within the UTTR would seem to be primary localities for archaeological resources. Mountain ranges with sedimentary-rock exposures are likely to yield caves and rockshelters, as has been documented in the Lakeside and Grassy Mountains (Workman et al. 1992a, 1992b, 1993a, 1993b). The Newfoundland Mountains, which also have sedimentary (limestone) strata, are likely to yield these site types.

CHAPTER 3

Research Design

Human Culture in the Past: Modeling Process and Behavior

Archaeologists not only study past lifeways, but seek also to explain past human behavior. Because archaeology is a diachronic science, and has as a primary concern the evolution of our species, the identification and explanation of cultural and behavioral changes in the past are of paramount importance to archaeologists. As Reid (1978) has pointed out, archaeologists begin by asking the basic questions of who, what, where, and when before turning to the more critical questions of how and why. According to some theoreticians, the past cannot be accurately recaptured because there is not just one past, but many, and our own experiences and backgrounds bias our interactions with data. Therefore, these "pasts" are essentially unknowable, because we cannot adequately filter out our biases to arrive at a requisite level of objectivity; the best archaeologists can hope to accomplish is to "tell stories" about the past (Hodder 1991). Artifacts and cultural features provide the objects of study for archaeologists, whose texts written from such study offer one representation (of which there are many) of the past (Shanks and Tilley 1987). Other archaeologists, oriented toward a behavioral approach, contend that the past is knowable, and that sufficient levels of objectivity can be achieved through the use of rigorous methods and by paying meticulous attention to every step of the research process. In this view, archaeologists must distinguish between archaeological context and systemic contexts in the study of material culture by understanding the formation processes, both cultural and noncultural, that create the archaeological record (Schiffer 1987). The key similarities between these two disparate schools of thought include the interaction between artifacts and environment, and artifact and archaeologist, thus underscoring the notion that archaeology is essentially a science of material culture.

A number of archaeologists, particularly Schiffer (1976), maintain that human behavior includes certain universal qualities, and that human action forms recurrent patterns in the archaeological record that can be identified and analyzed. Schiffer (1976) has long claimed that such concepts as "culture" have no analytical meaning in archaeology, that it is behavior we should study and seek to explain. Others, such as Flannery (1982), have called this assertion into question, pointing out that cultures have certain unique qualities and that critical information about the past can only be recovered by appreciating those unique qualities. These two views need not be considered as an "either/or"; both can be embraced in defining the essence of archaeological investigation. It can be stated that archaeology is a science that studies the past through its material culture to understand patterns and processes of human behavior and to understand how cultural practices shape and influence such patterns.

Research questions in modern archaeology can only be formulated meaningfully after the establishment of sound chronological information and a basic understanding of subsistence practices, settlement systems, and various aspects of cultural identity. Put another way, the development of research questions in a given archaeological context requires a fit between three factors: (1) the research topic itself; (2) the collection of data necessary to inform on the topic; and (3) the existing database of chronological, subsistence, and settlement information that determines the degree to which a topic can be refined and specified. Consequently, data requirements are critical to addressing any research question or domain. The resulting data sets, in and of themselves, describe rather than explain past human behavior.

The explanation of past human behavior and human societies is a synthetic endeavor that transforms data through the use of models or theoretical constructs based on the dynamics of complex adaptive systems. For anthropological archaeology, then, questions at the level of explanation become ethnological, rather than archaeological, in nature.

Research Themes (Historic Contexts) in Cultural Resource Management

In cultural resource management, research themes, or historic contexts, provide the analytical basis for determining the potential significance of cultural resources and, therefore, their eligibility for being included in the NRHP. It is impossible to evaluate the nature and integrity of cultural resources without the development of a research framework. The essence of research themes can be defined as follows:

> Historic contexts are those patterns, themes, or trends in history by which a specific occurrence, property, or site is understood and its meaning (and ultimately its significance) within prehistory or history is made clear. Historians, architectural historians, folklorists, archaeologists, and anthropologists use different words to describe this phenomenon such as trend, pattern, theme, or cultural affiliation, but ultimately the concept is the same.
>
> The concept of historic context is not a new one; it has been fundamental to the study of history since the 18th century and, arguably, earlier than that. Its core premise is that resources, properties, and happenings in history do not occur in a vacuum but rather are parts of larger trends or patterns [NPS 1991:7].

Significance evaluations are based upon criteria established within Title 36, Part 60, of the Code of Federal Regulations (CFR). Four criteria are described within the code, as is a general stipulation that the property be 50 years old or older. The eligibility of a property may be based on any of the criteria. Regarding the criteria, 36 CFR 60.4 states that:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and
> (a) That are associated with events that have made a significant contribution to the broad pattern of our history; or
> (b) that are associated with the lives of persons significant in our past; or
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinctions, or
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

A property determined to be eligible for listing in the NRHP is accorded the same status as a property formally included in the NRHP. This eligibility provides federal land managers with legal recourse for protecting and preserving the property.

Prehistoric Research Themes in the UTTR

Four research themes have been selected to highlight important trends in the prehistory of the UTTR and surrounding region. These are: (1) settlement and land use, (2) cultural affiliation, (3) lithic technology, and (4) the evolution of Great Basin ceramic traditions. Each is treated in turn, with a brief discussion of the nature of the research theme and pertinent data needs.

Settlement and Land Use

Understanding the ways that human societies relate to and perceive their physical surroundings and integrate their activities spatially is requisite to addressing issues of subsistence, economy, and social organization within a region. Detailed studies of settlement systems can also address issues of changes in various practices (e.g., subsistence) through time, and how such processes as interregional exchange, migration, and intraregional conflict might have affected the evolution of settlement and cultural development through time.

Data Requirements

This research theme requires the careful documentation of sites within a region, establishing a local chronology to determine contemporaneity between sites, determination of the range of activities that took place at various sites, and how sites related to each another in the regional settlement system. Careful documentation of artifact assemblages is essential for comparing sites to one another and for the determination of site function, as well as for understanding cultural relationships among the sites within a region.

Cultural Affiliation

Archaeologists working in North America perhaps now appreciate the cultural diversity of the prehistoric record more strongly than they formerly did, and have begun to recognize that variations in artifact assemblages within a site or a contemporaneous settlement system may be the result of distinct cultural or ethnic group coresidence. The is particularly true of such regions as the Southwest, where it is becoming evident that mobility was a way of life throughout the Formative period; people of differing cultural or ethnic affiliations often resided in the same communities. Regarding the Formative period in the Great Basin, it was formerly thought that a fairly homogenous culture, referred to as the Fremont, characterized the human occupation of the region. More recently, this has been called into question; some scholars now believe that a number of ethnically distinct groups inhabited the Great Basin during this time (Chapter 5). The issue of culture affiliation is important in the study of prehistory because it can be a component critical to understanding the evolution of adaptation within a region and is indicative of the diversity of ways in which human societies extract resources from, and arrange themselves spatially within, their environments.

Data Requirements

Careful documentation of artifact assemblages from sites is important. Distinct cultural groups are often recognizable through distinct technologies, tool types, ceramic designs, architectural styles, definition of ritual space, and subsistence practices.

Lithic Technology

This research theme is important in the study of Great Basin prehistory because stone tools dominate the artifact assemblages of sites for most of the period of prehistoric occupation. Studies of lithic technology not only document changes in tool types, tool functions, and tool designs through time, but also provide insights into changes in raw-material preferences and procurement strategies. From these observations, it is possible to address issues of subsistence changes through time and across space, and changes in the tool kit—such as the adoption of the bow and arrow and abandonment of the spear or atlatl. In addition, variations across space in lithic technology can provide insights into cultural or ethnic diversity and affiliation.

Data Requirements

Studies of lithic technology require documentation of tools, preforms, cores, and debitage from sites, as well as how manufacturing techniques and tool types vary through time and across space. Information about raw-material sources, both local and nonlocal, is critical as well.

The Evolution of Great Basin Ceramic Traditions

In the history of Great Basin archaeology, less emphasis may have been placed on Great Basin ceramics than on lithics from the area. This may be due in part to the fact that, as stated above, stone tools tend to dominate the assemblages of most known Great Basin prehistoric sites, but also because Great Basin ceramics lack the diversity and some of the aesthetic qualities of southwestern ceramics, perhaps making them, in the eyes of archaeologists, not quite as interesting to study. In some senses, Great Basin ceramics have been thought to be largely derivative of those in the Southwest. Nevertheless, there is much to be learned from studying Great Basin ceramics. The time of the initial appearance of ceramics in the different regions of the Great Basin varies considerably. The influences on the development of ceramics, deriving from the Southwest, the Numic spread, the Plains, or elsewhere, are not well understood. The adoption of ceramics is clearly an important event, as it changed patterns of storage, water transport, and economic exchange.

Data Requirements

Documentation of ceramic types, the use of clays and other materials for temper, surface treatment, and distribution of types through space and time all contribute to enhancing our knowledge of the evolution of Great Basin ceramic traditions. Determining where certain types were manufactured, based on mineralogical, chemical, or petrographic characteristics, is also critical to addressing this research theme.

Historical-Period Research Themes in the UTTR

Seven research themes have been selected to highlight important trends in the history of the UTTR and surrounding region. These include: (1) ranching, (2) mining, (3) transportation, (4) Native American–Euroamerican interactions, (5) government campaigns and explorations, (6) Mormon settlement, and (7) World War II–era use of the project area. Each is treated in turn, with a brief discussion of the nature of the research theme and pertinent archaeological data needs. Archival and documentary sources are, of course, also of primary importance when investigating the historical-period archaeological resources of the UTTR.

Ranching

Cattle ranching was a major economic industry in both Box Elder County and neighboring Elko County, Nevada, and was, therefore, highly influential on the Euroamerican settling of this region. For many years, these two counties were among the leaders in Great Basin beef production (Hulse 1991). Railroad accessibility promoted the initial growth of the industry in the late nineteenth and early twentieth centuries.

Data Requirements

Archaeological data classes attendant upon this research theme include features and artifacts associated with homesteads and ranches.

Mining

Mining was not as prosperous or as prominent a historical-period industry in the region as was livestock ranching. Gold mining occurred in Elko County, Nevada, but the strikes and yields there did not compare in quantity to the lodes discovered in such areas as Eureka, White Pines, and Pioche (Hulse 1991). In addition, silver and gold ores mined in the late 1880s from the mountains surrounding the UTTR were of a poor grade, and yields were low. Silver was mined at the north end of Wildcat Mountain in 1910, and shortly thereafter potash mining became extensive around Wendover (Dames and Moore 1996).

Data Requirements

Archaeological data classes relevant to this research theme include the remains of mines, cairns, homesteads, mining shacks, drill holes, and borings, as well as various equipment and tools used in nineteenth-century mining.

Transportation

Transportation is a particularly important historical-period research theme for the UTTR, as the discovery of an overland route from east of the Great Salt Lake to the Pacific Coast was sought for many years. Historically significant wagon trains—such as that of the ill-fated Donner-Reed party—moved through the region, and were followed by the railroads. The nation's first transcontinental railroad was completed in 1869 with the joining of the Central Pacific and Union Pacific Railroads just north of the Great Salt Lake. The railroad linked the nation together, and made the UTTR region accessible from both east and west. The Lincoln Highway, the first transcontinental highway, was built late in 1919 and used for approximately 10 years; it crossed Dugway Proving Ground just to the south of the UTTR.

Data Requirements

Archaeological data classes attendant upon this research theme include the remains of trails, homesteads, refuse scatters, and camps along the trails. Other relevant data include those related to material culture and camps associated with the construction of the early railroads and early highways in the region.

Native American–Euroamerican Interactions

The nature of Native American–Euroamerican interactions in any given region of the United States has generally been culled from accounts by settlers, explorers, soldiers, or priests. More recently, contact-period archaeology has become a domain studied more intensively, and this undertaking, coupled with early accounts and histories, has shed much new light on the topic. In addition, later historical-period interactions between Native Americans and Euroamericans have also become of increasing interest to archaeologists in recent years. Much of this has to do with increased interaction between archaeologists and Native Americans, in large part promoted by new laws, but also by recent theoretical developments and concerns in American archaeology and the growth of historical archaeology in the United States.

Data Requirements

Archaeological data needs important for this research theme include settlements containing both Euroamerican and Native American material culture in association with one another. Also important is evidence of conflict between the two groups at either Euroamerican or Native American settlements, and changes in Native American settlement patterns caused by Euroamerican incursions.

Government Campaigns and Exploration

This research theme is closely related to the theme of transportation and also focuses on the economic effects that government campaigns had on the region. In addition, it relates closely to the theme of Native American–Euroamerican interactions, as the establishment of the Pony Express in 1860 greatly impinged upon the territory and resources of native groups such as the Gosiute and Shoshone, creating conflicts between Native Americans and Euroamerican settlers. In 1849, the U.S. government began sponsoring campaigns of exploration in the Great Salt Lake region. The focus of many of these early expeditions, such as those led by Stansbury in 1849 and Simpson in 1859, was to establish wagon routes to various points in the West for economic purposes.

Data Requirements

Archaeological data needs attendant upon this research theme include settlements containing material culture relating to government campaigns and early military operation in the UTTR. Additional data needs include the identification of wagon trails used for such campaigns, and the remains of outposts, camps, pony express stations, and related settlements.

Mormon Settlement

According to Workman et al. (1993b), the members of the Church of Jesus Christ of Latter-day Saints were the first Euroamericans to journey to the Great Basin with the intent of settling there. They settled near the Great Salt Lake in 1847 and found the region to their liking for two reasons: first, because the region was within a remote portion of Mexican territory, and they felt that here they could freely practice their religion without being harassed, as they had been in Illinois and Missouri (Malouf and Findlay 1986); second, because they believed the region was a buffer zone between the Ute and the Shoshone—by settling here they would not create conflicts between themselves and Great Basin Native Americans. Mormon settlement, of course, had tremendous effects on the economy of the region through time, as well as on Native American–Euroamerican interactions.

Data Requirements

Archaeological data needs for this research theme include settlements containing Mormon material culture or material culture thought to be associated with Mormon occupation.

World War II–Era Use of the Region

The two ranges that presently comprise the UTTR were withdrawn from public use by President Franklin D. Roosevelt in 1940 and 1941. In response to the Japanese bombing of Pearl Harbor, the ranges became an air depot and, along with Dugway Proving Ground to the south, became sites for various munitions storing and testing projects. According to Dames and Moore (1996), this aspect of the region's history is the least well researched, and no archaeological sites related to World War II–era activity on the UTTR have been identified.

Data Requirements

Archaeological data needs relevant to this research theme include buildings and depots constructed during World War II on the UTTR. Material culture associated with the range of activities and duties of personnel stationed on the UTTR during World War II would also be relevant.

CHAPTER 4

Paleontology of the UTTR and Surrounding Region

Relatively little paleontological research has been conducted within the boundaries of the UTTR. This chapter focuses on the paleontological research that has been undertaken in mountainous areas near, as well as on, the UTTR, including the Stansbury, Silver Island, Newfoundland, Hogup, Terrace, Grassy, Lakeside, Cedar, and Pilot ranges, as well as the Lucin mining district and the Gold Hill area. At least 30 studies contribute to the knowledge of the invertebrate paleontology of these ranges and northwestern Utah in general (Arnold 1956; Bentley 1958; Blue 1960; Brooks 1954; Carpenter 1981; Chamberlain 1964, 1969; Cramer 1954; Doelling 1964; Jordan 1979; Lambert 1941; Maurer 1970; Nolan 1930; Palmer 1970; Paull 1982; Petersen 1969; Rich 1967; Rigby 1959; Roscoe 1963; Sadlick 1965; Setty 1963; Sheehan 1971; Steele 1960; Stifel 1964; Teichert 1958; Tint 1963; Walcott 1908; Wright 1961; Zabriskie 1970; Zeller 1957). Paleontological resources are present from the Cambrian to the Quaternary (Figure 6). The discussion presented here is organized chronologically, with accompanying tables that identify the geological formation, locality, and fossil types defined. The earliest known fossils from the mountain ranges and surrounding regions of northwestern Utah date to the mid-Cambrian, and it is with this era that the discussion begins.

Cambrian

The Cambrian period dates from approximately 540 to 505 million years ago (mya) (Hintze 1988). It was during this time that an explosion in the diversity and types of life-forms occurred, creating a multitude of new species. The earliest fossil finds from the mountain ranges of northwestern Utah derive from mid-Cambrian shales in the Stansbury range, where specimens of *Obolus* and *Linnarssonella* were identified (Walcott 1908). Additional Cambrian-aged fossils have been found in the Silver Island Mountains (Bentley 1958), the Lakeside Mountains (Doelling 1964), the Stansbury range (Arnold 1956; Lambert 1941; Teichert 1958), and the Gold Hill area (Nolan 1930). Given the fact that intercontinental seas covered Utah during this era, trilobites are important guide-fossils for the Cambrian throughout much of Utah. Table 5 provides a summary of studies on the Cambrian formations of northwestern Utah.

Ordovician

The Ordovician period spans 70 million years, from approximately 505 to 435 mya. Western Utah may have the most diverse Ordovician fossil assemblage in the world. According to Hintze (1988), inter-continental seas continued to cover Utah, and Ordovician guide-fossils are dominated by trilobites,

Era	Period		Epoch	Typical Utah rocks, fossils and events
CENOZOIC	Quaternary		Holocene	
			Pleistocene	
	Tertiary	Neogene	—2— Pliocene	
			—5— Miocene	
		Paleogene	—24— Oligocene	
			—37— Eocene	
			—58— Paleocene	Primitive mammals in Uinta Basin
MESOZOIC	—66— Cretaceous			Dinosaurs in Cedar Mountain formation near Moab
	—141— Jurassic			
	—208— Triassic			
PALEOZOIC	—245— Permian			
	Carboniferous	—290— Pennsylvanian		Very thick accumulation of sediments in the Oquirrh Basin
		—320— Mississippian		Crinoid columnals, brachiopods, snails, corals, and other invertebrate fossils are common in the Redwall and equivalent limestones
	—360— Devonian			Primitive fish, corals, brachiopods, conodonts and stromatoporoids
	—408— Silurian			Corals and brachiopods in the Laketown Dolomite
	—435— Ordovician			
	—505— Cambrian			
PRECAMBRIAN	—540— Late Proterozoic			
	—900— Middle Proterozoic			
	—1600— Early Proterozoic			
	—2500— Archean			

Millions of years ago: 0, 40, 80, 120, 160, 200, 240, 280, 320, 360, 400, 440, 480, 520, 560, 900, 1600, 2500, 3000

Figure 6. Geological timetable with comments on the paleontology of Utah (redrawn from Hintze 1988:inside front cover).

Table 5. Fossils Identified from Cambrian Formations in Northwestern Utah

Formation	Locality	Fossil
Abercrombie	Gold Hill area	*Bathyuriscus, Zacanthoides, Obolus, Linguella, Hyolithes, Elrathia, Paterina, Micromita*
Chisholm	Lakeside Mountains	*Glossopleura, Zacanthoides*
Marjum	Lakeside Mountains	*Bolaspidella*
Middle Cambrian shales	Stansbury Range	*Obolus, Linnarssonella*
Nounan–St. Charles	Lakeside Mountains	protozoa (?)
Opex	Stansbury Range	*Housia*
Ophir Group	Stansbury Range	*Ptychoparia*
Ophir Group	Stansbury Range	*Glossopleura, Iphidella*
Orr	Silver Island Range	*Pseudagnostus, Kormagnostus, Tricrepicephalus, Crepicephalus, Kingstonia, Genevievella, Maryvillia, Syspacheilus, Holcacephalus*
Swasey Limestone	Lakeside Mountains	*Prototreta*
Whirlwind	Lakeside Mountains	trilobites

Note: After Arnold (1956), Bentley (1958), Doelling (1964), Lambert (1941), Nolan (1930), Teichert (1958), and Walcott (1908).

with conodonts, graptolites, brachiopods, cephalopods, and other marine invertebrates also being prominent. Limestones, shales, quartzites, and dolomites are the most common formations from this era. Table 6 presents Ordovician fossil finds from northwestern Utah.

Silurian

The Silurian period spanned approximately 27 million years, from 435 to 408 mya; as such, it is the shortest of the Paleozoic periods. Dolomite is the only Silurian lithology in Utah, and much of it is has been assigned to one formation, the Laketown Dolomite. A major extinction episode occurred at the Ordovician-Silurian boundary; it has been referred to as one of the "Big Five" extinctions (see Raup 1991). Much of the marine invertebrate fauna was wiped out, while others, such as conodonts and graptolites, are extremely scarce in the Silurian of Utah. Corals and brachiopods are the among the most representative fossils in the Laketown Dolomite. Four paleontological studies (Doelling 1964; Nolan 1930; Sheehan 1971; Teichert 1958) report Silurian fossils from northwestern Utah. These are summarized in Table 7.

Table 6. Fossils Identified from Ordovician Formations of Northwestern Utah

Formation	Locality	Fossil
Ely Springs Dolomite	Silver Island Range	encrinites, abraded shells
Fish Haven Dolomite	Stansbury Range	*Halysites, Streptelasma*
Fish Haven Dolomite	Lakeside Mountains	stromatolites, *Halysites, Streptelasma*
Lehman	Lucin area	*Leperditia, Cybelopsis, Eleutherocentrus, Helicotoma*
Swan Peak Quartzite	Lakeside Mountains	*Orthambonites, Anomalorthis, Pseudomera, Receptaculites, Eleutherocentrus*
Unidentified strata	Stansbury Range	*Receptaculites, Nevadocoelia, Calycocoelia, Streptoselen, Anthaspidella, Hesperocoelia, Patellispongia, Archaeoscyphia, Zittelella, Eospongia, Hindia, Hudsonospongia*

Note: After Arnold (1956), Blue (1960), Carpenter (1981), Doelling (1964), and Rigby (1959).

Table 7. Fossils Identified in Silurian Formations of Northwestern Utah

Formation	Locality	Fossil
Laketown Dolomite	Gold Hill area	*Virgiana,* corals
Laketown Dolomite	Stansbury Range	*Favosites, Halysites, Eridophyllum*
Laketown Dolomite	Lakeside Mountains	*Platystrophia, Virgiana, Favosites, Halysites (?),* corals, crinoid stems, pentamerid brachiopods
Unnamed	Silver Island Range	*Eoplectodonta, Leptagonia, Leptostrophia, Ferganella, Ancillotechia, Atrypa, Atrypina, Janius, Plectatrypa, Cymbidium (?), Mezounia (?), Conchidium (?),* strophomenides, pentamerids, davidsoniaces

Note: After Doelling (1964), Nolan (1930), Sheehan (1971), Teichert (1958).

Devonian

The Devonian period spanned approximately 50 million years, from 408 to 360 mya. Devonian deposits are particularly widespread in western Utah, and more diverse than Ordovician or Silurian formations. Characteristic Devonian lithologies include dolomites, limestones, sandstones, breccias, and shales. Fossils are dominated by conodonts, which have been used to subdivide the Devonian into subperiods (Hintze 1988). Brachiopods, corals, stromatoporids, and the first primitive fish are also in evidence. Four paleontological studies (Blue 1960; Brooks 1954; Nolan 1930; Palmer 1970) have identified Devonian fossils in northwestern Utah. Table 8 summarizes these findings.

Table 8. Fossils Identified from Devonian Formations of Northwestern Utah

Formation	Locality	Fossil
Fitchville	Stansbury Range	*Syringopora, Turbophyllum, Lithostrotion, Caninia, Spirifer, Straparollus*
Guilmette	Lucin area	*Heliotes, Favosites, Atrypa, Syringopora, Prismatophyllum, Stringocephalus, Stromatopora, Cladopora, Spirifer, Martinia, Amphipora, Cyrtospirifer*
Guilmette	Gold Hill area	*Cladopora, Striatopora, Favosites, Syringopora, Stringocephalus, Atrypa, Martinia, Pycinodesma, Platyschisma (?), Clyclonema (?)*
Laketown	Stansbury Range	*Halysites, Favosites, Columnaria*
Sevy Dolomite	Gold Hill area	crinoid stems, gastropods
Simonson Dolomite	Lucin area	*Cladopora, Atrypa, Thammopora, Amphipora, Stringocephalus*
Simonson Dolomite	Gold Hill area	*Favosites, Bellerophon, Martinia, Stringocephalus, Atrypa*
Stansbury	Stansbury Range	fossiliferous limestone beds

Note: After Blue (1960), Brooks (1954), Nolan (1930), and Palmer (1970).

Carboniferous

Mississippian

The Mississippian period lasted for approximately 40 million years, from 360 to 320 mya. The deposits and geological history of the Mississippian are much more complex and diverse than earlier Paleozoic periods. Of particular significance in western Utah is a feature, the Oquirrh Basin, which is a depositional center where as much as 7,000 feet of Mississippian rocks were deposited (Hintze 1988). According to Hintze:

> Mississippian strata are more fossiliferous than most other Utah rocks. Traditionally, the Mississippian has been zoned on endothyrid and fusulinid formanifera, corals, brachiopods, and ammonoids. But recently conodonts have proved to be very useful, enabling excellent time resolution [Hintze 1988:29].

Fourteen paleontological studies in northwestern Utah have provided information about fossils from Mississippian deposits (Arnold 1956; Blue 1960; Chamberlain 1964, 1969; Cramer 1954; Doelling 1964; Maurer 1970; Nolan 1930; Palmer 1970; Petersen 1969; Sadlick 1965; Teichert 1958; Tint 1963; Zeller 1957). Table 9 provides a summary of the findings of these studies.

Table 9. Fossils Identified from Mississippian Formations of Northwestern Utah

Formation	Locality	Fossil
Chainman	Silver Island Mountains	*Rhipidomella, Caninia, Spirifer, Sartenaeria*
Chainman	Lucin area	*Cravenoceras, Eumophoceras*
Deseret	Stansbury Range	*Caninia, Triplophyllites*
Deseret Limestone	Lakeside Mountains	cup corals, stromatoporids, crinoid stems, gastropods, bryozoans
Deseret	Stansbury Island	rugose corals, spiriferid brachiopods
Deseret Limestone	Stansbury Range	*Dzhaprakoceras, Beyrichoceras,* nautiloids, brachiopods, pelecypods
Great Blue Limestone	Lakeside Mountains	*Faberophyllum, Orthotetes, Chonetes, Loxonema, Echinoconchus,* spiriferid brachiopods, cup corals, horn corals, bryozoans, brachiopods, crinoids
Great Blue Limestone	Cedar Mountains	*Lithostrotion, Ovatia, Triplophyllites, Striatifera, Torynifera, Faberophyllum, Spirifer, Endothyra, Plectogyra, Hyperammina, Tetrataxis, Brachythyris (?)*
Great Blue Limestone, Manning Canyon Shale, Chainman	Tooele County	*Proetus, Phillipsia, Paladin, Sevillia, Richterella, Ameura, Ditomopyge, Thigriffides (?)*
Great Blue	Stansbury Range	*Servillia*
Great Blue Limestone	Stansbury Range	*Endothyra, Orbias, Aulopora, Hederella, Fenestrelina, Fenestella, Polypora, Hemitrypa, Rhombopora, Sulcoretepora, Linoproductus, Pugnoides, Spirifer, Nucula, Composita, Leptodesma, Archaeocydaris, Lithostrotionella, Caninophyllum (?),* corals, bryozoans, crinoids
Great Blue Limestone	Stansbury Range	*Faberophyllum, Ekvasophyllum*
Humbug	Stansbury Range	*Lithostrotion*
Humbug	Stansbury Island	crinoid ossicles
Humbug	Lakeside Mountains	corals
Joana Limestone	Cedar Mountains	*Granuliferella, Paramillerella*
Manning Canyon Shale	Stansbury Range	*Spirifer, Dictyoclostus, Diaphragmus, Myalina, Composita, Cleiothyridina, Derbya (?)*
Manning Canyon	Cedar Mountains	*Cravenoceras, Eumophoceras, Leiorhynchus, Mooreoceras, Disciteroceras (?), Bactrites (?)*

Formation	Locality	Fossil
Manning Canyon Limestone, Great Blue Limestone, Humbug, Pine Canyon	Stansbury Range	*Paramillerella, Clavulinoides, Endothyra, Granuliferella, Bathysiphon, Textularia, Rhabdammina, Hyperammina, Astrorhiza, Tetrataxis, Reophax, Estheria, Bairdia, Glyptopleura, Monceratina, Bairdocypris, Pontocypris, Cytherella, Paraparchites, Bythocypris, Anematina, Girtyspira, Liospira, Isonema, Elasmonema, Composita*
Ochre Mountain	Stansbury Range	*Caninophyllum, Ekvasophyllum, Dibunophyllum, Lithostrotion*
Ochre Mountain	Gold Hill area	*Caninia, Rhopolosma*
Unnamed	Stansbury Range	*Syringopora, Composita, Brachythyris, Straparollus, Triplophyllites,* crinoids, cup corals

Note: After Arnold (1956), Blue (1960), Chamberlain (1964, 1969), Cramer (1954), Doelling (1964), Maurer (1970), Nolan (1930), Palmer (1970), Petersen (1969), Sadlick (1965), Teichert (1958), Tint (1963), and Zeller (1957).

Pennsylvanian-Permian

The Pennsylvanian period spanned about 30 million years, from approximately 320 to 290 mya; it is one of the briefest periods of the Paleozoic. It is during this time in northwestern Utah that the deposition of the Oquirrh Basin reaches its peak, and this is the defining formation for the era in northwestern Utah. Pennsylvanian strata more than 3 miles thick occur in the Oquirrh Basin Formation, and this has been subdivided into a number of series (Hintze 1988). Limestones and sandstones dominate the lithology of this formation. It is interesting to note that another unusual, dominant feature, the Paradox Basin, occurs at this time in southeastern Utah, although its lithology and depositional history are very distinct from the Oquirrh Basin. The Pennsylvanian-Permian boundary is not well defined throughout much of Utah. The Permian, which dates from approximately 290 to 245 mya, is well represented in Utah by early Permian formations, but much less so by later Permian deposits. Because the formations of these eras in western Utah are dominated by sedimentary deposits of marine origin, fossiliferous deposits are common. For both eras, conodonts are critical guide fossils, as are as crinoids, brachiopods, and bryozoans.

Thirteen studies in northwestern Utah have identified fossils of Pennsylvanian or Permian age (Blue 1960; Chamberlain 1969; Doelling 1964; Jordan 1979; Lambert 1941; Maurer 1970; Nolan 1930; Rich 1967; Sadlick 1965; Steele 1960; Teichert 1958; Wright 1961; Zabriskie 1970). The results of these studies are summarized in Table 10.

Triassic, Jurassic, and Cretaceous

In comparison to the rather abundant fossil record of the Paleozoic, very little evidence for Mesozoic-era life has been identified in northwestern Utah. Dinosaur fossils are evident at the end of the Triassic in the southwestern corner of Utah, but none have been identified in northwestern Utah. Our literature search

Table 10. Fossils Identified from Pennsylvanian-Permian Formations of Northwestern Utah

Formation	Locality	Fossils
Ely	Tooele County	*Donezella, Komia, Dvinella*
Ely Limestone	Cedar Mountains	*Fusulina*
Ferguson Mountain	Gold Hill area	*Cribostomum, Climacammina,* crinoids, bryozoans, fusulinds
Gerster Limestone	Cedar Mountains	*Composita, Spiriferina, Muriwoodia, Echinauris, Lingulodiscina, Batostomella, Rhynchopora, Fenestella*
Gerster	Gold Hill area	brachiopods, mollusks, bryozoans
Oquirrh-Desmoinesian Series	Stansbury Range	*Syringopora, Fusulina, Eoschubertella, Pseudostaffella, Fusulinella, Wedekindellina,* corals, bryozoans, brachiopods, algae, cryozoans
Oquirrh (middle to late)	Hogup Mountains	*Zoophycos, Teichichnus, Helminthoida*
Oquirrh (middle to late)	Grassy Mountains	*Zoophycos, Helminthoida, Phycodes*
Oquirrh-Wolfcampian Series	Grassy Mountains	*Helminthoida, Protopaleodictyon, Lophoctenium*
Oquirrh, Unit 3	Cedar Mountains	*Linoproductus, Dictyoclostus, Echinoconchus, Derbya, Neospirifer, Productus, Caninia, Ozawainella, Tetrataxis, Fusulinella, Prismopora, Archimedes, Mesolobus, Psuedofusulinella, Syringopora, Punctospirifer, Composita, Triticites, Antiquatonia, Fusulina, Crurythyris, Hustedia, Leiorhynchus, Lissomarginifera, Spirifer, Mylaina, Buxtonia, Schwagerina, Pseudoschwagerina,* brachiopods, gastropods
Oquirrh	Gold Hill area	fusulinids, bioclastics
Oquirrh, Unit 2	Cedar Mountains	*Chaetetes, Millerella, Fusulina, Triticites, Antiquatonia, Composita, Spirifer,* horn coral
Oquirrh-Morrowan Series	Stansbury Range	*Millerella, Profusulinella, Nankinella, Archimedes,* corals, brachiopods, bryozoans
Oquirrh-Derryan Series	Stansbury Range	*Komia, Osagia, Profusulinella, Pseudostaffella, Eoschubertella, Fusulina, Linoproductus*
Oquirrh-Missourian Series	Stansbury Range	*Archimedes, Caninia, Oketaella, Wedekindellina, Triticites, Schubertella,* bryozoans, corals, brachiopods
Oquirrh-Virgilian Series	Stansbury Range	*Schubertella, Waeringella, Triticites,* algae, corals, brachiopods, bryozoans, crinoids
Oquirrh-Wolfcampian Series	Stansbury Range	*Oketaella, Pseudofusulinella, Schubertella, Schwagerina, Triticites,* brachiopods, bryozoans, algae

Formation	Locality	Fossils
Oquirrh, Unit 1	Cedar Mountains	*Triplophyllites, Flexaria, Reticularina, Rhipidomella, Schizophoria, Composita, Pugnoides, Spirifer, Pecten, Antiquatonia, Anthracospirifer, Inflatia, Leiorhynchus, Celiotheridina, Orbiculoidea, Punctospirifer, Buxtonia (?), Nuculana (?),* bryozoans, gastropods
Oquirrh	Stansbury Range	trilobites
Oquirrh	Grassy Mountains	*Fusulina, Mesobolus, Dictyoclostus, Chaetetes, Orbiculoidea, Straparollus, Triticites, Pseudofusulinella, Bartramella, Schubertella, Schwagerina, Psedofusulina, Bradyina, Buxtonia, Meekella, Schinoconchus, Plagiglypta, Euphemitopsis, Derbya, Composita, Juresina, Acanthopecten, Myalina, Strebloconchria, Murchisonia (?),* trilobites, pelecypods, sponge spicules
Pequop	Lucin area	*Pentacrimus, Schwagerina, Parafusulina,* brachiopods, pelecypods, crinoids, fusulinds
Pequop	Gold Hill area	*Durhamina*, crinoids, fusulinds
Unnamed Permian	Cedar Mountains	brachiopods

Note: After Blue (1960), Chamberlain (1969), Doelling (1964), Jordan (1979), Lambert (1941), Maurer (1970), Nolan (1930), Rich (1967), Sadlick (1965), Steele (1960), Teichert (1958), Wright (1961), and Zabriskie (1970).

revealed two studies that focused on the Triassic era (which dates from 245 to 208 mya). Another major extinction event occurred at the end of the Triassic (Raup 1991).

Paull (1982) examined a thick Lower Triassic formation in the Terrace Mountains that consisted of shale, siltstone, and interbedded limestone, and identified an underlying formation, the Dinwoody, and an overlying one, the Thaynes. Both are early Triassic, and date before 240 mya. Stifel (1964) examined formations in the Terrace and Hogup Mountains that they also included both the Dinwoody and Thaynes formations. The results of their studies are presented in Table 11.

No studies were found on Jurassic (208–141 mya) formations in the study area.

The Cretaceous period (141–66 mya) was the last time that intercontinental seas covered what is now the North American continent. A major extinction event occurred at the end of the Cretaceous, which may have been largely the result of a 10-km-wide meteor that slammed into the Yucatan Peninsula of Mexico (Raup 1991). There were no studies relating to the Cretaceous period in the study area.

Tertiary

The Tertiary encompasses the periods of the Cenozoic up to the Pleistocene. These include the Paleocene (66–58 mya), Eocene (57.5–37 mya), Oligocene (37–24 mya), Miocene (24–5 mya), and Pliocene (5–ca. 2 mya). The intercontinental seas that once covered Utah dried up during the Cenozoic, and fossils of early mammals are evident in such Utah localities as the Uinta Basin in the northeastern part of the state. Lake beds also become evident in some parts of the state during this time.

Table 11. Fossils Identified from Triassic Formations of Northwestern Utah

Formation	Locality	Fossils
Dinwoody	Hogup Mountains	*Nucula, Claraia, Anodontophora, Eumorphotis, Myalina, Aviculopecten, Hindeodella, Lonchodina, Ozarkodina, Lingula,* microgastropods, microlumellae, echinoids, pelecypods, conodonts
Dinwoody	Terrace Mountains	*Hindeodus, Isarcicella, Ellisonia, Gyrochorte, Furnishius, Neogondolella, Gladiogondolella, Claraia, Neospathodus, Lingula* brachiopods, echinoids, bryozoans, crinoids, microgastropods
Thaynes	Hogup Mountains	*Dieneroceras, Paranannites, Meekoceras, Hindeodella, Hibbardella, Lonchodina, Spathognathodus, Lingula, Neoprioniodus,* pelecypods
Thaynes	Terrace Mountains	*Ellisonia, Meekoceras, Neospathodus, Gladiogondolella*

Note: After Paull (1982) and Stifel (1964).

Relatively little paleontological investigation of Tertiary deposits has been undertaken in northwestern Utah. Three studies were located during our literature search. Stifel (1964) examined the Salt Lake Formation, which is of Miocene–Pliocene age, in the Hogup Mountains and identified *Sphaerium, Bulimnea,* and *Planorbarius* fossils. Maurer (1970) examined an unnamed Tertiary deposit in the Cedar Mountains and identified *Physa, Viviparus,* and *Sphaerium* fossils. Blue (1960) examined the Salt Lake Formation in the Lucin area and identified *Sphaerium* and *Viviparus* fossils.

Quaternary

The Quaternary encompasses the Pleistocene (approximately 1.5 million to 10,000 years ago) and Holocene (10,000 years ago to the present). Our literature search revealed five invertebrate paleontological studies that have focused on Lake Bonneville sediments in northwestern Utah (Doelling 1964; Maurer 1970; Roscoe 1963; Setty 1963; Stifel 1964). The fossil assemblages are dominated by a diversity of diatoms and freshwater mollusks. Table 12 summarizes the results of these studies.

A number of studies that have documented Pleistocene vertebrate fauna in northwestern Utah have been undertaken. Nelson and Madsen (1980) list more than 30 localities where such finds have been made, although the majority of these are not particularly close to the project area. Finds in Salt Lake City County include remains of bison (*Bison* sp.), camel (*Camelops* sp.), musk ox (*Symbo cavifrons*), rodents, bighorn sheep (*Ovis* sp.), mammoths (*Mammuthus* sp.), horses (*Equus* sp.), bears (*Arctodus* sp.), and the now-extinct Bonneville cutthroat trout (*Salmo calrkii*).

Table 12. Fossils Identified from Quaternary Sediments of Northwestern Utah

Formation	Locality	Fossils
Lake Bonneville sediments	Bonneville Basin	Mollusks: *Anodota, Pisidium, Sphaerium, Physa, Stagnicola, Foassaria, Armiger, Gyraulus, Helisoma, Promenetus, Ferrissia, Amnicola, Valvata, Succinea, Lymnaea, Fluminicola, Pomatiopsis, Carinifex, Discus, Oreohelix*
Lake Bonneville sediments	Grassy Mountains	Ostracodes: *Candona, Lymnocythere* Gastropods: *Physa* Diatoms: *Surirella, Navicula, Epithemia, Cymbella, Amphora, Nitzschia, Pinnularia, Caloneis, Melosira, Cyclotella, Stephanodiscus, Fragilaria, Rhoicosphenia, Synedra, Cocconeis, Pinnularia*
Lake Bonneville sediments	various	Diatoms: *Surirella, Navicula, Epithemia, Cymbella, Amphora, Nitzschia, Cocconeis, Pinnularia, Caloneis, Diploneis, Stauroneis, Pleurosigma, Cymatopleura, Campylodiscus, Hantzschia, Denticula, Melosira, Cyclotella, Stephanodiscus, Coscinodiscus, Fragilaria, Rhoicosphenia, Synedra, Gamphonema,* gastropods, pelecypods, ostracodes

Note: After Doelling (1964), Maurer (1970), Roscoe (1963), Setty (1963), and Stifel (1964).

Summary:
Likely Localities of Paleontological Resources in the UTTR

Based on paleontological research in northwestern Utah, it is possible to identify some of the more likely fossil-bearing localities in the UTTR (Table 13). A number of paleontological studies have already been conducted in the Lakeside and Grassy mountain ranges (Doelling 1964; Jordan 1979; Sheehan 1971), and these have proved to be valuable areas for the identification of fossils. Both ranges contain diverse formations, from Cambrian to Quaternary. Formations identified from Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, Permian, Triassic, Miocene–Pliocene, and Quaternary deposits have yielded fossils in various parts of northwestern Utah. These ranges, therefore, are considered to be primary localities for fossil-bearing sites.

Paleontological research has not been reported from the Newfoundland Mountains, but this range also contains Cambrian, Ordovician, Silurian, Devonian, Pennsylvanian, Permian, Miocene–Pliocene, and Quaternary formations that have yielded fossils in northwestern Utah. The Newfoundland Mountains, therefore, are also considered to be a primary fossil-bearing locality.

We have not been able to locate geological profiles of the Wildcat or Kittycat ranges of the UTTR South, so their fossil-bearing potential is unknown. Given that all other ranges in northwestern Utah have yielded fossils, however, it is probable that these ranges are also prime localities for paleontological resources.

Finally, the Lake Bonneville sediments of the UTTR, particularly those found in mountain ranges, are likely fossil-bearing localities.

Table 13. Likely Localities for Paleontological Resources in the UTTR

Locality	Area of UTTR	Potential for Paleontological Resources
Grassy Mountains	north	high
Kittycat Mountains	south	unknown, probably high
Lake Bonneville sediments	north and south	high
Lakeside Mountains	north	high
Newfoundland Mountains	north	probably high
Wildcat Mountains	north	unknown, probably high

CHAPTER 5

Prehistoric Archaeology

A Brief History of Archaeological Research in the Great Salt Lake Region

The first report of prehistoric materials in the eastern Great Basin comes from the U.S. Geographical Survey west of the 100th Meridian; that project excavated some mounds (affiliated with the Sevier Fremont culture) near Provo, Utah, in 1872 (Severance 1874). Nearly all of the other early archaeological work in Utah focused on Virgin Anasazi sites in the southeastern corner of the state until 1930, when Julian Steward was hired by the University of Utah to develop an archaeological research program for the state. Steward was the first archaeologist to conduct excavations near the Great Salt Lake, with work at a number of rockshelter sites—including Black Rock Cave and the Promontory caves (Steward 1937). In 1935, Steward was replaced by John P. Gillin, who initiated work in several parts of Utah, including an excavation at Deadman Cave near the Great Salt Lake, which was conducted in the late 1930s by Elmer R. Smith (Smith 1941).

In 1948, Jesse D. Jennings was hired into the newly formed anthropology department at the University of Utah and established a long-term program of archaeological research in Utah, which included several new major projects and a statewide archaeological survey (Gunnerson 1959). Among these new projects were important excavations in the Great Salt Lake region, most significantly Jennings's excavations at Danger Cave and Juke Box Cave (Jennings 1957), the work of C. Melvin Aikens at Hogup Cave (Aikens 1970), and excavations at Stansbury Cave 1 (Jameson 1958). Jennings subsequently undertook important excavations, in the 1970s, at Cowboy Cave (Jennings 1980) and Sudden Shelter (Jennings et al. 1980). A number of other important rockshelter sites in the Great Salt Lake region were investigated in the 1960s and 1970s, including Sandwich Shelter (Marwitt et al. 1971), Swallow Shelter and the nearby sites of Thomas Shelter, Kimber Shelter, and Beatty Springs (Dalley 1976), Scribble Rock Shelter (Lindsay and Sargent 1979), Remnant Cave (Berry 1977), and Spotted Cave (Mock 1971). A series of sites critical to the understanding of the Great Salt Lake variant of the Fremont culture was excavated during this period as well, including the Levee and Knoll sites (Fry and Dalley 1979), Bear River Nos. 1–3, and Injun Creek (Aikens 1966; Shields and Dalley 1978). On the periphery of the Great Salt Lake region, excavations occurred at Western Canyon Rockshelter (Delisio 1971) in southern Idaho and at Amy's Shelter, Kachina Cave, and Smith Creek Cave in Smith Creek Canyon along the Nevada-Utah border (Bryan 1979; Gruhn 1979; Tuohy 1979). In addition, further work was undertaken on sites that had been previously investigated, such as Black Rock Cave (Madsen 1983) (Figure 7).

Recent investigations of rockshelter and cave sites in the Great Salt Lake region include a return expedition to Danger Cave led by David B. Madsen, with additional work undertaken at the nearby sites of Lakeside Cave and Floating Island Cave. Work was performed to refine long-term chronologies of the region and to perform a series of specialized studies on various materials, including faunal remains, botanical remains, perishable artifacts, lithics, and coprolites. Many of these studies were reported in preliminary form at the 21st Biennial Meeting of the Great Basin Anthropological Conference in 1988, but have yet to be published (see Workman et al. [1993b] for references on the conference papers).

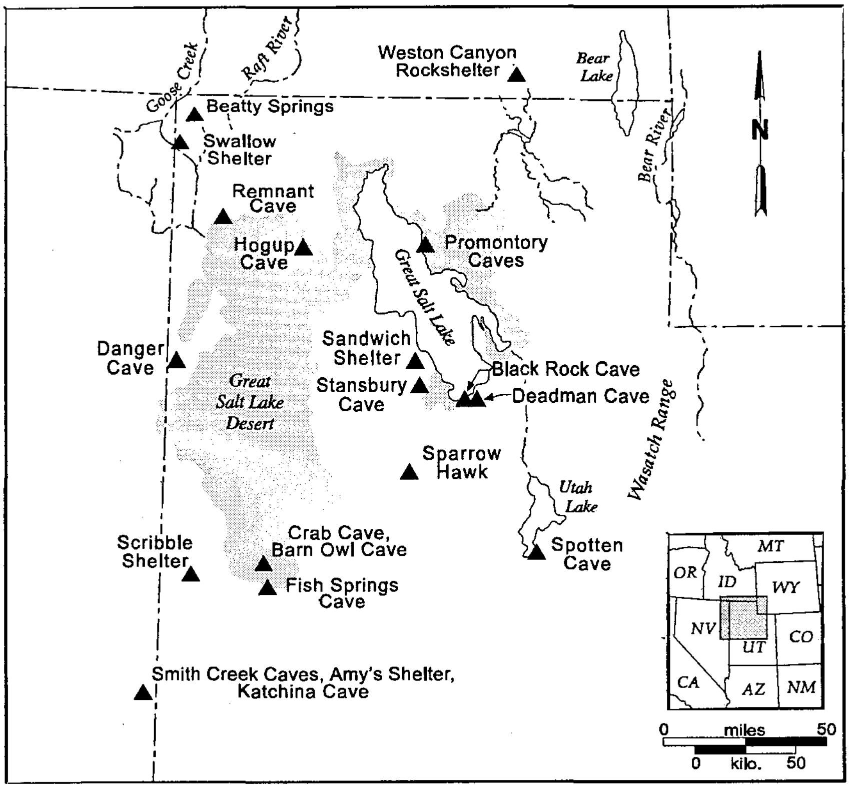

Figure 7. Map of northwestern Utah showing important sites (after Aikens and Madsen 1986:Figure 1).

More recently, the development of cultural resource management archaeology has led to a variety of projects near the current project area. According to Workman et al. (1993b), approximately 50 cultural resource management surveys have been undertaken within a 30-mile radius of the UTTR. The majority of these surveys have been conducted as part of renovations to transmission or seismic lines (Billat et al. 1989; Heath and Janetski 1982; Jacklin 1981; Nielson 1985, 1986, 1991, 1992; Nielson and Southworth 1992; Polk 1984; Price 1984), transportation corridor or off-borrow projects (Bunch 1988; Lindsay 1987; Moore 1994; Richens 1987; Russell 1986, 1987a, 1987b, 1987c; Schroedl 1985; Talbot 1988; Tipps 1984), federal land exchanges or modifications (Berry 1985; D. Christensen 1989; Dodge 1988a, 1998b, 1998c; Larralde 1992, 1993; Weder 1981), work at Dugway Proving Grounds, immediately south of Wendover AFR (Baker 1990a, 1990b; Billat 1989; Lupo and Metcalfe 1987; Zier 1984), or dike construction (Hauck 1986; Howard 1988; Senulis 1987a, 1987b). Monitoring projects have also been undertaken (Hockett and Murphy 1991).

Much of the cultural resource management work in Utah has been contracted by the Bureau of Land Management (BLM), the State of Utah, or the U.S. Army. Much of the work conducted in northeastern Nevada has been contracted, by either the BLM or the Nevada Department of Transportation. Salvage excavation projects include testing at Bonneville Estates Rockshelter as a response to extensive looting of the site, a project contracted by the Elko District of the BLM (Schroedl and Coulam 1989).

Archaeological Research within the Project Area

Archaeological fieldwork conducted within the project area has been undertaken in recent years by Hawkins and Madsen (1990), Arkush (1991), Workman and associates (Workman et al. 1992b, 1992c, 1993a, 1993b), Johnson and associates (Johnson and Arkush 1996, 1997; Johnson et al. 1994, 1995), and Weder (see below). A series of eight major surveys was conducted by the U.S. Air Force between 1991 and 1998. These surveys focused on the Little Mountain Test Facility and Hill AFB as well as on the Hill and Wendover AFRs). A conservative estimate of current survey coverage of the UTTR is about 15 percent. (This estimate does not include acreage covered by the numerous small surveys conducted by Weder.)

Research into the findings of the eight major surveys showed that 474 sites were recorded. Of these, 50 sites occur on the UTTR North, and 159 sites are located on the UTTR South (see appendix). The remaining sites are either dispersed throughout the other areas mentioned above or are located on non–U.S. Air Force federal lands.

As a result of these major surveys (see Johnson and Arkush 1996; Johnson et al. 1994, 1995) eight National Register districts have been proposed for the UTTR. These include the Wildcat Mountain area, the south Aragonite Dune Field, the Blue Lake area, the South Knoll Dune Field, the Wendover Air Auxiliary Field (in Elko County, Nevada), the Lakeside Mountains, the southern portion of the Newfoundland Mountains, and a district for historical-period resources. The eligibility of a site was determined based on its potential association with a proposed district. See Chapter 8 for information on the status of the proposed districts.

The first survey was a linear project along a proposed fiber-optics-cable route located in the southeastern portion of Hill AFR. No cultural resources were encountered during the survey (Arkush 1991). The second series of surveys, conducted in 1991, consisted of 42,320 acres, and was undertaken on the Little Mountain Test Facility, Hill AFB, Hill AFR, and Wendover AFR. The survey documented 81 prehistoric sites, all but 2 of which were previously unrecorded; 20 historical-period sites, all but 7 of which were previously unrecorded; and 1 multicomponent site. An additional 56 isolates (45 prehistoric, 11 historical period) were noted. All but one of the prehistoric sites and two of the historical-period sites were recorded at either Hill AFR or Wendover AFR. Prehistoric sites included 59 lithic scatters (one of which was considered a possible quarry), 15 caves or rockshelters, 6 lithic and ceramic scatters (all of Fremont affiliation), and 1 ceramic scatter.

The 20 historical-period sites consisted of five emigrant-wagon sites associated with the Donner-Reed party, five Euroamerican camps, three mining sites, two mustang corrals, two house foundations, one salt-evaporation feature, the Deep Creek railroad grade and associated telegraph lines, and the Hastings Cutoff wagon route.

The third series of surveys, conducted in 1992, consisted of 49 2-by-2-km blocks, or more than 45,000 acres, on the Hill and Wendover AFRs. This series of surveys yielded eight previously unrecorded sites. No sites had been previously recorded in the survey area. Sites included 5 lithic scatters, 2 caves or rockshelters, and 1 historical-period refuse dump. An additional 53 prehistoric isolates were documented. The authors suggest that the relative dearth of sites, compared to the earlier survey, was because this survey was conducted largely on landforms that were not conducive to human settlement (Workman et al. 1993a).

The fourth series of surveys, conducted in 1993, covered 41,230 acres on the Hill and Wendover AFRs. Some 40,800 acres of the survey were covered in 2-by-2-km blocks, and an additional 430 acres was undertaken on Hill AFR where a proposed railroad spur and storage and maintenance area for the Titan IV Solid Rocket Motor Storage Program are planned. Twenty-three prehistoric sites were documented during the survey. No sites had been recorded previously in the survey area. Sites included 20 lithic scatters, 2 caves or rockshelters, and 1 lithic-and-ceramic scatter. An additional 207 prehistoric isolates were documented (Workman et al. 1993b).

The fifth series of surveys, conducted in 1994, focused on two areas, the Lakeside Mountains and South Knolls Dune Field, and covered 41,330 acres. The survey yielded five prehistoric sites and 50 isolates. Sites included a rockshelter, two aboriginal quarries, and two lithic scatters, all of which the authors deemed to be potentially significant (Johnson et al. 1994).

The sixth series of surveys, conducted during the 1995 field season, focused on portions of the Wendover AFR and Wendover Auxiliary Airfield. Sixty-one areas were surveyed, covering 41,820 acres. The survey yielded 26 archaeological sites; 11 were located within the South Knolls Dune Field, and all were prehistoric lithic scatters that the authors found to be potentially significant as contributing elements to a proposed National Register district. Fifteen sites were located on the Wendover Auxiliary Airfield in Elko County, Nevada. Eleven sites were prehistoric in date; these included two rockshelters, four caves, a rock ring, an extensive rock-ring site, and three lithic scatters. All of these sites were found to be potentially significant as contributing elements to a proposed Wendover Air Auxiliary Range National Register District. Historical-period sites included two aircraft beacons, a wooden structure frame, and a turn-of-the-century bottle dump. The two aircraft beacons were considered to be significant (Johnson et al. 1995).

The seventh series of surveys, conducted in 1996, covered 13 survey areas and 10,520 acres within the Wildcat Mountains. The surveys yielded 22 prehistoric sites, all of which were lithic scatters. The authors found all of the sites of the significant as contributing elements to a proposed Wildcat Mountain National Register District (Johnson and Arkush 1996).

An eighth series of surveys, by Historical Research Associates (HRA), examined four areas on Wendover AFR pursuant to the development of a series of air-to-land target sites (HRA 1998). Fifty-nine archaeological sites and 354 isolates were recorded. Sites tended to cluster along the playas corresponding to the Gilbert Shoreline and were often characterized by Western Stemmed points dating to the Lake Bonneville period. This area would have been among the richest resource zones during the Lake Bonneville period. Of the 59 sites, HRA recommended that 8 be considered eligible under Criterion d, 32 be determined ineligible, and 19 be subjected to additional field investigations prior to making a final eligibility recommendation.

Weder's small surveys on the Hill and Wendover AFRs were carried out for proposed undertakings such as grading for bivouacs, new roads, generator and target sites, power lines, air-quality-monitoring or meteorological tower sites, backup ramps and storage sheds, thermal-treatment-unit sites, seismic hard-rock test sites, fiberoptic lines, and gravel pits (Weder 1993a, 1993b, 1994a, 1994b, 1994c, 1994d, 1994e, 1995a, 1995b, 1995c, 1995d, 1995e). Only one survey yielded cultural resources, representing two lithic scatters and 11 isolated occurrences. One scatter contained projectile points from the Great Basin Stemmed series. Perry (1990) undertook a survey of a 7.5-mile segment of road and several proposed cinetheodolite pad sites on Wendover AFR, and found one artifact scatter with fire-affected rock.

Two excavation projects have taken place in recent years on the UTTR. One of them, a project on a historical-period site (Hawkins and Madsen 1990), is discussed in Chapter 6. Johnson and Arkush (1997) conducted excavations at two caves and one open-air site in 1996 as a response to vandalism occurring at the sites. Site 42TO137, a rockshelter at the Mosquito Willy's Complex in the Blue Lake area, contained Archaic, Fremont, and Shoshonean material culture. Two radiocarbon analyses yielded 1-sigma calibrated dates of A.D. 362–719 and A.D. 1397–1439. The authors suggest that the site was used from ca. 2500 B.C. to A.D. 1800. The site probably functioned as a residential base. Site 42TO701 is a dry cave in the Lead Mine Hills. Recovery of botanical and faunal remains bore evidence of summer, fall, and winter use of the cave. Four calibrated radiocarbon dates ranged between 890 B.C. and A.D. 1175. Finally, site 26EK6384, Beacon Ridge Village, a series of rock rings, was investigated. No dates were derived, so the authors' comments on the period of use are speculative. They considered the site to be a village, which they claim contradicts the traditional archaeological view of residential camps on the mud flats.

Culture History

The culture history overview follows the commonly used period designations for the eastern Great Basin. The terminology and chronology follow Aikens and Madsen (1986), which in turn follows efforts by Madsen and O'Connell (1982), and have been employed recently for the project area by Workman et al. (1992c, 1993b) and Dames and Moore (1996). The development of the present chronology derives largely from the stratified cultural deposits at Danger Cave, Hogup Cave, and Sudden Shelter, as well as the Levee and Knoll sites (Aikens and Madsen 1986). Following the overview by period, a discussion of the Numic spread, one of the central research concerns in Great Basin archaeology, is presented.

Lake Bonneville Period (9000–7500 B.C.)

The Lake Bonneville period represents the earliest known evidence of human occupation in the eastern Great Basin. Culturally, it corresponds to the end of the Paleoindian period; geologically, it occurs at the terminal Pleistocene and Pleistocene-to-Holocene transition. Grayson (1993) has referred to this period as the Early Holocene. Aikens and Madsen (1986:154) state that this period "may represent a time of transition between terminal Pleistocene Paleo-indian big-game hunting and post-Pleistocene Desert Archaic foraging for plant foods and smaller game." Paleoindian sites in the New World are characterized by distinctive fluted projectile points, occasionally found in association with such extinct Pleistocene megafauna as mammoth, camel, bison, and horse. Most fluted-point discoveries have been isolated surface finds; this is true of fluted points recovered from the Great Basin, which makes dating them highly problematic (Grayson 1993).

Three cave sites in the eastern Great Basin have yielded dates on material culture of Paleoindian age, although no fluted points have been dated or found in these contexts. Bryan (1979) recovered a series of stemmed projectile points from a level at Smith Creek Cave in eastern Nevada that yielded a date of 11,200 B.P. These points are reminiscent of Lake Mohave points, a style that characterizes the Western Pluvial Lakes Tradition in the Great Basin. At Danger Cave, in the Bonneville Basin, a basal occupation level consisting of the remains of several hearths, milling stones, flaked-stone knives, and projectile points yielded a date of 10,270 B.P. (Jennings 1957). At nearby Hogup Cave, stemmed points from a 9,500-year-old level have been recovered (Aikens 1970; Aikens and Madsen 1986).

Material culture remains from the Lake Bonneville period are quite sparse. Sites from this period appear to have been located around lake margins or near springs. Lake Mohave–type points have been identified in Utah near the margins of Sevier Lake, an early Holocene body of fresh water that drained into the Great Salt Lake (Fike 1984; Madsen 1982; Madsen et al. 1976). Although it is possible that subsistence strategies were centered on the resources of the lake margins, it is also possible that upland and valley resources were also used by the highly mobile populations. It is during this period that Pleistocene vegetation communities were giving way to Holocene communities characteristic of a warmer, drier climate; the disappearance of the Pleistocene plant communities makes it very difficult to determine the range of subsistence resources that would have been available to people during the Lake Bonneville period.

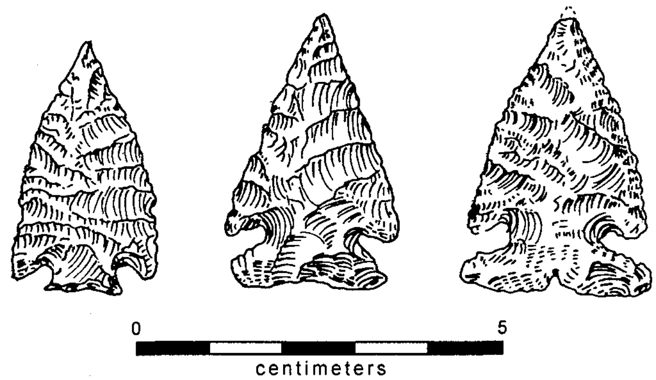

Figure 8. Characteristic Elko projectile points from northwestern Utah.

Wendover Period (7500–4000 B.C.)

Material Culture and Adaptations

The Wendover period corresponds to the early Archaic phases as defined in other areas of the Great Basin. Grayson (1993) refers to this period as the Middle Holocene. Culturally, the adaptations during this period (as well as those in the subsequent Black Rock period) have been widely referred to as the Desert Culture or Desert Archaic (Aikens 1983; Jennings 1957, 1964, 1974, 1978, 1989; Jennings and Norbeck 1955). The Desert Culture concept is discussed further, below. More sites have been identified from the Wendover period than from the Lake Bonneville period, and they are located in a wider range of environments. This period is well represented in northwestern Utah from strata at Danger Cave, Hogup Cave, Black Rock Cave, Sandwich Shelter, and Deadman Cave, as well as at such upland sites as Sudden Shelter and Western Canyon Rockshelter.

Willig and Aikens (1988) have discussed the nature of the Paleoindian-Archaic transition in the far west, noting that no abrupt changes in human adaptations occurred that separate these traditions. A considerable amount of the material culture carries over from the Lake Bonneville period into the early phase of the Wendover Period. The stemmed points described above, for example, continue into the Wendover period. Willig and Aikens (1988) feel that to talk about a "Paleoindian-Archaic" transition is to deal more with stereotypes than with meaningful archaeological discourse, and that, given the environmental diversity of the Great Basin, adaptations and transitions through time should be viewed from an ecological standpoint; adaptations in one area should not be extrapolated to larger regions. Aikens and Madsen (1986) suggest that the wide range of environments in which sites from this period are found can be attributed to a highly mobile, seasonally based lifestyle, with upland sites used primarily for hunting and lowland sites more oriented toward plant procurement. In terms of material culture, projectile points are characterized by a change from stemmed to corner-notched points, the earliest of which is the Elko series (Figure 8). These point types fall into the general Pinto tradition of the early Archaic, point styles that are found across the Great Basin, California, and portions of the Southwest. Two point types, the Elko Corner-notched and Elko Eared, are the hallmarks of the tradition, and are in evidence throughout the Wendover period (Holmer 1986; Thomas 1981a). These are large points with angles at the notches of less than 60°. Their size suggests that they were part of an atlatl-and-dart complex. Toward the end of the period, Gatecliff points are also in evidence, which are characterized by corner notches with angles that are greater than 60°.

Bone tools of various types appear for the first time. These include gravers, needles, and awls made from ungulate ribs or long bones, L-shaped awls made from ungulate scapulae, and splinter awls made from linear sections of ungulate long bones. All of these bone tool types are in evidence from the Wendover strata at Hogup Cave (Aikens 1970).

Grinding implements and basketry become increasingly significant in the archaeological record of the Wendover period, and are thought to have been part of a seed-processing technology (a primary tenet of the Desert Culture concept). The chaff from pickleweed (*Allenrolfea occidentalis*) was found in abundance within Hogup Cave, and is also prominent in Danger Cave (Aikens 1970). The seeds of pickleweed have been confirmed, through analyses of coprolites from these two caves, to have been an important food source (Fry 1976, 1978). A wide variety of other plants was also found in the cave deposits; many of these plants grow naturally on the shores of lakes, but others are from a variety of environmental zones at higher elevations. In the lowland, xeric communities of the eastern Great Basin, a wide spectrum of animals was hunted, although small game dominates the faunal assemblages; the evidence from Danger Cave, Hogup Cave, and Swallow Shelter all attest to this. At Hogup Cave, the prevalence of lagomorphs (rabbits) correlates with the presence of netting and cordage, suggesting that lagomorphs were communally hunted using nets and snares. In addition, the remarkable variety of avian remains at Hogup Cave from the Wendover period is greater than that of earlier or later occupations; no special tools for hunting birds have been defined (Aikens and Madsen 1986). In somewhat of a contrast to these sites, excavations at Bonneville Estates Rockshelter, located in northeastern Nevada adjacent to the Utah border, revealed a preference for rodents over lagomorphs in Wendover-period contexts, small game over large game, and contained virtually no avian remains (Schroedl and Coulam 1989). This underscores the diversity of local environments and localized hunting strategies.

The Desert Culture Concept

The Desert Culture concept was based on ethnographic data on the Western Shoshone generated by Julian Steward (1938). This mode of human adaptation was based on the sparse, scattered, unpredictable resources of the Great Basin xeric communities. Small bands of highly mobile people—little more than nuclear families—foraged the landscape, collecting plants and processing seeds using a technology that included grinding implements and basketry. Plants formed the bulk of the diet, but game was also important. Larger game was hunted by men, while smaller game, such as rodents and lagomorphs, was hunted communally. During winter, small bands might come together to exchange food and form temporary villages, which would have been located in areas where critical winter resources, such as piñon nuts, would have been stored or cached and where water was available. This adaptation remained essentially unchanged from the end of the Pleistocene until ca. 2000 B.P.

As enduring and useful as the Desert Culture concept has been, it is not without problems. Whereas Thomas (1971, 1972, 1973, 1974) found striking correlations between the archaeological record and Steward's descriptions, others, (e.g., Service 1962) argue that Steward's research was undertaken on a culture in disarray following European contact, and, therefore, should not be applied to the prehistoric record. Steward's model only considered low-elevation sites, because these were the areas used by the Great Basin peoples he studied. They were no longer using the alpine regions, for example, although the archaeological record indicates that these areas were used during the Archaic; in fact, they were used until early historical times. This was a component important to the transhumance of ancient Great Basin peoples that is not accounted for in the Desert Culture concept; while the concept accounts well for low-elevation adaptations, it leaves an incomplete picture of Great Basin Archaic adaptations.

Black Rock Period (4000 B.C.–A.D. 500)

The Black Rock period represents a continuation of the Archaic tradition of the eastern Great Basin. Grayson (1993) considers the beginning of this period onward as the Late Holocene. The onset of this period is described by Aikens and Madsen (1986:157) as follows: "[i]n conjunction with a dramatic increase in occupation sites during the early portion of this period, there was an apparent broadening of settlement patterns with a growing emphasis on the exploitation of upland zones." In northwestern Utah, the Black Rock period is well represented from deposits at Black Rock Cave, Hogup Cave, Danger Cave, Sudden Shelter, and Deadman Cave.

It is during this period that the Gypsum series of projectile points and other material culture make their initial appearance, although the Elko series remains prominent. Figure 9 shows some typical Gypsum-series artifacts. Sites containing both elements represent a 400-percent increase compared to those characterized by Wendover-period material culture. Many of the sites located in the Great Salt Lake region occur in upland regions rather than lake margins or basins, the first time a significant use of the uplands is in evidence in the eastern Great Basin (Dalley 1976; Gruhn 1979). This may have been a response, in part, to more arid conditions that resulted in diminished lake-margin resource bases (Mehringer 1977), and, coupled with an increase in population, may have compelled bands to investigate the advantages of upland resources. At Hogup Cave, coprolite analysis revealed that a more restricted range of plant foods were used (Fry 1976), and human occupation of the area declines throughout the Black Rock period. In addition, the faunal assemblages became smaller and less diverse. Mehringer (1986) notes that waterfowl remains and other shallow-water resources virtually disappear from the Hogup Cave deposits around 1000 B.C. as a result of a flooding episode; a similar occurrence effected those who used Danger Cave, and both caves were not used much after this time, although Hogup Cave does bear evidence of Fremont occupation. However, sites such as Fish Springs Cave, located at the southern edge of the Great Salt Desert and adjacent to spring marshes above the level of the postglacial lake rise, became more intensive loci of human activity (Marwitt 1986). Other rockshelters located at higher elevations, such as Bonneville Estates Rockshelter, also continued to be loci of intensive activity (Schroedl and Coulam 1989).

Although resource utilization changed during this period, material culture was not significantly affected, and no dramatic changed in material culture from the Wendover period occurred. Changes do include a reduction in size of projectile points, as the bow and arrow gradually replaced the atlatl and dart; although smaller, the diagnostic points of the later part of the period, such as the Rose Spring and Eastgate series, were still very similar in form to earlier types (Holmer 1986). The rod-and-bundle technique of foundation construction became the most commonly technique of basket manufacture.

Fremont Period (A.D. 500–1350)

After some 9,000 years of foraging adaptation in the Great Basin, the period from ca. A.D. 500–1350 marks an abrupt change in subsistence and settlement. Horticulture based on maize, beans, and squash, ceramics, substantial masonry dwelling and storage structures, and modeled clay figurines appear in the archaeological record for the first time. A unique rock-art style emerges at this time as well. Regional variations of these elements are quite diverse, as a series of geographically widespread complexes are evident in the archaeological record. Collectively, these variants have been referred to as "Fremont," and, although related culturally, the variation is significant enough to compel some researchers (e.g., D. Madsen 1989; Madsen and Lindsay 1977) to restrict the term to developments on the Colorado Plateau and use the term "Sevier" to refer to the related, contemporaneous occupations of the eastern Great Basin. Marwitt (1986), following Lohse (1980), offers the following comment on Madsen and Lindsay's (1977) cultural taxonomy:

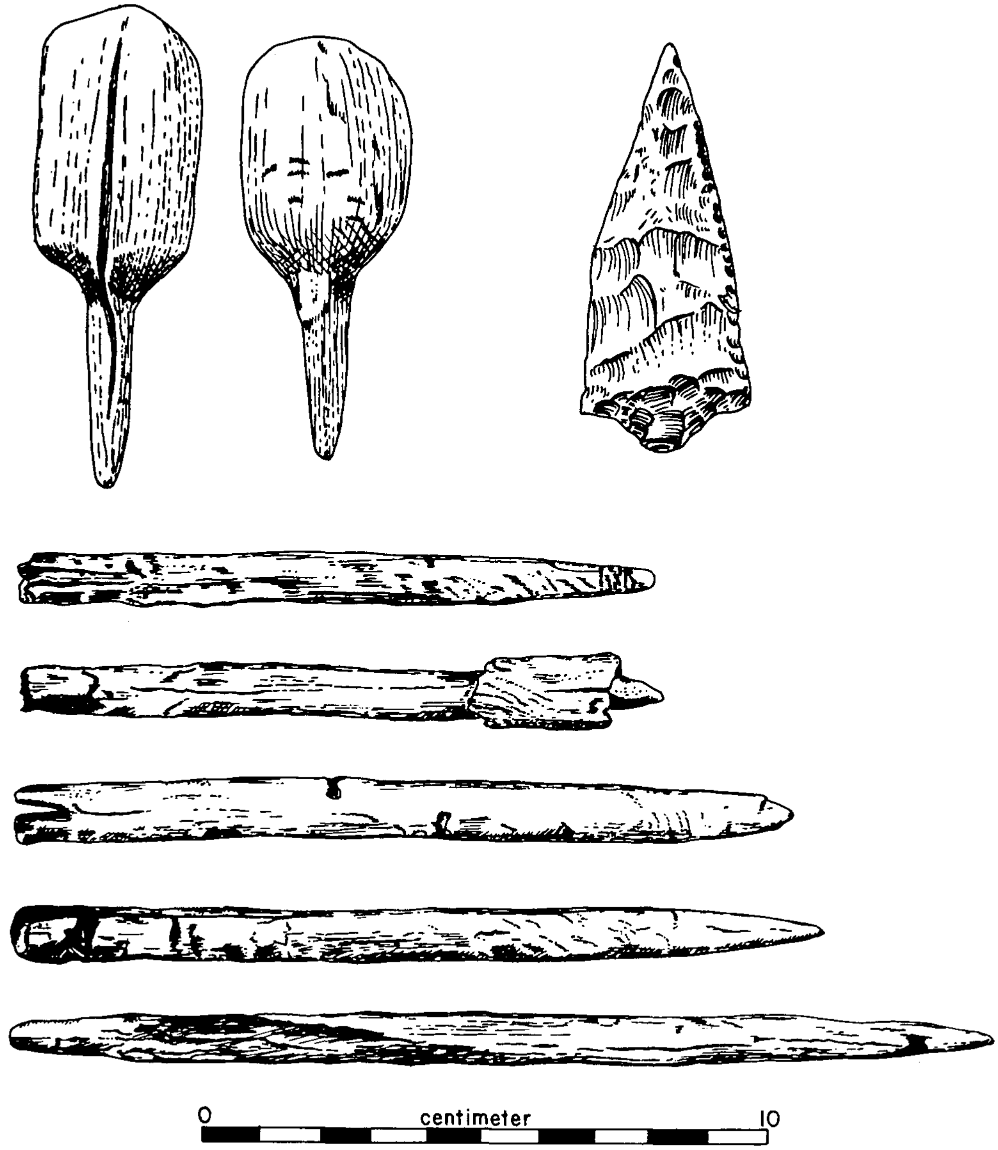

Figure 9. Characteristic Gypsum-series artifacts from the Great Basin (from Ezzo 1995:Figure 11).

> This interpretation has the advantage of correlating major cultural differences in subsistence, settlement pattern, and material remains with the major physiographic and environmental provinces of the region, and it clearly has a considerable degree of utility in clarifying the broad differences between the Basin and Colorado Plateau cultural patterns. It is also clear that the two patterns, whatever they are called, are culturally related. For this reason, many students retain the term Fremont, if only as a convenient label for the whole [Marwitt 1986:163–164].

The term "Fremont" was first employed by Morss (1931) based on archaeological investigations along the Fremont River in south-central Utah. Morss (1931) felt that the Fremont phenomenon was the result of a diffusion of southwestern cultural elements into the Great Basin; in addition to local populations adapting certain elements to their indigenous culture, some migration by southwestern peoples may have occurred. A number of other scholars, including Steward (1933), Wormington (1955), Gunnerson (1960, 1969), and Berry (1980), have adopted this idea. Recently, Workman et al. (1992c, 1993b) have also espoused this hypothesis, maintaining that the Fremont concept is best understood as an indigenous development that was influenced by southwestern peoples, most notably the Mogollon culture, and that this influence resulted from trade, diffusion of traits, and migration of southwestern people to the Great Basin.

Aikens (1966), in contrast, views the Fremont as being of Athapaskan origin, and feels that these people entered the Great Basin from the Plains about A.D. 500 and adopted various southwestern cultural elements into their lifeways, thus creating a fusion of traits from the Southwest and the Plains. Armelagos (1968) suggests that Aikens's hypothesis might be most judiciously tested using human skeletal data, but no intensive study of this type has yet taken place.

The problems of determining Fremont origins result from the widespread phenomenon labeled "Fremont" and the lack of temporal controls in most regions where it occurs. The timing of the emergence of Fremont is not known across the Great Basin; at only one site, Hogup Cave, is there continuity in the archaeological record from Archaic to Fremont. It is, of course, not possible to extrapolate from this one site to discuss the emergence of Fremont across the eastern Great Basin. An additional problem of the timing of emergence, as pointed out by D. Madsen (1979, 1989), is that Fremont cultures may be the result of groups with different ethnic origins, with some groups deriving from the Great Basin, others from the Plains, and others from the Southwest. Because of these problems, as well as variations in material culture (discussed below), the term "Fremont" is best employed only at a very general level, as a "convenient label for the whole," as suggested by Marwitt (1986:164).

Although it is generally held that the presence of maize-based agriculture, ceramics, and masonry architecture in the area is the result of indirect contacts with southwestern peoples, the overall influence of southwestern culture on the Great Basin at this time is not substantial. There is some evidence of trade between the two regions, but it does not appear to have been very intensive or widespread. The bow and arrow has completely replaced the atlatl and dart by this time, and while foraging continues to play an important role in subsistence practices, it clearly has ties to the Great Basin Archaic. This is particularly true of the Great Salt Lake area. The clay figurine and rock art traditions do not appear to have been significantly influenced by cultural developments in the Southwest.

Marwitt (1986:167) has described the Fremont manifestation in the Great Salt Lake area as "perhaps the most intriguing of all the variants." Interestingly, it is in this region of the eastern Great Basin that more of the Archaic material culture and adaptations appear to remain intact than elsewhere. Marsh environments become the preferred locality for sites during this time, and subsistence is based almost exclusively on the exploitation of wild resources. Many of the major sites at this time, such as the Levee and Knoll sites (Fry and Dalley 1979), Bear River Nos. 1, 2, and 3, and Injun Creek (Aikens 1966; Shields and Dalley 1978), all of which are located east of the Great Salt Lake, occur at elevations that are only slightly above the average stand of the Great Salt Lake. The soils in the areas around these sites are far too saline to permit agriculture; these sites may have been seasonally occupied to exploit waterfowl populations in the marshes. A number of rockshelters, such as Hogup Cave, Danger Cave, Juke Box Cave, Thomas shelter, Kimber Shelter, Beatty Springs, Swallow Shelter, and Scribble Rock Shelter, have evidence of Fremont occupation (James 1986), suggesting use as seasonal camps for hunting and processing seeds (Aikens 1970; Dalley 1976). Other sites in the Great Salt Lake region that have yielded Fremont material culture include the Bear River sites, Injun Creek, and the Levee and Knoll sites, all of which are located east of the Great Salt Lake.

In terms of material culture, the Great Salt Lake variant of Fremont is perhaps the most distinct of all variants. Unique elements include slate knives, cylindrical ground-stone pestles, side-notched projectile points, and etched stone tablets (Figure 10). Many of these elements are present in the Black Rock–period deposits at Hogup Cave. Bone tools, such as harpoon heads, knives, and whistles made of

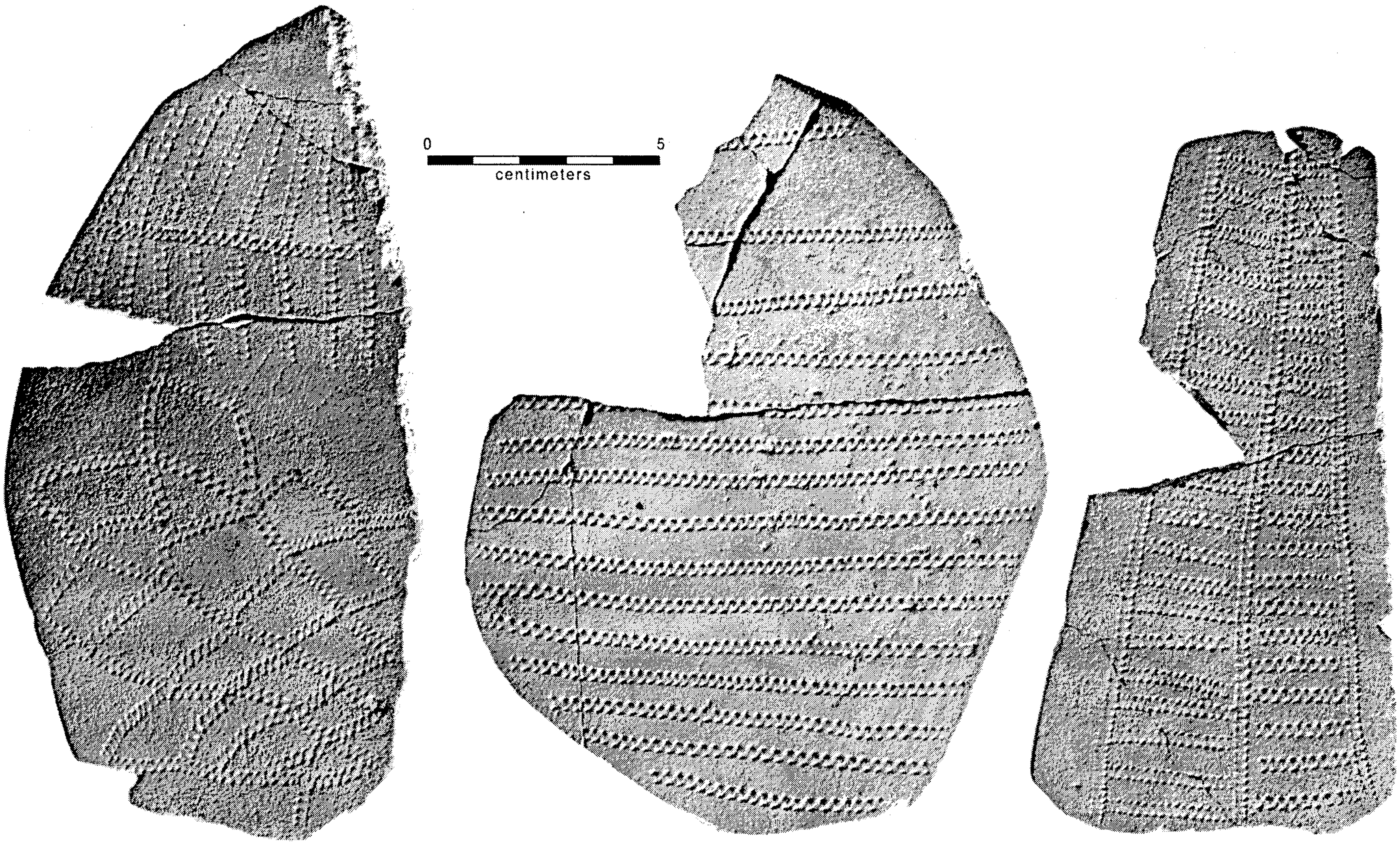

Figure 10. Etched stone tablets from Swallow Shelter (from Dalley 1976:Figure 24).

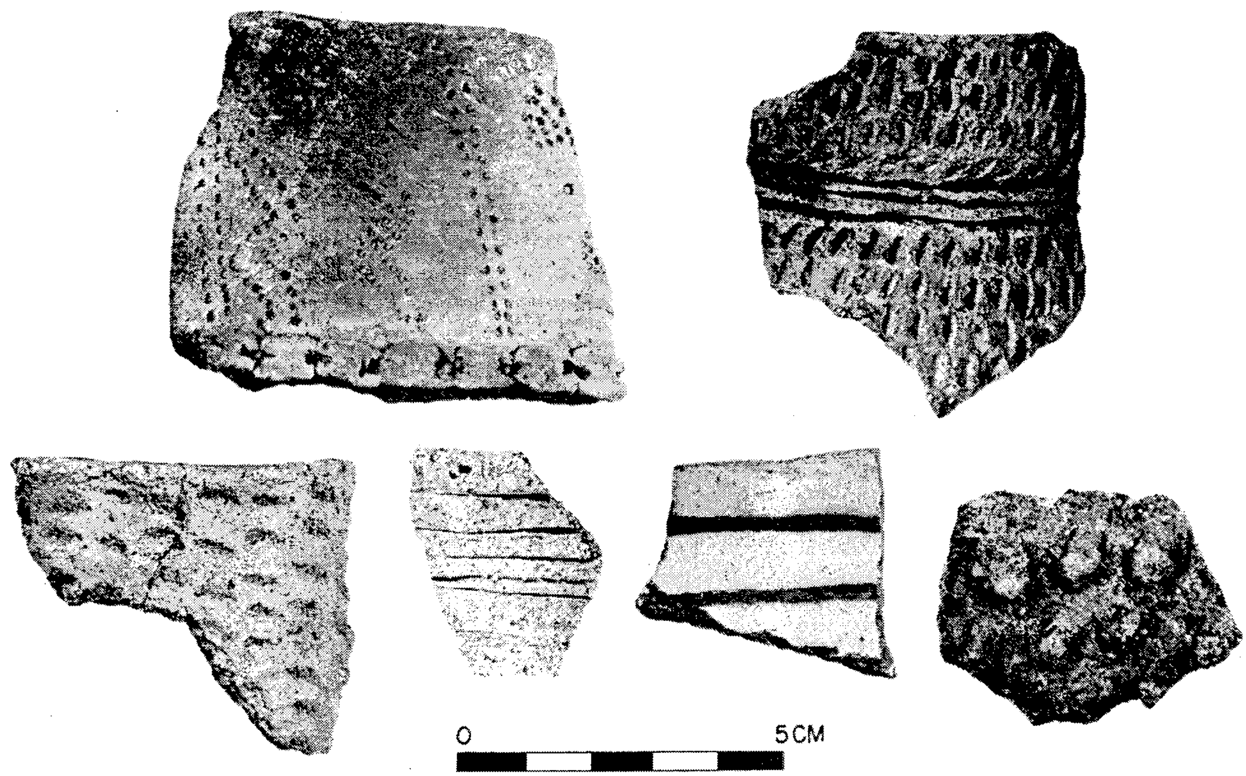

Figure 11. Examples of Great Salt Lake Gray pottery (from Shields and Dalley 1978:Figure 12).

deer or mountain sheep scapulae, are part of the Great Salt Lake variant not found elsewhere during the Fremont period.

The ceramic assemblage is dominated by Great Salt Lake Gray, a sand-tempered grayware that was manufactured using the coil-and-scrape method that is indicative of all other Fremont pottery (Figure 11). A very small percentage of the ceramic assemblage is comprised of Promontory Gray, which is unique to the Great Salt Lake region. This ceramic type is tempered with coarse calcite fragments and manufactured using the paddle-and-anvil method. Only a very small amount of painted or corrugated ceramics occur in this region, and these likely are the result of trade with the Parowan Fremont of central Utah and the Sevier Fremont of southwestern Utah (Madsen 1986; Marwitt 1986). James's (1986) functional analysis of Fremont vessels suggest that Great Salt Lake Gray vessels were manufactured for two general purposes: cooking and containing water. He infers this for the wide-mouthed, short-necked vessels that dominate assemblages at such sites as Swallow Shelter; the fact that many of the sherds from these vessels are blackened from repeated exposure to fire lends support to this inference. Vessels with long vertical necks, such as the vessels from Thomas Shelter, Kimber Shelter, and Beatty Springs, were used as water containers. The lack of vessels designed for storage led James (1986) to conclude that Fremont sites were occupied seasonally by mobile, largely foraging people.

Based on excavations at the Levee and Knoll sites, as well as on data from sites in the Bear River and Injun Creek localities, Fry and Dalley (1979) have developed a provisional chronology for the Great Salt Lake Fremont. The earlier phase, which they term the Bear River phase, dates from ca. A.D. 400 to approximately 1000 (based on radiocarbon analysis). This phase is characterized by seasonally occupied sites and hunting camps that lacked structures and small rancherias that feature semipermanent structures. Rose Spring projectile points, a holdover from the Archaic period, dominate the chipped-stone assemblage, and there appears to be continuity in material culture with the Black Rock period in general.

The following Levee phase (A.D. 100–1350) is best represented by the Levee and Knoll sites. Side-notched projectile points, grayware ceramics, and pit structures are characteristic of these sites, which are somewhat larger in size than sites from the Bear River phase. The pit dwellings suggest somewhat more long-term occupation of one site, but the deposits at Hogup Cave, which span the entire Fremont period, still lend support to the idea of a highly mobile, largely foraging population. Harvesting and processing of pickleweed continues to be important. Horticulture based on maize, beans, and squash, conversely, does not. Even at sites like Levee and Knoll, evidence suggests that this type of horticulture played a very minor role in the subsistence practices of the Great Salt Lake variant of the Fremont.

By ca. A.D. 1250, the Fremont culture appears to wane in a number of areas, and by A.D. 1350 the Fremont way of life had disappeared in the eastern Great Basin. The inhabitants then returned to a foraging way of life that appears to have had much in common with their Archaic predecessors. The demise of the Fremont is puzzling, and no suitable explanation presently exists for it. A number of scholars, including Rudy (1953), Taylor (1954, 1957), and Gunnerson (1960, 1969), have suggested that the Fremont people were ancestral to the ethnographic Paiute, Ute, and Shoshone. Climatic changes caused these people, who had adopted southwestern traits of farming, ceramics, and architecture, to revert to their previous lifestyle of foraging. Clear continuity between Fremont (or Archaic) material culture and that of Numic-speaking peoples is problematic and a topic of considerable debate, as is discussed below ("The Numic Spread"). Marwitt (1986) considers the idea of the Fremont being ancestral to the Numic-speaking peoples of the Great Basin to be a minority opinion.

Aikens (1966), in keeping with his Plains origin for the Fremont, suggests that the Fremont returned to the Plains after population pressures were created by the presence of Shoshonean peoples moving into the eastern Great Basin. More recently (Aikens 1983), he has noted that decreased moisture across the Southwest and Utah may have been inadequate to allow for the maintenance of maize-based horticulture. This may have driven the Fremont out of the region. He postulates that the Fremont became the Dismal River culture of western Kansas and Nebraska, Wyoming, and eastern Colorado. Although there is scant evidence to support this, the Dismal River culture, which appears very suddenly on the Plains around A.D. 1400, may be related to a Fremont influence. However, Aikens (1983) disagrees somewhat with his earlier notion by stating that Fremont material culture has never been identified to any significant degree outside the Fremont area, and, whatever the outcome of the Fremont was, Fremont cultural identity disappeared around A.D. 1350.

Late Prehistoric Period (A.D. 1350–Contact)

Relatively little attention has been paid to the late prehistoric period, and it has received very little discussion in synthetic overviews (see, e.g., Aikens 1983; d'Azevedo, ed. 1986). Implicit in this treatment appears to be the idea that the ethnographic cultures of the Great Basin, as first encountered by anthropologists, were living a lifestyle not terribly dissimilar to that of their ancestors several hundred years before. Aikens and Madsen (1986), for example, end their discussion of the prehistory of the eastern Great Basin with the advent of Fremont in the region, which is then the focus of discussion for Marwitt (1986). As discussed above, it is known that the inhabitants of the eastern Great Basin abandoned horticulture and returned to a foraging pattern of subsistence. The general consensus is that the late prehistoric period marks the time when Numic-speaking peoples entered the Great Basin, either displacing or replacing the Fremont, but certainly not evolving out of the Fremont tradition. The mechanisms by which this occurred are still uncertain, although, as discussed below, a number of hypotheses have been put forth. Characteristic chipped-stone tools of this period include small side-notched and triangular projectile points of the Desert Series.

Ceramics persist during this period. At Hogup Cave, Aikens (1970) found a level that contained both Fremont and Shoshonean ceramics, and another level with Shoshonean ceramics only. The latter dates to ca. A.D. 1500, although the mixture of Shoshonean and Fremont ceramics suggests that Shoshonean ceramics were present in the Great Salt Lake area prior to A.D. 1300.

Shoshonean (or Paiute-Shoshonean) ceramics have been defined archaeologically by virtue of the fact that ethnographic groups in the Great Basin have been observed making ceramics very similar to those found in archaeological deposits. However, Paiute-Shoshonean ceramics exhibit a tremendous degree of variability across space and are, therefore, the most poorly defined ceramics in the Great Basin (Prince 1986); vessel shape, manufacturing techniques, tempering materials, and decorative techniques all vary (Beck 1981; DeSart 1971; Fowler 1968). These ceramics are generally thick-walled and contain variable coarse inclusions. The basal portion of vessels were initially impressed on a basket (Tuohy 1963), then coils were added to the upper portion of the base, and then smoothed either by scraping or by using a paddle and anvil (Beck 1981). Surface treatment is quite variable, ranging from rough and scraped to very smooth, and the exterior surface is often textured as a means of decoration (Madsen 1986).

The Numic Spread

The Numic (Paiute, Ute, and Shoshone) entry into the Great Basin has been a long-standing question and a central focus of research and debate in Great Basin archaeology and anthropology. This has arisen, in part, because of the relatively uniform material culture and site locations that existed across the region for such a long period of time, as well as the extensions of Steward's (1938) ethnographic model of adaptation back several millennia in the form of the Desert culture (D. Fowler 1986). The first study of the subject was undertaken by Lamb (1958), who, based on linguistic data, claimed that Numic speakers entered the Great Basin sometime late in the prehistoric period. As discussed recently by Aikens (1994), archaeologists have since tried to incorporate Lamb's hypothesis in virtually every attempt to model the Numic expansion into the Great Basin.

Two general schools of thought on the subject have developed. The minority opinion in the present day has been espoused by Goss (1977) and Aikens and Witherspoon (1986), who have argued for an Archaic-period entry of the Paiute into the region, perhaps as early as 7000 B.P. Goss (1977) based his argument on linguistic data, claiming that Numic languages originated within the Great Basin and then radiated outward. Aikens and Witherspoon (1986) base their argument on similarities between Archaic and Paiute material culture and settlement patterns. In particular, the persistence of Elko projectile points through time is intriguing, and it is known that such points were used as knives by the historical-period Paiute (Rafferty and Blair 1984). Although Aikens and Witherspoon (1986) and Goss (1977) have argued for an early entry of the Paiute into the Great Basin, it should be noted that Aikens and Witherspoon (1986) have strongly rejected the linguistic data that forms the basis of Goss's (1977) argument. It is rather curious that, given the mixture of Shoshonean and Fremont pottery in a level at Hogup Cave, followed by a level of purely Shoshonean pottery, Aikens would espouse an early entry of the Numic-speaking peoples into the region. Although Aikens (1966) sees Fremont as intrusive, he fails to account for the appearance of Shoshonean ceramics and how this ties into the Archaic material culture of the Great Basin.

A second school of thought, including the work of Warren and Crabtree (Warren 1984; Warren and Crabtree 1986), Lyneis (1982, 1994), and Bettinger and associates (Bettinger 1991; Bettinger and Baumhoff 1982, 1983; Young and Bettinger 1992), have argued for a much later entry of Numic-speaking peoples into the Great Basin, perhaps no earlier than A.D. 1000. This idea appears stronger on the basis of available archaeological data and is the majority opinion at present. In the southern Great Basin, for example, Lyneis (1982, 1994) has suggested that the Paiute may not have settled in the region until after the Virgin Anasazi abandonment; as evidence, she cites the fact that where Paiute and Virgin Anasazi material culture co-occur at sites, the former always overlies the latter, with no mixing of the two in the same stratum.

Bettinger and Baumhoff (1982) cite significant differences in material culture between Great Basin Archaic and Paiute sites, as well as distinct petroglyph styles. Bettinger (1991; see also Bettinger and Baumhoff 1983) has argued that Numic peoples replaced pre-Numic peoples because their adaptive strategies, particularly to high-altitude ecosystems, allowed them to extract energy more efficiently from the challenging Great Basin environment. Support for this idea derives from the Alta Toquima site in eastern Nevada (Thomas 1982). Bettinger (1991) further argues that a population increase in California brought about pressures that forced a more efficient adaptation to alpine resources and environments. This shift accompanied population movements northward and eastward, so that Numic peoples reached the White Mountains of eastern California sometime after A.D. 600, Alta Toquima after A.D. 900 (see also Thomas 1982), and the eastern Great Basin after A.D. 1350. Young and Bettinger (1992) have reinforced this argument with an application of a simple population-movement computer simulation, but a number of assumptions, one being that Numic-speaking peoples moved into the Great Basin from a Death Valley homeland, have not been verified by archaeological data.

A symposium focusing on the Numic expansion was held in the early 1990s and published in 1994 (Madsen and Rhode 1994). The papers focus on a variety of environmental, ecological, archaeological, linguistic, and ethnographic data to further understanding of the phenomenon. Bettinger (1994), for example, combines linguistic data with his earlier archaeological claims to state that the linguistic data provide support for his model. Thomas (1994) is more cautious, noting that archaeologists tend to be uncritical of linguistic data and often use them in overly simplistic ways. Rhode and Madsen summarize the current state of research as follows:

> Areas of widespread consensus have emerged: that Numic expansion *probably* occurred during the past several thousand years, that Numic peoples *probably* originated in the southern or southwestern Great Basin, and that they *probably* spread into the eastern Great Basin, Colorado Plateau, and the Rockies relatively late in prehistory [emphasis in original] [Rhode and Madsen 1994:219].

The authors note that the ultimate causes of Numic expansion require much more consideration than they have been accorded to date. Aikens sums up the current data requirements as follows:

> Fundamental points are simply that Great Basin Numic prehistory is a problem of both linguistic and archaeological importance and that any satisfactory accounting of it must reconcile both linguistic and archaeological concerns [Aikens 1994:43].

Interestingly, one of the way that Rhode and Madsen (1994) suggest the Numic expansion question may be studied is through various genetic markers. The timing of the Numic spread throughout the Great Basin has been addressed recently by Larsen and Kelly (1995) in their bioarchaeological study of more than 200 burials from Stillwater Marsh in Carson Sink, western Nevada. Serum albumin and mitochondrial DNA analyses were undertaken toward this end; however, somewhat conflicting results were derived. The serum albumin analysis, based on the frequency of one allele, indicated that the Stillwater Marsh population had greater genetic affinity to the Yuman-speaking peoples of the lower Colorado River and the Southern Uto-Aztecan peoples (e.g., Pima) than with the Northern Uto-Aztecan peoples. The mitochondrial DNA analysis suggested a close tie with the Paiute and virtually no affinity with the Yuman or Southern Uto-Aztecan peoples.

A number of explanations for this discrepancy and potential problems with the data were considered by the authors. First, chronological controls of individual skeletons was highly problematic, and the entire burial population spanned a period of more then 1,500 years (ca. 2200–500 B.P.). A corollary to this is the fact that variability within the population could not be adequately addressed in terms of chronology. Second, the mitochondrial DNA analysis was based on a very small segment of the DNA, and the serum albumin analysis on only one allele, so the accuracy of interpretation could be problematic, as well as arbitrary. Third, it is possible that the Stillwater population became extinct, and any genetic similarities to living populations may simply be due to chance. Finally, the fact that each analysis could not rule out some level of affinity with Uto-Aztecan peoples suggests that possibly the spread of Numic peoples into the region occurred quite early, which would tend to support the models of Archaic-period entry as espoused by Aikens and Witherspoon (1986) and Goss (1977). Of course, this interpretation fails to consider material culture and settlement correlates. Therefore, the data from the human remains at Stillwater Marsh are inconclusive in this regard, and the issue of the Numic spread into the Great Basin continues to be a focus of research and debate.

CHAPTER 6

Historical Sketch: The UTTR and Surrounding Region

Much of the early history of the Great Salt Lake and surrounding region concerns efforts on the part of Euroamerican settlers and explorers to find an overland route to California and the Pacific Ocean. The Great Salt Lake and Desert proved to be formidable barriers to overland crossings, and a critical part of the region's history concerns the region as a transportation corridor linking the eastern United States with the Pacific Coast.

European Discovery of the Great Salt Lake

The members of the 1776 Escalante Expedition out of Santa Fe are reputed to be the first Europeans to hear of the Great Salt Lake. While in the vicinity of Utah Lake, Native Americans told them of a great inland sea to the north. The expedition was seeking a route to California, and did not venture north to seek the lake. In 1824, a daring, legendary fur trapper named James "Jim" Bridger took up a wager to determine the point of discharge of Bear River, and came upon the waters of the Great Salt Lake. The briny taste of the water led him to believe that he had reached the Pacific Ocean, but this notion was dispelled as early as 1826 when James Clyman circumnavigated the lake and fur trappers began to ply their trade on all sides of it (Miller 1987, 1989a).

In the 1830s, Captain B. L. E. Bonneville undertook a trapping expedition throughout the Great Basin (Figure 12). He visited the Great Salt Lake in 1833 and recounted his observations of it in his 1837 book, *The Rocky Mountains*. Attempts were made to name the lake after Bonneville, but the name "Great Salt Lake," which had been in use for over a decade at the time, remained. The Pleistocene pluvial lake that preceded the Great Salt Lake was given Bonneville's name. In 1843 and 1845, John C. Fremont undertook the first scientific studies of the lake (Figure 13). Rowing out to what would come to be known as Fremont Island, he systematically surveyed the lake using a spyglass and other optical instruments. It was during the first of these surveys that one of his assistants, Kit Carson, carved the now-famous Carson Cross into a rock formation near the peak of the island. Two later nineteenth-century scientific surveys designed to document the geography, ecology, and mineral wealth of the Great Salt Lake region were underwritten by the U.S. government. Howard Stansbury, who christened Fremont Island, directed the first of the surveys in the spring of 1850 (B. Madsen 1989), and Clarence King the second in 1869–1870 (Miller 1987, 1989a, 1989b).

Overland Wagon Routes to the West

In 1841, the Bartleson-Bidwell party made the first overland wagon expedition through Utah. They followed the Oregon Trail to Soda Springs, then turned south to follow the Bear River, planning to skirt

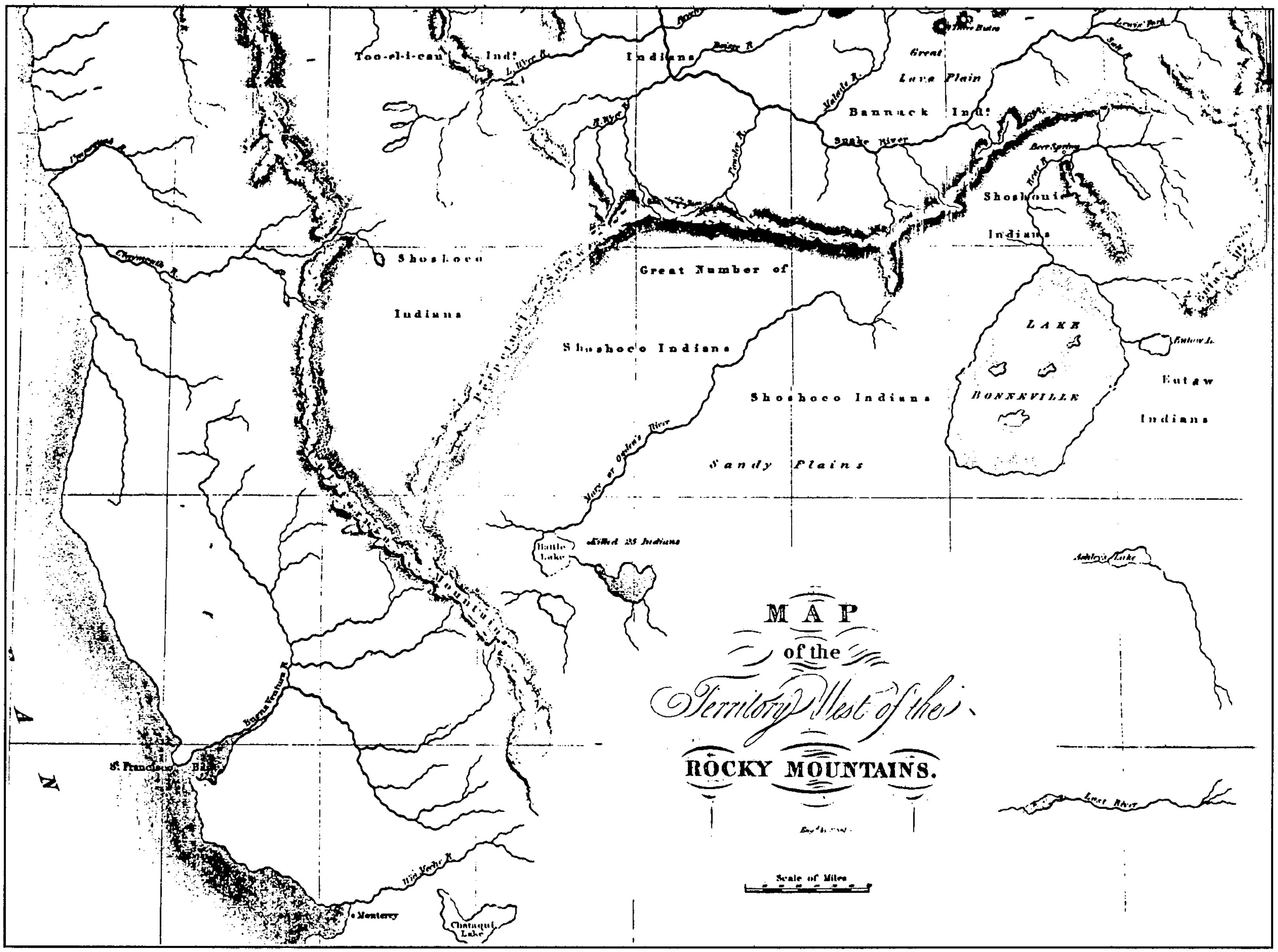

Figure 12. Bonneville's 1837 map of the Great Salt Lake region. Courtesy Utah State Historical Division.

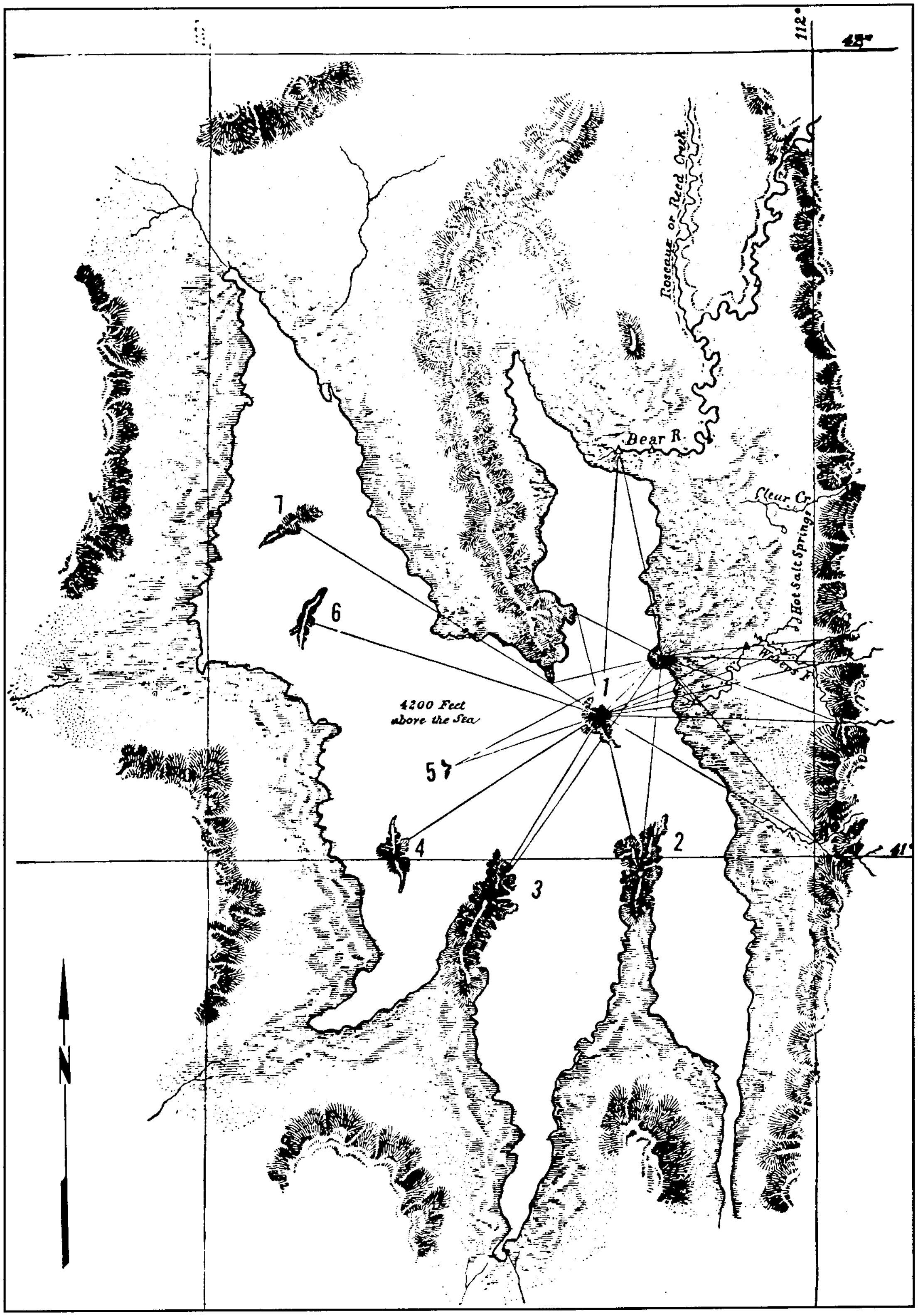

Figure 13. Fremont's 1843 map of the Great Salt Lake region.
Courtesy Utah State Historical Division.

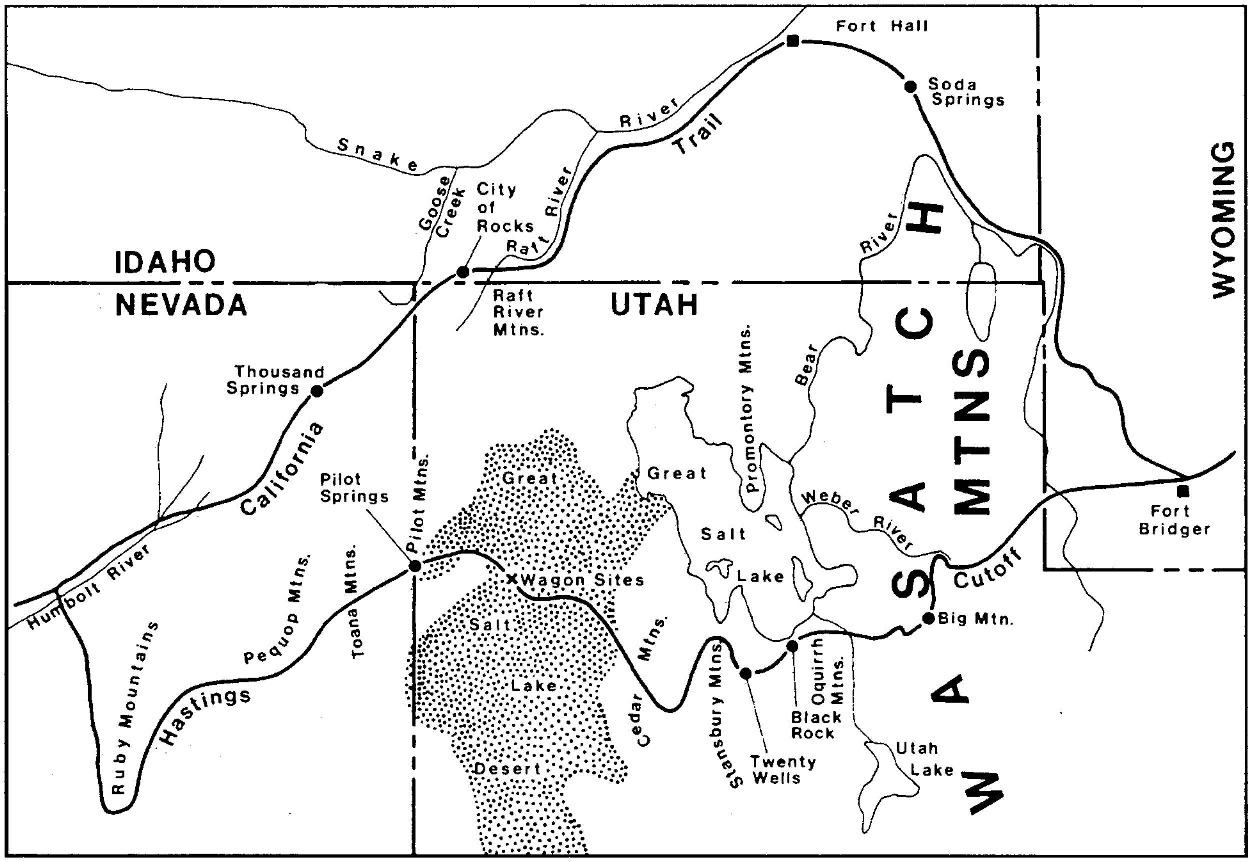

Figure 14. Map of the California Trail and Hastings Cutoff (from Hawkins and Madsen 1990:Figure 19). Courtesy University of Utah Press.

the northern edge of the Great Salt Lake and reach the Humboldt River, which they would follow into Nevada and California. They eventually made it to the east base of Pilot Peak on the Utah-Nevada border, but shortly thereafter had to abandon their wagons because of the difficulty of the terrain and continue on horseback.

In the early 1840s, Lansford Hastings attempted to capitalize on the "Oregon fever" that had struck thousands of eastern settlers by advocating a shortcut to the west coast. He advocated a route south of the Great Salt Lake, claiming it would save 200–450 miles on the trek. Hastings would eventually traverse this route, but on horseback, and he very irresponsibly failed to inform anyone that the route, which became known as the Hastings Cutoff, was far too difficult for wagon travel.

Although a few parties in the early 1840s, such as the Bryant-Russell party and the Harlan-Young party, made successful passages along the Hastings Cutoff, heeding Hastings's advice would prove tragic to a now-famous group of immigrants. In 1846, the Donner-Reed party (sometimes referred to as the Donner party), a wagon train of 80 immigrants with horses and oxen, headed west for California. Seduced by the prospect of a shortcut, they deviated from their intended course and made for the Hastings Cutoff. As mentioned above, previous overland routes west had journeyed to Soda Springs from Independence Rock, and then made for California by traveling north of the Great Salt Lake; this was part of the famed Oregon Trail (Hawkins and Madsen 1990) (Figure 14). The Donner-Reed route went south from South Pass to Fort Bridger and Salt Lake City, then followed the Hastings Cutoff south of the Great Salt Lake. Delays in the Wasatch Mountains and Great Salt Desert resulted in the abandonment of many of their animals, and by the time they reached the Sierras the winter snows were falling. Thirty-four members of the expedition fell victim to freezing, starvation, and, ultimately, cannibalism. After this, overland wagon routes to California crossed north of the Great Salt Lake (Hawking and Madsen 1990; Miller 1987, 1989b).

Excavations of several of the wagon sites in the Hastings Cutoff on the UTTR North were undertaken by Hawkins and Madsen from 1983 to 1988 (Hawkins and Madsen 1990). Five sites—42TO467, 42TO468, 42TO469, 42TO470, and 42TO471—were the focus of investigation. The material culture recovered from the sites included wagon parts and household goods, as well as weapon remnants probably associated with a military campaign (Figure 15).

Linking East and West: The Railroads

By the 1850s, the wagon trains were giving way to railroads throughout the United States; East and West were finally linked by rail on May 10, 1869. The first transcontinental railroad, linking the Union Pacific and Central Pacific lines, met at Promontory, Utah, north of the Great Salt Lake on this day, and a ceremonial gold spike was driven into the track to symbolize the meeting of east and west. Given the early history of the Great Salt Lake region, and the formidable barrier it presented to overland routes to the west coast, it seems fitting that the joining of the first transcontinental railroad should culminate just north of the lake. The line, however, as not without its difficulties. Full of steep curves and grades, it was beset by bottlenecks. Officials of the Southern Pacific Railroad had planned for years to alleviate these problems; work to remedy the situation began in 1902, with the Lucin Cutoff. Five years later, the first locomotives were steaming along the new line, which crossed over a large segment of the Great Salt Lake and was considered at the time to be one of the truly outstanding feats of engineering in American history. In the words of Miller (1987:41), traveling along the Lucin Cutoff was "going to sea by rail."

Mormon Settlement

In 1830, a millennialist group was organized in the town of Palmyra, New York, under the leadership of a charismatic prophet named Joseph Smith. Within two decades, this sect would become one of the 10 largest religious denominations in the United States (Hill 1989). Over the next 14 years, Smith and his ever-growing number of followers, who came to be known by outsiders as Mormons, struggled through bouts of persecution in New York, Ohio, Missouri, and Illinois, culminating in Smith's murder on June 27, 1844, by a town mob at the Carthage, Illinois, jail. Brigham Young took over the reins of power of the group, and when informed by Governor Ford of Illinois that protection for the Mormons could no longer be assured, Young agreed to have his people sell off their houses and land and move west to Utah, selected by Young as the new Zion, the seat of the Mormon Kingdom of God.

By mid-1847, the Mormons had decided to establish their initial colony in the Salt Lake Valley. Settling in to farm the valley, the new inhabitants found it less than idyllic:

> In the circumstances, some Saints despaired of surviving in the valley. After two weeks of fighting the voracious insects, the pioneers were somewhat relieved to gain an ally in their battle when thousands of white-winged gulls landed in the fields and began to devour the pests. The

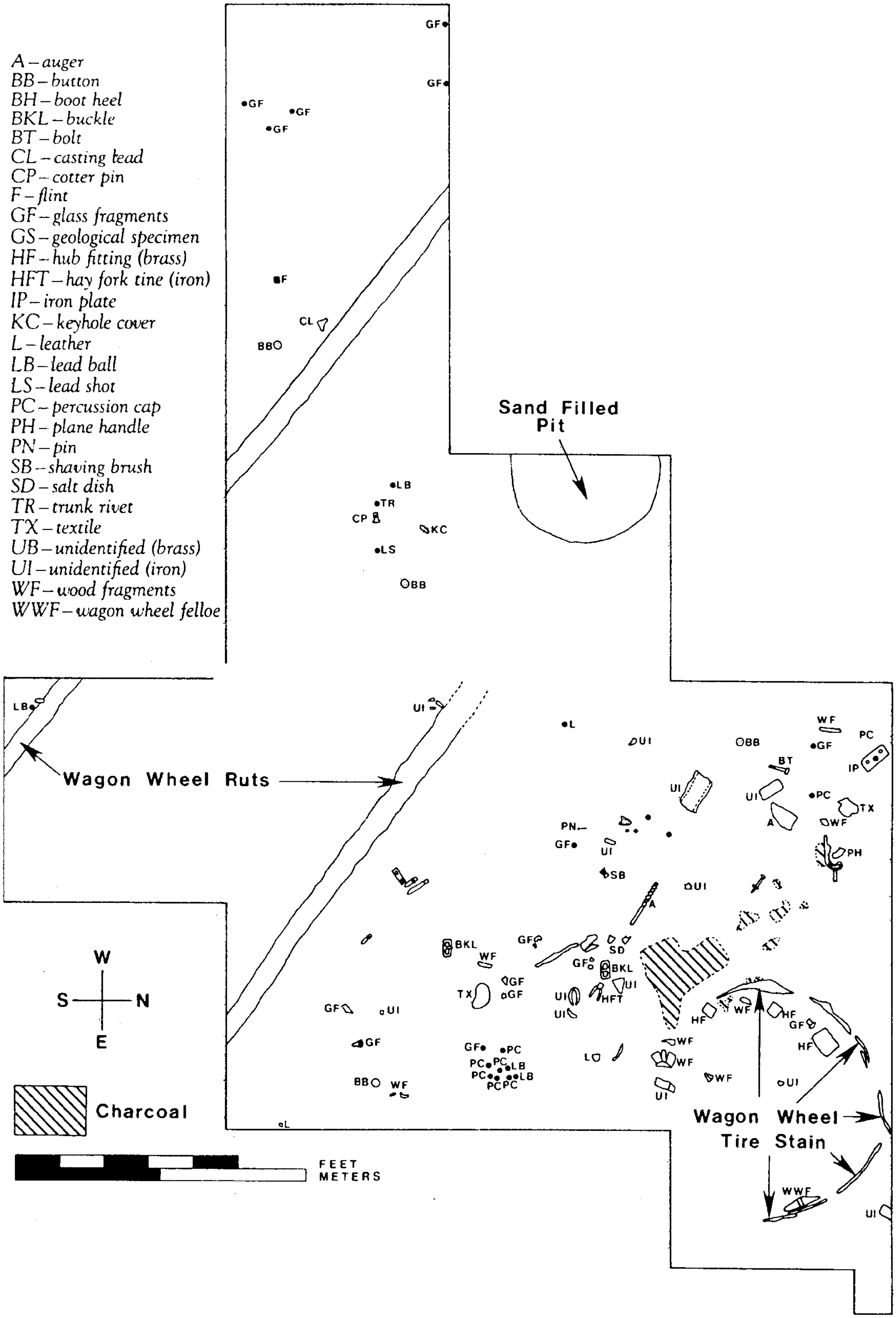

Figure 15. Excavation plan of 42TO467 (from Hawkins and Madsen 1990:Figure 32). Courtesy of University of Utah Press.

gulls helped stem the tide of cricket devastation, and their coming has since been regarded as a miracle by many, although little was said about it at the time. Perhaps the fact that the frost destroyed so much and the gulls left before the crickets were eliminated muted the Saints' enthusiasm [Campbell 1989a:127].

Over the next few years, energetic exploratory efforts were undertaken in a number of valleys near the Salt Lake Valley to expand Mormon settlement in the Great Basin. This was aided by ongoing scientific exploration of the Great Salt Lake, which served, among other things, to find overland wagon routes to the west. The Mormons found themselves in the heart of this route, which would allow them to expand their economy and influence through time (Campbell 1989a). Part of the success of the early economy of Utah can be attributed to the fact that people came to Utah seeking homes and refuge, rather than quick wealth. Economic growth occurred as an interaction of ideology, planning, and circumstance (May 1989).

Despite friendly intentions and the Mormon belief that Native Americans were members of the "chosen race," interactions between Mormons and Native Americans were fairly typical of those that occurred between Euroamerican settlers and native populations throughout the west. The Mormons sought to acquire land, and soon the local Native Americans realized that the settlers were there to stay. Fortuitously, the Salt Lake Valley was neutral territory for the Gosiute, Ute, and Western Shoshone, so initial settlement did not create immediate problems. However, movement into adjacent valleys began to create tension and occasional conflict. Slave-raiding from the south was a major fear and concern of Great Basin Native Americans, who lacked horses and firearms to protect themselves, and their anger over the Mormons' handling of the situation led to the so-called Walker War of 1853. Although few died in this series of brief skirmishes, it compelled the Mormons, who had failed in their plans to organize local Native Americans into self-sufficient, Euroamerican-style communities and convert them to the faith, to support reservation treaties and a policy of segregation rather than integration (Tyler 1989).

By 1857, the Mormons had founded approximately 100 towns in the Great Basin, including a line of settlements from Salt Lake City to San Bernardino, California. The pattern of colonization tended to follow a contiguous plan, under the auspices of the theodemocratic State of Deseret, which had been organized in 1849 (Figure 16). Brigham Young often sent men who held lofty position in the church to colonize new towns, so that the power of the Mormons would not be too heavily centralized in one place. This, in part, explains the success of the colonization process (Campbell 1989b). The sovereignty sought by the Mormons was challenged by the U.S. government in 1857, initiating the Utah War. Afterward, the Mormons continued to dominate the social, political, and economic life of the region, although the war brought an increased number of non-Mormons to the region. By 1862, Congress passed an anti-polygamy bill, although President Lincoln did not feel particularly compelled to enforce it (Larson 1989a).

By 1850, proselyting activities had extended to Europe, and some 27,000 British and 33,000 Scandinavians had converted, many of whom set sail for America and then went to Utah. The Perpetual Emigrating Fund Company was founded to assist Europeans with making the voyage. In all, more than 100,000 Mormons were helped directly or indirectly to relocate to Utah, 85,000 of whom came from Great Britain or northern Europe (Buchanan 1976; Larson 1989b; Mulder 1976).

In addition to such ambitious undertakings as the perpetual Emigrating Fund Company, Brigham Young established a mail line from the Missouri River to the Salt Lake Valley, but the revocation of the government mail contract, as well as the Utah War, put an end to the program, which Brigham Young estimated cost his people 200,000 dollars, in 1857. Although the Pony Express was carrying mail into the Salt Lake Valley by the early 1860s, most mail in the region was carried by Mormon travelers, businessmen, and church officials until the completion of the transcontinental railroad (May 1989).

Tension between Utah Mormons and the U.S. government continued after the Civil War, much of it caused by various acts of legislation aimed at the Mormons. In 1862, the Cullom Bill sought to subject

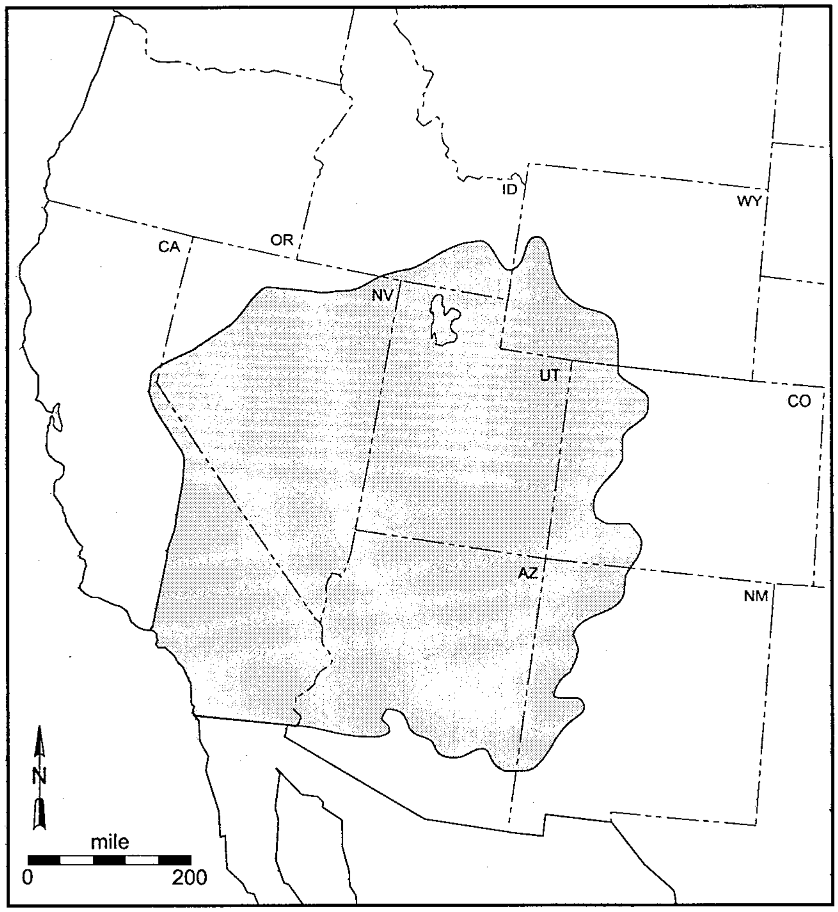

Figure 16. Proposed State of Deseret (from Walker and Bufkin 1986:20b).

Utah to greater federal control to break Mormon control of the judicial system; the bill also sought to give the president the power to use the military to enforce the law. The bill was never enacted, but Judge James B. McKean, appointed governor by President Grant, acted as if it had been. Attacking polygamy, he issued 130 indictments, including one against Brigham Young, but a Supreme Court decision determined that he had improperly selected the juries for the cases and the indictments were dropped. The Poland Act of 1874 restored the judicial systems to its previous configuration, and this, coupled with the failure of the Cullom Act and President Grant's reforms, relieved tensions between the two sides (Larson 1989a).

In the late 1870s, two events had tremendous repercussions on the destiny of the Mormons. First, Brigham Young died on August 29, 1877. Second, the Mormons challenged the Antibigamy Law of 1862 and lost, with Supreme Court rulings in 1879 and 1881 declaring the criminality of having multiple wives. It would be another decade before the Mormons in large part gave up this fight and the church declared that it was willing to abandon its practice of polygamy (Larson 1989a).

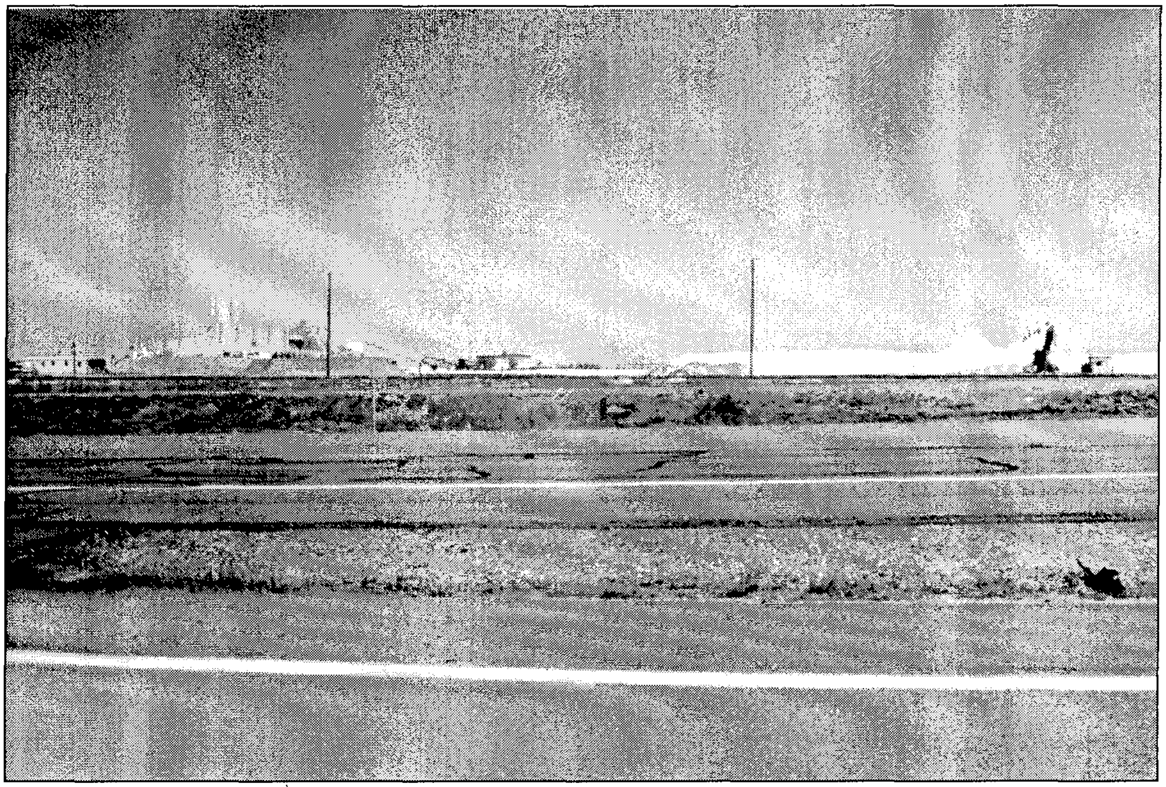

Figure 17. Present-day salt-mining operation north of I-80 (not on the UTTR).

Economic Growth: Ranching and Mining

As discussed in Chapter 3, cattle ranching was a major economic industry in both Box Elder County and neighboring Elko County, Nevada; it was highly influential on the Euroamerican settling of the region. For many years, these two counties were among the leaders in Great Basin beef production (Hulse 1991). Railroad accessibility promoted the initial growth of the industry in the late nineteenth and early twentieth centuries. By the 1920s, highway accessibility continued to promote ranching in the region.

Until the late 1860s, most of the roads and thoroughfares in Mormon territory were left to the Mormons to build and maintain. When the mineral wealth of Utah was first realized, the government interceded (May 1989). Mining, however, was not as prosperous or as prominent a historical-period industry in the region as was livestock ranching, and mining was far more prominent on the Nevada side of the region. Gold mining occurred in Elko County, Nevada, but the strikes and yields there did not compare in quantity to the lodes discovered in areas such as Eureka, White Pines, and Pioche (Hulse 1991). In addition, silver and gold ores mined in the mountains surrounding the UTTR in the late 1880s were of a poor grade and yields were low. Silver was mined at the north end of Wildcat Mountain in 1910, and shortly thereafter potash mining became extensive around Wendover (Dames and Moore 1996) and on the Bonneville Salt Flats (Miller 1987).

The Great Salt Desert has long been a focus of salt extraction, although Utah produces only about 1 percent of the nation's salt supply (Figure 17). Additional mineral extractions from the lake itself include various chlorides, sulphates, and magnesium, industries that began in the 1960s (Miller 1987; Toomey 1980).

Military Campaigns and Bases

Since well before becoming a state, Utah has had a U.S. military influence within its borders. Once again, this relates to Utah's role in the linking of East and West by an overland route. Several forts, including Forts Hall and Bridger, key nodes on the Oregon Trail, were located near the present-day boundaries of the state, and as part of the famous trail passed through the state; U.S. military personnel were never far away. Early scientific studies of the Great Salt Lake that were underwritten by the U.S. government and employed military personnel, such as Bonneville and Fremont, to spearhead these expeditions. As noted above, the Utah War of 1857–1858 brought U.S. military personnel into conflict with Mormon settlers over issues of sovereignty; afterward, many of the soldiers who participated in the war stayed on to live in Utah. In 1862, Fort Douglas was established by U.S. Army volunteers to protect government interests in Salt Lake City from Native Americans.

In 1939, under orders from President Roosevelt, the U.S. Government War Department developed a readiness plan in which military supply and maintenance depots were to be placed in strategic regions across the United States. Because it was considered safe from Japanese attack, yet offered quick, efficient access to the west coast, Utah became a major focus of military planning; it is estimated that World War II brought nearly 50,000 jobs to the state (J. Christensen 1989). One site selected as an air depot was in north-central Utah; the 3,000-acre site was adjacent to the Ogden Ordnance Depot in Davis County. Congress appropriated eight million dollars for the construction of Ogden Air Depot, which was then christened Hill Field. In November 1940, the field was activated by the Army Air Corps. During World War II, Hill Field provided supply support for many types of aircraft, including the A-20, B-17, B-24, B-29, P-40, P-47, and P-61. It also featured factory-line maintenance of aircraft that proved so efficient that it became a model for other such installations. Hill Field was critical to air logistical support during the war, and by 1943, 22,000 personnel were working there; by late 1946, with operations and production severely decreased, the work force had been reduced to 2,800. At that time, the primary role of Hill Field was as a storage site for aircraft and support equipment (U.S. Air Force 1994).

Wendover AFB was established during World War II to fill the need for heavy bombing and gunnery ranges, as well as for storage (Figure 18). Its original configuration covered 3.5 million acres, making it the largest military reserve in the country. Twenty-one heavy bombardment groups trained at Wendover during World War II, including the 509th Composite that dropped atomic bombs on Hiroshima and Nagasaki (J. Christensen 1989). After World War II, Wendover AFB was used for missile development, which included testing German V-1 rockets captured during the war (Figure 19). The American version of the V-1, which was designated the JB-2, was also tested on the Utah ranges. In 1946, the area became the location of the first Ground-to-Air Pilotless Aircraft (GAPA) missile testing site, and tests continued into 1947. The GAPA missile was designed to be a remote-controlled, supersonic weapon that could intercept aircraft flying at a wide variety of altitudes and speeds. To support the program, approximately 30 technicians moved to the range, and control bunkers and launching pads were constructed. After 40 launches of the missile, much valuable information was learned regarding surface-to-air missile technology (Launius 1991:347–350). The GAPA site is preserved on nearby BLM land.

Hill Field was renamed Hill AFB in February 1948. During the Korean War, B-26 and B-29 aircraft were reactivated, and, by 1952, 15,000 personnel were working at Hill AFB. Even after the Korean War, activity continued to be considerable at the base, with 14,000 employees there in 1955 (U.S. Air Force 1994). In 1950, Hill AFB began to oversee the aircraft using the UTTR, replacing the control tower at Wendover AFB in that role. The ranges themselves were operated by various Air Force units. Wendover AFB was deactivated and reactivated several times following World War II (e.g., in 1961 it was reactivated as Wendover Auxiliary AFB), but was finally declared surplus by the Air Force in 1962. Today the ranges Wendover AFR and Hill AFR) are collectively known as the UTTR, and are still

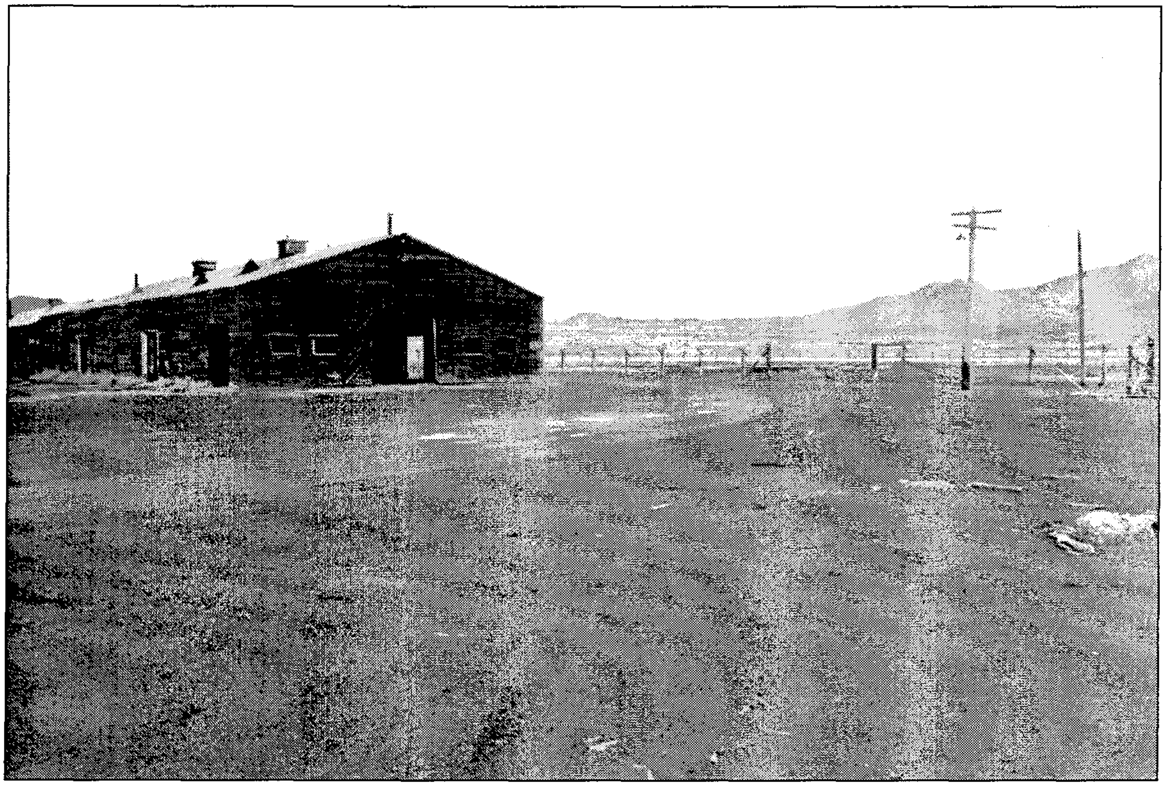

Figure 18. Abandoned warehouse and storage area, UTTR South (Wendover AFR) entrance gate. Range in background.

Figure 19. German V-1 rocket debris from testing, UTTR South (Wendover AFR).

administered by Hill AFB (under the U.S. Air Force Air Materiel Command). The UTTR's military activities focus on training missions that include air-to-ground, air-to-air, and ground troop training. The U.S. Air Force continues to be a major employer in the state of Utah (Dames and Moore 1996; Gwynn 1980).

Historical-Archaeological Evidence

Historical-Period Sites on the UTTR

Two surveys by Workman et al. (1992b, 1993b) yielded 22 historical-period sites on the UTTR. Site types include early-twentieth-century refuse dumps, camps, railroad grades, emigrant wagon sites, wagon routes, corrals, building foundations, habitation sites, salt-evaporation features, and mining sites. As discussed above, five of these sites—42TO467, 42TO468, 42TO469, 42TO470, and 42TO471—relate to the Donner-Reed party and were investigated by Hawkins and Madsen (1990). Workman et al. (1992b, 1993b) recommended that 15 of these sites were significant or potentially significant. They considered an additional site, 42TO752, the GAPA-missile testing site used in 1946 and 1947, to be significant. This site, however, is located on nearby BLM land rather than on the UTTR. For more information on historical-period sites, see the appendix.

CHAPTER 7

Native American Concerns

As discussed in Chapter 5, the spread of Numic-speaking peoples into the Great Basin provided the ancestral population for the modern Native Americans of the region (Figure 20). At the time of initial European contact, the Native Americans living in northwestern Utah were the Gosiute, a Western Shoshone group who spoke various dialects of the Shoshonean language, which is of the Central Numic branch. Utes, Northern Shoshone, and other Western Shoshone people used the area as well, for gathering salt and various wild resources (Tyler 1989). Much of the ethnographic data on the Western Shoshone derives from the classic works of Steward (1937, 1938, 1941, 1943, 1970), as well as more recent ethnographic works by Catherine Fowler (1977, 1982, 1986) and Thomas (1981b, 1983), as well as Malouf's (1966) ethnohistoric overview. Thomas (1986) edited a compendium of ethnohistorical sources, early ethnographic studies, and more recent synthetic papers on the Shoshone. Important ethnographic and ethnohistorical studies of the Ute include Stewart (1942), Jorgensen (1964, 1972), Janetski (1983), and Smith (1974). Well-written syntheses of the literature have been presented by Thomas et al. (1986) for the Western Shoshone and Callaway et al. (1986) for the Ute. The following ethnographic discussion is divided into thematic topics: sociopolitical organization; subsistence, habitation, and material culture; ideology and ceremonialism; external relations; and the reservation and post-reservation periods. The final section of the chapter focuses on current issues, such as NAGPRA-related concerns and TCPs.

Sociopolitical Organization

Western Shoshone sociopolitical organization was a focus of Steward's classic 1938 monograph. In effect, Steward found an absence of very many social institutions known among other Native American cultures. Well-defined groups beyond the simple village, such as men's institutions, significant ceremonialism, age grades, women's societies, and warfare, were all absent. Steward attributed this remarkably simply social structure to the rigors of the demanding environment in which the Western Shoshone found themselves—a place of meager, fluctuating resources that mandated an annual cycle of mobility.

Stability of social units tended to correlate with the resource base; the more stable the resources, the more stable the social unit. In areas of high unpredictability of resources, group size fluctuated markedly (Thomas et al. 1986). Some harvesting of grasses was undertaken; larger groups often formed during this time. Group composition was situational, depending on the proximity of families to such activities as crop harvesting. A number of social groups were given food-item names, but, again, membership fluctuated considerably and neither kinship structures nor territories were recognized. However, such groups did serve to define rights to resources in the more densely populated areas, where competition for resources was greatest (Fowler 1982).

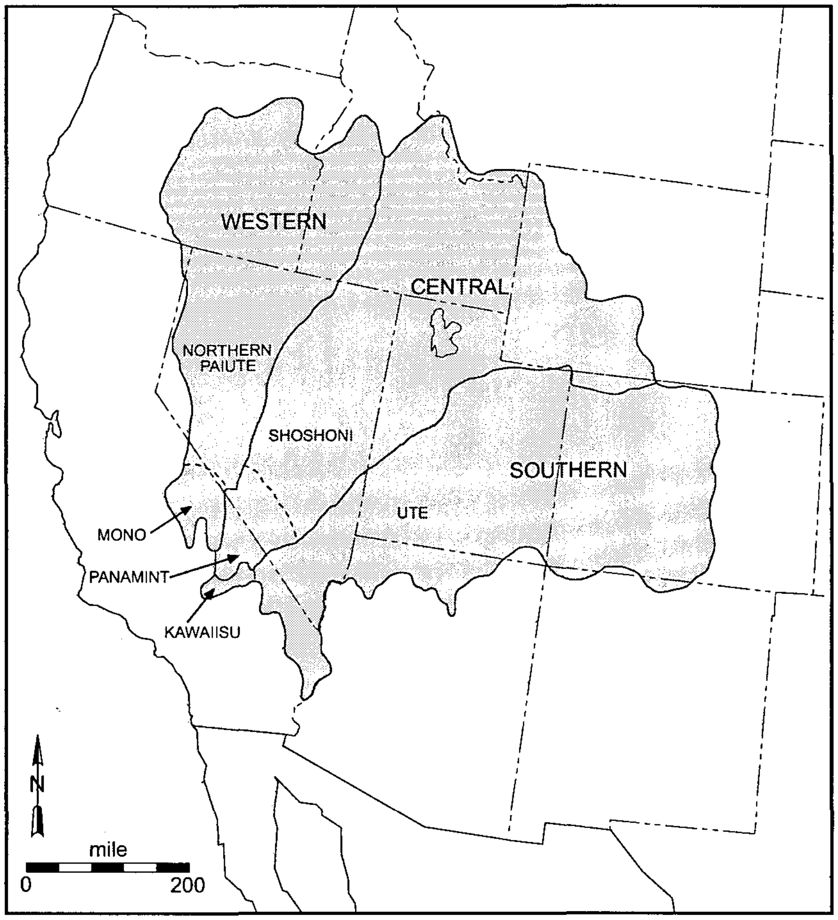

Figure 20. Distribution of Numic languages (after Bettinger and Baumhoff 1982:491).

The most stable political group was the winter village, which featured an informal headman and a shifting population. Village cohesion, however, was loose and the headman had little authority. Steward (1937) believed this structure was due in part to Euroamerican effects on Shoshone culture, although others, such as Stewart (1980), felt that this represented a model of prehistoric, band-level society.

Subsistence

The Western Shoshone employed a variety of strategies for obtaining food, and exploited a wide range of ecological zones to do so. From spring to fall, foraging groups consisted largely of families and family clusters. Group movements revolved around harvesting activities and the availability of patchy resources. During winter, food supplies were largely available in the form of cached seeds, nuts, dried meat, and other foods (Steward 1937). Seeds and pinyon nuts were dietary staples, and seed harvesting involved a number of strategies and techniques, including the use of wrapped sticks as seed beaters and cutting and tying seeds into bunches. Pinyon nuts were gathered in early autumn; in areas of dense masts, winter residential sites were set up. In less abundant areas, temporary camps were established in groves during the nutting period. Mesquite was another dietary staple, and to process the seed pods Western Shoshoneans used mortars and pestles. The pods were ground into flour and transported as cakes. Transport of seeds, pinyon nuts, and mesquite cakes often occurred in large cone-shaped baskets.

Hunted game contributed fewer calories than did plant foods. Several species, including bighorn sheep (*Ovis canadensis*), pronghorn (*Antilocapra americana*), deer (*Odocoileus* sp.), rabbit (*Sylvilagus* sp.), gopher, squirrel, and mouse, were regularly hunted. The Gosiute fished, and such birds as doves (Columbidae), mockingbirds (*Mimus polyglottos*), quail (*Callipepla* sp.)and sage hens were hunted (Thomas et al. 1986).

Habitation and Material Culture

Dwellings tended to be temporary and very simple in construction. A conical hut was built in winter that could accommodate a family of approximately six. Conically or domed-shaped sweat houses were common.

Western Shoshonean material culture was highlighted by basketry, including both coiled and twined forms. These items included baskets, seed beaters, winnowing trays, and conical carrying baskets. Bows for hunting were made of juniper or mountain mahogany and were backed with sinew. Shoshonean ceramics consisted of clay vessels bearing indented decoration on the exterior surface. Smoking pipes made of slate or various other stones were common.

In general, clothing was minimal, even in winter. Clothing and shoes were sewn of buckskin and other tanned animal hides. Hats and various types of moccasins were also made of twined sagebrush bark. Fur belts, shell and bone necklaces, and earrings were common adornments, as were face tattooing using wood-charcoal pigment and body paint made of a variety of mineral pigments (Thomas et al. 1986).

Ideology and Ceremonialism

Traditional religion among the Western Shoshone involved a simple, direct relationship with the supernatural. It was thought to be possible to obtain supernatural powers through dreams and visions. No formal priesthood existed, but three types of shamans were recognized: those capable of curing specific ailments, those with general curing powers, and those who used their power only for their own benefit. Curing generally involved laying hands on the sick.

Ceremonial activities were apparently rather meager among the traditional Western Shoshone. Festivals and ceremonies tended to coincide with times of food abundance, when such activities as pinyon-nut gathering (early fall), antelope hunting (spring), or rabbit drives were taking place. The most common ceremony was the Round Dance, which was variously incorporated into rituals surrounding mourning, courtship, and as a means to produce rain (Thomas et al. 1986).

External Relations

Early encounters between European and Native Americans in northwestern Utah were discussed briefly in Chapter 6. By the early nineteenth century, slave trading became an integral part of the economic network between Hispanics from New Mexico and Great Basin Native Americans. With Spain having lost its North American holdings in 1821, many Mexicans became prominent in the slave trade. In 1813, an expedition of seven men led by Mauricio Arze and Largo Garcia left Abiquiu, New Mexico, for the Utah Lake area to trade. Upon their return, the men testified in court that they had purchased Native American captives as part of their transactions. Many of the captives, who were largely women and children, were consigned to work on ranches in New Mexico. Euroamerican slave traders rarely captured slaves themselves, instead relying on Native Americans to provide them with captives. Those that did so tended to thrive, whereas the tribes from which their victims were taken suffered greatly. Many of the slaves were provided by Ute horsemen, particularly those led by Wakara, the man who would come to be known as Chief Walker and principal of the Walker War (see Chapter 6). The Gosiute and Southern Paiute, who resisted acquiring horses because it did not fit in with their way of life, were particularly victimized; the populations of some bands were decimated by the slave trade (Malouf and Findlay 1986; Shimkin 1986).

By the 1820s, fur trappers had made their way into the Great Basin. As discussed in Chapter 6, it was a fur trapper, James "Jim" Bridger, who is considered the first Euroamerican to set eyes on the Great Salt Lake. The intensive trapping of beavers disrupted much of the ecological balance in stream environments, and the consequences greatly affected Native Americans and led to a series of violent conflicts in several parts of the Great Basin. The Gosiute were largely unaffected by such activities, and relatively little trapping occurred in northwestern Utah (Malouf and Findlay 1986).

The Reservation and Post-Reservation Periods

By 1846, government agencies had been established to deal with Great Basin Native Americans and treaties began to be negotiated. The earliest treaty negotiated with the Gosiute was by Garland Hurt in 1855, and involved the establishment, among other things, of the Deep Creek Reservation. However, Euroamerican interest in the Gosiute territory waned, and the 1863 Treaty of Tooele Valley allowed a vast area to be set aside for the Gosiute, which allowed them to continue pursuing a foraging way of life even after most other Great Basin Native Americans had been confined to reservations (Clemmer and Stewart 1986). Nevertheless, the presence of Mormon communities in northwestern Utah affected Gosiute life, and repeated attempts by the Mormons at settling Gosiute into self-reliant, Euroamerican-style communities resulted in conflicts between the two sides (Thomas et al. 1986; Tyler 1989).

The Treaty of Tooele Valley, with the Treaty of Ruby Valley, also drafted in 1863, had some complex concessions, however. The Western Shoshone were to agree to cease hostilities against settlers and government officials (which they did), and give up their way of life at some unspecified future date and move to reservations, effectively conceding their lands to the government. Despite offers to subsidize the Western Shoshone with livestock, provisions, and clothing, they steadfastly refused to give up their lands. Shortly thereafter, representatives of the Western Shoshone requested lands near Grass Valley; when this was not granted, some of the Western Shoshone joined northern groups in sporadic raiding and warfare against Euroamerican settlements. Orders came for the Shoshone ca. 1878 to relocate to the Duck Valley Reservation in Idaho, but many refused. These conflicts continued into the twentieth century, when several reservations were set up in Utah and Nevada (Thomas et al. 1986).

Additional treaties concerned sharing of natural resources, peace and friendship, and still more reservations. For the Gosiute, a reservation of 17,745 acres was established in Skull Valley, Utah, in 1907. A 34,560-acre reservation at Goshute, Nevada, was established in 1917 (Clemmer and Stewart 1986).

The Treaty of Ruby Valley continued to be contested by Shoshonean groups into the late 1970s. The tribe claimed that their lands, totaling some 24 million acres, had never passed legally into the government's hands. Their claims were rejected in court, but 26 million dollars was paid to them in compensation. In 1980, it was ruled that the Shoshone had lost title to their lands not in 1863 by the Treaty of Ruby Valley, but in 1979 when the compensation was delivered to them. The decision was appealed to the Supreme Court, which upheld it in 1985 (Thomas et al. 1986).

NAGPRA, AIRFA, and TCPs

Recent federal legislation such as AIRFA and NAGPRA have brought archaeologists and Native Americans into contact with one another to a much greater degree than formerly was the case. Archaeological investigations now routinely incorporate Native American concerns about treatment of human skeletal remains and the discovery of sacred TCPs. More Native Americans are now being trained in archaeological field methods, and are more frequently being included as crew members on field projects. The recognition of landscapes imbued with sacred significance has allowed archaeologists to broaden the base from which they undertake analysis of data derived from the archaeological record.

Parker and King define a TCP as a resource

> that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community [Parker and King 1990:1].

Further, they sum up the key qualities of a TCP as follows:

> The cultural foundations of America's ethnic and social groups, be they Native American or historical immigrant, merit recognition and preservation, particularly where the properties that represent them continue to function as living parts of the communities that ascribe cultural value to them [Parker and King 1990:20].

The prehistory and ethnography of northwestern Utah clearly indicate the significant presence of Native Americans for several thousand years. The lands encompassed by the UTTR are, of course, no different. Any archaeological research undertaken on the UTTR must include dialogue with all interested Native American groups; this is likely to include members of several Ute and Shoshone reservations. Issues of primary concern include the treatment of human skeletal remains, should they be encountered, the definition of TCPs, and the degree to which Native American wish to be involved in each phase of the undertaking.

CHAPTER 8

Synthesis, Conclusions, and Management Recommendations

This report has sought to provide a baseline inventory, description, significance potential, and interpretation of the environment and cultural resources of the UTTR and adjacent areas as a tool for federal management. Based on past research, predictions as to the likely areas of paleontological and archaeological resources were made (Chapters 2 and 4). They are summarized below.

Paleontological Resources

A number of paleontological studies has been conducted in the Lakeside and Grassy mountain ranges (Doelling 1964; Jordan 1979; Sheehan 1971), and these have proved to be valuable areas for the identification of fossils. Both ranges exhibit diverse formations, from Cambrian to Quaternary in age. Formations identified from Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, Permian, Triassic, Miocene–Pliocene, and Quaternary deposits have yielded fossils in various parts of northwestern Utah. These ranges, therefore, are considered to be primary localities for fossil-bearing sites. Paleontological research has not been reported from the Newfoundland Mountains, but this range also contains Cambrian, Ordovician, Silurian, Devonian, Pennsylvanian, Permian, Miocene–Pliocene, and Quaternary formations, which have yielded fossils in northwestern Utah. The Newfoundland Mountains, therefore, are also considered to be a primary fossil-bearing locality. Given that all other ranges in northwestern Utah have yielded fossils, it is likely that the Kittycat and Wildcat ranges are also prime localities for paleontological resources. Finally, the Lake Bonneville sediments of the UTTR, particularly those found in mountain ranges, are likely fossil-bearing localities.

Archaeological Resources

As discussed in Chapter 2, archaeological resources in the UTTR and surrounding areas tend to be present in association with landforms that provide relatively easy passage through difficult terrain, near springs or other permanent water sources, and in areas where critical food resources were readily available. Access to a variety of environmental zones, generally defined by differing elevations, also appears to be a significant criterion in site location. The lower slopes and bases of the various mountain ranges within the UTTR would seem to be primary locations for archaeological resources. Mountain ranges with sedimentary-rock exposures are likely to yield caves and rockshelters, as has been documented in the Lakeside and Grassy Mountains (Workman et al. 1992a, 1992b, 1993b). The Newfoundland Mountains, which also have sedimentary (limestone) strata, are likely to contain these site types, as well. Finally, it should be mentioned that a significant, critical, overland wagon route, the Hastings Cutoff, runs through the UTTR; historical-period cultural resources are highly likely along this and related trails.

Managing the Cultural Resources of the UTTR

As of October 1998, 209 cultural resources had been documented on the UTTR. These include 172 prehistoric sites, 30 historical-period sites, 3 multicomponent sites, and 4 sites of unknown age. In the appendix that summarizes basic information on these resources, one column notes "Interpretive Potential." This assessment was added to the database (see Knoblock and Rose 1999) in order to alert cultural resource managers at Hill AFB to a site's potential for research in a relatively subjective sense, among other things. The reader will note, however, that for many of the sites listed, interpretive potential is unknown. In most cases this is because the IMACS form for the resource simply did not contain enough information to make a reasonable judgment.

Interpretive potential should not be confused with a site's NRHP eligibility status. Whether or not a site is determined potentially eligible for inclusion in the National Register depends upon evaluation within the context of an established research design. No comprehensive design for the eastern Great Basin has been available until recently (Bischoff et al. 1999), and the research themes used to evaluate sites have been less than comprehensive or even nonexistent. Most IMACS forms reviewed did not contain definitive information on a resource's eligibility status, and it was felt that adding what is known about eligibility determinations for these sites would simply cause more confusion. To adequately manage the currently known resources on the UTTR and to plan for responsible management in the future, it is essential that all sites be recorded thoroughly and evaluated within a regional context.

However, it is safe to say that research to date has provided a substantial contribution to Great Basin prehistory, particularly the investigations of such sites as Danger Cave and Juke Box Cave (Jennings 1957), Hogup Cave (Aikens 1970), Sudden Shelter (Jennings et al. 1980), Sandwich Shelter (Marwitt et al. 1971), Swallow Shelter, and the nearby sites of Thomas Shelter, Kimber Shelter, and Beatty Springs (Dalley 1976), Scribble Rock Shelter (Lindsay and Sargent 1979), Remnant Cave (Berry 1977), Spotted Cave (Mock 1971), the Levee and Knoll sites (Fry and Dalley 1979), Bear River Nos. 1, 2, and 3, and Injun Creek (Aikens 1966; Shields and Dalley 1978). In terms of historical-period cultural resources, the UTTR has yielded significant evidence of the Donner-Reed party at Hastings Cutoff (Hawkins and Madsen 1990). In sum, the nearly 1 million acres that comprise the UTTR is likely a very rich locality for prehistoric and historical-period cultural resources, as well as for paleontological resources.

Management of the UTTR's cultural resources is being implemented by means of reports such as this one, as well as the development of a permanent, computerized database of all known cultural resources (Knoblock and Rose 1999). The requirements of Sections 106 and 110 of the National Historic Preservation Act will drive future work on the UTTR, and documents such as this one will provide guidelines for developing historic contexts and pertinent research questions for purposes of the significance-evaluation process. A regional perspective has been developed in this report, and this will also factor into the development of meaningful research designs (also see Bischoff et al. 1999). Sensitivity to Native American concerns, discussions with Great Basin Native Americans, and the potential for identifying TCPs will also play a role in management strategies.

National Register Districts

As discussed in Chapter 5, eight National Register districts have been proposed for the UTTR. These include the Wildcat Mountain area, the south Aragonite Dune Field, the Blue Lake area, the South Knoll Dune Field, the Wendover Air Auxiliary Field (in Elko County, Nevada), the Lakeside Mountains, the southern portion of the Newfoundland Mountains, and a district for historical-period cultural resources. Although the investigators who proposed the districts consider the assessment to be complete and finalized, Martyn D. Tagg, HQ AFMC/CEVC cultural resources manager, has noted that nominations for these proposed districts have not been submitted (and are not likely to be submitted) to the National Register. There are currently no National Register districts on Hill AFB or the UTTR.

Conclusions

As stated above, the UTTR is likely a very rich locality for cultural and paleontological resources. The two ranges encompass a wide variety of environments, physiographic landforms, and resource zones, many of which would have been attractive to past peoples inhabiting the area. A long tradition of foraging throughout multiple environmental zones for resources characterizes Native American occupation of the region. The use of northwestern Utah as part of overland routes to link the eastern United States. with the Pacific Coast left an intriguing historical record in the region, many of the resources of which are contained (or probably contained) within the UTTR. This report has sought to emphasize the diversity of significant cultural resources in the greater region, noting that the localities of particularly significant cultural resources have analogs on the UTTR. Future work promises to add considerably to our current knowledge and understanding of past environments and past human behavior in northwestern Utah.

APPENDIX

Known Cultural Resources on the UTTR as of October 1998

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
UTTR North					
42BO430	prehistoric	cave/rockshelter	unknown		
42BO432	prehistoric	cave/rockshelter	unknown		
42BO434	prehistoric	cave/rockshelter	unknown		
42BO437	multicomponent	cave/rockshelter	unknown		
42BO536	prehistoric	flaked-stone artifact scatter	unknown		
42BO667	prehistoric	cave/rockshelter	yes, research potential high, a pristine cave site		
42BO668	prehistoric	cave/rockshelter	yes, research potential high, a pristine cave site		
42BO669	prehistoric	cave/rockshelter	yes, research potential high, a pristine cave site		
42BO670	prehistoric	cave/rockshelter	yes, research potential high, pristine cave site with midden deposit		
42BO671	prehistoric	cave/rockshelter	unknown		
42BO672	historical	historical-period artifact scatter	unknown		
42BO673	historical	historical-period artifact scatter	unknown		1900–1920
42BO674	historical	historical-period artifact scatter	unknown		1880–1920
42BO675	prehistoric	cave/rockshelter	unknown		
42BO676	prehistoric	cave/rockshelter	unknown		
42BO677	historical	historical-period artifact scatter with feature(s)	unknown	mineral extraction drill hole with rock and cement foundation	
42BO678	historical	historical-period artifact scatter	unknown		
42BO679	prehistoric	cave/rockshelter	yes, research potential high, a pristine cave site		
42BO680	prehistoric	cave/rockshelter	unknown		
42BO681	prehistoric	prehistoric flaked stone and ceramic artifact scatter	yes, research potential high, possible Gosiute Shoshone affiliation		
42BO682	prehistoric	prehistoric flaked stone artifact scatter with feature(s)	unknown		
42BO683	prehistoric	cave/rockshelter	unknown		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42BO684	prehistoric	prehistoric flaked and ground stone artifact scatter	yes, research potential high, site has several loci		
42BO685	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42BO686	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42BO687	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42BO688	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42BO689	prehistoric	prehistoric flaked stone and ceramic artifact scatter	unknown		
42BO690	prehistoric	prehistoric flaked stone and ceramic artifact scatter	unknown		
42BO691	prehistoric	prehistoric flaked stone and ceramic artifact scatter	unknown		
42BO692	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42BO693	prehistoric	prehistoric flaked stone artifact scatter with feature(s)	unknown		
42BO745	historical	historical-period artifact scatter	unknown		1900–1920
42BO746	prehistoric	cave/rockshelter	yes, research potential high, probable intact subsurface deposits		
42BO763	prehistoric	cave/rockshelter	yes, research potential high, deep stratigraphic deposits and human remains present		
42BO801	prehistoric	cave/rockshelter	unknown		
42BO809	prehistoric	cave/rockshelter	unknown		
42BO810	prehistoric	prehistoric lithic quarry	yes, research potential high, lithic quarry, few quarries are known from the project area		
42BO811	prehistoric	prehistoric lithic quarry	yes, research potential high, lithic quarry, few quarries are known from the project area		
42TO106	prehistoric	cave/rockshelter	unknown		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO107	prehistoric	cave/rockshelter	unknown		
42TO467	historical	historical-period feature	unknown		
42TO468	historical	historical-period feature	unknown		
42TO469	historical	historical-period feature	unknown		
42TO470	historical	historical-period feature	yes, research potential high; also high educational profile, site has been excavated and may be associated with the Donner-Reed party of 1846		
42TO471	historical	historical-period feature	yes, research potential high; also high educational profile, site has been excavated and may be associated with the Donner-Reed party of 1846		
42TO644	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO645	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO709	historical	historical-period feature	yes, research potential high, also high profile site type, contributes to the history of mid-19th century regional travel and wagon routes		
42TO787	prehistoric	cave/rockshelter	unknown		
UTTR South					
26EK6382	prehistoric	cave/rockshelter	unknown		
26EK6383	prehistoric	rock ring	unknown		
26EK6384	prehistoric	village site	yes, research potential high, some test excavation undertaken, may hold information on rock ring structures		
26EK6385	historical	historical-period feature	yes, research potential high, may provide information on WWII activities at Wendover Air Field	aircraft beacon tower topped with an acetylene powered light; constructed from metal tubing and wood	1940

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
26EK6386	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, extensive lithic scatter with several diagnostic projectile points, diverse raw materials, potential for sourcing studies		
26EK6387	prehistoric	prehistoric flaked stone artifact scatter	unknown		
26EK6388	prehistoric	cave/rockshelter	yes, research potential high, potential for buried cultural deposits, perishable artifacts noted, also high profile educational potential to demonstrate site vandalism		
26EK6390	prehistoric	cave/rockshelter	unknown		
26EK6391	prehistoric	prehistoric flaked stone artifact scatter	unknown		
26EK6392	prehistoric	cave/rockshelter	yes, research potential high, intact, buried, stratified cultural deposits, also high profile educational potential to demonstrate site vandalism		
26EK6393	historical	historical-period artifact scatter with feature(s)	unknown	wooden frame built of 8-by-10 timber associated with nearby quarry	1930–1940
26EK6394	historical	historical-period feature	yes, research potential high, associated with WW II training activities at Wendover Air Field	aircraft beacon tower topped with acetylene powered light	1940
26EK6395	prehistoric	cave/rockshelter	yes, research potential high, buried cultural deposits, features, high artifact diversity and density, also high profile educational potential to demonstrate site vandalism and pictographs		
26EK6396	historical	historical-period artifact scatter	unknown		
42TO13	prehistoric	cave/rockshelter	yes, research potential high (Danger Cave), extensive work conducted since the 1930s; also high profile educational potential		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO137	multicomponent	cave/rockshelter	yes, research potential high, two rockshelters with vandalized midden deposits but some intact strata; also high profile site because of its historical-period association with the recluse Mosquito Willy		1940
42TO173	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO30	unknown				
42TO37b	unknown				
42TO629	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO630	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO646	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO647	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO648	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO649	prehistoric	prehistoric flaked stone artifact scatter with feature(s)	unknown		
42TO650	prehistoric	prehistoric flaked and ground stone artifact scatter with ceramics	unknown		
42TO651	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO652	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO653	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO654	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO655	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO656	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO657	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO658	prehistoric	prehistoric flaked stone artifact scatter	unknown		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO659	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO660	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO661	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO662	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO663	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO664	prehistoric	prehistoric flaked stone artifact scatter with feature(s)	unknown		
42TO665	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO666	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO667	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO668	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO669	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO670	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO671	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO672	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO673	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO674	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO675	historical	historical-period feature	unknown	mine shafts and tailings	1900–1935
42TO676	historical	historical-period feature	unknown		
42TO677	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO678	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO679	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO680	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO681	prehistoric	prehistoric flaked stone artifact scatter	unknown		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO682	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO683	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO684	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO685	prehistoric	prehistoric flaked stone and ceramic artifact scatter	unknown		
42TO686	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO687	historical	historical-period feature	unknown	salt evaporation feature built from wooden planks, posts, and wire	1900–1930
42TO689	historical	historical-period feature	unknown	rock rubble house foundation built of limestone blocks set in cement	1910–1945
42TO690	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO691	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO692	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO693	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO694	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO695	prehistoric	prehistoric flaked stone and ceramic artifact scatter	unknown		
42TO696	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO697	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO698	historical	historical-period feature	unknown	mustang corral built from juniper posts and barbed wire	1930

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO699	historical	historical-period feature	unknown		1900–1917
42TO700	historical	historical-period feature	unknown	cement foundation and wooden structure	
42TO701	prehistoric	cave/rockshelter	yes, research potential high, although slightly disturbed by vandalism the site contains buried cultural deposits and visible features		
42TO702	prehistoric	cave/rockshelter	yes, research potential high, two pristine rockshelters with midden deposit and several artifact classes		
42TO703	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO704	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO705	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO706	prehistoric	prehistoric flaked and ground stone artifact scatter with ceramics	unknown		
42TO707	prehistoric	cave/rockshelter	unknown		
42TO708	historical	historical-period feature	yes, research potential high, contributes to regional railroad history		1917–1939
42TO745	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO746	prehistoric	prehistoric flaked stone artifact scatter with feature(s)	unknown		
42TO747	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, contributes to early Archaic period information in the Great Basin and lithic technology, extensive lithic assemblage		
42TO748	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO749	prehistoric	cave/rockshelter	yes, research potential high, rockshelter with intact buried cultural deposits		
42TO750	prehistoric	prehistoric flaked stone artifact scatter with feature(s)	unknown		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO766	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO767	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO768	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO769	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO770	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO771	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO772	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO773	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO774	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO775	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO776	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO777	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO778	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO779	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO780	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		A.D. 500–1300
42TO781	prehistoric	prehistoric flaked and ground stone artifact scatter with ceramics and feature(s)	unknown		
42TO782	prehistoric	prehistoric flaked stone and ceramic artifact scatter	unknown		
42TO783	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO784	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO785	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO786	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO805	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO843	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO844	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO845	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO846	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO847	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO848	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO849	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO850	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO851	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO852	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO853	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO905	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO906	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO907	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO908	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, pristine condition, large chert collection, possible sourcing and lithic technology studies		
42TO909	prehistoric	prehistoric flaked and ground stone artifact scatter	yes, research potential high, extensive lithic scatter, may inform on early Holocene lithic technology and settlement patterns of the Great Salt Lake Desert		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
42TO910	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO911	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO912	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO913	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO914	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO915	prehistoric	prehistoric flaked and ground stone artifact scatter	unknown		
42TO916	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO917	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO918	prehistoric	prehistoric flaked and ground stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO919	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO920	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO921	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO922	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO923	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO924	prehistoric	prehistoric flaked stone artifact scatter	yes, research potential high, may provide data on pre-archaic settlement along the Gilbert shoreline		
42TO925	prehistoric	prehistoric flaked stone artifact scatter	unknown		
42TO926	prehistoric	prehistoric flaked stone artifact scatter	unknown		

Site Number, by Location	Temporal Period	Site Type	Interpretive Potential	Description	Date
CRNV-01-2416	historical	historical-period artifact scatter	unknown		
CRNV-01-2832	prehistoric	prehistoric flaked stone artifact scatter	unknown		
CRNV-01-3777	prehistoric	prehistoric flaked stone artifact scatter	unknown		
CRNV-01-3778	prehistoric	prehistoric flaked stone artifact scatter	unknown		
CRNV-01-5279	unknown				
CRNV-01-5290	unknown				
CRNV-11-7852	prehistoric	cave/rockshelter	yes, research potential high, site contains buried deposits including charcoal and burned bone and potential to yield important paleoenvironmental data		
CRNV-11-7853	prehistoric	cave/rockshelter	yes, research potential high, extensive woodrat middens that can yield important paleoenvironmental data		
CRNV-11-8619	historical	historical-period artifact scatter	unknown		
CRNV-11-8630	historical	historical-period artifact scatter	unknown		
CRNV-11-8631	historical	historical-period feature	yes, research potential high, site associated with use of Wendover Air Field during WW II	WW II–period bunker made from railroad ties	
CRNV-11-8632	historical	historical-period feature	yes, research potential high, site shows high integrity and is associated with the use of the Wendover Air Field during WW II	bunker constructed of railroad ties	
CRNV-11-8633	multicomponent	multicomponent flaked stone and historical-period artifact scatter	unknown		1905–1945
CRNV-11-8634	prehistoric	prehistoric flaked stone artifact scatter	unknown		
CRNV-11-8635	historical	historical-period artifact scatter	unknown		

GLOSSARY

Compiled by Keith B. Knoblock, Joseph A. Ezzo, and S. Greg Johnson

AIRFA: The American Indian Religious Freedom Act. Legislation passed in 1978 to institute as a policy of the United States to protect and preserve for Native Americans their inherent right to believe, express, and exercise the traditional religions of their cultures. This includes access to sites, the use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

allele: Either of a pair of genes located at the same position on both members of a pair of chromosomes. Each member conveys characteristics that are inherited in accordance with Mendelian law.

atlatl: Item used to throw spears affixed with large dart points. The artifact is made from a linear piece of wood with a hook at the distal end that fits a socket on a spear. Stone weights are often affixed to the shaft to create a well-balanced tool that serves to extend the arm and greatly increase the distance and velocity that a spear can be thrown.

bioarchaeology: The archaeological study of human adaptation, health, and diet based primarily on the analysis of human remains.

brachiopod: A member of the phylum *Brachiopoda.* This group of marine animals have hinged upper and lower shells enclosing two arm-like parts with tentacles that are used to guide minute food particles to the mouth.

bryozoan: A member of a group of small water animals that form branching, moss-like colonies and reproduce by budding.

cephalopod: Any of a class of marine mollusks including octopus, squid, and cuttlefish that have a distinct head, a varying number of arms with suckers, and a sac-like, fin-bearing mantle.

coil-and-scrape method: A method used to construct ceramic vessels by hand using "snakes" or strips of plastic clay. The strip varies from thin to thick and is rolled between the hands and then attached with a pinching technique. Each coil is usually integrated with the previous one by scraping the surfaces with a variety of items including stones, shells, and seed pods. The resulting product is a smooth finish where the separate identity of each coil is lost.

conodont: A very small tooth-like Paleozoic fossil of uncertain identification.

coprolite: The fossilized excrement of animals (including humans). Also used to refer to desiccated prehistoric excrement.

Desert Culture: The Desert Culture is generally characterized as a tradition lacking agriculture, pottery, and permanent houses. Typical sites are comprised of refuse deposits, hearths, and the remains of temporary encampments. First documented archaeologically by Sayles and Antevs (1941), the Desert Culture adapted to the drying conditions of the terminal Pleistocene and may represent the ancestral roots of such groups as the Anasazi, Hohokam, Mogollon, Ute, Paiute, and Shoshone.

diatom: Any of a class of microscopic algae (division Chromophycota) whose cell walls consist of interlocking parts and valves and contain silica. Diatoms are a source of food for numerous forms of marine life.

endothyrid: Important guide fossil belonging to one of the several genera of Fusilindae.

ethnohistory: The study of documentary sources to provide ethnographic analysis of protohistoric and historical-period cultures.

fluted point: In North America, Clovis and Folsom fluted projectile points were used from about 11,500 to 10,500 years ago. The style is usually made from high quality, fine-grained material and has several diagnostic attributes, such as the basal flute and a lanceolate shape.

Foraminifera: Subclass of the Sarcodina; mostly marine unicellular animals of microscopic size composed of cemented, sedimentary grains or calcium carbonate.

fossiliferous: Stone containing previously organic, fossilized remains.

fusulind: Important guide fossil belonging to one of the several genera of Fusilindae. This Foraminifera is shaped like a grain of wheat.

GAPA: Ground-to-Air Pilotless Aircraft; the U.S. Air Force's first supersonic guided missile, which introduced the supersonic-missile test flight program.

graptolite: Extinct organism that produced chitinous enclosing and supporting structures. Generally considered a hydrozoan, but also considered by some paleontologists to be related to primitive chordates.

grayware: A ceramic type based on its surface being gray.

guide fossil: Any category of fossil used in the identification of a stratigraphic unit. A guide fossil has a short stratigraphic (temporal) range, broad ecological tolerance, wide geographic distribution, and occurs abundantly.

Mesozoic: Designating, or of, a geologic era occurring after the Paleozoic and before the Cenozoic periods, covering the time between 245 and 66 mya. The Mesozoic is characterized by the development and extinction of dinosaurs, and the appearance of flowering plants, birds, and grasses.

millenialist: A person who believes in the coming of an ideal society, particularly one predicated on Christian prophecy. Synonymous with "millenarian."

milling stone: Stone tool type used in processing food, especially wild and domesticated grains. The typical equipment consists of a handheld top stone scraped against a stationary bottom stone, with the material to be ground being placed between the two stones.

mitochondrial DNA: DNA contained in the mitochondria of the cell. This DNA is inherited completely from the individual's mother.

mollusk: Any of a large phylum of invertebrate animals including chitons, gastropods, cephalopods, scaphopods, and bivalves. The mollusk phylum is characterized by a soft, unsegmented body typically enclosed wholly or partially by a mantle and a calcareous shell. Most mollusks also have gills and a foot.

mortar and pestle: The mortar is a stone tool exhibiting various degrees of shaping that has a concavity pecked into one surface and is used with a pestle or hand stone to grind various materials. Mortars can be portable implements or bedrock features. The pestle is a thin, elongated, cylindrical stone used to crush, pound, or grind materials in the mortar.

NAGPRA: Native American Graves Protection and Repatriation Act of 1990. Legislation giving ownership or control of Native American cultural human remains and funerary objects that are excavated or discovered on federal or tribal lands to the appropriate Native American group based on location or cultural affiliation of the items found. The act contains provisions dealing with competing claims, museum inventories, repatriation standards, and the sharing of information.

Numic spread: Theory that suggests that Fremont farmers living in the region where the eastern Great Basin meets the Colorado Plateau were either pushed out or exterminated by tribes that spoke a Numic language, such as the Shoshone, Ute, and Paiute, who migrated from the southern California region.

paddle-and-anvil method: A method of thinning and compressing the wall of a clay pot by beating against an anvil with a paddle. The anvil is held inside the vessel, and the paddle is used on the outside. The paddle can be made from wood or stone. The anvil is convex and often made from wood, fired clay, or stone. Paddle-and-anvil techniques may be used in conjunction with the coil-and-scrape method or can be used alone to create a pot.

Paleoindian: This term represents people who entered North America through Asia ca. 15,000 years ago. The culture was adapted to the environment of the Late Pleistocene, and is generally represented archaeologically by fluted projectile points. These tools are representative of the Paleoindian emphasis on big-game hunting.

Paleozoic: Designating, or of, the geologic era between the Precambrian and the Mesozoic period, covering between 540 and 245 mya. The Paleozoic is characterized by the development of the first fish, amphibians, reptiles, and plants.

pit structure: The term "pit structure" encompasses a broad spectrum of structures varying greatly in size, shape, and construction technique. Pit structures can be round or four-sided, with walls made from earth, plastered mud, or adobe. The roof is composed of logs and small branches, which may be coated with mud plaster. Typically, pits are dug into the ground to serve as the structure's floor, which would also contain hearths and storage features.

pluvial: The action of rain. The term is used to refer to deposits left by rainwater or ephemeral streams; also used to refer to former periods of abundant rains.

pluvial lake: A lake formed by rainfall.

protozoa: Any of the Protozoa phylum. This subkingdom of microscopic animals is made up of single celled and/or a group of more or less identical cells living in water as parasites. This includes ciliates, flagellates, rhizopods, and sporozoans.

rockshelter: Rockshelters are typically natural caves, often occurring in limestone outcrops, that prehistorically provided shelter and storage areas. Rockshelters may represent fleeting episodes of use or long, formal occupations containing storage and processing features and architecture.

sand tempered: To mix or adulterate with sand. Used in reference to pottery types to reflect the use of sand to alter the properties of clays used for creating the pottery.

serum albumin: The most abundant protein of blood serum. Synthesized by the liver, the serum albumin serves to regulate osmotic pressure and carry certain metabolic products.

shaman: A priest or medicine man practicing the religion of certain American Indian and Eskimo tribes, based on a belief in good and evil spirits.

side-notched point: Projectile point with concave notches on the margins of the point to facilitate hafting; often associated with the late prehistoric, protohistoric, and historical periods.

stemmed point: Projectile point with an elongated stem emanating from the base. In the Great Basin, types include the Eastgate point and the Rose Spring expanding stem point, which may exhibit side or corner notches.

stromatoporoidea: Laminated organic body made of calcium carbonate; probably a distinct order of hydrozoans.

sweathouse: A structure that is used for ritual purification. It is heated intensively, usually by pouring water over hot stones.

traditional cultural property: A historically used place associated with beliefs or activities central to the lifeway and continuity of a traditional community. This term has also become synonymous with Native American sacred sites such as mountains or bodies of water.

trilobite: Any of the large class of Trilobata. Trilobites are extinct marine arthropods having a body divided by two furrows into three parts. Trilobites are found as fossils in rocks of many pre-Quaternary geological eras.

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Jorgensen, Joseph G.

1964 *The Ethnography and Acculturation of the Northern Ute.* Unpublished Ph.D. dissertation, University of Indiana, Bloomington.

1972 *The Sun Dance Religion: Power for the Powerless.* University of Chicago, Chicago.

Both studies are based in large part on ethnohistorical sources, dealing with a range of social issues of the Ute.

Knoblock, Keith B., and Martin Rose

1999 *Hill Air Force Base Cultural Resource Database Users' Manual.* Technical Report 99-49. Statistical Research, Tucson, Arizona.

Users's guide prepared by SRI to accompany the database of sites on the UTTR as of October 1998.

Lamb, Sydney M.

1958 Linguistic Prehistory in the Great Basin. *International Journal of American Linguistics* 24:95–100.

One of the first attempts to explain the Numic spread and the linguistic connections between prehistoric and ethnographic cultures of the Great Basin.

Lambert, H. C.

1941 *Structure and Stratigraphy of the Southern Stansbury Mountains, Tooele County, Utah.* Unpublished Master's thesis, University of Utah, Salt Lake City.

A paleontological study of Cambrian and Pennsylvanian formations in the southern Stansbury Mountains.

Launius, Roger D.

1991 Home on the Range: The U.S. Air Force Range in Utah, a Unique Military Resource. *Utah Historical Quarterly* 4:332–360.

A useful article on the history of the UTTR.

Larralde, Signa

1992 Summary Report of Cultural Resources Inspection for the Grayback Pit, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1993 Summary Report of Cultural Resources Inspection for Mobile Communications Site, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

Two reports of surveys during which a few cultural resources were recorded.

Larsen, Clark Spencer, and R. L. Kelly

1995 *Bioarchaeology of the Stillwater Marsh: Prehistoric Human Adaptation in the Western Great Basin.* Anthropological Paper of the American Museum of Natural History No. 77, New York.

An analysis of human skeletal remains focusing on mitochondrial DNA and serum albumin analyses to address the issue of the Numic spread.

Larson, Gustive O.

1989a The Mormon Gathering. In *Utah's History,* edited by Richard C. Poll, Thomas G. Alexander, Eugene E. Campbell, and David E. Miller, pp. 175–192. Utah State University Press, Logan.

1989b Government, Politics, and Conflict. In *Utah's History,* edited by Richard C. Poll, Thomas G. Alexander, Eugene E. Campbell, and David E. Miller, pp. 243–256. Utah State University Press, Logan.

Two articles focusing on the evolution of Mormon settlement and growth in northern Utah in the second half of the nineteenth century.

Lindsay, Le Mar W.

1987 Letter Report Regarding the Archaeological Clearance of the State Borrow Lands Borrow "L" Site North of Knolls, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

A report of a survey during which no cultural resources were documented.

Lindsay, La Mar W., and Kay Sargent

1979 *Prehistory of the Deep Creek Mountain Area, Western Utah.* Antiquities Section selected Papers 6(4). Utah Division of State History, Salt Lake City.

A report of work in the area around Scribble Rock Shelter.

Lohse, Ernest S.

1980 Fremont Settlement Pattern and Architectural Variability. In *Fremont Perspectives*, edited by David B. Madsen, pp. 41–54. Antiquities Section Selected Papers 7(16). Utah Division of State History, Salt Lake City.

One of the first studies to focus on architectural variability found at Fremont-period sites of the Great Basin.

Lupo, Karen, and Duncan Metcalfe

1987 An Archaeological Survey of Two Areas in the Vicinity of Wig Mountain, West-Central Utah, on the United States Dugway Proving Grounds. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

A report of a survey during which no cultural resources were documented.

Lyneis, Margaret M.

1982 Prehistory of the Southern Great Basin. In *Man and Environment in the Great Basin,* edited by David B. Madsen and James F. O'Connell, pp. 172–185. SAA Publication No. 2. Society for American Archaeology, Washington, D.C.

An overview of the southern Great Basin, incorporating ideas about the Numic spread.

1994 East and Onto the Plateaus? An Archaeological Examination of the Numic Expansion in Southern Nevada, Northern Arizona, and Southern Utah. In *Across the West: Human Population Movement and the Expansion of the Numa,* edited by David B. Madsen and David Rhode, pp. 141–149. University of Utah Press, Salt Lake City.

A focus on the Numic spread, postulating a late entry (post–A.D. 1000) of the Numa into the Great Basin.

MacMahon, J. A.

1988 Warm Deserts. In *North American Terrestrial Vegetation,* edited by M. G. Barbour and W. D. Billings, pp. 231–264. Publication No. 9. California Native Plant Society, Sacramento.

A discussion of western deserts in North America focusing on vegetation and environmental, topographic, and climatic variability.

Madsen, Brigham D., editor

1989 *Exploring the Great Salt Lake: The Stansbury Expedition of 1849–1850.* University of Utah Press, Salt Lake City.

A large volume reprinting much of Stansbury's account of his expedition, as well as technical records taken by his engineers.

Madsen, David B.

1979 The Fremont and the Sevier: Defining Prehistoric Agriculturalists North of the Anasazi. *American Antiquity* 44:711–722.

A study that questions the utility of such a broad application of the Fremont, suggesting instead the use of Sevier for various cultural manifestation in the Great Basin.

1982 Get It Where the Getting's Good: A Variable Model of Great Basin Subsistence and Settlement Based on Data from the Eastern Great Basin. In *Man and Environment in the Great Basin,* edited by David B. Madsen and James F. O'Connell, pp. 207–226. SAA Publication No. 2. Society for American Archaeology, Washington, D.C.

A study of human adaptation in the Great Basin based on site location, environmental variability, and subsistence strategies.

1983 *Black Rock Cave Revisited.* Cultural Resource Series No. 14. Utah Bureau of Land Management, Salt Lake City.

An analysis of material culture from a cave first excavated by Julian Steward in the 1930s.

1986 Prehistoric Ceramics. In *Great Basin,* edited by Warren L. d'Azevedo, pp. 206–214. Handbook of North American Indians, vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

A review of the major ceramic traditions in the Great Basin, their timing, distribution, and morphological attributes.

1989 *Exploring the Fremont.* Utah Museum of Natural History, Salt Lake City.

A discussion of the Fremont tradition, focusing on the variability in the archaeological record.

Madsen, David B., Donald R. Currey, and James H. Madsen, Jr.
1976 *Man, Mammoth, and Lake Fluctuations in Utah.* Antiquities Section Selected Papers 2(5). Utah Division of State History, Salt Lake City.

A discussion of terminal Pleistocene and early-Holocene environments and evidence for human occupation in the state of Utah.

Madsen, David B., and Le Mar W. Lindsay
1977 *Backhoe Village.* Antiquities Section Selected Papers 4(12). Utah Division of State History, Salt Lake City.

A report of an excavation at Backhoe Village, a Fremont site, in which the authors state that the term "Fremont" should have more restricted application and the term "Sevier" used in much of the Great Basin instead.

Madsen, David B., and James F. O'Connell (editors)
1982 *Man and Environment in the Great Basin.* SAA Publication No. 2. Society for American Archaeology, Washington, D.C.

An edited volume that takes an ecological approach to studying the human past of the Great Basin.

Madsen, David B., and David Rhode (editors)
1994 *Across the West: Human Population Movement and the Expansion of the Numa.* University of Utah Press, Salt Lake City.

A volume of papers focusing on the Numic expansion; papers consider environmental, ecological, linguistic, archaeological, and ethnographic data in their attempts to address this issue.

Malouf, Carling I.
1966 Ethnohistory in the Great Basin. In *The Current Status of Anthropological Research in the Great Basin: 1964,* edited by Warren L. d'Azevedo, pp. 1–38. Social Sciences and Humanities Publication No. 1. Desert Research Institute, Reno.

A review of ethnohistorical sources for Shoshonean peoples.

Malouf, Carling I., and John Findlay
1986 Euro-American Impact Before 1870. In *Great Basin,* edited by Warren L. d'Azevedo, pp. 499–516. Handbook of North American Indians, vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

This paper deals with early interactions between Euroamerican explorers and fur traders and Great Basin Native Americans.

Marwitt, John P.
1986 Fremont Cultures. In *Great Basin,* edited by Warren L. d'Azevedo, pp. 161–172. Handbook of North American Indians, vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

A review of current knowledge of the Fremont in the Great Basin, including ideas about its origins and demise.

Marwitt, John P., Gary F. Fry, and James M. Adovasio
1971 Sandwich Shelter. In *Great Basin Anthropological Conference 1970: Selected Papers,* pp. 27–36. Anthropological Papers No. 1. University of Oregon, Eugene.

Brief report of investigations at a small rockshelter in the Great Salt Lake region.

Maurer, R. E.
1970 *Geology of the Cedar Mountains, Tooele County, Utah.* Unpublished Ph.D. dissertation, University of Utah, Salt Lake City.

A paleontological study ranging from Mississippian to Quaternary deposits in the Cedar Mountains.

May, Dean L.
1989 Economic Beginnings. In *Utah's History,* edited by Richard C. Poll, Thomas G. Alexander, Eugene E. Campbell, and David E. Miller, pp. 193–216. Utah State University Press, Logan.

This paper focuses primarily on Mormon economic endeavors in the second half of the nineteenth century in northern Utah.

Mehringer, Peter J.
1977 Great Basin Late Quaternary Environments and Chronology. In *Models and Great Basin Prehistory: A Symposium,* edited by D. D. Fowler, pp. 113–167. Publications in the Social Sciences No. 12. Desert Research Institute, University of Nevada, Reno.

A review of current knowledge of past environments and climatic change through time.

1986 Prehistoric Environments. In *Great Basin,* edited by Warren L. d'Azevedo, pp. 31–50. Handbook of North American Indians, vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

A review paper dealing with the diversity of environments in the Great Basin in light of climatic variability across space and through time.

Miller, David E.

1987 *Great Salt Lake: Past and Present.* 3rd ed. Publishers Press, Salt Lake City.

1989a The Fur Trade and the Mountain Men. In *Utah's History,* edited by Richard C. Poll, Thomas G. Alexander, Eugene E. Campbell, and David E. Miller, pp. 53–70. Utah State University Press, Logan.

1989b Explorers and Trail Blazers. In *Utah's History,* edited by Richard C. Poll, Thomas G. Alexander, Eugene E. Campbell, and David E. Miller, pp. 71–91. Utah State University Press, Logan.

The three works offer insights into the European discovery and settlement of the Great Salt Lake region; the first of the three documents economic and recreational activities relating to the lake and region.

Mock, James M.

1971 *Archaeology of Spotted Cave, Utah County, Central Utah.* Unpublished Master's thesis, Brigham Young University, Provo, Utah.

A study of material culture from a small rockshelter site in northern Utah.

Moore, Mark W.

1994 *A Class III Cultural Resource Inventory of the Simplot Land Exchange Project, Elko County, Nevada.* Report submitted to the Bureau of Land Management, Elko District, Elko, Nevada.

A report of a survey in which 221 archaeological sites were recorded, 35 of which were found to be potentially significant.

Morss, Noel M.

1931 *The Ancient Culture of the Fremont River in Utah.* Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 12, No. 3. Harvard University, Cambridge, Massachusetts.

The study in which the Fremont tradition in the Great Basin was defined, with suggestions that it had a southwestern origin.

Mulder, William

1976 Scandinavian Saga. In *The Peoples of Utah,* edited by H. Z. Papanikolas, pp. 141–186. Utah State Historical Society, Salt Lake City.

A paper dealing with the Scandinavian migration to northern Utah in the second half of the nineteenth century, focusing on then-recent converts to the Mormon faith.

National Park Service

1991 *How to Apply the National Register Criteria for Evaluation.* Rev. ed. National Register Bulletin No. 15. U.S. Department of the Interior, National Park Service, Interagency Resource Division. Government Printing Office, Washington, D.C.

A bulletin designed to provide archaeologists working in cultural resource management with guidelines for developing research designs to apply the National Register criteria in the significance evaluation process of cultural resources.

Nelson, M. E., and J. H. Madsen, Jr.

1980 A Summary of Pleistocene, Fossil Vertebrate Localities in the Northern Bonneville Basin of Utah. In *Great Salt Lake: A Scientific, Historical, and Economic Overview,* edited by J. W. Gwynn, pp. 97–114. Bulletin No. 116. Utah Geological and Mineral Survey, Utah Department of Natural Resources, Salt Lake City.

A review of fossil-bearing localities in northwestern Utah with a description of the types of fossils, their locations, and the dates of their discovery.

Nielson, Asa A.

1985 An Archaeological Inventory of the U.S. Telecommunications, Inc 7.2 kV Distribution Line, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1986 An Archaeological Inventory of the Lakeside to Delle Substation Powerline Reconstruction. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1991 A Cultural Resource Inventory of the Proposed Utah Power and Light Marblehead-Aptus to UPSCI Tap Line and Substations, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1992 A Cultural Resource Inventory of the Proposed Water Well and Access Road Locations in Eastern Ripple Valley for U.S.C.P.I. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

Reports of four power-line surveys during which three prehistoric sites and one historical-period site were recorded.

Nielson, Asa A., and Don D. Southworth

1992 A Cultural Resource Inventory of Proposed Alternative Power Line Corridors for Utah Power and Light Company for Dugway Proving Grounds, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

Report of a power-line survey during which 14 prehistoric and 3 historical-period sites were recorded.

Nolan, T. B.

1930 Paleozoic Formation in the Gold Hill Quadrangle, Utah. *Washington Academy of Sciences Journal* 20:421–432.

A paleontological study of several localities in the Gold Hill area, with identification of fossils from Cambrian, Silurian, Devonian, Mississippian, and Permian formations.

Palmer, D. E.
1970 *Geology of Stansbury Island, Tooele County, Utah.* Unpublished Master's thesis, Brigham Young University, Provo.

A paleontological study of Stansbury Island, identifying fossils from Devonian, Mississippian, and Pennsylvanian–Permian formations.

Parker, Patricia L., and Thomas F. King
1990 *Guidelines for Evaluating and Documenting Traditional Cultural Properties.* National Register Bulletin No. 38. USDI National Park Service, Washington, D.C.

A government document defining the nature of TCPs, procedures for investigating them, and evaluating their significance.

Paull, P. K.
1982 Conodont Biostratigraphy of Lower Triassic Rocks, Terrace Mountains, Northwestern Utah. *Utah Geological Association Publication* 10:235–249.

A paleontological study of a thick Lower Triassic deposit in the Terrace Mountains.

Perry, Michael E.
1990 *Research Design for the Test and Evaluation of the Prehistoric Temporary Campsite (UTTR-25-1).* Submitted to Hill Air Force Base, Utah.

Report on a small survey on Wendover AFR during which one artifact scatter with fire-affected rock was found.

Petersen, M. S.
1969 The Occurrence of Ammonoids from the Lower Deseret Limestone, Northern Stansbury Mountains, Tooele County, Utah [abstract]. Abstracts with Program vol. 1, part 5, p. 63. Geological Society of America.

A paleontological investigation of a single Mississippian shale deposit in the Stansbury Mountains.

Polk, Michael R.
1984 *A Cultural Resource Survey of the Wendover, Nevada to Grouse Creek, Utah, 138kV Transmission Line.* Report submitted to Power Engineers, Inc.

Report of a power-line survey during which five prehistoric sites were recorded.

Price, Barry
1984 *An Archaeological Survey of One Seismic Test Line in Tacoma Valley, Elko County, Nevada, for Petty-Ray Geophysical/Geosource, Inc.* Report submitted to the Bureau of Land Management, Elko District, Elko, Nevada.

Report of a seismic line survey during which six prehistoric sites were recorded.

Prince, Eugene R.
1986 Shoshonean Pottery of the Western Great Basin. In *Pottery of the Great Basin and Adjacent Areas,* edited by Suzanne Griset, pp. 3–8. Anthropological Papers No. 111. University of Utah, Salt Lake City.

A brief discussion of the characteristics and temporal placement of Shoshonean ceramics in the western Great Basin.

Rafferty, Kevin, and Lynda M. Blair
1984 *Billy Goat Peak: An Investigation and Reinterpretation of Virgin Anasazi and Paiute Prehistory and Ethnohistory*. Report No. 2-6-1. Division of Anthropology Studies, Harry Reid Environmental Research Center, University of Nevada, Las Vegas.

Site report in which Elko-style lithics were documented as being used as knives by the Paiute in the late prehistoric and protohistoric periods.

Raup, D.
1991 *Extinction*. W. W. Norton, New York.

A popular, highly readable account of the nature of extinction, extinction episodes, and the purported causes of extinctions, from the Cambrian to the present.

Reid, J. Jefferson
1978 Response to Stress at Grasshopper Pueblo, Arizona. In *Discovering Past Behavior: Experiments in the Archaeology of the American Southwest,* edited by P. Grebinger, pp. 195–228. Gordon and Breach Publishing, New York.

An explanatory paper that uses several lines of evidence to determine possible reasons for the human abandonment of east-central Arizona in the early fifteenth century A.D.

Rhode, David, and David B. Madsen
1994 Where Are We? In *Across the West: Human Population Movement and the Expansion of the Numa,* edited by David B. Madsen and David Rhode, pp. 213–221. University of Utah Press, Salt Lake City.

A summary paper reviewing current ideas about the Numic spread, as well as future directions for research.

Rich, M.
1967 *Donezella* and *Dvinella*, Widespread Algae in Lower and Middle Pennsylvanian Rocks in East-Central Nevada and West-Central Utah. *Journal of Paleontology* 41:973–980.

A paleontological study of the Ely Limestone formation in Tooele County, documenting fossil algae.

Richens, Lane D.
1987 An Archaeological Survey of a Proposed Road for Sol-Aire Salt and Chemical Company Northeast of Delle, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

A report of a survey during which no cultural resources were documented.

Rigby, J. K.
1959 Some Ordovician Sponge Localities from Western Utah and Eastern Nevada [abstract]. *Proceedings of the Utah Academy of Science, Art, and Letters* 36:192.

A paleontological study of Ordovician sponges from several localities, including the Stansbury Range.

Roscoe, E. J.
1963 Stratigraphic Summary of Quaternary Bonneville Basin Mollusca. *Sterkiana* 9:1–23.

An extensive Paleontological review of fossil mollusks from Lake Bonneville sediments from a variety of localities.

Rudy, Jack R.
1953 *Archaeological Survey of Western Utah.* Anthropological Papers No. 12. University of Utah, Salt Lake City.

This work attempts to explain the demise of the Fremont, suggesting that the Fremont were ancestral to the ethnographic Paiute, Ute, and Shoshone.

Russell, Kenneth W.
1986 Cultural Resource Inventory of the Low Borrow Pit, No. 23080, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1987a Cultural Resource Inventory of the Grassy Mountain East Borrow Pit No. 23082 Extension, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1987b Cultural Resource Inventory of the Grassy Mountain West Borrow Pit No. 23083, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1987c Cultural Resource Inventory of the Magnesium Gravel Pit Prospect No. 23177, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

Reports of four borrow-pit surveys in which one significant cultural resource, a petroglyph site, was recorded.

Sadlick, W.
1965 *Biostratigraphy of the Chainman Formation (Carboniferous), Eastern Nevada and Western Utah.* Unpublished Ph.D. dissertation, University of Utah, Salt Lake City.

A paleontological study of the Chainman and Ely Limestone formations, including sections in the Silver Island Mountains.

Sayles, E. B., and Ernst Antevs
1941 *The Cochise Culture.* Medallion Papers No. 29. Gila Pueblo, Globe, Arizona.

The initial definition of Archaic-period adaptations in southeastern Arizona.

Schiffer, Michael B.
1976 *Behavioral Archaeology.* Academic Press, New York.

A book that describes a variant of processual archaeology using materials from the Joint Site in the American Southwest.

1987 *Formation Process of the Archaeological Record.* University of New Mexico Press, Albuquerque.

A volume defining and describing many of the natural and cultural processes involved in the formation of the archaeological record, and how such processes can affect the interpretation of archaeological materials.

Schroedl, Alan R.
1985 Cultural Resource Inventory of the Grassy Mountain Borrow Pit, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

Report of a borrow-pit survey during which no cultural resources were recorded.

Schroedl, Alan R., and Nancy J. Coulam
1989 *Bonneville Estates Rockshelter.* Report Submitted to the Bureau of Land Management, Elko District Office, Elko, Nevada.

Report of salvage excavations at a rockshelter site in response to extensive looting of the site.

Senulis, John A.
1987a Intensive Cultural Resource Survey and Inventory of the Proposed Brine Pipeline. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

1987b Intensive Cultural Resource Survey and Inventory of Proposed Borrow Pits, Dikes, and Haul Roads in the Great Salt Lake Desert. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

Reports of two surveys performed for the Amax Magnesium Corporation during which no cultural resources were recorded.

Service, Elman R.
1962 *Primitive Social Organization: An Evolutionary Perspective.* Random House, New York.

A theoretical treatise that attempted to develop a model of social evolution through successive stages of increasing sociopolitical complexity.

Setty, M. G. A. P.
1963 *Paleontology and Paleoecology of Diatoms of Lake Bonneville, Utah.* Unpublished Ph.D. dissertation, University of Utah, Salt Lake City.

A paleontological study of diatoms from Lake Bonneville sediments from a variety of localities.

Severance, Mark S.
1874 Preliminary Ethnological Report. In *U.S. Geographical and Geological Expeditions and Surveys West of the 100th Meridian: Progress Report for 1872,* pp. 55–56. U.S. Government Printing Office, Washington, D.C.

Report of the first archaeological excavations in Utah at a series of Sevier Fremont "mounds" near Provo.

Shanks, Michael, and Christopher Tilley
1987 *Re-constructing Archaeology: Theory and Practice.* Cambridge University Press, Cambridge.

A theoretical treatise that strongly criticizes and dismisses a scientific approach to archaeology, claiming that objectivity cannot be achieved, and that the archaeological record is better suited to study through critical theory.

Sheehan, P. M.
1971 *Silurian Brachiopods, Community Ecology, and Stratigraphic Geology in Western Utah and Eastern Nevada, with a Section on Late Ordovician Stratigraphy.* Unpublished Ph.D. dissertation, University of California, Berkeley.

A paleontological study of more than 40 localities, including the Lakeside Mountains, focusing on Silurian and Ordovician formations.

Shields, Wayne F., and Gardiner F. Dalley
1978 The Bear River No. 3. Site. *Miscellaneous Papers 22, University of Utah Anthropological Papers* 99:55–99, Salt Lake City.

Description of site excavation and material-culture analysis of a significant Fremont site in the Great Salt Lake region.

Shimkin, Dmitri
1986 Introduction of the Horse. In *Great Basin,* edited by Warren L. d'Azevedo, pp. 517–524. Handbook of North American Indians, vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

A brief treatment of the introduction of the horse by the Spanish to Great Basin Native Americans and some of the effects it had on traditional ways of life.

Smith, Anne M. Cooke
1974 *Ethnography of the Northern Ute.* Papers in Anthropology No. 17. Museum of New Mexico, Santa Fe.

A fairly thorough treatment of the lifeways and practices of the Northern Ute, a culmination of decades of research.

Smith, Elmer R.

1941 The Archaeology of Deadman Cave, Utah. *University of Utah Bulletin* 32(4):1–43.

One of the first excavations in the Great Salt Cave, following on Steward's work in the region.

Smith, G. I., and F. A. Street-Perrott

1983 Pluvial Lakes of the Western United States. In *Late-Quaternary Environments of the United States,* vol. 1, edited by S. C. Porter, pp. 190–212. University of Minnesota Press, Minneapolis.

A discussion of pluvial lake expansion and contraction throughout the late Pleistocene in the Great Basin and adjacent regions.

Statistical Research, Inc.

1995 *Phase I Project Implementation Report, Cultural Resource Archival Studies, Hill Air Force Base, Research Study Unit II—Archaeology.* Statistical Research, Tucson, Arizona. Submitted to the National Park Service, Interagency Archeological Services, Denver.

An interim report documenting work performed on Phase I of the project that includes the present synthetic report.

Steele, G.

1960 Pennsylvanian–Permian Stratigraphy of East-Central Nevada and Adjacent Utah. In *Intermountain Association of Petroleum Geologists Guidebook, Eleventh Annual Field Conference,* pp. 91–113.

A paleontological study of Pennsylvanian–Permian formations in the Cedar Mountains and Gold Hill areas.

Stephens, J. C.

1974 *Hydrologic Reconnaissance of the Southern Great Salt Lake Desert and Summary of the Hydrology of Northwestern Utah.* Technical Publication No. 42. Department of Natural Resources, State of Utah, Salt Lake City.

A hydrological overview of northwestern Utah.

Steward, Julian H.

1933 *Archaeological Problems of the Northern Periphery of the Southwest.* Bulletin No. 5. Museum of Northern Arizona, Flagstaff.

A discussion that includes support for Morss's hypothesis that the Fremont originated as a result of influences from the Southwest.

1937 *Ancient Caves of the Great Salt Lake Region.* Bulletin No. 116. Bureau of American Ethnology, Washington, D.C.

Report of the first systematic excavations in the Great Salt Lake region, focusing on Black Rock Cave and the Promontory caves.

1938 *Basin-Plateau Aboriginal Sociopolitical Groups.* Bulletin No. 120. Bureau of American Ethnology, Washington, D.C.

Classic ethnography of Shoshonean adaptations in the Great Basin.

1941 Cultural Element Distributions, XIII: Nevada Shoshone. *University of California Anthropological Records* 4(2):209–360. University of California Press, Berkeley.

1943 Cultural Element Distributions, XXIII: Northern and Gosiute Shoshoni. *University of California Anthropological Records* 8(3):263–392. University of California Press, Berkeley.

Two descriptive studies on different Great Basin Native American cultures.

1970 The Foundations of Basin-Plateau Shoshonean Society. In *Evolution and Ecology: Essays on Social Transformation,* edited by J. C. Steward and R. F. Murphy, pp. 366–406. University of Illinois Press, Urbana.

An overview of previous work, representing and interpreting data collected in the 1930s.

Stewart, Omer C.
1942 Cultural Element Distributions, XIV: Ute–Southern Paiute. *University of California Anthropological Records* 6(4):231–356. University of California Press, Berkeley.

A descriptive study of the Ute and Southern Paiute.

1980 Temoke Band of Shoshone and the Oasis Concept. *Nevada Historical Society Quarterly* 23:246–261.

A paper in which the author claims the Shoshone reflect a prehistoric band-level society.

Stifel, P. B.
1964 *Geology of the Terrace and Hogup Mountains, Box Elder County, Utah.* Unpublished Ph.D. dissertation, University of Utah, Salt Lake City.

A paleontological study focusing on Pennsylvanian-Permian, Triassic, and Tertiary formations.

Talbot, Richard K.
1988 A Cultural Resource Inventory of State Road 108, Skull Valley Road, Tooele County, Utah. Manuscript on file, Antiquities Section, Utah Division of State History, Salt Lake City.

A report of a survey during which three prehistoric sites were recorded.

Taylor, Dee C.
1954 *The Garrison Site: A Report of Archaeological Excavations in Snake Valley, Nevada–Utah.* Anthropological Papers No. 16. University of Utah, Salt Lake City.

1957 *Two Fremont Sites and Their Place in Southwestern Prehistory.* Anthropological Papers No. 29. University of Utah , Salt Lake City.

Both of these works attempt to explain the demise of the Fremont, suggesting that the Fremont were ancestral to the ethnographic Paiute, Ute, and Shoshone.

Teichert, J. A.
1958 *Geology of the Southern Stansbury Range, Tooele County, Utah.* Unpublished Master's thesis, University of Utah, Salt Lake City.

An extensive paleontological study documenting fossils from Cambrian, Ordovician, Silurian, Mississippian, and Pennsylvanian formations.

Thomas, David Hurst
1971 Historic and Prehistoric Land-Use Patterns at Reese River. *Nevada Historical Society Quarterly* 14(2):2–9.

1972 A Computer Simulation Model of Great Basin Shoshonean Subsistence and Settlement Patterns. In *Models in Archaeology,* edited by D. L. Clarke, pp. 671–704. Methuen, London.

1973 An Empirical Test of Steward's Model of Great Basin Subsistence. *American Antiquity* 38:155–176.

1974 An Archaeological Perspective on Shoshonean Bands. *American Anthropologist* 76:11–23.

The above four papers all seek to test Steward's ideas of the Desert Culture concept; in general they support his claims.

1981a How to Classify Projectile Points from Monitor Valley, Nevada. *Journal of California and Great Basin Anthropology* 3:7–43.

A summary of projectile-point types from excavations at several sites in Monitor Valley, Nevada, with implications for the Great Basin as a whole.

1981b Complexity among Great Basin Shoshoneans: The World's Least Affluent Hunter-Gatherers? In *Affluent Foragers: Pacific Coast East and West,* edited by S. Koyama and D. H. Thomas, pp. 19–52. Senri Ethnological Studies No. 9. National Museum of Ethnology, Osaka, Japan.

A study of Shoshonean subsistence and social organization.

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