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Lithics and Mobility at Land Hill and Hidden Hills: A Study of the Stone Tools and Debitage at Sites in the Santa Clara River Basin and on the Shivwits Plateau

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A thesis submitted to the faculty of
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Master of Arts

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ABSTRACT

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The Land Hill and Hidden Hills study areas were the site of the 2006 and 2007 Brigham Young University's archaeological field schools. The two study areas are located in contrasting environments; the Land Hill area is located along the Santa Clara River in southwestern Utah, and the Hidden Hills area was is located on the Shivwits Plateau in northwestern Arizona. The Land Hill study area is located within a well-watered environment which would support a primarily horticultural lifestyle. The Hidden Hills study area is located in an arid environment without permanent streams which would support a more mobile hunting lifestyle. The contrasting environments of these two study areas allowed for a study of the similarities and differences in the use of stone tools. Based on the results of the analysis and comparison of the stone tool and debitage assemblages, from sites in both areas throughout time, suggests that the people in the Land Hills study area actually seemed to be living a lifestyle similar to the people in the Hidden Hills area.

Keywords: stone tools, biface, projectile point, chipped stone, debitage, Virgin Ancestral Puebloan, Utah, Arizona, Santa Clara, Shivwits Plateau

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Appendix C

Appendix D

1 | Introduction

In 2006 and 2007, BYU conducted an archaeological field school in the Virgin Anasazi region of the Southwest. Field research was conducted in two areas approximately 80 km (50 miles) apart. The first area, Land Hill, is located along the Santa Clara River in the Saint George Basin in southwestern Utah; the second area, Hidden Hills, is located on the Shivwits Plateau in northwestern Arizona. Each area includes multiple archaeological sites. This thesis is a comparison of the flaked stone tools and the debitage resulting from their manufacture in these two areas, in order to infer past human subsistence behavior. This study seeks to identify evidence of different activities carried out at the sites. I examine the similarities and differences in what stone tools were being produced, how they were being produced, and the raw materials used. The work reported here shows that there are differences between the stone tools being created and used in the Land Hill and Hidden Hills areas, however, these differences were not as significant as originally expected. The stone tool assemblages from the Land Hill and Hidden Hills areas are very similar overall. The sites in the Land Hill study area actually had more formal tools than the sites in the Hidden Hills area which proves my original hypothesis, that the people living in the Land Hills sites emphasized farming and did very little hunting wrong. The results of the analysis suggests that the people in the Land Hills study area actually seemed to be living a lifestyle similar to the people in the Hidden Hills area.

The questions that I pose are the following: (1) what do the results of the analysis of the stone tools and debitage assemblages from sites located within the Land Hill and Hidden Hills study areas tell us about the differences in what stone tools were being used? (2) Is there a significant difference in what tool are being produced at the sites in the Land Hill and Hidden

Hills study areas between the sites in the two areas? (3) What do the patterns of stone tools and debitage tell us about the overall mobility at Land Hill and Hidden Hills throughout time? The reason I ask these questions is because the two study areas have contrasting environments; the Land Hill study area is in the Saint George Basin along the Santa Clara River, and the Hidden Hills area is near the on the Shivwits Plateau in an area that lacks permanent streams. Because of these contrasting environments the subsistence strategies followed by the people in the past may have also been dissimilar. The reason for studying variations in the stone tool assemblages is that the variations it what tools are present or absent at a site can potentially show the similarities or differences in how people were living. I hypothesize the variations that will be seen in the stone tool and debitage assemblages are:

1) The differences in subsistence are a greater emphasis on farming in the river basin versus more hunting on the plateau. The Land Hill area is located next to the Santa Clara River in the Saint George Basin in southwestern Utah. The presence of the river creates a well-watered environment. The presence of the Santa Clara River near the Land Hill sites would theoretically provide the prehistoric inhabitants with enough water to live a predominantly horticultural lifestyle. The Hidden Hills area is several thousand feet higher in elevation on the Shivwits Plateau in northwestern Arizona, and the study area is located within a pinyon-juniper woodland that lacks permanent streams. The lack of permanent streams near the Hidden Hills study area is the reason the hypothesis that the prehistoric inhabitants may have relied more on hunting and gathering rather than relying solely on farming is a possibility.

2) More hunting on the plateau will be evidenced by more projectile points and bifaces, as well as the debitage related to biface and projectile point production. Prehistoric groups relied on the use of bifaces, projectile points, and other formal tools for hunting. If there is a higher

percentage of bifaces and projectile points in comparison to the other tool types, then it may mean that there was probably more of an emphasis on hunting rather than farming.

3) If there was more farming along the Santa Clara River, then there should be less projectile point and formal tool production. Instead, expedient tool production, as well as bipolar and unifacially reduced cores will be predominant. The reason that informal or expedient tools would be more predominant is because; prehistoric groups who practiced a lifestyle that emphasized horticulture would generally not need many hunting tools that can reused and reworked. These people would not have as much of a need to create a tool that can last a long time, as well as, a tool easy to carry around while traveling long distances. Therefore, they may not invest the time into creating them, instead they would use more expedient and unretouched flakes. If there is a higher percentage of expedient tools rather than formal tools, then the prehistoric group may have been living a more horticultural and sedentary lifestyle.

Archaeologists have used the label "Virgin Anasazi" to refer to the cultural group that practiced horticulture in the Virgin River drainage of southwestern Utah, northwestern Arizona, and southeastern Nevada from A.D. 200 to 1250 or 1275 (Allison 2000:25). Some archaeologists feel that the term may be inappropriate, and prefer to use the term "Virgin Ancestral Puebloan", or the "Virgin People". For this thesis I will be referring to this cultural group as the Virgin Branch Puebloan (VBP), because I feel that it is the best term to describe the cultural group I discuss in this thesis.

I used the artifacts collected from 76 sites, located in Land Hill and Hidden Hills, that were surveyed, excavated, and either recorded or rerecorded in 2006 and 2007 during a field school conducted by BYU. Of the 76 sites, there were 21 in Utah and 55 in Arizona. Of the 55 Arizona sites, 19 had at least one test pit excavated. In Utah, 13 had at least one test pit excavated, and at two of the sites, there were extensive investigations, including the excavations of architectural features. From these tested and excavated sites, I analyzed all of the flaked stone tools and debitage that were collected. The analysis consisted of tool or flake type identification, material type identification, measuring, counting, and weighing of each object.

Artifacts recovered from one additional excavation in the Land Hill area is also included because it is close to the other Land Hill sites excavated by the 2006 and 2007 BYU field schools. I gathered data from excavations done at Three Mile Ruin (42WS50) excavated in 1962 by the University of Utah. The artifacts from Three Mile Ruin are located at the Natural History Museum of Utah and were reanalyzed by me for this thesis.

Although the two areas have contrasting environments, the occupational timelines of the sites are similar. The sites in the Hidden Hills and Land Hill study areas span from Pueblo I-III. Dating of the sites was determined by using architecture, ceramics, and C-14 dating. Due to the similarity in architecture and ceramics found at the sites in both areas, and the fact that many of the sites date to around the same time periods, I was able to make comparisons between the two areas throughout time. Table 1.1 lists the sites that have a reliable date associated with them, and the time period that each date to for the temporal comparisons.

The rest of the thesis is outlined as follows; chapters 2 and 3 provide the background information for the thesis. In Chapter 2 I provides a description of the environment of the Land Hill and Hidden Hills study areas. I also provide an introduction and provides a simplified chronological scheme for the Virgin Branch Puebloan region, and provides an overview of the excavations that were done in the Land Hill and Hidden Hills study areas. Chapter 3 discusses some of the past research done by William Parry and Robert Kelly (1987) about stone tools and mobility, which helped me to form my hypotheses. There is an outline of the methods that were used in my analysis of the stone tools and debitage, and definitions of the technological terms used.

Table 1.1. Time periods and list of corresponding sites.

Time Period	Land Hill Sites	Hidden Hills Sites
Pueblo I	42WS195	AZ A:10:24 (BLM)
	42WS1894	AZ A:10:29 (BLM)
	42WS1895	
	42WS1931	
Pueblo II	42WS1929	AZ A:10:26 (BLM)
	42WS1342	AZ A:10:36 (ASM)
	42WS1890	AZ A:10:10 (ASM)
	42WS210	AZ A:10:82 (ASM)
	42WS1344	AZ A:10:25 (BLM)
	42WS1345	AZ A:10:27 (ASM)
		AZ A:10:37 (ASM)
Pueblo III	42WS50	AZ A:10:16 (BLM)
		AZ A:10:20 (BLM)

Finally, in Chapters 4 and 5, I discuss my findings and what they mean. Chapter 4, presents what was found through my analysis of the stone tools and debitage from the Land Hill and Hidden Hills study areas. Chapter 5 is the concluding chapter that reviews and wraps up the thesis. This chapter starts discusses ideas about potential research that could possibly be done in the future and answers the questions posed at the beginning of the thesis.

2 | Background

This chapter provides the background information for the two research areas. The first section describes the location and environment of the two study areas. The second section discusses the archaeological culture that inhabited the region. The final section of this chapter provides an overview of the archaeological work that has been done in the relevant areas.

Environment

The Virgin Branch Puebloans (VBP) were a prehistoric group that inhabited the westernmost area of the Puebloan culture region in the American Southwest. The Virgin Branch Puebloan occupied the general area where Utah, Arizona, and Nevada meet. Lyneis (1995) divides this area into three distinct regions. The first region is in the Southern Nevada Lowlands, where the Moapa Valley is located. This region includes sites located along the Virgin and Muddy Rivers and it has a dry hot environment with about 10 cm of rainfall a year (Lyneis 1995). The second region, the St. George Basin, is located in southern Utah, which lies at an intermediate elevation between the Virgin Lowlands and the Plateaus, with an elevation of about 750-11250 meters above sea level (Lyneis 1995). The basin gets more rainfall than the lowlands and therefore has multiple springs and drainages that support rich vegetation (Lyneis 1995:203). The mountains surrounding the basin are also an important water source. Snow melt from the nearby Pine Valley Mountains flows down into the Santa Clara River, and the Virgin River gets some of its water from the uplands to the east. The fourth region is the Colorado Plateau, which extends from southern Utah to northwestern Arizona. Vegetation in this region includes pinyon and juniper woodlands in higher elevations. In the lower elevations vegetation includes Mohave, Sonoran, and Great Basin Desertscrub vegetation. The “annual precipitation ranges from about 23 to 33 cm, and about 60% falling in the winter” (Lyneis 1995:203).

The two study areas are located within the Basin and Plateau regions. The two areas are approximately 80km (50 miles) apart. The Land Hill area is located along the Santa Clara River in the Saint George Basin in southwestern Utah. The Hidden Hills and is located farther south and several thousand feet higher in elevation on the Shivwits Plateau in northwestern Arizona.

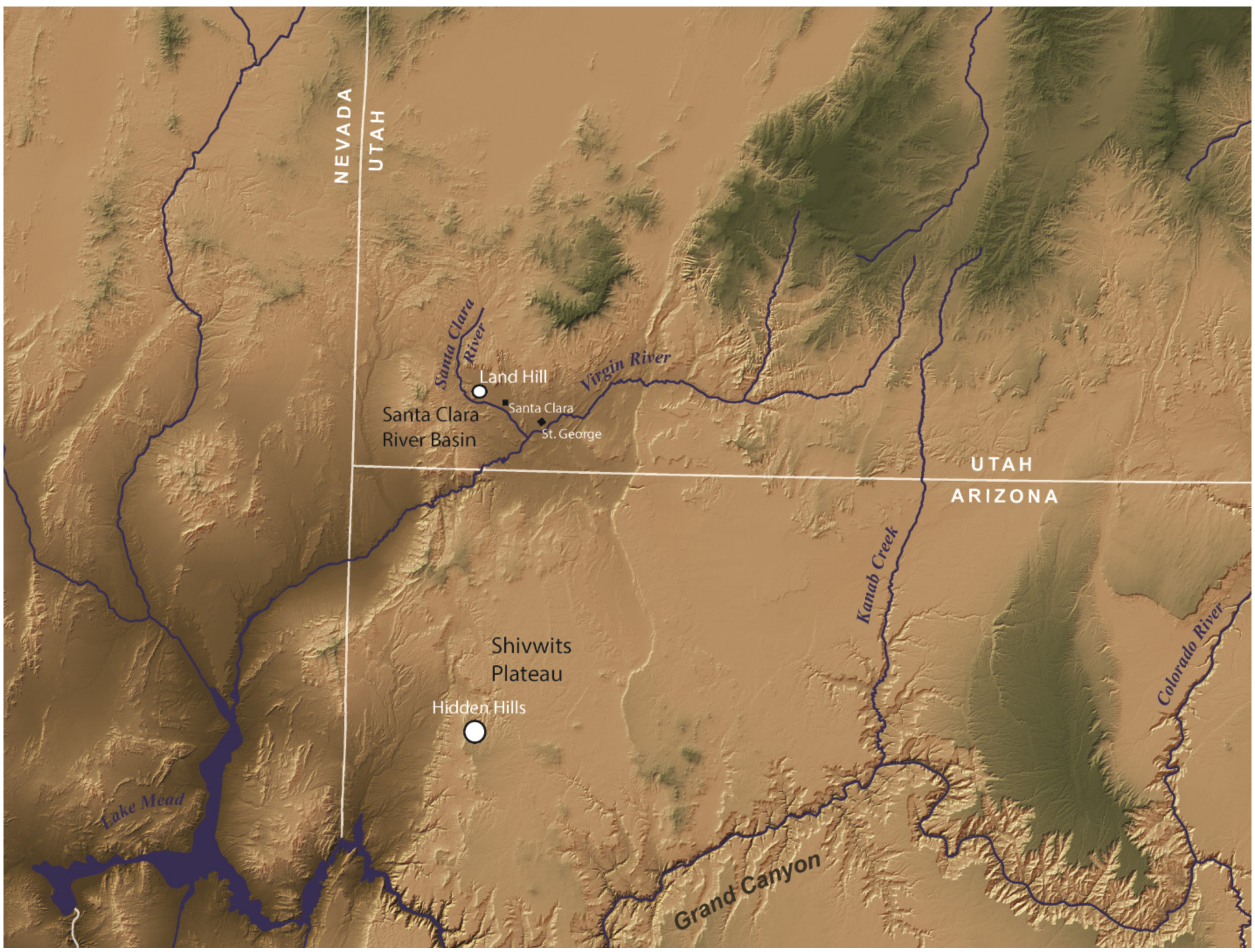

Figure 2.1. Overview showing the locations of the Land Hill and Hidden Hills study areas. Photo courtesy of Scott Ure.

Figure 2.2. View of Land Hill. Photograph from Brigham Young University field school archives.

Saint George Basin

The elevation of the Saint George Basin ranges from around 2,800 to 11,322 feet above sea level with a dry and warm climate. According to the Western Regional Climate Center, the annual average rainfall in this area is around 8 inches. It has about 215 frost-free days and 244 days without a hard freeze. The vegetation within the Saint George Basin is dominated by creosote bush and other associated Lower Sonoran plants, although there are cottonwood, mesquite, and desert willow found along the Santa Clara River (Allison 1990).

The presence of the Virgin River and its northern tributaries (Ash Creek, Quail Creek, and the Santa Clara River) within the Saint George Basin created a well-watered environment. The nearby Santa Clara River provided the prehistoric inhabitants with enough water to live and maintain a predominantly horticultural subsistence lifestyle (Allison 1990, 2006; Dalley and MacFadden 1988). The combination of a warm climate and an adequate water source also attracted settlers in the nineteenth century, and many of the towns they founded support large populations today. The Land Hill area is located within the Saint George Basin and includes a relatively dense cluster of sites located along a stretch of the Santa Clara River, west of the city of Santa Clara.

Figure 2.3. Photograph showing the environment of the Hidden Hills study area. Photograph from Brigham Young University field school archives.

Shivwits Plateau

The Shivwits Plateau covers more than 1000 square miles along the western edge of the Colorado Plateau north of the western Grand Canyon. The Hidden Hills area is located in this region. The Hidden Hills study area is located west of Poverty Mountain and about 45 miles south of the Utah-Arizona state line. It is bordered on the west by the Grand Wash Cliffs, which mark the western edges of both the Shivwits Plateau and the Colorado Plateau province. Hidden Canyon is the northern boundary and Pigeon Canyon, the southern boundary of the study area. The eastern edge of the study area is arbitrarily marked by the section line dividing Range 12 W and 13 W in the Public Lands Survey System (Allison 2010).

The Hidden Hills study area is located within a pinyon-juniper woodland that lacks permanent streams. Though there have been no formal subsistence studies completed for the Hidden Hills area, there was a small amount of faunal and macrobotanical data collected during the field schools. The findings support the theory that people may have been dry farming at some of the sites within the Hidden Hills study area. Records from a nearby remote weather station, however, suggest that summer rainfall may not have been sufficient to dry farm maize without trapping runoff (Allison 2000:168).

There are different theories about the subsistence strategies of the Virgin Branch Puebloan. In a study done on the VBP in the St. George Basin, Allison (1990) evaluated two different subsistence models for the Anasazi, one proposed by Dalley and McFadden (1988) and the other by Westfall et al. (1987). Dalley and McFadden (1988) argued that there was very little hunting, wild plant gathering was not important, and people were probably relied almost entirely on domesticated plants. Westfall et al. (1987) argue that hunting was very important, though there was a shift towards agriculture in the later period. Allison (1990) argues that there is strong evidence for intensive agriculture, but it was supplemented by hunting small and large game and the gathering of wild seeds.

The Virgin Branch Puebloans

The Virgin Branch Puebloan (VBP) is the western-most Ancestral Puebloan cultural group. The VBP are not as well documented or clearly defined as some other cultural groups in the Southwest. What archaeologists do know is that there were people occupying the region located from Kanab Creek (east) to Moapa Valley (west) and from the St. George Basin (north) to the Shivwits Plateau (south). The northern, western, and southern borders of this region were shared with different non-Ancestral Puebloan societies. There are three distinct areas within the region which help to define and understand where this cultural tradition was practiced: the plateaus, the basin, and the lowland areas, which are primarily found near rivers (Lyneis 1995: 202). These regions seem to have supported a large population from about A.D. 1 to 1300 (Allison 2010; Lyneis 1995). Archaeologists are still trying to determine whether there was really only one distinctive, well-defined cultural group in the area during that time.

There have not been many well documented studies in the VBP area. Lyneis (1995) wrote the article "The Virgin Anasazi, Far Western Puebloans," and this resource is the best synthesis of the VBP since that time. In that article, Lyneis discusses who the Far Western Puebloans were and how they lived. Lyneis outlines six different occupation periods in the VBP region, from Basketmaker II through early Pueblo III. The area is actually much more complex. While there is evidence of occupation of the region from Basketmaker II through Pueblo III, it is unclear whether the occupation was from a single cultural group or multiple groups moving in and out of the area.

The six occupation periods that Lyneis (1995) outlines a simplified chronological scheme for the Virgin Branch Puebloan region. The following period descriptions are meant to provide an idea of what may have been happening in this region during different times, but they are not to be taken as the full and complete representation of what was happening in the Virgin Branch Puebloan region during a specific time period.

Basketmaker II sites date from approximately 300 B.C. to A.D. 400. The buildings during this time consist of pit houses and rockshelters accompanied by outdoor storage cists. The sites were generally small and probably only consisted of small family groups living there seasonally (Lyneis 1995: 210-210).

Pueblo I sites date to approximately A.D. 800-1000. The building style during the Pueblo I time period consisted of slab-lined pit structures that sometimes included benches, and on some occasions, ventilation shafts, but no antechambers have been found for this time. There is evidence that this time period marks a change in the type of storage features used; there appears to have been a greater reliance on above ground storage rooms, which are lined up usually behind pit structures (Lyneis 1995:211-212).

Early Pueblo II sites date to about A.D. 1000 –1050, and they are generally very similar to Pueblo I sites; however, they have more storage rooms. The shape of storage rooms in Early Pueblo II are more rectangular as opposed to the oval storage rooms found for the Pueblo I period. Late Pueblo II sites date to A.D. 1050-1100 and are characterized by a change in architecture. Late Pueblo II sites have habitation rooms on the surface which are connected to above-ground storage rooms, pit structures are still utilized, and communities are typically set up in a courtyard fashion. It is believed that Pueblo II sites supported larger groups living together which could account for the change in architecture (Lyneis 1995:215-216).

According to Lyneis, the Early Pueblo III period dates from A.D. 1150 –1225. Radiocarbon dates, however, demonstrate the occupation of the Virgin region lasted until sometime close to A.D. 1300 (Allison 2010). These sites consist of enclosed circular courtyards with above-surface storage and habitation rooms, as well as pit structures (Lyneis 1995).

Archaeological Excavations

The archaeological excavations carried out in the Land Hill and Hidden Hills areas have been a mix of cultural resource management and academic research field work. In recent years there has been some work done on the Shivwits Plateau by the University of Nevada, Las Vegas. Below, I outline how and when the sites discussed in this thesis were excavated and provide the total numbers of tools, projectile points, and debitage collected.

BYU Field School Sites

During 2006 and 2007, the BYU field school documented 21 sites in Utah and 55 sites in Arizona. There were many different types of sites identified during the field school. The sites that were excavated were habitation sites and a few of the larger non-habitation sites. In Utah, many of the sites that were documented but not tested were rock art sites. In Arizona, many of the sites were non-tested artifact scatters. Of the 55 Arizona sites, 19 had at least one test pit excavated. In Utah, 13 of the sites had at least one test pit excavated, and at two of the sites there were extensive investigations, including the excavations of architectural features. Below, I describe the sites that were used in the temporal comparison of the stone tools and debitage assemblages; these sites were chosen for their favorable chronological comparisons between the Land Hill and Hidden Hills study areas. Tables 2.1 and 2.2 provide the radiocarbon dates that have been gathered in both areas.

Table 2.1. Radiocarbon dates, approximate time period for selected sites in Hidden Hills study area.

Site Number	Radiocarbon Date	Material Dated	Approximate Time Period
AZ:A:10:24 (BLM)	1050+/-40BP	Maize	Pueblo I
	1090+/-80BP	Charcoal	
	1160+/-40BP	Maize	
	1170+/-40BP	Maize	
	1390+/-50BP	Roof beam	
	1300+/-60BP	Charcoal	
AZ:A:10:29 (BLM)	1480+/-70 BP	Charcoal	Pueblo I
	1370+/-70 BP		
AZ:A:10:26 (BLM)	990+/-40BP	Maize	Early Pueblo II
AZ:A:10:36 (ASM)			Early Pueblo II
AZ:A:10:10 (ASM)	850+/-40 BP	Charcoal	Early-Mid Pueblo II
AZ:A:10:82 (ASM)			Mid Pueblo II
AZ:A:10:25 (BLM)	1230+/-40 BP	Maize	Mid Pueblo II
AZ:A:10:27 (ASM)	830+/-60BP	Charcoal	Late Pueblo II
	170+/-60BP	Charcoal	
AZ:A:10:37 (ASM)			Late Pueblo II
AZ:A:10:16 (BLM)			Pueblo III
AZ:A:10:20 (BLM)	840+/-40BP	Maize	Pueblo III
	750+/-40BP	Charcoal	
	650+/-40BP	Charcoal	

Note: When C14 dates were not available the age estimates were based on ceramics following the methods outlined in Allison (2000)

Table 2.2. Radiocarbon dates, approximate time period for select sites in the Land Hill study area.

Site Number	Radiocarbon Date	Material Dated	Approximate Time Period
42WS185			Late Basketmaker III Early Pueblo I??
42WS195	1220+/-40BP	Maize	Pueblo I
	1300+/-40BP	Maize	
42WS1894			Pueblo I
42WS1895			Pueblo I
42WS1931	1280+/-40BP	Maize	Late Pueblo I??
	1260+/-40BP	Maize	
42WS1929			Early Pueblo II??
42WS1342			Early Pueblo II and Mid to Late Pueblo II
42WS1890	900+/- 40BP	Maize	Mid to Late Pueblo II
42WS210			Pueblo II
42WS1344			Late Pueblo II??
42WS1345	880+/-40BP	Maize	Late Pueblo II??
	930+/-40BP	Maize	
42WS50	1020+/-40 BP	Maize	Pueblo III
42WS2187			Pueblo III
42WS2188			Pueblo III

Note: When C14 dates were not available the age estimates were based on ceramics following the methods outlined in Allison (2000).

The procedure that the field school followed at many of the sites included mapping, with surface collection of all the formal tools and diagnostic ceramics that were found. In many of the sites, at least one 2 x 2 meter surface collection area was selected within which all of the surface artifacts were collected. Finally, in one of the corners of the 2 x 2 meter collection area a 1 x 1 meter test pit was placed. Figure 2.4 is the final map of site AZ:A:10:20 showing the location of point plotted artifacts and the locations of where the test pits and surface collection units were located in relation to major features at the site. I have only included the site map for AZ A 10:20 as an example to better illustrate the excavation methods used by the field school, the rest of the site maps were not necessary.

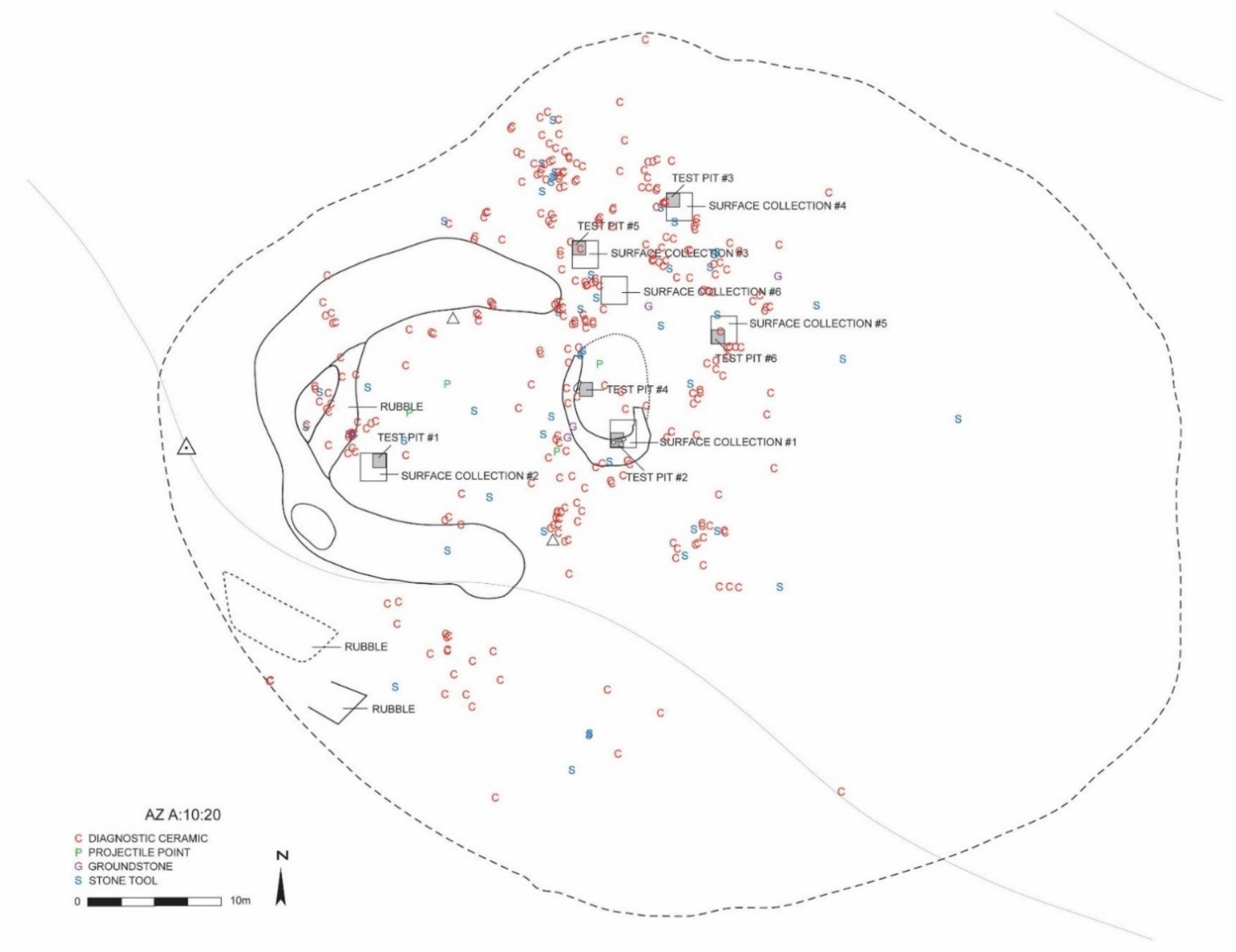

Figure 2.4. Map of AZ A:10:20 showing the locations of the point plotted artifacts, the surface collection units, and test pits. Map from Brigham Young University's field school archives.

Arizona Sites

AZ A 10:24 (BLM) (Pueblo I). This site was a large architectural complex with rubble mounds. The site had an old road running through it. The research design established for this site involved complete surface collection areas, test pits, and intensive mapping. There were 11 surface collection areas that were established across the site; with the collection areas placed where surface artifacts were abundant.

AZ A 10:28 (BLM) and AZ A 10:29 (BLM) (Pueblo I). These sites were originally recorded separately, but they were located very close together so Allison decided to group them into one site. The site consisted of a D-shaped rock structure, a C-shaped rock feature, a round structure, and a possible roomblock. The field school collected artifacts in three 2 x 2 meter surface collection grids but only excavated two 1 x 1 test pits within the surface collection grids one and three.

AZ A 10:26 (BLM) (Pueblo II). This site was 125 m north to south, and 125 m east to west. It was located on a relatively flat area, with a dirt road that runs along the northeast section of the site. There was a roomblock of three, or possibly four, rooms. In some places, there were upright slabs; these slabs appeared to mark the locations of the rooms, particularly in the eastern end of the roomblock where there were several upright slabs in a row. This feature was the only clear evidence of architecture on the site. The field school students collected artifacts from three 2 x 2 surface collection units and excavated one test pit within each.

AZ A 10:36 (ASM) (Pueblo II). This site was located on a small ridge north of a modern dirt road. It had an artifact scatter including ceramics and chipped stone. It also had an obvious roomblock with multiple upright slabs. The site also had evidence of several other rubble mounds, including one that was clearly circular. There was a circular rock structure 7.6 meters in diameter. There were two possible semi-circular rooms. The northern room contained very little rubble but appeared to have almost the entire room outlined with slabs. The southern room was full of rubble and has a possible wall along the west edge. There was a rubble mound that was roughly 8 m long and 2 m wide. It had heavy concentrations of rubble on the north and south ends. The field school students collected artifacts in one 2 x 2 meter collection unit. There were also three test pits excavated: one in the 2 x 2 collection unit, and two additional test pits in the circular rock structure.

AZ A 10:10 (ASM) (Pueblo II). This site consisted of a C-shaped mound. There was a mounded structure that was mostly defined as a low mound of sediment, within which at least three rooms were visible. There was a circular structure on the southwest end of the mounded structure. There were two rock concentrations on the site as well. One was south of the mounded structure. The second was southwest of the circular structure and was partially comprised of rubble from the structure, but some of the stones appear to be natural rock outcroppings. The students collected artifacts from one 2 x 2 meter collection unit with a test pit.

AZ A 10:82 (ASM) (Pueblo II). This site was located on a hill, there were two features that were noticed on the site; a C-shaped rubble mound and an artifact scatter. The rubble mound measures approximately 30 m from end to end and opens to the south. There was a possible roomblock, but evidence for room boundaries was not visible on the surface. The students collected artifacts from two 2 x 2 meter collection units, each with one test pit.

AZ A 10:25 (BLM) (Pueblo II). This was a large site, approximately 80 m north to south and 135 m east to west. It consisted of several long linear rubble mounds that were most likely roomblocks. There was also a circular rock alignment, several smaller rubble mounds, and several slightly raised mounds with very little to no rubble on them. The surface had the highest density of artifacts near the rubble mounds at the center of the site. There was a road that ran east to west and crosscut the site; it had disturbed several of the rubble mounds. Students collected artifacts from four 2 x 2 meter surface collection units, each had a text pit excavated. In addition to the surface collection and test pits, there was a test pit excavated in the rock alignment.

AZ A 10:27 (ASM) (Pueblo II). This site was located on a hilltop and consisted of at least three, possibly four, circular features, and associated or attached rectangular roomblocks. One of the round features was a masonry-lined pit structure that may have been a kiva feature that was located south of the main slope. There were very few associated artifacts down the slope from the kiva. The area between the main features had dark soil, possibly midden. The artifacts were very dense near the cluster of features.

AZ A 10:37 (ASM) (Pueblo II). This site was located on top of a high ridge with a gentle downward slope towards the south and southeast. This site consisted of a C-shaped rubble mound that may have nine or 10 rooms within it. There was one large slab-lined structure that may have been a habitation room. The site also had a slab-lined wall that could have been another habitation room and at least one isolated room to the south of the rubble mound. Two rock concentrations that may have also been rooms were to the south and southeast of the isolated room. The site boundary extended from the rubble mound to the south and east. The artifacts at this site were collected in three 2 x 2 meter surface collection units, and each surface collection unit had an excavated test pit.

AZ A 10:16 (BLM) (Pueblo III). This site was located in a relatively flat location northeast of a cliff edge. There was a natural limestone mound on the southwest side of the site. The site consisted of a large rubble mound and a rock alignment. The rock alignment ran east to west and consisted of six rocks, five of which appeared to be upright slabs. It was located south-southeast of the rubble mound. The artifacts at this site were collected in four surface collection units. There were no excavations done at the site.

AZ A 10:20 (BLM) (Pueblo III). This site was located on a small hill in a patch of juniper trees. There was a C-shaped roomblock measuring about 18.1 meters south to north and 18.5 meters from east to west. There was a U-shaped structure about 10-15 meters away from F5. There was also a rubble concentration on the south end of the site. The artifacts from this site were collected from six surface collection units, and each had one test pit excavated.

Utah Sites

42WS195 (Pueblo I). This site is located on the top of Land Hill. At 42WS195, two slab lined cists were excavated in 2006. In addition to the two cists; a 1 x 3 meter test trench was opened in a rubble mound where the exact locations of the walls were hard to determine. A second test trench was opened measuring 2 m long by 50 cm wide and it was placed within a severely damaged architectural feature that was possibly a large cist or a slab-lined pit structure. In addition to the excavation, the field school surface collected in transects across the entire site.

42WS1894 (Pueblo I). This site was located on the southeast slope of Land Hill, by the road. It is just north of 42WS195. This site consists of two rubble mounds, two cists, and a possible pithouse. The artifacts from this site were collected in three 2 x 2 meter surface collection units. There was only one test pit excavated in one of the collection units.

42WS1895 (Pueblo I). This site consists of a circular rubble mound. The field school collected all artifacts in two 2 x 2 surface collection units, excavated a test pit in one surface collection unit and excavated another 1 x 1 meter test pit in the circular rubble mound.

42WS1931 (Pueblo I). This site had a low, multi-room rubble mound, at least one isolated room, and extensive but shallow midden deposits. In 2007, the field school students were able to completely excavate four rooms found within the rubble mound, as well as the isolated room. In addition to the excavations, the field school students surface collected the entire site.

42WS1929 (Pueblo II). This site is on the edge of a low terrace slightly above, and east of, the Santa Clara River. The site consists of an alignment of stones, including upright slabs. The artifact collection activities on this site were one 2 x 2 meter surface collection unit and one excavated 1 x 1 meter test pit on the northeast end of the site.

42WS1890 (Pueblo II). This site is located in the valley by the Santa Clara River near the base of Land Hill. The site consists of a large arching, low rubble mound, which was probably a C-shaped roomblock and a circular depression, which was a probably a pithouse. The field school students collected artifacts from four 2 x 2 meter surface collection units and two 1 x 1 meter excavated test pits.

42WS210 (Pueblo II). This site is located on the west facing rim of Land Hill above the Santa Clara River. The site includes a continuous grouping of rock art running along 500 m of the Land Hill rim. There are also a few rockshelters on a bench along the rock art panels. The artifact collection on this site came from three 1 x 1 meter test pits and a small test trench excavated in the rockshelters.

42WS1344 (Pueblo II). This site is located on a small hill overlooking a road. The site consists of rubble mounds and a few rock alignments which could have been walls. There was also a large lithic and ceramic scatter located on the site. The field school students surface collected all of the diagnostic tools. The students also collected artifacts from one 2 x 2 meter surface collection unit and two test pits were also excavated on the site.

42WS1345 (Pueblo II). This site is located on a terrace east of the Santa Clara River. The site was badly vandalized and has an associated artifact scatter and possible linear roomblock, though it was very hard to determine. There is a large amount of rubble around the structural areas. The artifacts at this site were collected in eleven 2 x 2 meter surface collection units, two test pits.

42WS50 (3-Mile Ruin).

The University of Utah worked on 42WS50, a site along the bank of the Santa Clara River about three miles west of the town of Santa Clara. In 1949 the University of Utah conducted a survey of the Virgin River drainage area where they identified possible structures. They found a series of connected rooms which are organized in a large circular pattern with a diameter of about 115 feet. The rooms measure about six by ten and a half feet. In 1962. The University of Utah returned to the site and excavated part of the site (Aikens 1965).

The site consists of a courtyard-type pueblo with a number of contiguous rooms arranged in a circle around a central plaza. Excavations at the site uncovered 12 surface rooms and two pit structures. One of the rooms excavated, appears to be a primary dwelling unit, two of the rooms seemed to have originally served as storage rooms and secondarily as dwellings, and the nine remaining rooms appeared to be storage rooms. The pit structures both had hearths; these structures, however, are too small to be considered as dwellings (Aikens 1965).

3 | Methods

This chapter outlines the methods that were used in my analysis of the stone tools and debitage and the reasons behind those methods. It also provides definitions of the terms I use. I begin this chapter with a discussion of some of the previous research about stone tools and mobility that helped me form my hypotheses.

Stone Tools and Mobility

Archaeologists have long studied mobility and sedentism in archaeology. Studies dealing with stone tool manufacture and discard have often been linked to aspects of hunter-gatherer subsistence and mobility strategies. Many of the studies outline different theories about the mobility level of a group and what stone tools and debitage should be found at a site given that level of mobility (Andrefsky 2008; Carr 2012; Driskell 1986; Kelly 1983; Macdonald 2008; Odell 1996). This thesis is an examination of stone tools and debitage found at sites in contrasting environments to see whether there are any similarities or differences between the two assemblages. The hypotheses that this thesis is based on are: 1) The differences in subsistence may indicate a greater emphasis on farming in the river basin versus more hunting on the plateau; 2) More hunting by the people inhabiting the sites found in the Hidden Hills study area will be evidenced by more projectile points and debitage related to projectile point production; 3) If there was more farming along the Santa Clara River, then there should be less evidence of projectile point production, and evidence of other tools related to sedentism (e.g., utilized and retouched flakes) will be more predominant.

Since the 1970s archaeologists have been asking questions about stone tools that explore links between technology and aspects of different hunter-gatherer mobility and subsistence strategies. They have found that there are different levels of mobility and sedentism that can be identified through the stone tool assemblages left at a site. Binford (1979) discussed the formation of sites in reference to curated technologies. In another article Binford (1980) proposed two main types of mobility: residential mobility, which involved moving the base of operations for a group, and logistical mobility, which involved part of the group going out and harvesting or gathering and returning to the main base of operations. Most hunter-gatherer groups tend to use a mix of these methods. In 1992, Robert Kelly discussed the concept of mobility versus sedentism in archaeology. He proposed that there should not be a study of mobile versus sedentary but rather a group can be mobile for a while and slowly reduce or increase their mobility over time, depending on the surrounding conditions. He argues that there is no "Garden of Eden" on earth; no single location that can provide for all of a person's needs (Kelly 1992), and because of this, archaeologists need to recognize that there are different levels of mobility instead of just sedentary or mobile.

Early research into chipped stone technology by archeologists tended to focus on formally crafted stone tools. Later there was a shift to a study of the casual, expedient tools and cores. The expedient tools are generally made without any extra time or effort put into them. They were used for a specific purpose and most likely discarded afterwards. Parry and Kelly (1987) wrote about expedient core technology and sedentism. In their paper, they discuss the apparent shift from formal specialized tools to expedient informal tools, specifically cores (Parry and Kelly 1987). They proposed that the adoption of the expedient core technology was not part of a technological complex and did not correlate with the introduction of any one specific technological introduction. They argued that,

> The most striking correlation of expedient core technology appears to have been a shift in settlement patterns. In each area, the most significant decrease in the use of formal tools occurred at about the same time as the first occupation of large, nucleated, permanent villages. [Parry and Kelly 1987:297]

They argued that the increase in expedient technology was a direct consequence of a decrease in mobility.

Mobility of a group has a large effect on determining the role of stone tools. If the stones are large and weigh too much, mobile people will probably be less likely to carry large numbers of them around. The availability of raw materials affects whether a group of people needs to form tools that are designed to overcome a lack of access to local raw materials (e.g. bifaces or other standardized tools and cores). If raw materials are abundant or available nearby, there is no need to manufacture long-lasting portable tools; instead, tools would be made to fulfill a specific short-term task (Parry and Kelly 1987). Parry and Kelly (1987) concluded that the production of formal tools from standardized cores would be a more common practice among mobile residential groups because of their need to transport lithic materials across the landscape to the places they would be used. On the other hand, among sedentary populations, the portability of stone tools would not be as high of a priority, therefore, these groups would not invest as much time and effort into producing as many formal tools. Instead, they would probably start to emphasize the production and use of expedient and unretouched flakes.

Kelly (1988) discussed three different organizational roles for bifaces. According to Kelly, bifaces can be manufactured to play one or more of three roles: "1) as cores, although this does not preclude the biface itself from being used as a tool; 2) as long use-life tools, in which a tool's bifacialness is necessary to its anticipated role, which is to be resharpenable and useable for its function even if broken; 3) as a by-product of the shaping process, in which a tool's bifacialness is not an explicit intention of the maker; instead the tool is manufactured to fit a preexisting haft" (Kelly, 1988:719). The main idea that Kelly is trying to get at throughout this article is that, there is a need for archaeologists to develop better methods to detect the patterns of use for stone tool types in order to better determine their particular roles within a site (Kelly 1988:732). He argues that using the reduction sequence of tools can be misleading, especially since not all bifaces, for example, are alike, though they may leave similar evidence of reduction sequences.

Since around the mid-twentieth century archaeologists have been asking questions about hunter-gatherer mobility strategies. These questions have often looked toward formal stone tools and the reduction evidence left behind at a site to determine the level of mobility of a group. There are links between technology and aspects of different hunter-gatherer mobility and subsistence strategies. The mobility of a group has a large effect on determining the role of stone tools. The question is not whether the group is sedentary versus mobile, rather just how sedentary or mobile a group is. The following sections outline the methods that were used for the analysis of stone tools and debitage in an effort to answer the questions about how groups of people may have been living.

Debitage Analysis

Each artifact found during the excavations and surveys of the field schools had a field specimen number assigned. The debitage and other non-formal tools excavated under a same feature number and grid unit were grouped under the same field specimen number. The study of chipped stone has largely been focused on stone tools and their uses, and not debitage, but many archaeologists have tried to come up with ways to perform meaningful debitage analysis (Hall and Larson 2004; Shott 2015; Sullivan and Rozen 1985).

The analysis process for this thesis drew on the lithic analysis methods utilized by the Brigham Young University field schools and researchers. The descriptions of the flake types are also adapted from the analysis key used by BYU field schools and researchers. The first step was running the flakes through a ½ inch and ¼ inch screen in order to separate them into three different size categories (larger than ½ inch, ¼ - ½ inch, and smaller than ¼ inch). Once the flakes were grouped by size they were then sorted by material, and separated based on whether they had cortex, and then separated into flake type categories. Once I grouped all of the similar flakes into their categories, I placed them into numbered lots within their designated field specimen number, counted them, and weighed them. I also made notes regarding any flakes that seemed abnormal, e.g., possibly heat-treated. The key for the debitage analysis is included in appendix A. In the following three sections I discuss the material types found at the sites, the sources of some of these, and describe the different flake types found in the assemblages.

Material Types

During the first stage of analysis, the raw material type of the stone was identified. There are many different ways to classify stone types. For the purposes of this thesis the stone tool types were simplified into five different categories: quartzite, obsidian, chert, basalt, and other.

Quartzite. Quartzite is a metamorphic rock derived from quartz rich sandstone. "During metamorphism, the quartz grains in sandstone recrystallize, creating new, larger grains" (Farndon, 2006:117). Quartzite comes in fine or coarse grain. It is usually found as cobbles. During the initial thesis analysis, quartzite was separated into fine and coarse grained quartzite. These two categories were combined during later analysis in order to see patterns more clearly in the results. Quarzite is a common rock type found within the Land Hill and Hidden Hills study areas.

Obsidian. A glasslike rock that is formed by the rapid cooling of molten lava, "the result is a rock that is just like solid glass except slightly harder, and often jet black" (Farndon, 2006:72). Obsidian is a common stone type found on archaeological sites, especially in the western United States. Prehistorically obsidian was used to make bifaces, projectile points, and other stone tools. Obsidian is one of the easiest stones to work, and often people carried over long distances into the site from somewhere else.

Chert. A cryptocrystalline stone, which means "chert is made of quartz crystals so fine they can be seen only under a microscope" (Farndon, 2006:106). Chert is an incredibly hard rock similar to flint and comes in many different colors. Chert is the most common stone type found on the sites within the Land Hill and Hidden Hills study areas. Prehistorically, it was used to make bifaces, and other stone tools. During analysis there were many different colored chert categories identified. The different categories of colored chert were combined into one chert category during later analysis in order to see clearer patterns in the results of the analysis.

Basalt. A dark gray to black dense to fine-grained volcanic rock. Basalt is formed when flowing lava hits cool water. This stone type is not very common in the Hidden Hills study area. However, there is a large basalt outcrop near the sites within the Land Hill study area.

Other. This category was a catch-all for any type of stone that were unidentifiable.

Stone Sources

Since this thesis deals with stone tools and debitage, it is important to at least think about where people were getting materials. While I did not include an in-depth search for the exact source of each material type some sources were identified. The obsidian artifacts found at the Land Hill and Hidden Hills sites were sent out for x-ray fluorescence (XRF) analysis. Of the 223 specimens submitted for analysis, 198 come from the Panaca Summit obsidian source, 13 from the Kane Springs source, one is most likely from Wild Horse Canyon, four are from Rock Canyon, and seven are from unidentifiable sources. Of the 29 specimens from Arizona, 16 come from the Panaca Summit obsidian source, six from Kane Springs, and seven are from unidentifiable sources.

A large number of stone tools and debitage were also manufactured from chert. In Utah, there are chert gravels present near the Santa Clara River around all of the sites. In Arizona there is a pinkish-purple chert found in outcrops around a number of the sites. Chert is not as easily sourced as obsidian so it is difficult to know for sure where a number of the pieces were procured.

Flake Types

Primary decortication flakes are flakes which have cortex covering 50 percent or more of the exterior surface. They usually have a bulb of percussion and few or no dorsal flake scars. These flakes are produced during the primary reduction of raw material. If these flakes are present at a site it usually means people were working the raw material from a source with little to no reduction done prior to bringing the material to the site. These flakes are common at quarries or sites located close to a stone source.

Secondary decortication flakes are flakes that have cortex covering less than 50 percent of the exterior surface. They have a bulb of percussion and usually one to two flake scars. These flakes are produced during the secondary reduction of raw material. If these flakes are present at the site, it usually suggests people worked on reducing raw material from a source, or they are further reducing a cobble that has been brought in from an outside source. These flakes are evidence of early core reduction.

Primary shatter is classified as non-flake debris from the primary reduction process. These objects have cortex but do not exhibit a bulb, platform, or well-defined ventral and dorsal surfaces. These artifacts are produced during reduction of raw material and are usually blocky and angular in form. These flakes represent core material reduction usually during the primary reduction phase.

Internal flakes are flakes that have no cortex present and do not fall into the bifacial thinning flake category. These flakes are sometimes called secondary flakes. They have a bulb of percussion and are usually large with many flake scars on their dorsal surfaces. These flakes are produced during the reduction of material that has already had the cortex removed, and are often turned into stone tools. These flakes usually represent a further thinning of cores that may become bifaces later.

Bifacial thinning flakes contain some of all of the following characteristics: they are thin, flat, and fan out; multiple flake scars on the dorsal side of the flake; a small bulb of percussion; and a cross-section that slightly curves. This flake type is usually the result of percussion flaking while trying to thin a core or biface. When these flakes are present it usually means bifaces were being produced.

Tertiary flakes, also called retouch flakes, are small flakes that were removed during pressure flaking. These flakes are often a smaller type of bifacial thinning flake. They are usually narrower and have a very small bulb of percussion. Tertiary flakes are produced by the retouching of tool or flake edges, tool manufacture, or reshaping of existing tool edges. If these flakes are present at a site, it generally suggests that tools were being finished and/or reworked there.

Secondary shatter is non-flake debris that does not have any cortex. These objects are from the reduction process and do not contain a bulb, platform, or discernible interior surface. These artifacts are usually blocky and angular in form, and produced from reducing objects with percussion.

Stone Tools

The analysis for stone tools began by identifying the different types of stone tools. Once the stone tool type was identified, there are several more aspects that were closely examined. Once the tools were typed and their additional information recorded, the tool's length, width, and maximum thickness were measured in millimeters, and then the tools were weighed. Any unusual facts about the tools were recorded in the comments section of the data log. The key for the stone tool analysis is included in appendix B.

The following two sections describe the different tool types that were found in the stone tool assemblages. The first section describes all of the tool types. The stone tool description are adapted from the analysis key used by Brigham Young University. The second section provides the descriptions of the projectile points found in the collection. The projectile points are discussed separately since they are often used as temporal markers at sites, therefore I go into slightly more detail for each type.

Tool Types

A *scraper* is a formal tool with an edge that exhibits a greater than 45 degree edge angle and evenly spaced unifacial or bifacially retouch flake scars along one or more edges. The additional information recorded for these tools includes the number of edges with flaking and the angle of the edge. If these tools are present at the site it usually means the residents were scraping objects, possibly for hide or plant processing.

A *biface* is a formal tool with flakes that have been removed from the front and back of the artifact. These tools range from being blocky to thin with regular edges. The stage of the biface (early, middle, or late) was recorded, as well as the completeness of the biface. Early stage bifaces exhibit minimal modification. They are usually thick with irregular flaking along edges, flaking usually does not cross the midline of the object. Middle stage bifaces exhibit some controlled thinning with some flakes crossing the midline. The object is thin with retouch flakes present. Late stage bifaces are highly symmetrical in form, they have straight and regular edges. Bifaces are one of the most common kinds of stone tool archaeologists and other individuals find. This category often includes broken formal tools that may fit into other categories, but they are too broken to classify confidently enough into the other categories. The presence of bifaces along with manufacturing debris (e.g. biface-thinning flakes) associated with the production of the biface suggests that there was formal tool production at a site. If bifaces are present at the site without the accompanying flake debris then it is likely that the bifaces were made elsewhere and brought to the site. Examples of bifaces are pictured in Figure 3.1.

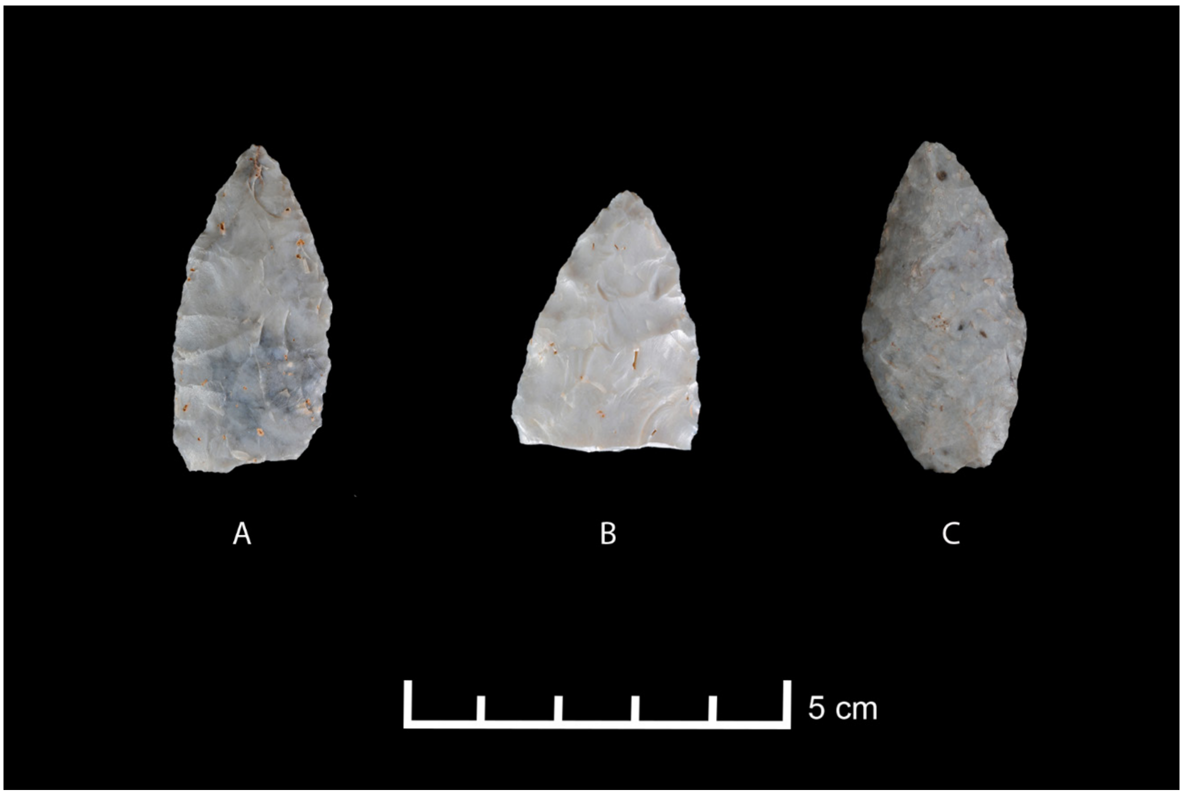

Figure 3.1. Example of bifaces from two sites in the Hidden Hills study area. A and B are from AZ A 10:24 (BLM), and C if from AZ A 10:27 (ASM).

There are two more formal tool types identified in the Land Hill and Hidden Hills stone tool stone tool assemblages; drills and choppers. A *drill* is a formal tool with a pointed end that is usually long and bifacially worked. These tools were used to drill holes into things. The completeness of the object was recorded for each drill. A *chopper* is a formal tool made from a cobble that has flakes removed from at least one side and may be unifacial or bifacially flaked on one edge.

A *utilized flake/modified flake* is a non-formal, expedient tool. It is a flake that exhibits regular edge damage on one or more sides. The location and extent (number of sides) of the wear was recorded. These artifacts are often common in stone tool assemblages. Utilized flakes are made by using the flake to cut something; they do not require extra modification beyond taking a large flake off of a core, though they are occasionally resharpened for further use. Modified flakes generally have some sort of flaking on one or more of the edges; this modification is usually for resharpening or reshaping the flake. Examples of utilized flakes are pictured in Figure 3.2.

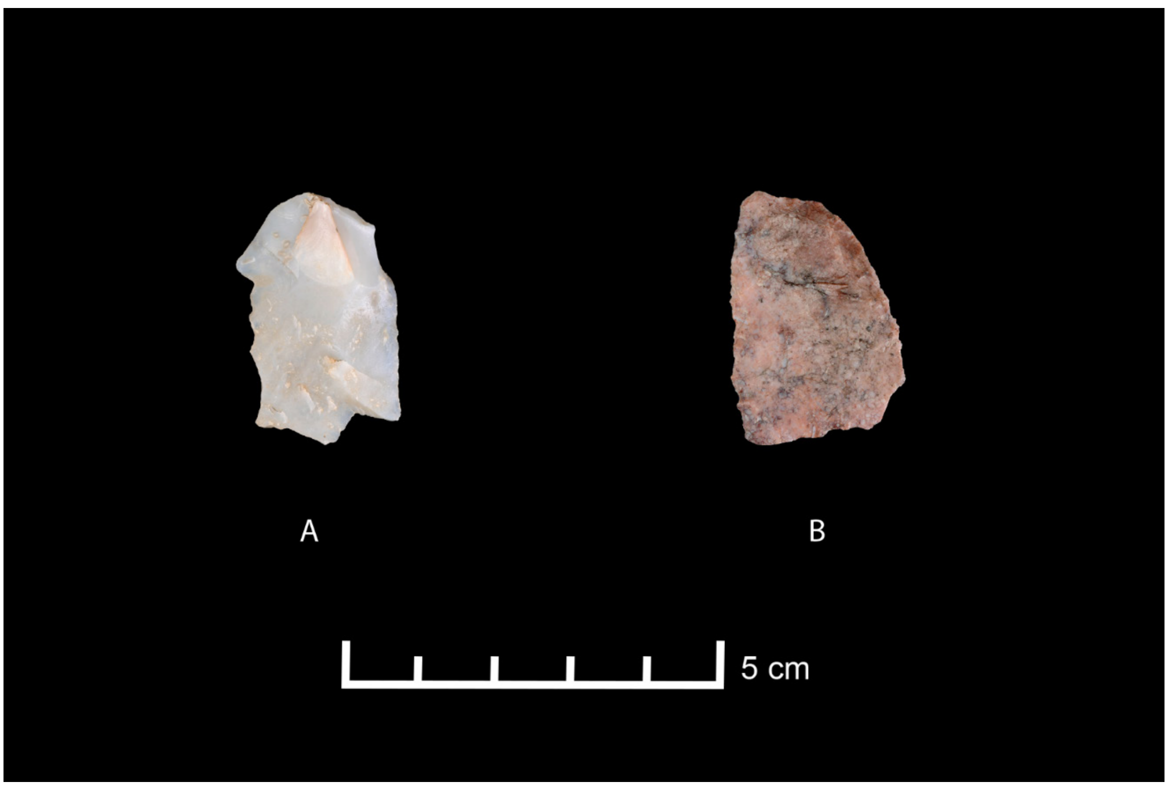

Figure 3.2. Examples of utilized flakes from Hidden Hills. A and B are from AZ A 10:28 (BLM).

There are two additional non-formal tools identified in the Land Hill and Hidden Hills stone tool assemblages; cores and hammerstones. A *core,* is a tool that exhibits two or more negative flake scars. These tools are made when the worker removes flakes for a different type of tool. There are different types of cores: multidirectional, unidirectional, and bipolar. A *hammerstone* is a tool that only exhibits pounding on one or more areas. This artifact would have been used to remove flakes from a core or biface. Hammerstones are found at most sites. These artifacts are used to cut or chop larger objects.

Projectile Points

There were three main categories of projectile points found at the sites. The first includes points belonging to the Elko cluster of atlatl points, the second is the Rosegate cluster of arrow points. The final type includes stemmed arrow points that do not really fit in anywhere in the known typologies. Below is a description of each cluster overall, as well as descriptions of each point type present.

The Elko cluster was first defined by Heizer and Baumhoff (1961) based on collections from South Fork Shelter, Nevada. It included Elko Eared, Elko Corner Notched, and Elko Side-Notched types (Heizer and Baumhoff 1961). The Elko cluster generally starts appearing in the archaeological record during the Late Archaic period about 1500-1300B.C. and continues until around A.D. 600-700 (Heizer and Hester 1978; Justice 2002). They are generally considered to be atlatl dart points. Richard Holmer argues that the Elko points started in the Early Archaic, and there are some that date to that time period; however, most come from Late Archaic sites. Holmer also does not believe that the Elko series is continuous; he believes that there are two hiatuses (Holmer 1986:101). He proposes that the morphology of the corner notched and the side notched were just a gradual change overtime and not two separate point types (Holmer 1986:102) Examples of Elko cluster points are pictured in Figure 3.3.

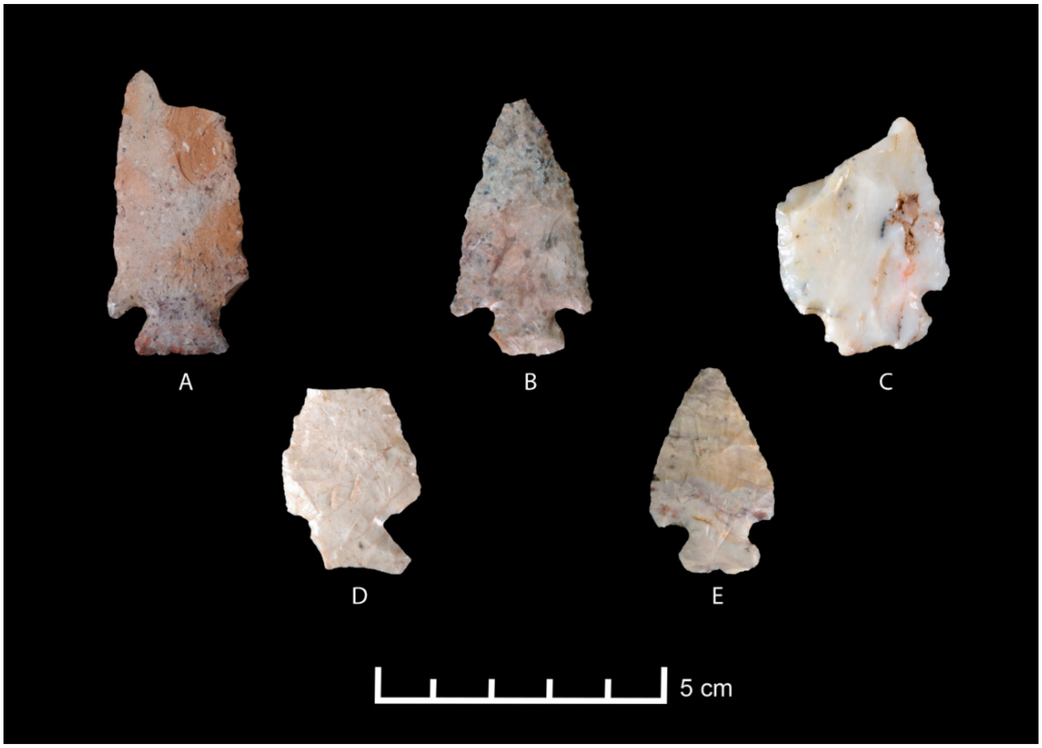

Figure 3.3. Examples of Elko series projectile points from various sites in the Hidden Hills study area. Elko Corner Notched (A, B, and D) Elko Side Notched (C) Elko Eared (E).

Elko Eared points are "a corner notched point made from a trianguloid preform with indented or concave basal ears. The notches are typically narrow and deep, placed at the corner of a preform" (Justice 2002:298). The shoulders of the points are generally much wider than the basal ears. These points are generally made using a combination of percussion and pressure flaking. The final retouching of the point was done mostly with pressure flaking.

Elko Corner-Notched points are "a triangular-shaped corner notched point with a straight base" (Justice 2002:310). These points usually differ greatly in the depth, width, and angle of the notches. These points are made with a combination of percussion and pressure flaking. The shaping and notching of these points was probably done by pressure flaking.

Elko Side-Notched points are similar to Elko corner-notched points. The side-notched points are triangular in shape, with a straight base and notches in the side. These points are generally made using a combination of percussion and pressure flaking. The final retouching of the point was probably done mostly with pressure flaking.

The Rosegate cluster was first named by David Hurst Thomas (1981). He combined the Rose Spring Corner notched and Eastgate Expanding Stem point types into a broad category he called Rosegate. This cluster is thought to be part of the early bow and arrow development (Justice 2002). The Rosegate cluster also includes Parowan Basal notched points, which are found nearby and date to the same time period. It is believed that these points are followed by the Cottonwood Triangular and Desert Side-Notched points (Heizer and Hester 1978). Examples of Rosegate cluster points are pictured in Figure 3.4.

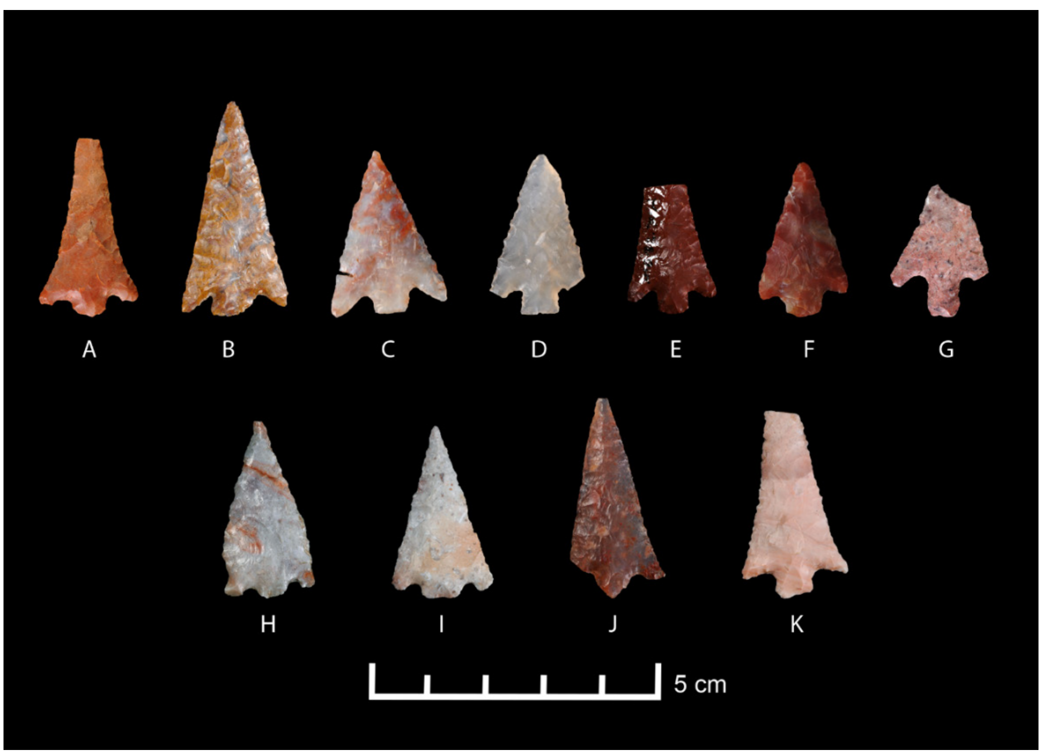

Figure 3.4. Examples of Rosegate points from various site in the Land Hill and Hidden Hills study areas. Parowan Basal Notched (A-E), Eastgate (H-I), Rose Spring Corner Notched (F-G, and J-K).

The *Rose Spring Corner-Notched* type was first discovered on the Rose Spring site in Owens Valley, California. This point is a narrow triangular arrowhead type similar to the Eastgate Expanding Stem. The base of a Rose Spring point ranges from a slightly contracted and roughly straight stem to an expanding stem that approach the side notches. These points were usually made from a flake blank or a small biface using pressure flaking. These points belong to one of the earliest arrow point types in the Great Basin, and date from around A.D. 500 to 1300 (Justice 2002).

Eastgate points are "wide trianguloid arrow point with deep notches placed along the base, leaving squared shoulder barbs and a narrow expanding stem" (Justice 2002:330). The bases of these points can vary from straight to convex. The expanding stem comes from the notches being slightly angled inward often parallel with the blade edges. These points generally date to the same time as Rose Spring points.

Parowan Basal-Notched points have an "isosceles triangular form with shallow notches inset from a straight basal edge" (Justice 2002:336). These points are generally manufactured by pressure flaking with shallow, U-shaped notches. Holmer and Weder (1980) performed a study of several post Archaic projectile points. They used ceramic dates to determine that Parowan Basal-Notches date to around A.D 950 to 1150 (Holmer and Weder 1980:64; Justice 2002). Named for Parowan Valley, Utah, these points are often associated with the Parowan Fremont occupation of southwestern Utah, but they are also common at VBP sites in the Saint George Basin and elsewhere. Since these points are similar in size and shape to the Rose Spring and Eastgate Expanding points, Parowan Basal-Notched points are included in the Rosegate cluster of points.

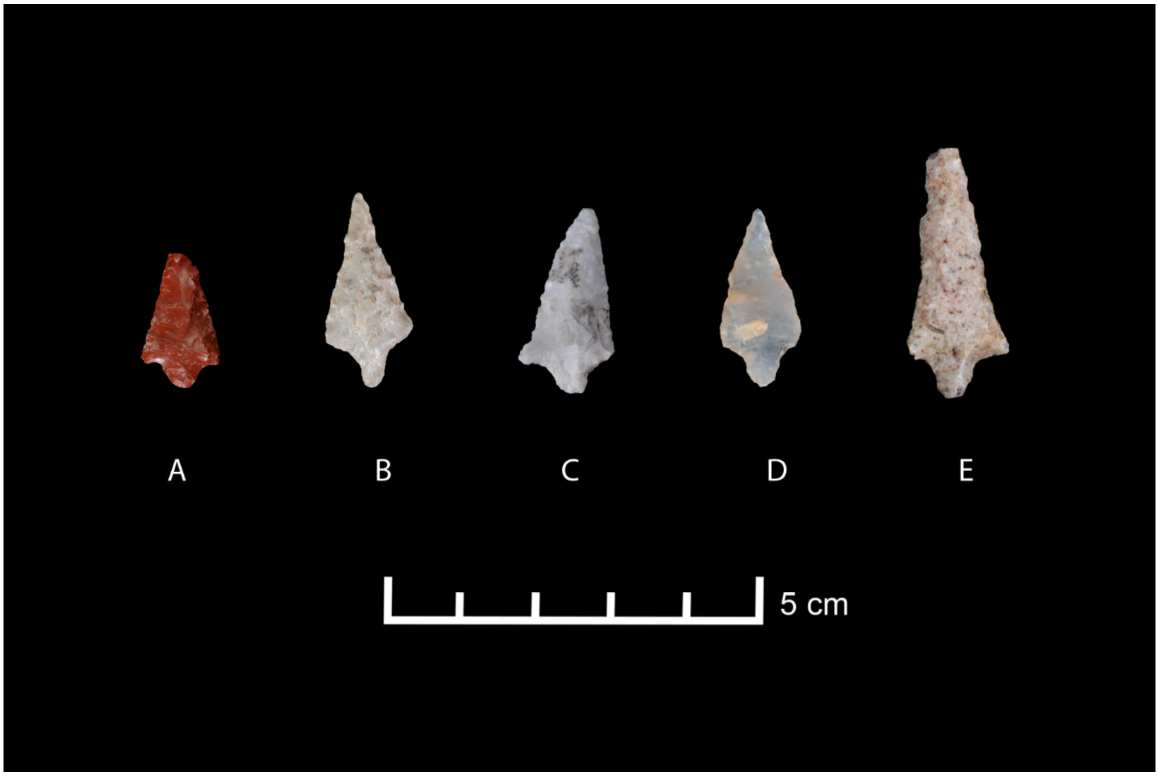

Figure 3.5. Examples of undesignated stemmed points from various sites in the Hidden Hills study areas. (A-B) from AZ A 10:24 (BLM), C from AZ A 10:36 (ASM), D from AZ A 10:29 (BLM), and E from AZ A 10:27 (ASM).

The final type of projectile point commonly found during analysis was an undesignated, stemmed projectile point that overlaps in form with Rosegate points. These points are long and thin with a small stem. They do not have a formal name, but they are found in the Parowan Valley and surrounding Virgin areas. Examples of the undesignated stemmed projectile points are pictured in Figure 3.5.

4 | Analysis

This chapter presents the results of the analysis conducted during the course of this thesis. The chapter begins with a discussion of potential artifact loss from the surface of the sites. The second section discusses the stone tool and debitage analysis results from all of the sites in both study areas. The third section discusses the analysis results from the specific sites used to compare the two study areas throughout time. The final section of the chapter provides a summary of the analysis results and their implications.

The assemblages used in this thesis were collected using both systematic collection of all tools, general surface collection of all formal tools, and excavation. The collection methods of artifacts differed from site to site. The sites located in Land Hill study area were near roads and populated areas with easy access for people; therefore it is likely that many artifacts were removed by visitors. Many of the Land Hill sites had looter holes found on them. The Hidden Hill sites, on the other hand, are farther away from populated areas. There are BLM maintained roads running through some of the sites; however, the surface assemblages of the sites in the Hidden Hills study area seem to be less disturbed. Tables 4.1, 4.2, 4.3, and 4.4 show the counts and percentages of the formal tools and debitage found during the systematic surface and excavated collection within the Land Hill and Hidden Hills study areas.

If there were no difference between the surface and subsurface of the sites one should find the same or nearly the same percentage of formal tools. There is some surface loss in both areas; but the Land Hill sites seem to have fewer tools found on the surface. Table 4.2 shows that there are eight sites that had a higher percentage of tools found in the subsurface collection, three sites had more tools on found in the surface collections, and there is only one site that have the same percentage of tools found during the surface and the subsurface collection. In the Hidden Hills study area four of the sites had more tools found in the subsurface collection, 17 sites had a higher percentage tools that were found in the surface collections, and two of the sites had the same percentage of tools found during the surface and subsurface collections. The sites in the Land Hill study area appear to have more tools found in the subsurface collection than in the surface collections. The sites in the Hidden Hills area appear to have more intact surface assemblages. There are more sites that have a larger percentage of tools found on the surface. Because of this it is difficult to see the similarities and differences between the surface and subsurface collections within the study areas. Therefore, the analysis and conclusions will be focused on the subsurface collections found at the sites within each of the study areas, because the subsurface assemblage represents the best data from each of the study areas.

Table 4.1. Counts of tools and debitage from sites in the Land Hill study area.

Sites	Surface			Subsurface		
	Debitage	Tools	Totals	Debitage	Tools	Totals
42WS50	-	-	-	217	25	242
42WS185	19	1	20	90	2	92
42WS195	1197	11	1208	815	13	828
42WS210	-	-	-	9	1	10
42WS1344	54	9	63	77	1	78
42WS1345	167	2	169	807	5	812
42WS1890	93	-	93	90	2	92
42WS1894	18	2	20	6	-	6
42WS1895	47	1	48	41	3	44
42WS1897	22	1	23	7	1	8
42WS1929	24	2	26	45	1	46
42WS1931	341	5	346	565	19	584
Totals	1982	34	2016	2769	73	2842

Table 4.2. Percentage of tools found on the surface vs subsurface on the Land Hill sites.

Sites	Surface	Subsurface	Difference
42WS50	-	10.3	-10.3
42WS185	0.9	1.8	-0.9
42WS195	0.5	0.6	-0.1
42WS210	-	10.0	-10.0
42WS1344	6.4	0.7	5.7
42WS1345	0.2	0.5	-0.3
42WS1890	-	1.1	-1.1
42WS1894	7.7	-	7.7
42WS1895	1.1	3.3	-2.2
42WS1897	3.2	3.2	0.0
42WS1929	2.8	1.4	1.4
42WS1931	0.5	2.0	-1.5

Table 4.3. Counts of tools and debitage from sites in the Hidden Hills study area.

Sites	Surface			Subsurface		
	Debitage	Tools	Totals	Debitage	Tools	Totals
AZ A 10:10 (ASM)	-	-	-	5	2	7
AZ A 10:16 (BLM)	107	-	107	3	-	3
AZ A 10:20 (BLM)	223	253	476	26	3	29
AZ A 10:24 (BLM)	1009	1792	2801	75	60	135
AZ A 10:25 (BLM)	68	395	463	-	14	14
AZ A 10:26 (ASM)	70	-	70	5	-	5
AZ A 10:26 (BLM)	184	216	400	5	10	15
AZ A 10:27 (ASM)	380	380	760	34	18	52
AZ A 10:28 (BLM)	279	58	337	40	5	45
AZ A 10:28 (ASM)	9	-	9	-	-	-
AZ A 10:29 (ASM)	8	-	8	-	-	-
AZ A 10:29 (BLM)	52	9	61	30	-	30
AZ A 10:32 (ASM)	-	-	-	1	-	1
AZ A 10:36 (ASM)	10	26	36	1	3	4
AZ A 10:37 (ASM)	137	233	370	3	2	5
AZ A 10:38 (ASM)	59	48	107	1	1	2
AZ A 10:51 (ASM)	-	-	-	1	-	1
AZ A 10:53 (ASM)	-	-	-	1	-	1

Table 4.3. Continued.

Sites	Surface			Subsurface		
	Debitage	Tools	Totals	Debitage	Tools	Totals
AZ A 10:55 (ASM)	-	-	-	2	-	2
AZ A 10:67 (ASM)	-	-	-	1	-	1
AZ A 10:74 (ASM)	-	17	17	-	1	1
AZ A 10:76 (ASM)	7	-	7	1	-	1
AZ A 10:80 (ASM)	-	-	-	1	-	1
AZ A 10:82 (ASM)	53	63	116	1	1	2
AZ A 10:83 (ASM)	7	-	7	1	-	1
Totals	2662	3490	6152	238	120	358

Table 4.4. Percentage of tools found on the surface vs subsurface on the Hidden Hills sites.

Sites	Surface	Subsurface	Difference
AZ A 10:10 (ASM)	2.9	1.1	1.7
AZ A 10:16 (BLM)	2.7	-	2.7
AZ A 10:20 (BLM)	5.1	0.6	4.6
AZ A 10:24 (BLM)	2.6	2.0	0.5
AZ A 10:25 (BLM)	-	2.9	-2.9
AZ A 10:26 (ASM)	6.7	-	6.7
AZ A 10:26 (BLM)	1.2	2.4	-1.2
AZ A 10:27 (ASM)	4.2	2.2	2.0
AZ A 10:28 (BLM)	10.5	1.3	9.2
AZ A 10:28 (ASM)	-	-	-
AZ A 10:29 (ASM)	-	-	-
AZ A 10:29 (BLM)	33.0	-	33.0
AZ A 10:32 (ASM)	100.0	-	100.0
AZ A 10:36 (ASM)	2.5	7.5	-5.0
AZ A 10:37 (ASM)	0.8	0.5	0.3
AZ A 10:38 (ASM)	0.9	0.9	0.0
AZ A 10:51 (ASM)	100.0	-	100.0
AZ A 10:53 (ASM)	100.0	-	100.0
AZ A 10:55 (ASM)	100.0	-	100.0
AZ A 10:67 (ASM)	100.0	-	100.0
AZ A 10:74 (ASM)	-	5.6	-5.6
AZ A 10:76 (ASM)	12.5	-	12.5
AZ A 10:80 (ASM)	100.0	-	100.0
AZ A 10:82 (ASM)	0.8	0.8	0.0
AZ A 10:83 (ASM)	12.5	-	12.5

Debitage From All Sites

The debitage sample that was used for this thesis included 6,313 flakes. Table 4.5 shows the counts and Table 4.6 shows the percentages of the different flakes types found at sites in the Land Hill and Hidden Hills study areas. Most of the debitage found at the Hidden Hills sites were either primary or secondary shatter. There were slightly more decortication flakes found at the Hidden Hills sites. In the Hidden Hills area bifacial thinning flakes make up 5.4% of the assemblage, and in Land Hill area they make up 10.7% of the flake assemblage. The ratio of internal to bifacial thinning flakes found on the Hidden Hills sites is 3.2:1. On the Land Hill sites the ratio of internal to bifacial thinning flakes is 1.4:1. This means that Land Hill has the higher percentage of bifacial thinning flakes.

Table 4.5. Counts of the different flake types within each study area.

Flake type	Land Hill	Hidden Hills
Decortication Flakes	137	348
Primary Shatter	515	1248
Secondary Shatter	1419	1151
Internal Flakes	401	607
Bifacial Thinning Flakes	297	190
Totals	2769	3544

Table 4.6. Percentages of the different flake types within each study area.

Flake type	Land Hill	Hidden Hills
Decortication Flakes	4.9	9.8
Primary Shatter	18.6	35.2
Secondary Shatter	51.2	32.5
Internal Flakes	14.5	17.1
Bifacial Thinning Flakes	10.7	5.4

Chert made up a majority of the debitage in both study areas making up over 80% of the entire collection. Table 4.7 shows the counts and Table 4.8 shows the percentage of material types found at each site. There was more variation in the material types from Land Hill. The materials used in the Hidden Hills study area were primarily chert and quartzite.

Table 4.7. Counts of flake material types of the Land Hill and Hidden Hills sites.

Material Type	Land Hill	Hidden Hills
Chert	2273	2879
Quartzite	126	428
Obsidian	97	3
Basalt	126	8
Other Type	147	226
Totals	2769	3544

Table 4.8. Percentage of flake material types of the Land Hill and Hidden Hills sites.

Material Type	Land Hill	Hidden Hills
Chert	82.1	81.2
Quartzite	4.6	12.1
Obsidian	3.5	0.1
Basalt	4.6	0.2
Other Type	5.3	6.4

Tools

This section discusses the count and percentages of the tool types found within the Land Hill and Hidden Hills study areas. Tables 4.9 and 4.10 show the counts and percentages of each tool type discussed in this section. The tools are discussed individually in the next few sections. Formal tools in this study refers to: bifaces, projectile points, scrapers, uniface, chopper, and drills. Non-formal tools in this study refers to: utilized and modified flakes, cores, and hammerstones.

Table 4.9. Counts of tool types from all sites in the Land Hill and Hidden Hills areas.

Tool Type	Land Hill	Hidden Hills
Scraper	13	10
Biface	30	62
Projectile Point	11	37
Drill	2	2
Uniface	5	2
Chopper	1	0
Utilized/Modified	41	55
Core	24	19
Other Types	2	3
Total	129	190

Table 4.10. Percentages of tool types from all sites in the Land Hill and Hidden Hills areas.

Tool Type	Land Hill	Hidden Hills
Scraper	10.1	5.3
Biface	23.3	32.6
Projectile Point	8.5	19.5
Drill	1.6	1.1
Uniface	3.9	1.1
Chopper	0.8	0.0
Utilized/Modified	31.8	28.9
Core	18.6	10.0
Other Types	1.6	1.6

Bifaces

There were 108 bifaces found during excavations in the Land Hill and Hidden Hills study areas. They make up 29% of the tools collected in subsurface excavations during the 2006 and 2007 field seasons. The sites in the Land Hill area had 30 bifaces which made up 23.3% of the area's stone tool assemblage, and Hidden Hills had 62 bifaces which made up 32.6% of the area's stone tools assemblage. Table 4.11 shows the counts of the biface stages in each of the study areas, and Table 4.12 shows the percentage of the bifaces in the two study areas. When the bifaces were first analyzed they were separated into Stage1, Stage 2, and Stage 3. Most of these early stage bifaces are actually multidirectional cores and not formal tools so artifacts originally identified as Stage 1 bifaces are tabulated as cores.

Table 4.11. Count of biface stages within the Land Hill and Hidden Hills study areas.

Biface Stages	Land Hill	Hidden Hills
1	10	7
2	13	17
3	17	44
Total	40	68

Table 4.12. Percentage of biface stages within the Land Hill and Hidden Hills study areas.

Biface Stages	Land Hill	Hidden Hills
1	25	10.3
2	32.5	25.1
3	42.5	64.7

Projectile Points

Projectile points are classified as formal tools. There were 49 projectile points found in the excavated collections of sites across Land Hill and Hidden Hills. There were 11 projectile points at the Land Hill sites which make up 8.5% of the state's stone tool assemblage. Hidden Hills had 38 projectile points which make up 19.5% of the stone tools collected from those sites. Table 4.13 shows the counts of the different projectile point types found in each of the study areas assemblages. Table 4.14 shows the percentage of projectile point types within the Land Hill and Hidden Hills collections.

Table 4.13. The counts of different projectile point types in the Land Hill and Hidden Hills study areas.

Point type	Land Hill	Hidden Hills
Rose Springs	3	22
Rosegate	4	6
Parowan Basal	3	2
Small Stemmed	-	1
Elko Corner notched	-	3
Eastgate	-	2
Unknown	1	2
Total	11	38

Table 4.14. Percentages of different projectile point types in the Land Hill and Hidden Hills study areas.

Point type	Land Hill	Hidden Hills
Rose Springs	27.3	57.9
Rosegate	36.4	15.8
Parowan Basal	27.3	5.3
Small Stemmed	-	2.6
Elko Corner notched	-	7.9
Eastgate	-	5.3
Unknown	9.1	5.3

A majority of the projectile points recovered from the sites were fragmented. Table 4.15 shows the counts of the point fragments in each study area. Table 4.16 shows the percentage of different fragment types within each study area. In Land Hill only six of the points were complete, and in Hidden Hills there were 12 complete points found.

Table 4.15. Counts of fragment types in the Land Hill and Hidden Hills area.

Fragments	Land Hill	Hidden Hills
Complete	6	23
Distal Fragment	3	1
Lateral Fragment	-	1
Middle Fragment	-	1
Proximal Fragment	2	12

Table 4.16. Percentage of fragment types in the Land Hill and Hidden Hills area.

Fragments	Land Hill	Hidden Hills
Complete	54.5	60.5
Distal Fragment	27.3	2.6
Lateral Fragment	-	2.6
Middle Fragment	-	2.6
Proximal Fragment	18.2	31.6

Scrapers

Scrapers are classified as formal tools. There were 23 scrapers found on the sites across both study areas. Scrapers make up 10.1% of the stone tool assemblage in the Land Hills study area. Scrapers make up 5.3% of the stone tools within the Hidden Hills study area.

Other Formal Tools

The rest of the formal tools are unifaces, choppers, and drills. These final formal tool categories make up small percentages of the Land Hill and Hidden Hills stone tool assemblages. Unifaces make up a total of 3.9% in the Land Hill collection and 1.1% in the Hidden Hills assemblage. Drills make up 1.6% of the Land Hill stone tool assemblage, and 1.1% of the Hidden Hills collection. Finally, choppers make up only 0.8% of the Land Hill stone tool assemblage, the Hidden Hills area does not have any choppers in the subsurface level.

Cores

Cores are classified as non-formal tools. There were 43 cores found on the sites across the Land Hill and Hidden Hills study areas. Cores make up 18.6% of the total stone tool assemblage in Land Hill. Cores make up 10% of the stone tools found in Land Hills. These cores include stage one bifaces as multidirectional cores. Cores may still be underrepresented because some of smaller cores may have been put into the secondary shatter category of debitage during analysis.

Utilized Flakes

Utilized flakes and modified flakes were combined into one category. These tools are classified as expedient and non-formal. There were 96 of these expedient tools found across the sites in both study areas. Utilized flakes make up 31% of the stone tool assemblage in the Land Hill area, and 28.9% in the Hidden Hills area.

Other Tools

This category is classified as non-formal. The category of other tools includes gravers and hammerstones. These tool categories were put into a residual category because they contained the fewest numbers of tools. The number of other tools found at the sites in both study areas is 5 they only make up 4% of the total stone tool assemblage. There were 2 other tools found at the Land Hill sites and 3 in the Hidden Hills study area.

Comparisons Between States

There are differences between the Hidden Hills and Land Hill study areas that one can notice by comparing the percentages of multiple different categories the between the two areas. Figure 4.1 shows the comparison of different flake types that were found in the Land Hill and Hidden Hills study areas. The large presence of bifacial thinning and secondary shatter coupled with the smaller percentage of decortication flakes at the Land Hill sites may suggest use of stone that was previously worked and may have been brought onto the site from a distant source. In the Hidden Hills study area 9.8% flakes found were decortication flakes while in Land Hill area only 4.9% of the flakes found on the sites were decortication flakes. The ratio of internal flakes to bifacial thinning flakes within each study areas is 1.4:1 at Land Hill, and 3.2:1 at Hidden Hills sites. There are a higher percentage of bifacial thinning flakes on the Land Hills sites than at the sites in the Hidden Hills study area.

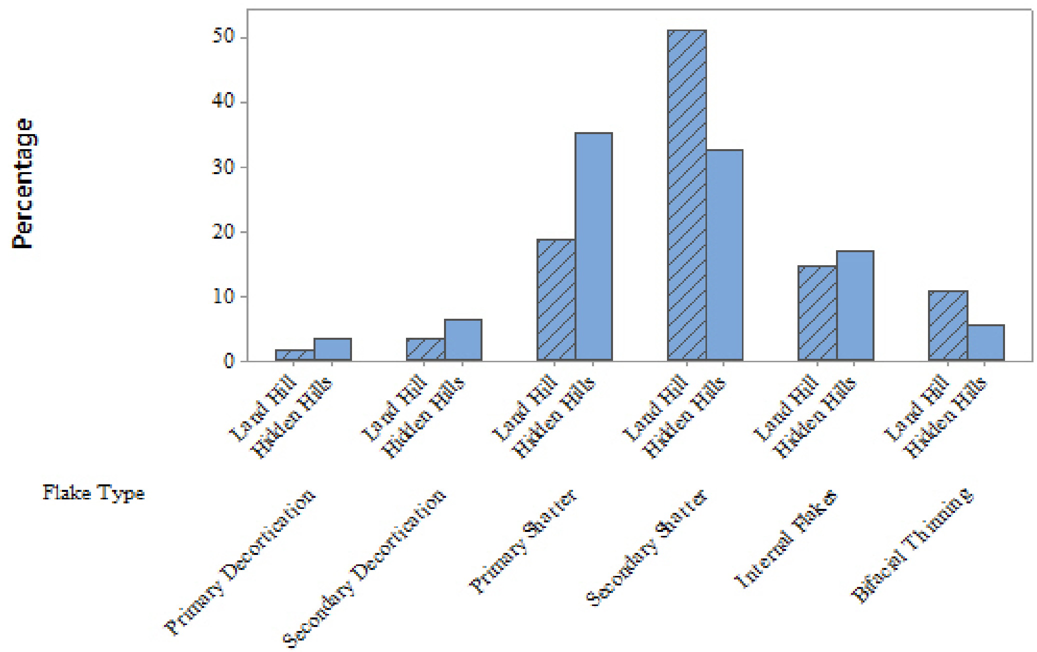

Figure 4.1. Chart comparing the percentage of flake types at Land Hill and Hidden Hills.

The flaked material found on both study areas show that chert was the most common stone used for tool manufacture; it made up at least 80% of the material type in study areas. Figure 4.2 shows the comparison of material types between the Land Hill and Hidden Hills study areas. As shown in Figure 4.2, the sites within Hidden Hills have a high percentage of chert, quartzite, and other unidentified materials which they used to manufacture stone tools. In the Land Hill area, as Figure 4.2 shows, there was slightly more variation in the different stone types used. Basalt, obsidian, and quartzite were used about evenly with each making up about 4 to 5% of the collection. The other stone category makes up around 6% of the assemblage, and is only slightly higher than the Hidden Hills sites. These findings may suggest that the sites on Hidden Hills may have had better access to chert and quartzite than any other stone type. In the Land Hill study area, chert is still the most predominant stone type, but the presence of other material types may suggest that people had access to other, and in some cases, finer material types.

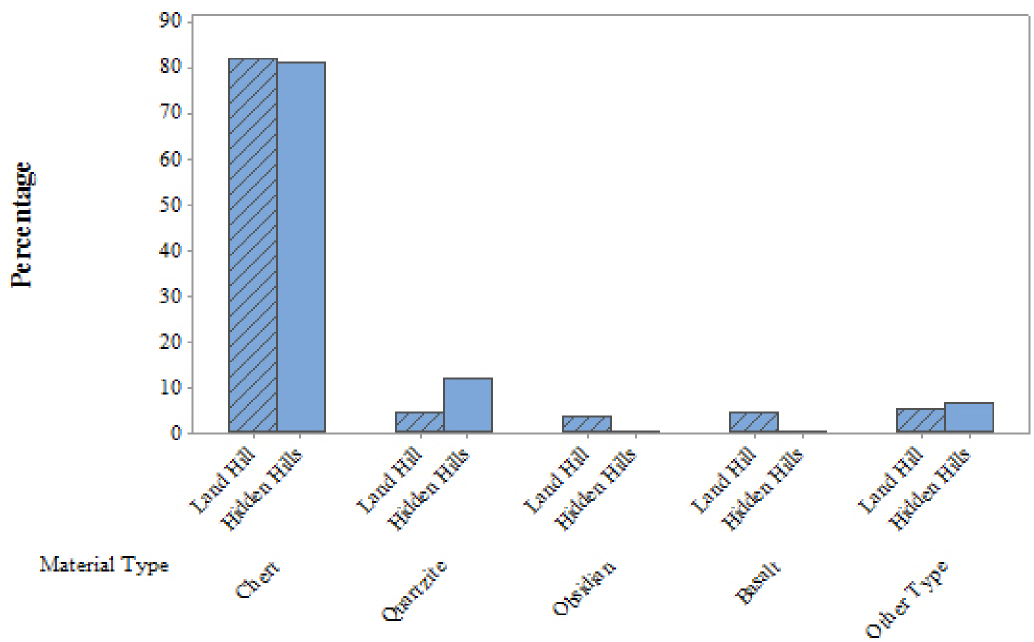

Figure 4.2. Chart comparing the percentages of flake material types between Utah and Arizona.

The percentage of the stone tools found on the sites located in the Land Hill and Hidden Hills areas can be found in Figure 4.3. The sites in both of the study areas had large numbers of utilized or modified flakes (31.8% in Land Hill and 28.9% in Hidden Hills), which is common for most archaeological sites. The percentage of bifaces and cores at the Land Hill sites are the next highest tool percentages for Land Hill. In Hidden Hills, the sites contained mostly bifaces, utilized flakes, and projectile points. Cores made up about 10% of the Hidden Hills assemblage, and the rest of the tool categories made up 5% or less of the tools. When looking at the ratio of formal to informal tools in both study areas, in Land Hill there is ratio 1.3:1 formal tools to informal tools, Hidden Hills has a ratio of 1.7:1 formal to informal. This means that between the two study areas there is a difference in the percentage of formal tools found at the Land Hill and Hidden Hills sites. There was a lot of debitage found in both areas; therefore, the ratio of flakes to formal or informal tools is large. At the Land Hill there are 34:1 pieces of debitage to formal tools and 44:1 pieces of debitage to informal tools. At the Hidden Hills sites there are 28:1 pieces of debitage to formal tools and 12:1 pieces of debitage to informal tools.

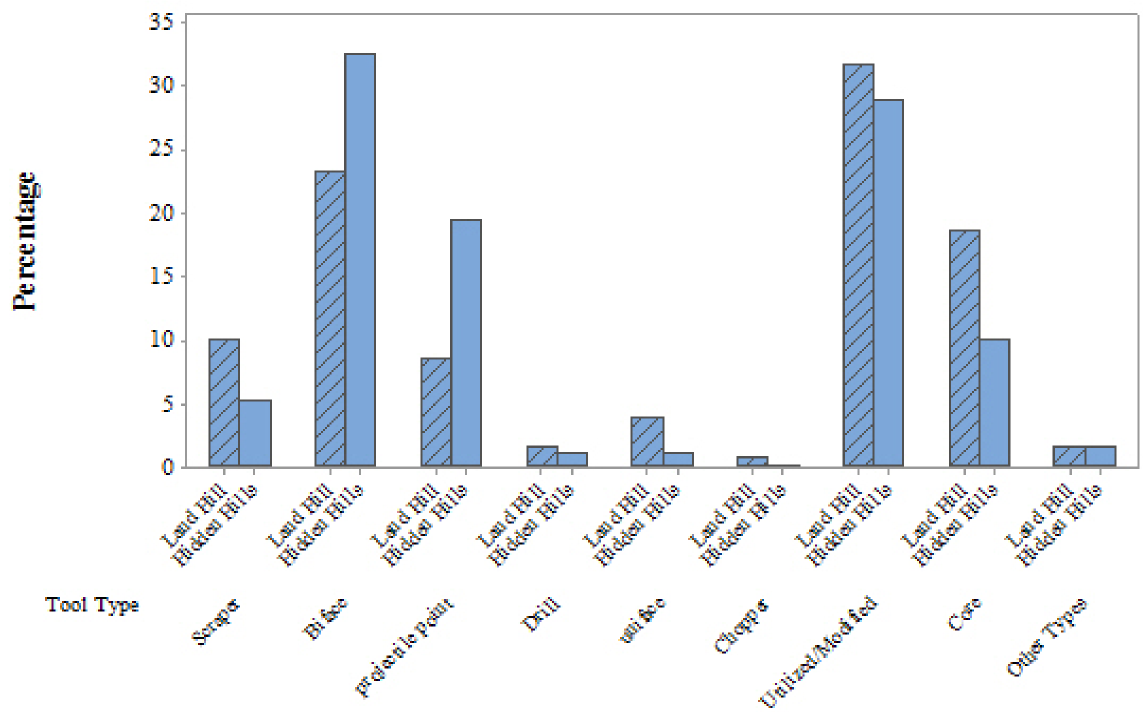

Figure 4.3. Chart comparing the percentages of stone tools in the Land Hill and Hidden Hills areas.

Time Period

This section discusses the different time periods of the Hidden Hills and Land Hill areas. This section is separated into three different time periods. Within each time period section is a breakdown of the artifacts found on the sites that specifically date to a certain time period.

Pueblo I

The sites that date to Pueblo I are AZ A:10:24 (BLM), AZ A:10:29 (BLM), 42WS195, 42WS1894, 42WS1895, and 42WS1931. The most common flake debris that were found on the Pueblo I sites were primary and secondary shatter. These two categories made up 68% of the flake assemblage in the two study areas. Internal flakes made up 18% in Land Hill and 14% in Hidden Hills, and the final three categories (primary decortication, secondary decortication, and bifacial thinning flakes) each make up 10% or less of the flake assemblage. Tables 4.17 and 4.18 show the counts and percentage of the flake types for the Pueblo I sites. The decortication flakes make up a total of 4% of the Land Hill flake assemblage and 9% of the Hidden Hills collection. When compared to all of the other flakes within each study area there is a ratio of 24:1 at Land Hill and 10:1 flakes to decortication flakes at the Hidden Hills sites. Focusing on just the bifacial thinning flakes and internal flakes within each study area, there are 1.7:1 internal flakes to bifacial thinning flakes at Land Hill and 1.8:1 internal flakes to bifacial thinning flakes in the Hidden Hills study area.

Table 4.17 Counts of flake types in the Land Hill and Hidden Hills areas during Pueblo I.

Flake Type	Land Hill	Hidden Hills	Totals
Primary Decortication	23	54	77
Secondary Decortication	36	114	227
Primary Shatter	281	628	909
Secondary Shatter	682	606	1288
Internal Flakes	255	256	511
Bifacial Thinning Flakes	150	143	293
Totals	1427	1801	3228

Table 4.18 Percentage of flake types in the Land Hill and Hidden Hills area during Pueblo I.

Flake Type	Land Hill	Hidden Hills	Totals
Primary Decortication	1.6	3.0	2.4
Secondary Decortication	2.5	6.3	7.0
Primary Shatter	19.7	34.9	28.2
Secondary Shatter	47.8	33.6	39.9
Internal Flakes	17.9	14.2	15.8
Bifacial Thinning Flakes	10.5	7.9	9.1

The counts and percentages of the different stone tools types found at the Pueblo I sites can be seen in Tables 4.19 and 4.20. There were 87 formal tools and 64 expedient tools collected during field work for this time period. The most prominent tool type found in the Land Hill assemblage was utilized or modified flakes; they account for 36.9% of the Land Hill Pueblo I stone tool assemblage. In addition to the utilized and modified flakes, the Land Hills sites had bifaces (20%), cores (13.8%), projectile points (12.3%), and scrapers (10.8%). The most common formal tools found on the Hidden Hills Pueblo I sites were bifaces; these tools make up 32.6% of the entire Hidden Hills Pueblo I stone tool assemblage. In addition to the bifaces the Pueblo I Hidden Hills sites have projectile points (22.1%), utilized and modified flakes (18.6%), and cores (15.1%). The final four categories of the Hidden Hills Pueblo I stone tools each make up less than 5% of the stone tools assemblage. The ratio of debitage to formal tools found at the

Land Hills sites is 45:1, and at the Hidden Hills sites it is 33:1. The ratio of debitage to informal tools found at the Land Hill sites is 43:1, and at the Hidden Hills sites it is 58:1. The ratio of formal to informal tools at the Land Hill sites is just about 1:1, and in the Hidden Hills area it is just about 2:1.

Table 4.19. Count of tool types in the Land Hill and Hidden Hills areas during Pueblo I.

Tool Type	Land Hill	Hidden Hills	Totals
Scraper	7	5	12
Biface	13	28	41
projectile point	8	19	27
Drill	2	2	4
uniface	2	1	3
Chopper	-	-	0
Utilized/Modified	24	16	40
Core	9	13	22
Other Types	-	2	2
Totals	65	86	151

Table 4.20. Percentage of Tool types in the Land Hill and Hidden Hills areas during Pueblo I.

Tool Type	Land Hill	Hidden Hills	Totals
Scraper	10.8	5.8	7.9
Biface	20.0	32.6	27.2
projectile point	12.3	22.1	17.9
Drill	3.1	2.3	2.6
uniface	3.1	1.2	2.0
Chopper	-	-	-
Utilized/Modified	36.9	18.6	26.5
Core	13.8	15.1	14.6
Other Types	-	2.3	1.3

Pueblo II

The sites that date to Pueblo II are; AZ A:10:10 (ASM), AZ A:10:25 (BLM), AZ A:10:26 (BLM), AZ A:10:27 (ASM), AZ A:10:36 (ASM), AZ A:10:37 (ASM), AZ A:10:82 (ASM), 42WS210, 42WS1344, 42WS1345, 42WS1890, and 42WS1929. The totals of the flake types for the Pueblo II sites are very similar to the quantities found at the Pueblo I sites. Tables 4.21 and 4.22 show the counts and percentages of the flake types for the Pueblo II sites. The most common flake debris that was found on the sites was primary and secondary shatter, with these two categories making up 71% of the flake assemblage. Internal flakes made up 16%, and the final three categories primary decortication, secondary decortication, and bifacial thinning flakes each make up less than 10% of the flake assemblage.

When compared to all flakes within each study area there is a ratio of 69:1 (69 flakes to 1 decortication flake) at Land Hill and 10:1 (10 flakes to 1 decortication flake) at the Hidden Hills sites. Focusing on just the bifacial thinning flakes and internal flakes within each study area, there are 1.4:1 bifacial thinning flakes to internal flakes at Land Hill and 9:1 internal to bifacial thinning flakes in the Hidden Hills study area.

Table 4.21. Counts of Pueblo II flake types in the Land Hill and Hidden Hills areas.

Flake Type	Land Hill	Hidden Hills	Totals
Primary Decortication	8	49	57
Secondary Decortication	7	85	92
Primary Shatter	163	472	635
Secondary Shatter	631	445	1076
Internal Flakes	93	283	376
Bifacial Thinning Flakes	126	33	159
Totals	1028	1367	2395

Table 4.22. Percentage of Pueblo II flake types in the Land Hill and Hidden Hills areas.

Flake Type	Land Hill	Hidden Hills	Totals
Primary Decortication	0.8	3.6	2.4
Secondary Decortication	0.7	6.2	3.8
Primary Shatter	15.9	34.5	26.5
Secondary Shatter	61.4	32.6	44.9
Internal Flakes	9.0	20.7	15.7
Bifacial Thinning Flakes	12.3	2.4	6.6

There were 58 formal tools and 44 expedient tools collected from Pueblo II sites during field work. The most prominent tools found in the stone tool assemblage are the utilized or modified flakes (34.3%) and bifaces (32.4%); at the Pueblo II sites they account for 32-34% of the stone tool assemblage. Projectile points make up (16.7%) of the Pueblo II stone tools assemblage. The final 16.6% of Pueblo II tools are scrapers (5.9%), cores (5.9%), additional tool types (2.9%), the unifaces (1%) and choppers (1%) make up the final 2%. Table 4.23 and 4.24 shows the counts and percentages of stone tools by state that date from Pueblo II.

The ratio of debitage to formal tools found at the Land Hills sites is 144:1, and at the Hidden Hills sites it is 28:1. The ratio of debitage to informal tools found at the Land Hill sites is 257:1, and at the Hidden Hills sites it is 34:1. The ratio of formal to informal tools at the Land Hill sites is just about 2.3:1, and in the Hidden Hills area it is just about 1.2:1.

Table 4.23. Counts of Pueblo II tool types divided by state.

Tool Type	Land Hill	Hidden Hills	Totals
Scraper	2	4	6
Biface	3	30	33
projectile point	3	14	17
Drill	-	-	-
uniface	-	1	1
Chopper	1	-	1
Utilized/Modified	1	34	35
Core	1	5	6
Other Types	2	1	3
Totals	13	89	102

Table 4.24. Percentage of Pueblo II tool types in the Land Hill and Hidden Hills areas.

Tool Type	Land Hill	Hidden Hills	Totals
Scraper	15.4	4.5	5.9
Biface	23.1	33.7	32.4
projectile point	23.1	15.7	16.7
Drill	-	-	-
uniface	-	1.1	1.0
Chopper	7.7	-	1.0
Utilized/Modified	7.7	38.2	34.3
Core	7.7	5.6	5.9
Other Types	15.4	1.1	2.9

Pueblo III

The sites that date to Pueblo III are AZ A:10:16 (BLM), AZ A:10:20 (BLM), and 42WS50. The most common flake debris found on Pueblo III sites were primary and secondary shatter, and this category makes up 63.6% of the flake assemblage. Internal flakes make up 18% of the flake assemblage. Decortication flakes make up 12% of the stone tool assemblage. Finally, bifacial thinning flakes make up 6.6%. Tables 4.25 and 4.26 show the percentage and counts of the flake types for the Pueblo III sites broken down by study area.

When compared to all of the other flakes within each study area there is a ratio of 11:1 (11 flakes to 1 decortication flake) at Land Hill and 7:1 (7 flakes to 1 decortication flake) at the Hidden Hills sites. Focusing on just the Hills study area. Bifacial thinning flakes and internal flakes within each study area, there are 2.2:1 internal to bifacial thinning flakes at Land Hill and 3:1 internal to bifacial thinning flakes in the Hidden Hills study area.

Table 4.25. Pueblo III flake types in the Land Hill and Hidden Hills areas during Pueblo III.

Flake Type	Land Hill	Hidden Hills	Totals
Primary Decortication	6	13	19
Secondary Decortication	13	25	38
Primary Shatter	39	96	135
Secondary Shatter	101	63	164
Internal Flakes	40	43	83
Bifacial Thinning Flakes	18	13	31
Totals	217	253	470

Table 4.26. Pueblo III percentage of flake types in the Land Hill and Hidden Hills areas.

Flake Type	Land Hill	Hidden Hills	Totals
Primary Decortication	2.8	5.1	4.0
Secondary Decortication	6.0	9.9	8.1
Primary Shatter	18.0	37.9	28.7
Secondary Shatter	46.5	24.9	34.9
Internal Flakes	18.4	17.0	17.7
Bifacial Thinning Flakes	8.3	5.1	6.6

There were 21 formal tools and 77 expedient tools collected from Pueblo III sites during field work. The most prominent tool found in the stone tool assemblage is utilized or modified flakes; they account for 30.6% of the Pueblo III stone tool assemblage. Bifaces (28.6%) and cores (26.5%) make up the other two tool types that have the highest percentage of the Pueblo III stone tool assemblage. The final three tool types that complete the Pueblo III stone tool assemblages for the two study areas are; scrapers (6.1%), unifaces (6.1%), and projectile points (2.0%). The counts and percentages of the stone tool types for the Pueblo III sites in the Land Hill and Hidden Hills can be found on Tables 4.27 and 4.28.

The ratio of debitage to formal tools found at the Land Hills sites is 11:1, and at the Hidden Hills sites it is 127:1. The ratio of debitage to informal tools found at the Land Hill sites is 9:1, and at the Hidden Hills sites it is 84:1. The large difference in ratio of debitage to tools during Pueblo III may be due to a sampling error. There was almost no tools found at the Pueblo

III Hidden Hills sites and all of there is a possibility that all of the debitage may not have been collected at 42WS50 the only Land Hill site included in this study. The ratio of formal to informal tools at the Land Hill sites is just about 1.3:1, and in the Hidden Hills area it is just about 1.5:1.

Table 4.27. Pueblo III tool types in the Land Hill and Hidden Hills areas during Pueblo III.

Tool Type	Land Hill	Hidden Hills	Totals
Scraper	3	-	3
Biface	13	1	14
projectile point	-	1	1
Drill	-	-	-
uniface	3	-	3
Chopper	-	-	-
Utilized/Modified	13	2	15
Core	12	1	13
Other Types	-	-	-
Totals	44	5	49

Table 4.28. Percentage of Tool types in the Land Hill and Hidden Hills areas during Pueblo III.

Tool Type	Land Hill	Hidden Hills	Totals
Scraper	6.8	-	6.1
Biface	29.5	20.0	28.6
projectile point	-	20.0	2.0
Drill	-	-	-
uniface	6.8	-	6.1
Chopper	-	-	-
Utilized/Modified	29.5	40.0	30.6
Core	27.3	20.0	26.5
Other Types	-	-	-

Comparison of Temporal Trends

This section discusses the comparisons between the Land Hill and Hidden Hills areas in relation to time period. This portion of the analysis chapter only focuses on the sites from the two study areas that date to Pueblo I, II, or III. Table 4.29 lists the sites that either have a reliable radio carbon date or have been date using ceramics, and the time period that each date to for the comparison.

Table 4.29. Time periods and the list of corresponding sites.

Time Period	Utah Sites	Arizona Sites
Pueblo I	42WS195	AZ A:10:24 (BLM)
	42WS1894	AZ A:10:29 (BLM)
	42WS1895	
	42WS1931	
Pueblo II	*42WS1929*	AZ A:10:26 (BLM)
	42WS1342	*AZ A:10:36 (ASM)*
	42WS1890	AZ A:10:10 (ASM)
	42WS210	*AZ A:10:82 (ASM)*
	42WS1344	AZ A:10:25 (BLM)
	42WS1345	AZ A:10:27 (ASM)
		AZ A:10:37 (ASM)
Pueblo III	42WS50	*AZ A:10:16 (BLM)*
		AZ A:10:20 (BLM)

Note: Italicized sites are dated using only ceramics.

Material Type

Chert is the stone material primarily used in both study areas. The Hidden Hills sites also had a small percentage of quartzite and other unidentified stone types. The sites in the Land Hill area have slightly more variety in stone materials. The Land Hill sites have obsidian, basalt, quartzite, and some unidentified stone types, in addition to the chert. Much like the Hidden Hills sites, the percentages of non-chert materials are low, each making up less than 10% of the stone assemblage. Figure 4.4 shows a correspondence analysis of the time periods in relation to material type. Tables 4.30 and 4.31 show the counts and percentages of the different material types that went into the correspondence analysis. Figure 4.4 shows there is split between the two areas with the Arizona sites cluster more towards quartzite and the Utah sites cluster towards obsidian, basalt, and other stone types. Each area is continually using chert throughout time.

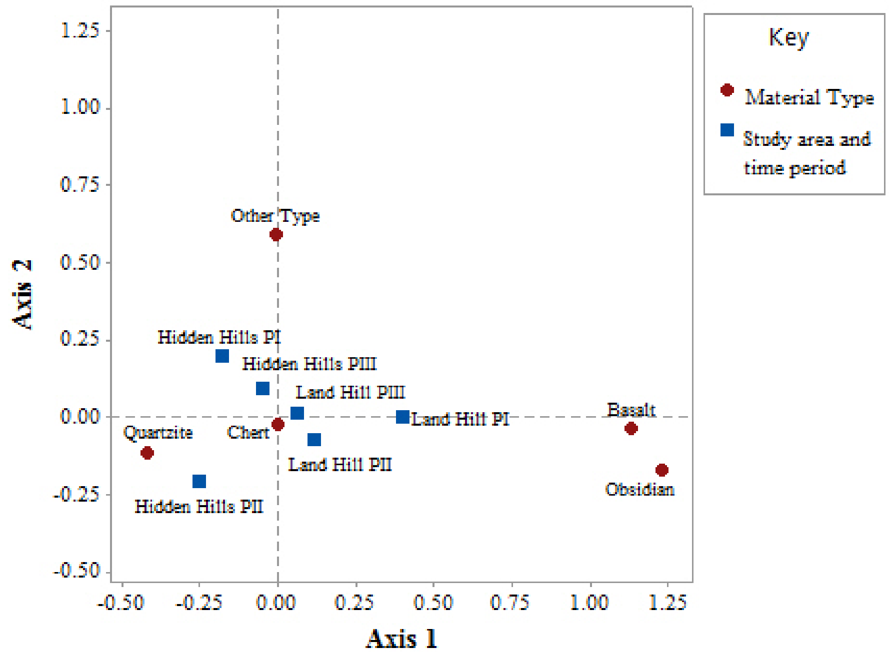

Figure 4.4. Correspondence analysis showing the association of materials in the study areas throughout time.

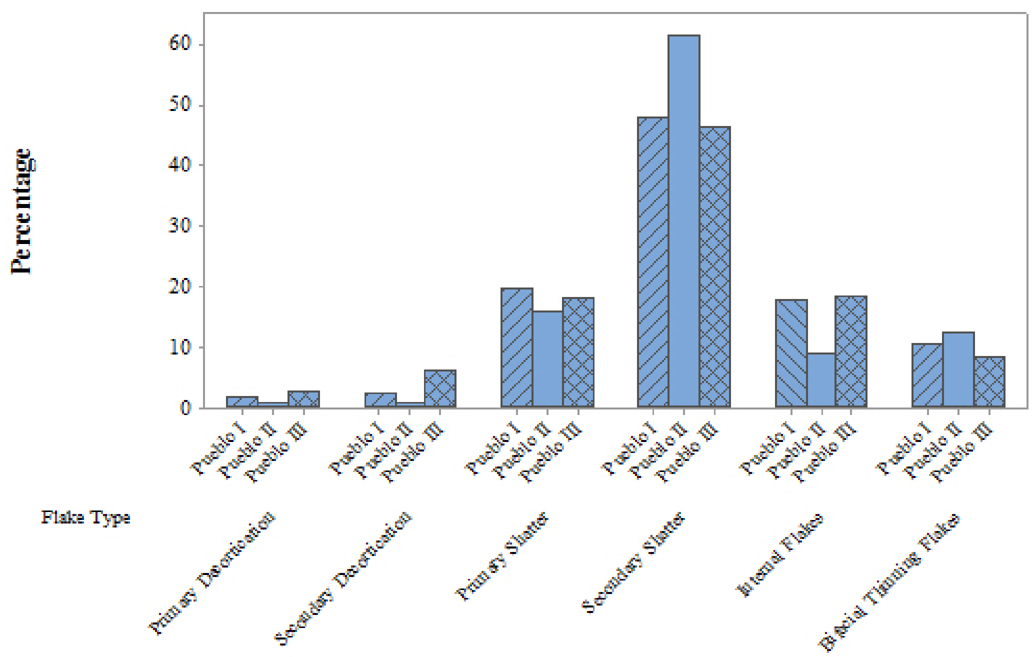

Figure 4.5. Chart showing the percentages of flake types at Land Hill sites through time.

Table 4.30. Counts of material types split by time period and study area.

Material	Pueblo I		Pueblo II		Pueblo III	
	Land Hill	Hidden Hills	Land Hill	Hidden Hills	Land Hill	Hidden Hills
Chert	1115	1405	889	1132	193	230
Quartzite	73	199	40	213	7	6
Obsidian	72	0	21	3	1	0
Basalt	79	7	21	1	5	0
Other Type	88	190	34	18	11	17
Total	1427	1801	1005	1367	217	253

Table 4.31. Percentage of material types split by time period and study area.

Material	Pueblo I		Pueblo II		Pueblo III	
	Land Hill	Hidden Hills	Land Hill	Hidden Hills	Land Hill	Hidden Hills
Chert	78.1	78.0	88.5	82.8	88.9	90.9
Quartzite	5.1	11.0	4.0	15.6	3.2	2.4
Obsidian	5.0	0.0	2.1	0.2	0.5	0.0
Basalt	5.5	0.4	2.1	0.1	2.3	0.0
Other Type	6.2	10.5	3.4	1.3	5.1	6.7

Flake Type

Land Hill: The most common flake debris collected from the Land Hill sites was secondary shatter. Figure 4.5 shows the percentage of flake types by time period within the Land Hills study area. There is a small number of primary and secondary decortication flakes found at the Land Hill sites throughout all of the time periods; the percentage appears to increase through time with the highest percentage found in the Pueblo III assemblage. Land Hill has a large amount of secondary shatter. There was about the same percentage of primary shatter, internal flakes, and bifacial thinning flakes found at the sites for all three of the time periods. Primary shatter and internal flakes have higher percentages during Pueblo I and III. Secondary shatter and bifacial thinning flakes have their highest percentage during the Pueblo II time period.

Hidden Hills: Primary and secondary shatter were the most common flake debris collected from the Hidden Hills sites. Figure 4.6 show the percentages of each flake type within the two study areas. Figure 4.6 shows that the smallest percentages of flake types on the Hidden Hills sites were primary and secondary decortication flakes, as well as bifacial thinning flakes. The Pueblo III sites in the Hidden Hills study area have the highest primary shatter, as well as primary and secondary decortication flakes. There was a higher percentage of internal flakes than bifacial flakes in all of the time periods, the lowest percentage of bifacial flakes was in the Pueblo II assemblages.

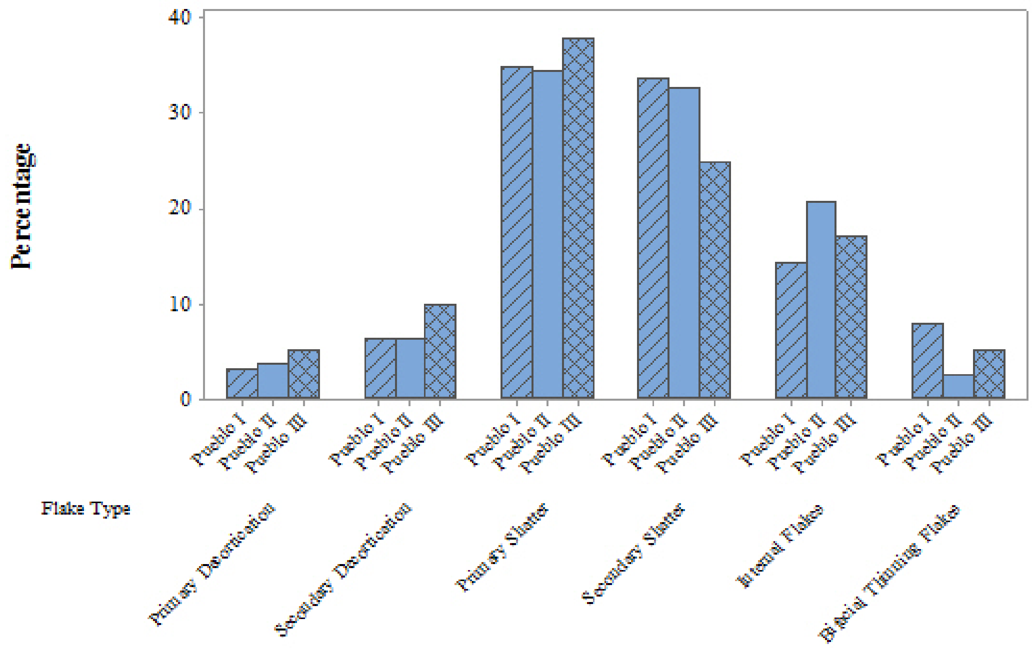

Figure 4.6. Graph showing the percentages of flake types at Hidden Hills sites through time.

Comparison: The differences between the study areas show up when the flake type percentages are closely examined. Figures 4.5 and 4.6 show the percentages of the different flakes through time within each study areas flake assemblage. These figures show that sites in both study areas have high amounts of secondary shatter, Hidden Hills also has a large percentage of primary shatter. The Land Hill area has a higher percentage of secondary shatter throughout all of the time periods. The other flake types have around the same percentages, therefore look very similar when presented in bar charts.

The most notable differences between the study areas can be seen in the Pueblo II assemblage. Land Hill had more secondary shatter during the Pueblo II time period, and the internal and bifacial thinning flakes between the two areas vary. During Pueblo II the percentage of internal flakes at the Land Hill sites decreases while the percentage of bifacial thinning flakes increases. In Hidden Hills during Pueblo II the internal flakes increase to their highest percentage while the bifacial thinning flakes decrease to their lowest percentage. The change in internal and bifacial thinning flakes in the two study areas can also be seen by looking at the ratio of the two flake types. Figure 4.7 shows the ratio of internal to bifacial thinning flakes through time in both study areas. For Land Hill, the ratio of internal to bifacial thinning flakes is lower in Pueblo I and III and slightly higher in Pueblo II. The Hidden Hills ratios are similar but more pronounced, with lower percentage of bifacial thinning flakes found during Pueblo I and III and highest during Pueblo II.

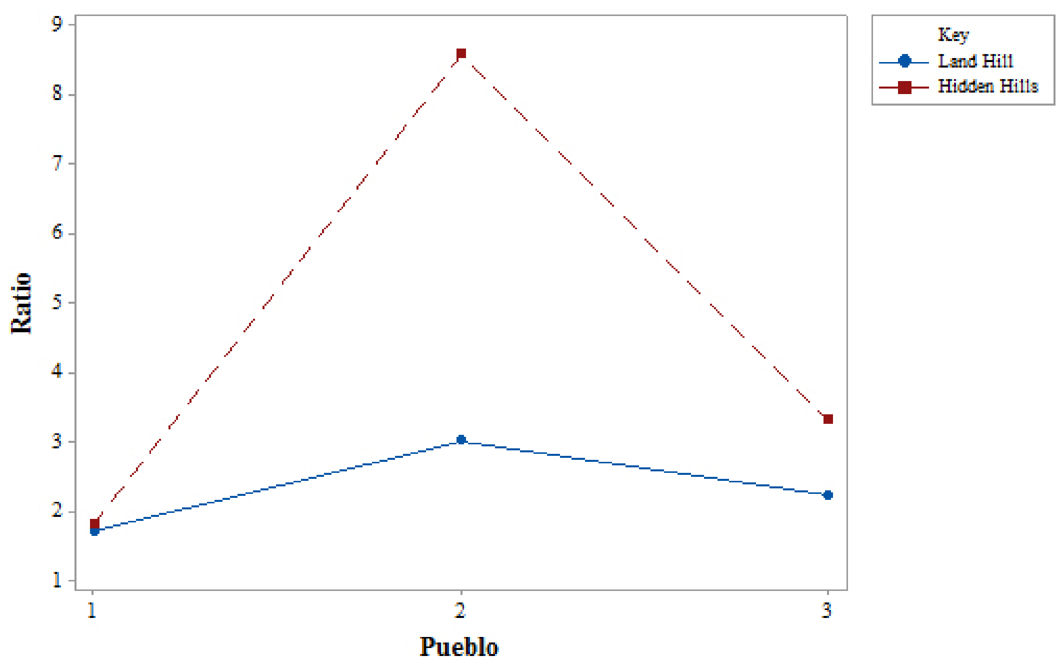

Figure 4.7. Ratio of bifacial thinning flakes to internal flakes by study area through time.

The correspondence analysis in Figure 4.8 shows a pattern in the distribution of flake types throughout time. Tables 4.32 and 4.33 show the count and percentages of the Land Hill and Hidden Hills sites throughout time. The correspondence analysis shows a split between the Land Hill and Hidden Hills study areas. This split shows that the Hidden Hills sites throughout time seem to cluster towards flakes in later bifacial production, while the Land Hill sites throughout time seem to cluster near the flake types of early stages of reduction. This means that the Hidden Hills sites cluster towards the flake types that are associated with early formal tool production or the reduction of raw material. In contrast the Land Hills sites cluster towards the flakes that are associated with later formal tool production and the finishing off of tools. The results of this correspondence analysis appear to contradict one of the original hypotheses of this thesis; which is that there would be more debitage associated with biface and projectile point production in the Hidden Hills study area, and little to no debitage associated with biface and projectile point production at the sites located in the Land Hill study area.

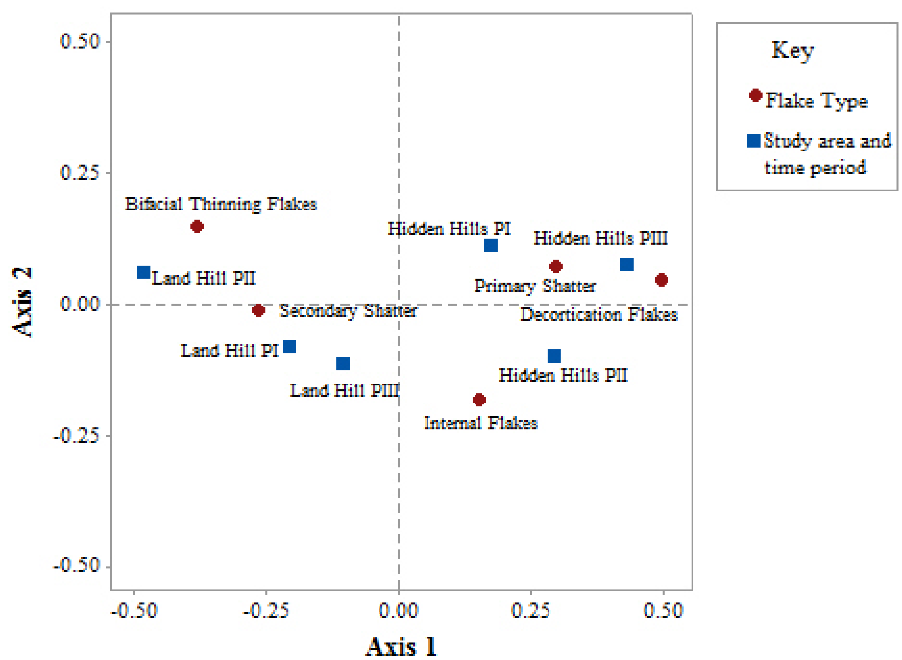

Figure 4.8. Correspondence analysis showing the distribution of flake types by study area and time period.

Table 4.32. Counts of flake types split by time period and study area.

Material	Pueblo I		Pueblo II		Pueblo III	
	Land Hill	Hidden Hills	Land Hill	Hidden Hills	Land Hill	Hidden Hills
Decortication	59	168	15	134	19	38
Primary Shatter	281	628	163	472	39	96
Secondary Shatter	682	606	631	445	101	63
Internal Flakes	255	256	93	283	40	43
Bifacial Thinning	150	143	126	33	18	13
Total	1427	1801	1028	1367	217	253

Table 4.33. Percentages of flake types split by time period and study area.

Material	Pueblo I		Pueblo II		Pueblo III	
	Land Hill	Hidden Hills	Land Hill	Hidden Hills	Land Hill	Hidden Hills
Decortication	4.1	9.3	1.5	9.8	8.8	15.0
Primary Shatter	19.7	34.9	15.9	34.5	18.0	37.9
Secondary Shatter	47.8	33.6	61.4	32.6	46.5	24.9
Internal Flakes	17.9	14.2	9.0	20.7	18.4	17.0
Bifacial Thinning	10.5	7.9	12.3	2.4	8.3	5.1

Stone Tools

Land Hill: The most common tools throughout time on the Land Hill sites are utilized or modified flakes. Figure 4.9 shows the ratio of formal to informal tools in both areas throughout the three time periods. During the Pueblo II time period, there was a larger ratio of formal tools to informal tools. The ratio of formal to informal tools starts low during Pueblo I (1:1) and rises during Pueblo II (2.3:1) and then falls down to the level for Pueblo III (1.3:1).

The Land Hill study area had high percentages of bifaces throughout all three time periods, and the percentage of biface increased throughout time. Land Hill had many scrapers, projectile points, cores, and utilized and modified flakes. The percentages for scrapers and projectile points all start low in Pueblo I, increase during Pueblo II and drop during Pueblo III. The core and utilized and modified flake tool types all have higher percentages during Pueblo I, decrease to the lowest percentages during Pueblo II, and increase again to a higher percentage during Pueblo III. Figure 4.10 shows the percentage of stone tools throughout time.

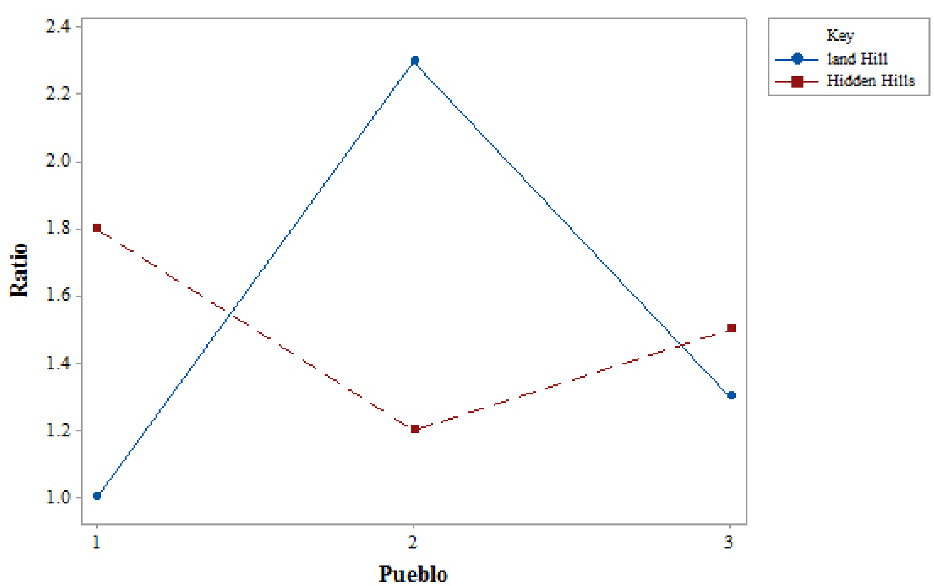

Figure 4.9. Graph showing the ratio of formal to informal tools throughout different time periods.

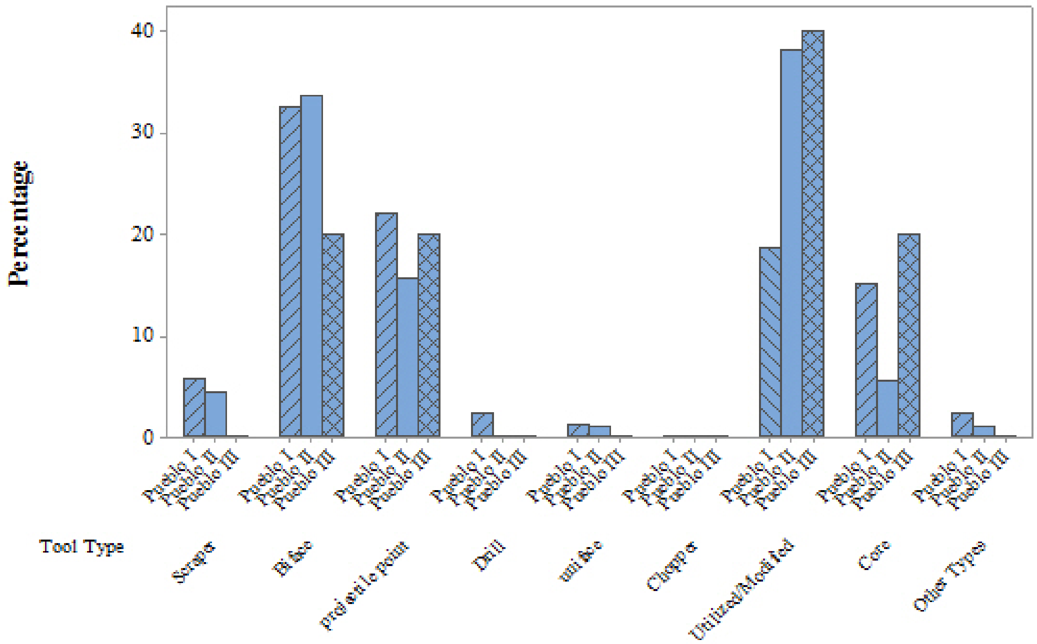

Figure 4.10. Chart of the Land Hill stone tools through time.

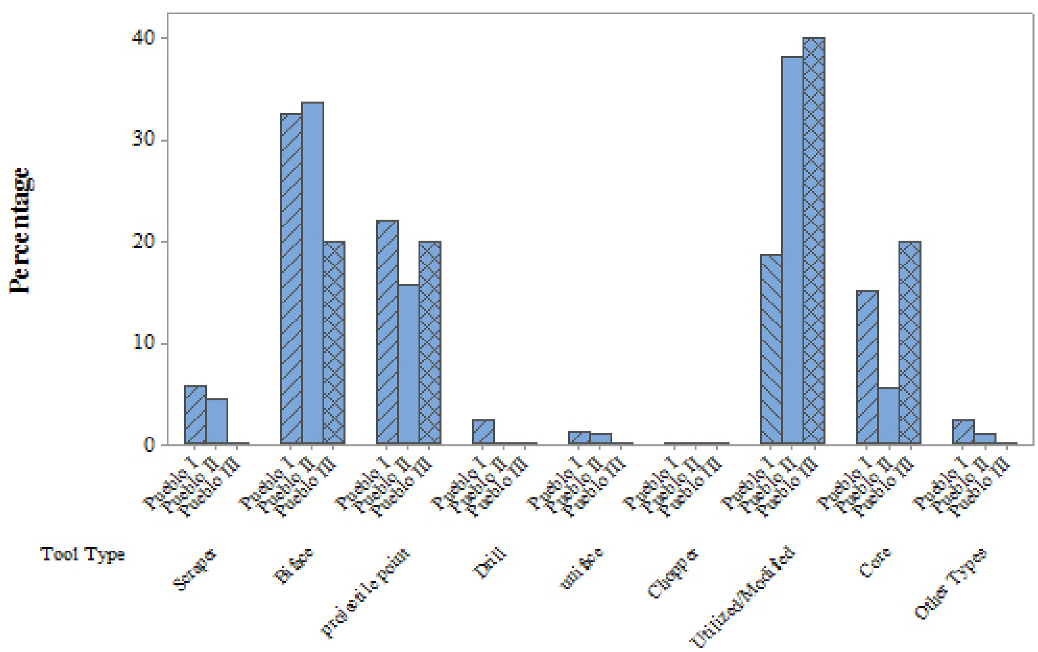

Figure 4.11. Chart of the Hidden Hills Stone Tools through Time

Hidden Hills: The most common tools throughout time on the Hidden Hills sites are utilized or modified flakes and bifaces. Figure 4.11 shows the percentage of stone tools throughout time. The ratio of formal to informal tools can be seen in Figure 4.10. During Pueblo I the ratio of formal to informal is 1.8:1, during Pueblo II the ratio decreases to 1.2:1, and during Pueblo III the ratio increases again to 1.5:1.

The Hidden Hills tool assemblage has high percentages of bifaces, projectile points, utilized flakes, bifaces, and cores. The four main tool type present (projectile points, utilized flakes, bifaces, and cores) make up at least 20% each in the stone tools assemblages throughout time. During the Pueblo I and II time periods biface percentages are high, then the percentage of bifaces drop during the Pueblo III period. During the Pueblo I period utilized and modified flakes percentages are around 20% and then during the Pueblo II and Pueblo III periods the percentage increases to around 40%. During Pueblo I the projectile point and core percentages are high, then during Pueblo II they drop, and during Pueblo III they increase again. Overall, in the Hidden Hills study area there are four main tool type present; bifaces, projectile points, cores, and utilized and modified flakes. The percentages of these tool types fluctuate throughout time.

Comparison: The stone tool type that is consistently present with a high percentage throughout time is bifaces. The stone tool percentages in the Land Hill areas fluctuate through time more than the stone tool percentages in the Hidden Hills study area. Figure 4.10 shows that the ratio of formal tools to informal tools throughout time; this figure shows that during Pueblo I and III the sites in the Land Hill study area have a higher ratio of formal tools, which means that the Land Hill sites had more formal tools than the Hidden Hills sites during these time periods. During Pueblo II the Hidden Hills sites had a much higher ratio of formal tools than the sites in the Land Hill area. This is due to the drop in the presence of informal tools at the Land Hill sites during the Pueblo II time period.

The interesting thing to notice in the Land Hill stone tool assemblage is the abundance of formal tools when compared to the Hidden Hills area throughout all three time periods. This is interesting because one of the hypotheses of this thesis is that in a sedentary lifestyle people would not really have invested as much time and effort into creating bifaces and projectile points, instead they would create more informal tools like utilized and modified flakes and cores. Instead of decreasing the use of formal tools throughout time the percentages increase during the Pueblo I and II time periods. The Pueblo III stone tool assemblage shows an increase in the percentage of bifaces but a decrease in scrapers and projectile points, though this may be the effect of the sample size. The informal tools have high percent of utilized and modified flakes, as well as cores during the Pueblo I and III time periods, but the Pueblo II sites show a decrease in the percentage of utilized and modified flakes and cores.

The Hidden Hills sites on the other hand show that projectile points and bifaces are present in high percentages without much change. The big changes in the Hidden Hills study area are an increase in the presence of utilized flakes within the Hidden Hills study area during Pueblo I. There is also a decrease in the presence of cores during the Pueblo II time period similar to the Land Hill percentages of cores. Overall, the breakdown of the different tool types throughout time is rather similar in the two study areas.

Summary of Results

The differences between the Hidden Hills and Land Hill areas do not appear to be as significant as was originally proposed in Chapter 1. The first section of this chapter discussed the issue of surface loss in both states. That section indicates there may have been some losses of formal tools on the surface in both areas. In Land Hill there were eight sites that had a higher percentage of tools found in the subsurface collection, three sites had more tools on found in the surface collections, and there is only one site that has the same percentage of tools found during the surface and the subsurface collection. In the Hidden Hills study area four of the sites had more tools found in the subsurface collection, 17 sites had a higher percentage of tools that were found in the surface collections, and two of the sites had the same percentage of tools found during the surface and subsurface collections. This led to the conclusion that the sites in the Land Hill study area appear to have more tools found in the subsurface collection than in the surface collections, and the sites in the Hidden Hills area appear to have more intact surface assemblages. Because of this, the rest of the analysis performed for Chapter 4 focused on the subsurface assemblages from both of the study areas, since this was the best data in the collection.

The second section of this chapter discussed the flake and stone tool types of all the sites in both of the study areas. This section indicates that most of the debitage found at the Hidden Hills sites were either primary or secondary shatter. There were slightly more decortication flakes found at sites within the Hidden Hills area. This could suggest that the people living at the Hidden Hills sites could be preforming more early stage bifacial reduction or other tool production. The fact that bifaces and projectile points appear to be the two most common formal tools on the Hidden Hills sites goes with the hypothesis that the people who were living on these sites were more mobile, or at least more invested in hunting, than the people living in the Land Hill area. That hypothesis states that if people were more mobile they would have more need for formal tools like bifaces and projectile points, whereas if the people who lived at these sites were more sedentary, there would be less need to put the time and effort into a formal tool when an expedient one would do just fine. The fact that bifaces are the second most common tool type found at the sites in the Land Hill study area goes against the hypothesis that the people who were living at these sites were not very mobile or invested in hunting. That hypothesis states that people living less mobile lifestyles would not need to make, use, break, or repair as many formal tools like bifaces and projectile points, however, they are present and common at many of the sites within the Land Hill study area. Overall, the distribution of the tools is not what was expected at the beginning of this thesis.

The final section of this chapter compared the sites located in the Land Hill and Hidden Hills study areas throughout time period. The Land Hill sites throughout time seem to have more flakes that are associated with later core reduction, while the Hidden Hills sites throughout time seem to have a higher percentages of the flake types often associated with flakes relating to of early core reduction. This means that the Hidden Hills sites had more flake types that are associated with early formal tool production or the reduction of raw material. The results of this section of the analysis appear to contradict one of the original hypotheses of this thesis; that there would be more debitage associated with biface and projectile point production at sites within the Hidden Hills study area. The ratios of formal to informal tools showed that there was a lower ratio of formal to informal tools in the Land Hill area during the Pueblo I and III time periods and a big increase during Pueblo II. The Hidden Hills sites have a higher percentage of formal to informal tools during Pueblo I and III. The formal to informal stone tool ratio decreases slightly during the Pueblo II time period. The results presented in this chapter are reviewed and discussed in more detail in the following, final chapter.

5 | Discussion and Conclusion

This chapter begins with ideas for potential future research. The second section answers the questions that were posed at the beginning of the thesis; 1) What do the results of the analysis of these assemblages tell us about the differences in what stone tools were being used for? 2) Is there a significant difference between the sites in the two areas? 3) What do the patterns of stone tool debitage tell us about the overall mobility at Land Hill and Hidden Hills throughout time? The final section of this chapter discusses the conclusions and wraps up the thesis.

Potential Future Research

During the course of my research, I became aware of some areas that I would have liked to explore further. There is a need for a more in depth look at the core technology within these assemblages, specifically bipolar core technology. If bipolar cores are common, that may mean that materials were scarcer and the groups had to make their material last a lot longer before they could go and procure more. I also would have liked to look deeper into bipolar core technology because its use on these sites may shed some more light on the way of life in these two areas.

There are other artifact types that can be looked at in order to help answer the questions posed in this thesis. Groundstone could be looked at alongside the chipped stone tools and debitage. Groundstone is present on many sites and can help put together the puzzle of how a group was living there. The presence of groundstone at a site generally means that people were living and processing food at a site. The combination of groundstone and chipped stone can potentially answer these questions easily and with more evidence. Groundstone is generally used for processing plants for food. When groundstone research is combined with the research into chipped stone tools that are also found on the site, observations can be made about how reliant the group was on hunting and gathering versus farming. Faunal bone would also be another good artifact to look at in combination with stone tools. With the combination of chipped stone and faunal bone analysis there is potential to make observations as to how much hunting may have been done. There are many ways that a future researcher may look at these questions, my thesis will at least be something to start with.

Discussion

What do the results of the analysis of these assemblages tell us about the differences in what stone tools were being used? Is there a significant difference between sites in the two areas?

The results of the analysis showed that there were differences between the sites in two study areas. These differences were not as substantial as I first hypothesized. When the flake types were compared, the analysis showed that the sites in both of the study areas had high percentages of shatter in their flake assemblages. Land Hill had a ratio of 1.4:1 internal to bifacial thinning flakes and Hidden Hills had a ratio of 3.2:1 internal to bifacial thinning flakes. This means that there were a higher percentage of bifacial thinning flakes within the Land Hill area, than in the Hidden Hills area. The stone tools assemblages showed that ratio of informal tools to formal tools was around the same in both of the study areas. Land Hill had a ratio of 1.3:1 and Hidden Hills had a ratio of 1.7:1, this means that there are slightly more formal tools found in the Land Hill study area than in the Hidden Hills area. The next few paragraphs go into more detail about the findings between the two study areas.

When comparing the stone material from the two study areas the analysis showed that the sites in both areas had a large amount of chert. At sites within the Hidden Hills study area there is less variation in the other stone material types; quartzite and other unidentified materials were used alongside chert. In the Land Hill area, there is more variation in material type; basalt, obsidian, quartzite, and other unidentified materials were also used. This may mean that people living in the sites within the Land Hill area had access to more stone types, which may be from location, trade, or going out to the source to get the different material. Chert makes up over 80% of the material in each study area, and the other materials all make up less than 10% individually within each study area.

The fact that chert is the most common stone material used within these study areas means that the people living probably had access to a local chert. In the Hidden Hills study area there were some sites that had small chert outcrops located on or near the site. The Land Hill study area was located near a river and near an outcrop of basalt. The river was probably the main source of raw stone materials for the sites in the Land Hill area. There are chert cobbles found in the gravel deposits along the Santa Clara River, and the small percentages of the other stone materials used at the sites would have probably also been procured either in or near the river.

The flake types present in each study area show some differences in what stone tools the prehistoric inhabitants may have produced. The Hidden Hills area had more flakes than the Land Hill area in its debitage assemblage. The highest percent of flake debris in both study areas was flake shatter. The Land Hill sites had more secondary shatter and more bifacial thinning flakes, the Hidden Hill sites had a slightly higher percentage of all the flake types with the exception of secondary shatter and bifacial thinning flakes. The fact that the sites in the Land Hill area had such a large percentage of bifacial thinning flakes is unexpected, because it goes against the hypothesis that the people living in the Land Hill area had a greater emphasis on farming. The large percentage of bifacial thinning flakes seems to suggest that they may have relied on hunting more than originally thought. The ratio of bifacial thinning flakes to internal flakes is slightly higher in Land Hill than in Hidden Hills which also contradicts the hypothesis proposed early in this thesis, that the people living on the Land Hill sites were farming more than hunting, therefore, they invested more time in producing less formal like utilized and retouched flakes.

The comparison of the stone tool assemblages between the two study areas showed that both areas had a high percentage of utilized and modified flakes, bifaces, projectile points, and cores. The percent of projectile points and bifaces is higher in the Hidden Hills study area which helps to confirm one of the hypotheses proposed at the beginning of this thesis. The hypothesis proposed that the people living in the Hidden Hills area were more mobile than the people in the Land Hills study area, because they appear to be producing more formal than informal tools.

When looking at the ratio of formal to informal tools in both study areas, the Land Hill study area has 1.3:1 to Hidden Hills 1.7:1 informal to formal tools. This means that between the two study areas there is a small difference in the amount of formal tools found at the Land Hill sites than within the Hidden Hills study area. The ratio of debitage to formal or informal tools in the Land Hill study area is 34:1 formal tools and 44:1 informal tools, meaning the sites in the Land Hill area had more formal tools. In the Hidden Hills study area the difference is more significant, the ratios of debitage to tools are 28:1 formal tools and 12:1 informal tools found.

Overall, when looking at the stone tools and debitage from the Land Hill and Hidden Hills sites all together there are some interesting and unexpected differences and similarities. The fact that there are more informal tools than formal tools found at the sites within the Hidden Hills study area is surprising because I expected the sites in the Hidden Hills area would have more formal stone tools for hunting, which it does, when compared to the Land Hill study area. However, when the Hidden Hills assemblages are looked at separate from Land Hill, there are more informal tools than formal tools. This might mean that the people living in at the sites in the Hidden Hills study area were hunting but they may have been relying on farming much more than I originally thought. It can also mean that the formal tools that were being repaired or made somewhere else and brought into the site, where they were either left or taken out of the sites again when the individual left. The fact that there was a large percentage of bifaces and bifacial thinning flakes found at the Land Hill sites is surprising because it goes against the hypothesis that the people living on the sites in the Land Hill area emphasized farming over hunting. Perhaps the people living within the Land Hill study area hunted more than I thought that they would. When the two study areas are compared to each other the Hidden Hills assemblages suggests that there is more mobility and emphasis on hunting than in the Land Hill area.

What do the patterns of stone tools and debitage tell us about the mobility at Land Hill and Hidden Hills throughout time?

Based on the stone tools and debitage, it appears that overall the subsistence systems in the Land Hill and Hidden Hills study areas were very similar and did not change very much throughout time. The stone tool type that is consistently present with a high percentage throughout time is bifaces. The Hidden Hills sites fluctuated in the percentages of the different tool types. This is reflected in the ratios of formal to informal tools. During the Pueblo II time period the Hidden Hills sites had a much higher ratio of formal tools than the sites in the Land Hill area. This is due to the drop in the presence of informal tools at the Land Hills sites during the Pueblo II time period. This may have been because people were coming in and settling down.

Based on the tool and flake assemblages that were gathered and analyzed it can be said that the sites in Land Hill and Hidden Hills were occupied as habitation sites for groups living in the area.

Conclusions

The sites in the project areas had a rather large percentage of projectile points throughout time in both areas, but they had higher percentages of bifaces, utilized, and modified flakes. Parry and Kelly (1987) argued "the most striking correlation of expedient core technology appears to have been a shift in settlement patterns. In each area, the most significant decrease in the use of formal tools occurred at about the same time as the first occupation of large, nucleated, permanent villages." (Parry and Kelly 1987:297). This means there should be more expedient tools and cores found in a site assemblage if they were living a relatively settled lifestyle. Kelly (1988) suggested that bifaces can be manufactured to fulfill one or more of three roles as a core, a long use-life tool, or a by-product of the shaping process. There was a high percentage of stage three bifaces in both areas (43% in Land Hill and 65% in Hidden Hills), meaning that they most likely part of a broken formal tool. I believe that many of the bifaces stage one and two bifaces (57% in Land Hill) found on the sites in the Land Hill study area may have been used as cores for the informal tools that were being produced. However, the presence of such high percentages of all three stages of bifaces (65% stage one and 35% stage two and three) in the Hidden Hills study area throughout time suggests that they were being used to create other formal tools for use.

Since the sites in Hidden Hills study area did not have a very significant increase or decrease in formal or informal tools between the states or throughout time. I believe it is because these sites were probably occupied by the start of Pueblo I and through Pueblo III without much change as to how they subsisted. Many of the sites in the Hidden Hills study area had architectural elements, meaning that substantial time and effort were put into creating a place to live, which is not something a mostly mobile group would do. Though I cannot say definitively that what was happening without looking at more variables than just the stone tools and debitage; perhaps the presence of projectile points at the sites throughout all of the time periods suggests that they were hunting; slightly more so in the Hidden Hills area than in the Land Hill area.

The sites in Land Hill study area had an increase of formal tools during Pueblo II. There were higher percentages of scrapers, bifaces, and projectile points present during this time period as well. Perhaps the increase had to do with a bad growing season or an increase in the population, requiring people to go out and hunt more. I think that maybe during Pueblo II there was a little more hunting since the projectile points, biface, and scraper percentages were higher. Following Pueblo II there is an increase in the percentages of utilized flakes and cores, and a decrease in projectile points and scrapers.

Overall, it is difficult to say what was happening at the sites in Land Hill and Hidden Hills using the stone tool and debitage assemblages alone. What can be said is, when looking at the stone tools, the sites look more similar than different. There are some differences, such as the Land Hill sites having a slightly higher percentage of formal tools than the Hidden Hills sites. That is interesting because one of the hypothesis proposed in this thesis was that sites in the Hidden Hills study area would have more formal tools. Though the reason that there are so little formal tools left on the sites in the Hidden Hills area may be because people are going out and using them for hunting. When the tools are being used while hunting they may get lost, broken, or something else can happen that can cause the formal tools to be lost, and therefore the tools do not make it back to the site. In conclusion, the differences between the two areas are present, but they are small. When looking at the stone tools and debitage assemblages it looks as if the way that people were living and using the land was very similar despite the differing environments. This thesis suggests that even though people were living in different environments, they still produced and used the same tools.

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Appendix A: Debitage Analysis Key

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LITHICS ANALYSIS KEY
DEBITAGE

Site Number	Smithsonian Number
FS Number	From field specimen bag
Feature Numbers	Enter up to three Feature numbers in the order they appear on the bag
Lot No.	Assigned sequentially within each FS bag during analysis to groups of debitage that share analytical information. Each division of flakes (i.e., all large obsidian internal flakes) will get a lot number (lot numbers start with 1 for each new FS #). Place the flakes in separate bags and write the FS# and Lot # on the bag.
Material:	Sort all debitage by material (use categories and codes from the Lithic Material Analysis Categories sheet).
Size Sorting:	Process all debitage through ½" screen. Sort into size categories (micro <½" and large >½") maintaining the materials categories. Enter M (for micro) or L (for large) in the size column.
Cortex:	Sort by presence/absence of cortex. Enter P (for present) or A (for absent) in the cortex column.
Flake Type:	Analyze flake types using the following key, and enter the appropriate code in the flake type column of the analysis form.

Flakes without cortex:	*Bifacial thinning flake* (BF) - Usually thin, fan-shaped flake with multiple dorsal flake scars.
	Secondary shatter (SS) - Usually thick, angular waste lacking bulb of percussion, platform, dorsal ridge, etc.
	Internal Flake (IF) - Catch-all category for variety of flake types without cortex.
Flakes with Cortex:	*Primary decortication* (PD) - flakes with nearly all (75-100%) of the dorsal surface covered with cortex; seldom more than one flake scar. Usually cortex on striking platform.
	Secondary decortication (SD) - flakes with less than 75% of the dorsal surface covered by cortex and more than one flake scar.
	Primary shatter (PS) - Angular core waste lacking bulb of percussion, platforms, etc., but with some cortex present.
Other:	*Other* (OT) - Any debitage that does not fit in one of the above categories. Describe in comments.

Total Quantity	Count all flakes in this category and place sum in this column.
Weight	Weigh all debitage in each material/flake type category.
Comments:	Observations on this assemblage or "other" flakes. Example of observations might include evidence of heat treating in the form of pot lids.

MUSEUM OF PEOPLES AND CULTURES
LITHIC MATERIALS ANALYSIS CATEGORIES

Code	Material
OB	Obsidian
BA	Basalt
PW	Petrified Wood, various colors
CH	Chalcedony, clear or transparent material
CC	Chert, white grading to light gray
CR	Chert predominantly red to brown with some gold; jasper.
CD	Chert, dark gray to nearly black
CO	Chert, any other color that doesn’t fit the previous descriptions
CP	Local (to Shivwits Plateau) pink/purple chert; spotty in many samples
QC	Quartzite, coarse grained; various colors
QU	Quartzite, fine grained; various colors; may blend to chert
OT	Other
ZZ	Unknown material

Appendix B: Stone Tool Analysis Key

MUSEUM OF PEOPLES AND CULTURES
LITHICS ANALYSIS KEY
TOOLS

Site Number: Smithsonian Number

FS Number: From field specimen bag

Feature Numbers: Enter up to Feature numbers in the order they appear on the bag

Specimen No: Unique number of artifact. If analysis lumps more than one flake, ignore this entry.

Mtrl: **Material**. See Lithic Material Analysis Categories on attached sheet.

Uniface: Enter appropriate code

Type
(S) SideFlaking along one edge.
(E) End Flaking along the distal end.
(O) Other Describe in comments.
(M) Multiple Flaking along more than one edge.

Angle
(HI) Angle created by flaking is more than 45 degrees.
(LO) Angle created by flaking is less than 45 degrees.
(BO) Objects exhibits HI and LO wear along two or more edges.

Biface: Enter appropriate number
(1) Bifaces exhibiting only minimal modification. Usually thick with sinuous edges. Usually very irregular in flaking and along edges. Flaking usually does not cross the midline of the object.
(2) Some controlled thinning with some crossing of the midline. Object is thin with retouch flakes present.
(3) Highly symmetrical in form. Controlled thinning with straight and regular edges. Often this is the distal end of a projectile point.
(4) Projectile point
(5) Drill/Awl

Completeness: C for complete; FD for distal fragment; FP for basal fragment; FL for lateral fragment, FM for mid section.

Projectile Point type: Use codes in IMACS handbook attached. For projectile points ONLY, measure the Total Height and Blade Width even if they are incomplete. Indicate incompleteness by placing “(B)” after the measurement.

Other Tool: Use appropriate code

- (C) Core: Lithic object on which flakes have been removed. Must have three negative flake scars.
- (H) Hammerstone: Object which exhibits pounding wear along with no flaking.
- (C/H) Core/hammerstone: A core also used as a hammer stone.
- (P) Chopper: Object which exhibits pounding wear, **along** with primary or secondary flaking.
- (O) Other: Any other modification on a flake. Describe in comments. Scrapers are included in this category- make sure to note it is a scraper in the comments column. Also in the angle
- (U) Utilized flake: Exhibits wear but no obvious modification.

Wear: Object exhibiting distinct wear along one or more edges. Wear must be uniform and regular. Wear includes polish, stepped fractures, crushing. Includes utilized flakes (flakes not exhibiting modification but show evidence of wear).

I. Quantity
- (1) One edge
- (2) Two edges
- (3) Three or more edges
- (O) Other, describe in comments

II. Location of wear
- (S) Distal end
- (P) Proximal end
- (I) Side
- (B) Broken edge (wear located along broken edge)
- (M) Wear located in two or more of the above areas

III. Shape of wear edge
- (S) Straight
- (V) Concave
- (X) Convex
- (N) Notch
- (P) Point
- (M) More than one of the above

Size: Length: Measure maximum length if not broken on that dimension (longest dimension).
Width: Maximum width of tool if not broken on that dimension (second longest dimension).
Thickness: Maximum thickness of tool (shortest dimension).
Weight: Weight of tools in grams.

MUSEUM OF PEOPLES AND CULTURES
PROJECTILE POINT CATEGORIES
(FROM IMAC'S FORM)

Code	Material
CA	Elko Series
CM	Gypsum
DC	Rose Spring Series
DE	Parowan Basal-Notched
DG	Eastgate Series
EC	Desert Side-Notched
ZB	Small Side-Notched
ZF	Small Stemmed
ZO	Small Contracting Stem
ZZ	Unknown Unspecified Type

Appendix C: Arizona Stone Tool and Debitage Analysis Data

Table C.1. Arizona point plotted tools by site.

Site	Utilized Flake	Modified flake	Scraper	Biface	Projectile Point	Drill	Core	Uniface	Total
AZ A 10:16 (BLM)	1	2	0	8	4	1	0	0	16
AZ A 10:24 (BLM)	1	0	0	8	11	0	0	0	20
AZ A 10:25 (ASM)	2	0	1	2	0	0	0	0	5
AZ A 10:25 (BLM)	5	0	0	2	2	0	0	0	9
AZ A 10:26 (ASM)	8	0	2	7	2	0	1	0	20
AZ A 10:26 (BLM)	0	0	1	4	3	0	0	0	8
AZ A 10:27 (ASM)	2	0	0	4	4	0	0	0	10
AZ A 10:28 (ASM)	20	0	1	9	1	0	1	0	32
AZ A 10:29 (ASM)	1	0	0	0	0	0	0	0	1
AZ A 10:31 (ASM)	5	0	2	0	0	0	1	0	8
AZ A 10:33 (ASM)	1	0	0	4	0	0	0	0	5
AZ A 10:36 (ASM)	28	0	2	3	4	1	1	1	40
AZ A 10:37 (ASM)	12	0	2	3	3	0	0	0	20
AZ A 10:38 (ASM)	37	0	2	6	0	0	0	0	45
AZ A 10:57 (ASM)	0	0	0	0	2	0	0	0	2
AZ A 10:58 (ASM)	0	0	0	1	1	0	0	0	2
AZ A 10:59 (ASM)	0	0	0	0	1	0	0	0	1
AZ A 10:61 (ASM)	0	0	0	0	2	1	0	0	3
AZ A 10:65 (ASM)	0	0	0	5	2	0	0	0	7
AZ A 10:66 (ASM)	0	0	0	0	1	0	0	0	1
AZ A 10:67 (ASM)	0	0	0	1	0	0	0	0	1
AZ A 10:73 (ASM)	0	0	0	2	0	0	0	0	2
AZ A 10:74 (ASM)	2	0	0	4	1	0	1	0	8
AZ A 10:76 (ASM)	3	0	1	1	1	0	0	0	6
AZ A 10:79 (ASM)	0	0	0	0	1	0	0	0	1
AZ A 10:82 (ASM)	7	0	1	4	0	0	0	0	12
AZ A 10:83 (ASM)	0	0	1	3	0	0	0	0	4
AZ BN IF	0	0	0	3	5	0	0	0	8
Total	135	2	16	84	51	3	5	1	297

Table C.2. Material type of Arizona point plotted tools by site.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
AZ A 10:16 (BLM)	6	3	1	2	0	1	0	0	3	0	0	16
AZ A 10:24 (BLM)	7	8	2	1	1	0	0	0	1	0	0	20
AZ A 10:25 (ASM)	4	0	1	0	0	0	0	0	0	0	0	5
AZ A 10:25 (BLM)	5	0	1	1	2	0	0	0	0	0	0	9
AZ A 10:26 (ASM)	13	1	2	3	1	0	0	0	0	0	0	20
AZ A 10:26 (BLM)	6	0	1	1	0	0	0	0	0	0	0	8
AZ A 10:27 (ASM)	6	0	0	0	1	0	1	0	2	0	0	10
AZ A 10:28 (ASM)	19	2	5	3	0	3	0	0	0	0	0	32
AZ A 10:29 (ASM)	0	1	0	0	0	0	0	0	0	0	0	1
AZ A 10:31 (ASM)	0	1	0	7	0	0	0	0	0	0	0	8
AZ A 10:33 (ASM)	1	3	0	1	0	0	0	0	0	0	0	5
AZ A 10:36 (ASM)	23	3	5	1	1	3	1	2	1	0	0	40
AZ A 10:37 (ASM)	10	0	4	3	2	1	0	0	0	0	0	20
AZ A 10:38 (ASM)	28	6	3	3	2	0	2	0	1	0	0	45
AZ A 10:57 (ASM)	1	0	0	1	0	0	0	0	0	0	0	2
AZ A 10:58 (ASM)	2	0	0	0	0	0	0	0	0	0	0	2
AZ A 10:59 (ASM)	1	0	0	0	0	0	0	0	0	0	0	1
AZ A 10:61 (ASM)	2	0	0	1	0	0	0	0	0	0	0	3
AZ A 10:65 (ASM)	1	3	0	2	0	1	0	0	0	0	0	7
AZ A 10:66 (ASM)	0	0	1	0	0	0	0	0	0	0	0	1
AZ A 10:67 (ASM)	0	0	1	0	0	0	0	0	0	0	0	1
AZ A 10:73 (ASM)	2	0	0	0	0	0	0	0	0	0	0	2
AZ A 10:74 (ASM)	6	1	0	0	0	1	0	0	0	0	0	8
AZ A 10:76 (ASM)	4	0	0	1	1	0	0	0	0	0	0	6
AZ A 10:79 (ASM)	0	0	1	0	0	0	0	0	0	0	0	1
AZ A 10:82 (ASM)	8	2	1	0	0	0	0	0	1	0	0	12
AZ A 10:83 (ASM)	2	0	2	0	0	0	0	0	0	0	0	4
AZ BN IF	3	2	0	0	1	1	0	0	1	0	0	8
Total	160	36	31	31	12	11	4	2	10	0	0	297

Table C.3. Biface stages of Arizona point plotted bifaces by site.

Site	Stage 1	Stage 2	Stage 3	Total
AZ A 10:16 (BLM)	2	2	4	8
AZ A 10:24 (BLM)	0	1	7	8
AZ A 10:25 (ASM)	0	0	2	2
AZ A 10:25 (BLM)	1	0	1	2
AZ A 10:26 (ASM)	3	2	2	7
AZ A 10:26 (BLM)	0	0	4	4
AZ A 10:27 (ASM)	0	0	4	4
AZ A 10:28 (ASM)	3	4	2	9
AZ A 10:33 (ASM)	0	2	2	4
AZ A 10:36 (ASM)	0	1	2	3
AZ A 10:37 (ASM)	1	1	1	3
AZ A 10:38 (ASM)	1	1	4	6
AZ A 10:58 (ASM)	1	0	0	1
AZ A 10:65 (ASM)	0	1	4	5
AZ A 10:67 (ASM)	0	0	1	1
AZ A 10:73 (ASM)	0	1	1	2
AZ A 10:74 (ASM)	0	1	3	4
AZ A 10:76 (ASM)	0	1	0	1
AZ A 10:82 (ASM)	0	2	2	4
AZ A 10:83 (ASM)	0	1	2	3
AZ BN IF	0	0	3	3
Total	12	21	51	84

Table C.4. Arizona surface flake types by state.

Site	PD	SD	SS	PS	IF	BF	Total
AZ A 10:10 (ASM)	7	10	55	16	20	5	113
AZ A 10:16 (BLM)	7	13	32	42	13	0	107
AZ A 10:20 (BLM)	18	20	61	88	23	13	223
AZ A 10:24 (BLM)	23	59	371	393	103	60	1009
AZ A 10:25 (BLM)	0	4	27	12	25	0	68
AZ A 10:26 (ASM)	4	6	22	25	11	2	70
AZ A 10:26 (BLM)	5	16	73	39	45	6	184
AZ A 10:27 (ASM)	20	27	111	134	78	10	380
AZ A 10:28 (ASM)	0	2	1	5	1	0	9
AZ A 10:28 (BLM)	10	12	117	46	94	0	279
AZ A 10:29 (ASM)	0	1	2	4	0	1	8
AZ A 10:29 (BLM)	1	4	9	28	9	1	52
AZ A 10:36 (ASM)	0	0	3	4	3	0	10
AZ A 10:37 (ASM)	3	4	47	73	9	1	137
AZ A 10:38 (ASM)	1	2	14	39	2	1	59
AZ A 10:76 (ASM)	0	2	1	3	1	0	7
AZ A 10:82 (ASM)	0	3	17	26	4	3	53
AZ A 10:83 (ASM)	0	0	2	3	2	0	7
Total	99	185	965	980	443	103	2775

Table C.5. Material type of surface flakes in Arizona.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
AZ A 10:10 (ASM)	14	7	22	28	29	13	0	0	0	0	0	113
AZ A 10:16 (BLM)	36	9	24	16	7	13	2	0	0	0	0	107
AZ A 10:20 (BLM)	105	16	26	13	28	19	0	6	0	0	10	223
AZ A 10:24 (BLM)	501	102	43	41	109	71	54	23	5	4	56	1009
AZ A 10:25 (BLM)	29	13	3	2	12	9	0	0	0	0	0	68
AZ A 10:26 (ASM)	14	10	7	10	0	23	4	2	0	0	0	70
AZ A 10:26 (BLM)	80	19	16	33	16	13	3	0	3	0	1	184
AZ A 10:27 (ASM)	125	56	8	97	4	57	1	30	0	1	1	380
AZ A 10:28 (ASM)	1	1	1	2	0	1	3	0	0	0	0	9
AZ A 10:28 (BLM)	102	36	18	45	60	12	1	4	1	0	0	279
AZ A 10:29 (ASM)	4	0	3	1	0	0	0	0	0	0	0	8
AZ A 10:29 (BLM)	20	15	6	3	3	3	0	0	0	1	1	52
AZ A 10:36 (ASM)	4	0	1	1	1	0	2	1	0	0	0	10
AZ A 10:37 (ASM)	87	5	5	16	4	5	13	2	0	0	0	137
AZ A 10:38 (ASM)	26	3	0	13	3	6	0	8	0	0	0	59
AZ A 10:76 (ASM)	2	3	0	0	1	1	0	0	0	0	0	7
AZ A 10:82 (ASM)	9	7	4	5	2	1	14	9	1	0	1	53
AZ A 10:83 (ASM)	2	1	2	0	0	0	1	1	0	0	0	7
Total	1161	303	189	326	279	247	98	86	10	6	70	2775

Table C.6. Arizona surface tools type by site.

Site	Scraper	Biface	Projectile Point	Drill	Uniface	Chopper	Core	Utilized/ Modified Flake	Graver	Total
AZ A 10:10 (ASM)	0	4	1	0	0	0	1	12	0	18
AZ A 10:16 (BLM)	0	3	0	0	0	0	0	4	0	7
AZ A 10:20 (BLM)	2	14	4	0	5	1	5	28	0	59
AZ A 10:24 (BLM)	19	43	9	2	1	1	20	23	0	118
AZ A 10:25 (BLM)	0	0	0	0	0	0	0	1	0	1
AZ A 10:26 (ASM)	3	2	0	0	0	0	1	2	0	8
AZ A 10:26 (BLM)	1	2	1	0	1	0	0	9	0	14
AZ A 10:27 (ASM)	7	16	10	1	0	0	0	26	0	60
AZ A 10:28 (BLM)	9	28	2	0	1	0	1	109	1	151
AZ A 10:29 (ASM)	0	0	0	0	0	0	0	1	0	1
AZ A 10:29 (BLM)	6	14	8	0	1	0	0	30	0	60
AZ A 10:32 (ASM)	0	0	1	0	0	0	0	0	0	1
AZ A 10:36 (ASM)	0	1	0	0	0	0	0	0	0	1
AZ A 10:37 (ASM)	0	2	1	0	0	0	0	6	0	9
AZ A 10:38 (ASM)	0	1	0	0	0	0	0	3	0	4
AZ A 10:51 (ASM)	0	0	1	0	0	0	0	0	0	1
AZ A 10:53 (ASM)	0	0	1	0	0	0	0	0	0	1
AZ A 10:55 (ASM)	0	0	2	0	0	0	0	0	0	2
AZ A 10:67 (ASM)	0	0	1	0	0	0	0	0	0	1
AZ A 10:76 (ASM)	1	0	0	0	0	0	1	0	0	2
AZ A 10:80 (ASM)	0	0	1	0	0	0	0	0	0	1
AZ A 10:82 (ASM)	0	1	0	0	0	0	0	2	0	3
AZ A 10:83 (ASM)	0	1	0	0	0	0	0	0	0	1
Total	48	132	43	3	9	1	29	256	1	524

Table C.7. Material type of surface tools in Arizona.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
AZ A 10:10 (ASM)	9	0	1	6	1	0	0	0	1	0	0	18
AZ A 10:16 (BLM)	4	0	1	2	0	0	0	0	0	0	0	7
AZ A 10:20 (BLM)	22	10	7	6	6	5	0	1	2	0	0	59
AZ A 10:24 (BLM)	60	25	12	3	8	2	1	2	4	0	1	118
AZ A 10:25 (BLM)	1	0	0	0	0	0	0	0	0	0	0	1
AZ A 10:26 (ASM)	6	0	1	1	0	0	0	0	0	0	0	8
AZ A 10:26 (BLM)	6	7	0	0	0	1	0	0	0	0	0	14
AZ A 10:27 (ASM)	29	6	6	7	3	7	0	2	0	0	0	60
AZ A 10:28 (BLM)	1	1	0	4	0	0	0	0	1	0	0	7
AZ A 10:29 (ASM)	1	0	0	0	0	0	0	0	0	0	0	1
AZ A 10:29 (BLM)	33	14	4	3	4	0	0	0	2	0	0	60
AZ A 10:32 (ASM)	1	0	0	0	0	0	0	0	0	0	0	1
AZ A 10:36 (ASM)	1	0	0	0	0	0	0	0	0	0	0	1
AZ A 10:37 (ASM)	4	2	0	1	1	0	1	0	0	0	0	9
AZ A 10:38 (ASM)	4	0	0	0	0	0	0	0	0	0	0	4
AZ A 10:51 (ASM)	0	0	1	0	0	0	0	0	0	0	0	1
AZ A 10:53 (ASM)	0	0	1	0	0	0	0	0	0	0	0	1
AZ A 10:55 (ASM)	1	1	0	0	0	0	0	0	0	0	0	2
AZ A 10:67 (ASM)	1	0	0	0	0	0	0	0	0	0	0	1
AZ A 10:76 (ASM)	0	1	1	0	0	0	0	0	0	0	0	2
AZ A 10:80 (ASM)	0	0	1	0	0	0	0	0	0	0	0	1
AZ A 10:82 (ASM)	2	0	0	0	1	0	0	0	0	0	0	3
AZ A 10:83 (ASM)	0	0	1	0	0	0	0	0	0	0	0	1
Total	186	67	37	33	24	15	2	5	10	0	1	380

Table C.8. Biface stages of Arizona surface bifaces by site.

Site	Stage 1	Stage 2	Stage 3	Total
AZ A 10:10 (ASM)	2	0	8	10
AZ A 10:16 (BLM)	1	1	1	3
AZ A 10:20 (BLM)	4	4	6	14
AZ A 10:24 (BLM)	7	14	22	43
AZ A 10:26 (ASM)	0	1	1	2
AZ A 10:26 (BLM)	0	0	2	2
AZ A 10:27 (ASM)	2	2	12	16
AZ A 10:28 (BLM)	4	7	17	28
AZ A 10:29 (BLM)	0	3	11	14
AZ A 10:36 (ASM)	0	0	1	1
AZ A 10:37 (ASM)	0	2	0	2
AZ A 10:38 (ASM)	0	0	1	1
AZ A 10:82 (ASM)	0	0	1	1
AZ A 10:83 (ASM)	0	1	0	1
Total	20	35	83	138

Table C.9. Arizona subsurface flake types by state.

Site	PD	SD	PS	SS	IF	BF	Total
AZ A 10:10 (ASM)	4	6	11	24	7	2	54
AZ A 10:20 (BLM)	13	25	96	63	43	13	253
AZ A 10:24 (BLM)	54	114	627	604	250	143	1792
AZ A 10:25 (BLM)	13	29	82	145	113	13	395
AZ A 10:26 (BLM)	6	17	42	80	66	5	216
AZ A 10:27 (ASM)	20	27	134	111	78	10	380
AZ A 10:28 (BLM)	4	2	9	19	23	1	58
AZ A 10:29 (BLM)	0	0	1	2	6	0	9
AZ A 10:36 (ASM)	1	1	5	12	7	0	26
AZ A 10:37 (ASM)	5	4	166	47	9	2	233
AZ A 10:38 (ASM)	0	1	32	15	0	0	48
AZ A 10:74 (ASM)	1	0	11	3	2	0	17
AZ A 10:82 (ASM)	0	1	32	26	3	1	63
Total	121	227	1248	1151	607	190	3544

Table C.10. Material type of subsurface flakes in Arizona.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
AZ A 10:10 (ASM)	16	6	1	19	7	3	0	0	0	0	2	54
AZ A 10:20 (BLM)	105	12	55	12	32	14	2	4	0	0	17	253
AZ A 10:24 (BLM)	654	209	98	73	193	169	124	75	0	7	190	1792
AZ A 10:25 (BLM)	109	109	33	17	35	52	15	10	2	0	13	395
AZ A 10:26 (BLM)	80	55	24	10	15	18	5	8	1	0	0	216
AZ A 10:27 (ASM)	125	56	8	97	4	57	1	30	0	1	1	380
AZ A 10:28 (BLM)	15	10	6	5	11	8	0	2	0	0	1	58
AZ A 10:29 (BLM)	3	2	1	1	2	0	0	0	0	0	0	9
AZ A 10:36 (ASM)	10	1	2	0	5	4	0	4	0	0	0	26
AZ A 10:37 (ASM)	90	7	7	33	1	2	76	17	0	0	0	233
AZ A 10:38 (ASM)	2	27	2	3	1	7	2	4	0	0	0	48
AZ A 10:74 (ASM)	9	1	0	1	1	3	1	1	0	0	0	17
AZ A 10:82 (ASM)	6	3	3	1	1	0	40	7	0	0	2	63
Total	1224	498	240	272	308	337	266	162	3	8	226	3544

Table C.11. Arizona subsurface tools type by site.

Site	Scraper	Biface	Projectile Point	Drill	Uniface	Utilized/ Modified flake	Core	Hammerstone	Total
AZ A 10:10 (ASM)	0	2	0	0	0	1	0	0	3
AZ A 10:20 (BLM)	0	2	1	0	0	2	0	0	5
AZ A 10:24 (BLM)	5	33	19	2	1	16	8	2	86
AZ A 10:25 (BLM)	0	7	6	0	1	11	4	0	29
AZ A 10:26 (BLM)	0	7	3	0	0	5	0	0	15
AZ A 10:27 (ASM)	3	11	4	0	0	9	0	0	27
AZ A 10:28 (BLM)	0	3	2	0	0	2	0	0	7
AZ A 10:36 (ASM)	1	2	0	0	0	3	0	0	6
AZ A 10:37 (ASM)	0	2	0	0	0	4	1	0	7
AZ A 10:38 (ASM)	1	0	0	0	0	1	0	0	2
AZ A 10:74 (ASM)	0	0	1	0	0	0	0	0	1
AZ A 10:82 (ASM)	0	0	1	0	0	1	0	0	2
Total	10	69	37	2	2	55	13	2	190

Table C.12. Material type of subsurface tools in Arizona.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
AZ A 10:10 (ASM)	2	1	0	0	0	0	0	0	0	0	0	3
AZ A 10:20 (BLM)	2	1	1	1	0	0	0	0	0	0	0	5
AZ A 10:24 (BLM)	43	20	9	4	4	2	0	1	2	0	1	86
AZ A 10:25 (BLM)	13	7	3	4	2	0	0	0	0	0	0	29
AZ A 10:26 (BLM)	3	5	3	1	1	1	0	1	0	0	0	15
AZ A 10:27 (ASM)	12	5	3	3	1	1	1	0	1	0	0	27
AZ A 10:28 (BLM)	1	1	0	4	0	0	0	0	1	0	0	7
AZ A 10:36 (ASM)	4	0	1	0	0	1	0	0	0	0	0	6
AZ A 10:37 (ASM)	5	1	0	1	0	0	0	0	0	0	0	7
AZ A 10:38 (ASM)	0	2	0	0	0	0	0	0	0	0	0	2
AZ A 10:74 (ASM)	1	0	0	0	0	0	0	0	0	0	0	1
AZ A 10:82 (ASM)	0	1	1	0	0	0	0	0	0	0	0	2
Total	86	44	21	18	8	5	1	2	4	0	1	190

Table C.13. Biface stages of Arizona subsurface bifaces by site.

Site	Stage 1	Stage 2	Stage 3	Total
AZ A 10:10 (ASM)	0	2	0	2
AZ A 10:20 (BLM)	1	1	0	2
AZ A 10:24 (BLM)	5	8	20	33
AZ A 10:25 (BLM)	0	1	6	7
AZ A 10:26 (BLM)	1	2	3	6
AZ A 10:27 (ASM)	0	2	9	11
AZ A 10:28 (BLM)	0	1	2	3
AZ A 10:36 (ASM)	0	0	2	2
AZ A 10:37 (ASM)	0	0	2	2
Total	7	17	44	68

Appendix D: Utah Stone Tool and Debitage Analysis Data

Table D.1. Utah point plotted tool types by state.

Site	Scraper	Biface	Projectile Point	Total
42WS195	0	3	1	4
42WS1344	1	1	1	3
42WS1345	1	4	1	6
Total	2	8	3	13

Table D.2. Material type of point plotted tool types in Utah.

Site	CC	CR	CO	CP	CH	OB	BA	OT	Total
42WS195	1	0	0	0	1	1	0	1	4
42WS1344	1	1	1	0	0	0	0	0	3
42WS1345	1	1	2	0	1	0	1	0	6
Total	3	2	3	0	2	1	1	1	13

Table D.3. Biface stages of Utah point plotted bifaces by site.

Site	Stage 1	Stage 2	Stage 3	Total
42WS195	0	1	2	3
42WS1344	0	0	1	1
42WS1345	0	2	2	4
Total	0	3	5	8

Table D.4. Utah surface flake types by state.

Site	PD	SD	SS	PS	IF	BF	Total
42WS185	0	1	10	3	5	0	19
42WS195	10	29	662	249	147	100	1197
42WS1344	0	2	34	7	4	7	54
42WS1345	1	2	123	17	17	7	167
42WS1890	0	1	52	21	13	6	93
42WS1894	0	0	6	6	6	0	18
42WS1895	2	0	31	8	6	0	47
42WS1897	0	0	9	6	6	1	22
42WS1929	2	0	11	2	5	4	24
42WS1931	5	15	152	57	78	34	341
Total	20	50	1090	376	287	159	1982

Table D.5. Material type of surface flakes in Utah.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
42WS185	3	0	0	0	0	0	5	1	0	8	2	19
42WS195	351	149	54	0	208	101	25	63	13	52	181	1197
42WS1344	14	20	3	0	5	4	0	1	0	1	6	54
42WS1345	54	44	13	0	6	11	0	3	27	4	5	167
42WS1890	41	23	5	0	7	11	1	0	5	0	0	93
42WS1894	9	2	2	0	0	3	0	2	0	0	0	18
42WS1895	10	11	9	0	1	10	2	2	0	0	2	47
42WS1897	13	3	2	0	0	2	0	0	2	0	0	22
42WS1929	6	7	1	0	6	2	0	1	1	0	0	24
42WS1931	112	76	21	0	46	39	1	6	33	5	2	341
Total	613	335	110	0	279	183	34	79	81	70	198	1982

Table D.6. Utah surface tools type by site.

Site	Utilized Flake	Scraper	Biface	Projectile Point	Drill	Uniface	Chopper	Core/ Chopper	Core	Modified Flake	Hammerstone	Total
42WS185	0	1	0	0	0	0	0	0	0	0	0	1
42WS195	1	0	7	3	1	0	0	0	0	0	0	11
42WS1344	2	3	2	0	0	1	3	0	1	0	1	11
42WS1345	0	2	0	0	0	0	0	0	0	0	0	2
42WS1890	0	0	0	0	0	0	0	0	1	0	0	1
42WS1894	1	0	2	0	0	0	0	0	0	0	0	2
42WS1895	0	0	0	0	0	1	0	0	0	0	0	1
42WS1897	0	1	0	0	0	0	0	0	1	0	0	2
42WS1929	0	0	1	0	0	0	1	0	0	0	0	2
42WS1931	3	2	3	0	0	0	0	0	1	1	0	7
Total	7	9	15	3	1	2	4	0	4	1	1	40

Table D.7. Material type of surface tools in Utah.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
42WS185	0	0	0	0	0	0	0	0	0	1	0	1
42WS195	4	5	1	0	0	2	0	0	0	0	0	12
42WS1344	5	2	1	0	2	0	0	3	0	0	0	13
42WS1345	0	0	0	0	0	0	0	1	0	1	0	2
42WS1890	1	0	0	0	0	0	0	0	0	0	0	1
42WS1894	2	0	0	0	0	1	0	0	0	0	0	3
42WS1895	0	1	0	0	0	0	0	0	0	0	0	1
42WS1897	0	0	1	0	0	0	0	0	1	0	0	2
42WS1929	0	1	0	0	0	0	0	1	0	0	0	2
42WS1931	1	2	1	0	1	1	0	2	2	0	0	10
Total	13	11	4	0	3	4	0	7	3	2	0	47

Table D.8. Biface stages of Utah surface bifaces by site.

Site	Stage 1	Stage 2	Stage 3	Total
42WS195	0	1	6	7
42WS1344	1	1	0	2
42WS1345	0	0	0	0
42WS1894	2	0	0	2
42WS1929	0	0	1	1
Total	3	2	7	12

Table D.9. Utah subsurface flake types by state.

Site	PD	SD	PS	SS	IF	BF	Total
42WS50	6	13	39	101	40	18	217
42WS185	3	39	30	3	13	2	90
42WS195	12	13	182	412	149	47	815
42WS210	1	0	1	3	3	1	9
42WS1344	2	0	12	42	10	11	77
42WS1345	5	7	132	514	53	96	807
42WS1890	0	0	8	49	21	12	90
42WS1894	1	0	0	4	1	0	6
42WS1895	1	1	3	28	7	1	41
42WS1897	2	0	2	2	0	1	7
42WS1929	0	0	10	23	6	6	45
42WS1931	9	22	96	238	98	102	565
Total	42	95	515	1419	401	297	2769

Table D.10. Material type of subsurface flakes in Utah.

Site	CC	CR	CO	CH	CD	QU	QC	OB	BA	OT	Total
42WS50	77	87	0	13	16	0	7	1	5	11	217
42WS185	9	20	4	13	6	3	2	0	18	15	90
42WS195	206	172	46	83	88	21	29	7	76	87	815
42WS210	2	1	1	4	1	0	0	0	0	0	9
42WS1344	14	20	3	5	4	0	1	0	1	6	54
42WS1345	286	218	10	111	80	6	31	17	20	28	807
42WS1890	29	20	11	11	15	1	0	3	0	0	90
42WS1894	2	2	1	0	1	0	0	0	0	0	6
42WS1895	12	15	8	0	4	0	0	1	0	1	41
42WS1897	2	4	0	0	0	0	0	0	1	0	7
42WS1929	13	15	3	6	6	0	1	1	0	0	45
42WS1931	133	163	38	68	73	14	9	64	3	0	565
Total	785	737	125	314	294	45	80	94	124	148	2746

Table D.11. Utah subsurface tools type by site.

Site	Scraper	Biface	Projectile Point	Drill	Uniface	Core/Chopper	Chopper	Utilized Flake	Core	Hammerstone	Total
42WS50	3	18	0	0	3	1	0	13	6	0	44
42WS185	1	1	0	0	0	0	0	2	1	0	5
42WS195	3	4	4	0	2	0	0	6	1	0	20
42WS210	1	0	0	0	0	0	0	0	0	0	1
42WS1344	0	1	0	0	0	0	0	0	0	0	1
42WS1345	1	2	1	0	0	0	1	1	1	1	8
42WS1890	0	0	2	0	0	0	0	0	0	0	2
42WS1894	0	0	0	0	0	0	0	0	1	0	1
42WS1895	0	1	2	0	0	0	0	0	0	0	3
42WS1897	0	1	0	0	0	0	0	1	0	0	2
42WS1929	0	1	0	0	0	0	0	0	0	0	1
42WS1931	4	11	2	2	0	0	0	18	4	0	41
Total	13	40	11	2	5	1	1	41	14	1	129

Table D.12. Material type of subsurface tools in Utah.

Site	CC	CR	CO	CP	CH	CD	QU	QC	OB	BA	OT	Total
42WS50	17	19	2	0	1	3	0	0	1	0	1	44
42WS185	0	2	1	0	0	0	1	0	0	1	0	5
42WS195	7	4	0	0	1	1	0	0	5	0	2	20
42WS210	1	0	0	0	0	0	0	0	0	0	0	1
42WS1344	0	0	0	0	0	1	0	0	0	0	0	1
42WS1345	4	1	0	0	0	0	0	1	0	1	1	8
42WS1890	0	1	0	0	1	0	0	0	0	0	0	2
42WS1894	0	1	0	0	0	0	0	0	0	0	0	1
42WS1895	1	0	0	0	0	0	0	0	2	0	0	3
42WS1897	0	1	0	0	0	0	0	0	1	0	0	2
42WS1929	1	0	0	0	0	0	0	0	0	0	0	1
42WS1931	10	14	6	0	4	2	0	0	3	0	2	41
Total	41	43	9	0	7	7	1	1	12	2	6	129

Table D.13. Biface stages of Utah subsurface bifaces by site.

Site	Stage 1	Stage 2	Stage 3	Total
42WS50	5	8	5	18
42WS185	1	0	0	1
42WS195	2	1	1	4
42WS1344	0	1	0	1
42WS1345	0	0	2	2
42WS1895	0	0	1	1
42WS1897	0	0	1	1
42WS1929	1	0	0	1
42WS1931	1	3	7	11
Total	10	13	17	40