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EXPLORING THE SHIWITS PRODUCTION ZONE

by

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Weber State University, Ogden, Utah
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A thesis submitted in partial fulfillment
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ABSTRACT

Exploring the Shivwits Production Zone

By

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The Shivwits Plateau is situated on the Arizona Strip in the northwest corner of Arizona. It is a relatively unexplored area rich in archaeological resources. This study provides three areas of exploration of the prehistoric Virgin Anasazi Pueblo period. Three research questions are posed. Are there substantial Virgin Puebloan sites on the Shivwits Plateau? Through compiled site data and analysis of settlement models the information supports the conclusion that there was a substantial prehistoric use of the Shivwits Plateau.

A specific question about pottery production guides the second part of the research. Was the sherd-tempered Shivwits Plain and Shivwits Corrugated pottery produced on the Shivwits Plateau? Samples collected from five sites on the Plateau are examined. Temporal analysis and characterization cannot support the hypothesis at this time.

Integrating the settlement information and the ceramic analysis provides the third area of question. Were the sites on the Shivwits Plateau situated to take advantage of movement of people and goods, particularly the Shivwits Plain
and Shivwits Corrugated pottery, between the upland Western Plateaus and the neighboring Lowland Muddy-Virgin Valley? Examining the information from the five sample sites there is not a strong indication these sites were involved in interaction with the lowland. It is important to note that the absence of affirming evidence does not rule out the possibility of pottery production or of sites situated to take advantage of trade or travel. There is simply not enough information available to reach absolute conclusions about the Shivwits Plateau.

The primary goal of this research is to provide a base of information about the archaeological potential of the Shivwits Plateau.
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CHAPTER ONE

INTRODUCTION

The Shivwits Plateau is situated on the Arizona Strip in the northwest corner of Arizona. It is on the western extent of the Colorado Plateau physiographic system and is the last large "step" of the Plateau's staircase leading to the Mohave Desert lowland and the southern tip of the Great Basin. "Exploring the Shivwits Production Zone" is a study of the Virgin Anasazi, ancestral Pueblo culture group on the Shivwits Plateau. This study includes a critical review of site records and settlement information and an examination of ceramic assemblages of five Anasazi sites on the Plateau. The ceramic analysis provides insight into pottery production with particular attention to the Shivwits variety of gray ware. The study area and the sites examined are in the northwest corner of Arizona within the recently designated Grand Canyon Parashant National Monument. The time period of this prehistoric occupation is Pueblo I and Pueblo II, from ca. A.D. 800 through A.D. 1150 (Fairley 1989b).

This thesis explores one geographic area with attention focused on three general research questions. First, are there substantial Puebloan sites on the Shivwits Plateau? Second, was the Puebloan sherd-tempered Shivwits Plain and Shivwits Corrugated pottery made on the Shivwits Plateau? Third, were the Puebloan sites on the Plateau situated to facilitate movement of people and
goods between the upland sites of the Uinkaret Plateau and the lowland sites in Moapa Valley? These specific questions fall within the three larger research domains of settlement pattern, technology, and intra-regional contact and interaction.

Research Objectives

The first goal of this thesis is to provide a platform of collective data and descriptive information on a little explored area of archaeological geography. Existing models are examined to provide a framework for research. The second goal is to encourage further research about the Virgin Anasazi occupation of the Shivwits Plateau and the role the area played in the regional cultural system. Alternative models are presented as stepping stones for future exploration.

Very little is known about the archaeology of the Shivwits Plateau. It has been a "black box," an unspectacular area with "really nothing there." Conversely it has been considered an area where so little is known that one could make "anything you want" happen there when considering Virgin Anasazi research questions. It is situated between two substantial habitation areas of the Virgin Anasazi. West of the Shivwits Plateau, the Moapa Valley is well known for the lowland Anasazi sites. The Lost City Pueblo Grande de Nevada sites excavated from the 1920s through the 1990s have provided much information about the Ancestral Pueblo people. There are also many documented sites around Mt. Trumbull, on the Uinkaret Plateau to the east. Mt. Trumbull is well known in Virgin Anasazi research for the distinctive olivine xenoliths used as temper in one
pottery ware. This ware, Moapa Gray Ware, of the prehistoric Virgin Anasazi pottery provides a key to understanding aspects of prehistoric movement.

It is difficult to point to one area of research without considering the complex interaction of cultural systems. This research explores three areas of cultural development. It provides documentation of settlement patterns. It examines pottery production and distribution. The synthesis of these two research domains then addresses the broader research domain of intra-regional interaction. Each of these research areas is presented with the specific questions noted above. The models used to explore each of these areas are presented in the analysis chapters.

Chapter Two provides an overview of the culture history of the Virgin Anasazi people. The generally accepted temporal sequences are summarized to provide a framework of the time period considered here. Prehistoric occupation areas are outlined to provide a geographic context for the research. General models for Virgin Anasazi research are briefly summarized to provide an understanding of the previous areas of study. Of particular interest are the previously proposed models of settlement patterns and production and distribution, or exchange.

Chapter Three outlines the geography, geology, climate, and biotic nature of the Shivwits Plateau. The Shivwits Plateau is the "land between." It is situated between two known archaeological areas; it is between two geologic steps in the Colorado Plateau "staircase"; it is between two different environmental and ecological zones.

Natural barriers that form the boundary of the Shivwits Plateau are the Hurricane Cliffs on the east and the Grand Wash Cliffs on the west. Canyons cut
through the cliffs and provide travel corridors. From a logistic viewpoint the Shivwits Plateau is a logical travel corridor between the upland sites of Mt. Trumbull and the lowland communities of the Moapa Valley. The intermediary nature of the Shivwits Plateau makes it an ideal 'natural laboratory' to study the Virgin Anasazi.

Chapter Four is an exploration of settlement patterns on the Shivwits Plateau. The site information was gathered from files of the Lake Mead National Recreation Area (LMNRA) offices in Boulder City, Nevada, and the Arizona Strip District Office of the Bureau of Land Management (BLM) in St. George, Utah. The compiled information is from reports and original site forms. Where and how people organize themselves across the landscape are based on many factors. Virgin Anasazi settlement models are applied to the compiled information to determine if there are any recognizable patterns for the Shivwits Plateau.

Chapter Five explores the pottery of the Virgin Puebloan area. The information presented here includes a review of past ceramic research in the Virgin Anasazi region including temporal information and pottery distribution patterns. Pottery samples were collected from five sites on the Shivwits Plateau. The sites represent a wide area geographically. The first part of the ceramic analysis for the collections provides temporal placement for the sites. This is a basis for examining the distribution of Shivwits Plain and Shivwits Corrugated pottery and for considering the relationship of the sample sites across time and across the landscape.

Chapter Six explores the question of where the Shivwits Plain and Shivwits Corrugated pottery was produced. That is the primary research focus. To
examine questions of production locale, pottery was collected at five sites on the Shivwits Plateau using a systematic random sampling. The collections were examined in the laboratory and information was recorded for over 4,000 sherds. The data gathered provides general temporal information for the five sites. The ceramic analysis provides a baseline of data to examine the question of production provenience. Models of production from the Virgin area are reviewed with reference to the data findings. This is the first systematic collection and ceramic analysis for the Shivwits Plateau.

Chapter Seven integrates the settlement information and the ceramic analysis. As noted before, each area of research is intricately tied to understanding the system as a whole. The documentation of settlement patterns and of pottery production are integral to understanding intra-regional contact and interaction. Combining this information and examining models provides a more complete view of the expectations for intra-regional contact and interaction.

The final area addressed in this research is the position of the Shivwits Plateau populations in this intra-regional interaction. Were the sites on the Shivwits Plateau situated to take advantage of travel or trade between the upland area on the Uinkaret Plateau and the Lowland communities in the Moapa Valley? Fairley and Geib (1989:241) state, “socioeconomic interaction and exchange is one method through which cultural contact is mediated.”

Chapter Eight explores a picture of the past on the Shivwits Plateau. A critical element of any research is to identify the questions that have been answered and provide direction for future research. Site information for the entire Shivwits Plateau has not been compiled before this time. No systematic study of the
ceramic analysis of assemblages on the Shivwits Plateau has been conducted prior to this thesis. A model of Virgin Anasazi use of the Shivwits Plateau has never been developed prior to this research. By examining the models for settlement pattern, pottery production, and intra-regional interaction this thesis provides a basis for, and hopefully an interest in, future research. While this chapter ends the thesis it will not be the final chapter of research on the Shivwits Plateau.
CHAPTER TWO

CULTURE HISTORY

The Virgin Branch Anasazi is an archaeological definition of a prehistoric cultural group. The Virgin Branch Anasazi are considered a part of the larger Anasazi prehistoric Pueblo culture that stretched from northern New Mexico across northern Arizona into southeast Nevada, north and east to Utah and Colorado. The sub-divisions or branches of Anasazi are Chaco Canyon, Mesa Verde, Kayenta, and Virgin (Cordell 1997). The Virgin Anasazi area is named for the Virgin River drainage system that traverses Utah, Arizona, and Nevada.

The early use of cultigens is usually considered the beginning of the development that defines the Anasazi culture. By 300 B.C. corn, squash, and beans were a part of the suite of the "Early Agricultural Period" of development in the Southwest (Cordell 1997). Researchers working in the Anasazi area usually follow the Pecos classification system. The Pecos developmental phases are the Basketmaker II, Basketmaker III, and the Pueblo I through Pueblo IV. The Virgin Anasazi area has recognizable development through the Pecos sequence up to the early Pueblo III (Lyneis 1996). Although the earliest local date for occupation is A.D. 1, Fairley (1989b) estimates Virgin Anasazi occupation is from roughly 300 B.C. to A.D. 1225.
The Virgin Anasazi geographic area is defined by the “surviving attributes,” or form of the material culture. Harold Colton as quoted in Fairley (1989a:101) defined the Virgin Branch Anasazi as separate and distinct in form with a culture history that spanned the entire Pecos developmental sequence. Pottery and architectural patterns are some of the defining features and McFadden (1996) proposes that a diversity of architectural forms and the wide range of archaeological landscapes are defining features of the Virgin Anasazi.

Geography

The geographic Virgin Anasazi area is usually defined as north and west of the Colorado River from Paria Canyon to the Muddy River in Nevada. The Grand Canyon is the far southern range and the northern extent falls north of Zion National Park, Bryce Canyon, and the Grand Staircase National Monument in Utah (Lyneis 1996; McFadden 1996; Walling et al. 1986). This geographic area also covers a wide range of ecological environments. The upland sites on the Colorado Plateau are in the 2100 m to 1500 m elevation range and within the upland or transitional zone of conifer forest. The lowland sites in the Muddy-Virgin River Valley are 350 m to 500 m in elevation and within the low desert environment of the Mohave Desert.

Lyneis (1996) divided the occupation into archaeological districts that correspond roughly with the geographic and environmental areas (Figure 1). The water available for farming is one important factor in each of the defined districts. The Eastern Plateaus and the Western Plateaus district sites are most often situated in the pinyon juniper forests with adjacent sage flats. Dry farming would
have been dependent on winter snow pack melting in the spring and on the summer rains and runoff. The Lowland Muddy-Virgin Valleys are river valleys winding through the Mohave Desert known for extreme summer heat. Most sites are situated along the edges of the river valleys for easy access to the perennial Muddy and Virgin Rivers. The St. George Basin District is a lowland area. Sites cluster around the Virgin and Santa Clara Rivers. Both the St. George Basin and the Lowland Muddy-Virgin Valleys offer opportunities for flood plain farming.

Figure 1. Map showing Virgin Anasazi districts as described by Lyneis.
Chronology

Various chronological frameworks have been proposed to describe the local Virgin Anasazi developments within the Pecos classification framework. The chronology proposed by Fairley (1989b) for the Arizona Strip is generally accepted for the Virgin Anasazi area (Lyneis 1992a). Fairley uses the Pecos terms but identifies them as a chronology tied to calendar dates. Those dates are derived from developmental markers that have been reliably dated through research.

It is easy to fall into the habit of defining a series of traits that correspond to the time periods and neglect the diversity of adaptation. The Virgin Anasazi area represents a very dynamic and flexible system. The time periods discussed here are only a tool used to help organize information.

**Basketmaker II ca. 300 B.C. – A.D. 400**

The early Basketmaker periods are most commonly defined as a mixed horticultural and foraging adaptation. Early use of corn has been documented across the Virgin area. Slab-lined cists were used for storage. Corn and cists have been found in Black Dog Cave in the Lowland Muddy-Virgin Valley; in Cave DuPont in the Kanab area of the Eastern Plateaus; and Rock Canyon Shelter on Western Plateaus (Amsden 1949; Janetski and Wilde 1989; Lyneis 1999a; Nusbaum 1922).

Architectural information for the Basketmaker II indicates a common use of rock shelter or cave sites. Pithouses are documented widely across the Virgin area within the Basketmaker II period (Talbot 1998). The shape and depth of pithouses are described as being usually circular to oval. Some have an interior
bench and some are slab lined. Some pithouses have slab or clay lined hearths. Only a few have documented lateral entryways (Talbot 1998:8.21). Pithouses generally do not have storage features inside. Outside pits and rock shelters were used as storage locations.

Basketmaker II sites are noted in the Lowland Muddy-Virgin Valley, the St. George Basin, and the upland plateaus. McFadden (1996:30) describes a "residential mobility model of settlement" for the Virgin Anasazi. Many Virgin area sites are multi-component sites that exhibit a "horizontal stratigraphy" showing distinct architectural features from Basketmaker II through Pueblo periods. Discrete associated middens often spread across a site area indicating several temporal occupations often through the Pueblo periods.

The Lowland Muddy-Virgin Valley and St. George Basin sites are situated near the rivers and are interpreted to be associated with flood plain farming. At Black Dog Mesa and in the upper Muddy River area, sites are situated on benches above the Muddy River flood plain. In the upland Eastern and Western Plateaus, sites are associated with a shift to dry farming. These shifts may have been based on short-term environmental fluctuations that caused depletion of soils or other necessary resources (McFadden 1996). The wide dispersal of Basketmaker II sites across the Virgin Anasazi area is attributed to the general Basketmaker II pattern in the Southwest including the San Juan area. Fairley (1989a:108) describes this as a "highly mobile settlement-subsistence strategy" with low population density that necessitated travel to maintain contact for marriage partners and a key to dispersal of a "uniform cultural tradition over a wide area."
The Basketmaker II period is universally defined by the absence of pottery. Pottery is one of the more commonly traced items in later time periods so the lack of pottery makes it difficult to document intra or inter-regional interaction during this period. Items considered diagnostic of Basketmaker II include square toe fringe sandals, S-curved "rabbit sticks," twined *apocynum* bags, and two-rod and bundle coiled baskets. These items are widely dispersed across the Virgin area. Exotic *Olivella* shell beads and abalone shell are noted in Basketmaker II context (Amsden 1949). The occurrence and distribution of those items in Virgin area Basketmaker II context is not well documented. The form of contact and interaction is still debated. The questions for this period in Virgin Anasazi tend to focus on migration of people and timing of the introduction of horticulture-dependent lifestyle and the concomitant Basketmaker traditions. Trade of exotic items is not well explored in Basketmaker II outside of the migration vs. in-situ development debate.

**Basketmaker III ca. A.D. 400 – 800**

The Basketmaker III period is considered a continuation of the previous Basketmaker II. The subsistence is a more universal dependence on horticulture with the addition of more domesticates, including beans. The bow and arrow and pottery were added to the technology base. In a horticultural subsistence economy pottery vessels are useful for food storage and for preparation. Beans require a long boiling period. The addition of beans in the diet may be tied to the introduction of pottery although the timing in the Anasazi area is inconclusive (Geib and Spurr 2000:197).
Pithouses continue into the Basketmaker III period. It is difficult to distinguish between the two periods on the basis of architecture. Pithouses are both shallow and deep. The interior bases are sometimes lined with upright slabs. Pithouses with benches were noted in the Lowland Muddy-Virgin Valley and in the St. George Basin at Zion National Park (Schroeder 1955; Shutler 1961). The pithouses sometimes occur in clusters. Associated storage features are outside the pithouse. Storage features are usually round pits lined with slab and adobe. These features are sometimes single and sometimes occur in clusters (Dalley and McFadden 1985). There seems to be no standard layout to the Basketmaker III architectural arrangement.

Shutler (1961) noted several Basketmaker III sites in the lowland Moapa Valley. These were situated on gravel benches above the valley floodplain. In the St. George Basin some of the Little Man sites have pithouses with Basketmaker III radiocarbon dates. Authors of the Little Man report expressed extreme skepticism about the dates due to the associated artifact assemblage. The probable "old wood" problem was blamed (Dalley and McFadden 1988). Baker and Billat (1992) reported Basketmaker III pit structures with associated storage cists on the middle Virgin River. The Hurricane Ridge site near the Virgin River is well dated to the Basketmaker III period but exhibits the Virgin diversity. It is a single occupation site comprised of a series of storage rooms possibly associated with a habitation site a distance away (Buck and Perry 1999).

The Basketmaker sites on the upland Western Plateaus are found in Tuweep Valley, and on the Shivwits Plateau and Little Creek Mountain (Fairley 1989b; Heid 1982; Shutler 1961). Those areas have not been excavated but the artifacts
and presence of visible slab structures indicate upland use during Basketmaker III. Inventories of the Grand Staircase and Upper Virgin River in the Eastern Plateaus documented 79 Basketmaker III sites described as small residential units (McFadden 1996). Both upland dry farming areas and the lowland perennial stream areas were used during the Basketmaker III period.

The introduction and widespread use of pottery provides an easier marker for recognizing movement and interaction. Logandale Gray Ware is identified in Basketmaker sites in the Moapa Valley. Production and distribution appears to be limited to the Lowland Muddy-Virgin Valley lowland. Olivine tempered Moapa Gray Ware is produced on the Uinkaret Plateau (Lyneis 1992a). The geographic distribution during Basketmaker III is not well documented. Sand tempered gray ware is widespread due to the ubiquitous nature of sand available for temper.

Intra and inter-regional interaction is not well documented for the Basketmaker III Period. Turquoise, shell, tool-stone, foods, and salt are possible items of trade. Turquoise mines at Halloran Springs west of the Virgin area appear to have been used by Virgin Anasazi and the neighboring Patayan during the Basketmaker III period (Warren 1984). Shell ornaments and beads have been recovered in sites in the Lowland Muddy-Virgin Valley. The St. George basin has one documented Haliotis ornament from the Basketmaker III Period (Allison 2000:Table 29). The Haliotis are from the west coast of California.

Pueblo I Period ca. A.D. 800-1000

The Pueblo I Period is very similar to the preceding Basketmaker III in terms of settlement and subsistence. The continued reliance on horticulture is apparent. However, the degree of reliance during all time periods is a continuing
subject of debate in Virgin Anasazi research. Myhrer (1986) and Allison (1990) both explore these issues. Shifts in settlement areas may reflect a reaction to environmental changes and a buffering for subsistence needs. Heid (1982) attributed a movement from the edges of Little Creek Mesa to the central mesa area between Basketmaker III and Pueblo I to the deeper soils available for horticulture.

The site layouts exhibit diversity. The pithouse forms are fairly consistent but there appears to be a move in the St. George Basin toward two or more built in clusters. Another feature that seems to be fairly common in the Pueblo I development is the arrangement of a series of round slab-lined storage pits in an arc. Walling et al. (1986:191-227) report an excellent example. The uncalibrated radiocarbon dates for the site fall just prior to the stated Pueblo I period, but Walling et al. place the site in the Pueblo I period due, in part, to the pottery.

In the Lowland Muddy-Virgin Valley area some sites show scattered pithouses with no apparent planned layout (Fairley 1989b:120; Shutler 1961:15). Shutler’s (1961:14-16) Lost City phase pithouse descriptions note oval or round pits with two D-shape half circle pithouses. The pithouses range in size from approximately 2 m to over 7 m in diameter. Interior finish is varied. Some are slab lined and some adobe lined. Four interior hearths are clay rimed. Pithouses occur as singles or in clusters that are widely spaced. Storage pits resemble the pithouses but are smaller.

Settlement patterns for Pueblo I are dynamic. In the Eastern Plateaus McFadden’s (1996:15) research shows a decline in sites for the upper Virgin area while the Grand Staircase shows an increase in site numbers during the
Pueblo I period. This shift may be due to changing environmental conditions. At the interface of the St. George Basin and the Western Plateaus, sites existing in both the upland and lowland may have been related. Fairley (1989b:120) proposed a model of possible seasonal movement to take advantage of upland resources of the Little Creek Mesa and still maintain a horticultural base in the basin river area. The Basketmaker III site described by Buck and Perry (1999) at Hurricane Ridge is an isolated storage cluster near the Virgin River at the interface of the upland and lowland basin. While this cluster is earlier, it indicates a possible pattern of habitation well away from dispersed storage areas.

Pottery production continues throughout the Pueblo I period. Painted designs are found on both olivine-tempered Moapa Ware and on the sand-tempered ware that is the Tusayan Ware, Virgin Series. The design styles are described as “analogs” of the well-dated Kayenta pottery sequence. While the nature of the Kayenta-Virgin relationship is a continuing debate, evidence of Kayenta pottery is found in the Eastern Plateaus Virgin area. Fairley (1989b:127) describes it as a “low level exchange of Kayenta Anasazi ceramics during this period, but the exchange seems to have been an important element of the Virgin Anasazi economy.”

Within the Virgin area the frequency of the olivine-tempered Moapa wares moving from the upland Western Plateaus to the Lowland Muddy-Virgin Valley begins to rise (Lyneis 1986:57). This indicates an increased contact and movement between the Western Plateaus and the lowland Moapa Valley. Some researchers have proposed the Moapa Valley sites were situated to facilitate trade of valued goods such as turquoise and shell across the Virgin area and
beyond (Rafferty 1990). The small amount of information for the Period does not support a massive trade system at this time. Allison’s (2000:Tables 27, 28, and 29) tabulation of known ornaments recovered lists only two *Olivella* beads and one turquoise bead for the Pueblo I time period. Both of these occurrences are at Cliff’s Edge, a site in the lowland along the Virgin River. Excavation recovery techniques may also play a part in the small numbers recovered.

**Pueblo II Period A.D. 1000-1150**

The Pueblo II is the best documented time period for the Virgin Anasazi area. Settlement expanded into more diverse geography. Architecture evolved from the standard pithouse to surface structures. Contact and interaction within the Virgin area shows definite patterns of movement that change through the period. Pottery design styles changed more frequently. The variability of site locations has spawned an array of explanatory models. Most models involve the question of reliance on horticulture. Subsistence strategies continued to rely primarily on horticulture. While none deny the primary use of horticulture, the degree of supplemental hunting and foraging is subject for debate.

Settlement patterns during the Pueblo II period show expanded use in each of the geographic areas. The upland plateaus show a trend toward sites in areas of deep soil suitable for dry farming. In the Western Plateau area there is evidence of agricultural terraces and water control features for rainwater runoff (Wells 1991). Expansion into canyon locations may have been to take advantage of patches of arable land with the increased probability that water drainage would be available.
The Eastern Plateaus show an increase in the number of sites during the Pueblo II. McFadden (1996:15) notes a correlation between periods of low effective moisture and the movement to higher elevations to take advantage of upland precipitation. Later in the Pueblo II period the trend is reversed when a moister climate returned (McFadden 1996:15). The Powell, Paria, Kanab, Walhalla, and flanks of the Kaibab plateau all show an increase in use after A.D. 1050.

In the St. George Basin many of the sites cluster along the Virgin River and the tributary Santa Clara River. The Little Man sites and the Quail Creek sites with Pueblo II components are excavated examples of this river area adaptation (Dalley and McFadden 1988; Walling et al.1986). Allison (1990:64-87) describes the Anasazi Valley sites along the Santa Clara River, excavated in 1988.

The greatest site density in the Lowland Muddy-Virgin Valleys occurs during the Pueblo II. Most sites exhibit the continuing trend of habitation on the low benches above the valley flood plains. The sites extend along the length of the Muddy River to the confluence with the Virgin River. In that distance there are distinct site clusters that sometimes reflect distinct temporal occupation (Allison 2000; Lyneis 1986,1992b). Some sites show recurrent use of the same location during Basketmaker and Pueblo II times (Olson 1979).

Changes in material culture have prompted researchers to further divide Pueblo II into an early, middle, and late designation. Architecture shows variability across geographic districts and through time. The characteristic architectural form of the Virgin Anasazi Pueblo II is one or more habitation rooms with a cluster of connecting storage rooms. A common pattern in all areas is
Sequential building. Rooms were abandoned, taken apart, rebuilt, remodeled and even sometimes used for burials and then abandoned. McFadden (1996:30) views the abandonment and subsequent reoccupation of the same houses or locales as a result of micro changes in climate or deterioration of the environment; a model he calls "residential mobility."

General trends can be seen in the variable site layout, or form, and construction technique. In the Eastern Plateaus the influence of the Kayenta is noticeable. Sites are masonry with linear or rectilinear layout of usually rectangular or square rooms. The increase in reliance on horticulture necessitates larger amounts of storage space. McFadden (1996:21) notes that "most" upland architecture is devoted to storage. In the Western Plateaus the site layouts usually form a gently curving arc consisting of a masonry habitation room with attached storage rooms. Later sites seem to evolve into full C or U shape arrangements of rooms. Other forms include a D, V, L, or even an E shape (Fairley 1989b:130-135). The L and E shape may also be due to Kayenta influence.

The St. George Basin and the Lowland Muddy-Virgin Valley sites show an arc or curvilinear layout (Lyneis 1986:Figures 2-5). The Main Ridge sites in the Muddy River Valley are situated on gravel knolls, terraces, or fingers and form seems to follow the contour of the hills rather than a strictly formal pattern (Lyneis 1992a:27). Later sites are sometimes a more formal C shape with an open plaza, or a circle with an enclosed central plaza. Even the largest sites are small by comparison with other Anasazi areas. Lyneis (1996:18) estimates most of the sites housed three to five families. The largest sites have 50 to 70 rooms but the
room size is small and most space would have been dedicated to storage (Lyneis 1986, 1992a). Sites in the St. George basin are diverse but stone masonry with cobbles and slabs are quite common. Floors are usually clay and some have slabs or cobbles set in adobe clay. Shutler (1961:15-16) describes the diversity of building materials of the Lowland Muddy-Virgin Valley area as using all types of masonry. Jacal and adobe are common techniques. "However, walls composed of adobe layers pressed into the proper shape and built up one upon another like the coils of a pot have been found" (Shutler 1961:15).

The Kayenta influence on architectural form is evidence of inter-regional contact and interaction. Kayenta populations may have moved into the Eastern Plateaus area during the Pueblo II. Ongoing research on the Grand Staircase National Monument should provide new information about the nature of the interface area.

Pottery in the Eastern Plateaus is often identified as Kayenta. During this period red ware pottery was imported into the Virgin area. Tsegi Orange Ware, produced in the Kayenta "heartland," is found as far away as the St. George Basin and the Lowland Muddy-Virgin Valley by the middle Pueblo II (Lyneis 1992a:33). San Juan Red Ware produced in the Four Corners area of the Mesa Verde Anasazi has a similar introduction in the Virgin area and is identified in the middle Pueblo II sites in the Lowland Muddy-Virgin Valley. The Eastern Plateaus interaction zone continues into the late Pueblo II and into Pueblo III.

A somewhat separate area of intra-regional interaction involving Western Plateaus, and the Lowland Muddy-Virgin Valley and St. George Basin areas is evident. The most easily recognized evidence is the movement of olivine
tempered Moapa wares from the upland plateaus to the lowland in the Muddy River valley. Frequency of Moapa ware increases in the lowland sites to nearly 30 percent in the middle Pueblo II and then falls off to less than 5 percent in the later sites (Lyneis 1992a:35; Olson 1979:350-351). Allison (2000:97-136) devotes an entire chapter to olivine tempered pottery distributions through time. The distribution of the sherd-tempered Shivwits Plain and Shivwits Corrugated follows roughly the same trend as the olivine temper Moapa ware (Lyneis 1992:88). The locale of production for Shivwits Plain and Shivwits Corrugated is the focus of research discussed later in this paper.

Turquoise and shell are more widely documented for the Pueblo II. Two cited occurrences of turquoise are available from the Kanab Creek area at the interface of the Eastern and Western Plateaus for early Pueblo II and middle to late Pueblo II finds are documented for five sites in the St. George Basin (Allison 2000:Table 27). Shell ornaments and beads are documented for six sites in the interface of the Eastern and Western Plateaus in the early Pueblo II. The same area has three documented occurrences of shell in middle Pueblo II sites. The Western Plateaus area has one documented occurrence of shell for the middle Pueblo II. The St. George Basin has shell documented for all periods with two occurrences in the early Pueblo II, one in the middle Pueblo II, and three in the late Pueblo II (Allison 2000:Tables 28 and 29). This evidence is very fragmentary and most certainly does not represent the true distribution. It does however point to the fact that interaction was continuing throughout the Pueblo II. Exotic items were transported at least as far as the Western and Eastern Plateau interface area. Allison's tabulations are for areas outside the Lowland Muddy-Virgin...
Valleys. A similar tabulation for all sites in the Lowland Muddy-Virgin Valley area is not available but Lyneis' (1992a:58-64, 1992b) compilation of burial data for the middle Pueblo II, Main Ridge site indicated five burials had both shell and turquoise and one burial had turquoise alone. The late Pueblo II Adam 2 site had both shell and turquoise (Lyneis et al.1989:69-73). Mesa House, a late Pueblo II site had both shell and turquoise (Hayden 1930).

Pueblo III Period ca. 1150 – 1200/1225

The Pueblo III time period established by Fairley represents the last occupation of the region by the Virgin Anasazi. There is disagreement about the exact terminus but the decline for most areas actually began in the late Pueblo II after A.D. 1100. Much of the Virgin Area was abandoned before the Pueblo III. The radiocarbon dates for the Adam 2 site calibrate into the 1200s. Mesa House is also a late site but does not have calibrated dates. By the 1300s the Virgin Anasazi sites in the Lowland Muddy-Virgin Valleys are not apparent. About 25 years later the decline in the St. George Basin is also complete (Lyneis 1996:Figure 2.2). The reasons for the decline and eventual abandonment are still active research topics. The intensification of agriculture evident in the early and middle Pueblo II period and the increased population may have placed the Virgin Anasazi at risk during extreme environmental stress (Larson and Michaelsen 1990). Whatever the cause there is no hard evidence of vast eastward migrations in the data available (Lyneis 1996:25).

Settlement patterns show the population decline across the Virgin Anasazi area. Ceramic cross dating shows the Lowland Muddy-Virgin Valleys to be abandoned before the introduction of Pueblo III pottery styles. In the St. George
Basin pottery styles indicate a longer occupation. Lyneis (1996:26) places the disappearance of Anasazi cultural traits at "A.D. 1175 or so." The Quail Creek sites have evidence of occupation into the early 1200s (Fairley 1989b:139). The Western Plateaus have continued use in the upland area around Mt. Trumbull and the Tuweep area just north of the Grand Canyon. The time of abandonment of the Mt. Trumbull area is uncertain but indications through ceramic cross-dating and radiocarbon dates for a few sites fall in the A.D. 1200 to 1250 ranges (Fairley 1989b:139). Westfall et al. (1987:93) report the final abandonment of the Pinenut site at A.D. 1275. The Eastern Plateaus and the inner Grand Canyon also show indication of occupation into the early 1200s. Lyneis (1996:20) suggests that it is also possible that there was some small-scale aggregation of population on the Eastern and Western Plateaus although it was not comparable with other instances in the Anasazi area. The larger sites are occupied later.

One noticeable architectural trend in the Pueblo III is the influence of Kayenta style. The use of a linear sequence of rooms is found in the Eastern Plateaus. The Coombs site is an example of this and probably represents a Kayenta population rather than just a stylistic influence on local populations (Dean 2002:133). Sites also show the continuing pattern of use abandonment and reoccupation. Examples are stone and mud masonry with special attention to storage rooms. This is a continuation of the trends in Pueblo II.

Contact and interaction is most documented with the Kayenta to the east. Intrusion of Kayenta pottery and design styles is seen on sites in the Eastern and Western Plateaus. Polychrome pottery is found at a few sites in the Mt. Trumbull area of the Western Plateaus (Diana Hawks, personal communication 1999).
Social and Ceremonial Considerations

Throughout the Virgin Anasazi sequence the settlement pattern appears to be one of “dispersed households.” These households probably included one to three families. Occasionally there are clusters of these individual units. Lyneis (1996) considered the question of social structure at the Main Ridge in the Lowland Virgin-Muddy Valley area. An examination of mortuary data indicated that even during one of the highest population and site density time periods there was not notable social differentiation. Burial goods did not indicate an elite class existed. The residential mobility described by McFadden (1996) would be consistent with an egalitarian society with a small group decision-making process.

The kiva ceremonial chamber common in most Anasazi areas is not well documented in the Virgin Anasazi area. Only a handful are discussed and fewer still have been affirmed by researchers. Lyneis (1996:22) notes two possibilities in her research of the literature. One in Zion National Park, was documented by Schroeder in 1955 and one in the interface area of the Eastern and Western Plateaus area of Kanab, Utah. The Eastern Plateaus show more likely candidates but they may be related to Kayenta intrusion. All of the possible examples are found at the larger sites (Lyneis:1996:22).

The Virgin Anasazi culture history shows a long-term occupation spanning the entire developmental sequence from Basketmaker II beginning around 300 B.C. through Pueblo II and the eventual abandonment in the Pueblo III sometime around A.D. 1270. Throughout this occupation a horticultural subsistence system is evident. Settlement patterns are likely related to the degree of reliance on domesticated crops and therefore to a degree on the environmental fluctuations.
All the geographic range is utilized from upland plateaus to lowland river floodplains. Architecture also reflects the subsistence systems with storage increasing through time. Pithouses are used for a long span with a gradual move to surface structures with connected storage rooms. Contact and interaction with outside groups is evident throughout the region and temporal span. Intra-regional patterns of contact are also evident in the movement of "local" products from one Virgin area to another. These patterns are dynamic, reflecting as yet unknown causes. Ongoing research questions reflect the need to refine chronology, define social systems, explore interaction, examine subsistence and health, and understand the long-term success of this group of people.
CHAPTER THREE

THE STUDY AREA: GEOLOGY, GEOGRAPHY, AND NATURAL RESOURCES OF THE SHIWWITS PLATEAU

Geography

The Shivwits Plateau is the "land between." The Mohave Desert and the southern tip of the Great Basin lie to the west with elevations of 385 m. To the east Mt. Trumbull is at 2,447 m with an upland ecological zone. The Shivwits Plateau ranges from 2,155 m to 1514 m.

The Plateau is roughly 87 km long running north to south and 38 km wide east to west. It is defined by the faults forming the Hurricane Cliffs on the east and the Grand Wash Cliffs on the west. These features would have proved substantial obstacles to easy travel from the Uinkaret highlands to the Moapa lowlands. Canyons on the Grand Wash Cliffs provide access down from the Shivwits Plateau. Jump Canyon, Hidden Canyon, and Pigeon Canyon are all passageways off the cliffs and could be used as travel corridors. The Grand Canyon terminates the south end of the Plateau. Andrus Canyon and Parashant Canyon cut deep into the Plateau leading to the Grand Canyon. Seegmiller Mountain and Wolf Hole Mountain mark the northern terminus of the Plateau. Quail Canyon and Black Rock Gulch lead northward down toward the St. George
Basin. The highest elevations on the Plateau are found in the south at Mt. Dellenbaugh at 2,156 m and slope gradually down toward the north in Wolf Hole Valley at 1,542 m.

Geology of the Shivwits Plateau

The Shivwits Plateau is the lowest and last step west in the Colorado Plateaus system (Figure 2). The Hurricane fault forms the steep face of the Hurricane Cliffs. The vertical drop from Uinkaret Plateau to the base of the Hurricane Cliffs is over 300 m. From the edge of the Shivwits Plateau down to the base of the Lower Grand Wash Cliffs the vertical drop is 650 m in two steps. The Hurricane fault forms the face of the Hurricane Cliffs and the Grand Wash fault forms the scarp of the Grand Wash Cliffs.

Figure 2. Cross-section of geography west-to-east.

The major geologic formations of the Shivwits Plateau are the Miocene and Cenozoic lavas. These are K-Ar dated to a range of 7.5 to 6 million years old. They cap the upper Paleozoic and Mesozoic rocks. Those include the Kaibab
formation and the Moenkopi formation. Kaibab exposures on most of the Shivwits Plateau are limestone and Moenkopi is sandstone. A six million year old Cenozoic basalt overlies Moenkopi sandstone on Grassy Mountain 25 km northeast of the Grand Canyon (Lucchitta 1990). On the south end of the Plateau, exposures of Hermit shale and Coconino sandstone are found below the north rim of the Grand Canyon. Much of the basalt on the Wilson and Moore geologic map is listed as Quaternary basalts. Quaternary cinder cones record the latest episodes of fault offset on the Hurricane fault (Huntoon 1990). In the central area of the Shivwits Plateau, Grassy Mountain, Poverty Mountain, Poverty Knoll, and Andrus Canyon are noted as Quaternary basalts on the 1959 Wilson and Moore geologic map. On the south end of the Plateau the Quaternary basalts overlie Kaibab limestone around Yellow John Mountain and Kelly Point (Wilson and Moore 1959).

Outcrops of chert are found in the Kaibab limestone. Some are nodule form and some are massive exposures. Both are possible toolstone sources. Other features of archaeological interest are the location of basaltic clay soils that could have been used in pottery manufacture. Soil maps indicate basaltic clay soils are found around many of the basalt exposures. Grassy Mountain, Poverty Mountain and Mt. Dellenbaugh are all listed as having clay soils (DeWall 1994). Other clay soils are found on the north end of the plateau, west of Wolf Hole Mountain, and in the Black Rock Mountains where the geologic formations are listed as Quaternary basalt. The vesicular basalts and the Moenkopi sandstone are possible ground stone sources.
Biotic Communities of the Shivwits Plateau

**Flora**

Biotic communities listed for the Shivwits Plateau consist of Rocky Mountain and Madrean Montane Conifer Forests; Great Basin Conifer Woodlands; Plains and Great Basin Grasslands; and Great Basin Desert Scrub (Brown 1994). Rocky Mountain and Madrean Montane Conifer Forest is found in small areas at the higher elevations on Mt. Dellenbaugh on the south end of the Plateau. Ponderosa pine (*P. ponderosa* var.) is the dominant vegetation with Gambel's Oak (*Quercus gambelii*) and New Mexican Locust (*Robinia neomexicana*) also included. Great Basin Conifer Woodlands comprise much of the Shivwits Plateau community. Juniper (*Juniperus*) and pinyon (*Pinus*) are the dominant vegetation across most of the Shivwits Plateau. The Plains and Great Basin Grasslands is the other predominant biotic community found on the Shivwits Plateau. Various grasses are common on much of the Plateau in the eastern and north half including Indian Rice Grass (*Oryzopsis hymenoides*), Galletta (*Hilaria jamsesii*), and Blue Grama (*Bouteloua gracilis*). Big sage (*Artemesia tridentata*) has encroached where grazing has depleted grass. Great Basin Desert Scrub is found in patches on both north and south ends of the Plateau. Plants include sagebrush (*Artemesia tridentata*), prickly pear and cholla cactus (*Opuntia*), Mormon tea (*Ephedra*), and agave (*Agave utahensis*).

**Fauna**

Animals native across the region that might have provided significant food resources prehistorically include mule deer (*Odocoileus hemionus*), antelope (*Antelope capra americana*), desert bighorn (*Ovis canadensis*), jackrabbit (*Lepus*),
wild turkey (*Meleagris gallopavo*), and chuckwalla (*Sauromallus obesus*). These are only a few of the known species. For a full list of biotic resources refer to the volume edited by Brown (1994).

**Climate and Precipitation**

Modern climate records compiled by Allison (2000:161-183) report the temperatures and precipitation from recording stations on the Shivwits Plateau. Allison analyzed the data to determine if farming was possible in each area. The Tweeds Point weather station is on the western edge of the Shivwits Plateau near the central portion of the Grand Wash Cliffs. The Yellow John Mountain station is near the south end of the Plateau in the East Fork of Parashant Wash. It is 245 m higher in elevation than the Tweeds Point station.

Both stations indicate a summer dominant weather rainfall pattern. Yellow John station received an annual average of 38 cm (15 inches) of precipitation. Tweeds Point received only 11 cm (4.5 inches) of rainfall during the growing season with annual average of around 22 cm (9 inches). The summer rainfall at Tweeds Point would not provide enough moisture for dry farming.

Temperatures at Yellow John station were notably colder possibly due to canyon downdrafts. The number of frost-free days for Yellow John was 95, far below the number required for maize farming. Tweeds Point shows an average of about 220 frost-free days. Precipitation and days between killing frosts indicate that neither the Yellow John station location nor the Tweeds Point station location would have been suitable for maize agriculture. These calculations are from weather information collected from the mid 1980s into the 1990s over a period of
nine years for Tweeds Point and 10 years for Yellow John Mountain (DeWall 1994). There may be other areas on the Plateau that would have provided adequate precipitation and temperatures for farming. Prehistoric fluctuations also might have provided enough difference to make farming possible.

Water Resources

There are 23 springs marked on USGS topographic maps for the area. Those cluster in the Wolf Hole area, the Hidden Canyon and Rattlesnake Canyon area, lower Pigeon Canyon, Poverty Mountain, and Grassy Mountain areas. The Hidden Canyon and Pigeon Canyon Springs are off the Plateau proper but within easy travel distance and on probable travel corridors. Other water sources have been developed for modern use through wells and catch ponds. Wolf Hole Lake is a dry lake area that sometimes holds water for many weeks during summer rain seasons.
CHAPTER FOUR

SETTLEMENT PATTERNS

Are there substantial sites on the Shivwits Plateau? Regarding the question of settlement patterns on the Shivwits Plateau Fairley and Geib (1989:220) had this observation, “At this point, it is impossible to determine which areas on the Shivwits Plateau are most likely to have the most dense site concentrations or even if such concentrations exist.”

Since 1989 more surveys have been completed and more data have been added to site files. Even with that additional information it is still difficult, if not impossible, to determine where sites will be found. Settlement selections are often a complex interaction of factors that might include critical resources, culture history, defensibility, environment, and even esoteric considerations such as aesthetic view or belief systems (Fairley and Geib 1989).

This exploration of settlement information includes a compilation of site information, an examination of previous settlement models, and an analysis of the models with the site information. The collection of site information was gathered from agency site files and previous survey records. The settlement models reviewed are from models previously proposed for the Virgin area. Those models draw from various research domains including subsistence, environment, trade and exchange. It is useful to examine the Shivwits site information within
the framework of the existing models to develop a model or models that might explain the settlement patterns of the area.

**Method**

The compiled information for the Shivwits Plateau was gathered from site files at the Lake Mead National Recreation Area Cultural Resource Office in Boulder City, Nevada and the Bureau of Land Management, Arizona Strip District, Cultural Resource files in St. George, Utah. Additional information was collected from the Wells (1991) report.

The compiled data include only sites with Virgin Anasazi components that also show evidence of some form of structural feature. Site types reviewed include pueblos, town/village, pithouses, room blocks, single rooms, and stone features. This information was taken from the recorded designation whenever possible. At times site sketch maps listed structural features when the accompanying forms did not. Those were included as best interpretations. Ceramic and lithic scatters or campsites were not included.

The information categories noted for each site included: site type, time period, number of rooms, vegetation, soil, ceramic varieties, topographic quad name, and elevation. Not all of these categories were available on all of the site forms.

**Limitations of the Information**

The site information for the Shivwits Plateau should be viewed with caution. There are several problems with the original information. Three areas of concern
are the limited nature of agency driven projects, inconsistent recording format, and inexperience of the recorders.

Most of the survey information has been project driven. Surveys were limited to "impact" areas around specific projects. Often these were narrow road corridors, fence lines, pipelines or water catch ponds. Some of the larger projects such as burn areas or grazing improvements did not allow enough manpower or time for complete coverage. Two research-oriented surveys were limited to small areas. The early Baldwin (1967) fieldwork done in 1942 was a piecemeal visit to site locations. Shutler's work in 1955 and 1956 was limited primarily to the south end of the Shivwits Plateau. Information about the survey method was not available in the records examined. The Adjacent Lands Survey in 1978 was research oriented and used probabilistic sampling but did not include the areas north or west from Parashant Canyon. Logistic difficulties preempted many of the random transect area from being covered and crew spacing was "dependent on density of ground cover" (Teague and McClellan 1978:8).

Much of the site information is inconsistent. Some sites have been documented very well and some early recordings have only a few cryptic notes. One of the most common problems is the assignment of site type. Some site records list a one room structural feature as a "pueblo." Some records list several connected rooms and stone features as a single room. Environmental data are inconsistent. Vegetation recording is usually fairly reliable to the dominant plants level. The most discrepancy is found in soils notation. Some site records do not note any soils. One example of a cryptic soil description is, "brown."
Temporal designations and ceramic identification are most difficult for inexperienced recorders. When temporal assignments are noted on site forms they are very broad and sometimes in error due to misidentification of pottery or the lack of any temporally diagnostic artifacts. Many field recorders have little or no experience with ceramic identification. Often even experienced researchers have misidentified pieces in the field. Shutler identified a brown ware pottery from the Shivwits Plateau as Paiute pottery though it was likely the Puebloan Shivwits Plain and Shivwits Corrugated (Allison 2000:48; Lyneis 1992a:46). Lyneis examined some of the Baldwin collection and identified Shivwits pottery that had been classified incorrectly (Lyneis 1992a). Wells' (1991) survey collections were identified in the laboratory and are probably the most reliable.

Compiled Information

There are 73 sites documented for the Shivwits Plateau that have architectural features. Figure 3 shows the percent of the total for each site type. Site types were combined in two categories for further analysis. Sites identified by the recorders as pueblos and one site listed as a town/village are considered together under the "Pueblos" category. Pithouses, roomblocks, rooms, and stone features are combined under the category "Other Structures." The totals for each category were then sorted by temporal designations, number of rooms, vegetation, soils, pottery, and geographic location on the Shivwits Plateau.
Figure 3. Chart showing percent of known sites on the Shivwits Plateau by type.

Pueblos

Temporal designations. There are 38 sites identified on site records as pueblos on the Shivwits Plateau. Some sites are assigned to more than one temporal context. Three sites are assigned Basketmaker or Early Pueblo I temporal designation. Twenty-seven sites are Pueblo II, and five sites are listed as late Pueblo II. Ten pueblo sites are of undetermined age.

Number of rooms. Twenty-seven pueblo sites have 10 or more rooms. Of the 27 multi-room pueblos, 13 are C shape, one is a U shape, one L shape, and one is an "arc." Six pueblos have less than nine rooms. One is listed as a linear four-
room pueblo. Two pueblos have a possible kiva. Three pueblos are documented with an undetermined number of rooms.

*Vegetation.* Vegetation information on site forms indicated 38 of the pueblos are in juniper pinyon vegetation areas. Two sites in the juniper pinyon zone also list ponderosa as an adjacent species. Eighteen of the juniper pinyon sites also list sage as adjacent in the vegetation, indicating a possible association with deep soils. One site form lists sage as the dominant plant with oak and manzanita, normally associated with the Montane forests of higher elevation. Only one site has grass as the dominant species. Two site forms do not list vegetation.

*Soil.* Soil information is inconsistent. Ten pueblo sites are listed to have basalt or igneous related soils or substrate. Only three of those list a basalt clay loam that might be important to pottery production. Seven site records list limestone or limestone substrate. Five site records list sandstone, basalt, and limestone. Three indicate a “red sandy” soil of sandstone origin. Five sites have a “brown lowe & pase” soil type. Three site records are unspecific and describe soil as alluvium, gravel, or just brown. Five site records do not list soil.

*Pottery.* Pottery records are listed for 20 pueblo sites. Tallies here indicate only the presence of wares on sites. They do not attempt to document frequency. Only 15 of the sites list grayware. It is assumed however that if any pottery was present that grayware would be found accompanying other wares. Twelve sites have black-on-gray wares. Eight sites have corrugated. Redware is documented on six sites. Shivwits Plain is documented on two sites, and Shivwits Corrugated
on one. One piece of polychrome is listed on a Grassy Mountain area site. Only one brownware occurrence is noted.

Figure 4. Distribution of known pueblo sites across the Shivwits Plateau.

**Location on the Shivwits Plateau.** Thirty-six of the pueblo sites are documented in BLM files and two are from LMNRA files. Eight sites are in the northwest and north central area. This is in the general area of Wolf Hole Mountain and Wolf Hole Valley. Two pueblos are in the central Sullivan Draw area that has dominant grasslands with juniper pinyon interface. Eleven pueblo sites are found in the west central area near the Grand Wash Cliffs and Hidden
Hills. Eleven pueblos are in the south central area around the flanks of Grassy Mountain. Six of the sites are in the southern area of the Shivwits plateau in the Whitmore and Mt. Dellenbaugh area. Figure 4 shows the distribution by area.

Other Structures

The same categories of site information were considered for site forms listing pithouses, room blocks, rooms, structures, and stone features or possible structures. "Other Structures," will be used here to refer to these as a group, exclusive of the previous pueblos.

Temporal designations. There are 35 Other Structures on the Shivwits Plateau. One site record lists an Archaic component with a P II component. No sites are identified as P I. Twenty-seven sites are identified to be P II time period with three listed as Late P II. Seven of the Other Structures are unknown age.

Number of rooms. The majority of the structural sites are less than five rooms. Nineteen of the sites are one or two room sites. Eleven sites have three to five rooms. Two of the small sites have agricultural features, including check dams, water control features, or agricultural field clearings. Two sites are large. One of those has nine or more rooms and one has 15 rooms. Three are unknown size.

Vegetation. Juniper pinyon community is the dominant vegetation for most of the sites. Thirty sites list juniper and pinyon as the dominant vegetation and 18 of those also list sage as dominant. Two site records note grass as dominant. One site has blackbrush as a secondary species and is lower elevation.

Soils. Eighteen site records list basalt substrate or basalt cobbles, boulders, or volcanic soils in site locations. Three records indicate limestone as a substrate or soil component. Limestone, sandstone, basalt, and mudstone are listed in
soils context on three site records. Only two site records list clay soils. Six records do not list any soil or geologic context.

Pottery. Pottery is noted on 26 of the records for structures. Nineteen site records identify grayware pottery. Black-on-gray is identified on 13 site records. Three site records list corrugated grayware, while 11 list Shivwits Corrugated and 16 note Shivwits Plain. Four site records note redware or black-on-red and three note black-on-gray painted corrugated.

![Pie chart](image)

Figure 5. Distribution of Other Structure sites known on Shivwits Plateau.

Location on the Shivwits Plateau. Most of the documented other structure sites are on the south end of the Shivwits Plateau (Figure 5). This might be a
factor of site type definitions and the intensity of the area survey. The Wells
(1991) survey and the more recent Lake Mead National Recreation Area
prescribed burn survey records are more consistent in identifying sites by the
standard AZ Site recording definitions. These surveys were also more intense in
coverage than previous surveys conducted in other areas of the Shivwits
Plateau. Twenty structures are identified in site records from the south area
around Price Point, Mt. Dellenbaugh, and Whitmore Wash. The three agricultural
features are also in this area. Five sites are listed in the northwest and north
central area. Two are listed in the northeast and two are in the west central
Hidden Hills area. The Grassy Mountain survey records list six structures in the
south central area of the Shivwits Plateau.

Patterning the Shivwits Information

The information compiled from site records has problems as previously noted.
Consideration of models for other areas of Virgin Anasazi settlement patterns is
helpful in understanding the Shivwits information. Hopefully, these models with
the compiled information will be of use in future research.

Models

Researchers in the Virgin Anasazi region have used models from different
research domains to explain the data that exist in the "natural laboratory" of the
sites on the landscape. Three of those areas might be useful to help filter the
Shiwits information. The three areas considered are subsistence, environment,
trade and social organization. All of these areas necessarily overlap and cannot
be considered without respect to a system of interaction with many complicated variables.

Subsistence Models. Subsistence models for Virgin Anasazi have focused on the question of intensity of the use of horticulture. The first basic model presented by researchers is the full-time farming model presented by Dalley and McFadden (1988) for the Little Man site in the St. George Basin. This model suggests full time reliance on cultivated crops. This explains accretional growth and reuse of sites over long periods of time.

Other researchers in the St. George Basin have proposed models of seasonal reliance on uplands for hunting to supplement the use of domesticates (Allison 1990; Westfall, et al. 1987). Expectations for this model on the Shivwits plateau might include use of the Shivwits as an upland foraging area for residents in the St. George Basin and Moapa Valley. Sites should be small camps with only a few small structural habitation areas.

Studies in the Moapa Valley suggest a reliance on local resources and an increase in the use of cultivated crops through the Pueblo II time (Lyneis 1992a; Myhrer 1986). This model would support evidence of populations from the lowlands having little use of the Shivwits Plateau and little interaction with populations either there or on the higher region of Mt. Trumbull. What interactions did occur would likely diminish through time. These models are based on the presence of substantial populations in a reliable water environment.

Environmental Models. Freeze potential and seasonal rainfall would have made farming a more dangerous proposition on the upland plateaus than in the lowland basins along the perennial streams. Farming on the upland plateaus
depended more on rainfall, runoff, spring seeps, and hand watering (Huffman 1993). Huffman’s (1993) model for the upland settlements of the Uinkaret and Kanab Plateaus presents an environmental view of the subsistence question. The upper plateaus were the primary habitation. The canyon rim was used for dry farming and the canyons and lower Esplanade of the Grand Canyon were used for seasonal gathering. The Shivwits Plateau might have supported a similar use pattern. It is lower in elevation but has a similar rainfall and environmental system. Agricultural sites would be expected in the areas close to the rim.

McFadden (1996:30) describes the settlement pattern of the Grand Staircase Plateaus as “several types of multi-component sites...as representing a specialized and long-lived pattern of use.” The model McFadden proposes is that of a residential mobility which would allow use of a variety of “agricultural niches.” Both small and large changes in environmental resources such as firewood availability, insect infestation, or undependable rainfall would allow both periodic and inter-annual movement. On the Shivwits Plateau this model would produce expectations of a variety of sites in different, but agriculturally suitable, environmental locations. Sites could vary in size and show multiple temporal occupations.

Trade and Social Organization. Various models of trade have implicated the Shivwits Plateau as something of a crossroads for movement of commodities. Early trade models suggested the Moapa Valley was a center for domination of exotic materials production and distribution (Lyneis 1984; Rafferty 1990). Later research by Lyneis (1992a; 1992b; 1996) indicates this hierarchical control...
probably did not exist but the distribution of pottery from the Uinkaret Plateau to the Moapa Valley is viewed as an important factor in regional interaction. The Shivwits Plateau definitely played a part in this movement (Lyneis 1992b; Wells 1991).

Allison (2000) presents a model of social interaction to explain the nature of exchange in the Virgin Anasazi region. His research deals specifically with the distribution of the Moapa olivine tempered pottery from the area of production on the Uinkaret Plateau to the Moapa Valley lowlands. The model is a form of risk buffering and mutualism. Risk of crop failure in the uplands would have made trade with the lowland area beneficial to the upland pottery producers. The lowland farming communities would have benefited from the exchange, as they would save the fuel resources required to fire the pottery. In simple terms the model presents a "food for pots" exchange where economic contact would also maintain social ties. This model suggests upland populations periodically visited the lowlands to bring pottery and share in harvest of lowland crops.

This exchange from the Uinkaret Plateau would involve the Shivwits as a possible trade route. Expectations for site distribution on the Shivwits Plateau might include both temporary camps and small settlements along possible travel corridors. Small agricultural dry farm sites might be expected. Sites for pottery production might also be found.

Some of the settlement information compiled here is applicable to models proposed above. While by no means comprehensive, the site information might help form future research designs that will increase our understanding of the prehistoric use of the Shivwits Plateau.
Subsistence. The subsistence models were proposed for the lowland basins but they have implications for the upland areas also. If the lowland groups were completely reliant on cultivated crops or only have seasonal reliance on upland foraging, forays to the uplands should be short. Sites should not show substantial architecture.

The Shivwits sites do show substantial time investment in architecture with 27 multi-room pueblos and two structural sites with more than nine rooms. If the Plateau was used for foraging forays from the lowlands, more sedentary groups also used it at various times. If Myhrer's (1986) model of increased dependence on horticulture is correct we might see fewer small sites on the Plateau through time. The decrease in olivine tempered pottery in the Moapa Valley might indicate lowland populations were no longer foraging in the uplands where they could get pottery (Allison 2000; Lyneis, et al. 1989). This kind of change is not visible in the site information outlined here. It is most likely that populations living on the Shivwits Plateau continued to live there. Many of the sites are recorded as Pueblo II affiliation and eight Shivwits sites are recorded as late Pueblo II or Pueblo III.

While full time agriculture would be a risky proposition on the Shivwits Plateau, McFadden's (1996) environmental model might provide a viable scenario. Using environmental niches suitable to agriculture is a possibility. Populations living on the Plateaus could afford to move to areas with better conditions and return in later years. This would be evident in sites that were used and abandoned then reused at later times. Tight temporal controls are lacking and no excavation has been done. It is hard to discern the nature of occupation,
abandonment, and reuse from site records. Some site records indicate changing pottery types that are considered to be time markers for various time periods. Eight sites are assigned to more than one time period.

Huffman's (1993) research on the Uinkaret Plateau is the closest geographically and environmentally to the south end of the Shivwits Plateau. His model of primary habitation on the rim of the Grand Canyon, with foraging into the canyons is the only model directly supported by the site information for the Shivwits. Wells (1991) reports the presence of farming features on three sites, 11 field houses and cleared field plots. In addition, agave growing below the rim, and roasting pits, indicate use of the lower canyon resources. This model is specific to the south end of the canyon and may not help explain other areas on the north and west Plateau.

The exchange model of risk buffering and mutualism assumes both ends of the trade have fairly constant occupation of their respective areas. Researchers are confident the olivine temper pottery was manufactured on the upper plateaus and transported to the Moapa Valley (Allison 2000; Lyneis1992a). Moapa Gray Ware is made close to the source of olivine on the Uinkaret Plateau and Lyneis (1992a) suggests the sherd-tempered Shivwits ware is made on the Shivwits Plateau. If Allison's trade model is correct we might expect to find many structures on the Uinkaret Plateau and also evidence of some substantial time investment in structures on the Shivwits Plateau. In addition, sites on the Shivwits Plateau might be situated to take advantage of travel corridors between the upland and lowland areas.
The Uinkaret Plateau has substantial and long-term habitation areas (Moffitt and Chang 1975). Site records for the Shivwits Plateau show 73 known sites with Pueblo and structural features. Of those sites, 48 have multiple rooms. Eighteen are listed as C shape or linear pueblos. This is not a huge number but it does indicate substantial time investment in architecture. Only a tiny fraction of the total acreage of the Shivwits Plateau has been systematically investigated. The Wells survey on the south end identified 33 per square mile. Those include all site types including artifact scatters and structural sites. The density of the southern area of the Shivwits Plateau is comparable to the site density of the Mt. Trumbull survey area (Wells 1991:145). There is evidence of substantial prehistoric use of the Shivwits plateau.

Sites on the Shivwits Plateau might be situated to take advantage of trade with the lower valley. Some areas do appear to have site clusters near possible travel corridors to lowlands. The south end of the Plateau has access to the canyons and drainage of the Grand Canyon and Colorado River. Schroeder's (1961) analysis of Willow Beach ceramics and Baldwin's (1978) descriptions of pottery from the southern end of the Shivwits Plateau suggest this was an area of contact and trade with the Lower Colorado, Patayan people.

Some sites appear to cluster around Grassy Mountain in the central area. Seventeen structural sites are documented. A total of 75 sites in 1640 acres were recorded during inventory for the Grassy Mountain/Agway Valley Push range improvement project (Herron 1998). This is a site density of 30 per square mile and is comparable to the recorded densities from the surveys on the southern Shivwits Plateau and in the Mt. Trumbull area. Grassy Mountain sits between
Parashant Canyon and Agway Canyon. Both lead to the Grand Canyon and Colorado River Drainage.

The west central Hidden Hills area has 13 documented structural sites. Eleven of those are multi room-pueblos. Hidden Hills is a large area of deep soil and lies on the edge of the upper Grand Wash Cliffs. Two canyons provide access off the cliffs and allow westward travel toward the Moapa Valley. Pigeon Canyon and Hidden Canyon are both possible travel corridors.

The northwest and north central areas of Wolf Hole Valley and Sullivan Draw are the most isolated from canyon corridors. A total of 18 sites are documented for these areas. It is possible this area was used for access to the St. George Basin but the sites could have been situated to take advantage of other desirable characteristics such as the deep soils and slightly lower elevations for agriculture.

The trade models can be supported in both site density and substantial investment in structural sites along possible travel corridors. Other information ancillary to the site data is the presence of non-local turquoise and shell beads recovered from Hidden Hills sites in the course of this research. Non-local Tsegi Orange and Jeddito Yellow pottery was collected from the southern sites (Wells 1991). Non-local red ware is documented on 11 site records across the Plateau.

The large grassland areas in the east central area of the Shivwits Plateau are notably devoid of sites. Whether this is a factor of survey information or prehistoric choice is unknown, but the central grasslands are slightly north of the direct travel line from Mt. Trumbull to the south canyons. The choice may be more dependent on vegetation zones. On the rest of the Plateau the most consistent pattern is the site location in juniper and pinyon woodlands. Seventy of
the 73 pueblo and other structural sites are situated in the woodlands. That trend has been noted by most archaeologists who work on the Arizona Strip (Diana Hawks personal communication, 1998).

As with most studies of the Virgin Anasazi area no one model can explain the variability that characterizes this long and successful adaptation. It seems likely that pieces of each model will fit in certain circumstances. Hunting and foraging buffer models from the lowland farming populations are least explored by this information. There are many campsites and lithic scatters on the Plateau. Those were not included in this study but they warrant further investigation. McFadden's (1996) model of mobility and diversity is easily recognizable on the Shivwits Plateau. His study had the advantage of large blocks of survey information. Hopefully such studies will be possible for the Shivwits Plateau in the future. Huffman's (1993) model will work well in studies of land use of the unique Grand Canyon and Esplanade environment. Allison's (2000) trade model should be further explored with relation specifically to zones of production for more samples from the Shivwits Plateau. The following chapters expand information about zones of production for the Shivwits pottery.
CHAPTER FIVE

CERAMIC ANALYSIS OVERVIEW AND
TEMPORAL DESIGNATION

Ceramic studies have been a mainstay in Southwest archaeology. Pottery has been used as a key to chronology, social organization, and regional interaction (Skibo and Feinman 1999). Some of these issues have been examined in recent research for the Virgin area but there are still many gaps in the data (Allison 2000; Lyneis 1992a, 1992b, 1997a). The general goal of this study is to provide a baseline of information. Organization of the information includes a review of the basic ware and temper categories and introduction of the pottery chronology of the area. Models of production are presented to provide a framework of expectations and guidelines for the analysis. For this study pottery was collected from five sites across the Shivwits Plateau. A brief description of the sites and their locations is provided. Description of the methodology includes the sampling strategy and laboratory procedure. Analysis includes the tabulation of data, establishing a chronology for the sites, and exploration of the models.

Classification of Virgin Area Pueblo Pottery

Colton (1952) developed the classification for Virgin area pottery. Through time there have been clarifications and additions but most researchers still rely
on Colton's system. Colton (1952:2) described wares as a method of categorizing pottery sherds, usually based on "basic methods of manufacture," such as firing or temper inclusions. In the Virgin area varieties of white, gray, red, and brown ware pottery are found. The construction technique for all Virgin wares is coil-and-scrape. Finishing technique and design style further separate the various wares into types.

Red Wares

The red wares were created by a firing method that allowed oxidation of the vessel during the latter part of the firing process. Three varieties of red wares have been identified in the Virgin area. Two of those are almost certainly imported. The Tsegi Orange Ware is sherd tempered and made in the Kayenta Anasazi area beginning around A.D. 1000. The San Juan Red Ware is tempered with andesite sand and made in southwestern Colorado or the southeastern Utah area of the Mesa Verde Anasazi. San Juan Red Ware was made from about A.D. 750 into the A.D. 1000s but does not appear in the Virgin area until after A.D. 1000 (Allison 2000:68-70). The third variety is a sand-tempered red ware that may be a Virgin ware produced in the Kanab area on the plateaus (Lyneis 1992a:31-32).

Gray Wares

Gray wares are made with a reducing atmosphere during firing. The temper inclusions and clay characteristics are used to identify four gray wares and the painted "white" equivalents produced in the Virgin area. Logandale Gray Ware is limestone-tempered and is not known to have any painted or white types. Moapa Gray Ware is tempered with olivine and the painted types are considered
included in the gray wares. Tusayan Gray Ware, Virgin Series, is sand-tempered. Colton (1952) classifies the painted types under the Tusayan White Ware, Virgin Series. Shinarump Gray Ware is a sand-tempered ware with dark firing clay and the painted types are grouped as Shinarump White Ware. Other gray and white wares are found in the Virgin area in small amounts but are considered intrusive or trade items. Table 1 shows the Virgin gray wares and styles with corresponding type names.

Table 1. Virgin Pottery Wares and Types by Design Style.

<table>
<thead>
<tr>
<th>Ware</th>
<th>Tusayan Gray Ware</th>
<th>Moapa Gray Ware</th>
<th>Logandale Gray Ware</th>
<th>Shivwits Plain &amp; Corrugated</th>
<th>Shinarump Plain &amp; White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Style</td>
<td>Sand temper Light clay</td>
<td>Olivine temper</td>
<td>Limestone temper</td>
<td>Sherd temper with olivine</td>
<td>Sand temper Dark clay</td>
</tr>
<tr>
<td>Lino</td>
<td>Mesquite Black-on-gray</td>
<td>Boulder Black-on-gray None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Kana-a</td>
<td>Washington Black-on-gray</td>
<td>Boysag Black-on-gray None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Black Mesa</td>
<td>St. George B/g Orderville B/g (corrugated)</td>
<td>Trumbull B/g Toroweep B/g (corrugated) None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Sosi</td>
<td>North Creek B/g Style A Hurricane B/g (corrugated)</td>
<td>Moapa B/g Whitmore B/g (corrugated) None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Dogoszhi</td>
<td>North Creek B/g Style B Hildale B/g (corrugated)</td>
<td>Slide Mtn. B/g Whitmore B/g (corrugated) None</td>
<td>None</td>
<td>Virgin B/w Style B</td>
<td></td>
</tr>
<tr>
<td>Flagstaff</td>
<td>Glendale B/g Parashant B/g (corrugated)</td>
<td>Poverty Mtn. B/g Tuckup B/G (corrugated) None</td>
<td>None</td>
<td>Unknown</td>
<td></td>
</tr>
</tbody>
</table>
Logandale Gray Ware. Colton (1952:83) identifies Logandale Gray Ware as "quite the poorest pottery made in the Southwest." The limestone temper breaks down in firing temperatures above 500° C and leaves pits and crumbling paste. When fired at lower temperatures the clay is still soft. Logandale Gray Ware is considered to have a limited area of production (Colton 1952; Lyneis 1996). It is found most extensively in the Lowland Muddy-Virgin Valley and is often associated with early sites from Basketmaker III. It is not widely distributed across the Virgin region and was most likely produced in the lowlands. Logandale Gray is the only type identified for the Logandale Gray Ware group. Corrugated varieties of Logandale Gray are not documented. No painted types have been described for Logandale Gray.

Shinarump Gray and Shinarump White Ware. The Shinarump Ware category is problematic. It has been inconsistently identified through time. As defined by Colton, the ware has a dark gray or brown surface color. It is made with iron-rich, dark-firing clay, with light angular fragments and sometimes "slight quantities of quartz sand." The ambiguous term "white angular fragments" has led to inconsistent identification and classification over time. More recent identifications include Euler's description of the surface color as "primarily purplish: sometimes gray-brown" (Walling and Thompson 1988:51). Lyneis (1997a:3) describes the color as "steely gray," but gives more detailed description of the primarily quartz sand temper. An overview of the past problems is included in the Lyneis (1997a) paper. The Shinarump Ware includes the Shinarump Gray and Shinarump Corrugated types. Shinarump White Ware includes two known design styles
designated Virgin Black-on-white and Toquerville Black-on-white. Production areas for the Shinarump Ware are still being explored.

*Tusayan Gray Ware Virgin Series.* The third ware category is the sand-tempered Tusayan Gray Ware, Virgin Series. The undecorated sand tempered gray wares were used throughout the temporal duration and across the geographic span of the Virgin Anasazi. The Tusayan Gray Ware was likely manufactured across the Virgin region. Due to the ubiquitous nature of sand, specific sources have not been identified, making it difficult to trace movement. The plain type is North Creek Gray and the corrugated type, with indented coils, is North Creek Corrugated. Colton (1952) categorizes the painted types under the Tusayan White Ware, Virgin Series. The design styles that determine the types are analogous to the Kayenta Series styles.

*Moapa Gray Ware.* Moapa Gray Ware is tempered with olivine. The temper is found on the Uinkaret Plateau around the volcanic formations of Mt. Trumbull, Mt. Emma, Vulcan’s Throne, and Toroweep Valley north of the Grand Canyon in the Western Plateaus area. Road crews working east of Mt. Trumbull recently discovered large nodules of olivine in a volcanic cinder area. The nodules are bundles of olivine crystals that can be easily broken apart. Crystals can then be rubbed off of the broken nodule and the grains provide an olivine temper with no further processing. The olivine temper in Moapa Gray Ware usually has very angular crystals that show little indication of rounding from grinding. Consistent clay attributes suggest the Moapa Gray Ware was made close to the temper source (Allison 2000; Lyneis 1992a:30). The provenience of the olivine temper and the ease of its identification make this ware an easily traceable item.
geographically. Moapa Gray Ware is found throughout the time span but the geographic distribution changes through time (Lyneis 1992a). Boulder Gray is the plain type of Moapa Gray Ware and Moapa Brown is the type identified with brown clay. Moapa Corrugated is named for the corrugated indented finish. The painted Moapa Gray Ware types are identified by the design styles of the analogous Kayenta Series.

**Shivwits Plain and Shivwits Corrugated.** Shivwits Plain and Shivwits Corrugated pottery are the focus of this study. Shivwits was not described or formally defined by Colton as a ware. It was defined as a type by Lyneis (1992a:44-46) in both a plain and corrugated gray ware. The dark gray to black-firing grainy clay with crushed pottery sherds and small fragments of olivine as temper are the defining characteristics of Shivwits pottery. The following is a summary of Lyneis’ description. The core colors are dark gray to black. The core texture is usually grainy although some samples are not. It is usually fired in a neutral atmosphere with red margins when oxidized. The sherd temper is usually from crushed Moapa Gray Ware pottery and small bits of olivine and quartz are frequently visible, presumably from the Moapa Ware temper. The crushed sherd temper is sometimes light gray against the dark clay and sometimes is from crushed Shivwits pottery with dark clay. Surface colors are usually dark, ranging from reddish brown to very dark gray. Refired colors range from the high chromas of the Munsell color chart in red, reddish yellow, and yellowish red to the medium and low chromas of reddish brown and light reddish brown. Shivwits pottery is most often a jar form with bowls being rare. Jar rims range from slightly everted to strongly everted at more than a 45 degree angle. No painted varieties
have been identified. The manufacture dates are from A.D. 1000 to 1150, and the manufacturing area is assumed to be on the Shivwits and Uinkaret Plateaus. Shivwits Plain was distributed from the Uinkaret Plateau to the Muddy-Virgin Valley lowlands and in the St. George Basin.

Lyneis proposed that the sherd-tempered Shivwits pottery was made on the Shivwits Plateau. This proposal was based on the appearance of dark firing clays that might be available around the basaltic formations on the Plateau. The Shivwits pottery is tempered with crushed Moapa ware pottery that should be abundant on the Shivwits Plateau (Lyneis 1992a).

This research addresses the question of where the Shivwits pottery was produced. Examination of pottery sherds collected from five sites in four areas on the Shivwits plateau addresses the question of distribution of wares and potential production areas. Analysis of over 4,000 sherds provides data for testing general models of pottery production and for further exploration of the implications of the Shivwits pottery distribution. The assemblages are compared within each site, between the five sites, and on a broader area context.

Ceramic Chronology

Virgin pottery chronology is based largely on the neighboring Kayenta sequences. While the Kayenta area has had the advantage of dendrochronology for cross-dating of pottery styles, dating for the Virgin sequence has not been as well established. Those sequences are still being developed and refined. While there are problems in assuming cognate styles follow the same dates, this is still one of the best temporal indicators we have (Allison 2000; Fairley 1989b).
Design styles, jar rim forms, introduction of corrugation, the import of exotic types from areas with better dating, and distribution trends are all clues to the ceramic chronology for the Virgin area.

**Design Styles**

Design styles are most commonly used to date pottery assemblages. The Virgin painted pottery styles are comparable to the Kayenta styles in execution and temporal assignment.

*Lino.* Colton and Hargrave (1937:194) define Lino style as having narrow lines with ticks or fringe, and free dots often placed between parallel lines. The designs are "crudely executed." The Lino style in Tusayan White Ware, Virgin Series is Mesquite Black-on-gray. The equivalent Moapa Ware is Boulder Black-on-gray. Lino is an early style usually associated with Basketmaker III sites.

*Kana-a.* The Pueblo I design style is Kana-a, recognized by fine and narrow lines often in parallel series. The fine lines almost always carry over at junctions. Small solids or triangles occur and sometimes have "very small pendant dots (less than 1mm in diameter) or short fringe-line lines" (Colton 1952:39). The fringe is sometimes "pinate" or on both sides of an axis line. Again the designs are "marked by crudity of brushwork" (Colton and Hargrave 1937:206). The Tusayan Virgin Series type with Kana-a style is Washington Black-on-gray. The olivine-tempered Moapa version is Boysag Black-on-gray.

*Black Mesa.* Black Mesa design style is sometimes referred to as St. George style in the Virgin area (Dalley and McFadden 1985). This early Pueblo II style as defined by Colton (1952:34) has wide horizontal lines, large solids, and triangles sometimes set in opposing series. Solids have large pendant dots. Curved lines
are rare but interlocking scrolls are sometimes found. Colton (1952:41) also notes a “narrow stripe just below the rim” for the Tusayan Virgin Series type, St. George Black-on-gray. A corrugated exterior with painted interior is the Orderville Black-on-gray type. The Moapa ware with Black Mesa style is Trumbull Black-on-gray and if the exterior is corrugated it is Toroweap Black-on-gray. Other distinguishing features of the types are pendant dots on solids that seem to form a scallop effect, and stepped triangles (Walling and Thompson 1988:229). Both of these types sometimes have an “across the bowl” or bilateral design layout rather than covering the circumference of the bowl. This is distinctive to the Virgin area and probably carries into the middle Pueblo II time. The pendant dots also disappear in the later versions of this design style. This causes some confusion with the next style.

Sosi. Sosi design style probably begins in the early to middle Pueblo II time period but is most common in the middle Pueblo II. It is characterized as “bold and free” (Colton and Hargrave 1937:212) with large solids including triangles arranged in stepped pattern. Horizontal stripes or broad lines are a “major part of the design.” North Creek Black-on-gray is the Tusayan, Virgin Series type name and the corrugated and painted version is Hurricane Black-on-gray. Moapa Black-on-gray is the Moapa type and the corrugated and painted type is Whitmore Black-on-gray. Colton (1952:46) notes a “horizontal stripe or wide lines at or just below the rim.” Broad lines are in parallel series of two to five lines. Triangles are sometimes “excessively elongated.”

Dogoszhi. Dogoszhi design style is distinctively different from the Sosi. It consists of “panels containing diagonal or vertical narrow-line
hatching...diagonal hatching predominates” (Colton and Hargrave 1937:210). The panels are formed with framing lines about one to three millimeters wide and are usually rectangular or triangular and sometimes curved. This design style is also North Creek Black-on-gray type in the Tusayan, Virgin Series. Thompson (Walling et al. 1986:335) added Hurricane Black-on-gray to designate the corrugated Dogoszhi Virgin Series type. The Moapa varieties are Moapa Black-on-gray and Fern Glen Black-on-gray for the corrugated type. This is somewhat confusing because the Sosi styles are sometimes referred to as North Creek Black-on-gray Style A and Moapa Black-on-gray Style A. The Dogoszhi are designated as Style B. Lyneis (1997b) proposed dropping the separate designation for Dogoszhi because hatched elements sometimes occur with broad lines and it is uncertain if there is really a temporal difference. This revision is still under consideration.

**Flagstaff.** The Flagstaff design is a late Pueblo II to Pueblo III style. It is usually a pattern that covers the entire vessel. Barbed and pinnate lines are a diagnostic characteristic and are sometimes arranged in opposing pairs. Diagonal and rectangular fine lines form cross-hatching. Dots are sometimes placed in open squares. Small solid triangles sometimes occur with interlocking hooks (Colton and Hargrave 1937:226). Glendale Black-on-gray is the Tusayan Virgin Series and Parashant Black-on-gray is the corrugated version. Moapa ware with Flagstaff style translates to the Poverty Mountain Black-on-gray and the corrugated Tuckup Black-on-gray. These types were added by Thompson (Walling et al. 1986) in his Quail Creek ceramic analysis.
Jar Rim Forms

Pottery jars for the Virgin area usually have out-curving or everted rim forms. Those rim forms become more everted through time and have some use as a temporal diagnostic (Allison 2000:65; Thompson 1988:230). Early jars have longer necks and rim forms have little or no eversion. This is usually considered characteristic of jars during the Basketmaker III period. There is a slight difference in the Pueblo I jars, but the most noticeable change is the Pueblo II jars which are sharply everted (Allison 2000:65). Colton and Hargrave (1937:10) use designations A for no eversion, B is slightly everted at about 30 degrees, C is moderately everted at 45 degrees and D is sharply everted at more than 75 degrees (Allison 2000:65; Allison and Coleman 1998:9.13). Colton and Hargrave's A and B are probably applicable for the Basketmaker III and Pueblo I jars. Form C is intermediate and is probably a Pueblo II rim characteristic. The Pueblo II jars probably correspond to Colton and Hargrave's (1937) form D as shown in Figure 6.

![Diagram of Jar Rim Eversion](image)

Figure 6. Rim form eversion after Colton and Hargrave (1937).
Corrugation

Corrugation consists of indenting the clay coils on the exterior surface of the vessel with a finger or similar tool. This characteristic finish was not adopted in the Virgin area until the beginning of the middle Pueblo II period. In other Anasazi areas the corrugation follows a trajectory. The earliest form is simple neck banding or leaving unindented coil bands. In later forms coils were indented to form vessels that had a corrugated texture. Corrugation covered the entire body in the later vessels and, outside the Virgin area, corrugated vessels virtually replace all plain wares. In the Virgin area the corrugation is introduced later the later technical development stage and is full body corrugation from the outset beginning about A.D. 1050. Corrugated vessels increase in numbers but they never replace plain jars (Allison 2000:66; Lyneis 1992a:34). The increasing frequency has been useful in seriating the lowland sites where the late Pueblo II Mesa House site is reported to have 69 percent corrugated gray wares (Lyneis 1992a:34).

Imported Wares

The distribution of imported pottery is a useful tool to help place sites in a temporal framework. The imported San Juan Red Ware was made in southwestern Colorado to southeastern Utah and is a product of the Mesa Verde Anasazi. The ware was produced from A.D. 750 into the eleventh century. After about A.D. 850 it had a red slip. There are varying design styles but this pottery does not appear in the Virgin area until shortly before its production ended around A.D. 1050 (Allison 2000:68). It is noted at Virgin sites in the middle
Pueblo II and is never abundant. The sherd-tempered Tsegi Orange Ware was made in the Kayenta area. Tsegi Orange Ware has two design styles that begin at roughly the same time but the Medicine Black-on-red ends sometime in the twelfth century. Tusayan Black-on-red continues through the twelfth and possibly into the thirteenth century (Allison 2000:Table 3). Tusayan Black-on-red is a design roughly comparable to Dogoszhi with thin lined and parallel thin lines with hatching between. Medicine Black-on-red has solid design elements with narrow lines. In the Virgin area the presence of imported red ware could be a characteristic of middle to late Pueblo II sites (Lyneis 1992a:33). Allison (2000:69) notes that San Juan Red ware may appear alone on the earlier sites and the Tsegi imports and locally made sand-tempered red ware might appear alone on later sites in the late Pueblo II to Pueblo III. The imported polychrome pottery, usually red with two paint colors for design, is almost universally a marker for Pueblo III or later. Polychrome is uncommon in the Virgin area pottery assemblages, especially in the Lowland Muddy-Virgin Valley.

Painted Kayenta Black-on-white types are sometimes found in the Virgin area. They usually stand out as having a clean smooth white finish or possible slip with vivid black paint. These imports have a true slip with clean quartz sand for temper usually in fine clay. Design styles are well dated for the Kayenta pottery but due to the small numbers found in the Virgin area they should be only a cross-reference rather than a determining temporal indicator.

**Distribution Patterns**

There are patterns in distribution of various pottery wares in the Virgin area that seem to be temporally diagnostic. Based on the consistency of clay colors
and the limited distribution within the lowland area sites, it is assumed the limestone-tempered Logandale gray ware was produced in the Muddy-Virgin Valley lowlands (Myhrer and Lyneis 1985:28). It is one of the earliest types of pottery and is most common as jar forms. Colton places Logandale Gray Ware as a Basketmaker III variety that was used again in Pueblo II. He determined this by the shape of the rims for some Logandale jars. Lyneis (personal communication 2002) disagrees with the placement of Logandale at later sites. Logandale is not often noted outside of the lowlands. Of the Pueblo I and Pueblo II sites with published documentation, Bovine Bluff and Cliffs Edge in the Muddy and Virgin River valleys have the highest amount of Logandale with 59 percent and 15 percent respectively (Myhrer and Lyneis 1985:29). Cliffs Edge is earlier but both have radiocarbon dates that fall within the Pueblo I time range. Other early Pueblo II sites have less than one percent Logandale showing a dramatic decline and abandonment of the ware.

In the Lowland Muddy-Virgin Valley the olivine-tempered Moapa Gray ware shows a pattern of increase in the early Pueblo II period and then a decline with the late Pueblo II almost void of the ware. Moapa Gray Ware is found at sites as early as A.D. 600 but is not common until the middle Pueblo II. It occurs in highest frequency at Main Ridge, Steve Perkins and other middle Pueblo II sites at about a 30 percent frequency (Allison 2000:104; Lyneis 1992a; Myhrer and Lyneis 1985:29; Olson 1979). A rapid decline occurs and the later Adam 2 and Mesa House sites have almost no olivine-tempered pottery. This indicates changing patterns of contact between the upland Eastern and Western Plateaus and the Lowland Muddy-Virgin Valley.
Figure 7. Location of sample sites on the Shivwits Plateau.
The Study Sites

With assistance of BLM archaeologist John Herron, several sites were identified in the existing site records of the Arizona Strip Bureau of Land Management (BLM) files as potential collection sites. Five pueblo sites were selected for pottery collection. Several sites were visited in the Spring of 1999 to get a general idea of the available resource. Figure 7 shows the location of selected sample sites. Criteria for selecting the pottery study sites were:

1. The sites are Virgin Anasazi Puebloan sites.
2. Sites have structural elements to indicate a habitation or pueblo area.
3. Sites represent a wide geographic range of the plateau.
4. Sites have an adequate amount of pottery for collection.
5. Surface pottery and architecture might be for early to middle Pueblo II.

Sample Site Descriptions

**AZ:A:6:67 BLM Cropperville.** The Cropperville site is in the north central area of the Shivwits Plateau. It is south and west of the large open grassland areas of the Plateau. Situated on a low ridge at an elevation of 1,655 m (5,430 ft), in pinyon juniper forest, the site overlooks sagebrush meadow openings on the north and south. The site was first documented in 1988 with little information provided on recording forms at that time. It was re-recorded in 1996 by John Herron and documented as a "Town Village" on AZ site forms. The site has three room block areas and a surrounding artifact scatter extending 105 m north to south and 75 m east to west. The total site area is roughly 5,700 m². The site was looted sometime before 1996 and a miniature pot was turned over to the BLM office. The pottery noted include grayware with some corrugated, redware,
and black-on-gray painted. The small amount of corrugated ware and the painted
designs suggest an early to middle PII use period.

**AZ:A:10:24 BLM Poverty Mountain Ridge East.** The Poverty Mountain Ridge
East site is in the Hidden Hills area in the west central portion of the Shivwits
Plateau. It is one of a series of five sites extending along a northeast to
southwest-trending ridge. The selected site is at an elevation of 1,932 m (6,340
ft). The site and adjacent artifact scatter has a maximum extent from 130 m east
to west and 70 m north to south. The site area is 6,000 m², and vegetation is a
mix of cliffrose, oak, pinyon juniper, and sagebrush. Most of the surrounding area
is similar forest with small open grass areas. The site was recorded in 1988 and
has been revisited but not documented since then. The site was whimsically
called Poverty Mt. Ridge "suburb" on an early sketch map. It was first recorded
as a pueblo site with 10 rooms measured and at least four more inferred from the
rubble. At that time the site had a road through it along the ridge top and
vandalism holes dug in two areas. The site has five areas of extensive rubble
that may represent different structural units or different occupations. The pottery
scatter is spread out from two concentration areas. Pottery noted in preliminary
surveys were grayware, a few corrugated and black-on-gray painted with fine
lines and pendant dots indicating a possible early to mid Pueblo II occupation.
Other notable items were shell barrel beads and turquoise. Both shell and
turquoise are imported items. West of this site, along Poverty Ridge, four more
pueblo sites have been documented.

**AZ:A:10:26 BLM Zack's Bag.** Zack's Bag is a pueblo site in the Hidden Hills
area in the west central portion of the Shivwits Plateau. It is about 1.6 km south
of the Poverty Ridge sites at an elevation of 1,877 m (6,160 ft). The site was first recorded in 1988 and updated on the pottery site evaluation in April 1999. It is recorded as a roomblock that arcs roughly southwest. Within the roomblock are four definable rooms and two or more that are indistinct. A possible pit feature and a rock alignment were also noted south of the main structure area. The structure and associated artifact scatter extend 100 m east to west and 63 m north to south. The site area covers 4,600 m² on a gentle slope to the southwest, and vegetation on site is pinyon juniper with tall sage. A two-track road from old logging operations crosses one artifact concentration area west of the structures. The site has had both old and recent vandalism. Pottery on the surface includes grayware, possible sherd tempered ware, a few black-on-gray. No corrugated sherds were noted. Pottery noted during the evaluation indicated an early Pueblo II time period. This site was selected for sample collection and as a suitable test excavation area in the vandalized room.

AZ:A:10:16 BLM Drew’s Site. Drew’s Site is a small pueblo in the south end of the Hidden Hills area. It is in the west central area of the Plateau at an elevation of 1,935 m (6,350 feet) near the edge of the Upper Grand Wash Cliffs. These cliffs are the western boundary of the Shivwits Plateau. The topography west and southwest of the site slopes off steeply toward Pigeon Canyon. The canyon provides a travel corridor off the steep precipice of the Grand Wash Cliffs westward toward the Lower Grand Wash and on toward the Moapa Valley lowlands. The site is situated between two low limestone rises. Drew’s site was first recorded in 1983. It is a C-shaped pueblo oriented east-southeast. The pueblo area and adjacent artifact scatter covers an area measuring 39 m north to
south and 46 m east to west. The site area is 1,400 m² and the artifact scatter does not extend far beyond the structure. The vegetation on the site includes cliffrose, sage, and small oak trees, with pinyon juniper surrounding the site area. The site is adjacent to a small two-track road and a well-worn cattle trail crosses the site on the west side. One small pothole was noted during the site visit. There is a small amount of debitage with chert and obsidian scattered across the site. The chert is red and yellow and occurs in the limestone outcrops in the area. The pottery assemblage includes grayware, black-on-gray, redware, and some corrugated grayware. The thin lines on painted pottery and a small amount of corrugated pottery indicate a possible early to middle Pueblo II occupation.

AZ:A:11:72 ASM Trip House. Trip House is an arc of rooms forming a “C-shaped” pueblo facing roughly south-southeast. It is in the south central area of the Shivwits Plateau at the east foot of Grassy Mountain. Elevation of the site location is 1,688 m (5,540 ft). Trip House is one of 75 sites recorded during a Bureau of Land Management project survey. Other sites recorded in the area include structures, lithic scatters, and numerous roasting pit features. The Trip House site is 50 m north to south and 40 m east to west at the maximum extent. With the irregular site boundaries the total site area is 1,150 m². Vegetation on the site includes pinyon juniper, cliffrose, sagebrush, shrub oak, barberry, ephedra, and cacti. Cattle grazing and natural erosion are the major impact agents on Trip House. The artifact assemblage on the site includes lithic debitage of chert and chalcedony, ground stone mano and metate fragments, and pottery. The pottery includes grayware, black-on-gray, and redware. The absence of any corrugated indicates a possible early Pueblo II occupation.
Field Method

Each site was measured and a field map drawn to determine the site area available for sampling. A datum was chosen and a marker was placed for reference. Random number tables were used to select five cardinal directions from 0 to 360 degrees. Each number selected was used as a compass bearing from the datum. The distance available for that direction to the site boundary was noted from the field map and a second number table was used to select the distance from the datum. A secondary datum was set at that direction and distance. A “dog leash” sampling method suggested by Allison (personal communication 1999) was used. A string 3 m long was tied to each secondary datum to draw a circle 6 m in diameter giving a sample area of 28.27 m² per sample unit. All surface pottery sherds were collected. Special care was taken to identify any non-pottery items that might have been used in pottery production. Those included temper material, unfired clay, and smoothing stones. Lithic debitage was not collected, but diagnostic projectiles within the sample areas were collected. Exotic items that might be helpful in documenting long distance trade or contact were collected when encountered in mapping or sampling.

AZ:A:10:26 BLM Zack’s Bag, which had been recently looted, was tested in the disturbed area. The test objective was to recover any carbon samples for dating, and to reveal any discernable architectural sequence. Artifacts from the test unit were collected in arbitrary 10 cm levels. These included, faunal, lithic, and pottery material.
Table 2. Pottery Samples by Sherd Count and Gram Weight.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>DATA</th>
<th>SAMPLE UNIT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SU #1</td>
<td>SU #2</td>
</tr>
<tr>
<td>AZ:A:10:16</td>
<td>BLM</td>
<td>Count of sherd</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td>BLM</td>
<td>Sum of weight</td>
<td>457.65</td>
</tr>
<tr>
<td>AZ:A:10:24</td>
<td>BLM</td>
<td>Count of sherd</td>
<td>661</td>
</tr>
<tr>
<td></td>
<td>BLM</td>
<td>Sum of weight</td>
<td>1938.42</td>
</tr>
<tr>
<td>AZ:A:10:26</td>
<td>BLM</td>
<td>Count of sherd</td>
<td>370.28</td>
</tr>
<tr>
<td></td>
<td>BLM</td>
<td>Sum of weight</td>
<td>106.14</td>
</tr>
<tr>
<td>AZ:A:11:72</td>
<td>ASM</td>
<td>Count of sherd</td>
<td>349</td>
</tr>
<tr>
<td></td>
<td>ASM</td>
<td>Sum of weight</td>
<td>1244.01</td>
</tr>
<tr>
<td>Total count of sherd</td>
<td></td>
<td>1375</td>
<td>1224</td>
</tr>
<tr>
<td>Total sum of weight</td>
<td></td>
<td>4118.50</td>
<td>3152.65</td>
</tr>
</tbody>
</table>

There were 3,835 sherds collected in the sample units. Five sample units were collected at the three largest sites: AZ:A:10:24 BLM, AZ:A:10:26 BLM, both in the Hidden Hills area, and AZ:A:6:67 BLM. Each sample unit was roughly 28.27 m² with a total of 141.37 m² sampled for each site. Four sample units were collected from the two smaller sites, AZ:A:10:16 BLM and AZ:A:11:72 ASM for a total sample area of 113.09 m² for each site. Table 2 shows the total sherd counts from sample units for each site. A total of 4,334 sherds were collected. Sixty-two sherds were collected in grab samples and 437 sherds were collected from the test excavation at Zack's Bag.

Ceramic Analysis

The analysis is presented here in four parts. The initial objective is to determine a temporal placement for each site. The temporal placement will allow comparison between sites and between early, middle, and late Pueblo II sites on
the Shivwits Plateau. Temporal analysis includes assignment of design styles of painted pottery, frequency of corrugated pottery, rim forms eversion, and identification of imported red ware types. The second analysis area is the identification of temper and wares for each site. The third area is a review of models for determining production areas. These will serve to organize the information and address the initial research question of where the sherd-tempered Shivwits pottery was made. The last part of the analysis compares the information of all sites with application to the models described.

Laboratory Method

All of the sherds collected were cataloged according to the general ware categories of gray ware, black-on-gray painted, redware, and corrugated gray ware. Preliminary analysis of each sherd was done to record manufacturing technology, segment, vessel form, and thickness of the sherd. Manufacturing technology considered a coil and scrape, paddle and anvil, and press or pinch forming technique. The segment identified body sherds and rims, with consideration of the rim eversion and finish shape. An attempt was made to identify bowl or jar from the body sherds but the rim is a better indication of vessel form. An average thickness was measured for each sherd.

Each sherd was examined on a fresh cross-section break with a trinocular stereo zoom microscope at a magnification of 20x to record paste attributes. The attributes examined were primary temper, secondary temper, exterior surface color, interior or core color, and core or clay texture. After the temper was identified the size of the temper, the sort and angularity of temper particles was
noted. An estimation of percent of temper in the paste was made by point counting temper grains through a 10 x 10 mm eyepiece grid and checked with a judgmental visual comparison to standard tables from the geologic field identification cards.

Surface treatment was recorded. Design elements were recorded for painted wares using both the guide from Allison and Coleman (1998) and Lyneis' (1999b) guides to note potential temporally sensitive elements such as broad lines, narrow lines, ticks, dots, pendant dots, and triangles. Corrugated finishes were noted according to styles from guides from the Kayenta area provided by Winston Hurst and Edge of the Cedars Museum in Blanding, Utah.

Refiring for Clay Potential

A sample of sherds was selected for refiring to compare the oxidation potential of the clays. This technique was used in hopes of identifying likeness or dissimilarity of clay used for different wares and to allow a comparison of wares between sites. The furnace provided an equal oxidizing atmosphere for the sherd and revealed oxidized color potential of the clay. Clays from different sources or geologic areas should show variation in refire color due to the mineral content of the clay.

Temporal Analysis

The ceramic temporal analysis for the study sites is based on design style, frequency of corrugated pottery, rim form or eversion, and the presence of imported redware. Table 3 provides an outline of the factors evaluated based on Allison's (2000:71-73) criteria. Painted sherds are often difficult to assign to design styles. Many of the sherds are very small and do not show enough of the
design to get a good indication of the entire vessel. Design styles were evaluated by two methods. The first method was to assign the sherds directly to a design style and then compare the designations for the entire site. The second method used was to count elements for presence or absence of some of the more common temporal indicators. This method was taken from Allison’s (Allison and Coleman 1998:Table 9.1) evaluation of design elements on an early Pueblo II Virgin Anasazi site.

Table 3. Design Element Analysis after Allison (Allison and Coleman 1998:Table 9-1).

<table>
<thead>
<tr>
<th>Style</th>
<th>Fine or Narrow Lines to −5.0mm</th>
<th>Wide Lines 5.0+ mm</th>
<th>No Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>No solids</td>
<td>Style 1 (Kana-a)</td>
<td>Style 5 (Black Mesa or Sosi)</td>
<td>Unidentified</td>
</tr>
<tr>
<td>Solids with fringe lines</td>
<td>Style 2 (Kana-a)</td>
<td>Style 6 (Transitional Kana-a to Black Mesa)</td>
<td>Style 9 (Probable Kana-a)</td>
</tr>
<tr>
<td>Solids with dots</td>
<td>Style 3 (Transitional Kana-a to Black Mesa)</td>
<td>Style 7 (Black Mesa)</td>
<td>Style 10 (Probable Black Mesa)</td>
</tr>
<tr>
<td>Unembellished solids</td>
<td>Style 1 (Kana-a)</td>
<td>Style 8 (Black Mesa or Sosi)</td>
<td>Style 11 (Unclassified)</td>
</tr>
</tbody>
</table>

In this design element analysis, Styles 1, 2, and 4 are equivalent to Kana-a, or a Pueblo I designation. Style 9 is probably Kana-a. Styles 3 and 6 are transitional Kana-a to Black Mesa and are late Pueblo I to early Pueblo II. Style 7 is definitely Black Mesa and style 10 is probably Black Mesa, both in the early Pueblo II. Styles 5 and 8 are Black Mesa or Sosi moving into the middle Pueblo II. This design analysis does not consider either the earliest Basketmaker III, Lino...
style, or the late Pueblo II styles that would be designated in the Sosi and Dogoszhi. Lino is characterized by free floating dots and fine lines. Dogoszhi elements are fine parallel lines sometimes hatched with diagonal fine lines. In Table 4 adding two rows to Allison's table covers both of these design styles.

<table>
<thead>
<tr>
<th>Allison’s Styles</th>
<th>Fine or Narrow Lines to −5.0 mm</th>
<th>Wide Lines 5.0+ mm</th>
<th>No Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>No solids</td>
<td>Style 1 (Kana-a)</td>
<td>Style 5 (Black Mesa or Sosi)</td>
<td>Unidentified</td>
</tr>
<tr>
<td>Solids with fringe lines</td>
<td>Style 2 (Kana-a)</td>
<td>Style 6 (Transitional Kana-a to Black Mesa)</td>
<td>Style 9 (Probable Kana-a)</td>
</tr>
<tr>
<td>Solids with dots</td>
<td>Style 3 (Transitional Kana-a to Black Mesa)</td>
<td>Style 7 (Black Mesa)</td>
<td>Style 10 (Probable Black Mesa)</td>
</tr>
<tr>
<td>Unembellished solids</td>
<td>Style 1 (Kana-a)</td>
<td>Style 8 (Black Mesa or Sosi)</td>
<td>Style 11 (Unclassified)</td>
</tr>
<tr>
<td>Additional Styles</td>
<td>Style 12 (Lino)</td>
<td>Style 13 (Possible Black Mesa)</td>
<td>Style 14 (Lino)</td>
</tr>
<tr>
<td>Free dots</td>
<td>Style 15 (Dogoszhi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hatched panels or lines at acute angles</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AZ:A:6:67 BLM Cropperville. Design styles fall into the early to middle Pueblo II time period. Following Allison's style element analysis most of the painted sherds fall into Style 5 and 8 which corresponds to a transitional Black Mesa to Sosi. Twenty-four sherds have wide lines and solids and two of those have pendant dots characteristic of Black Mesa style. One rim sherd has a possible Virgin characteristic across the bowl design attributed to the St. George and Trumbull black-on-gray types with Black Mesa style. Overall the designs seem to
fit within the Black Mesa style. One imported sherd was identified as a Kayenta, Black Mesa black-on-white.

Rim forms are most closely Colton’s A and B with slight to moderate eversion. Eight evert between 0 and 20 degrees. Five are between 20 and 45 degrees. Only two are greater than 45 degrees. The slight to moderate eversion places the majority of jar rims in the Pueblo I time period according to Allison (2000:65; Allison and Coleman 1998:9.13). Lyneis’ (1992a) analysis of the Main Ridge pottery indicated a predominant Sosi design style of painted pottery with grayware jar rims in the B, or slight to moderate eversion. The designation of Main Ridge as middle Pueblo II site with slight and moderate jar rim eversion may be applicable to Cropperville also. Many of the rims examined are very small and the true curvature is difficult to establish. Within this assemblage there are at least two canteen rims that tend to be straight with a slight lip rather than a true eversion. Canteen rims have not been widely explored.

Eight imported redware sherds were collected in sample units on the site. Seven are andesite tempered, San Juan Ware. One is in the general sand-tempered redware, probably Kanab or Shinarump. Five of the eight are a painted black-on-red. The amount of redware by count is 1.48 percent and 0.88 percent by weight. Grab samples at the site also recovered a San Juan seed jar and bowl rim. Both have Medicine Black-on-red style. Imported red wares appear at about the same time as corrugated finish at the beginning of the middle Pueblo II although they could be slightly earlier. They are known to account for 1 to 2 percent of the pottery on middle Pueblo II sites (Allison 2000:71). The red ware recovered from the Cropperville site falls within this range.
Corrugated pottery on the site is only 2.78 percent by count and 3.95 percent by weight. The roughly 3 percent corrugated totals place the site at the beginning of the middle Pueblo II time period. Corrugation of pottery is one marker for identifying middle Pueblo II and the low frequency at this site indicates the early introduction stage.

With consideration of the design styles, rim forms, redware, and corrugated pottery from the sample unit collections the Cropperville site probably falls in toward the end of the early Pueblo II to the beginning of the middle Pueblo II. The painted designs could be Black Mesa or Sosi. The rims seem too early but they are similar to the rims from the middle Pueblo II Main Ridge site. The small amount of corrugated indicates it was early in the development of corrugation. The low frequency also indicates that even if the site has a Pueblo I component indicated by the jar rims, there was corrugated pottery to indicate a later occupation. The consistency of the design styles with broad lines and solids does not show the variation to include a long temporal occupation. The imported San Juan Red Ware was usually made earlier than the other red wares. It began in A.D. 750 and was made up until about A.D. 1000, and imported to the Virgin area after that. The beginning date for middle Pueblo II is around A. D. 1050. The Cropperville site appears to be roughly contemporaneous with the Main Ridge site in the Lowland Muddy-Virgin Valley.

AZ:A:10:24 BLM Poverty Mountain Ridge East. The Poverty Mountain Ridge East site is a large site with architecture that suggests different building episodes. There are distinct separated structure areas. The pottery at the site indicates a possible long or recurrent occupation but the assemblage is biased toward an
early occupation, mostly in the Pueblo I to early Pueblo II. According to the
design element count, 52 of the 114 painted sherds fall into styles 1, 2, 4, and 9
for a Kana-a or probable Kana-a designation. One sherd has the characteristic
free dot that places it in Style 12, or Lino, that is even earlier. Fifteen sherds fall
in styles 5 and 8 for a Black Mesa or Sosi designation. Twenty-two have
unembellished solids with no lines that are Style 11, or unclassified. The
remaining pieces only have enough to say they are painted but design elements
are not identifiable. The Lino and Kana-a sherds place the site in the
Basketmaker to Pueblo I range. The Black Mesa or Sosi are early Pueblo II to
middle Pueblo II.

Jar rim forms appear to be mostly early with slight to moderate eversion.
Eight are only slightly everted from zero to 20 degrees in rim form A. Nine have
rim form B that are moderately everted from 20 to 45 degrees. Seven are
strongly everted with six in form C at 45 to 63 degrees and one that everts more
than 63 degrees is a D. According to Allison and Coleman (1998:9.13) "Pueblo I
rims will be mostly B's with a few A's and C's." In looking at the spread, jar rims
are fairly evenly spread between A, B, and C but the strongly everted Pueblo II
rims are the smallest proportion.

There was no red ware recovered in the sample units. The red wares are not
commonly found on Virgin sites dating before middle Pueblo II. The absence of
red ware in the collection is consistent with an occupation prior to middle Pueblo
II.

Corrugated pottery was rare. Only 10 sherds were recovered representing
less than one percent of the site total in both count (.73 percent) and weight (.97
percent). The sherds recovered were all found in Sample Unit 4. Even within the sample unit they represent only eight percent of the sherds of that unit.

Corrugated pottery production begins in the middle Pueblo II period. The small amount of corrugated pottery indicates an occupation before middle Pueblo II with a possible later use or even just a visit with a single pot drop.

The overall temporal analysis indicates Poverty Mountain Ridge East is an early site. The design elements are predominantly thin lines with Pueblo I, or Kana-a characteristic of "marked crudity of brushwork" (Colton and Hargrave 1937:206) and fringe lines appended to solids. The identified Black Mesa to Sosi style elements are broad lines and solids. Those are difficult to distinguish on small sherds so it is possible that they fall closer to the Pueblo I or early Pueblo II. There really is nothing to define one style or the other. The rim forms are mostly Pueblo I with only one that is strongly everted and definitely Pueblo II. The small amount of corrugated pottery and the absence of red ware indicate an occupation before middle Pueblo II. If the site had been used for any extensive period during Pueblo II there should be more strongly everted rims and greater percentage of corrugation. This site seems to fit into the Pueblo I and early Pueblo II and is earlier than the Main Ridge site in the Lowland Muddy-Virgin Valleys area.

AZ:A:10:26 BLM Zack's Bag. Zack's Bag is 1.6 km south southeast of the Poverty Mountain Ridge East site. The pottery sherds at Zack's Bag are the smallest of all five collection sites. The average weight is 1.93 g while the average weight for the other sites is 3.04 g. The painted pottery is even smaller. The small size of sherds makes identifying design styles and rim forms difficult.
Corrugated pottery and red ware should be identifiable even in small sherds. A small test excavation was conducted where a looter's hole had disturbed one room structure. The excavation pottery was not included in the random sample unit totals but it is noted here only for presence or absence of categories to help determine temporal placement.

On most of the painted pottery it is only possible to determine if it is painted or not. Forty-two of the 64 pieces are unidentified or unclassified. The sherds with elements that can be measured have 21 in the Pueblo I or Kana-a group of Styles 1, 2, and 4, or the probable Kana-a Style 9. One fits in Style 3 that is transitional between Kana-a and Black Mesa, and one is a probable Black Mesa Style 10. There is nothing to indicate these sherds might fit in the later styles. The most probable placement by design style is the Pueblo I or early Pueblo II. The large number of unclassified and undetermined sherds make this placement tenuous.

There are 13 rims identified by eversion. Seven rims are slightly everted in category A from zero to 20 degrees. Five rims are B everting moderately between 20 and 45 degrees and only one rim everts more than 45 degrees in the C category. Most rims then fall into the Basketmaker to Pueblo I form. Only one rim fits in the Pueblo II that is strongly everted. One rim from the test area in the looters' backdirt is strongly everted.

There was only one red ware sherd recovered in the sample units and none were found in the test excavation. The one red ware that was identified is sand-tempered and is even questionable as a true red ware. It could represent a misfired Shinarump Black-on-white painted ware. The one sherd recovered out of
1330 only represents 0.08 percent of the collection. Redware is never recorded in abundance on Virgin sites but the virtual absence points to an early occupation before early to middle Pueblo II.

No corrugated sherds were collected in the sample units and none were found in the test unit. Lack of corrugated pottery is usually associated with an occupation before middle Pueblo II. The combination of one questionable redware sherd and no corrugated pottery is a stronger indicator of an occupation during the Pueblo I or early Pueblo II.

The identifiable design elements in the Kana-a groups, the absence of corrugated pottery, and the Pueblo I rim forms point to a Pueblo I to early Pueblo II occupation. Even with the small sherds it is doubtful that later design styles are present. Lack of corrugated pottery in over 1,755 sherds collected in the sample units and the test excavation, is a very strong indicator of an early site even with the highly broken nature of the assemblage.

**AZ:A:10:16 BLM Drew’s Site.** Drew’s site is the smallest in area and represents the latest occupation of the sites selected for collection. It is a more defined “C” shape block of rooms. Both the pottery and the architecture indicate a later occupation.

The design styles from Drew’s Site pottery fall mostly into the thin lines of styles 1, 2, and 4 defined by Allison as the Pueblo I style Kana-a. Kana-a also has a characteristic of lines that “almost always carry over at junctions,” and “small solid triangles” with “crudity of brushwork” (Colton and Hargrave 1937:206). Allison’s original element analysis was designed to classify a Pueblo I to early Pueblo II site. It does not work well with later styles. The late Pueblo II
Sosi or Dogoszhi were not considered. True Dogoszhi style always has thin parallel lines in hatched panels. On small sherds hatched panels may only appear as thin lines intersecting to form acute angles. In evaluating later sites the Style 1 of "no solids and fine or narrow lines" could be considered a possible Sosi if the lines are narrow from 3.5 to 5 mm, parallel, and form "stripes." It is more easily adapted to represent a Dogoszhi style when the lines are well executed, intersect at acute angles, and do not carry over at junctions. On larger sherds the hatched panels are more easily defined. The category added to Allison's original chart (Table 4) as Style 15 is Dogoszhi that represents a late Pueblo II or Pueblo III style. On the first evaluation 16 sherds fit into the Style 1 as a Kana-a design element designation. None of the sherds exhibited any of the other Kana-a characteristics. When reevaluated with the revised Style 1 and the added Style 15 the same 16 sherds were equally divided with eight as possible Sosi and eight Dogoszhi. The remaining sherds are unidentified or unclassified.

Rim sherds collected have the strongly everting form characteristic of Pueblo II. Only three rims could be measured but all are everted from 45 to 90 degrees of the Colton forms C and D.

Red ware at Drew's Site represents 2.81 percent by count and 2.35 percent by weight. This is consistent with an occupation of middle Pueblo II or later. Five of the red ware sherds collected are the sand-tempered red ware from the Kanab, Utah area. The sand-tempered red ware was probably produced sometime in the late Pueblo II time although that is not yet well defined. Two of the sand-tempered sherds have a painted thin line design and can be classified as probable late Pueblo II.
The percentage of corrugated pottery is very high in the collection. This is a strong indication of a late Pueblo II or even Pueblo III site. Of the 249 sherds collected 144 are corrugated and 4 are painted and corrugated. The total represents 59 percent by count and 58 percent by weight. Allison (2000:72) indicates the percentage of corrugated pottery for late Pueblo II sites can be “more than about 20 percent” and the “Pueblo III assemblages are characterized by high frequencies of corrugated sherds, more than about 40 percent.” The high frequency of corrugated pottery at Drew’s site indicates a Pueblo III occupation.

The identification of Sosi or later Dogoszhi painted designs supports a late Pueblo II or Pueblo III occupation. The imported red ware and the thin line designs on two red sherds are further evidence of a late site. The high frequency of corrugated pottery is the best indicator of a Pueblo III site.

AZ:A:11:72 ASM Trip House. Trip House is a small pueblo structural site and farthest south of the collection sites. Of the 342 sherds collected, there are 29 painted pieces and the rest were gray ware. There are no corrugated or red sherds in the sample units.

The painted pottery represents 8 percent of the collection by count and 7 percent of the collection by weight. This is similar to the amounts for the other sites. Twelve of the sherds are unidentified or unclassified. There are five sherds in the Kana-a Styles 1, 2, and 4. Eleven are Styles 5 and 8 and are either the early to middle Pueblo II Black Mesa or Sosi. One sherd is an intrusive Kayenta white ware with fine thin lines in the design style. It is a possible Dogoszhi or Late Pueblo II. The overall consistency of the painted elements with broad lines would place the site in the early to middle Pueblo II.
Three jar rims are have almost no eversion and are well within Colton's form A. There are four moderately everted between 20 and 45 degrees in form B, making a total of seven rims that are prior to Pueblo II. Only one has a strongly everted Pueblo II rim form C.

As noted before there were no red ware sherds and no corrugated sherds collected. This indicates the site is probably earlier than middle Pueblo II. The early rim forms and the absence of corrugated pottery place the site at the earlier choice of the early to middle Pueblo II design styles. The information is consistent with an early Pueblo II occupation and could be slightly earlier.
CHAPTER SIX

DEFINING CERAMIC PRODUCTION

Distribution patterns for Moapa Gray Ware pottery and the Moapa Ware painted pottery have been established largely because the production area is close to the provenience of the unique olivine mineral used for temper (Lyneis 1992a:44). Colton and Hargrave (1937:27) state, "A result of the study of pottery types and sherds collected on archaeological surveys is the idea that there is a definite, often small, geographic area in which a pottery type is manufactured."

The second area explored in this ceramic analysis is the manufacture of the Shivwits Plain pottery. Lyneis (1992a) hypothesized that the sherd-tempered Shivwits Plain pottery was made on the Shivwits Plateau and transported to lowland areas of the Muddy and Virgin Valleys. This chapter explores that hypothesis. Was the Puebloan sherd-tempered Shivwits Plain pottery made on the Shivwits Plateau?

Methods and Models for Defining Production Areas

The Shivwits Plateau is one of the least documented areas of the Virgin Anasazi occupation. Little ceramic analysis has been conducted for the Shivwits sites. Without compositional data, the production area for the Shivwits sherd-tempered pottery is difficult to determine. Broken pottery is ubiquitous at

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production sites and would have been readily available to the prehistoric potter. While it seems an almost impossible task, three basic methods that might be useful for determining production area for the Shivwits Plain pottery are worth exploring. The first and most direct evidence of pottery manufacture is the presence of pottery making tools, firing areas, features, and remains of the firing process at the site (Rice 1987:177, 413). A second model requires identification of material sources and applies ethnographic observations to determine distances potters might travel for the necessary resources. The observations come from the “exploitable threshold model” (Arnold 1988:35) to calculate the distance potters travel to collect clay, temper, or other necessities of pottery production. The third model involves distribution of the frequencies of pottery types to infer areas of production. Rice (1987:413) and Orton et al. (1993:203) call this a “gravity model” or “distribution from a central point” where pottery is most abundant closest to the place it was produced.

**Direct Evidence Model**

The direct evidence models suggest a list of features or artifacts that are related to pottery manufacture. It is important to note that while presence of this direct evidence may indicate a production area, conversely, not finding the direct evidence does not rule out the area for production. Much of the direct evidence is also ambiguous and could have been created by processes other than pottery production. As pointed out by Sullivan (1988) direct evidence is difficult to document for Southwest archaeological sites.

Firing features might include kilns or burned or reddened soil areas, large ash deposits, or fire-affected stones. Trench kilns are associated with the Pueblo III
pottery in the Kayenta area (Heacock 1995). Formal firing features or kilns have not been found in the Virgin Anasazi area. It is assumed that most pottery was open-fired with the fuel source directly over the vessels. This would leave an area of reddened soil and ash or fire-affected rock. Unfortunately this is almost impossible to distinguish from fires used for other purposes. In open firing the dried vessels are sometimes covered with large "waster" sherds to protect the pots from fire clouding. A combination of fire reddened ground and abundant pottery from "wasters" is a slightly better indication of firing but it is still difficult to distinguish from other functions. The abundant sherds and burning could also be associated with a midden area (Orton et al. 1993:127).

Pottery making tools, including worked sherd smoothers or scrapers, polishing stones, or puki pieces used to form bowls and align painted designs, are associated with prehistoric pottery making. Identification of polishing stones for working pottery is uncertain. Dalley and McFadden (1988:268) identified 35 "polishing stones" but stopped short of inferring the specific function. Pottery sherd scraping tools should have a bevel on the convex edge of the curve due to direction and scraping wear. Other scraping tools might include gourd rinds or wood pieces. These do not preserve well in open sites on surface collections. Puki bowls are used to set clay coils in to form the new vessel. They are sometimes a large piece of a broken bowl or jar with drilled holes at equal distances around the edges to use as a guide when painting designs on new vessels (Kelly Hayes-Gilpin, personal communication 1997).

Unfired clay or pieces of unfired vessels are also direct evidence of manufacture areas. Ethnographically, clay is sometimes collected and processed
and then stored at production locations (Rice 1987:179). Raw clay for pottery making is difficult to distinguish from natural soil clays that might occur at sites. Evidence of formed or worked clay that has not been fired is difficult to find because it "melts" away when wet. Unfired or under fired pottery pieces are similar to the clays and lack durability. Recovery is rare but they are a good indication of a pottery production area. Similar to the clay storage, temper that has been sorted and prepared might be found at a production site. An exotic or unique temper such as olivine transported to the site is possible evidence of production.

**Exploitable Threshold Model**

The exploitable threshold model defines the distances potters may travel to obtain raw materials. Those materials include clay, temper, water, fuel, and pigment or special clay for slips. Arnold (1988:20-60) calculated these distances from ethnographic sources then noted the frequency that each distance appeared in the study for each resource. The pottery making community was considered to be the center and the raw materials around the site area provide the resource base.

The model is only a base for further investigation. Numerous variables complicate the basic calculation and not all resources are equally reported in the existing information. Fuels resources are not as well recorded as clay. The quality of material required for the vessels produced is also a factor in distance equations. A utilitarian pot that is frequently replaced will not necessitate traveling a long distance to obtain clay or temper. The size of the vessel being made may also determine the type of clay needed. The montmorillonite clays absorb more
water during processing and tend to crack and sag during drying and firing due to water loss. A large pot may require clay with less shrinkage to prevent cracking while drying. If large vessels are desired and the appropriate clay is not available locally, the potter may travel longer distances to obtain clay with the desired properties.

Temper material can alleviate some clay problems. A temper with high thermal shock resistance is desirable for cooking vessels but storage vessels may not require the continual shock resistance and a different temper may be suitable. Some potters require specific fuel for different parts of the firing process to control smoke and fire clouding of finished vessels. Water quality may play a part in clay preparation. Saltwater raises firing temperature and calcite tempered pottery can be fired to greater vitrification of the clay body making a stronger pot that is more desirable for cooking (Arnold 1988:27).

The potters consider each of these aspects and make decisions about the cost and benefit of travel to material sources. These decisions may or may not be a conscious judgement and cultural factors or source "ownership" may also play a part (Rye 1981:17). Each of these items has a practical distance threshold that potters choose not to cross.

Clay Resource Distance Thresholds

Arnold's (1988:50) sample shows a range of distance traveled to clay sources. The range is from less than 1 km to 50 km. The most commonly reported distance is 1 km or less, which represents 33 percent of the sample. Most distances fall within the less than 1 to 7 km range. Eighty-four percent of his sample falls in that range and 7 km is considered the upper threshold. In terms of
travel time to retrieve clay, potters travel less than one day to the source and back. Some of the larger distances reported include travel by canoe on water. Canoe travel increases the time threshold up to several days and supplies brought back are sometimes stock for a year of pottery making.

Temper and decorative finish materials may also require travel. Distance thresholds for temper are similar to those reported for clay. Fifty-four percent of reported distances are 1 km or less. The upper threshold is between 6 and 9 km with 97 percent of the sample reporting travel from less than one up to 9 km (Arnold 1988:52). Paint and slip sources are typically farther away. The most commonly reported travel distances range from on-site availability to a distance of 10 km. In one example, walking to gather slip material takes about a half of a day. This material is chosen for its special purpose as a non-stick-cooking surface (Arnold 1988:53).

Fuel resources and water are essential to pottery making. Rapid population expansion and deforestation make fuel resources costly and increasingly distant in the ethnographic examples. Locally available resources are most commonly used but when supplies run out some potters move to other areas. Some potters change the preferred fuel type and some rely on supply from outside. In areas of fuel shortage some pottery making communities sell the unfired pots to other groups who transport and fire the vessels in forested areas. No distance thresholds are calculated for fuel resources because the recorded information is limited. Distance to water source is not calculated because it is assumed that water is essential for everyday activities. Potters will have access to adequate water for other reasons.
Arnold's model expressed above was developed to predict the adoption of pottery technology. The distances to resources are his defining factors. Large distances from clay and temper would likely prevent the adoption of pottery technology. A group that is already making pottery may choose to travel further for preferred clay or temper resources especially if their favored sources are unavailable. If pottery has become an essential technology modification of clay choice, temper, or fuel are also alternatives. This model may prove interesting in order to explore the developing technology of early prehistoric pottery in the Virgin Anasazi area and on the Shivwits Plateau.

**Distribution From a Central Point – Gravity Model**

When the production area of a variety of pottery is not known it is very difficult to identify distribution patterns. Conversely distribution may be the key to determining production areas. The gravity model assumes the largest concentration of an item, in this case Shivwits Plain and Shivwits Corrugated pottery, will be close to the production area. At greater distances from the source less of the pottery should be found (Orton et al. 1993; Rice 1987). Orton, et al. (1993:203) define three areas where the increased concentration should be evident. Closest to the production area there should be an increase in the proportion of the sites with the product, an increase in the proportion of the product on those sites, and an increase in the range of types or vessel form on the sites.

The pottery may have been made at one site or more than one in the area. The number of sites with the pottery should be higher than more distant areas. This is likely due to the similarity of resources available and the shared
technology. The abundance of the pottery from production would also result in distribution to the local area first.

The second increase is in the proportion of the product on the sites. In the production process when vessels are broken they are sometimes used for wasters to cover other pots in firing and eventually discarded. Pots used locally also have a higher disposal rate on the site. Utility vessels are less likely to be transported long distances but ethnographic evidence records the exchange of utility pots in the modern Pueblo cultures (Brunson 1985:122). Large heavy pots will probably not be transported as far.

According to Orton et al. (1993:206), an increased range of styles or vessel form should be evident at the sites in the production area. The potters may make a variety for personal use or have a variety of shapes created for distribution to other areas (Orton et al. 1993:206). As the technique and knowledge of the constituent clay and temper improves there may be a greater range of experimentation with shape and size. The issues of standardization and specialization also deal with variability in vessel form. While those are not debated here it is possible they are another explanation of product variability.

 Evaluating the Sites for Production

The focus for this ceramic analysis is to identify possible production areas for the sherd-tempered Shivwits pottery. The first step identifies the characteristics of Shivwits pottery from the site sample collections on the Shivwits Plateau. On the Shivwits Plateau the Shivwits pottery is found with both plain and corrugated finish indicating a production continuing into the middle Pueblo II. Characteristics
of the pottery are the combination of dark firing clay body with a crumbly or grainy texture and sherd temper of crushed Moapa Gray Ware with some having small amounts of crushed Tusayan Gray Ware, or even Shivwits ware (Lyneis 1992b:45). There are almost always pieces of olivine in the temper or in the clay body. Lyneis (personal communication 2002) indicates even when olivine is not visible under the microscope the thinsection examination reveals olivine in almost all Shivwits pottery in question.

**Method**

Microscopic analysis was used to identify the temper types and clay texture. Shivwits pottery was identified in the collections from each of the sites. In the following section each site is evaluated with the criteria from the Direct Evidence model and the Threshold Model. The site proportions are noted and will be compared among all the sites in the following section.

The direct evidence evaluated included possible firing features, clay or temper grinding areas, and pottery making tools. While there was no direct evidence of pottery production features identified on any of the sites it is possible that the open firing areas for the low fired Shivwits pottery would be difficult to see in surface survey. The expectation of finding kiln areas was not high. In mapping the site areas there were no definite areas of reddened or heavy charcoal ash deposit. Only one site, AZ:A:10:24 BLM, Poverty Mountain Ridge East had what appeared to be a charcoal ash deposit with pottery. That was in an area interpreted as a midden rather than a firing area. Only a few worked sherds were recovered that might have served as pottery tools. These were not definite pottery production tools. Again in surface collection there was little
expectation of recognizing or recovering tools. None of the sites had what appeared to be large numbers of burned sherds or wasters. With low-fired pottery, wasters may not have been used, as fire clouding may not have been a concern for utility ware.

Resource thresholds were evaluated for each site. Distances to potential clay sources, temper, water, and fuel were considered. The clay used to make Shivwits pottery is dark firing, iron rich clay. Refiring of the sherds turned the Shivwits pottery to a fairly consistent red to dark reddish brown identified by the Munsell color chart. No specific clay sources have been identified. Figure 8 is a soils map prepared by the Bureau of Land Management to help identify potential areas of clay resources.

Three of the sample sites in the Hidden Hills are in the area designated as clay soil. Since the temper material is Moapa Gray Ware pottery, the amounts of Moapa Gray Ware were considered as criteria for availability. All of the sites have varying amounts of Moapa Gray Ware. Distances to water were measured from the sites to mapped springs. Water sources available prehistorically have not been determined. All of the sites are within pinyon juniper woodland areas and have potential fuel resources on site.

Sample Sites and Production Models

Direct Evidence and Threshold Evaluations

AZ:A:6:67 BLM Cropperville. There are 30 Shivwits pottery sherds in the sample collected from Cropperville. One sherd is Shivwits Corrugated. The only direct evidence of pottery production was a small olivine nodule fragment. Olivine
is not local to the area and was transported over 48 km from the source area on
the Uinkaret Plateau.

The Cropperville site is 7 km outside of the area of clay soil. There are likely
more precise locations of potential clay. The soils maps are not detailed enough
to identify those. Seven kilometers is at the upper limit of travel distance for clay
resources according to the Arnold (1988:50) model. Moapa Gray Ware pottery is
available for use as temper on the site. The Moapa Ware makes up 64.26
percent by count and 69.22 percent of the pottery collected by weight. It is
interesting to note that the olivine piece was transported to the site far beyond
the temper threshold limit of 9 km. Water sources listed on USGS topographic
maps are springs 6.1 and 6.9 km away. Threshold limits are not calculated for
water as it is assumed a habitation site will be situated close to water for
domestic use. Fuel resources are available in the pinyon juniper, oak, and
sagebrush on and surrounding the site. It is assumed the vegetation patterns are
similar to prehistoric conditions of the Pueblo period. There is no research to
document pollen patterns or botanical remains available for the area.

AZ:A:10:24 BLM Poverty Mountain Ridge East. There are 31 sherds of
Shivwits pottery in the Poverty Mountain Ridge East sample. One piece of
unfired clay was found in an area of heavy ceramic concentration. Two pottery
sherds with ground edges collected with the sample units were identified as
possible pottery making tools. They were both worked sherds with a beveled
ground edge that is similar to a ground sherd pottery-finishing tool at the Lost
City Museum in the Lowland Muddy-Virgin Valley area. There were no features
interpreted as direct evidence for pottery production. One midden area had been
disturbed and contained dark charcoal and numerous sherds but there was no evidence to indicate it was a firing feature.

Poverty Mountain Ridge East is in the Hidden Hills within the clay soil area. No specific source of clay was found. The olivine-tempered pottery available for the crushed sherd temper was the most common ware on the site. It represented over 61.72 percent by count and 65.51 percent by weight. The nearest water documented on the USGS maps is Coyote Springs over 7 km away. There is a drainage in the valley adjacent to the site. Fuel is common at the site. It is in the pinyon juniper forest and has oak and sage on the site and in the surrounding area.

AZ:A:10:26 BLM Zack’s Bag. Only nine Shivwits pottery sherds were collected in the sample units at Zack’s Bag. The site is 1 km south of Poverty Mountain Ridge East and also in the Hidden Hills area of clay soils. Hard compacted clay that was found in the fill of the test excavation is probably not pottery clay but it indicates the potential of clay soils on the site. Moapa Gray Ware available for crushed sherd temper represents 77.97 percent of the sample unit collections by count and 81.86 percent by weight, with 1,037 sherds. This is the largest number from any of the sites. The nearest water source known is Coyote Springs at 6.4 km. This is, however, in Pigeon Canyon and it is a steep descent and a long distance to travel. The fuel available on site is pinyon juniper with oak and sagebrush.
Figure 8. Clay soils map showing sample site location.
AZ:A:10:16 BLM Drew's Site. Drew's Site sample units yielded 140 Shivwits pottery sherds. That number represented the most found at any of the collection sites. There was no direct evidence for pottery production noted at the site. No potential pottery making tools were noted. Only one worked sherd was noted and that was a disk form fragment probably from a drilled pendant.

Drew's Site is right at the edge of the clay soils of Hidden Hills and on the edge of a canyon tributary to Pigeon Canyon. Clay soils overlay the limestone substrate. Olivine tempered Moapa Gray Ware available for temper represents 24.5 and 24.11 percent of the sample by count and weight respectively. If the large number of Shivwits is left out of the count, the Moapa Gray Ware represents 54 percent of the remaining assemblage by weight and count. The nearest water is in Pigeon canyon 2.6 km in a straight distance. The actual travel to Coyote Springs would probably be more than 3 km and involve a vertical descent of 347 m and a substantial climb to return. Fuel is available on the site and surrounding the site, with pinyon juniper, oak, and sagebrush. The trees are not as dense on the edge of the canyon as the other sites. In the 1980s the Bureau of Land Management removed large tracts of pinyon juniper forest north of the site.

AZ:A:11:72 ASM Trip House. There were only four sherds of Shivwits pottery collected at Trip House. There was no direct evidence of pottery firing either in features or pottery making tools. Trip House is the farthest south of the collection sites and less than 1 km from clay soil profile for Grassy Mountain. Grassy Mountain is a basalt formation and the potential for basaltic or iron rich clay was one consideration for choosing the site area for collection. Trip House has the
The highest percentage of olivine-tempered pottery of the collection sites at Moapa Gray Ware available for crushed sherd temper represented 88.3 percent by count and 86.98 percent by weight from the sample units. The nearest water source is Shultz Spring 3.4 km east of the site. Other springs are located on the southwest side of Grassy Mountain west of the site, about 7 km away.

**Shivwits Production and the Gravity Model**

The expectations of the gravity model were evaluated by calculating quantities of wares and temper types. All of the site totals were compared to evaluate distribution patterns. The criteria for evaluating possible production areas are the increase in the proportion of sites with the product, an increased proportion of the product on sites, and increase in variety of vessel form (Orton et al. 1993). Because the sites show different temporal occupations they cannot be compared directly to determine a production pattern at a given time but the temporal analysis also provides an opportunity to view distribution patterns through time. While the sample size for each site is adequate to establish proportions of Shivwits ware on each site, the small sample of only five sites is not large enough to see much of a pattern for the entire Shivwits Plateau.

The descriptive information of Shivwits pottery for each site identifies corrugated Shivwits sherds, rim sherds, and form to evaluate the range of vessel form. The vessel form is noted to indicate any special use of the ware at each site. Vessel forms are calculated from subjective designations depending on the quality of the interior finish. The corrugation and rim forms might also identify possible temporal information for the Shivwits ware at each site. Rims are scarce and only represent seven vessels in the entire study collection. The clay
information from refiring the Shivwits sherds is reviewed to note possible
differences in clay source selection between sites.

Table 5. Percent of Wares for Sample Sites by Count.

<table>
<thead>
<tr>
<th>Ware</th>
<th>SITE NUMBER</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AZA:10:16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BLM</td>
<td></td>
</tr>
<tr>
<td>Kanab</td>
<td>1.61%</td>
<td>0.13%</td>
</tr>
<tr>
<td>Kayenta</td>
<td>0.40%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Logandale</td>
<td>0.00%</td>
<td>0.08%</td>
</tr>
<tr>
<td>Moapa</td>
<td>24.50%</td>
<td>67.67%</td>
</tr>
<tr>
<td>San Juan</td>
<td>0.00%</td>
<td>0.18%</td>
</tr>
<tr>
<td>Shinarump</td>
<td>3.21%</td>
<td>3.89%</td>
</tr>
<tr>
<td>Shivwits</td>
<td>56.22%</td>
<td>5.58%</td>
</tr>
<tr>
<td>Tusayan</td>
<td>8.84%</td>
<td>21.96%</td>
</tr>
<tr>
<td>Unidentified</td>
<td>4.82%</td>
<td>0.31%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0.40%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Totals</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Table 5 shows the distribution percentages of all Moapa Gray Ware, Shivwits
Plain and Corrugated and other pottery wares collected for each site. The
percentages for Shivwits pottery were plotted on the map in Figure 9 to show
distribution of the ware across the study area. Three sites fall in the zero to two
percent range. One site is the five percent range, and one site is over 50 percent.

AZ:A:6:67 BLM Cropperville. The Cropperville sample units yielded 30
Shivwits pottery sherds. That number represents 5.56 percent of the pottery
collected at the site by count and 4.90 percent by weight. One Shivwits sherd is
corrugated. Of the sherds 26 are probable jar sherds, two are possible bowl
sherds, and 2 are unidentified. Three rim sherds were collected, two are jars with
straight or slightly everted rims. One is a bowl rim.
Figure 9. Distribution of Shivwits pottery by percent of each site sample.
AZ:A:10:24 BLM Poverty Mountain Ridge East. There are 31 Shivwits sherds in the Poverty Mountain Ridge East sample collection. That number represents only 2.26 percent of the site sample by count and 2.52 percent by weight. Nine sherds are corrugated. No Shivwits rim sherds were found. Two are possible bowl sherds and 29 are probable jar sherds. One painted sherd was identified as Shivwits by the olivine sherd temper and crumbling texture of the dark clay. Painted Shivwits pottery has not been identified before. This may represent a new variety as discussed in the Shivwits characteristics evaluation.

AZ:A:10:26 BLM Zack’s Bag. Zack’s Bag has the lowest percentage of Shivwits Pottery in the study, with nine sherds out of 1330 collected. That represents only 0.68 percent by count and 0.61 percent by weight. Eight of the sherds are probable jar sherds and one is a possible bowl. None of the sherds are corrugated but two rim sherds were identified. The jar rims are only slightly to moderately everted.

AZ:A:10:16 BLM Drew’s Site. The largest amount of Shivwits pottery was collected at Drew’s Site. There are 140 sherds that represent 56.22 percent of the collected sample unit collections by count and 55.67 percent by weight. Only two sherds are identified as possible bowl sherds, six are unknown, and the remaining are probable jar sherds. Most of the Shivwits sherds are corrugated. Of the 103 corrugated sherds 61 have corrugation patterns that are well developed and fall into the Moenkopi or Exuberant patterns, noted as later in the Kayenta series corrugation development. There is one worked sherd that is a quarter of a small disk ground from a corrugated jar sherd. Two rims were found that are highly everted.
AZ:A:11:72 ASM Trip House. There were only four sherds identified as Shivwits in the sample collection from Trip House. That is the smallest number but not the smallest percentage. Shivwits pottery represents 1.17 percent by count and 1.44 percent by weight. Two are jar sherds and one of those is a rim with moderate eversion. Two are bowl sherds that are possible painted Shivwits. These should be refired to determine whether the clay is true Shivwits.

Table 6 gives the breakdown for criteria evaluated in the Gravity Model. The only site with a significantly higher percentage of Shivwits ware within the site sample is AZ:A:10:16 BLM Drew's Site. The Gravity Model is the strongest indication for production for Drew's Site. With 56.22 percent by count and 56.67 percent by weight it is far more likely than the other sites sampled to have been a production site by the model criteria. Shivwits pottery is represented by both corrugated and plain ware. There is not a large amount of difference in vessel form. Most of the sherds represent jars but the expectation is that Shivwits pottery was probably a utility ware and jars would be the more common form expected. One worked sherd could be considered an additional “form” possibly used for adornment as a pendant. The two jar rims were not complete enough to estimate an orifice diameter and they may represent the same vessel.

There is no indication of pottery production within the criteria of the Direct Evidence Model, however this is not unexpected. Sullivan’s (1988) study of potential pottery production sites in the southwest indicates the evidence of production is difficult to identify and can sometimes be confused with other functions.
Table 6. Site Evaluation by Gravity Model Criteria.

<table>
<thead>
<tr>
<th>Shivwits pottery</th>
<th>Sherd Count</th>
<th>% by count</th>
<th>% by weight</th>
<th>Corrugated Plain</th>
<th>Bowls Jars</th>
<th>Worked</th>
<th>Rims</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ:A:6:67 BLM Cropperville</td>
<td>30</td>
<td>5.56%</td>
<td>4.89%</td>
<td>1 crg = 3%</td>
<td>2 bowls 26 jars 2?</td>
<td>None</td>
<td>2 jar 1 bowl</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM Poverty Mountain Ridge East</td>
<td>31</td>
<td>2.26%</td>
<td>2.52%</td>
<td>9 crg = 29% 22 plain = 70%</td>
<td>2 bowls 29 jars</td>
<td>1 painted</td>
<td>0</td>
</tr>
<tr>
<td>AZ:A:10:26 BLM Zack’s Bag</td>
<td>9</td>
<td>0.68%</td>
<td>0.61%</td>
<td>0 crg = 0% 9 plain = 100%</td>
<td>1 bowls 8 jars</td>
<td>None</td>
<td>2 jars</td>
</tr>
<tr>
<td>AZ:A:10:16 BLM Drew’s Site</td>
<td>140</td>
<td>56.22%</td>
<td>55.67%</td>
<td>103 crg = 74% 37 plain = 26%</td>
<td>2 bowls 131 jars 6?</td>
<td>1 disk</td>
<td>2 jars</td>
</tr>
<tr>
<td>AZ:A:11:72A SM Trip House</td>
<td>4</td>
<td>1.17%</td>
<td>1.44%</td>
<td>2 B/G = 50% 2 plain = 50%</td>
<td>2 bowls 2 jars</td>
<td>2 painted</td>
<td>1 jar</td>
</tr>
</tbody>
</table>

Using the Threshold Model criteria as an indicator for possible pottery production, the site is within the threshold ranges for available clay, temper, and fuel. Water sources for the site are questionable considering the steep canyon descent to the nearest known spring. All of the sites have adequate fuel source in the pinyon juniper forest. The temporal placement for Drew’s site in the Pueblo III period indicates an increased use and possibly increased production of Shivwits pottery during the later times.

Cropperville, AZ:A:6:67 BLM, is the next possible production area when considering the Gravity Model criteria. The proportion of Shivwits pottery is 5.56 percent by count. It is less than the proportions found in the Lowland Muddy-Virgin Valley sites at a similar time period. It is substantially less than Drew’s Site and there is little variation in the vessel form or finish represented. There was no direct evidence of pottery production noted for Cropperville. The olivine nodule
found on the site indicates a possible production area for Moapa Gray Ware but not directly for Shivwits pottery. The site is outside of the threshold limits for clay soils although it is likely there are clay sources that are not represented on the maps. Moapa Gray Ware is available for use as crushed sherd temper with roughly 65 percent of the sherds in the sample having olivine. Water sources are outside the logical threshold and would not likely have been carried over 6 km for use in pottery production. Cropperville is estimated to be a middle Pueblo II site roughly contemporaneous with the Main Ridge Site in the Lowland Muddy Virgin Valley. Lyneis' (1992a:Table 15) indicates Shivwits pottery represents 13.9 percent of the Main Ridge Sample. Cropperville has less Shivwits than Main Ridge but slightly more corrugated at 3.3 percent compared to 1.1 percent. Cropperville is not a likely candidate for Shivwits pottery production.

The Hidden Hills sites both have less than 3 percent Shivwits pottery in the sample collected. AZ:A:10:24 BLM. Poverty Mountain Ridge East has about 2.26 and 2.52 percent Shivwits pottery by count and weight respectively. The total sherd sample is the largest sample collected in the study. There is variability in the Shivwits vessel forms. Corrugated and plain pottery, jars and bowls are represented. While the painted sherd remains in question, it is a bowl with olivine sherd temper and dark crumbling clay. The site has the most direct evidence for pottery production; however, two possible scraping tools and one piece of unfired clay are not conclusive evidence of pottery making. Even if the tools are pottery tools they are not necessarily exclusive to making Shivwits pottery.

The site falls well within the threshold limits with potential clay soils on site and over 60 percent of the pottery is Moapa Gray Ware with potential for the
crushed sherd temper. The known water source is beyond the logical threshold for pottery making at over 7 km away. The site is large enough to presume there was a closer water source prehistorically. Poverty Mountain Ridge East was probably occupied in the Pueblo I to early Pueblo II range. Shivwits pottery appears in the Lowland Virgin area during the early Pueblo II so it is possible production began on early sites. This site does not appear to be a Shivwits production site. Of the 10 corrugated sherd s in the sample nine of those are Shivwits. That could indicate an intrusive pot on an early site. The sample from this site does not indicate a Shivwits pottery production area.

The second Hidden Hills, Zack’s Bag, is the least likely production site for Shivwits pottery according to the proportion of the ware in the collection. Less than 1 percent of the pottery is Shivwits. Only nine of 1330 sherds are identified as Shivwits. There is little variation in the vessel form or finish. Two jar rims do indicate at least two different vessels at the site but none are corrugated and only one can be identified as bowl sherd from the rim. The site is within the area of clay soils and has over 78 percent olivine-tempered Moapa Gray Ware. The known water source is over 6 km away and in Pigeon Canyon. There was likely another water source prehistorically and it is unlikely water was carried a great distance for pottery making. Zack’s Bag is also a probable Pueblo I to early Pueblo II site. It is not a considered a potential Shivwits pottery production site.

Trip House is farthest south of the sample sites. It only has a little over 1 percent Shivwits pottery represented in the sample collection. Of the four Shivwits sherds, two are questionable as true Shivwits. The two painted sherds may be Moapa Gray Ware that had sherd added. That is not uncommon but the
clay is really the determining factor. If the sherds are Moapa Gray Ware that was not completely fired then only two pieces of Shivwits pottery would remain, representing 0.5 percent Shivwits in the sample. Jars and bowls are equal in number and one rim is a jar form with moderate eversion.

There was no direct evidence for pottery production documented for the site. The clay soils are within the low threshold range at 1km. The site sample is fairly small but it has about 87 percent Moapa Gray Ware for possible temper. Water is available at springs 3.4 km and about 5 km away. Trip House is evaluated as an early Pueblo II site and may be even earlier. It is not considered a Shivwits production site.

The early sites have the least amount of Shivwits pottery. Poverty Mountain Ridge East and Zack's Bag in the Hidden Hills, and Trip House by Grassy Mountain are all within the Pueblo I to early Pueblo II time. They have similar distribution of Shivwits pottery at less than 3 percent. If the corrugated Shivwits pieces are considered intrusive at Poverty Mountain Ridge East, eliminating them from the count leaves the Shivwits proportion at 1.6 percent by count and .91 percent by weight. All three sites are then under 1.5 percent Shivwits pottery. When considering the temporal indications of the Shivwits pottery, the early sites have very little indication of production or use of Shivwits. The middle Pueblo II site, Cropperville, has a larger proportion of Shivwits pottery but still less than the amounts reported for the Main Ridge in the Lowland Muddy-Virgin Valley. Cropperville may be slightly earlier but there is no strong indication of Shivwits production. It is unlikely that this site was an exporter of Shivwits ware to the contemporaneous sites in the Lowland.
The Pueblo III site, Drew's Site, is the most likely site for Shivwits production of the sampled sites. It is a small habitation site with only six to eight rooms. It could have been a production site but there is not evidence that the pottery was intended for distribution to the Lowland areas. This site was originally selected for sampling because of its proximity to a logical travel corridor, Pigeon Canyon. The canyon provides a passageway from the Shivwits Plateau toward the Lowland Valleys. The original hypothesis assumed Shivwits pottery was made on the Shivwits Plateau and transported to the Lowland Valley. The early sites on the Plateau have very little Shivwits pottery and very little is found in the assemblages of the early Lowland sites. The middle Pueblo II site, Cropperville, sampled on the Plateau has less Shivwits pottery than the Lowland, Main Ridge site documented to a similar time period. The Pueblo III, Drew's Site, is in the right location and it has a large proportion of Shivwits pottery to indicate the possibility of export. However, the late sites in the Lowland Muddy-Virgin Valley do not have Shivwits pottery in the assemblages. The Adam Site, considered a late Pueblo II site, has no Shivwits pottery and only 3.3 percent Moapa Gray Ware (Lyneis 1992a:Table 15). The contact between the Upland Plateaus and the Lowland Valleys was disrupted by the late Pueblo II period. It was even less evident later, just before the Lowland area was abandoned.

Characterizing Shivwits Pottery

Characterization analysis of pottery provides further information about possible production areas. The characterization of Shivwits pottery is expected to show a relative consistency among the samples from the different sites if there
was a limited production area. If the pottery was produced at several different locations it should show a diversity of key characteristics. The characteristics considered are physical aspects, paste attributes, and final finish. Physical attributes include finish, vessel form, vessel segment, opening diameter, and wall thickness. Paste attributes of the temper and clay are the general categories considered. Primary and secondary temper types are documented. The amount of temper in the clay body is measured as a percentage of the paste. Attributes of the temper grains measured are grain size, uniformity or sort of the temper grains, and roundness. Clay attributes are described in exterior finish color, core color, and clay texture. The last area explored is stylistic finish of the corrugation or painted design.

Ranges and averages for the total project sample characterize the Shivwits sample collection and individual site comparisons provide a perspective of possible variation across the sample area. One site, AZ:A:11:72 ASM Trip House, has only four sherd-tempered pottery pieces. Two of those were the painted bowl pieces that are questionable as Shivwits pottery. Trip House is not considered in the site comparisons unless otherwise noted.

Shivwits pottery represented 5.58 percent of the entire collection with 214 out of 3835 sherds collected as noted in Tables 2 and 5. The percentage by weight is very close at 6.16 percent. Of the 214 sherds 52 percent are Shivwits Corrugated and 46 percent are Shivwits Plain. The remaining are identified as a black-on-gray painted variety that has not been described in the literature.

Comparing the Sample Sites
Drew's Site, AZ:A:10:16, has the largest number and the highest frequency of Shivwits pottery. The 140 Shivwits sherds represented 65 percent of the study sample of Shivwits pottery. This site also has the most corrugated Shivwits pottery. None of the other sites were close to those frequencies.

**Vessel Form.** Jars are the most common Shivwits body form with 196 sherds representing 91 percent of the collection. Lyneis (1992a:46) states that bowls are rare. The identification of jars and bowls here is based on the degree of smoothing of interior surfaces. Rims provide a more reliable means of determining vessel form. Only eight rims were found in the sample. Only one is a bowl found at the Cropperville site. All of the sites except AZ:A:11:72 ASM Trip House have similar counts for the proportion of bowls and jars. Overall the sites have 92 percent jars by count and 94 percent by weight. Trip House has two bowls and two jars. The bowls are possibly painted and one jar sherd has a slightly everted rim.

Drew's Site and Poverty Mountain Ridge East have very similar frequency of jars at under 94 percent. The two remaining sites all have more than 85 percent jar sherds. Table 7 gives the counts for vessel form for each site.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>FORM</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jar</td>
<td>Unknown</td>
</tr>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>131</td>
<td>6</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>29</td>
<td>2</td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>26</td>
<td>9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>196</td>
<td>8</td>
</tr>
</tbody>
</table>

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Segment. Only eight rims were found and only one of those is from a possible bowl. There are three rims in the Cropperville sample. One is from a miniature jar with an estimated orifice diameter of less than 2 cm. One jar rim has estimated orifice diameter of 14 cm. All jar rims recovered are only slightly everted. Drew's Site with the largest count of Shivwits pottery has only two rim sherds. Table 8 gives the counts for segment and divides the rims by eversion as shown earlier in Figure 6.

Table 8. Shivwits Pottery Body and Rim Count.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>VESSELS SEGMENT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Body</td>
<td>Rim A</td>
</tr>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>138</td>
<td>2</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>206</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 9. Average Thickness in mm of Shivwits Sherds.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>CATEGORY</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gray</td>
<td>Corrugated</td>
</tr>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>5.32</td>
<td>5.56</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>3.89</td>
<td>5.11</td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>4.38</td>
<td>4.38</td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>5.50</td>
<td>3.90</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4.66</td>
<td>5.51</td>
</tr>
</tbody>
</table>

Thickness. Vessel wall thickness was calculated from the average thickness for each sherd. Table 9 is an overview of average thickness. Shivwits vessel wall
thickness ranges from 2.9 mm to 7.7 mm with an average thickness of 5.51 mm for corrugated and 4.66 mm for plain vessels. Poverty Mountain Ridge East has the widest range of wall thickness overall.

*Primary Temper.* Crushed Moapa Gray Ware was used to temper Shivwits pottery. This is a defining characteristic of the Shivwits Plain and Shivwits Corrugated pottery. There is always some amount of olivine in the pottery either intentionally added or added as part of the crushed sherd temper. Occasionally even Shivwits pottery is crushed to make temper for new Shivwits vessels. In the ceramic analysis, temper is identified by the classes of olivine-sherd, sherd, olivine, sand and quartz-sherd. Olivine-sherd is the most common primary temper, found in 184 sherds representing 85 percent of the collection. Olivine was identified as the primary temper in only six sherds (Table 10).

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>PRIMARY TEMPER</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Olivine-sherd</td>
<td>Sherd</td>
</tr>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>122</td>
<td>13</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>AZ:A:6.67 BLM</td>
<td>27</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>184</td>
<td>21</td>
</tr>
</tbody>
</table>

All of the sites have more olivine-sherd primary temper examples than any other category. Zack's Bag has the lowest occurrence with only 67 percent. This
number may be artificially low due to the small sample size of the Shivwits pottery. There are only nine Shivwits sherds in the sample collection from Zack’s Bag, but the entire pottery sample from the site is 1330 sherds. It is also the only site with a sherd containing sand as the primary temper. Drew’s site has the largest sample and the largest variety of temper. There are five temper types listed but this site has the largest amount of Shivwits pottery.

Secondary Temper. Eighty-four sherds have a secondary temper, most commonly olivine (Table 11). Olivine is counted as a secondary temper in 47 percent of the sherds collected and sand is identified as secondary in 44 percent. Olivine-sherd is the secondary temper in only two Shivwits sherds. Both of those have sand as the primary temper.

Only 32 percent of the Shivwits sherds from Drew’s Site have a secondary temper. Sand is the most common secondary temper at this site with 71 percent of the secondary temper in either mixed sand or quartz sand. The original identification noted four different classes of sand in the secondary temper. This is the most diverse mix of the sites but also represents the largest sample of Shivwits pottery.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>Olivine</th>
<th>Olivine-sherd</th>
<th>Quartz</th>
<th>Sand</th>
<th>Sherd</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>10</td>
<td>1</td>
<td>12</td>
<td>20</td>
<td>2</td>
<td>45</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>12</td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>TOTAL</td>
<td>41</td>
<td>2</td>
<td>13</td>
<td>24</td>
<td>4</td>
<td>84</td>
</tr>
</tbody>
</table>
Temper Attributes

Attributes of the temper include the amount of temper, the size of temper grains, uniformity of grain size (sort), and how rounded the grains are. These attributes are sometimes used to identify temper sources, production methods, or intended use of the pot.

Amount of Temper. Amount of temper is expressed as a percentage of the clay body (Table 12). Sherds were examined in cross-section on a fresh break and point counted under a microscope within a 10 x 10 mm eyepiece grid. The sherds were compared to geologic identification cards for verification. Most of the sherds have between 15 percent and 30 percent temper. There are 159 sherds in that range or 74 percent of the Shivwits collection. At the extreme ends five sherds have 50 percent temper in the clay body and three have less than 5 percent.

Table 12. Count of Shivwits Sherds by Percent of Temper in Paste.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>PERCENT OF TEMPER</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0  5  10  15  20  25  30  35  40  45  50</td>
<td></td>
</tr>
<tr>
<td>AZA:10:16 BLM</td>
<td>3 1 7 19 35 17 33 11 10 1 3</td>
<td>140</td>
</tr>
<tr>
<td>AZA:10:24 BLM</td>
<td>3 6 5 4 3 8 2</td>
<td>31</td>
</tr>
<tr>
<td>AZA:10:26 BLM</td>
<td>1 4 2 1 1</td>
<td>9</td>
</tr>
<tr>
<td>AZA:10:72 ASM</td>
<td>1 1 1 1</td>
<td>4</td>
</tr>
<tr>
<td>AZA:6:67 BLM</td>
<td>1 7 4 8 6 1 1</td>
<td>30</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3 5 14 32 48 31 48 15 12 1 5</td>
<td>214</td>
</tr>
</tbody>
</table>

All of the sites show the same tendency toward the median range of 15 percent to 30 percent temper. Poverty Mountain Ridge East is biased slightly toward the lower range. Only 6 percent, or two sherds, are above 30 percent temper.
temper and 14 sherds have less than 30 percent temper. This represents 45 percent of the Shivwits pottery from the site sample collection. The calculated average amount of temper is 20 percent. Drew's Site and Cropperville both average 25 percent.

*Grain Size.* The grain size was measured for the largest visible grain of temper in the sherd. The average of largest grain size for all sites is .94 mm (Table 13). Drew's Site has the smallest grain size average at .80 mm and the most sherds. The average size for the other sites, excluding Drew's Site, is 1.23 mm.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>Average of size</th>
<th>Max. of size</th>
<th>Min. of size</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>0.80</td>
<td>3.0</td>
<td>0.1</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>1.22</td>
<td>1.9</td>
<td>0.5</td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>1.41</td>
<td>3.1</td>
<td>0.8</td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>1.18</td>
<td>1.7</td>
<td>0.7</td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>1.11</td>
<td>2.9</td>
<td>0.4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4.66</td>
<td>5.51</td>
<td>5.00</td>
</tr>
</tbody>
</table>

*Uniformity of Grain Size (Sort).* The uniformity of grain size is measured by the "sort" as defined by geologic field identification cards. Orton et al. (1993:238-239) give examples of the categories. Table 14 shows that the crushed sherd temper is usually poorly sorted. Over 60 percent of the Shivwits pottery has poorly sorted temper, 23 percent is moderately sorted, and only 15 percent, 32 sherds, are in the well-sorted to very well-sorted category and two are not reported because the sherds were burned and grains could not be identified.
Drew’s Site has the most diversity of sort with sherds in all categories, but sherds are most consistently in the poorly sorted range. The two Hidden Hills sites, Poverty Mountain Ridge East and Zack’s Bag, do not have any sherds that fit in the well-sorted or very-well sorted temper categories.

Table 14. Count of Shivwits Sherds by Temper Sort.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>Moderate</th>
<th>Poor</th>
<th>Well</th>
<th>Very well</th>
<th>Unknown</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>41</td>
<td>69</td>
<td>27</td>
<td>1</td>
<td>2</td>
<td>140</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>2</td>
<td>29</td>
<td>8</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>1</td>
<td>1</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>2</td>
<td>20</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>TOTAL</td>
<td>51</td>
<td>129</td>
<td>31</td>
<td>1</td>
<td>2</td>
<td>214</td>
</tr>
</tbody>
</table>

Table 15. Rounding of Temper Grains in Shivwits Pottery.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>Angular</th>
<th>Rounded</th>
<th>Sub-angular</th>
<th>Sub-round</th>
<th>Unknown</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>43</td>
<td>1</td>
<td>58</td>
<td>36</td>
<td>2</td>
<td>140</td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>29</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:26 BLM</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:72 ASM</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>27</td>
<td>3</td>
<td></td>
<td>2</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>105</td>
<td>2</td>
<td>65</td>
<td>40</td>
<td>2</td>
<td>214</td>
</tr>
</tbody>
</table>

Rounding of Grains. Temper is also characterized by the roundness of the grains that might indicate a special source for sand tempers; or in the case of sherd temper it might indicate how the temper was processed. Temper rounding was identified by a geologic field identification card. Crushed sherd temper grains...
are predominantly angular to sub-angular; 79 percent of the sample analyzed falls in that category (Table 15). Eighteen percent are sub-rounded and only two sherds have rounded temper grains. The sherds from all of the sites have mostly angular and sub-angular temper grains. Drew's Site and Zack's Bag both have a higher occurrence of rounded grains than the other sites.

Clay Attributes. Clay attributes are identified to help determine clay content, source, and firing method. Clays with high iron content fired in an oxidizing atmosphere produce a red to orange surface. Clays high in organic content sometimes produce a light surface with a dark interior core if they are not fired long enough to burn out organic carbon. Clay from similar source materials may exhibit a variety of exterior and core colors due to unequal firing conditions.

Exterior Color. The exterior surface color of Shivwits Plain and Corrugated pottery is mostly dark gray to brownish gray or reddish brown (Table 16). The dark exterior colors are found on 157 sherds or 73 percent of the collected Shivwits pottery. Fifty-six sherds are lighter gray and light brown. That represents 26 percent of the Shivwits pottery.

The Shivwits pottery from Drew's Site is dark. Only 13 sherds are in the gray and lighter color groups. This represents only 9 percent of the Shivwits sample collection from the site. More than half of the collected Shivwits sherds from Zack's Bag and Cropperville are in the gray to light color designation. These colors are from the initial analysis. The refired sherds were more carefully recorded with the Munsell soil color charts.
Table 16. Exterior Color of Shivwits Pottery.

<table>
<thead>
<tr>
<th>EXTERIOR COLOR</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-black</td>
<td>1</td>
</tr>
<tr>
<td>D-brown</td>
<td>56</td>
</tr>
<tr>
<td>D-dark brown</td>
<td>9</td>
</tr>
<tr>
<td>D-dark gray</td>
<td>46</td>
</tr>
<tr>
<td>D-gray brown</td>
<td>3</td>
</tr>
<tr>
<td>D-orange</td>
<td>3</td>
</tr>
<tr>
<td>D-red</td>
<td>2</td>
</tr>
<tr>
<td>D-red brown</td>
<td>37</td>
</tr>
<tr>
<td>D-red gray</td>
<td>1</td>
</tr>
<tr>
<td>L-buff</td>
<td>5</td>
</tr>
<tr>
<td>L-gray</td>
<td>27</td>
</tr>
<tr>
<td>L-light brown</td>
<td>3</td>
</tr>
<tr>
<td>L-light gray</td>
<td>19</td>
</tr>
<tr>
<td>L-light red brown</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 17. Color of Core in Shivwits Pottery.

<table>
<thead>
<tr>
<th>CORE COLOR</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-black</td>
<td>1</td>
</tr>
<tr>
<td>D-brown</td>
<td>18</td>
</tr>
<tr>
<td>D-brown gray</td>
<td>1</td>
</tr>
<tr>
<td>D-dark brown</td>
<td>10</td>
</tr>
<tr>
<td>D-dark gray</td>
<td>139</td>
</tr>
<tr>
<td>D-gray brown</td>
<td>2</td>
</tr>
<tr>
<td>D-red</td>
<td>1</td>
</tr>
<tr>
<td>D-red brown</td>
<td>10</td>
</tr>
<tr>
<td>L-buff</td>
<td>2</td>
</tr>
<tr>
<td>L-gray</td>
<td>27</td>
</tr>
<tr>
<td>L-light gray</td>
<td>2</td>
</tr>
<tr>
<td>L-light red brown</td>
<td>1</td>
</tr>
</tbody>
</table>

Core Color. The “dark gray to black” core color described by Lyneis (1992a:45) is a defining trait for Shivwits pottery. Shivwits sherds should be in the dark color categories but some are identified as having a lighter core. Thirty-two sherds have a light color core. Twenty-nine of those are identified as Shivwits.
because their exterior color was dark or there was only olivine-sherd temper and
the texture was crumbly or grainy. More of the sherds from Drew's site have
brown in the core colors. Almost 25 percent are brownish as compared to only 3
percent and 13 percent for other sites. Two sherds of nine, or 22 percent have
brown core color in the collection from Zack's Bag.

Texture. Grainy clay texture is also a defining characteristic of Shivwits
pottery. Texture was recorded in descriptive terms from crumbly to grainy, platy,
fine, or vitrified (Table 18). Over 80 percent of the Shivwits variety pottery has
crumbly to grainy clay. Twenty have vitrified clay, 18 have platy clay, and four
have fine clay.

Cropperville is the most different in clay texture. Only 11 sherds have crumbly
or grainy clay. Seventeen are have platy or fine clay and none are vitrified. There
are no sherds with fine clay and only one with platy clay in the collection from
Drew's Site. Some of the vitrified sherds also have characteristics of a platy or
fine clay but firing temperatures altered the structure so it is difficult to identify the
true clay characteristics.

<table>
<thead>
<tr>
<th>CLAY TEXTURE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crumbly</td>
<td>144</td>
</tr>
<tr>
<td>Crumbly-platy</td>
<td>1</td>
</tr>
<tr>
<td>Fine</td>
<td>4</td>
</tr>
<tr>
<td>Grainy</td>
<td>27</td>
</tr>
<tr>
<td>Platy</td>
<td>18</td>
</tr>
<tr>
<td>Vitrified</td>
<td>13</td>
</tr>
<tr>
<td>Vitrified-crumbly</td>
<td>2</td>
</tr>
<tr>
<td>Vitrified-fine</td>
<td>1</td>
</tr>
<tr>
<td>Vitrified-grainy</td>
<td>2</td>
</tr>
<tr>
<td>Vitrified-platy</td>
<td>2</td>
</tr>
</tbody>
</table>
Analysis of Refired Shivwits Pottery

Refiring was done to equalize the variables and identify the color potential of Shivwits pottery clay. A sample of the Shivwits collection was refired to determine if the same clay or similar clay sources were used. The exterior color and core of all the collected pottery was recorded as well as the texture of the clay, all observed in a fresh break. Representative samples from each temper category were refired and when possible samples of dark and light cores for each were included.

Each sherd selected was cut with a gem saw and a control portion was labeled and retained. The refire samples were placed in a computer-controlled furnace, heated to 950° C and held at temperature for 15 minutes. The sherds were allowed to cool slowly for 24 hours in the furnace. The refiring process provides a uniform oxidizing environment. Control sherds and the refired “twins” were documented using the Munsell soil color charts for consistent color notation. The clay colors after refiring were all a reddish orange to orange exterior.

The color names derived from the Munsell categories provide one way to look for similarities or differences in clay. Only 11 Shivwits sherd-tempered pieces were refired. Six of the sherds refired to red. Three other sherds were also in the reddish range. They were reddish yellow, reddish brown, and dark reddish brown. One sherd had light gray clay before refiring and was pinkish white refired. One sherd with a dark gray core and light gray exterior surface color
refired to pinkish white. These two sherds are considered with the Moapa Gray Ware.

The Munsell system of identification includes three parts: hue, value, and chroma. The hue refers to the area of the color spectrum usually in the red, yellow and combinations of those. The lower value numbers are darker and the higher chroma numbers are more intense. Most of the refired sherds are 2.5YR and 5YR yellow-red hue groups. Eight are in the 3, 4, or 5 value range and are darker, with 5 being the middle of the chart. Nine are in the high, more intense chroma of 4/4, 6/4, and 8/4, with the mid range between 3 and 4. Table 19 shows the Munsell color designations with the color name.

One sherd, originally gray, refired to reddish yellow with a 6/6 value and chroma. The remaining eight, red and reddish sherds have value and chroma of 3/4 and 4/4, 5/6, and 5/8. These Munsell colors were also identified by Lyneis (1992a:45) for the sherd-tempered Shivwits pottery from the Arizona Strip. Allison (2000:Table 23) refired 216 Shivwits Plain and corrugated sherds from the Shivwits Plateau. He categorized the sherds into color groups developed by Windes (1977). The refired sherds from the Shivwits Plateau collection fit into Windes' group 5, 6, 7, and Allison's added group 8 with group 6 being the most common. Eight of the 11 Shivwits sherds refired in this study are in group 6. The sherds refired are from four of the sample sites. Site AZ:A:10:26 Zack's Bag, does not have any Shivwits sherds large enough to refire. All four sites have refired Shivwits pottery in color group 6.
Table 19. Munsell Refire Data for Shivwits Plain and Shivwits Corrugated.

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>Core color before</th>
<th>Munsell refire hue</th>
<th>Value/ chroma</th>
<th>Windes' Group</th>
<th>Color name</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>dark gray</td>
<td>2.5YR</td>
<td>3/4</td>
<td>6a</td>
<td>dark reddish brown</td>
<td>Crg</td>
</tr>
<tr>
<td>AZ:A:11:72 ASM</td>
<td>very dark gray</td>
<td>2.5YR</td>
<td>4/4</td>
<td>6</td>
<td>reddish brown</td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>dark reddish gray</td>
<td>2.5YR</td>
<td>4/8</td>
<td>6a</td>
<td>red</td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>dark gray</td>
<td>2.5YR</td>
<td>5/6</td>
<td>6</td>
<td>red</td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>very dark gray</td>
<td>2.5YR</td>
<td>5/6</td>
<td>6</td>
<td>Crg</td>
<td></td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>very dark gray</td>
<td>2.5YR</td>
<td>5/6</td>
<td>6</td>
<td>red</td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:16 BLM</td>
<td>very dark gray</td>
<td>2.5YR</td>
<td>5/8</td>
<td>6</td>
<td>red</td>
<td>Crg</td>
</tr>
<tr>
<td>AZ:A:11:72 ASM</td>
<td>very dark gray</td>
<td>2.5YR</td>
<td>5/8</td>
<td>6</td>
<td>red</td>
<td></td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>gray</td>
<td>5YR</td>
<td>6/6</td>
<td>5</td>
<td>reddish yellow</td>
<td></td>
</tr>
<tr>
<td>AZ:A:6:67 BLM</td>
<td>white</td>
<td>5YR</td>
<td>8/3</td>
<td>2a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AZ:A:10:24 BLM</td>
<td>dark gray</td>
<td>7.5YR</td>
<td>8/2</td>
<td>2</td>
<td>pinkish white</td>
<td></td>
</tr>
</tbody>
</table>

Temper for all refired sherds is sherd-olivine.

As a comparison, the olivine-tempered Moapa Gray Ware refired was consistently lighter. Color names are from pink, to pinkish white, yellowish red, and reddish yellow. All of the Moapa Gray sherds are in the 5YR and 7.5YR hue. All are above the middle value in the 5, 6, 7, and 8 range. Over half are in the /1, /2, and /3 chromas. They fall into Windes' color groups 2 and 5. The sand-tempered pottery is variable and is categorized in Windes' groups 2, 4, 5, and 6. Allison's (2000) data, Lyneis' (1992a) data, and this small sample show variability in refire color. Lyneis (1992a:45) reports the refire colors from Shivwits Plateau sherds in the reddish brown category with chromas of /2, /3, and /4. Allison
(2000:142) reports more high chromas of /4, /5, /6, and /8. This sample is more like the Allison sample with chromas of /4, /6, and /8. Allison's sherds are mostly in color group 6 and this collection is mostly color group 6. Allison (2000:138) points out that the variability within the refire color "indicates that multiple distinct clay sources and/or recipes were used."

The comparison of refired colors from different wares from the Shivwits Plateau samples show that the clay chosen for Shivwits Pottery and for Moapa Gray Ware was fairly consistent within each ware, and consistently different between the wares. Shivwits pottery sherds collected in other areas have more variability in the refire colors (Allison 2000:Table 23).

Exploring Attributes

The characterization of Shivwits pottery from the sample collection was not expected to resolve the question of where pottery was produced. The information presented here is a descriptive analysis that adds to a body of knowledge about Shivwits pottery. It falls short of providing proof of the production of Shivwits Plain and Shivwits Corrugated pottery on the Shivwits Plateau, but it does not preclude that hypothesis.

The attribute and the refire analyses show a relative consistency within the sample in vessel form, rim eversion, primary temper, and clay selection. The other attributes illustrate the diversity of the ware. Plain and corrugated vessels are almost equally represented. Vessel wall thickness has a wide range of size from 2.9 mm to 7.7 mm.
The temper attributes showed some unexpected variability. Secondary temper was surprising in the amount of sand used. One personal preconception was that the secondary temper would almost always be olivine. Sand is not dominant but is almost equal with olivine and is diverse in variety. Feldspar, quartz, mixed sand, sand are categories recorded. Amount of temper is variable. Shivwits sherds have from less than 5 percent temper to 50 percent or more. The average amount is 25 percent but the central tendency spreads almost evenly from 15 percent to 35 percent which is a wide range. Average grain size is fairly large at .94 mm. The range is a tiny 0.1 mm to a very large temper grain of 3.1 mm. The temper grain size for Shivwits pottery from Drew's Site is slightly smaller and has almost the same range. Grain size and rounding of the grains might indicate a variety of production techniques. Olivine-tempered pottery sherds are crushed and ground to make the temper for Shivwits. The more rounded and smaller grains might indicate the tempering pottery is processed more carefully. Sharp edges break off when rubbed on grinding surfaces. The sample shows mostly angular fragments but a fairly large number show a degree of rounding from processing.

Clay attributes are most consistent in the refire color. There are notable variations in a few refired sherds. One is a brown sherd with dark gray core that refired to pinkish white. While the clay choice shows relative consistency in the dark firing, probable high iron content and crumbly clays, there are apparently variable clay sources to produce similar end results. Core and refire color of the clay is fairly consistent with a high iron content clay. Most of the core colors are dark and the refire colors are a deep oxidized red to dark reddish brown.
Shivwits Black-on-gray? Some of the variability notable here is the departure from "known" Shivwits Plain and Corrugated characteristics. Lyneis (1992a:46) characterizes vessel forms with "no painted version of Shivwits Plain." Three sherds identified as Shivwits have painted designs. One is questionable as a painted sherd. Two are painted with an identifiable broad line and narrow line design. One is from Trip House and one from Poverty Mountain Ridge East. Both have a light gray exterior with dark gray crumbly clay and olivine-sherd primary temper with no secondary temper. It is possible that the dark core is carbon rather than iron. These sherds should be refired to determine the clay potential.

Unusual Vessels. Canteens and small water jars are not known in Shivwits Plain pottery (Lyneis 1992a:49). One small jar rim sherd was collected with the sample from Zack's Bag. It has a dark gray vitrified grainy core, olivine-sherd temper and an estimated rim orifice diameter of 2 mm. This is probably not a canteen but a miniature jar.

Conclusions

The original research question explored is: Was the Shivwits Plain and Shivwits Corrugated pottery made on the Shivwits Plateau? The models explored can neither confirm nor exclude this original hypothesis. The only pieces to support the direct evidence model are two possible pottery scraping tools collected at Poverty Mountain Ridge East along with a piece of unfired clay. But that is not unexpected. These are questionable as evidence of pottery production, and if they are pottery production indicators there is no indication that Poverty Mountain Ridge East was a Shivwits pottery production site. It is difficult
to positively identify either firing features or production tools in the case of pottery fired at low temperatures without formal firing kilns. The frequency of Shivwits pottery at the site represents only about 2.5 percent of the sample. Although there were no direct evidence artifacts or features observed at the other sites that does not preclude the possibility that they are there. Sub-surface testing of ash midden areas or other features would be helpful in identifying firing or preparation areas for pottery production. Excavation of features might uncover more production-related artifacts. Sullivan (1988:33) recommends “excavation strategies to include narrow-spaced trenching and extensive stripping of extramural areas, middens, and trash areas.” Within the confines of this study only one small area disturbed by looters was tested. There were no firing features or pottery production artifacts identified.

The Threshold Model was inconclusive. All of the sites are within the upper threshold of 7 km from clay soils. This does not mean the presence of clay soils is a pottery clay source, only that there is a possible pottery clay source. Two of the sites are in clay soil or potential clay areas. Two are adjacent to known clay soils and possible clay resources. The sites closest to suspected iron rich clay source areas had the least amounts of Shivwits Pottery. Trip House is in an area adjacent to basaltic clay soils around Grassy Mountain and it has the least amount of Shivwits pottery in the sample collection. Zack’s Bag is in the clay soils area and has less than one percent Shivwits pottery. Poverty Mountain Ridge East is in an area of clay soils and has only 2.26 percent Shivwits pottery. Drew’s Site is adjacent to the clay soils of the Hidden Hills and has over 56 percent Shivwits pottery in the sample collection.
All of the sites have temper material on site. All of the sites have available fuel on site. None of the sites are known to be closer than 3 km from a water source. Drew's Site is closest to a known water source and is the most likely Shivwits pottery production site. The water source is deep in Pigeon Canyon and over 2 km away from the site. Drew's Site has the highest frequency of Shivwits pottery.

The Gravity Model stipulates the increased frequency of the pottery on each site and the increased frequency of sites with the pottery as indicators of production. The third criteria is the increased variety of vessel forms on the site. Drew's Site is the only site with an increased frequency of Shivwits pottery. It has a frequency of 56 percent. There are corrugated and plain vessels represented and two possible bowl sherds. Two jar rims represent one vessel with a strongly everted rim. None of the other sample sites has the frequency of Shivwits pottery as that found at Drew's Site. If Drew's Site is a production site it may also serve as an indicator of when the Shivwits pottery was made. Drew's Site is a Pueblo III site. The site with the next highest frequency, Cropperville, with 5.5 percent Shivwits pottery, is a middle Pueblo II site. Cropperville has a lower frequency than the Lowland Muddy-Virgin Valley site, Main Ridge, that is roughly the same Middle Pueblo II time period. The other sites are early Pueblo II, and Pueblo I to Early Pueblo II. They all have less than 3 percent Shivwits pottery. Zack's bag is the lowest frequency with only .68 percent Shivwits pottery. It is an early Pueblo I to Pueblo II site. All of the sites have some Shivwits pottery. There appears to be an increase in frequency through time.

The refire and the attribute analyses show a consistency in clay choice. Other attributes show variability within a median range. Most of the Shivwits pottery
sherds come from jars although there is some diversity of form. Shivwits Corrugated is most common at Drew's Site and only slightly represented at the other sites. Two painted sherds may represent a Shivwits black-on-gray that has not been documented prior to this study. The Shivwits Plateau may have been a production area for Shivwits Plain and Corrugated pottery but the data are inconclusive.

It is possible that the sites selected for the sample just “missed” the Shivwits pottery. Other collections from the Shivwits Plateau made as grab samples for survey reports include a large number of Shivwits Plain and Shivwits Corrugated sherds. Wells (1991:117) reports Shivwits pottery on 50 sites in the survey area. Twenty of those have both Shivwits Plain and Corrugated varieties. Wells’ survey area was in the far south end of the Shivwits Plateau. It is in the vicinity of Mt. Dellenbaugh, a volcanic formation on the edge of the Grand Canyon. The survey area is south of the Grassy Mountain sample site AZ:A:11:72 ASM Trip House. Allison’s (2000) refire of sherds collected from the Shivwits Plateau came from four sites on the Plateau. Three of those are south of the sample area for this study. The sherds were not systematically collected so the frequency for the sites is not known. If the first criteria of the Gravity Model, an increased frequency of sites with the ware is considered, the south end of the Shivwits Plateau may be a possible production area.

The sample collection area for this study is still a largely untapped resource. There are 32 pueblo sites documented in site files in the area around Grassy Mountain and north to Hidden Hills and the central Plateau, and over 20 other sites documented with architectural features are documented in the Mt.
Dellenbaugh area. One site in the area of Trip House did have Shivwits Pottery. It was not found until after the sample collections were made. A grab sample from the site was identified as Shivwits Plain. Only a small fraction of the area has been systematically surveyed. As always, more research is needed.
CHAPTER SEVEN

INTEGRATING THE INFORMATION

CONTACT AND INTERACTION

Contact and interaction between the Western Plateaus and the Lowland Muddy-Virgin Valley populations has been documented in past research through analyses of pottery and exotic materials (Allison 2000; Lyneis 1992a). The scale of the interaction has been sometimes described as grand and sometimes a simple reciprocal exchange. Rafferty (1990) described a "Pan-Southwestern Trade System," involving highly organized long distance trade of valued goods as a basis for a system of interaction that integrated the Virgin Anasazi with the Meso-American trade networks. Allison (2000) described a system of exchange involving selected households involved in mutual exchange of unequal resources.

The research in this section is an integration of the settlement information and production analysis for the Shivwits Plain and Corrugated pottery. The specific research question proposed is: Were the sites on the Shivwits Plateau situated to take advantage of travel or trade between the upland settlements on the Uinkaret Plateau and the Lowland Muddy-Virgin Valley population? This question requires information about settlement models with particular attention to critical placement of sites in possible travel corridors. It also requires information about the
production and distribution of pottery. The five ceramic study sites explored in Chapter Five will provide examples for location and production that can be compared to expectations in the models of interaction. The site location information from Chapter Four will provide an overall picture of the known site locations within the proposed interaction zone.

Plog (1977:129) proposed a framework for evaluating exchange networks. This research is not expected to uncover the details of exchange, but Plog's outline is useful in evaluating the models of interaction. In this case the question is interaction rather than strictly exchange. The most directly accessible information is the artifact and settlement remains. Social interaction is beyond the scope of the data here, but it is an important factor in the models presented and it is certainly important to understanding the nature of interaction.

A Framework for Interaction

All of the following questions are based on Plog's (1977:129) outline for examining exchange networks. The first question is content of the interaction. What is the range of the materials being transferred? In this study the focus has been the nature of pottery distribution. Other items noted in the culture history presented in Chapter Two are exotic materials including shell beads and turquoise.

What quantity of goods were involved? Studies in the Lowland Muddy-Virgin Valley indicate a relatively large quantity of pottery was transported from the upland Western Plateau. Nearly 30 percent of the pottery recovered in the
Lowland during the middle Pueblo II is imported olivine-tempered Moapa Gray Ware (Allison 2000:97-136; Lyneis 1992a:35; Olson 1979:350-351).

The third question is diversity. What is the diversity of materials that were involved in the interaction? Items involved in the interaction are primarily two varieties of pottery, the Moapa Gray Ware and Shivwits. Turquoise, shell, salt, and food goods may have also been involved but there is little direct evidence of these (Allison 2000; Lyneis 1992a:66-77). Other items may have been involved but there are no good data for movement of sand tempered wares.

What is the size of the interaction area? The area of interest involves the Lowland Muddy-Virgin Valleys and the upland Western Plateaus. The distance is roughly 150 km and involves more than 10,000 km².

What is the temporal duration? The temporal duration of the interaction is from the Pueblo I through the Pueblo II or about A.D. 800 through 1150. The primary focus is the Pueblo II when the interaction increases and then seems to end abruptly.

What is the directionality of the interaction? The visible evidence is of a one-direction movement of pottery from the upland to the lowland area. There are probably items and elements of interaction that are simply not visible in the record. Those might include perishable goods, social contacts, or marriage partners.

What is the symmetry of the interaction? The interaction appears to be asymmetrical with only the one directional flow visible. Allison's (2000) model proposes an alternative explanation of the symmetry that will be discussed further.
Is the interaction centralized? It does not appear to be a centralized interaction. Allison (2000:159) has documented differential involvement of the lowland households indicating specific interaction partnerships on the household-to-household level.

How complex is the network of interaction? It is likely that the interaction changed through time. Again, there are competing models that range from descriptions of highly complex systems to the simplest person-to-person contact.

Models of Interaction and Settlement

**Subsistence Models**

The subsistence models assume varying degrees of reliance on horticulture. The model proposed by Westfall et al. (1987) is for periodic upland foraging to supplement a marginal dependence on horticulture. This model was proposed for the lowland St. George Basin and involved the use of uplands north of St. George as foraging areas. The same model could be applied to the Lowland Muddy-Virgin Valley and the Western Plateaus upland areas.

Foraging in the uplands might provide access to Shivwits pottery. This provides two possibilities. Foragers used the upland to produce pottery while in the area. If the foragers were producers, pottery production should be informal and not overly visible on the landscape. The other possibility is that there was contact with pottery producers on the Shivwits Plateau during foraging episodes. Shivwits pottery could then be taken back to the lowland.

Some of the elements described by Plog (1977) are of interest. The subsistence foraging model would be applicable in situations of interaction that
involve a low quantity of goods, maybe a few vessels at a time. This is possible for the Pueblo I when the frequency of Shivwits pottery is low in the Lowland Muddy-Virgin Valley. From the sample sites in this study the Pueblo I to early Pueblo II sites also have very little Shivwits Plain pottery. The size of the area of interaction could be large due to unequal foraging resources. The interaction could be asymmetrical or symmetrical involving exchange of resources, and it would not be complex.

Expectations of the model would be to find smaller dispersed foraging camps or small structural sites. Sites situated for foraging should be found in foraging resource areas such as pinyon forests. If there are resident Shivwits populations and lowland foragers there should be both substantial and ephemeral sites. If the foragers are producing pottery the camps should be located in areas with pottery making resources described in the threshold Model (Arnold 1988:20-60).

The sites on the Shivwits Plateau are variable in architecture. Thirty-eight pueblos are documented. Some are multi-room structures that are more substantial than would be expected for seasonal foraging. The other structures are less substantial but the site records do not always provide adequate information. The five sites from the sample all have substantial architecture and are not interpreted as seasonal camps.

The sites on the Shivwits Plateau are almost all located in areas of pinyon forest. The forest location would have provided both foraging opportunities and fuel resources for pottery production. The sample study sites on the Shivwits Plateau are within the threshold ranges for clay soils. Three of the sites are in the Hidden Hills area close to the edge of the Grand Wash Cliffs and have access to
the canyon corridors for travel to foraging areas. Evidence for pottery production on the sample sites was minimal. The evidence for pottery production by mobile seasonal foraging parties would be even more difficult to prove.

The subsistence foraging model is difficult to interpret with the data available. Research was focused on structural sites and not camp areas. Other surveys have documented campsite or lithic scatter features. Wells (1991:27) states, "artifact scatters are the most common site type (37 sites)." Herron's (1998) Grassy Mountain survey identified 63 lithic or artifact scatters or camps and 52 lithic isolates and 11 roasting pits. Both of these survey areas are in the southern end of the Shivwits Plateau. Temporal affiliations are not mentioned for the artifact scatters. It is evident that foraging resources were used but it is not possible with the data available to tell whether it was lowland foraging parties or upland residents using the resources.

Residential Mobility Model

The second model explored is McFadden's (1996) model of residential mobility. McFadden (1996:30) describes the settlement pattern of the Grand Staircase in the Eastern Plateaus area as "several types of multi-component sites...as representing a specialized and long-lived pattern of use." The model assumes residential mobility that would allow use of a variety of "agricultural niches." It should be applicable to the Western Plateaus area and the Lowland Muddy-Virgin Valley could be considered as another area available for the adaptive strategy.

If the people using the Shivwits Plateau maintained a pattern of residential mobility they might also include the lowlands in the use pattern. Expectations
would be for sites to have recurrent occupation and rebuilding in both areas. The sites would be located in a variety of areas to take advantage of diverse ecological situations. The sites would not need to be located for access to canyons for travel.

The study sites are possible examples of occupation, abandonment, and reuse. Poverty Mountain Ridge East and Cropperville both have separated roomblock areas that could represent different building episodes. The temporal controls are not well enough established to see small periods of abandonment. Three of the sample sites have pottery that spans the Pueblo I and possibly early Pueblo II. These could be recurrent rather than continual occupation.

Plog's (1977) concept of exchange or interaction is not directly applicable if the populations themselves were moving and carrying pots for their own consumption. There may be some exchange if previously inhabited areas were being shared with newcomers but it would not be in large quantities.

Expectations for pottery production would remain the same as those from the production models in the ceramic analysis. There should be direct evidence, thresholds of pottery resources should apply, and production areas should show increasing frequency for the Shivwits pottery. Pottery could be produced on the Shivwits Plateau sites and move to the lowland when the potters move their residences. Expectations would be for pots in the Lowland to show variability due to individual potters carrying their own wares to new residences in the lowlands.

If the people moved to the lowlands, the Shivwits pottery might move with them. Allison (2000) proposed that households in the lowland area had specific trade partners producing pottery on the upland plateaus. This was evident in the
diversity of the refire colors in the pottery from the lowland sites. The same
diversity could also occur if individual potters moved to the lowland residence
with their pots. This does not explain the increase through time and the
abundance of upland pottery at the lowland sites during the middle Pueblo II. A
large number of people would have to move residence in increasing numbers
through time. The data available do not address that possibility.

**Risk Buffering and Mutualism**

The model Allison (2000) proposed in his research of pottery distribution
explores social interaction to explain the nature of exchange in the Virgin Anasazi
region. His model was presented in the settlement information section, Chapter
Four, of this research. It is relevant to combine the settlement information with
the data generated in the ceramic analysis and is presented here in that context.

The model is a form of risk buffering and mutualism. Allison’s (2000) original
research deals specifically with the distribution of the Moapa olivine tempered
pottery from the area of production on the Uinkaret Plateau to the Moapa Valley
lowlands. The model is proposed to explain the apparent asymmetrical
interaction and the lack of complexity exhibited in the interaction area.

The risk buffering mutualism model proposes: Risk of crop failure in the
uplands would have made trade with the lowland area beneficial to the upland
pottery producers. The lowland farming communities would have benefited from
the exchange, as they would save the fuel resources required to fire the pottery.
In simple terms the model presents a “food for pots” exchange where economic
contact would also maintain social ties. This model suggests upland populations
periodically visited the lowlands to bring pottery and share in harvest of lowland crops.

This exchange from the Uinkaret Plateau would involve the Shivwits as a possible trade route. Expectations for site distribution on the Shivwits Plateau might include both temporary camps and small settlements along possible travel corridors. Site locations on the Shivwits Plateau should be situated in areas to provide easy access off the Grand Wash Cliffs. Expectations for pottery would include the elements from the production models of direct evidence, resource thresholds, and the gravity model. There should be evidence of production for distribution indicating a scale above just what is needed for household use. One element of Allison’s model is that the lowland populations did not have adequate fuel for pottery making on a large scale. This is one of the elements of the threshold model for pottery production. High frequencies of Shivwits pottery would be expected in production areas especially if the vessels were intended for exchange.

The sites on the Shivwits Plateau exhibit characteristics of both small settlements and larger habitation units. Sites are situated near possible travel corridors. Poverty Mountain Ridge East and Zack’s Bag are both in the Hidden Hills area. They are close to the rim of the Upper Grand Wash Cliffs within 5 km of Rattlesnake Canyon, a tributary drainage of Hidden Canyon. Hidden Canyon is a possible travel corridor off the Grand Wash Cliffs west toward the Lowland Muddy-Virgin Valley. Drew’s Site is on the edge of Pigeon Canyon. Cropperville is 16 km from the Grand Wash Cliffs but only 5 km from the head of Jump Canyon. Jump Canyon is a travel route off the Grand Wash Cliffs. Trip House in
the Grassy Mountain area is 16 km from Pigeon Canyon but it is between Parashant Canyon and Andrus Canyon. Parashant and Andrus Canyon are tributary to the Grand Canyon and not a direct access to the Muddy-Virgin Valley.

Drew’s Site is the most likely of the sample sites to be a pottery production site for Shivwits Plain and Corrugated pottery. It is within threshold limits for pottery resources. It has the highest frequency of Shivwits pottery. It is on a possible travel corridor. Drew’s Site is considered a Pueblo III site. In the Lowland Muddy-Virgin Valley the Shivwits pottery is most abundant on middle Pueblo II sites. It diminishes, and is gone from the assemblages by Pueblo III.

Drew’s site was considered the most promising evidence of interaction between the upland and the lowland sites but the timing is wrong. The Shivwits Corrugated is abundant on Drew’s Site, but Shivwits Corrugated is rare in lowland collections (Lyneis 1992a:46)

**Other Evidence of Contact and Interaction**

The focus of this research has been pottery. Other items also provide evidence of contact and interaction. Three *Olivella* shell beads, one turquoise disk bead, and fragments of worked turquoise were found at the Shivwits pottery sample sites. This exotic material has not been documented in this area before.

The shell beads and turquoise fragments were found at AZ:A:10:24 BLM Poverty Mountain Ridge East. The turquoise disk bead and raw turquoise were found at the site just to the south, AZ:A:10:26 BLM Zack’s Bag. Seven stone disk beads were found on these two sites. Both of these sites are considered to be Pueblo I to early Pueblo II.
Shell beads and turquoise are two exotic items that are found at Virgin sites through the occupation sequence (Fairley:1989b:53-84). Lyneis (1992a:68-69) describes the turquoise and marine shell beads found in the Main Ridge collections. Turquoise found at the Main Ridge probably came from different sources. The closest source is the Sullivan Mine near Boulder City 65 km from Main Ridge. Other sources are even further away.

The *Olivella* shell beads are spire lopped and are probably *O. biplicatta*, and *O. dama* but the diagnostic characteristics are ground away in the process of making the bead. Both species are marine shell and originate in the Pacific Coast or Gulf Coast.

These items may have been distributed through the Lowland Muddy-Virgin Valleys to the sites on the Shivwits Plateau. Lyneis (1992a) examined shell ornaments from the Main Ridge site. They were valued items usually associated with burials. This is the first documentation of shell beads on the Shivwits Plateau and it is one of the few documented items that might have been traded from the Lowland to the upland Western Plateaus.

Conclusions

It is difficult to answer the research question proposed for this section: Were the sites on the Shivwits Plateau situated to take advantage of travel or trade between the upland settlements on the Uinkaret Plateau and the Lowland Muddy-Virgin Valley population? The information from the analysis of settlement patterns indicate this is possible. There are substantial sites on the Shivwits Plateau in the area of possible travel corridors. The ceramic analysis is not
conclusive. The only site with a large amount of Shivwits pottery does not fit into the right time period. The site is in the right place, with the right pottery at the wrong time. The turquoise and shell beads recovered from the sample sites are evidence that exotic goods were distributed to the area but the extent of the distribution is still not well documented. There is still too little information about the Shivwits Plateau to describe the nature of trade in exotic material. It is known that the Shivwits pottery and the Moapa Gray Ware traveled from the upland Western Plateaus to the Lowland Muddy-Virgin Valley. Very little is known about movement of goods from the Lowland to the Shivwits and Uinkaret Plateaus.
CHAPTER EIGHT

THE FUTURE OF THE PAST

CONCLUSIONS

The title of the research was intended to have a double meaning. "Exploring the Shivwits Production Zone" provides an overview of archaeology of the Virgin Anasazi use of the Shivwits Plateau. It also explores the production of Shivwits Plain and Shivwits Corrugated pottery on the Plateau. The Shivwits Plateau is a large, untapped natural archaeological laboratory.

Three specific questions were addressed within the course of the research: First, are there substantial Puebloan sites on the Shivwits Plateau? Second, was the Shivwits Plain pottery made on the Shivwits Plateau? Third, were the sites on the Shivwits Plateau situated to facilitate movement of people and goods between the upland sites of the Uinkaret Plateau and the Lowland Muddy-Virgin Valley sites?

Compiled site records indicate there was substantial use of the Shivwits Plateau during the prehistoric Pueblo period. There are 38 sites documented as Pueblos and 35 "other structures" spanning late Basketmaker through the late Pueblo II and into the Pueblo III. The sites are spread across the Plateau from the Wolf Hole Valley grasslands to the conifer forests of Mt. Dellenbaugh. Site densities in recent survey areas are comparable with the adjacent Uinkaret
Plateau and Mt. Trumbull area with over 30 sites per square kilometer. Several models were examined to provide a framework to view the settlement information.

The question of the production area for Shivwits Plain pottery was proposed by Lyneis (1992a) with her formal definition of the type. Shivwits Plain pottery is found at sites in the Lowland Muddy-Virgin Valley area, and increased in numbers on sites from the early Pueblo II through the middle Pueblo II period. Lyneis proposed that the Shivwits Plateau was the logical production area. The ceramic analysis of pottery collected from five sites on the Plateau addressed this question. The sites range from Pueblo I and early Pueblo II to Pueblo II and one Pueblo III. Analysis of the sample collections shows the only site with a substantial amount of Shivwits pottery is Drew's Site that dates to the Pueblo III period. The other sites have only small amounts of Shivwits pottery and none of the sites have conclusive evidence of pottery production.

The third question explored is the position of sites with relation to the possibility of contact and interaction with the lowland populations. The only site that might have been a production area does not fit in the right time period. Drew's Site has a high frequency of Shivwits Corrugated pottery and fits in the Pueblo III period. It is situated at the edge of Pigeon Canyon, a possible travel corridor. The frequency of Shivwits Plain at the lowland sites diminishes after the middle Pueblo II and is virtually absent at late Pueblo II and Pueblo III sites. As stated before, Drew's Site is in the right place, with the right pottery, at the wrong time.
Throughout this research I have drawn heavily on the work done by Lyneis (1992a) and Allison (2000). Allison’s research shows a strong relationship between the upland Western Plateaus and the Lowland Muddy-Virgin Valley sites. Refire analysis of Shivwits pottery from the sample sites shows a similarity to Allison’s refire of pottery from the upland and lowland sites.

The selection of sites for the study was intended to provide information for sites contemporaneous with the Main Ridge site (Lyneis 1992a). Upon analysis only one site was identified as a close temporal match. Croppenville has only a small amount of Shivwits pottery at roughly 6 percent of the sample. It is not a likely source of Shivwits pottery for the Main Ridge site. There is not conclusive evidence from this study that the Shivwits Plateau sites were situated to take advantage of trade with the lowland populations. That does not preclude the possibility. There are many more sites. The sample from five sites is small. Both Allison (2000) and Lyneis (1992a) examined sherds collected on the Shivwits Plateau. Wells’ (1991) information for the south end of the Plateau seems promising. The south end of the Plateau may have the highest potential for production but the entire Shivwits Plateau plays an important part in understanding prehistoric Puebloan contact between the upland Western Plateaus and the Lowland Muddy-Virgin Valley populations. Other sites should be included in systematic collections to examine the pottery and expand the data. Chemical characterization of pottery should be considered as well as petrographic analysis for a more precise identification of pottery production resources.
While the samples collected were not extensive, sites selected revealed new information that warrants further study about Shivwits pottery. Three sherds are identified as a painted Shivwits pottery. This variety has never been described. One miniature jar rim of Shivwits Plain pottery is an uncommon form for the type.

A Model for the Shivwits Plateau

It is unrealistic to assume that one model can explain the large area and temporal duration of the span of Virgin Anasazi use of the Shivwits Plateau. There is evidence of contact between the populations on the Shivwits Plateau and the Uinkaret Plateau and with the Lowland Muddy-Virgin Valley populations. Based partly on the residential mobility and the risk buffering mutualism models from McFadden (1996) and Allison (2000) the following falls short of a formal model. It is an idea for further exploration.

Virgin Anasazi people used a wide variety of environmental areas. Adaptations to the extreme heat of the lowland river environment and the use of upland areas with cold winters are documented. The use of hunting to supplement horticulture was probably variable through time. The Virgin Anasazi probably never abandoned horticulture in favor of full-time hunting, but it is possible that a pattern of residential mobility existed allowing groups moving to buffer against hard times. Lowland populations probably maintained contact with upland groups and even seasonally visited for trade of pottery, valued goods, or food. Maintaining this contact would continue relationships and allow small groups of people to move in times of localized environmental stress and possibly join other residential groups. As populations increased the available land use
areas became more valuable and some form of claim for resources may have
If specific trading partners or family kin groups left the lowland areas the trade
patterns would end. Drew's Site from this sample had a large amount of
corrugated pottery that never reached the lowland. The Shivwits Plateau had
continued use after contact with the lowland ended.

The Shivwits Plateau is an intermediary zone in climate and geography. It has
usually been considered a passageway between the other better known
archaeological areas. Throughout this study I have considered the nature of the
Shivwits Plateau in that intermediate range. It is apparent after compiling site
information, analyzing pottery, and walking the sites of the Shivwits Plateau, that
it is more than just the "land between." The Shivwits Plateau is an important area
with substantial archaeological resource. The overall goal of this research was to
provide a base of information about the archaeological resources and the
characteristics and distribution of Shivwits Plain and Corrugated pottery on the
Shivwits Plateau. While this chapter ends this study it is not the end of
exploration of the Shivwits production zone.
REFERENCES CITED

Allison, J. R.


Allison, J. A. and A. Coleman

Amsden, C. A.
1949 Prehistoric Southwesterners from Basketmaker to Pueblo. Southwest Museum, Los Angeles.

Arnold, D. E.

1992 Late Basketmaker Archaeology on the Middle Virgin River, Washington County, Utah. Utah Archaeology 5:77-101.

Baldwin, G. C.


146
Brown, D. E. (editor)  
1994 *Biotic Communities Southwestern United States and Northwestern Mexico*. University of Utah Press, Salt Lake City.

Brunson, J. L.  

Buck P. and L. Perry  

Colton, H. S.  

Colton, H. S. and L. L. Hargrave  

Cordell, L.  

Dalley, G. F. and D. A. McFadden  


Dean, J. S.  

DeWall, A. A.  
Fairley, H.


Fairley, H. and P. R. Geib


Geib, P. and K. Spurr


Hayden, I.


Heacock, L. A.


Heid, J. L.

1982 Settlement Patterns on Little Creek Mountain, Utah. Western Anasazi Reports. 3(2). Cedar City, Utah.

Herron, J. M.

1998 Cultural Resource Inventory Record BLM – 014-1998-01, Grassy Mountain / Agway Valley Push Project. Ms. on file Arizona Strip Bureau of Land Management file, St. George, UT.
Huffman, J.

Huntoon, P. W.

Janetski J. and J. Wilde

Larson, D. O. and J. Michaelsen

Lucchitta, I.

Lyneis, M. M.


1999b A Guide to Virgin Anasazi Ceramics, Ceramics Workshop Jennifer Jack-Dixie Chapter Utah Statewide Archaeological Society. Ms. on file University of Nevada Las Vegas, Department of Anthropology and Lost City Museum, Overton, NV.

Lyneis, M. M., M. Rusco, and K. Myhrer

McFadden, D. A.

Moffitt, K. and C. Chang

Myhrer, K.

Myhrer, K. and M. M. Lyneis

Nusbaum, J. L.
1922 A Basketmaker Cave in Kane County, Utah, with notes on the artifacts by A. V. Kidder and S. J. Gurnsey. Indian Notes and Monographs, Museum of the American Indian, Heye Foundation, New York.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Olson, K.  
1979 An Attribute Analysis of Muddy River Ceramics. Western Anasazi Reports, 2:303-364.

Orton, C., P. Tyers and A. Vince  
1993 Pottery in Archaeology. Press Syndicate of the University of Cambridge, Cambridge.

Plog, F.  

Rafferty, K.  

Rice, P. M.  

Rye, O. S.  

Shroeder, A. H.  


Shutler, R. Jr.  

Skibo, J. M. and G. M. Feinman (editors)  

Sullivan, A. P.  
Teague, G. A. and C. McClellan

Talbot, R. K.

Thompson, R. A.

Walling, B. A. and R. A. Thompson
1988 Archaeology of the Dead Raven Site. Prepared for the Kane County Commission by Intersearch, Cedar City.

Walling, B. A., R. A. Thompson, G. F. Dalley and D. G. Weder

Warren, C. N.

Wells, S. J.

Westfall D. A., W. E. Davis, and E. Blinman

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