EXCAVATIONS AT THE ROAD KILL SITE (42KA4859):

An Early Virgin Branch Ancestral Puebloan Farmstead on the Eastern Grand Staircase

By Douglas McFadden, Matthew Zweifel, Gardiner Dalley, Geralyn McEwen, Roger McPeek & Barbara Frank
Edited by Jerry D. Spangler

Grand Staircase Escalante National Monument
Special Publication No. 6

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Cover: View of Park Wash facing south towards Road Kill Site

Editor’s Note

It is with both pride and sadness that we present “the Road Kill report,” as Doug liked to call it. Doug’s all-to-early passing has left a glaring hole in the ranks of Southwestern archaeologists, and especially for those of us who work in the Virgin Ancestral Puebloan region. A true “dirt archaeologist” and researcher to the end, he inspired and mentored more archaeologists than he could ever have imagined. Most of this manuscript is Doug’s work - ideas he gleaned from decades of field work and research. He left us a draft manuscript with the hope we would finish it. We hope he would have been proud of how it turned out.

- Jerry D. Spangler

“What remained of 42KA4859 was flattened like road kill; run over, bloodied, partially disarticulated, and abused by passersby but it was still recognizable for what it had once been” (Doug McFadden)

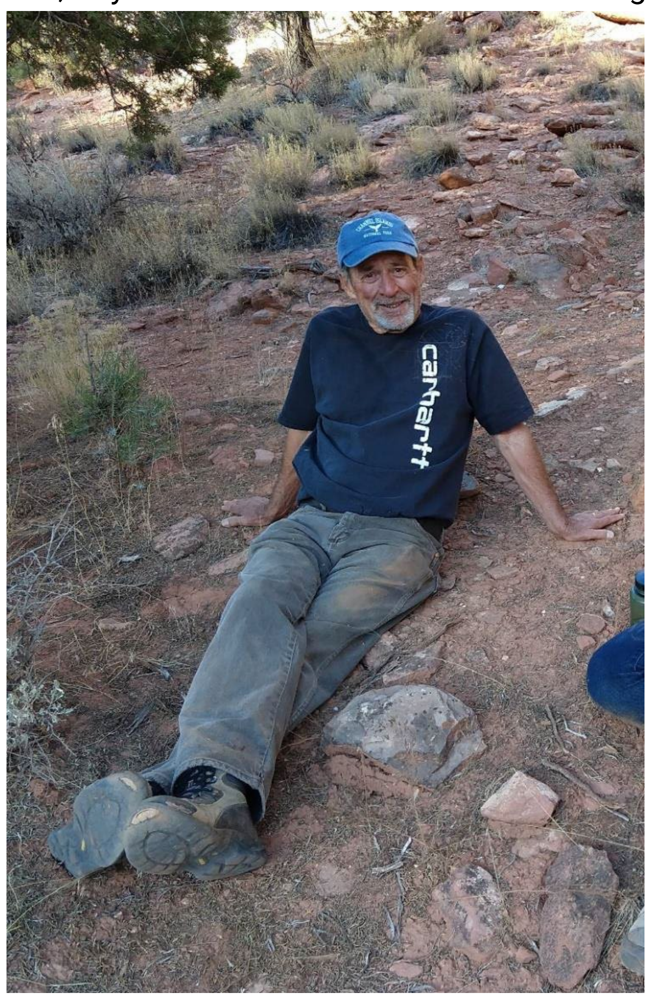
DEDICATION

Douglas Averill McFadden

1947-2022

Ask Doug about the archaeology of the Grand Staircase and Escalante River Country, and he would get a twinkle in his eye, offer up his trademark grin, and launch into an enlightened soliloquy on the *people* who once lived here. It was always about people. He talked about the ancient ones, sure. But he also had a unique ability to explain the past in ways that were relatable to people living today: School groups, scouting groups, land managers, field schools, county commissioners, meddlesome archaeologists. He was endlessly patient, never condescending, and kind to all – a legacy that lives on. Doug left us on August 3, 2022, a year after being diagnosed with pancreatic cancer. He was working on the Road Kill report until his final days.

I found a sticky note on which Doug had written, “My role models are Ruth Bader Ginsburg and Alex Trebec. They just kept on working” even after their own pancreatic cancer diagnoses. For Doug, archaeology was a passion, not a job.



Doug grew up in Lyndhurst, a middle-class suburb of Cleveland, and he attended college at Grand Valley State (now University) in Grand Valley, Michigan. He took an anthropology course given by Dr. Richard Flanders and he was hooked, even though he didn’t know what he was going to do with an archaeology degree. He was offered a graduate assistantship at Western Michigan, but the Vietnam draft put the kibosh on that (those who remember the 60s will recall the annual “lottery” based on birthdays to see who got drafted; Doug’s birthday was No. 22).

After being honorably discharged, he knew he wanted to go back to grad school, but he wanted to be out West. He was sold on public lands early on, and we decided to establish residency in Colorado. He later received his degree from the University of Northern Colorado, and we then spent time working on Saxon and Roman archaeological sites in England, returning to Colorado to do archaeological inventories for the Forest Service timber sales in Pagosa Springs. There were not a lot of archaeology jobs to be had in those days.

In 1976, the Bureau of Land Management announced a permanent job opening in a place called Kanab, Utah. Doug had no idea what he was getting into, but it didn't take him long to realize fate had dropped us into the middle of an area rich in archaeological resources. The whole BLM district was about 5 million acres, and Doug was responsible for about half of those and the other half of the district was handled by Gardiner Dalley. So, with projects in the Great Basin country, Doug would be Gardner's "crew," and over here, in Kanab and Escalante, Gardner would be Doug's "crew." They made a good team and became the best of friends. Later, the BLM hired Geralyn McEwen, and they collectively became known as the Three Musketeers.

They did quite a bit of excavation over the years and were responsible for a lot of "firsts": the first tree ring dates, the first radio carbon dates, and as you will read in this volume, the first excavations of Early Puebloan Period residences in the St. George Basin. When the Grand Staircase-Escalante National Monument was designated in 1996, Doug was given the choice of staying with the Kanab Field Office or working for the newly created GSENM. Since he didn't want to give up not even one acre, he decided to do both jobs, which he never regretted. With the unflagging support of Marietta Eaton, his boss and head of the program, they expanded the archaeology program but with more support than ever before. They also hired Matt Zweifel, who continued as the lead archeologist after Doug retired in 2006. Matt carried on many of the traditions started by Doug 30 years before.

Doug never really retired, at least not in the traditional sense. He started his own private consulting company (McFadden Archaeological Consulting), taking on selected investigations that held a personal interest in the Vermilion Cliffs National Monument, Grand Canyon-Parashant National Monument, the Paria Plateau, the Kaibab National Forest, and elsewhere on the Arizona Strip. Our winters were spent on our boat sailing the Sea of Cortez, but even then, archaeology was not far from his mind. When we would walk along the beaches around San Carlos, Doug would photograph and record shell middens and the agave roasting pits we would find high up on the hills in rock shelters.

All the co-authors of this volume have "Doug" stories to tell, all of them rooted in the deep friendships he had with Matt, Roger, Geralyn, and Barb. Matt and Roger both remarked on Doug's penchant for using toilet paper to mark his survey transects (toilet paper easily dissolves with the first rainstorm and he found it preferable to flagging tape). After one survey, Doug grinned, looking out over 40 acres of toilet paper and exclaimed, "By God, isn't that beautiful?" As Matt recalls, "Beauty is in the eye of the beholder, but yes, Doug, it was beautiful."

Roger remembers Doug's inherent mistrust of hand-held GPS units, preferring his trusty compass. "Doug educated me on transects and trowel work, but the real classroom occurred every night around a campfire with boxed red wine, seeking answers to questions that were always on his mind concerning the lifeway of prehistoric people and the landscape we were on."

I would also go with Doug to record sites. My job? He had this rope that he would loop into a circle 3 feet in diameter. My job was to count all the pottery inside the loop.

Fortuitously, we were able to have a celebration of Doug's life before he passed, and it coincided with our 50th wedding anniversary.

I wish to thank Jerry D. Spangler for the countless hours he spent editing this monograph. If it wasn't for him, this volume would not be published. I also want to thank all the authors involved. Gardner, Geralyn and Doug made a good team, surveying countless miles and excavating sites in the hot desert. They had lots of laughs and memories together.

Matt Zweifel, besides the faunal analysis, also edited drafts of Road Kill while Doug was still alive. I still have copies of Matt's recognizable print in the margins with red fine-line sharpies. He had many good ideas, thoughts and questions about the manuscript. Dr. R. Roger McPeek is a retired rheumatologist, an avocational pottery expert, and close friend. He also walked many miles with Doug and had some interesting talks around campfires. Barbara Walling did the stone and lithics analysis. She is the curator of the SUU cultural resources lab in Cedar City – the most organized and tidy lab I have ever seen. I could spend hours looking around.

I also want to thank Linda Scott Cummings and Kathryn Puseman for the macrofloral and pollen results.

If I missed someone, I am very sorry. Doug had many professional friends and colleagues that kept his archeological and anthropological mind stimulated.

- **Johanna "Jo" McFadden**

Abstract

This report describes excavations at the Road Kill site, a Virgin Branch Ancestral Puebloan farmstead on the Grand Staircase considered typical of the “Early Puebloan Period” circa AD 700-1050, which spanned the local Late Basket Maker III, Pueblo I, and Early Pueblo II periods. As one of several partially excavated sites investigated by the BLM’s cultural resource management program, we consider Road Kill as a case study illustrating the complex relationship between site structure, settlement, andsubsistence. Central to our understanding of these relationships is the observation that virtually all excavated farmsteads on the Grand Staircase have yielded evidence that they were intermittently occupied over various lengths of time.

We conclude that a practice of shifting cultivation accounts well for a proposed model of “sequential settlement” in multiple settings and often on previously occupied sites, and that the occupants relied heavily on domesticated crops while allowing for local foraging opportunities that supplemented their diet.

Many researchers have assumed that the dividing line between the Virgin and Kayenta cultural areas was Kanab Creek. Demonstrated here is that the Grand Staircase, and perhaps the St. George Basin populations, were participants in a common “Virgin” tradition during the Early Puebloan Period. Awareness of this “traditional” Virgin behavior during the Early Puebloan Period provides context for addressing material culture changes that occurred during the succeeding Late Pueblo II-Pueblo III Period.

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Chapter 1

Project Background

The Road Kill site (42KA4859) is located in Park Wash in central Kane County (Figure 1.1) on lands managed by the Grand Staircase-Escalante National Monument (GSENM). The site is in found on a former School Trust section that was transferred to the Monument under an agreement with the State of Utah in 1998. That agreement included swapping school sections within the monument for two large public land blocks near Hatch in Garfield County and East Clark Bench in Kane County. The Monument then assumed responsibility for cultural resources management on the newly acquired sections. Road Kill was subsequently selected for excavation because it was exposed and was being degraded by road maintenance.

The cultural resources program at GSENM at that time was led by the lead author, who was aided by Matthew Zweifel, at the time a GSENM archaeologist and later McFadden's successor. Thanks are due to Marietta Eaton, Assistant Monument Manager for cultural resources, as well as Monument Manager Kate Canon, both of whom recognized and supported the excavation, not only as mitigation under Section 106 of the National Historic Preservation Act of 1966 (NHPA), but also as an appropriate allocation of limited resources for the purpose of expanding our knowledge of prehistory within the context of the Monument's public science and education program.

Beginning in the mid-1970s, the Bureau of Land Management (BLM) conducted inventories and excavations in the region within the context of Cultural Resource Management (CRM) objectives articulated in the NHPA and its implementing regulations (36CFR800). The northern Grand Staircase region was initially managed by the Kanab Resource Area and the Paria Resource Area, which were later combined into a single management unit, the Kanab Field Office, which operated under the lead of the Cedar City District Office. After 1996, GSENM was also managed under the lead of the Cedar City District Office.

Partial excavations on damaged sites found in Washington, Kane, and Garfield Counties previously managed by the Cedar City District have yielded valuable data that have been reported in several BLM publications. Earlier excavations at Early Puebloan Period (EPP) sites were carried out in the St. George Basin at the Red Cliffs Site, as reported in Utah *BLM Cultural Resources Series* No. 17 (Dalley and McFadden 1985), and the Little Man Sites, as reported in Utah *BLM Cultural Resources Series* No. 23 (Dalley and McFadden 1988). Although the focus of this volume is the eastern Virgin Puebloan region, the site structure and

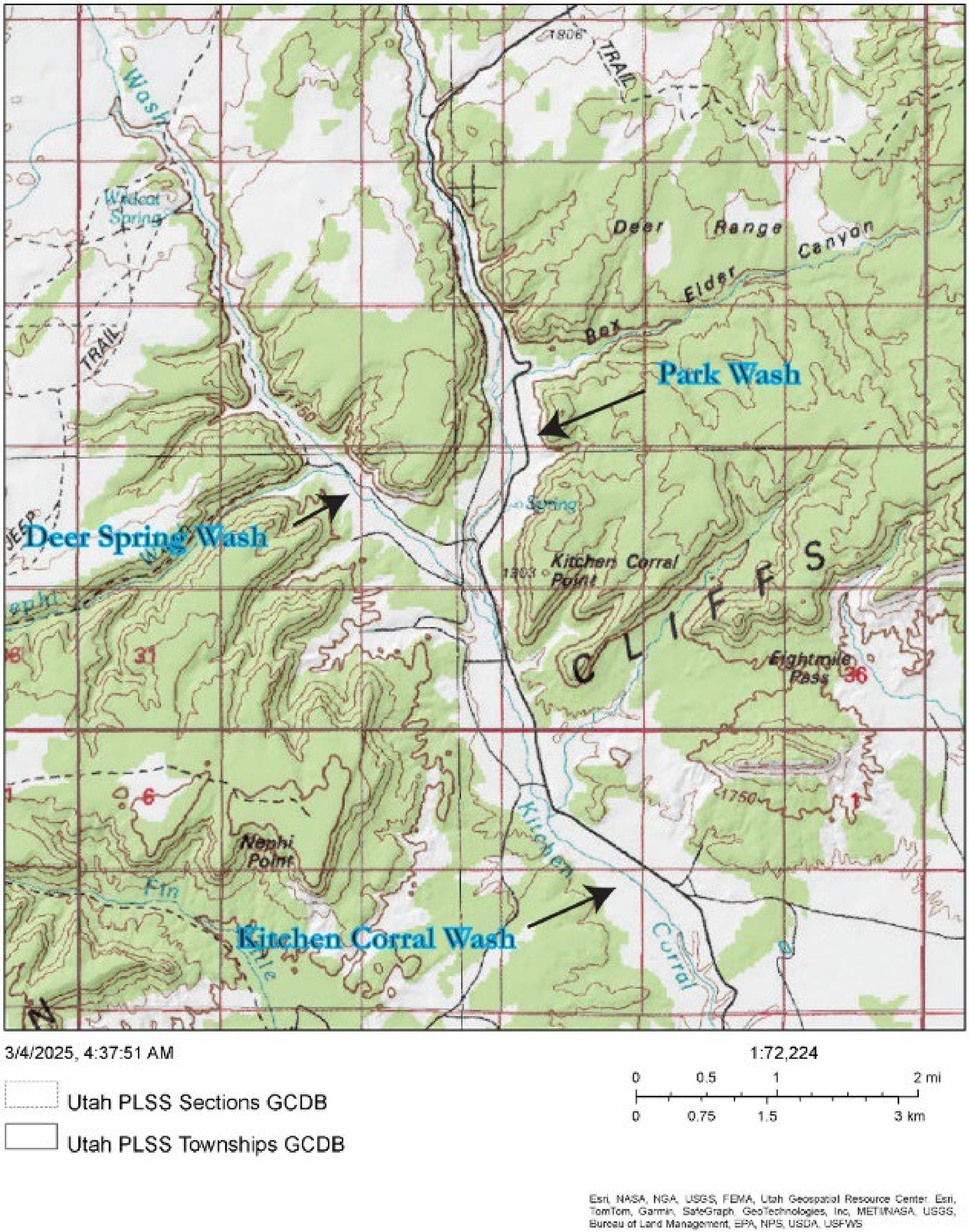

Figure 1.1: Topographic map indicating the location of the three major drainages that comprise the Kitchen Corral drainage: Deer Spring Wash, Park Wash, and Kitchen Corral Wash.

development found at Road Kill are very similar to those in the St. George Basin. Several local mitigation projects also contribute to this discussion, including the Kanab site (Nickens and Kvamme 1981), the Dead Raven site (Walling and Thompson 2004), and the Park Wash site (Ahlstrom 2000).

The accumulated radiocarbon assays, tree-ring dates, and associated data from these excavated sites were summarized in Utah *BLM Cultural Resource Series* No. 28 (McFadden 2016) and *BLM Cultural Resource Series* No. 30 (Spangler and Zweifel 2021). The Road Kill site was briefly described in both volumes, but this monograph provides a full report on the site.

Excavations at the Road Kill site were undertaken over two field seasons. They were initiated May 1, 2001, and continued sporadically until September 11, 2001. The features were then backfilled, but the grid nails remained in place over the winter. Crews returned May 6-9, 2002, to better define the relationship between the segments on the east and west sides of the road. A contour map was produced and the last of the feature notes were closed out. Similar to the excavations at the Park Wash site, which was also bisected by the same county road, excavations at Road Kill involved barricading the west segment and allowing traffic to use the north bound "lane." Limiting excavations in this way added yet another twist to excavation procedures but ultimately did not hinder the work.

The nature of the crew varied through time, but the core team included Gardiner Dalley, Geralyn McEwen, and Matthew Zweifel, with assistance from neighboring North Kaibab Forest Service Archaeologist Connie Reid Zweifel and her summer temporaries Shawn Kimberling and Jeff Davidson. Barbara Warner's Kanab High School students also participated as part of an educational exercise. Cataloging artifacts, rendered plans, and profile drawings, as well as excavation, was done by Camille Ensle with assistance from Charlene Miles.

This volume's contributors have experience on many early Virgin Puebloan sites in both the St. George Basin and the uplands. As a result, notes on "their" individual features, as well as general observations on site layout and structure, were part of a common approach that solidified as the excavations proceeded and resulted in this report. Although Barbara Frank did not participate directly in the Road Kill excavations, she has been the principle investigator for numerous excavations on the Grand Staircase, as well as the St. George Basin. Barbara's analysis of ground stone and flaked stone materials from the Park Wash and Dead Raven sites provide excellent context for her analysis of the very similar assemblages reported in this volume. R. Roger McPeek, a dedicated avocational archaeologist with a keen interest in ceramics, analyzed the pottery and provided insightful comments.

Excavations on both the Road Kill and Park Wash sites were restricted to features found in the roadbed with the exception of partially damaged features extending beyond the road disturbance that were deemed important to provide context. Limiting excavation in this way salvages threatened resources while preserving the remainder of the site for future investigations. That said, it also has the distinct disadvantage of not providing the context necessary to understand how the excavated features relate to the overall site. To resolve this dilemma, we address the interpretation of Road Kill within the context of other Early Puebloan investigations on the Grand Staircase.

Most archaeologists, given a choice, prefer to work in quiet seclusion focused on the tasks at hand, unhampered by questions and comments from visitors. Excavating in a county roadbed, though not secluded, provided a rewarding chance to interact with the public, including local ranchers like Calvin Johnson and Chuck Bau. Visiting archaeological field schools from Brigham Young University, Utah State University, Southern Utah University, UNLV/Desert Research Institute, and Yavapai College provided lively exchanges. In addition, BLM personnel, including State Director Sally Wisely, curious Congressional aides, and the Southern Utah News took the opportunity to visit. The Kanab High School outdoor science class got their hands dirty when appropriate. There is no question that public visitation to active excavations on public lands is rewarding for all involved and should be encouraged whenever possible.

Coinciding with the excavations, the new Monument visitor center display team was exploring interpretation options for the Kanab facility. Road Kill was considered for a mock-up archaeological display, but eventually the team decided on the more visually impressive Arroyo Site. Continuing in this vein, this report is meant not only to document the excavations and disseminate data to other researchers, but also to inform the interested public as part of the Monument's science education mission.

Organization of the Report

The upshot of a Cultural Resource Management program of small-scale, opportunistic mitigation excavations, laudable as the approach may be, is that it results in a skewed dataset: a partial roomblock here, a pit house without storage features there, portions of a site damaged or simply missing, and so on. Much like the parable of the blind men and the elephant, it is sometimes difficult to tell just what part of a site you have a hold of. This dilemma is addressed here by considering site structure and the formation processes that shaped the archaeological record during a period of relative stability from about AD 700 to AD 1050. In so doing, we take the opportunity to review earlier research and present the prehistoric context for what we term "the Early Puebloan Period" (EPP) on the eastern Grand Staircase.

Another goal of this report is to consider subsistence through a range of interrelated domains that are affected by subsistence practices. The issue of subsistence being "mixed," "reliant," "dependent," and "committed" to agriculture, and to what degree, is largely a matter of semantics and is considered unproductive. Highly variable botanical and faunal collections can be biased by preservation (both good and poor), as well as sampling error. This is particularly so on sites that are only partially excavated. The presence, absence, or ubiquity of a particular species is far from definitive. The approach taken here is to consider multiple domains and integrate them. The result builds around our interpretation of Road Kill, which we considered to be a study of residential mobility. Considered below are several domains that, when integrated, address different aspects of economic behavior and the mobility that made it possible. The Road Kill excavation is an apt case study in which we highlight site structure as an important aspect of the *type* of mobility practiced on the eastern Grand Staircase during the EPP.

Apart from the primary task of describing the Road Kill excavations, we consider the Grand Staircase as one of several environmentally and culturally distinct physiographic zones (following Stokes 1986) with agricultural potential in the Virgin Puebloan region. It is considered an appropriate unit of study based on material culture, i.e. architectural types and styles, ceramic wares, tool stone technology, etc. In short, we consider it as socially and economically self-sufficient but with undefined ties to other arable physiographic zones including but not limited to the lower Virgin River-Moapa Valley, Uinkaret Plateau, St. George Basin, Kaibab Plateau, and Kanab Plateau.

Although we recognize Basketmaker origins for all the Virgin Puebloan sub-areas, our focus is on the period spanning AD 700-1050 during which there is clearly consistency, continuity, and cohesiveness of both material culture and settlement behavior. This temporal unit is not a taxonomic category but rather a period of conservativeness and slow change conducive to the study of economic and social behavior. This period of ontogenesis was succeeded in all the Virgin Puebloan subareas by various types and degrees of material culture change during the Late Pueblo II and Pueblo III periods (AD 1050-1280). Contact with either the Fremont or the Kayenta Branch is not indicated during the EPP.

It is recognized that much of the excavation data during this period on the Grand Staircase is the result of limited, mitigation-driven, small-scale excavations. Considered are the pros and cons of a sample that is biased by the size, number, and location of excavation units, as well as their depth, function, and especially their relationships. The Road Kill excavation is an excellent case study of this type of situation. Along with previous excavation data from contemporary sites in the Kitchen Corral drainage, a model of the developmental processes that resulted in Virgin Puebloan site structure is proposed in the final sections.

A great benefit of CRM programs on public land is the opportunity to conduct large-scale inventories that eventually result in better understanding of site distribution patterns - and hence settlement patterns. We offer only a condensed view here but encourage continued study. A similar view to that presented here was offered in an earlier article (McFadden 1996) wherein it was noted that habitation sites (i.e., those with visible architecture) are located within an arable zone between 1,525-2,135 m (5,000-7,000 feet) elevation. Outlying sites tend to be small and lightly occupied, and long-term or intensely occupied base camps in these areas are rare. This pattern proposed that local collecting tethered to the residential sites was the common approach to subsistence.

Direct subsistence data is derived from a variety of sources: In the form of short-term dietary remains as found in coprolite analysis of digested meals (Reinhard et al. 2012), long-term diet based on stable carbon analysis (Martin 1997, 1999), macrobotanical and faunal remains (Landon 2010), and pollen found in various contexts on site (this volume). We suggest that the ubiquitous evidence of maize, beans, turkeys, squash, and weedy plants (Cheno-ams) *and* the local availability of wild foodstuffs are a strong indication of a sedentary agricultural settlement strategy.

Others have interpreted these data as evidence for a "mixed" subsistence base, an ambiguous term at best (Baker and Billat 1992, Westfall 1987, Westfall et al. 2008, Talbot and Richens 2009, Janetski 2017; see also Nickens and Kvamme 1981 and Walling and Thompson 2004 for more local observations). We attempt to consider aspects of the archaeological record that address how subsistence practices were structured. We contend that rather than simply asserting that native foods, to one degree or another, indicate a "mixed" subsistence base, that we shift the focus to consider the relationship or *effect* that diet/subsistence practices had on settlement and site structure. In other words, we look at how subsistence behavior shaped the archaeological record on the eastern Grand Staircase. In large measure this is an issue of mobility versus sedentism.

The degree, extent, and duration of mobile behavior and the type of sedentism practiced is at the crux of Virgin Puebloan subsistence studies. Several models of mobility practiced by agriculturalists are presented in the next section. Our focus is on observations of repeated occupation as supported by both site distribution and subsistence data. The sequential occupation of farmsteads is just one of several tactics related to subsistence behavior operative during the EPP that shaped the archaeological record on the Grand Staircase. While it was not a singular strategy, we suggest it was common behavior. Our goal then is to reconcile this observation with settlement patterning and subsistence practices.

In summary, the Road Kill report is presented as a case study for assessing the relationship between site structure and inferences regarding residential mobility. Apart from simply describing the excavations and offering an interpretation, we take the opportunity to better contextualize the data in time and space, and to discuss the reliability of previous interpretations that were based on limited distributional and excavation data. The following sections will: (1) Consider the database by reviewing previous excavations during the EPP (AD 700-1050); (2) Discuss potential models of settlement that have previously been put forward; (3) Present the Road Kill excavation data; (4) Consider extant site distribution data, subsistence data, and site structure as they relate to one another in terms of human behavior; and (5) Present a model of settlement and subsistence behavior congruent with the above datasets for the EPP on the eastern Grand Staircase.

It is hoped that this report will serve in some measure as a contextual statement for sites on GSENM and adjacent areas during the EPP. As recent events demonstrate, artificial administrative boundaries come and go but basic research requirements stay the same. To the extent that testing and limited excavations continue in the Grand Staircase, it is hoped that this document is useful for determining Section 106 eligibility for similar sites, as well as structuring research designs and interpreting data in the future.

Chapter 2
Physical Environment

The Road Kill site is located near the eastern edge of the Grand Staircase subdivision of the Colorado Plateau physiographic province as traditionally defined (Stokes 1986). It lies at the base of the Vermilion Cliffs at an elevation of 1,743 m (5,720 feet) along Park Wash, one of two tributaries that merge to form Kitchen Corral Wash, itself a major tributary of the Paria River (see Figure 1.1 above).

Park Wash trends north-to-south through the Vermilion Cliffs, forming a canyon nearly 100 m deep. Talus-covered slopes of the Springdale Member of the Moenave Formation are exposed a few meters above the canyon floor alluvium. The near vertical cliffs of Kayenta Formation sandstone overlays the Moenave. Several rock shelters with storage structures are found at the contact between the two formations.

Road Kill is situated on the east side of the wash at the base of the talus slope on the east, and it extends west towards the edge of the deep alluvial deposits along the wash. Its location limits exposure to early morning sun. At this point, the canyon floor is level and 100 to 150 m wide. The fill is comprised of stratified bands of alluvium incised by the modern channel, which is presently about 12.5 m deep and 20-30 m wide (Figure 2.1). Prehistoric agricultural fields are

Figure 2.1: View of Park Wash facing south. The wash at this point is about 12.5 m deep.

assumed to have been adjacent to the site, although a pollen sample from the cutbank about a meter below the present surface was negative for the presence of maize. It is possible, perhaps probable given recent studies, that the prehistoric wash ran at a level considerably below the modern bank.

Geological Resources

Virtually all the building material on site is Moenave Formation sandstone obtained from the talus slopes above the site. The Moenave is characterized as a massive unit of cross-bedded aeolian sandstone forming shelves, benches, slopes, alcoves, and overhangs (Figure 2.2). Raw construction stones are abundant as small, blocky material suitable for masonry walls and as tabular slabs for lining cists.

Clay used on site for mortar, clay floors, and wattle-and-daub structures is a light tan/buff color like that is exposed in the wash just below the site, possibly a Cretaceous sediment originating upstream in the Gray Cliffs. It is also possible that Cretaceous clays, either residual or mineral, were used for the manufacture of local pottery (see Larson et al. 1996). The site itself lies on a sandy, red clay substrate thought to occur elsewhere in the drainage. It is not exposed in the bank of the wash, and it was used sparingly for construction.

Outcrops of the Petrified Forest Member of the Chinle clay underlying the Moenave Formation are exposed downstream, but there is no evidence of it at Road Kill. There has been speculation, however, that it was a clay source for producing Shinarump Plain, a

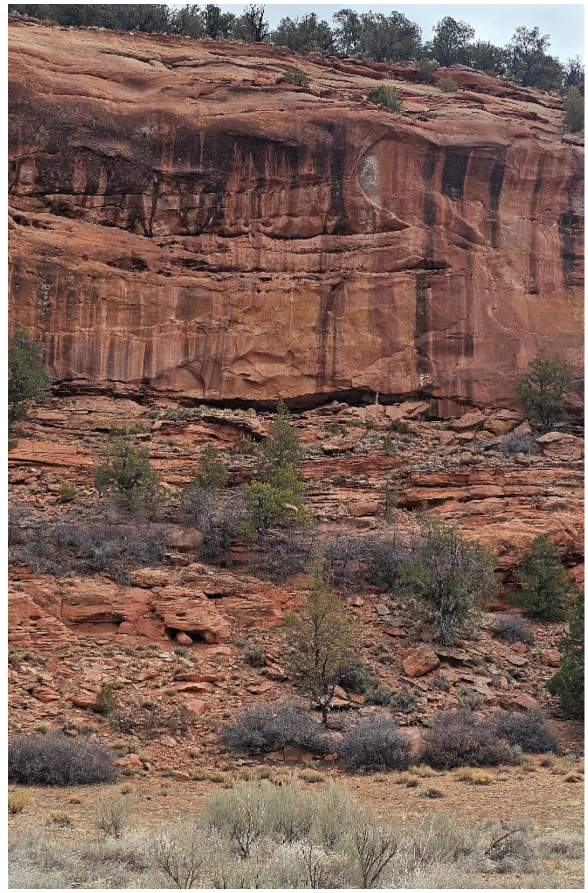

Figure 2.2: Moenave Formation sandstone formation above the Road Kill site. Photo by Dan Bauer, courtesy of Colorado Plateau Archaeological Alliance.

locally produced gray ware (Perry 2000, Larson et al.1996). As discussed later in this volume, it is entirely possible that Cretaceous clays were used for Virgin Series white wares and Chinle clays for utilitarian gray wares. This significant issue has yet to be resolved.

There are also a considerable number of quartzite cobble hammerstones strewn over the talus slope above Road Kill. We initially thought them to be part of a local lag deposit, but more likely they were procured from sources elsewhere and brought to the site. Virtually all the cobbles show significant battering and were probably used to dress building stone.

Vegetation

The local plant community is Upper Sonoran. Talus slopes are dominated by pinyon (*Pinus edulis*) and juniper (*Juniperus osteospermata*), along with single-leaf ash (*Fraxius anomala*.), Mormon tea (*Ephedra viridis*), buffalo berry (*Sheperdia rotundifolia*), fragrant sumac (*Rhus aromatica*), and serviceberry (*Amelancher utahensis*). The canyon floor alluvium groundcover is primarily big sage (*Artimesia tridentada*) and warm-season grasses (Figure 2.3). No native riparian species occur in the wash today. It is interesting to note, however, that cattail (*Typha sp*.) pollen occurs in small amounts at Road Kill and all other Early Puebloan Period (EPP) sites excavated in the Kitchen Corral drainage.

Faunal Resources

The best proxy data as to what fauna was available prehistorically comes from the Arroyo Site, a Late Pueblo II site about 6 km downstream from Road Kill. Nauta (2012) described the faunal assemblage there as consisting of mule deer (5%), pronghorn (15%), mountain sheep (23%) and elk (1%). Butchering was apparently conducted on site, suggesting that, at least in some cases, entire animals were brought to the site rather than butchered in the field. This suggests that hunting took place nearby. In addition to big game animals, hares and rabbits made up 32% of the collection. Whether these percentages reflect food preferences or sampling error, it is surprising that the mule deer count is low given Road Kill's location

Figure 2.3: Environmental overview of the Park Wash floodplain, looking north. Photo: Dan Bauer, courtesy of Colorado Plateau Archaeological Alliance.

along a mule deer migration corridor. Each fall, mule deer migrate south from the Paunsaugunt Plateau summer range through these canyons to winter ranges 16-24 km below Road Kill. Pronghorn, although no longer present, likely occupied the same open range year-round. The canyon system along Park Wash would also have been good mountain sheep habitat.

Precipitation and Surface Water

Average annual precipitation in the Paria Basin is about 30 cm (12 inches). Precipitation is bi-seasonal with a low point in June during the "spring drought" and a rainfall maximum occurring between July and October (Hereford 1986). Modern precipitation records from Kimball Valley 11 km to the southeast of Road Kill indicate a modern average of about 30 cm (11 inches). This figure is likely less than that received at Road Kill because Kimball Valley is somewhat lower in elevation. More importantly, available moisture along the Vermilion Cliffs is significantly enhanced by flash floods during intense summer thundershowers.

Several springs occur within the canyon system, the closest in Box Elder Canyon 2.2 km to the southeast. Flooding in the canyon system was experienced July 10, 2001, when a moderate flood occurred in Park Wash and Deer Spring Wash even though local rain was light (Figure 2.4). This suggests that precipitation in higher elevations, including the distant Paunsaugunt Plateau, may have provided enough stream flow at lower elevations to germinate maize during the spring.

Hydrology

The alluvial history of the Paria Basin has been described as one of "short-term climatic variability," and that alluvial sediments were derived primarily from erosion of the steep slopes of the canyon (Hereford 1986:293). Within the canyon itself, the talus slopes provided tertiary slope wash of both sediment and water.

This suggests the potential for small agricultural fields, or "outwash fields," along the base of the cliffs in addition to fields along the larger stream courses. Given the highly variable alluvial settings along the course of the drainage, we might consider climate change and human reactions to it as a local phenomenon rather than a regional one. Outwash fields located at the mouth of tributary washes would have been particularly susceptible to the effects of local storms. In this regard, the impact of early Ancestral Puebloan climate stress (Benson and Berry 2009) might be viewed on a scale as small as an individual site.

The viability of Park Wash for farming probably varied over time and from place to place. At present, the alluvial deposits average about 100 m wide along the reach immediately adjacent to Road Kill. An individual floodplain segment about 250 m long would have provided about 5 acres of arable fields. The modern arroyo is entrenched 12.5 m in the vicinity of the site and is about 25 m wide. It meanders the length of the canyon, significantly reducing potential field areas. Four kilometers downstream from Road Kill, just above the Park Wash confluence with Deer Spring Wash, the channel is presently aggrading and is now only a

Figure 2.4: Local flood event in Box Elder Wash near its confluence with Park Wash that supports Hereford's (1986) observation that secondary drainages scoured by floods were a significant source of sediment in the primary channels.

few meters below the flood plain. If this was the case prehistorically, different reaches of the wash may have had varying agricultural potential.

Alluvial Geomorphology

Richard Hereford's pioneering study of modern alluvial history in the Paria Basin included Park Wash, Deer Spring Wash, and Kitchen Corral Wash. His study focused on understanding the chronology and possible causes of "recent changes in alluvial-valley morphology," and he concluded that "short-term climatic variations (were) a causal mechanism in landscape evolution" (Hereford 1986:293).

Of particular relevance to both the Road Kill and Park Wash sites is his cross-section of alluvial deposits at locality PW in Park Wash (Figure 2.5). At this point the channel is a little over 100 m wide between the colluvium that forms its banks. The uppermost deposit is represented by the Cottonwood Terrace (CT), which may abut, underlie, or even cover both sites. The lower modern deposits suggest how rapidly cut-and-fill episodes might have occurred in the past.

Building on Hereford's work, a subsequent study focused on modern sediment loads in the drainage system (Graf et al. 1991). The authors suggested that floodplain aggregation is caused by monsoonal storm flooding during the summer and fall (enhanced by El Nino [ENSO] conditions), and that its preservation is aided by lower flows during the winter.

Research carried out by graduate students under the guidance of Cathrine Rigsby, East Carolina University, in conjunction with the California State University, Long Beach archaeological field school, made substantial efforts towards our understanding of the fluvial history of Kitchen Corral Wash and its major tributaries, Deer Spring Wash and Park Wash (Dernbach 1992). Fifteen terrace profiles were mapped and described. The P4 profile is the northernmost and is located in Park Wash between the Park Wash and Road Kill sites. It was described as 70 m long by 16 m high with five distinct trenching events in the lower portion of the terrace alluvium (Figure 2.4). Dernbach found that each of the three washes contained similar terrace profiles that represented cut-and-fill events.

Building on Dernbach's findings, subsequent investigations (Kulp 1995; Rigsby and Kulp 1994) provide a sequence of radiocarbon dates for five cut-and-fill events that ranged from Basketmaker through historic times (also reported in Appendix F in McFadden 2016). The dates were collected from a composite of profiles from stations throughout the three drainages. Whether they correlate with Dernbach's P4 profile is not clear. These studies suggest there is good potential to correlate Puebloan occupations with cut-and-fill events throughout the drainage system.

As Dernbach observed, "The five channel trenching episodes are attributed to five episodes of increased frequency of intense precipitation. If rates of modern arroyo incision can be assumed, it is believed that each of the five erosional events occurred over a period of less than 30 years. The filling events are the result of five episodes of increases in annual precipitation that increased in duration with time" (Dernbach 1992: 95).

Based on reconstructions of the alluvial history of the Kitchen Corral drainage, Rigsby and Kulp (1994) concluded that major climate change was not a significant factor during the Ancestral Puebloan occupation, and that "any climatic trends that evoked [Ancestral Puebloan] culture change were operating on a yearly or decadal scale rather than on the scale of major regional climatic shifts" (Kulp and Rigsby 1996).

Historical records of down-cutting events agree with the above, suggesting that regional down-cutting events were asynchronous due to local causal mechanisms (Webb et al. 1991:3). This view accords well with observations in the Kitchen Corral drainage, as well as the nature of site occupation and population movements across the broader Grand Staircase.

Both Hereford (1986) and Dernbach (1992) indicated that modern arroyos with heights ranging from 6-16 m greatly exceed earlier ones. Kulp (1995) and Kulp and Rigsby (1996) provided radiocarbon dates for a similar profile. If the Cottonwood Terrace underlies all the fill units, as Hereford (1986:299) assumed, and it is the equivalent of Old Terrace Alluvium (OTA), as Kulp and Rigsby (1996) believed, we would expect sites from all periods to occur on the uppermost surface (terrace) of the drainage. Further, if the Anasazi

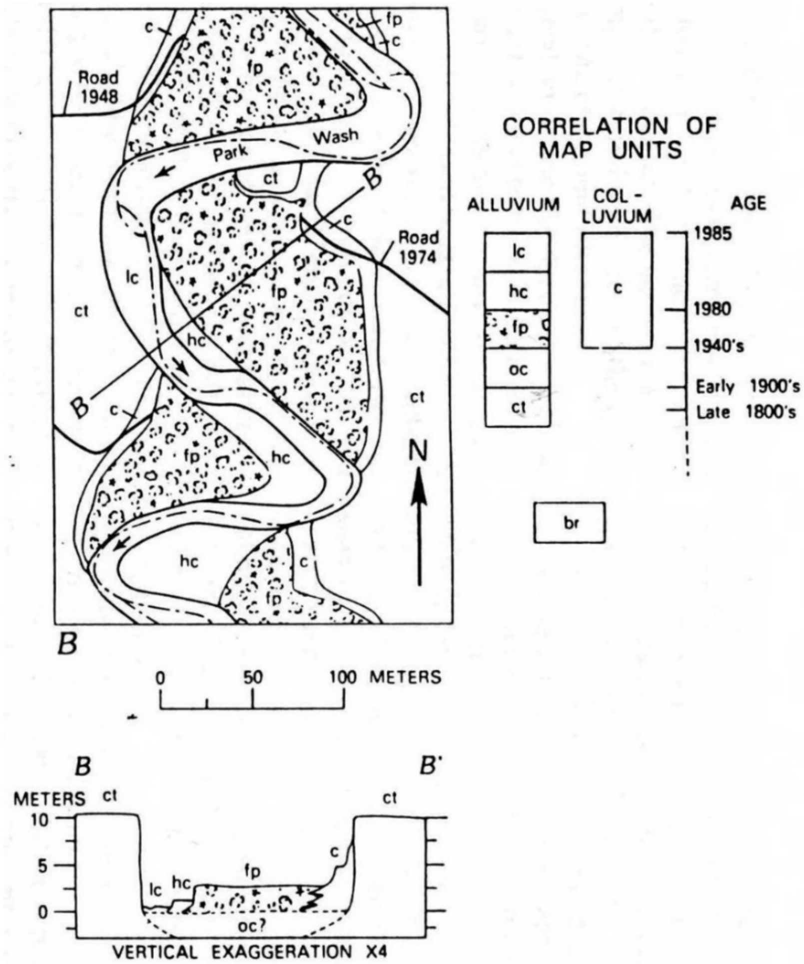

Figure 2.5: Reproduction of Hereford's (1986) plan map and cross-section of Park Wash located just north of its confluence with Deer Spring Wash. Legend: CT = cottonwood terrace; OC = older channel alluvium; FP = flood plain; HC high channel: LC = low channel; C =colluvium.

Habitation Alluvium units have always been as much as 10 m below the modern surface, we might expect this to be the case in Park Wash and nearby Deer Spring Wash.

This raises important questions. Kulp and Rigsby (1996:15) identified Unit P as Pre-Anasazi Habitation fill in Kitchen Corral Wash and Park Wash. Can we identify these surfaces along the margins of the canyons? Was regional arroyo cutting asynchronous (Webb et al. 1991), or was it "coincident throughout the study area" (Hereford 1986:293)? Hereford went on to qualify this statement, indicating that "...deposition was essentially synchronous, although each stratigraphic section records a slightly different depositional history" (Hereford 1986: 306).

If the above is accurate, it is obvious why a pollen sample taken from sediments a meter below the present arroyo edge at Road Kill did not yield maize pollen. It might also place the western edge of the Road Kill cist alignment precariously close to the old arroyo edge, which could account for construction of an alignment that extends awkwardly upslope to the east.

Environment Summary

The physical environment of Park Wash and the larger Kitchen Corral drainage hold a full range of native floral and faunal species, as identified in the paleo-botanical and palynological analyses. Not only are they available near habitation sites, but they are found in quantity along both the base and rims of the Grand Staircase cliffs. Agricultural approaches available to Road Kill occupants would have included dry farming, slope wash fields, alluvial outwash fields, and subirrigation in riparian areas. Each represents an opportunity to meet the challenges of changing environmental circumstances.

The complex alluvial history of Kitchen Corral drainage offers an exceptional opportunity to correlate settlement along its banks with natural events. The larger Grand Staircase spans three separate drainage basins: the Paria River, Kanab Creek, and the Virgin River. This offers potential for explaining settlement across multiple basins.

How these natural conditions affected the behavior of Grand Staircase populations, and hence structured the archaeological record, is a central concern of this report. Our working hypothesis is that the dynamics of localized weather events, rather than long-term climate regimes, and their impact on the various arable landscapes constituted the single most important factor affecting agricultural viability.

The several geomorphologic studies seem to be complimentary, if not in total agreement with one another. But there remain good opportunities to further pursue the relationship between the alluvial history of the Kitchen Corral drainage and the culture history found there and in Park Wash and Deer Spring Wash.

Chapter 3
Virgin Puebloan Cultural Landscape

Several scholars have considered Kanab Creek to be a boundary between Virgin Puebloans to the west and Kayenta Puebloans to the east (Ambler 1996; Euler 1994, Lyneis 1995). Others have argued that Puebloan groups east and west of Kanab Creek were indistinguishable except for a brief period of about 50 years in Late Pueblo II times (McFadden 2012, 2016; Spangler and Zweifel 2021). It is hoped that this report sheds additional insight into the questions surrounding the regional Virgin Puebloan tradition that, at minimum, included the St George Basin and Grand Staircase during the Early Puebloan Period (EPP).

The Virgin Puebloan region (Figure 3.1) consists of distinct physiographic settings, each with a relatively high density of sites, in some cases up to 100 sites per square mile. Most of these display some form of architecture. Some of these landscapes are contiguous, while others are virtual "islands" separated by considerably less hospitable country. Although highly variable, each setting has agricultural prerequisites: adequate moisture (precipitation or live water), a sufficiently long frost-free season, and arable soils. The variability of soil types farmed in the region is diverse: alluvial outwash deposits, volcanic soils, deltaic/fluvial sediments, and aeolian accumulations. Constructed agricultural features such as check dams and terraces have seldom been identified, except for the extreme eastern flanks of the Kaibab Plateau. In general, the subareas were occupied throughout the Formative Period (AD 550-1280). Interaction between them is demonstrated by similar material culture, although population growth seems to have been largely internal with little evidence for large scale population movement. Intermarriage might best account for the nature and scale of this type of relationship.

Viewed as individual landscapes, each of the above districts have unique characteristics. All have good agricultural potential but highly variable foraging opportunities. Some economic plant species are locally available, others at a distance. Most are seasonally available, which may or may not conflict with the scheduling of agricultural activities. Examples of specialized foraging locales include Sand Hollow (Talbot and Richens 2009) and the Beaver Dam Slope (Moffitt et al. 1978). Sites in these situations appear to be the result of logistical forays from agricultural farmsteads in the St. George Basin.

If foraging involved residential movement to base camps beyond the agricultural bases, the evidence to support this idea is sparse. We would expect base camps to display intense uses, such as middens, multiple hearths, temporary brush structures, and abundant projectile points and ground s

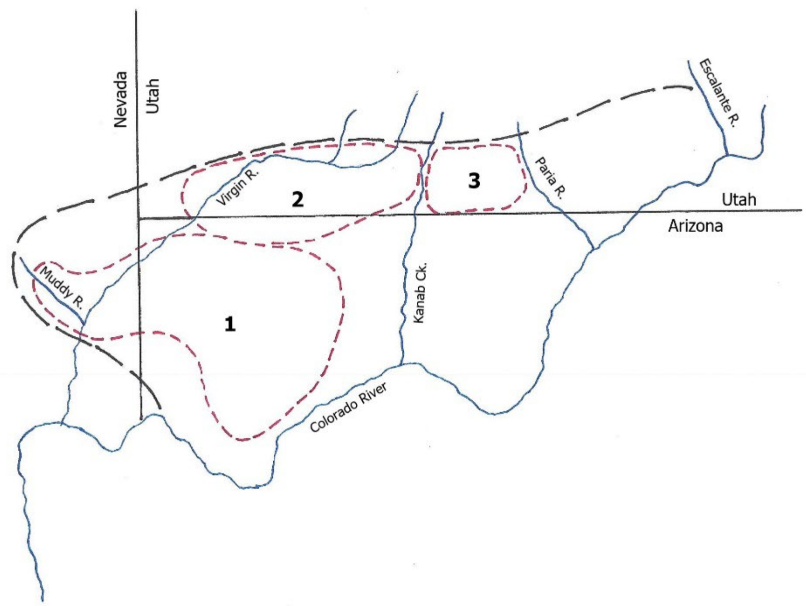

Figure 3.1: Map of Virgin Ancestral Puebloan geographic area (heavy dashed line), and the three three main districts discussed in this chapter. (1) Uinkaret Plateau/Lower Virgin River; (2) western Grand Staircase/St George Basin; and (3) eastern Grand Staircase.

tone. A few rock shelters such as Antelope Cave on the Uinkaret Plateau are known to have these characteristics (Janetski et al. 2013). Yet it is difficult to know where these farmer-foragers originated.

The primary archaeological districts are defined in part by high frequencies of the dominant ceramic types, although types are not mutually exclusive to each district. Overlaps occur, and they vary in different ways through time and space, sometimes by series, sometimes by ware, occasionally by intrusive types from the Kayenta region. For example, on the eastern Grand Staircase, Virgin Series white ware bowls (Mesquite Black-on-gray and Washington Black-on-gray) are strongly associated with Shinarump Plain through Pueblo I times, and they are eventually replaced by Shinarump white wares in Pueblo II times. In the St. George Basin, Virgin Series pottery is dominant. Moapa Gray Ware intrudes into the St. George Basin during certain periods, and it is found in the Grand Staircase in trace amounts. Design styles have motifs in common across the region. Intrusive Kayenta white wares occur in varying frequencies through time and across the region, but always in trace amounts during the EPP. Clearly, if ceramic frequencies are taken as a proxy for group interaction or even population movement, we have a logical but very complex means of assessing intraregional relationships.

Two notable exceptions (considered special cases) include the Fiftymile Mountain-Escalante River drainage where the initial Fremont occupation was eventually succeeded by an Ancestral Puebloan intrusion after about AD 1050, and the eastern Arizona Strip where Virgin and Kayenta populations came into significant contact during the first half of the 11th century. There, agricultural features proliferated on the slopes of the Kaibab Plateau and in House Rock Valley (McFadden 2004). This was followed by the apparent development of a tradition of Kayenta-like ceramic styles, forms, and corrugation techniques produced on locally manufactured wares. The emergence of new pueblo layouts marks the end of the EPP at about AD 1050.

The Grand Staircase, therefore, is viewed as socially integrated on a regional level, while economically self-sufficient at the local level. A comparable ethnographic analogy might be Isabel Kelly's Southern Paiute "economic clusters" model where groups shared cultural traditions but with varied subsistence strategies (Kelly 1964). Although a central research goal should be to compare and contrast the major sub-areas within the Virgin Puebloan region, this report will primarily focus on the eastern Grand Staircase, with particular emphasis on the Kitchen Corral drainage during the EPP.

Grand Staircase Subarea

Although the Grand Staircase is a physiographic subsection (Stokes 1986), it is viewed here as a cultural unit. The cliffs and benches of the "Staircase" offer a geologically varied agricultural zone spanning nearly 915 m (3,000 feet) in elevation and extending almost 100 miles from the Hurricane Fault east to the Cockscombs of the Kaibab Monocline and Paria River. The benches and cliffs influence the movement of big game animals, as well as the distribution of locally available seeds, nuts, and tubers. An optimal setting would include prime agricultural lands, key native floral species, and extraordinary hunting opportunities, although it is rare in the Southwest to find all three together.

Settlement of the Grand Staircase is best described on two levels: 1) the propensity for individual sites to display some degree of long-term use, probably discontinuous, over multiple generations, and 2) major drainages, such as Kitchen Corral, that appear to have been occupied through the entire Virgin Pueblo sequence. It is the relationship between site-use histories, occupational sequences, and natural events that structures the perspective of this report. Occupants of the Grand Staircase during the EPP are considered Virgin Branch Ancestral Puebloans, with close ties to populations as far west as the St. George Basin. After this period, the eastern Virgin region was heavily influenced by the Kayenta and underwent significant material culture changes not found farther west (McFadden 2012).

Temporal Schemes

Many Virgin Puebloan organizational constructs have been developed over the past 80 years to address the regional chronology (Altschul and Fairley 1989; Gladwin and Gladwin 1934; Harrington 1930; Lyneis 1995; Shutler 1961; Spangler and Zweifel 2021; Talbot 1998; Thompson 1986). Some are local chronologies, while others have been applied across much broader regions (see Figure 3.2). The Grand Staircase and St George Basin sequences are now supported by hundreds of radiocarbon dates (Spangler and Codding 2025). Frequency seriation has also been

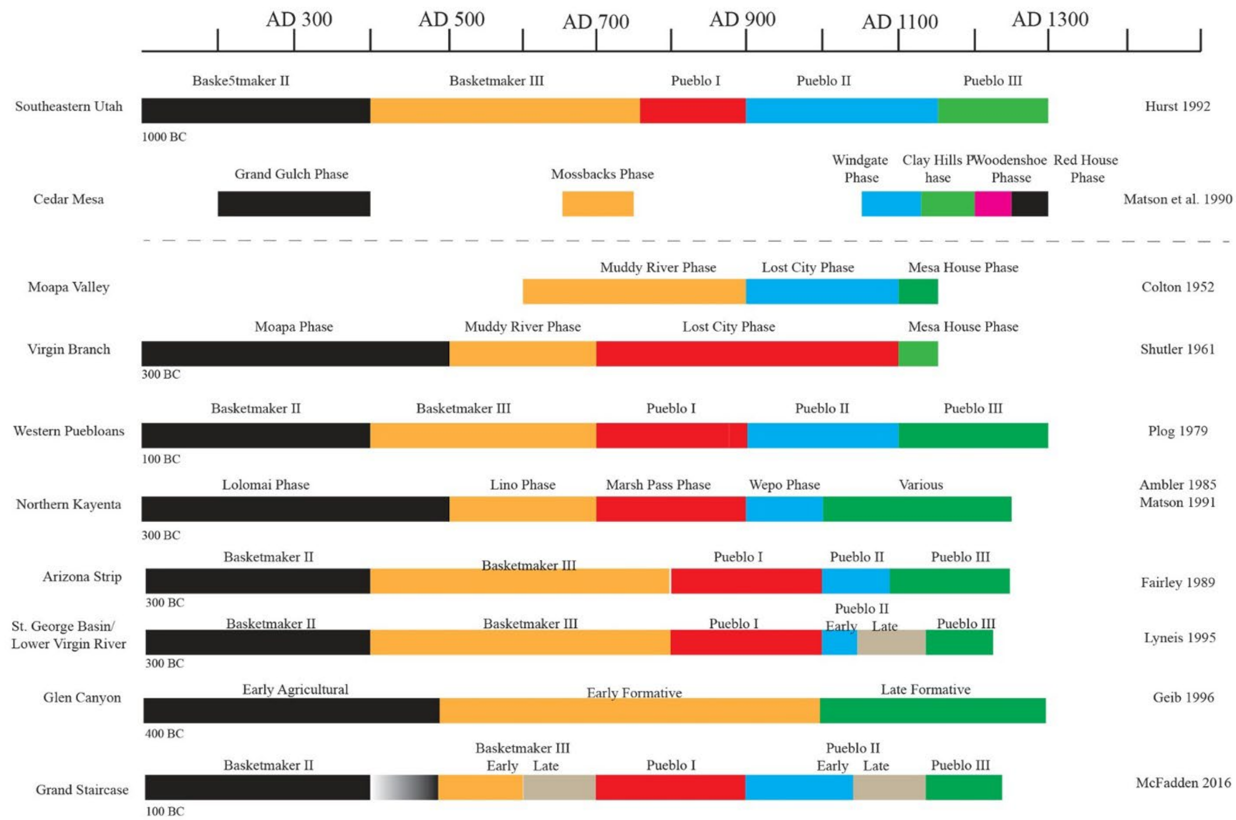

Figure 3.2: Comparison chart of various Ancestral Puebloan temporal schemes proposed for the Southwest, after Spangler and Zweifel (2021).

employed to provide a relative temporal sequence. This practice involved plotting the ratio of corrugated ceramics to plain ceramics to order the sequence (Moffitt and Chang 1978; Lyneis 1986, 1992a; O'Hara 2009). This method assumes (1) a consistent rate of change over time and (2) the integrity of the assemblage.

It is increasingly apparent, however, that Virgin Puebloan ceramic frequencies and associations vary across the region for reasons that are not well understood. For example, jar rim forms for Virgin Puebloan plain gray wares (both Virgin Series and Shinarump Series) during the EPP form a regular continuum from slightly curved in Pueblo I times to strongly everted in Pueblo II times (Dalley and McFadden 1985). This progression, however, appears not to be the case for Moapa Gray Ware (Sakai 2014). The EPP sites described in this volume, including Road Kill, strongly support the gray ware rim eversion sequence.

Absolute dates for the introduction of pottery styles, including corrugation, are also problematic. On the Grand Staircase, the introduction of corrugated pottery occurs abruptly sometime after AD 1050 and at the same time the frequency of plain gray pottery declines dramatically. On the far west side of the region, corrugated pottery is reported as early as AD 950 (Lyneis 1986; Sakai 2014, 2017), although this early date is not consistent with corrugated wares elsewhere in the Southwest (Pierce 1999). For these reasons, the development of local ceramic chronologies for each subarea seems the most prudent course. The local ceramic sequence is reasonably well documented for both the Grand Staircase and St George Basin districts during the EPP and later periods.

Middle Pueblo II

A "Middle Pueblo II" designation, as an undated ceramic category, has been applied to sites across the region. On the Grand Staircase, its definition is critical to understanding the nature and timing of the end of the EPP and the advent of the Late Pueblo II period. The use of corrugated-to-plain sherd ratios (Lyneis 1986) and other qualities such as the presence of Sosi-like, non-ticked white wares from surface collections is not without issues peculiar to the Virgin Puebloan area.

Potentially confounding temporal placement is a tendency to assume that surface assemblages are representative of a site. Lyneis (1986:58) used corrugation and temper as reliable high frequency variables to describe temporal sequences "when representative surface collections are available." Richard Thompson wrestled with the problem of "anachronistic associations" on his Arizona Strip surveys (Thompson 1979:250) and eventually resolved it through excavation of the Mixmaster Site (42WS920) on Little Creek Mountain, where multiple occupations over time were amply demonstrated.

The Grand Staircase chronology is based largely on radiocarbon dating and tree-ring dates accumulated since the early 1980s (see Spangler and Zweifel 2021 for a complete catalog). A growing number of radiocarbon assays and tree-ring dates provide reasonable temporal control over material culture, architecture, and ceramic types and styles. In some cases, however, the periods used do not correspond well with those in other subareas. A definable Middle Pueblo II period is a case in point. Although Middle Pueblo II is a logical construct based on a combination of early and late ceramic traits that originate in the Kayenta region, ceramic change on the far east side of the Virgin Puebloan region was apparently more abrupt than elsewhere. There may not be a true link between roomblock architecture and the surface ceramic assemblages used to date them. If roomblocks or cist alignments were built over a long period, the ceramic assemblages could be misleading mixtures, or "congeries" as Geib (1996) called them.

Individual sites with a range of temporally sensitive pottery types that are associated with specific features or areas of a site *can* be discerned, at least on the Grand Staircase and probably the St. George Basin. As we discuss later, complex, long-lived site construction histories are a common trait of many Virgin Puebloan agricultural sites in both areas. Given that "congeries" of Early Pueblo II and Late Pueblo II ceramic assemblages can be interpreted as "middle PII," it is important to be cautious when making temporal assignments without thoroughly examining their actual associations.

The Grand Staircase temporal periods, although unique in terms of material culture, correspond well to traditional Pecos Classification schemes, hinting that local cultural changes were a reaction to common regional stimuli. One example of this is the advent of the Late Pueblo II period, often referred to as the "Pueblo II expansion," between AD 1050 and AD 1100. More recently, this has been referred to as "Kayenta intrusion" (Lyneis 1995, or the "Virgin-Kayenta interface" (Collette 2009). Central to the nature of this critical juncture is the absence of a defined Middle Pueblo II ceramic assemblage as described for the west side of the Virgin region (Lyneis 1986; Sakai 2014, 2017; Walling and Thompson 1986).

The Late Pueblo II period on the Grand Staircase is marked by the introduction of corrugated ceramics, Sosi and Dogoszhi Black-on-white types, Tsegi Orange Ware, and new linear architectural forms. These developments are believed to have originated in and around House Rock Valley. These changes occurred at different rates in the western districts, and in some areas, they did not occur at all. This variability in the acceptance of ceramic styles, architectural forms, and artifacts such as Bull Creek points may be attributed to factors specific to these distant regions, including their physical and social distance from eastern influences. See also Ambler's (1996) hypothesis of individual social identities for each of the Virgin Puebloan areas based on this variability.

St. George Basin and the Grand Staircase: Commonalities and Contrasts

Aikens (1966) first addressed the relationship between the St. George Basin or the "western Virgin area" and the uplands of the Grand Staircase, which he called the "Kayenta - eastern Virgin area." He found the material culture and reliance on farming to be very similar between the two areas. The multitude of inventories and excavations conducted since Aikens' initial observations clearly demonstrate there is, in fact, little difference in material culture between the two areas. But there are important differences. Agricultural settlements in the St. George Basin are tethered to perennially watered stream courses and springs, while those to the east could also rely on rainfall for dry farming or floodwater irrigation. Reliance on maize seems to have been the same between the two areas, based on dietary studies (Martin 1997, 1999; Landon 2010). Site structure reflecting extremely complex and lengthy occupations of small farmsteads - some as long as 600 years - are assumed to be a result of episodic occupations rather than continuous ones.

Settlement systems and subsistence practices in the St. George Basin will not be addressed at length here. Given the ceramic and architectural similarities during the EPP, we cannot rule out a reciprocal relationship of some sort between the two areas. For example, the distinctive Cave Valley rock art style, believed to be Basketmaker III-Pueblo I in age, is common to both areas. This is clearly not the case during the succeeding Late Pueblo II period when considerable disparity between the two areas is apparent. Salient differences include both pit house and roomblock architecture. Sometime after AD 1050, the distinctive EPP-style benched pit house fell into disuse in both areas

(McFadden 2016: Figure 118). After this time, and only in the uplands, it was replaced by deep, kiva-like structures and formal L-shaped and linear roomblocks, some with plazas and courtyards. Also appearing at this time were Bull Creek projectile points, an abundance of spindle whorls, and the distinctive Eastern Virgin rock art style (Schaafsma 1971: Figure 119; Steward 1941).

Apart from new ceramic types and styles and the shift from cist storage to surface units, it could be argued that little changed during Late Pueblo II times in the St George Basin. What this means in terms of changing social interaction between the two areas is unclear. The causes of abandonment and reoccupation in these two different environmental settings were surely different. The push from one seems likely to have been at least as strong as the pull to another.

The above observations were reinforced by investigations at 42WS2232, a complex farmstead in the St George Basin near the confluence of the Santa Clara and Virgin Rivers. Excavations there revealed a classic example of long-term sequential occupations (Hutmacher 2012). An impressive sequence of superimposed early Puebloan storage and residential structures was found to be overlaid and intruded into by a Late Pueblo II occupation. The site structure of the nearby Southgate sites, as yet unreported, was similar. Several displayed both superimposed occupations and what might be called “horizontal” stratigraphy via accretional additions to the storage and habitation room alignments.

Chapter 4
Previous Research

In this section, we discuss excavated sites on the eastern Grand Staircase, especially those in the Kitchen Corral drainage, that date to the Early Puebloan Period (EPP). As discussed below, we believe the social and cultural identity of the local populace were part of a common Virgin Puebloan tradition similar in most regards to Virgin Branch populations as far west as the St. George Basin. Road Kill and several other sites are discussed here as case studies representing this period.

The eastern side of the Grand Staircase has been of archaeological interest for almost a century, and much of that early research focused on the Kitchen Corral drainage. Julian Steward conducted the first serious archeological investigations in 1932 (Steward 1941), focusing on the area between Johnson Canyon and the Paria River. Steward documented 142 sites, of which about a third were in the Kitchen Corral drainage. Steward described and photographed Site 37, located immediately above the Road Kill site, as “Caves and rock shelters containing masonry walls, also circular stone and adobe house” (Figure 4.1, now recorded as 42KA1735). Although he did not mention the Road Kill roomblock located immediately below Site 37, he apparently “lumped” several sites that would now be recorded separately.

Three of Steward’s sheltered sites were stabilized by the Mesa Verde stabilization team, and two of these, 42KA1811 and 42KA4860, were subsequently radiocarbon dated to the Pueblo I period (Table 4.1). One Wall Ruin (42KA4860) consisted of a sheltered granary and camp, and the radiocarbon date was roughly contemporaneous with the nearby Road Kill site.

Steward’s hand-drawn map of Site 61 and its description as “slab cist and sherds” may, in fact, be the partially excavated Park Wash site (42KA4859). Based on both ceramics and architecture, Steward recognized that the archaeology of the area was “roughly comparable to the Basket Maker II, III, Pueblo I, and II periods of the San Juan drainage” (Steward 1941:287).

Steward's approach involved plotting the distribution of different types of sites according to the Pecos Classification system. Of particular interest to this report, his maps illustrated little temporal difference in their overall distribution. Further, he identified multi-component sites with both early slab structures and late masonry houses. These observations and the nature of the sites themselves are directly relevant to the interpretation of Road Kill.

Perhaps as significant were Steward’s observations on local pottery. He recognized a range of early, transitional, and late types from the Johnson Canyon and Paria River region. Early types were called Basketmaker Black-on-gray and Paria Gray; transitional types were

Figure 4.1: View of 42KA4860 (One Wall Ruin) immediately above the Road Kill site.

considered "probably Sevier black-on-gray and perhaps North Creek gray" (Steward 1941:299). He added a new type among the late wares, "Johnson gray-tan," that included both plain and corrugated wares, although he also noted the similarity of Johnson gray-tan and Paria Gray "flaring-mouth" forms.

Steward also illustrated the rim forms of plain gray jars of all types. We now recognize a sequence of rim forms in both the Grand Staircase and St. George Basin based on the degree of eversion with early gray wares exhibiting slight or no eversion at all and late gray wares exhibiting extreme eversion. In fact, his type site for Basket Maker black-on-gray, noted to be associated with Paria Gray, was his Site 2 (now 42KA1811), which has been radiocarbon dated to Pueblo I times (see Table 4.1). He illustrated painted types that are similar to Mesquite/Washington Black-on-gray, and rim forms that we now consider typical of the Basketmaker III, Pueblo I, and early Pueblo II periods. Of interest here is that the full range of rim forms occurs in both Paria Gray and Johnson gray-tan. It is also worth mentioning that he had difficulty assigning names to "scores" of sherds due to the range of variation of paste and temper.

We can now say with confidence that Steward identified a range of plain gray rim forms that are temporally sensitive. Central to the developing thesis of this report, the range of variation often occurs on the same site. Steward's type names have long been abandoned (see Colton 1952, Lister 1964). Today, the paste and temper variation of these types is expressed as Shinarump Series gray wares and white wares and Virgin Series gray wares and white wares.

Steward's architectural sequence aptly described early "slab structures" similar to those at Road Kill, as well as later "rectangular masonry houses." Of relevance to recurrent occupation of sites is his statement that the occurrence of cist architecture on sites with masonry structures was "a survival of the use of such structures into later times…" (Steward 1941:288).

Several decades after Steward's investigations, Mel Aikens' excavations at the Bonanza Dune site (42KA1076) in Johnson Canyon might be considered a milestone in eastern Virgin Puebloan research (Aikens 1965). As described by Jennings (1978), the excavation of six "sequent occupations," at least five of them within the early Puebloan period, helped shape the view of Virgin Puebloan sedentism discussed in this volume.

Still farther up the canyon, Aikens also tested the very large (60 by 120 m) Sand Hills site (42KA1060), identifying 10 storage rooms in three discrete areas (Aikens 1965). Ceramics recovered at Sand Hills were predominately plain gray. In fact, ceramics on all the sites were plain gray, indicating the primary occupation was during the EPP.

Nearby, BLM excavations at 42KA2147 salvaged the remains of a damaged pit house and three storage cists (one with a hearth) dated to the Pueblo I period (McFadden 2016). A short distance north, excavations at the Dead Raven site identified a cist alignment with a lightly constructed surface "work" room and two pit houses (Walling and Thompson 2004). All are closely associated with Johnson Wash, and most display evidence for complex developmental histories.

Selected Early Puebloan Sites

Several relatively complete excavations on the Grand Staircase have contributed to our knowledge of EPP site structure.

The Kanab Site

The Kanab site (42KA1969) is a small Pueblo I-Early Pueblo II farmstead on the bank of Kanab Creek (Nickens and Kvamme 1981). Excavations revealed slab pavements or "patios" thought to be storage feature remnants and a typical Early Pueblo II benched pit house. Underlying the structures was an aceramic deposit dated to the end of Basketmaker II or the beginning of Basketmaker III times (ca. AD 550).

The presence of everted North Creek Gray jar rims, a dominance of St. George Black-on-gray pottery, and two radiocarbon dates suggested a terminal date in the last half of the 11th century (Nickens and Kvamme 1981:68). BLM archaeologists undertook additional excavation of midden deposits after that report was completed. Given 40-plus years of hindsight and several new radiocarbon dates, a more nuanced description of the site's settlement history can now be offered.

Based on style, orientation, and superimposition of cists, "patio" pavements, and a small roomblock, a good argument can be made for a sequence of three construction episodes. On an artifactual basis, Rose Spring and Abajo projectile points support a Pueblo I or earlier occupation.

Ceramics are largely early Pueblo II types, but Pueblo I-style jar rims were present as well (Nickens and Kvamme 1981: Figure 38). In addition, 15 sherds of Bluff Black-on-red, a Pueblo I type common to the San Juan Basin, were positively identified. More recent radiocarbon dates run on curated turkey bone yielded a date of AD 730-976 (Beta-157844), and an artiodactyl long bone dated to AD 688-935 (Beta-157845) that both support the architectural and artifactual evidence for a much longer, possibly intermittent, occupation (see Table 4.1)

Dead Raven

The Dead Raven site (42KA2667), located in Johnson Canyon, is a typical Early Pueblo II farmstead (Walling and Thompson 2004). The excavated portion of this site revealed a cist alignment with an adjacent surface room and two pit houses, one associated with a nearby room/cist alignment that was not excavated. The pottery consisted of nearly equal amounts of Shinarump Series and Virgin Series. Apart from a single decorated Shinarump sherd, all painted designs were Washington Black-on-gray and St. George Black-on-gray, both Virgin Series types. In most respects, the architecture and artifacts compare well to sites in the St. George Basin. Two of the three radiocarbon dates are EPP dates (see Table 4.1).

The arable setting and large storage capacity all suggest a farming occupation. Additional evidence for agriculture includes abundant maize and bean macrofossils. Mule deer, mountain sheep, and jackrabbit bone, as well as an assemblage of modified bone, attest to the importance of game animals believed to have been locally available in the canyon.

The excavated portion of Dead Raven is part of a much larger complex with roomblocks, pit houses and middens. In this regard, it is not unlike the Sand Hills site located upstream (Aikens 1965). Ceramics on these additional components are all assignable to the EPP, but it is not known whether they were contemporary or sequentially occupied

42KA6293

This site, one of the few completely excavated Early Pueblo II farmsteads in the region, is situated on the alluvium of Kanab Creek just north of Kanab and is one of the better examples of its type reported on the Grand Staircase (Nash 2013). Its layout consisted of a roomblock, a ramada-covered activity area, and a pit house. The range of radiocarbon dates suggested "multiple occupations" during Basketmaker III, Pueblo I, and early Pueblo II times. One of the five radiocarbon dates is clearly an EPP date (see Table 4.1), and a non-cutting tree-ring date of AD 1022+vv from the pit house represents one of the latest dates for the period preceding the "Kayenta intrusion." Given a few years for the missing rings, and as much as a generation for the occupation of the pit house, Nash (2013) believed the site was last occupied at about AD 1050.

The pit house varies in the following ways from the typical EPP layout: It is moderately deep with an encircling bench that is narrow and more shelf-like, the six supporting posts are incorporated into the wall rather than set into the bench, and no floor features were observed other than a clay-coped hearth with a radial clay-pole enclosure extending to the vent shaft on the southeast.

As was the case at the Kanab Site, the ceramic assemblage was dominated by North Creek Gray with only a minor percentage of Shinarump Plain. Given the absence of any red wares and corrugated types, this site demonstrates how isolated the Grand Staircase district was from the Kayenta region during Early Pueblo II times. Tree-ring dates from nearby Cottonwood Canyon Cliff Dwelling (42KA1504) suggest that the significant changes in material culture that occurred during the succeeding Late Pueblo II period were underway by at least AD 1099 (Tipps 1989).

South Creek Site (42WS1712)

Farther afield but still on the Grand Staircase is the South Creek site (Walling and Thompson 1988), located at an elevation of 1,280 m (4,200 feet) along perennially flowing South Creek, a tributary to the East Fork of the Virgin River. The South Creek site occupies an intermediate zone between the uplands and the St. George Basin. It consisted of a pit house, a three-room storage alignment, and two isolated storage cists. While the ceramic assemblage of 1,392 sherds was dominated by Virgin Series (early Pueblo II types), three radiocarbon dates were substantially earlier (see Table 4.1). The pit house was partially slab-lined, had a long and narrow, Pueblo I-style vent shaft extending to the east and a slab-lined hearth. Human remains were recovered in the pit house fill representing one of the few burials assigned to the EPP. Site layout and radiocarbon dates suggested the possibility of an earlier “palimpsest” occupation.

Other Investigations

The South Creek site is similar to other EPP sites in and around Zion National Park (Schroeder 1955), as well as upstream on the benches above the East Fork of the Virgin River where high densities of small farmsteads occur that are virtually all early (McFadden 1996). A number of early Puebloan sites have been investigated to the west. These include the Hildale site (42WS2195) near Short Creek (Nielson 1998), and several sites excavated by the Southern Utah University Archaeological Field School on and near Little Creek Mountain (Barbara Frank, personal communication, 2020). All are good examples of sequentially occupied farmsteads.

Partial excavations were carried out by Utah State University archaeological field school (Simms et al. 2017) at three sites in the Seaman Wash drainage: Two Bin (42KA4894), Weeping Juniper (42KA4895), and Vermilion Vista (42KA4896). The excavations are recent examples of limited excavation where selected features were dug instead of a complete site investigation. They are among several hundred architectural sites ranging from Basketmaker II to Pueblo III times in the Seaman Wash drainage.

Inferences based on partial descriptions of site structure are inherently open to question. Many sites in the Kitchen

Table 4.1: EPP Radiocarbon Dates

	Site Name	Dated Material	Conventional Age BP	$\delta^{13}C$ ‰	*95 Percent Probability*	*Median Probability*	*Lab No.*
42KA1811	Nipple Alcove	Wood	1290 ±50	-25.3	AD 658-868	AD 733	Beta-109805
		Rabbitbrush Twigs	1150 ±40	-24.4	AD 777-986	AD 898	Beta-109804
		Zea Mays	1060 ±50	-9.7	AD 866-1126	AD 982	Beta-109803
42KA1969	Kanab Site	Charcoal	1460 ±120	Uncorrected	AD 339-849	AD 589	RL-1398
		Artiodactyl Bone	1220 ±40	n/a	AD 688-935	AD 811	Beta-157845
		Turkey Bone	1170 ±40	n/a	AD 730-976	AD 865	Beta-157844
		Charcoal	990 ±110	Uncorrected	AD 789-1250	AD 1063	RL-1396
		Charcoal	810 ±110	Uncorrected	AD 1016-1381	AD 1205	RL-1397
42KA2584		Charcoal	960 ±50	n/a	AD 1000-1202	AD 1097	Beta-8419
		Charcoal	840 ±50	n/a	AD 1055-1269	AD 1205	Beta-8420
42KA2594		Charcoal	1130 ±120	n/a	AD 676-1161	AD 905	Beta-8422
		Charcoal	1100 ±50	n/a	AD 785-1025	AD 940	Beta-8423
42KA2667	Dead Raven	Charcoal	1690 ±80	n/a	AD 196-547	AD 370	Beta-23053
		Charcoal	1120 ±70	n/a	AD 719-1066	AD 916	Beta-23054
		Charcoal	1010 ±60	n/a	AD 899-1177	AD 1040	Beta-23055
42KA4280	Park Wash	Wood	1450 ±40	-23.6	AD 554-652	AD 613	Beta-125911
		Zea Mays	1240 ±40	-11.2	AD 679-882	AD 786	Beta-131667
42KA4860		Wood	1200 ±40	-24.3	AD 701-954	AD 831	Beta-134478
42KA6293		Zea Mays	1170 ±40	-11.2 AMS	AD 726-976	AD 866	Beta-252926
42WS1712	South Creek	Charcoal	1630 ±80	n/a	AD 256-590	AD 441	Beta-14580
		Charcoal	1350 ±50	n/a	AD 608-796	AD 681	Beta-14579
		Charcoal	1270 ±70	n/a	AD 656-942	AD 758	Beta-14578

This table includes only radiocarbon data discussed in this chapter. For a more comprehensive catalog of EPP dates, see Spangler and Zweifel (2021) and the Utah Statewide Radiocarbon Database curated at the University of Utah Archaeological Center (Spangler and Codding 2025). Calibrations were generated using the R Package and the Intcal20 radiocarbon calibration curve (Reimer et al. 2020).

Corral drainage, including Road Kill and Park Wash, are also incomplete data recovery excavations subject to the same shortcomings. Our goal then is to develop a sense of site structure based on the more complete excavations described above and consider them in the broader context of overall settlement.

EPP Investigations in the Kitchen Corral Drainage

Kitchen Corral Wash is one of several north-to-south south drainages with high site densities found in the eastern Grand Staircase. A relatively active academic research and cultural resource management program in the Kitchen Corral drainage provides context for assessing the Road Kill site. Excavations of the Arroyo site (McFadden 2012) and those carried out by the University of California, Long Beach field school at Pottery Knoll (Larson et al. 1996) addressed only the Late Pueblo II and Pueblo III components. Both sites, however, show evidence of earlier occupations.

The variability of site structure is evident at two sequentially occupied pit houses at the Park Wash site (Ahlstrom 2000). This farmstead, essentially contemporaneous with Road Kill, lies about a kilometer to the south and in a similar setting along the wash. Both sites were bisected by the same road. The Park Wash data recovery yielded two pit houses, while the Road Kill excavations exposed storage features associated with light surface habitations. In some cases, these results might have been construed as functional differences between two site types.

Vermilion Cliffs Project

Investigations by Abajo Archaeology (Westfall 1985) are particularly relevant and are described here in greater detail to allow comparison with the features excavated at Road Kill. The setting is a sparsely vegetated barren expanse of Chinle clay cut by minor water courses that may have provided flood water farming opportunities that augmented farming of the alluvium of nearby Kitchen Corral Wash.

Of 26 prehistoric sites that could be assigned a temporal period, 10 were identified as having Basketmaker III or Pueblo I components, one was assigned to the Pueblo I-Pueblo II period, and seven were Pueblo II and/or Pueblo III occupations. The Formative sites were organized into four functional types: (1) limited activity, (2) short-term camp, (3) base camp, and (4) habitation/storage. Of the five prehistoric sites tested, 42KA2584 and 42KA2594 yielded radiocarbon dates (see Table 4.1) and/or had features relevant to our discussion of early Puebloan site structure. Site 42KA2592, although not excavated, is also a BMIII-PI site with a large slab-lined pit structure, pit house depressions, a midden, and a nearby roomblock consisting of two or three rectangular rooms.

42KA2594

Initially this site was recorded as a small Basketmaker III-Pueblo I settlement with circular slab-lined pit structures, a slab-lined hearth, and midden deposits. The surface artifacts included a variety of ground stone and chipped-stone tools consisting of projectile points, biface fragments, manos, metates, hammerstones, abraded cobbles, a bead, and quartzite cobbles (Westfall 1985: Table 6.2). At 1,719 m (5,640 feet) in elevation, the site is within a dry farming agricultural zone. While it is located some 1,100 meters from the alluvium of Kitchen Corral Wash, it seems reasonable that the small drainages and basins nearby were also farmed.

Feature 1 on the north side of the site is a circular alignment of slab uprights about 2.5 m in diameter that was visible on the surface (Figure 4.2). A test pit excavated in the southeast corner of the structure identified a clay floor at a depth of 45 cm. The structure was assumed to be a pit house, although the clay floor apparently was not probed for subfloor paving slabs. Fill of the structure was described as representing three depositional episodes: clean sand and ash on the floor overlaid by complex deposits including charcoal, burned clay daub, ash, and burned squash seeds and rinds that were "suggestive of deliberate deposition of structural debris and fire pit contents," and post-occupational filling. These fill sequences suggested the structure was "re-occupied after the initial construction and occupation…" (Westfall 1985:69, 73).

About 10 m to the southeast of Feature 1 are closely spaced Features 3 and 6. Neither were tested but F3 was described as very similar in size and probable function to F1. F6 was thought to be a surface jacal structure given its rock alignments and numerous chunks of associated daub. In addition, three slab-lined hearths (Features 2, 4, and 5) occur across the site from southwest to northeast. A 10-15 cm thick trash midden consisting of ashy soil, chipped stone and ground stone artifacts, and numerous sherds was identified on the east side of the site. These extramural features are common on Pueblo I sites in the both the St George Basin and Grand Staircase.

Wilson (1985) identified the 503 sherds as Shinarump Series (n=392), Virgin-Kayenta (n=110), and one white ware sherd with a Pueblo I design element. Two radiocarbon dates confirmed a Basketmaker III- Pueblo I temporal placement (see Table 4.1). In all, 42KA2594 is essentially contemporary with the Road Kill and Park Wash sites. Artifact assemblages are similar, and ceramics are comparable in quantity and type.

Surface evidence at 42KA2594 is not easily "read," as is the case for many residential sites during this period, but substantial architecture is clearly present. No faunal bone was recovered, probably due to poor preservation or sampling error. Although maize pollen was present, the processing of wild plant resources was considered a dominant activity on what was regarded as a "hinterland" site.

An alternative interpretation, based on our sample of EPP site layouts, is that Feature 1 is possibly a large storage cist with one or more jacal structures and/or ramadas to the southeast. If, in fact, it is a "mini pit house," Feature 1 represents a typical Virgin residential type found in both the St George Basin and at the nearby Arroyo site. From Basketmaker times onward, the Kitchen Corral drainage was primarily a farming locale. Site 42KA2594 is located close to potential fields. If the features on site do indeed include one or more storage cists, jacal or pit house dwellings, and extramural hearths, the layout compares well with our conception of what an initial EPP farmstead might look like.

42KA2584

This site consists of an isolated jacal pit house set amidst talus boulders and an associated scatter of lithics and sherds (Figure 4.3). A large number of hammerstones and cobble tools (n=49) were also collected from the surface of the site. The structure measured 2.8 m in diameter with a maximum depth of 12 cm. Floor features included four pits, one of which was thought to be a hearth. Floor contact artifacts included five sherds (unknown type), a Parowan Basal-

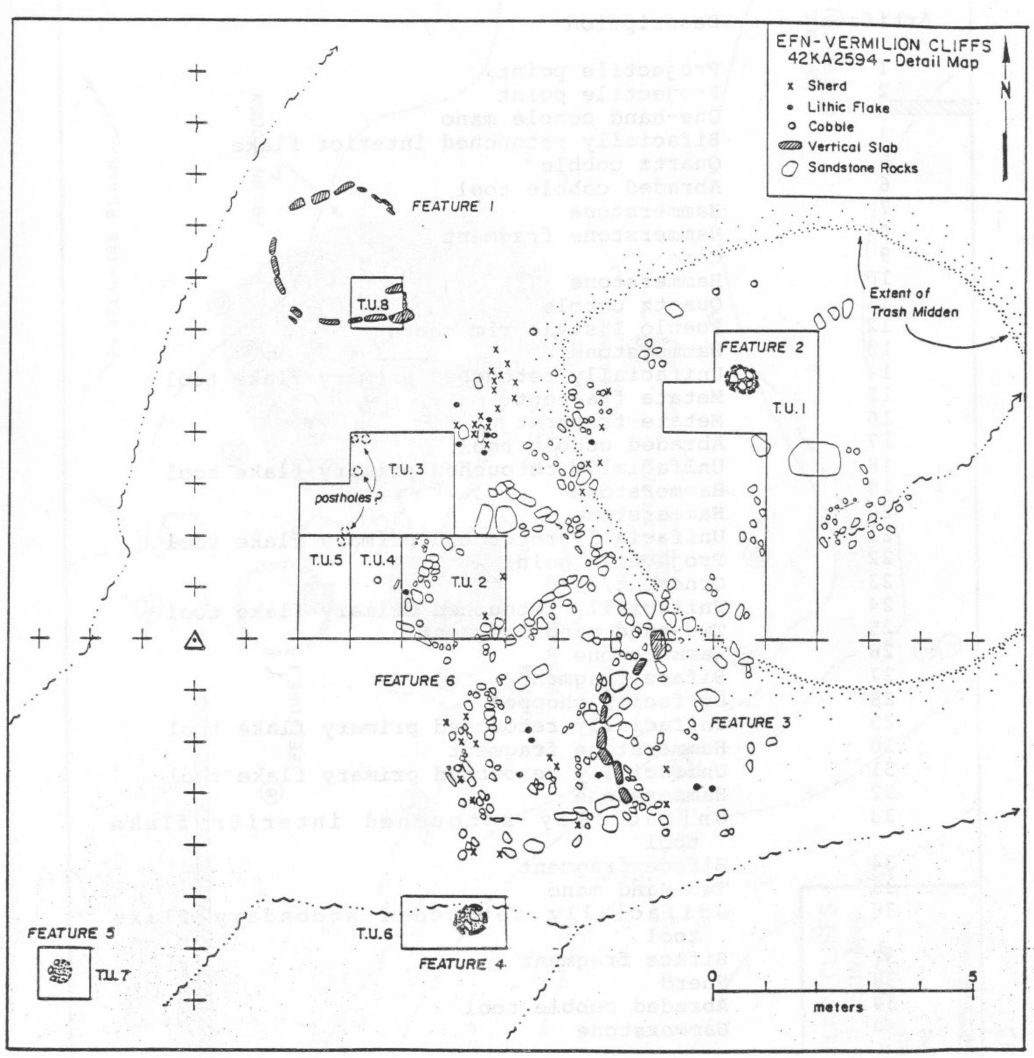

Figure 4.2: Plan map of 42KA2594 (after Westfall 1985).

notched point, lithics, ground stone, and a grinding slab (Westfall 1985). In all, the structure compares favorably with other shallow jacal habitations in the region.

The site yielded 42 sherds identified as Shinarump (n=29) and "Virgin-Kayenta" (n=13). The majority were plain gray, but five corrugated sherds were reported. Nine sherds were classified as white ware types, one of which had a Basketmaker design style. One of two calibrated radiocarbon dates suggests an occupation at the end of the EPP or beginning of the Late Pueblo II period (see Table 4.1). The corrugated ceramics also support the idea of long-term use or perhaps just a visit during Late Pueblo II times. Westfall (1985:63) believed the site functioned as a small, temporary base camp focused on foraging for various resources to be transported to permanent settlements elsewhere in the general vicinity. Substantial Late Pueblo II sites occurring near the site would seem to be at odds with this scenario.

An alternate interpretation is offered here. Rather than assuming the site

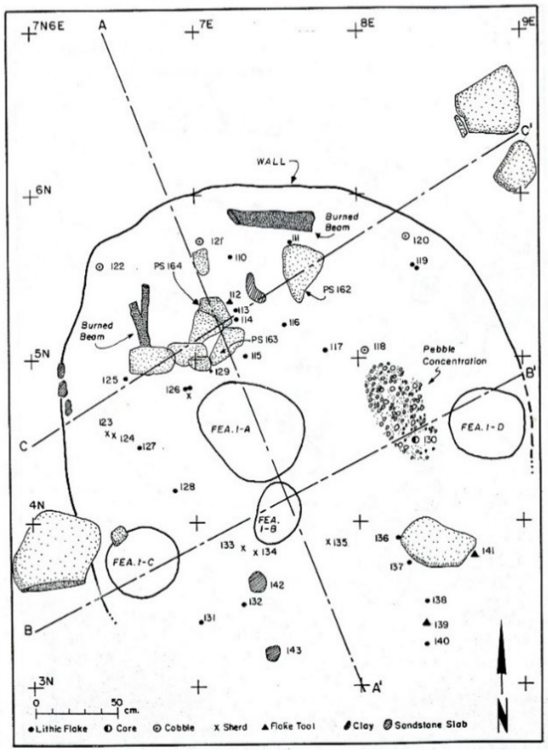

Figure 4.3: Plan view of 42KA2584, Feature 1 (after Westfall 1985).

functioned as a foraging camp, it could well be that the isolated, lightly constructed habitation apparently lacking storage facilities was a field house associated with agriculture. Richard Thompson observed that similar structures found at 42KA2662 in Johnson Canyon also functioned as field houses (Thompson, in McFadden 2016). However, unlike Pueblo II field houses and shelters known on the eastern Arizona Strip that were "day use" sites, the structure and artifacts at 42KA2584 suggest more intensive use, perhaps as a residence used during the growing season. The Road Kill residential rooms to be described later are very similar in terms of size, construction, and artifact content.

The Vermilion Cliffs Project sites were considered "hinterland" satellites located at a distance from major settlements. The tool assemblages and botanical data indicated that procurement and processing of wild plant resources was significant. The role agriculture played was not clearly specified, although maize pollen and maize and squash macrofossils were present (Westfall 1985:195). While maize itself could have been transported, maize pollen suggests there were nearby maize fields. Squash fragments also seem most likely to have been grown locally rather than transported. Westfall, however, chose to emphasize the presence of other local species, including cheno-ams, stressing that the apparent subsistence focus was on non-domesticates. The wide range of artifacts, including trough metates, is comparable to those found on residential sites exhibiting at least some degree of sedentism. The combination of artifacts and habitation structures suggest these informal layouts are examples of site structure that would be expected during the initial occupation of a farmstead rather than a foraging outpost.

A very similar site (42WS4145) excavated by the Southern Utah University field school on Little Creek Mountain may provide additional insight into the above interpretation. It was described as a "field house" consisting of a small lightly constructed circular structure 2.5 m in diameter with a masonry base (Barbara Walling, personal communication 2001). It was associated with two roasting pits and two slab-lined storage cists. A macrobotanical analysis found maize as the most ubiquitous species of non-wood remains (Landon 2010).

Park Wash Site (42KA4280)

The Park Wash site lies about 5 km north of the Vermilion Cliffs Project sites and downstream from Road Kill in a similar canyon setting. It was excavated under similar constraints as Road Kill, that is, it was bisected by the same road and excavations were largely limited to features actually in the roadbed. It also consists of both storage and residential structures. In contrast, excavations there exposed two partially superimposed pit houses, as opposed to the lightly constructed surface residential rooms found at Road Kill.

The earlier pit house at Park Wash was radiocarbon dated to the Basket Maker III period and the later one to the Pueblo I period (Table 4.1). Both were occupied during the same period as the Road Kill site. Botanical and faunal remains indicate it was clearly an agricultural site with a sedentary population. The presence of human remains on the floor of the earlier structure is one of the rare examples of an early Puebloan interment.

Numerous artifacts were found *in situ*, including three restorable vessels and an extensive ground stone assemblage. After the structure burned, collapsed, and filled, a Pueblo I pit house was constructed over the top. Activity on site between the occupation of these two structures is not known. At the time of its abandonment, the hearth contents included rodent remains that suggested dietary distress (Ahlstrom 2000; McFadden 2016).

Post-abandonment fill of the Pueblo I structure indicated a subsequent occupation or continued occupation of the site. In addition, deep deposits predating the pit house sequence indicated an earlier occupation of unknown age and extent. The total sequence of occupations could not be determined given the limited excavations, but at minimum there is evidence for as many as five occupational events on this modest site.

In summary, investigations since 1985 have demonstrated that Kitchen Corral Wash and the eastern Grand Staircase is far from being a "hinterland" (McFadden 1996; Lyneis 1995). Pueblo site densities slowly increased over time, suggesting steady growth throughout the EPP. Rather than a settlement of small satellite sites tethered to central pueblos, the pattern appears to be one of small sites interspersed among what we might consider to be successful farmsteads with substantial architecture. Some sites might not have been as successful as others, or they were abandoned early on. But growth and expansion continued at nearby sites.

More investigations have been conducted in the St. George Basin, largely the result of mitigation, than any other subarea of the Virgin Puebloan region. Having worked in both areas, Aikens (1965) pointed out that Virgin Puebloan sites in the two areas are closely related in terms of material cultural. Several of the authors of this volume have spent a good deal of time in both areas, as well, and have reached the same conclusion. It is intriguing that many, if not most, excavated sites in the St. George Basin display long and often-discontinuous occupational sequences, and that internal features from one region to the next are virtually indistinguishable during the EPP. Site layouts, ceramic assemblages, artifact types, and pit house styles are identical.

Cultural Resource Management Inventories

In the above discussion, we contrasted and compared the EPP evidence in the eastern Grand Staircase to that in the St. George Basin, or lateral relationships. In this section, we examined the vertical relationship of farming sites at lower elevations to special use sites at higher elevations.

The great contribution of long-term cultural resource management programs is the ability to conduct extensive inventories of large tracts of public land. A concerted inventory effort by the Kanab Field Office since the early 1980s and continued by Grand Staircase-Escalante National Monument (GSENM) has resulted in the recording of more than 500 Formative sites ranging from Basketmaker II through Pueblo III times. Characterized as dispersed communities, more than 80 percent of the sites recorded are architectural. Many are clearly multi-component based on the surface evidence. They occur in a variety of agricultural settings, ranging from dry-farming environments to alluvial outwash situations. In ascending order on the Grand Staircase, they occur in similar densities along the Shinarump Cliffs in aeolian dry farming situations, at the base of the Vermilion Cliffs in outwash settings, and on the Wygaret Terrace above, again in largely dry farming situations.

More recently, a Section 106 compliance inventory of an additional 12,000 acres was conducted, adding more than 300 sites to the database. These inventories were conducted in two distinct areas: at the base of the Vermilion Cliffs at about 1,675 m (5,500 feet), and above the White Cliffs on the Skutumpah Terrace at about 1,980 m (6,500 feet). Site types and their distribution segregate well, supporting earlier findings in a very satisfying way. The higher Skutumpah Terrace is dominated by foraging sites with virtually no evidence of agriculture, and the lower Vermilion Cliffs tract has both agricultural *and* limited activity sites (Table 4.2).

A GIS analysis demonstrated that architectural sites at the base of the Vermilion Cliffs were closely associated with arable soils and landforms (Landon 2011). In fact, virtually all architectural sites, with the exception of a single aceramic site at 42KA7262, occur in the previously identified agricultural zone where artifact scatters and camps appear to be interspersed with habitation sites. The sites were assigned temporal ranges from the Archaic through Late Prehistoric times, but few could be confidently assigned to the EPP.

This distribution of sites argues for recording spatial data in as much detail as possible, splitting whenever possible and lumping only when there is no other alternative. We note that recent compliance inventories in many cases have combined what were originally recorded as discrete sites into a single large site with multiple loci thus skewing site frequencies. In one case, a locus measuring 670 by 295 m was recorded as a single site, thereby eliminating useful spatial, temporal, and functional characteristics. Considering the bias of lumping, which reduces site counts of all types and makes the distributional data less useful, we can make the following observations:

- 199 limited activity sites were identified on the Skutumpah Terrace, mostly artifact scatters and camps. The vast majority displayed little evidence of Ancestral Puebloan use. There is significant evidence for both Archaic and Ancestral Paiute foraging.
- The Skutumpah Terrace has about half the site density compared to the Vermilion Cliffs unit, and it has little, if any, evidence of habitation sites.
- The highest limited activity site densities a re in the agricultural zone where there is an average density of 29 sites per square mile.
- If only limited activity sites from all periods are considered, the site density of both areas is about the same: Vermilion Cliffs is 18 per square mile and Skutumpah Terrace is 14 per square mile. This suggests that foraging opportunities were similar in both areas.
- The size and complexity of architectural sites range from “rock scatters with sherds” (often early) to substantial masonry roomblocks (generally late). In several cases, these later sites are extensive and multicomponent suggesting variable lengths and periods of occupation.
- The greatest distance between foraging sites on the Skutumpah Terrace and habitation sites below the Vermilion Cliffs is about 40 km (25 miles). The closest is a mere stone’s throw away. Use of both areas by the Vermilion Cliffs sedentary population, perhaps on a seasonal basis, would not have been difficult. A review of Skutumpah site affiliation, however, offers little support for logistical foraging from agricultural bases.

The higher site densities below the White Cliffs, in what we can reasonably term the “agricultural zone,” appear to be the result of farmers foraging nearby. In effect, foraging was practiced in the farming zone, but farming did not occur in the foraging zone. The reasons for this distribution are not clear but are likely environmental. In fact, it may be that there are few early Puebloan foraging sites in *either* area.

Table 4.2: Recent Section 106 Compliance Inventories on the Eastern Grand Staircase.

Inventory	Inventoried Acres	Number of prehistoric sites	Density (per square mile)	Architectural (number and percent)	Limited Activity (number and percent)
Vermilion Cliffs					
Jenny Clay	1543	127	51	48	79
Kitchen Sage	1158	17	9	2	15
Petrified Hollow	1190	28	15	14	14
Totals	**3891**	**172**	**29** (mean)	**64** (37%)	**108** (63%)
Skutumpah Terrace					
Upper Kanab Creek Phase I	2774	49	11	(1?)	48
Phase II	1476	43	19	0	43
Phase III	2300	77	20	0	77
Coal Hollow-Mill Creek	2375	22	6	0	22
Totals	**8925**	**191**	**14** (mean)	1?	**190** (100%)

Chapter 5

Grand Staircase Settlement and Subsistence: An Overview

It seems reasonable to assume that working out settlement patterns and their relationship to subsistence practices within defined geographic/environmental settings should be one of goals of cultural resource management. Given the relatively thorough sample of what we consider to be the agricultural and foraging zones on the eastern Grand Staircase, what model of settlement patterning and subsistence practices best accounts for the site distribution pattern during the Early Puebloan Period (EPP)?

The initial introduction of maize on the Grand Staircase now appears to have occurred as early as BC 1000 (Roberts et al. 2022). By at least AD 1, Basketmaker II farmers were established over the entire Virgin Puebloan region (Spangler and Zweifel 2021). Based on stable carbon isotope analysis, maize was a primary component of the Basketmaker diet (Martin 1999, Zweifel et al. 2006). Whether the first agriculturalists in the region were immigrant agriculturalists as favored by some (Janetski 2017; Roberts et al. 2022), were indigenous Archaic people experimenting with domesticates, or they were part of a group-to-group transmission network, the process of acceptance involved some form of mobility that is not easily documented. We should expect different forms of mobility to develop after farming was established.

The Models

Several general models of settlement and mobility potentially apply to the Grand Staircase, and each offers insights into various forms of mobility that may be worth considering.

Fallow-Valley Pattern

This form of mobility was described for southwest New Mexico as a community-level strategy of moving the residential base from valley to valley within a larger territory on a cycle of 20 to 75 years (Nelson and Anyon 1996:277). Their expectations for this type of behavior are, however, at odds with ours. Specifically, their data demonstrated a lack of remodeling and superimposed architectural remains (1996:279), which is a key characteristic of Virgin Puebloan site structure. The main difference, however, is one of scale; it seems unlikely the dispersed communities of the Grand Staircase would be subject to either environmental or social pressure to move as described by Nelson and Anyon. It is possible, however, that mobility along these lines occurred for the larger, more socially and economically integrated groups during the succeeding Late Pueblo II period.

Muddy Creek Model

This model is based on local intensive inventory data from the Muddy Creek

Project in the East Fork of the Virgin River drainage. Fawcett and Latady (1998) noted a range of site types, including villages, long-term camps, short term camps, and limited activity sites. BLM inventory data in the upper Virgin River area offers little support for the presence of long-term camps. Virtually all potential long-term sites display architecture that, in our view, likely represent sedentary farmsteads. Most recorded sites on the upper Virgin River occur within the agricultural zone found between 1,525-2,135 m (5,000-7,000 feet) and display some form of architecture, which is taken as an indication of agricultural-based sedentism. To some extent, discerning site layouts in the upper East Fork is hampered by deep sandy soils and fragmented Carmel Limestone building stone. Because virtually all Formative sites in the drainage are EPP pit houses, jacal structures, and storage cists, there is little evidence of formal surface architecture. In terms of settlement, it is difficult to understand how the proposed interspersed camps and habitations would have related to one another. Were they contemporary, sequentially occupied, or a mix of foragers and farmers?

Foraging Catchment Zones

In fact, small non-architectural camps and milling stations have been securely identified in the upper reaches of the East Fork of the Virgin River. They are in non-arable sandy settings and are a short walk from a dense cluster of upland residential sites (McFadden 2009). They appear to have been used for processing ricegrass or sand dropseed, based on the abundance of ground stone tools. Given their proximity to residential sites, seasonal logistical forays best account for their presence.

Specialized catchment zones are known elsewhere in the region. At Sand Hollow, sites on the edge of the St. George Basin present a similar scenario (Talbot and Richens 2009). Agave, where available in quantity, such as the Beaver Dam Slope, may have been exploited in a similar way (Moffitt et al. 1978; see also Eskenazi and Roberts 2010). Directly above the Vermilion Cliffs agricultural zone, on the Skutumpah Terrace, camps and activity areas have been identified in limited numbers (see Halbirt and Gualtieri 1981; Keller 1987). A consistent “strategy” of wild resource exploitation, however, is difficult to demonstrate on the Grand Staircase. Specialized collecting catchments surely occurred throughout the region, but those identified thus far represent what would have involved only short logistical forays from established pueblos.

Farmer-Forager Model

There is little evidence on the Grand Staircase to support the “adaptive diversity” model proposed for the adjacent Fremont (Madsen and Simms 1998). Neither distributional patterns nor internal site structure data suggest foragers were living alongside farmers, much less farmers turning to full-time foraging and vice versa. However, there is abundant evidence for agricultural adaptations to the varied arable settings of the Virgin Puebloan region.

Fremont sites on the north margin of the Grand Staircase and east portions of the monument display decidedly different spatial and internal patterning than Virgin

Puebloan sites during the EPP (Jordan and Talbot 2002; Talbot et al .2002). In fact, Fremont sites offer an excellent counterpoint for assessing Virgin Puebloan subsistence practices. Site types, their structure, and distribution demonstrate very well the differences in mobility between the Virgin and Fremont. While the two culture areas are next to each other, there is little evidence for interaction between the two populations during the EPP (but see Gunnerson 2002 for an alternative view).

The Virgin Pattern

This model of settlement on the Grand Staircase was based largely on the distributional data gathered east of Kanab from the inventory of three separate arable zones (McFadden 1993, 1996). Each zone held the full range of sites from Basketmaker to Late Pueblo II/III times. The likelihood that each of these different settings were simultaneously occupied for nearly a thousand years seems unlikely. While many of the sites displayed a range of ceramic and architectural styles that indicated multiple occupations, little excavation data existed at the time to demonstrate the timing of such events. Based on these data, an adaptive strategy of residential mobility was proposed that involved shifting between established farmsteads located in different agricultural settings.

While the distributional data supporting this form of mobility between agricultural sites have grown over the past 25 years, it remained for new excavation data to demonstrate actual episodes of occupation, as well as their timing. Road Kill was viewed as an opportunity to address such events and test the model in the context of other small-site excavations. While the model continues to have merit, it is reconsidered here and couched in terms of a recurrent behavior rather than a conscious subsistence "strategy."

Black Mesa Pattern

Shirley Powell (1983) proposed a model of seasonal occupations on Black Mesa. She suggested that sites were seasonally occupied prior to AD 1050; after that time, the occupations were year-around. A number of criteria were examined, including faunal remains, floral diversity, hearth locations (interior and exterior), middens, and storage patterns (Cordell 1984:196). These variables are reviewed for Grand Staircase sites, as well, but with very different results.

Mixed Subsistence Model

Probably the dominant model of Virgin Puebloan subsistence, asserts a "mixed" subsistence base (Westfall 1985, 1987, Baker and Billat 1996; Fawcett and Latady 1998). Implicit is the assumption that some degree of mobility was involved in hunting and gathering. Interpretations at the Vermilion Cliffs Project sites in the Kitchen Corral Wash drainage favored the exploitation of wild plant resources over agricultural ones, and that agriculture was "not a major subsistence activity." Based on the macrofloral and pollen data, it was believed that settlement involved small temporary or seasonal sites in the "hinterlands beyond major settlements" (Westfall 1985:195). Essentially, macrofloral and pollen remains were treated as proxy data for inferring mobility.

Serial Migration Model

Bernardini (2005) considered several concepts relevant to our consideration of population movement and settlement as informed by Hopi traditional knowledge as it relates to group identity, size, and organization. Proposing a general model for population movement across the Kayenta region, he envisioned "a prehistoric landscape filled with small, subclan-like, fissionable groups, each making independent decisions about when and where to move" (2005:36). He believed that modern indigenous groups are "splitters" when it came to cultural identity. "For them, the meaningful *emic* scale of social identity is often rather small, at the level of a lineage or clan (ca. 15-50 people)" (2005:33). He referred to these uncoordinated movements across the landscape as "serial migrations."

Bernardini's observations are useful here in two ways. First, whether the initial occupants were an indigenous Archaic population or corn-farming immigrants, they would have dispersed across the arable portions of the Grand Staircase landscape in a similar fashion. Second, after farmsteads were established, it was likely the family unit made decisions to move, either to new locations or to reestablish residences on a previously occupied site. Most Virgin Branch sites seem to have operated on this scale.

In summary, we agree that mobility patterns offer critical insight into behaviors associated with the practice of agriculture. Early in the EPP, range expansion reached its natural limits within the region. While serial movement to *new* potentially arable settings became unproductive or impossible, reoccupation of temporarily abandoned locales became a viable option. Over time, this behavior, inherent in both settlement patterns and site structure, became what might best be considered a "tradition."

Subsistence

The primary function of a settlement system is to connect people with their subsistence base. It is also the primary means we have for assessing the degree and nature of group mobility. The interpretation of subsistence practices, based on macrofloral evidence, faunal collections, and economic pollen types is vulnerable to sampling error, as are assertions regarding the degree of reliance on particular foods. Dietary studies based on stable carbon isotopes (Martin 1999, Zweifel et al. 2006) and coprolite analysis (Reinhard et al. 2012) are, in our opinion, on firmer ground. These datasets have led researchers to make assumptions regarding patterns of mobility but often with little settlement data to support their position.

The approach taken in this volume is to employ distributional data from reasonably extensive inventory, as well as site structure data from Road Kill and similar sites, to access the subsistence data in a broader context. We conclude that the Virgin Puebloans on the eastern Grand Staircase were, since Basketmaker III times or even before, residentially based agriculturalists who obtained locally available wild foodstuffs. This was, in part, a result of big game availability that coincided with agricultural opportunities. While native flora and fauna were an important aspect of subsistence, it was the practice of agriculture that structured the overall settlement.

Janetski (2017) described subsistence data from sheltered and open camps on the west margin of the Grand Staircase that border the St. George Basin. He concluded that early farmers in the Virgin region pursued various wild resources despite a strong commitment to farmed foods (2017:236). He accepted Martin's (1999:505) analysis that found a 75% reliance on maize (± 10%), but he considered the wild resources comprising the remaining 25% of the diet to be "significant." In contrast, others have argued that domestic crops accounted for less than 20% of the Virgin Puebloan diet, and that it was domestic crops that supplemented a "wild-resource-based diet" (Murray and Polk 2008:59).

We agree with Janetski's conclusions (2017; see also Janetski et al. 2013) but suggest that logistic movement to foraging camps likely originated on farmsteads in the St. George Basin to exploit the flora and fauna found in higher elevations surrounding the basin. The questions then become how, where, and under what circumstances did they obtain the other 25 percent of the diet?

Foraging and farming "zones" vary across the region, sometimes coinciding with one another, sometimes not. In practice, distinguishing one group's "hinterland" foraging base from another's agricultural zone is not a reasonable expectation – particularly if periodic movement between sites occurred. Given the variability of environmental settings and foraging options, postulating a monolithic subsistence strategy is not warranted. On the eastern Grand Staircase, however, the farming and foraging zones merge and overlap. Changes in elevation on the order of thousands of feet are less than a day's walk from an agricultural zone, making a wide range of floral and faunal resources reasonably accessible.

We are focused on settlement patterns and the type of mobility required to access both domesticated and native resources. On the eastern Grand Staircase, wild floral, faunal, and domesticated foodstuffs are usually found near each other under typical conditions. Therefore, understanding subsistence practices involves analyzing mobility patterns rather than making assumptions about dependence on specific foodstuffs.

Research Orientation

Gardiner Dalley's description of storage architecture at the Red Cliffs site in the St. George Basin, excavated in the late 1970s, became a guiding theme of subsequent excavations, as well as intensive inventories, on both the Grand Staircase uplands and St. George Basin. As he observed:

Found rather fascinating are the storage rooms and storage cists ... the obvious care and detail in constructing and sealing the rooms; the accretional nature of the room blocks; the evidence for patching, rebuilding, reflooring; both reuse and apparent avoidance of earlier structures by later people; the attached but separate nature of the rooms in the blocks; and the *complicated occupational sequence.... Also observed was a rather "nice evolution" of cist to storage room, and vague alignment to contiguous alignments* (*in Dalley and McFadden 1985: 159-160).*

The descriptions of roomblock development from a "core" of two or three storage rooms associated with a residence was a critical insight for understanding the accretional nature of roomblock development. Even relatively large roomblocks appeared to have an active component on the scale of an initial core or two. It was assumed that such a pattern had profound implications for understanding settlement patterns and subsistence practices. What was not readily apparent in the St. George Basin excavation data was the cause and frequency of the occupational/building events. Indeed, given the varied environmental settings across the Virgin Puebloan region, different causes were assumed. Based largely on survey observations, it was suspected this behavior extended to upland sites on Little Creek Mountain and the Grand Staircase.

The earliest detailed description of Ancestral Puebloan sequential occupations of a residential site on the Grand Staircase resulted from the Bonanza Dune excavations in Johnson Canyon. Bonanza Dune (Figure 5.1), located in one of the more agriculturally favorable drainages on the eastern Grand Staircase, yielded unequivocal evidence of a lengthy occupational history based on the 21 superimposed structures, including storage cists and pit houses (Aikens 1965). Clean blow sand was observed on the floors of the pit houses, indicating that the structures were intact when abandoned, that "leave-takings were orderly," and that the whole settlement was evacuated at the same time (Aikens 1966:29).

Jennings (1978:111) was impressed with the site's use history, describing it as six sequent complexes of two or three structures used contemporaneously; but occupancy was not continuous from one complex to the next. Yet the structures were said to be "astonishingly uniform," and that "abandonments seem to have been done in a systematically planned way..." (1978:116).

Jennings and Aikens did not speculate on the cause of these abandonments or where the inhabitants went. Addressing the relationship between occupational episodes at Bonanza Dune would require a better understanding of local settlement history that would not develop until a more precise local chronology was developed, the entire range of site types was described, and the full geographical extent of site distribution was known. Where the occupants went, why they left, and what they did during the intervening periods are questions that relate to mobility, which is a central focus of this report.

Describing the relationship between site occupational histories, i.e. site structure, and regional site distribution is the primary means of assessing the type and timing of mobility. In our view, an understanding of the nature of mobility is a prerequisite for addressing subsistence practices. There is little question that the Virgin Puebloans were primarily sedentary agriculturalists.

Figure 5.1: View of Bonanza Dune being excavated in 1963 (Photo: BLM Files).

Essentially, the objective here is to describe the *nature* of Virgin sedentism and how it accounts for both the wild and domesticated elements of the subsistence data.

In summary, our approach involves both synchronic and diachronic perspectives drawn from individual sites, as well as settlement patterning based on distributional data. The synchronic view expands on the concept of "site structure." We contend that even sites with only minimal evidence for architecture are likely emergent sedentary sites focused on farming. Site size and complexity are viewed as measures of agricultural success and occupational longevity. Evidence for various intensities of foraging are to be expected but agriculture is considered the primary activity that structured the archaeological remains.

In terms of site distribution, the interpretation that sites with jacal structures and storage units were outlying camps focused on native flora and fauna seems strained (Westfall 1985). Kitchen Corral was the focus of considerable farming activity during Basketmaker III and Pueblo I times (possibly less so during EPP but sites are well represented nearby). Interspersing limited activity sites amongst residential pueblos seems an unlikely strategy, whereas the movement of small groups into new agricultural niches seems more reasonable.

The diachronic aspects of site structure are nicely illustrated by the Park Wash (Ahlstrom 2000) and Road Kill excavations. Both have undefined early occupations, followed by the construction of a substantial roomblock in the case of Road Kill, and two superimposed pit houses at Park Wash. Road Kill's roomblock fits the "site core" concept well by demonstrating continued use and expansion over time, even while portions of the cist alignment appear to have fallen into disuse.

Chapter 6
Excavations

The Road Kill site was partially excavated during the 2001 and 2002 field seasons to mitigate impacts from both the initial construction of the Kitchen Corral Road and the on-going use and maintenance of the road. Although the site is in a less-than-ideal situation, it was selected for excavation because of its significant research potential. The most obvious feature prior to excavation was the remnant of a slab-lined cist (F2) exposed in the eastern cut bank and several charcoal and clay-stained areas in the roadbed itself. Additional debris on the west side of the road suggested a linear alignment of architectural features that are oriented northeast-southwest. The initial assessment of the ceramics indicated that the majority were plain gray body sherds that were not particularly temporally sensitive. Combined, architectural and ceramic evidence suggested a Pueblo I (AD 700-900) or possibly early Pueblo II (AD 900-1050) occupation.

Eight major features were subsequently excavated including: three storage cists, two residential rooms, two connecting compartments or pavements, and an exterior hearth/activity area (Figure 6.1 and Figure 6.2). Several significant but badly damaged features were found in the roadbed that escaped interpretation (F9, F48). One partial surface/room (F43) was only partially exposed, and several areas of the site are essentially undisturbed, and they clearly have potential for additional features. Our excavation methods and explorations allowed working out at least a partial sequence of construction events for the major features. These are firmly dated to Basketmaker III and early Pueblo I times, but there is also evidence for both earlier and later features. Pollen and macro analysis yielded excellent evidence for a reliance on maize agriculture.

It is apparent that the cists extend to both the east and west sides of the road, forming an alignment approximately 25 m long. Only the central 15 m segment was investigated. Virgin Puebloan roomblocks are known to range from 8 m long at 42WS268 to more than 40 m long at 42WS325. Excavations within the roadbed, as well as excavation of features contiguous to those directly impacted, revealed what appears to be a formal alignment of slab-lined storage cists (F2, F8, and F26), each with a lightly constructed and shallow residential room immediately to the south (F37, F11, and F15). The entire alignment may total seven or eight cists. The only feature not directly associated with the alignment was an extra-mural hearth/activity area (F12) located to the south of the alignment. The following are descriptions of completely excavated and interpreted features which have been assigned names, as well as numbered features normally dropped at this stage, but which are retained here because they were not fully excavated and, at least potentially, could be opened again in the future.

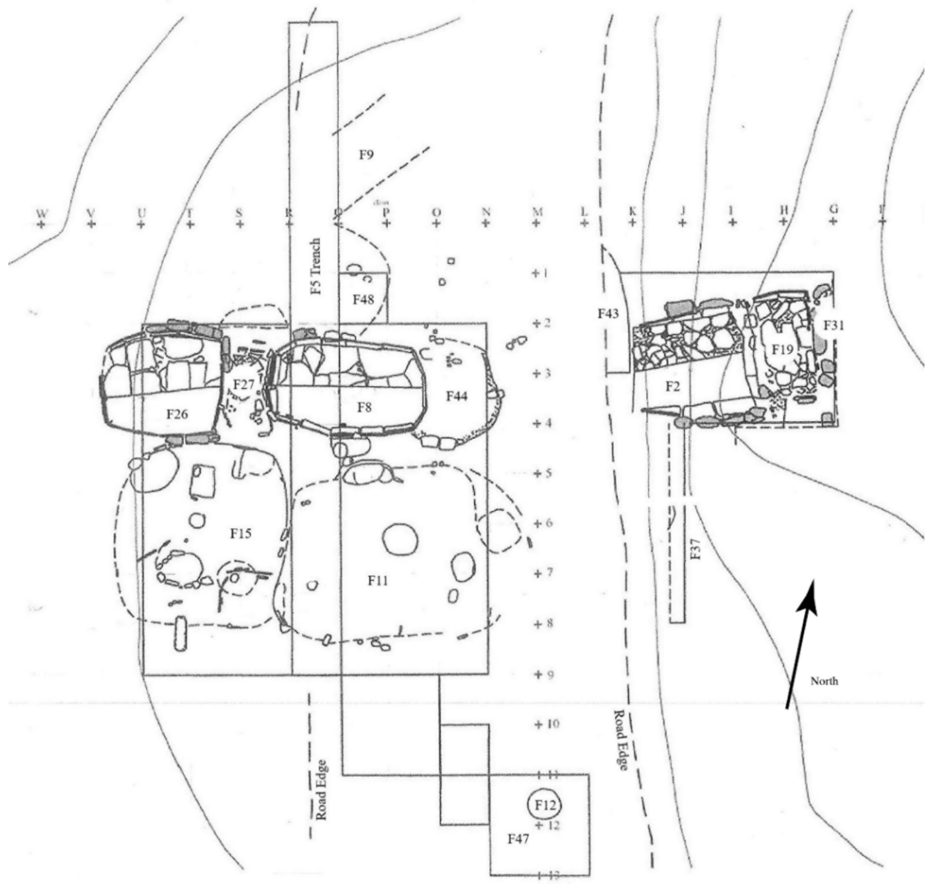

Figure 6.1: Project map with 50cm contour line intervals, excavation units and roadbed.

Division of the site into east and west segments was useful early on because the roadbed had bisected the alignment. Eventually, two vague surfaces were defined that appear to connect the two segments. Even so, the proposed overall construction sequence is based on radiocarbon dates and, to a degree, speculation about the unity of the two segments. To take on a complex site like Road Kill that has multiple episodes of construction extending more than a century was a difficult task. Adding to the challenge was a road bulldozed through the middle of the site, looters' pits, and a long history of artifact collecting.

The following descriptions include questionable deposits and damaged features to allow the reader to assess reliability of the data. We hope the positive results reported here inspires managers and archaeologists alike to think twice before writing off a damaged site as not significant because it "lacks integrity."

Methods

The Road Kill site is bisected by unsurfaced County Road #580. It has been impacted by routine grading and light-but-continuous traffic over several decades. Initial excavation involved quickly removing loose overburden, suspect deposits, and spoil from road grading disturbances. This was followed by skim-shoveling and troweling the roadbed until a compacted charcoal-stained surface was exposed (F3). A 1-by-6 m north-south trending exploration trench (F5) was cut along the west edge of the road to establish a measure of vertical control, as well as horizontal definition of emerging features. These features consisted of slab uprights backed by masonry that were eventually defined as Cist 2, and an expanse of stained clay that dev eloped into Room 2 and Room 3. The F5 trench was eventually extended to define additional features to the north. After establishing horizontal and vertical definition of the major features, fill was processed through ¼-inch screens.

After the initial cleanup of loose spoil and grader dirt, the orientation of the suspected alignment was clearly exposed. A datum and baseline were established just north of the features that facilitated gridding of 1-b y-1 m units over the area to the southeast and extended where necessary. The grid was oriented to the apparent orientation of the alignment rather than cardinal directions. Designation of the units employed an alpha-numeric system. In several cases, units were expanded to create exploratory trenches of various widths. The F5 exploratory trench was extended at right angles to the apparent axis of the features, thereby exposing the area to the northwest "behind" the alignment, as well as the cists and rooms themselves.

The grid system provided good initial horizontal control over artifact proveniences. Vertical control on the west segment was limited to disturbed deposits consisting of a thin cap of compressed small rock and clay immediately overlaying the stained deposits of Room 2. The floor of Room 2 and the adjacent occupation surfaces were literally just a few swipes of the

Figure 6.2: View to west over the cist alignment during excavation. Note proximity of the modern Park Wash bank. Traffic in the north- bound lane presented periodic opportunities for interaction with the traveling public. F19 and cist 3 are in the foreground.

grader blade from being destroyed. Spoil from the road grader on the west side of the road was also quickly removed. On the upper end of the east segment a few centimeters of colluvium and washed deposits overlaid the alignment. Once cultural features were defined the grid provenience was dropped in favor of individual features themselves. The grid was expanded with cloth tapes to create the contour map (see Figure 6.1 above). Final mapping was done with a plane table and alidade for vertical control, and the grid system for mapping cultural features. Reestablishing the grid using the datum and baseline will allow future work on the site to be tied into the excavations reported here.

A few comments about nomenclature are in order. The "feature system" used to describe the excavation process was developed by Jennings (1959), and the details have been summarized elsewhere (Dalley and McFadden 1988, McFadden 2012) and are not repeated here. In a departure from Jennings' system, only completely excavated features have been assigned descriptive names and sequential numbers, as has been the standard practice for excavated sites on BLM-administered lands in this region. Descriptive terms like soil contact, surface, and fill unit have been retained. These features can be easily relocated and excavated in the future given the site datum, grid system, and field notes. The feature notes are on file at GSENM offices in Kanab and the Southern Utah University Archaeological Repository in Cedar City.

Carbon proved to be relatively common, and samples from a variety of contexts were collected. An initial suite of radiocarbon dates on arboreal charcoal were instructive, although two of the dates were anomalously early. A second suite of AMS dates from maize extracted during the macrobotanical analysis were even more definitive (see Table 6.1 at the end of this chapter).

West Segment Feature Descriptions

The western segment was initially explored by opening the F5 exploratory trench across possible feature areas. Final excavation results revealed Cists 1 and 2, connected by a pavement (F27) and also attached to Room 1 and Room 2, both lightly constructed residential features on the south.

F5 Exploration Trench

This trench parallels the west edge of the roadbed and it was opened to explore the stained roadbed (F3) and apparent features observed on the west side of the road (Figure 6.3; see also Figure 6.1 above). It served well for identifying both Cist 2 (F8) and adjacent Room 2 (F11). Initially laid out as a 1-by-7 m unit, it was later extended another 6 meters to explore the area north of the roomblock. Approximately 2 m north of Cist 2 a contact consisting of tabular rock and stained sand was encountered (F9). This feature spanned the width of the trench but was not further explored. It is apparently aceramic, and it could predate the main occupation, although its relationship with those features was not clearly established (this is discussed further in Chapter 7 on relationships and occupational episodes).

Figure 6.3: View of the F5 initial exploration trench to northwest. Note F11 (Room 2) in foreground and F8 (Cist 2) masonry just beyond. F4 deposit is immediately to the left. Early features F48 and F9 are under the plastic sheeting.

Figure 6.4: View to east across site: initial exposure of F4 rubble in foreground overlying F26 (Cist 1), the F5 trench and the initial exposure of F8 (Cist 2) in middle ground, F2 (Cist 3) profile in background. Exposure of the F37 area to its right is in progress.

F4 Deposit

F4, which was visible on the site surface, was defined as a distinct rubble mound of sizable rock in a variable matrix of sand and clay covering an area about 3 by 3 m and extending west from the F5 trench. It partially overlay slab uprights (F26) that eventually defined Cist 1 and the connecting pavement (F27) between Cist 1 and Cist 2. It was initially considered possible that the deposit was a prehistoric “stockpile” of building stone (Figure 6.4). The n ature of the deposit was therefore considered critical to reconstruction of the site’s use history and feature relationships. Although ambiguous, most (or all) of the deposit was eventually considered disturbed by either looters or road grading. The sheer quantity and unknown source of the rock suggested that it represented a significant construction activity, perhaps cist construction.

Figure 6.5: Cist 1 initial definition, note uprights. F44 (looter rock pile) behind, and F27 clay surface to photo right. View is to north.

Cist 1 (F26)

The history of Cist 1 construction, associations, abandonment, and post-abandonment processes proved to be the most complex, due in part to the nature of the overlying F4 deposit and the variable units of fill within it. Cist 1 was initially visible as an alignment of five slab uprights forming an L or U shape 2 to 3 m west of the F5 trench. It was overlaid by the F4 rock and clay deposits to a maximum thickness of 25 cm on the east and tapering off to the west. The F4 deposit extended a maximum of 20 cm below the tops of the upright slabs in the central portion of the cist. A depression in the center was thought to be a looters pit. The overlying deposits were screened and found to be entirely devoid of artifacts.

Underlying the F4 level was a midden-like deposit of charcoal-stained clay (F35) that appeared to be largely undisturbed. On the east, a portion of this deposit was overlaid by apparent wall collapse (Figure 6.5 and Figure 6.6). On the north and east, the fill was in contact with the upright wall slabs. The mottled nature of the deposit indicated that F35 was not entirely structural, as evidenced by the recovery of several artifacts, including a maul, an edge abrader, two edge pounders, a fragment of copper mineral, a small amount of ocher, 17 flakes, a few sherds, and a stone pipe. Charred timber fragments from the deposit were subsequently radiocarbon dated, yielding a date somewhat later than proposed for

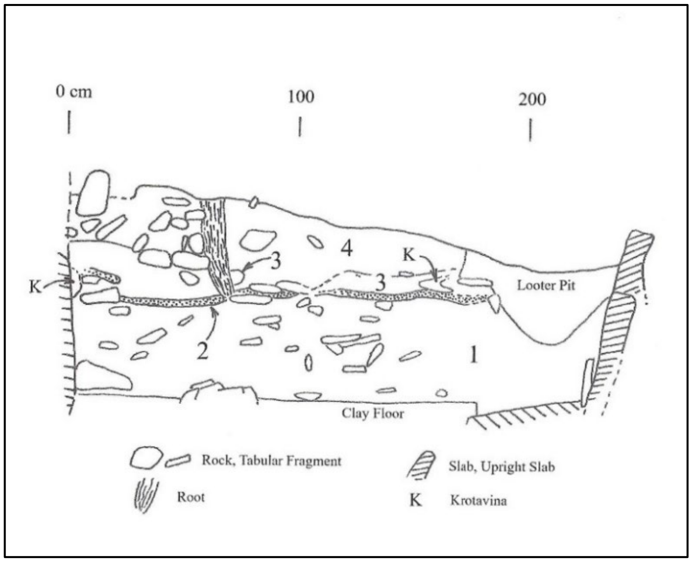

Figure 6.6: East-west profile, south face of excavation bisecting the fill of Cist 1 (F26), north half of the cist fill has been removed. Upper: F4 rock and clay to various depths. Middle: F35 mottled and midden-like with wall-fall in NW corner. Floor contact: Skiff of organic material.

the cist itself. Supporting that F35 represented a prehistoric deposit is its differentiation from what was a distinct intrusive pit (looters) on the extreme west end of Cist 1.

The underlying deposit (F36) was clearly structural fill made up of tan clay and thin tabular sandstone fragments. The deposit lay directly on the cist floor. It held 16 small flakes, 10 sherds, one unmodified bone, and a core scraper. A thin laminate of silt, which had accumulated after the structure collapsed, lay between F35 and F36.

A thin deposit of organic material lay on the surface of the floor. A pollen sample was collected from this fill along the face of the profile, but it was not analyzed. On the west end where a wall slab was missing and presumed to have been removed prehistorically, the floor and exterior were probed, revealing a single layer of floor slabs lying directly on red sandy clay (F13). A central wall slab removed on the north wall largely reaffirmed this observation, but some mottled clay and charcoal noted in the upper 20 cm indicated that Cist 1 cut a cultural deposit, suggesting that F13 might not have been totally sterile.

Cist 1, Upper Walls

The construction of Cist 1 was similar to that of Cist 2 and Cist 3 but there are differences. The coursed masonry upper wall is not dressed like Cist 3, and it is larger, thicker, and better selected than the stone used in Cist 2. Up to three courses of the upper masonry walls remain intact on the east side of Cist 1 where the lower lining slabs are shorter.

Cist 1, Floor

The floor of Cist 1 is constructed of good-sized sandstone slabs, some approaching 1 m in length where exposed on the west half. The slab floor abuts the base of upright slab wall in places and is chinked around the edge where necessary. This has created a slightly basined floor surface, which has been partially double slabbed in the center. The pavement is covered with 1 to 4 cm of mottled tan clay similar to that used in the residential room floors, along with small patches of red clay. It seems likely that the floor, slab walls, and upper masonry was a seamless surface of clay similar to 42KA1811 (see Steward 1941: Plate 44a). Slightly imbedded in the floor clay abutting the south wall was a cobble or a “stepping stone” (Hayden 1930:47).

Figure 6.7: Facing south, Cist 1 as excavated. Subfloor pavement exposed on north, clay floor on south. Note possible cobble "stepping stone" set into clay along south wall.

Cist 1, Final Definition

Cist 1 is sub-rectilinear storage feature with slightly convex sides on the north, south, and east, while the two west slabs form a straight wall (Figure 6.7) It is lined with four slabs on both the north and south, and three slabs on each end. Gaps between the lining slabs are chinked with spall. The largest slab is 80 cm tall by 60 cm wide. Only one slab in the northwest corner exhibits any shaping, and it might have been recycled. Overall measurements of the cist are 2.12 m long by 1.75 m wide, with a maximum depth of 85 cm on the east side. The interior volume is approximately 3.15 cubic meters. The lining slabs are roughly the same height, but the upper edges were uneven. Presumably, the encircling masonry wall that backed them also served to level the roof. The masonry remnant on the south edge of Cist 1 abuts the north edge of Room 1 (Figure 6.8). On a speculative note, it is conceivable that Cist 1 extended another meter east which might make it more symmetrical and better align it with Room 1. If so, the F27 connecting pavement would have been constructed after a rebuild of Cist 1.

In summary, pockets of upper fill (F35) in Cist 1 were initially thought to represent prehistoric deposition after or during the process of its collapse rather than back-dirt from the looting of Room 1. Support for this comes from a radiocarbon assay on charcoal that returned a date of Cal. AD 676-982 (Beta-167443). This date is somewhat later than that obtained from a hearth in Room 1 but coeval with a date for the F40 hearth located in the east segment of the site. In fact, it is the latest date on the site. This allows for the possibility that the contents of the cist (and the overlying F4 rock) were a result of activities that occurred later in the site's occupational sequence. The concentration of artifacts in the upper fill

(F35) might be a result of a prehistoric cache, although it must be noted that the adjacent Room 1 appears to have two looters' pits (F33, F34). Cist 1 is in near perfect alignment with Cist 2, and they could have been used at the same time, at least for a period. A relatively late radiocarbon date and abundant artifacts in the upper fill suggest that it had partially collapsed while other portions of the site were occupied.

Cist 2 (F8)

This feature was exposed in the F5 exploration trench as slab uprights with associated structural clay fill about 5 cm below the road surface. It was soon defined as a large, slab-lined, sub-rectangular cist with nearly parallel sides and rounded ends. Nearly the entire structure is in the roadbed, and the eastern wall slabs were neatly "trimmed" by road grading.

After the deposits were described, photographed, and sketched in profile (see Figure 6.9), the remainder of the fill was removed in 10 cm levels within grid units R3, R4, Q3, Q4, and Q5. Level 1 was the upper charcoal-laden fill that contained nearly all the chipped stone and ceramic artifacts associated with this structure. Level 2 was made up of collapsed superstructure debris consisting of massive amounts of small rock and structural clay, as well as some nicely patterned intact wall fall. Level 3 was a small amount of rock and solid structural clay which overlaid the floor.

These deposits depicted a straightforward sequence of post abandonment events: "meltdown" of clay, collapse of roof and walls (Level 2), and then accumulation of post-collapse cultural debris (Level 1) (Figure 6.10, Figure 6.11, and Figure 6.12). Of particular interest was the occurrence of a large, dressed slab, perhaps an entry

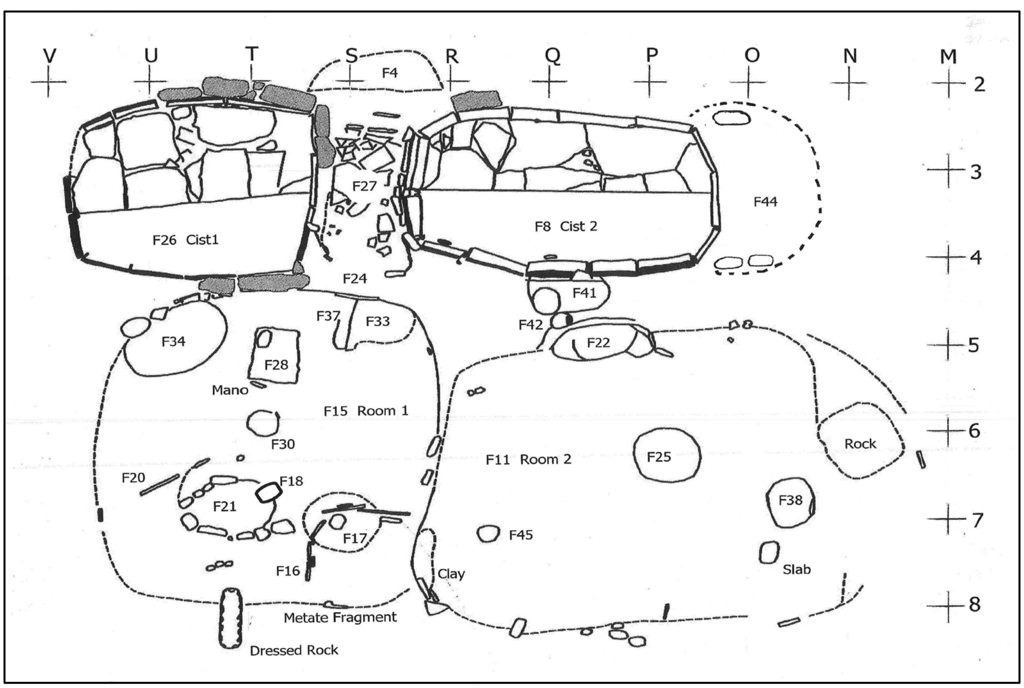

Figure 6.8: Plan map of Cists 1 and 2, Rooms 1 and 2. Note also F27, inter-cist pavement. Grid north is to top of diagram.

Figure 6.9: Facing south. Cist 2 structural fill excavation sequence in the F5 exploration trench. Left, initial exposure of structural rock and clay. Middle, patterned tabular stone wall fall further exposed on south and clay on north. Right, subfloor pavement exposed to the north and overlying clay floor on south.

closing stone, in the upper fill that is similar to one incorporated into the east wall of Cist 3. A few centimeters of midden deposit were found under it, and was taken as evidence for a dumping episode that occurred after the structure fell into disuse. Removing the structure's fill proved to be an excellent unit for training volunteers; a total of seven individuals worked on this feature over

Figure 6.10: Facing est. Cist 2 profile in F5 trench illustrating post-collapse fill overlying clay and rock structural fill just above floor. See also Figure 6.11 (below).

time. In all, 74 potsherds, 46 flakes, shell, modified bone, projectile points (n=2), a disk, a bead, an edge abrader, and worked pebbles were found evenly distributed throughout the fill. The cist was clearly not in use while other portions of the site were active.

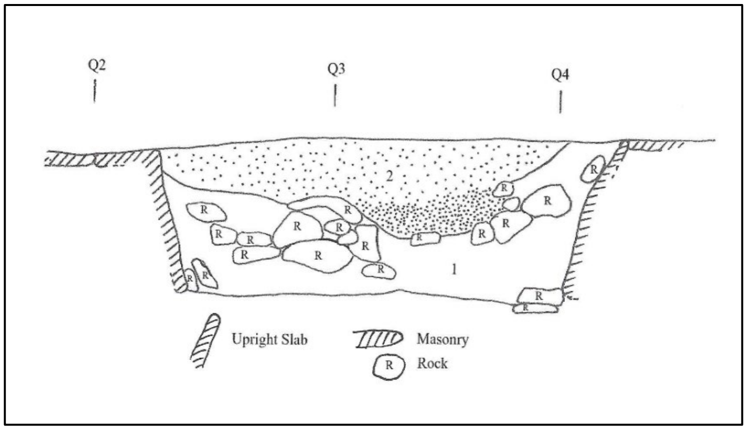

Figure 6.11: Facing east. Cist 2 profile in F5 trench illustrating post-collapse fill, Level 1, overlying clay and rock structural fill, Level 2, just above floor.

Cist 2 was well constructed and large, measuring 1.55 m wide by 2.85 cm long and 72 cm deep from the top of the lining slab on the west. It had a volume of 3.18 cubic meters. It was constructed with 15 sandstone slabs that were dressed to fit together. The slabs varied in thickness from 3 cm to 9 cm, and they leaned outward a few degrees towards their tops.

Figure 6.12: Facing west. Cist 2 final definition. Note slab uprights trimmed by road grader in foreground.

Evidence for the coursed masonry upper walls was removed by road grading except for two base rocks on the west that were exposed in the F5 trench. Other evidence for upper wall construction comes from the fill which contained coursed wall fall and a large amount of irregular and unshaped rock in a matrix of structural clay. There is no way to determine the height of the masonry wall, but it seems reasonable that a masonry superstructure would have been at least as high as the structure is deep. This would effectively double the volume of this structure to 6.36 cubic meters.

The sandstone lining slabs were carefully fitted, chinked in places with rock spalls, and sealed with a layer of gray clay. The subfloor was constructed of fragmented sandstone slabs laid somewhat unevenly, but generally flat, sloping up slightly around the edges. These floor slabs were covered with a thin level of gray clay, forming the upper sealed surface of the floor. A floor slab was removed on the west end, revealing that the floor was constructed over clean red sand.

Cist 2 Associations

The use history of Cist 2 appears to be straightforward. Construction occurred either before, after, or concurrently with Cist 1. It fell into disuse while the site was still occupied (or reoccupied) as evidenced by cultural fill. It was possibly used concurrently with the F44 surface to the east; the F41 pit or vault on the south, and the slab pavement (F27) connecting it to Cist 1 on the west. It seems likely that Room 2 was contemporary, as well. The size, shape, and construction of the cist is entirely consistent with Virgin Pueblo I style. A small charcoal sample from the floor yielded a radiocarbon date of Cal. BC 100 – AD 70 (Beta 167439), which is obviously too early. The date suggests the possibility of an earlier component at this site.

Connecting Pavement (F27)

The overlying F4 deposits were removed to expose this feature as an area of tan structural clay between Cists 1 and 2. Removal of 10 cm of overlying structural clay exposed a crude slab pavement (Figure 6.13). Slabs were not present on the south, although the clay surface extended nearly to Room 1. A couple of very thin slab uprights and a larger well-set slab upright form a right angle on the east. On the north, several small uprights form an edge. The surface is essentially flat and laps up against both Cist 1 and Cist 2 (Figure 6.14). Only about 50% of the surface is underlain with slabs, making it an unlikely candidate for storage. A hammerstone was found

Figure 6.13: F27 connecting pavement sectioned.

against the east slab edge. Occupying the space between the cists, the pavement provided a relatively protected activity area or storage space. A low roof could have spanned the two cists, but we found no evidence of this. The feature was not probed to determine the nature of underlying deposits.

Room 1 (F15)

Room 1 is a lightly constructed surface residential structure abutting Cist 1 on the north (see Figure 6.9 above). It was defined by its associated fill and by a few small rocks set around the perimeter. Structural clay was abundant in the fill, although there was no actual daub or stick impressed clay. Room 1 was square with rounded corners, and it measured approximately 3.5 m by 3.5 m

Figure 6.14: Facing east. Final excavation photo of Cist 1 (lower), Cist 2 (upper) and the F27 connecting pavement. Note slabs removed in each cist wall. Subfloor slabs are exposed on left, the clay floor surface on right.

and had an unprepared floor surface at about the level of the surrounding exterior ground surface. Formal floor features included a rebuilt hearth, a central post hole, and a curving slab alignment/enclosure in the southeast corner. Additional features exposed on the floor included slab uprights and shallow basins that might represent earlier features or possibly even predate the room itself. Two looters' pits, F33 and F34, are located on the north side of the structure. Overlying ashy deposits indicated the structure had burned. And it had apparently been purposefully abandoned as several artifacts were found *in situ* on the floor surface (Figure 6.15 and Figure 6.16).

Figure 6.15: Facing east. Exposure of Room 1 (F15), lower right of photo. Note Cist 1 (foreground), Cist 2 (middle), and Cist 3 on the opposite side of the road. Note also F33 and F34 pits in the northern edge of Room 1.

Room 1 Description

Fill of the structure was initially observed in the S7 grid 10-15 cm below the road bed surface. It was made up of a midden-like fill containing potsherds, a few flakes, and a small, hafted graver. The area was explored and defined using the grid system and the exposed limits of Room 2 (F11) on the east and Cist 1 (F26) on the north to determine the extent of Room 1. Eventually, structural

Figure 6.16: Facing north, Room 1 (F15) as exposed. Note F33 and F34 pitsat the northern edge of the room, Cist 2 in upper right corner, and open shallow excavation block in foreground.

clay over an uneven eart hen floor, a few slab uprights, the presence of formal floor features, and several ground stone artifacts defined its limits. The looter's pits in the northwest and northeast corners of the structure may have occurred at the same time Cist 1 was disturbed.

The floor of Room 1 is essentially compacted earth on the natural, red-hued alluvium substrate (F13). It is well-defined in places, and it appears stained and discolored from use and the apparent burning of the presumed jacal superstructure. A single posthole (F30) was located near the center of the structure. It measured approximately 30 cm in diameter and 30 cm deep. The posthole was cut into clean sand, and it was straight sided on south, undercut on north, and it had a small slab and cobble set on opposing sides. The fill was a loam with a slightly reddish cast.

Room 1 fill was variable and challenging to excavate. It consisted of a ca. 10 cm thick level of lumps and lenses of white/gray clay in a sandy matrix. Charcoal fragments suggested it had burnt, at least in part, as had the adjacent Room 2. Unfortunately, no timbers or fired jacal daub were encountered in the fill.

The hearth (F21) is located off-center towards the south corner of the structure. Somewhat oval shaped, it measures 90 cm by 70 cm in diameter, and 10 cm deep. About three-quarters of it was lined with small rock, a metate fragment, and two slabs, while the northeast side was simply defined by a clay lining. The fill was ashy, containing wood that was not completely combusted, as well as charcoal, along with some soil and clay mixed in (Figure 6.17).

Underlying the upper hearth fill was a

Figure 6.17: Facing south. Room 1 hearth (F21) as initially defined

deeper unlined pit. It was separated by the same tan clay seen in limited quantities in both Room 1 and Room 2. The lower hearth fill was a variable reddish-tan sand which contained charcoal fragments (Figure 6.18). The upper rock lining and clay "rebuild" had the effect of decreasing the hearth's depth and perhaps formalizing it. A well-set, 55 cm long slab and a smaller upright (F20) are set just west of the hearth. Removal of 15 cm of fill on the west side of the hearth identified a shallow dish-shaped basin. Its function remains unknown.

A bulk soil sample collected from the lower fill of the hearth yielded charcoal identified as sage (*Artemisia*), rabbitbrush (*Chrysothamnus),* juniper, (*Juniperus*), pine (*Pinus),* and oak *(Quercus)*. Two large composite charcoal samples from both the upper and lower hearth fills yielded inverted dates probably compromised by the mix of species (Table 6.1). Floral remains were mostly maize fragments that yielded a more reliable date.

Prominent among the floor features is a curving alignment (F16) of slab uprights in the southeast quadrant of the room. An edge-set metate fragment on the south and a mass of white clay on the east suggests an antechamber-like enclosure. The slabs are 15 cm tall and were heavily burnt. Overall, the enclosed area is about 1 m in diameter. The worn metate fragment likely reflects on the duration of the site's occupation prior to the construction of Room 1.

Underlying the central portion of the F16 slab alignment was a circular pit measuring 80 cm in diameter and 8 cm to 10 cm deep. The sand fill was lightly stained with charcoal flecks. The F16 slabs were set into fill, indicating an earlier configuration of the Room 1 floor features, perhaps an ash pit contemporary with the earlier hearth level. Or it could be an extramural pit that preceded construction of the room entirely.

Room 1, Intrusive Features

F34 is an oval shaped floor break measuring approximately 1 m long by 50 cm wide, located in the northwest corner of the structure's fill. It follows, in part, a series of rocks that coincide with the edge of Room 1. Fill was loose brown, homogenous material, and unmistakably a pothole. Room 1 fill was shallower (ca. 10 cm), and the looters quickly penetrated through it to the sterile red sandy substratum (F13).

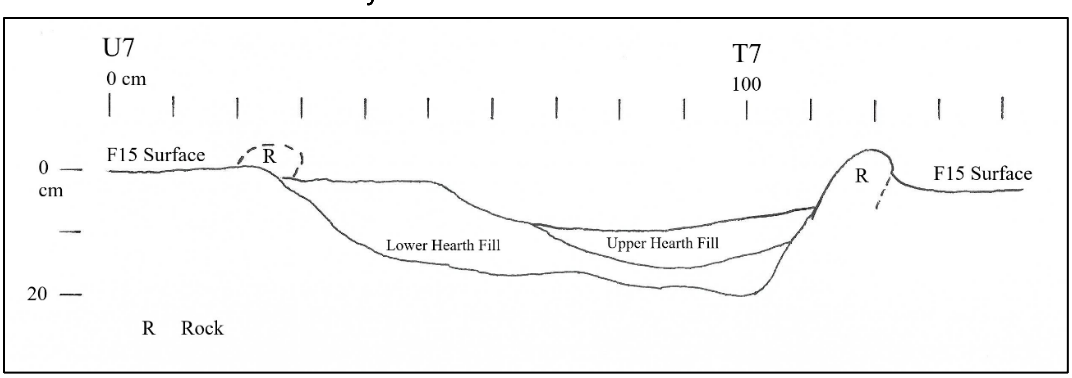

Figure 6.18: Profile of Room 1 hearth (F21).

In the northeast corner, another floor break, F33, is an asymmetrical intrusive pit measuring 45 cm by 25 cm and up to 15 cm deep. Like the F34 pit, it was cut into clean red sand (F13). The fill included structural material containing charcoal and several gray ware sherds. It abuts a slab upright that formed the north edge of Room 1. It is bounded on the west by a mass of clay (F39) resting on the floor surface, and we suspected looters had cut away a prehistoric floor pit in this area of the structure (see Room 2, F22 "vault").

It is possible that the fill of these potholes contributed to the artifact laden upper fill level of Cist 1. However, the radiocarbon date on the associated timber fragment from Cist 1 yielded a later date than all three from the Room 1 hearth (see Table 6.1). It seems unlikely that a concentration of artifacts would have occurred in the looted area only to be redeposited in Cist 1.

Room 1, Pollen and Macrobotanical Analyses

A single pollen sample was extracted from a bulk soil sample collected from a floor contact context beneath the F28 dressed slab found on the floor of Room 1. The pollen results (see sample #188) included maize and a relatively high count of *Chenopodium*, as well as other native flora including cattail (*Typha*). Macrofloral analysis identified maize, *Chenopodium*, and bee weed (*Cleome*) that may have been processed in the structure.

Room 1, Dating

Charcoal from the upper fill of the rebuilt Room 1 hearth dated to Cal. AD 440-652 (Beta-167441), and charcoal from the lower fill dated to Cal. AD 475-816 (Beta-167442). The two dates are inverted but have overlapping 95 percent probabilities. Both are fuel wood charcoal that are probably "old wood," and therefore the dates are likely earlier than the structure itself. A date from maize recovered from the Room 1 hearth provides a more reliable date of Cal. AD 660-790 (Beta-179632) with a median midpoint of AD 724.

In summary, floor contact artifacts were relatively abundant in Room 1. They included a large, 60 cm long by 48 cm wide and 5 cm thick, partially dressed and somewhat polished sandstone slab (F28), which could be an unfinished entry slab or metate blank. A quartzite cobble lay on it and a mano was found on the floor next to it. The two or three centimeters of fill beneath it was collected for the bulk soil sample discussed above. A substantial trough metate (F18) partially overlaid the Room 1 hearth and nearby was a maul. The presence of sherds, flakes, cobble tools, ground stone fragments, unmodified bone, a polished stone effigy, and a projectile point reflect a variety of domestic activities.

The floor features in Room 1 suggest a complex history of use. As noted above, the hearth had two distinct levels. To its east, the ash pit depression (F17) could have been associated with the earlier level of the hearth, and the F16 alignment was clearly constructed over it. Its location suggests that the F16 enclosure could have functioned as both an entry feature and a deflector. If so, it is unclear how it relates to Room 2. It is possible

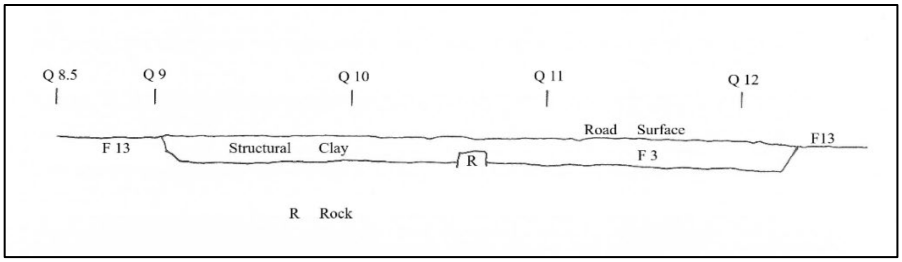

Figure 6.19: Profile sketch of Room 2 (F11).

that the "entry" enclosure was reworked to accommodate the construction of Room 2. If so, Rooms 1 and 2, might have been built in sequence. We can say that Room 1's history of use, as suggested by superimposed features, indicates at least two configurations (or periods of use). This presents an interesting question. If Cist 1 and Room 1 form a "suite," how would the active life of a heavily constructed and valuable cist compare with that of a lightly constructed jacal room?

The floor surface on the north lapped up against the encircling lower wall of Cist 1, suggesting it was contemporary with it. Room 2, a similar surface structure, abuts it on the east. The association with Cist 1 seems clear, but the relationship between Room 1 and Room 2 is ambiguous.

Room 2 (F11)

Evidence of this structure was initially visible in the F5 exploration trench as a 10 cm-thick, gray-green deposit of structural clay containing abundant charcoal. Excavated in 1 m grid units, its extent was eventually defined by structural clay bounded or circumscribed by an occasional small rock set into the F13 sterile red substrate (Figure 6.19). It measured about 5 m by 3 m, and it was somewhat irregular in shape. The maximum depth of fill was 15 cm on the west and it feathered out on the east due to grading. A radiocarbon date on medium-sized charcoal from fill in the southwest quarter (Q7), presumably roofing material, yielded a date of Cal. AD 348-643 (Beta-167437).

Lying entirely within the roadbed, road grading had removed an unknown amount of feature overburden. The remaining disturbed deposits were not screened and were quickly removed. Underlying it was a few centimeters thick deposit of dense tan structural clay containing charcoal and fragmented rock, which lay directly on the mottled red floor surface. A few flakes and sherds were scattered throughout this fill. The floor itself consisted of laminates of clay and sand with tan clay adhering to or pressed into it. In places, it appeared that the clay floor was a centimeter or two thick. Ash and charcoal on the floor and in the fill, although patchy, indicated that the structure had burned.

Room 2, F22 Vault/Bin

A formal, well-constructed bin or vault, somewhat disturbed by rodent borrowing, was found within Room 2 against the north wall (Figure 6.20). The overall dimensions were 110 cm by 40 cm and 45 cm deep. Cut into the sterile red substrate, it has vertical sides except

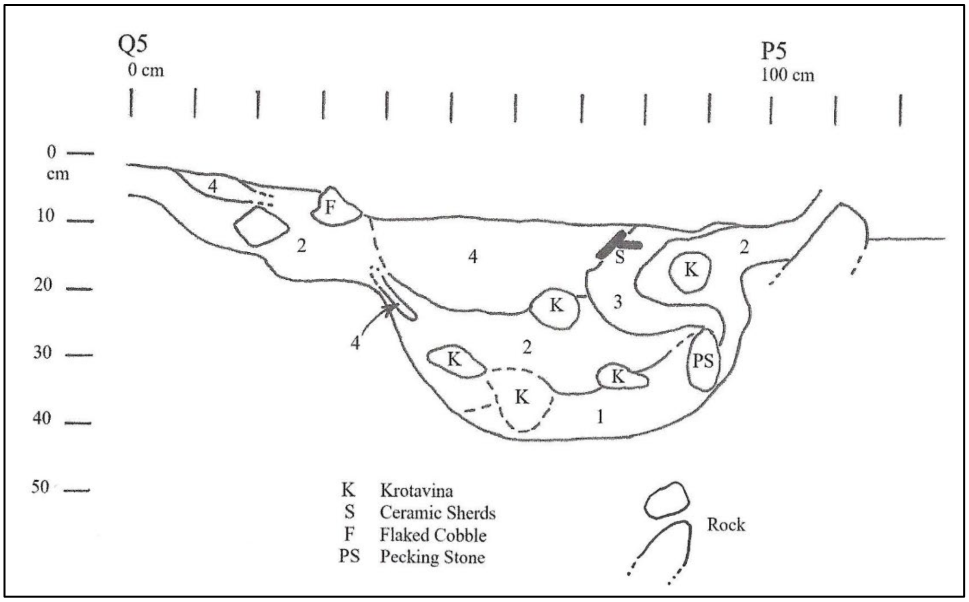

Figure 6.20: F22 vault profile.

where it is undercut on the north. The fill was disturbed by rodent borrowing, but mixed sand and charcoal with pockets of clay were consistent with the overlying deposit of roof-fall. It contained several artifacts, including a hammerstone, a pecking stone, a biface, a gray ware sherd, and a quartzite flake. The upper edge on the north is formed by a 5 cm to 7 cm wide band of gray/tan structural clay. The east edge is defined by three small edge-set slabs.

The surfaces on each side of the pit average about 15 cm below the floor surface of Room 2 and are fairly level. Similar formal features, termed “vaults,” are found in Pueblo I and early Pueblo II pit houses where these wing-like surfaces appear to have supported sticks which spanned the central pit (see Dalley and McFadden 1988).

F42 is an oval pit measuring 22 cm by 18 cm and 14 cm deep, perhaps representing a post hole. It is nicely sculpted into the clay that forms the north edge of the F22 vault and the perimeter of Room 2. The pit was lined with a sandstone slab, and the fill was

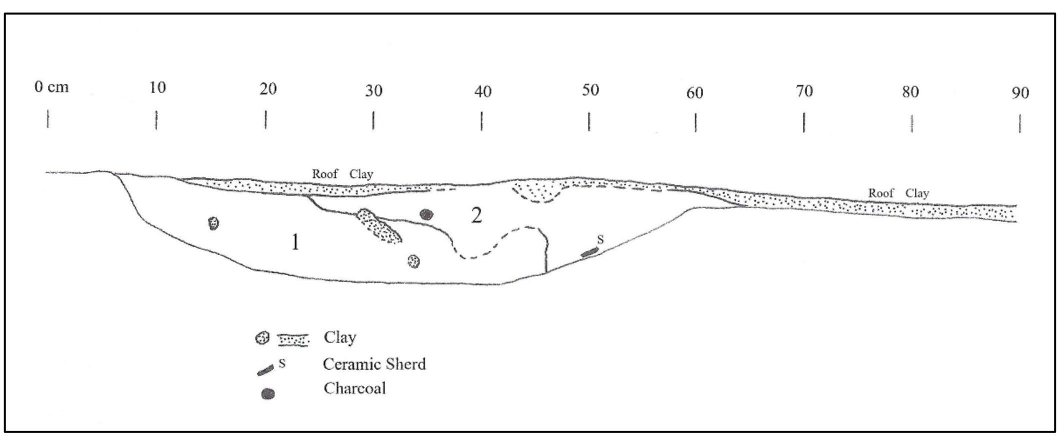

Figure 6.21: Profile view of F38 sand-filled floor basin.

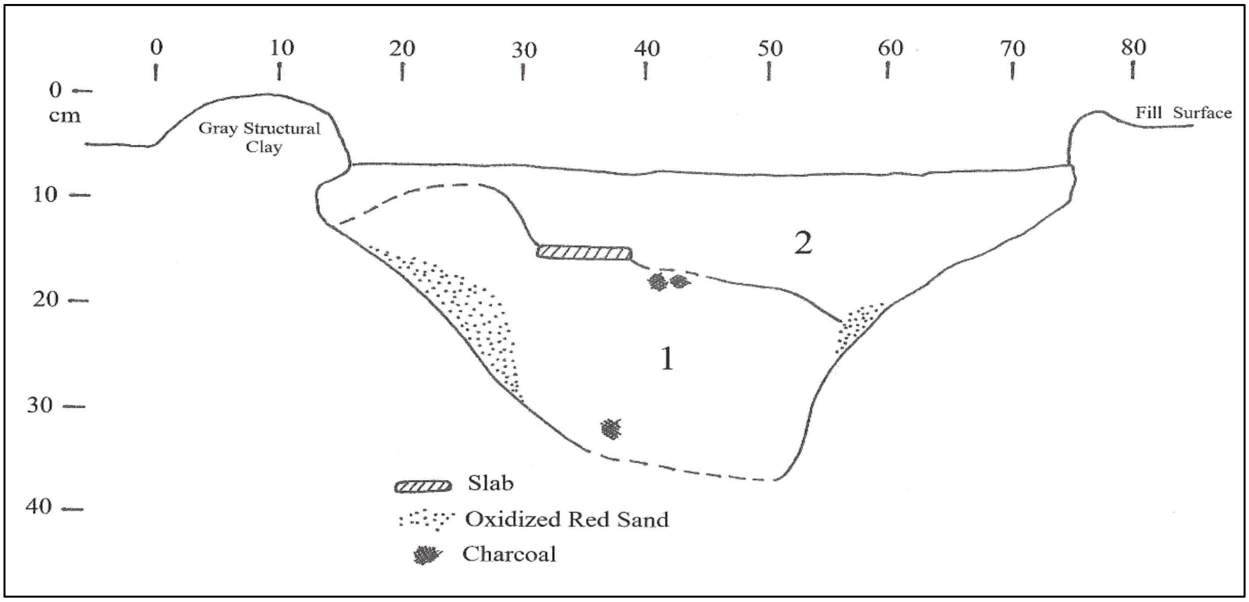

Figure 6.22: Profile view of hearth (F25) in Room 2.

clean, red sand. It represents the only indication of roof support encountered.

F45 is a shallow depression in the southwest quadrant of the Room 2 floor. It is circular and dish-shaped, measuring 20 cm in diameter and 4 cm deep. The fill was structural roof fall. Three fragments of a stone disk and a single gray ware sherd were recovered from the fill. The depression would have served well as a pot rest.

F38 is a larger shallow basin measuring 58 cm by 48 cm with an 8 cm deep dish shaped bottom (Figure 6.21). A single gray ware sherd was pressed into the bottom of this feature. The fill consisted of 3 cm of roof clay containing charcoal fragments, underlaid by fairly clean, buff-colored aeolian sand. Additional artifacts included 13 gray ware sherds, four unmodified bone fragments, and a non-diagnostic stemmed and shouldered arrow point. It was apparently a purposeful deposit, and the sand may have been procured off site. Like F45, it would have functioned well as a pot rest.

Room 2, F25 Hearth

This feature was initially difficult to work due to the compacted roof fall lying over it. The hearth was eventually defined as roughly 80 cm in diameter. It was partially clay-lined with encircling tan clay coping 5 cm to 15 cm wide (Figure 6.22 and Figure 6.23). The pit was symmetrical and conical in shape, extending 30 cm below the floor. The lower pit sand walls were oxidized red and blackened at the base.

Figure 6.23: Room 2 hearth (F25) with sectioning for floatation sample recovery.

The upper fill consisted of 10 to 15 cm of tan, sandy clay exhibiting minor charcoal flecking; the lower fill was 15 cm of mottled brown and black ashy deposits. Artifacts scattered in the fill included a large quartzite cobble which was slightly impressed into the upper fill, a few gray ware sherds, and one Washington Black-on-gray sherd. A thick black charcoal deposit up to 4 cm thick was located immediately to the east, and it was probably a result of cleaning out the hearth.

The analysis of two macrofossil samples (186 and 103/108) recovered from this feature identified the use of oak, pinyon pine, rabbitbrush, juniper, and sagebrush as fuel. The analysts suggested that maize cobs could also have been used as fuel, which seems unnecessary in a wooded upland setting unless burning was a ready form of disposal. A wide range of domesticated and charred wild remains were also identified including maize, beans, small charred bone fragments, mustard, goosefoot, and saltbush. This combination represents a mix of domesticates and local native species very much like the results of the coprolite analysis undertaken at Antelope Cave (Reinhart et al. 2012). In addition, the presence of 17 small flakes indicated that lithic reduction activities took place inside the structure.

Two radiocarbon samples were also recovered from the hearth. One composite charcoal sample returned a date of Cal. AD 588-885 (Beta-167438) and one on maize, from the macrobotanical sample, returned a date of Cal. AD 623-771 (Beta 179631). Considered along with the earlier roof fall date of Cal. AD 348-643 (Beta 167437), discussed above, the three dates from Room 2 all overlap, although there is the potential they are sequential.

F41 Pit

F41 is an elongated pit centered on and abutting Cist 2 on the north, and the F22 bin and F42 pit on the south. It measures 78 cm by 30 cm and is 6 cm deep on the east side. There is a secondary depression on the west end that is 28 cm in diameter and 13 cm deep. The associated fill was clay and charcoal, not unlike the structural fill of Room 2. Artifacts included a few flakes, sherds, and an edge abrader. Lying outside of Room 2 and abutting the central slab on the south edge of Cist 2, it was conceivably cut by the excavation of the cist, although this seems unlikely. Its function and relationship with these features are problematic. A composite sample of charcoal yielded a calibrated date of Cal. AD 554-768 (Beta-167444), which is earlier but also overlaps dates from the hearth of Room 2.

Nested on the bottom of the secondary depression was a plain gray sherd and an oxidized sherd with an early painted design. The reddish hue on the interior of the bowl initially suggested it was a red ware sherd, although R. Roger McPeek (this volume) determined it was a misfired or unintentionally refired Washington Black-on-gray sherd. The occurrence of aberrant “red ware” is common and is discussed in the ceramics section.

Feature 44 Surface

F44 lay squarely in the center of the roadbed, and. it was defined as a clay

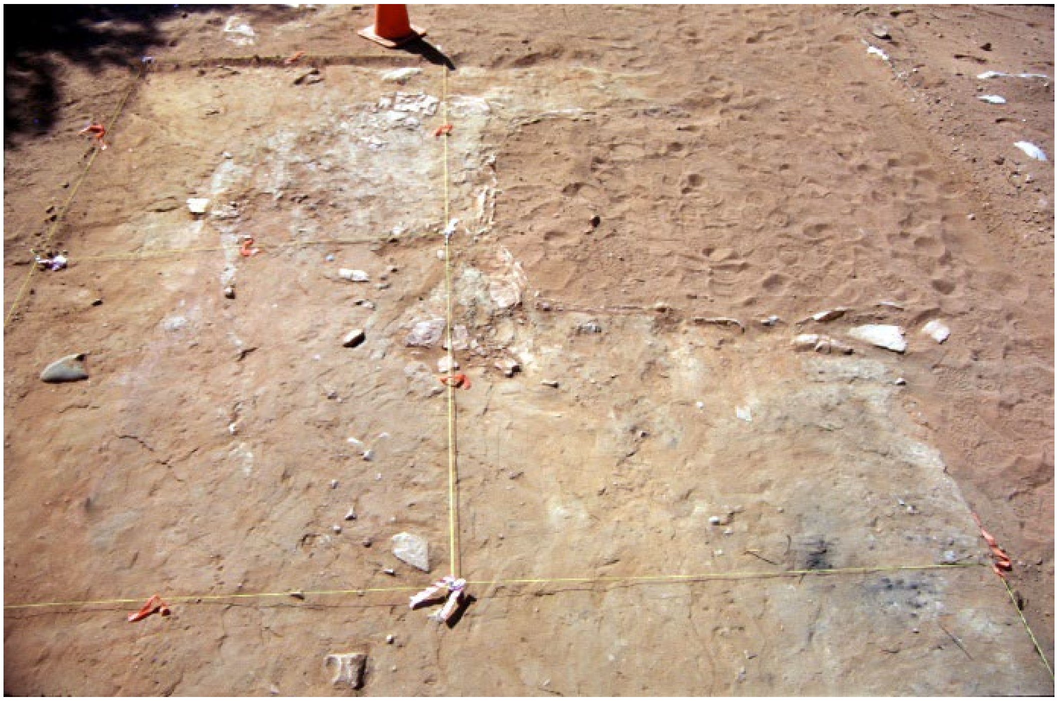

Figure 6.24: Facing south. F44 surface on left abutting Cist 2 on right. Cist 2 has been back- filled; note upright slabs trimmed to road surface. The backfilled F5 trench is on the extreme right with F48 stain to its lower left.

"surface" bordered by rock and abutting the east end of Cist 2 (Figure 6.24). It was approximately 2 m wide (north-south) and it extended east 1.2 m beyond Cist 2. Like Cist 2, it was trimmed to the level of its upright wall slabs by the road grader, making their relationship problematic. It either abutted Cist 2 or it was constructed earlier and was subsequently cut by the construction of the cist. While the actual occupation surface appeared to have been trimmed away by road grading, enough of the feature remained to make observations.

On the south edge of F44 are two elongated rocks, one measuring 30 cm by 20 cm and the other 35 cm by 20 cm, and both are several centimeters thick. They are oriented as a possible extension of the base of the Cist 2 masonry wall. There is little question that the feature was entirely outlined with a basal course of rock that was subsequently graded away, leaving only the interior clay. The adjacent slab uprights forming Cist 2 were also trimmed by the road grader, supporting this theory. No surface on or in the clay could be defined, but as it was further excavated a large broken sandstone slab measuring 30 cm by 25 cm, and located in a slight depression, was exposed. This slab could either be the remnant of a floor surface or more likely an internal feature such as a metate platform or mealing bin. Definition of the F44 surface was less obvious on the north where it was defined by a concentration of clay and a scatter of small broken tabular sandstone.

The removal of a slab in the east wall of Cist 2 gave no indication of additional depth for F44. In plan view, elevation level, and positioning, F44 appears

Figure 6.25: F12 hearth shown sectioned for profile and bulk sample collection.

similar to a connecting pavement. If so, Cist 3 would have been nearly 3 m longer than its present exposure in the eastern segment of the site, which seems unlikely. Or it is possible that F44 was associated with F43 (described below) which seems more likely. A third possibility is that the east and west segments of the site, as it has been excavated, were not physically connected.

Extramural Features

Exterior Hearth (F12)

This is a formally constructed slab-lined hearth located 8 m southeast of the cist alignments in the "northbound lane." Essentially, it is centered between the east and west segments. Although trimmed by road grading, it and the surrounding artifacts and features appear to be essentially intact, suggesting it was part of an activity area.

The hearth was overlaid by a 1 to 2 cm layer of dark clay that extended into Grid N12. The circular basin measured 60 cm in diameter and 12 cm deep. It was lined with small sandstone slabs set into tan and gray clay that also lined the bottom of the hearth (Figure 6.25, Figure 6.26, and Figure 6.27). The fill was stained sand and clay with charcoal flecking and gravel from an unknown source. Cultural material within the fill included small bone fragments, plain gray ware sherds, quartzite and chert flakes, and a small, stemmed Parowan Basal-notched projectile point.

Surrounding the hearth was an expanse of dark gray clay, small sandstone tabular rock (possibly displaced hearth slabs trimmed by the grader), a gray ware sherd, a small sandstone slab, and a used or modified quartzite cobble. A shallow depression 8 cm in diameter might have served as a pot rest was found 20 cm to the east.

Two macrofloral samples from the hearth suggested that activities here focused on food processing and preparation. Although no native species were present, both charred beans and maize fragments were recovered. Fuel

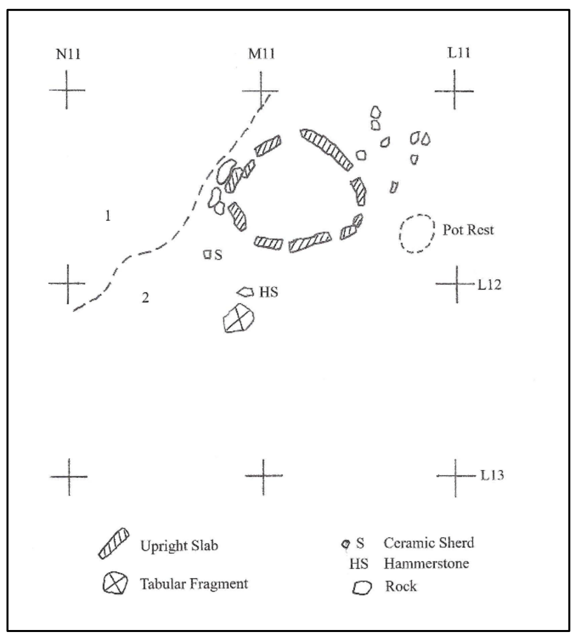

Figure 6.26: F12 hearth profile. Soil unit 1, dark gray/black compacted clay; 2, reddish/orange compacted clay.

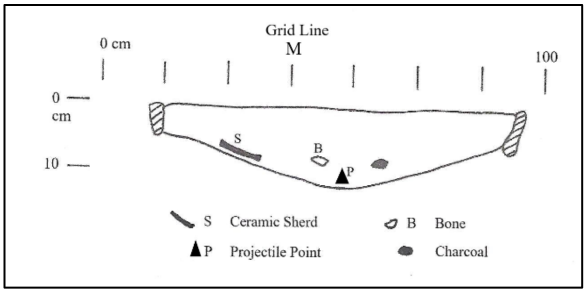

Figure 6.27: F12 hearth plan view map. Soil unit 1, dark gray/black compacted clay; 2, reddish/orange compacted clay.

wood charcoal consisted of pinyon, juniper, ash, and sage. In addition, both charred and uncharred bone fragments were recovered. Cultural material consisted of 11 flakes and a single plain gray ware sherd. The maize fragments yielded a radiocarbon date Cal AD 659-827 (Beta-179633) with a median intercept of AD 724, a date coeval with the maize dates from the hearths in Room 1 and Room 2.

F47 Activity Area

F47 represents a well-defined feature, but its actual horizontal and vertical contexts could not be determined. As is the case elsewhere at Road Kill, vertical control suffers from both the unknown nature and amount of the overlying deposit. The same is true for its surrounding context. While F12 was considered an outdoor hearth at the time of excavation, the associated artifacts, clay deposit, and evidence of food processing suggest it may have been the locus of more complex activities that were enclosed or at least roofed by a ramada.

Potential Early Features

Features that are potential earlier than the radiocarbon dated features discussed above occur to the northwest of Cist 1 and Cist 2. They were not fully explored but seem to represent occupational events that preceded the construction of the cist alignment. Two surprisingly early and apparently out-of-context radiocarbon dates support this possibility (Table 6.1).

F9 is a soil contact exposed over approximately 3 m in the F5 trench north of the cist alignment. The fill consists of scrappy tabular rock and dark brown loamy silt with some clay bordered by the sterile red substrate (F13) on the south. A Lino Black-on-gray sherd was noted during cleanup. While it is considered a separate feature, it may be related in some fashion to F48 on its southeast.

F48 is a roughly semicircular deposit of gray, charcoal flecked and mottled clay located immediately north of Cist 2 in grid units Q1 and Q2. Its profile along the north edge of grid unit Q2, was excavated to native soil to a maximum depth of 12 cm. The dish-shaped surface yielded a few flakes and sherds, including a Basketmaker III-style jar rim on the sterile native surface. Apparently, it is not directly associated with Cist 2. Neither F9 nor F48 were fully explored.

East Segment Feature Descriptions

Cist 3 (F2)

Cist 3 is the remnant of a deep, slab-lined storage feature. It was initially visible in the cut bank on the east side of the road as slab uprights backed by coursed masonry on the north and south sides (Figure 6.28 and Figure 6.29). It was excavated into sterile red soil at the base

Figure 6.28: Cist 3 initial profile on the left; exploration of F37 area in progress on right.

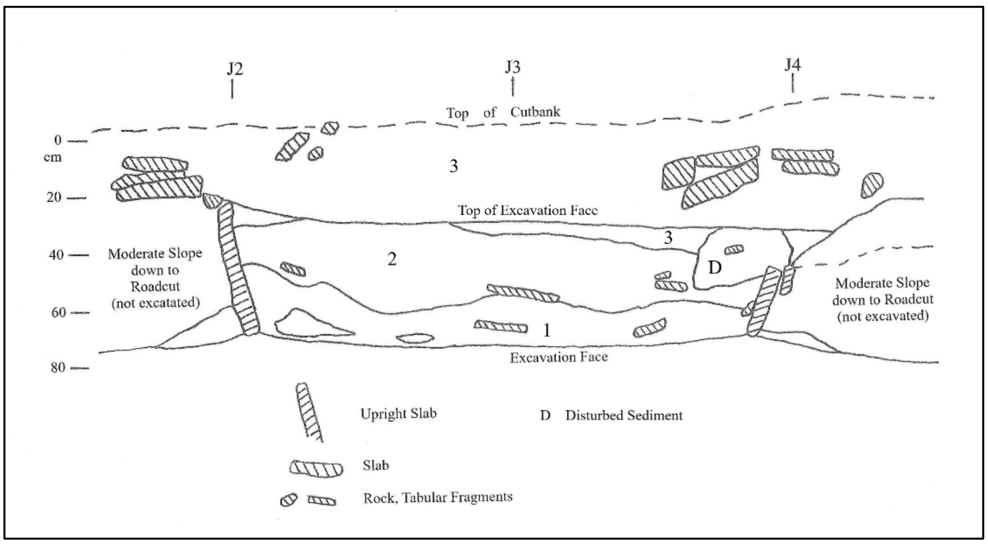

Figure 6.29: Profile view map of Cist 3, F19 pavement, and F31 uprights.

of the talus slope. The lower walls of this rectangular structure were lined with slightly dressed sandstone slabs, three on the north and three on the south. They vary in height from 85 cm to 64 cm tall, and they average about 5 cm thick. They appear to be composed of local Moenave sandstone. The slabs seem to have been "robbed" or recycled from other features as evidenced by the butt of an apparently snapped off wall slab. The remaining upright was a large, nicely dressed slab 80 cm tall by 57 cm wide. At variance with the other two cists, Cist 3 may have been repurposed from an earlier structure. All the remaining slabs are well-fitted with small spall rock chinking the gaps. A plain gray bowl sherd was inserted between the slabs on the south wall.

Like Cist 1 and Cist 2, the subfloor was a carefully fitted sandstone slab pavement that was sealed with 2 cm to 3 cm of charcoal-flecked tan clay (Figure 6.30 and Figure 6.31). Of possible relevance to recycled construction stone, the size of the tabular stone used in the floor is considerably smaller and more fragmented than that used in either Cist 1 or Cist 2.

Figure 6.30: Cist 3 structural fill with upper fill unit removed. Note apparent cultural fill behind missing wall slabs on the left.

The masonry upper walls were constructed of selected or dressed elongated sandstone better formed than the upper walls of Cist 1 and Cist 2. Six courses remain on the north and three courses on the east. No mortar remained between courses. The building stone varies in size with the largest measuring 73 cm long by 17 cm wide and 10 cm thick. The coursed masonry of the upper

Figure 6.31: Cist 3 (F2) with fill having been excavated showing missing slabs. The clay floor has been removed on the north side. Note the remaining lower courses of masonry walls atop the upright slabs.

wall served to level the interior lining slabs and presumably served as a platform on which roof timbers rested. Figure 6.31: Cist 3 (F2) with fill having been excavated showing missing slabs. The clay floor has been removed on the north side. Note the remaining lower courses of masonry walls atop the upright slabs. The masonry is flush with the face of the slabs and would have allowed a prepared clay plaster lining to have been applied over the entire wall.

The fill of the feature was primarily masonry rubble similar in size and form to the rock which made up the upper walls (see Figure 6.30 above). Both the east-west and north-south profiles were consistent, but structural rock was noted to be denser and higher in the fill on the east. The profile displayed the following units: 1) lower fill consisting of red structural clay with broken sandstone lining slabs, and a single elongated upper wall rock resting on the floor; 2) variable tabular rock and clay debris with superstructure rock higher on the east and decreasing to the west (in places it consisted of heavy rock that might have been upper masonry wall collapse); and 3) upper sandy loam with charcoal flecking and thin sandstone slabs similar to those which made up the F19 pavement. It seems likely that after a period of disuse, the upper wall rock tumbled in from the east wall when the wall slabs were pulled for use in later construction efforts. This suggests that Cist 3 fell into disuse prior to the abandonment of the site.

The excavated portion of the cist measures 1.78 m wide on the east, 1.65 m wide on the west, and is presently 2.18 m long and about 85 cm deep. The remaining pit itself has a volume of about 3.19 cubic meters. Assuming a width to length ratio of 2:1, about 37% of the cist was cut away on the west. This increases the cist volume to about 4.37 cubic meters. As described above, the upper walls were constructed of coursed masonry that originated just below the top of the upright lining slabs. A superstructure of about the same height as depth (1.7 m overall) would have doubled the volume to nearly 9 cubic meters.

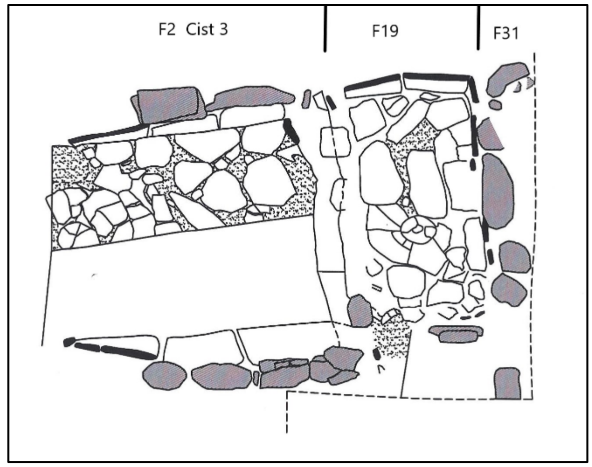

Figure 6.32: Plan view map of Cist 3, F19 pavement, and F31 uprights.

Pavement (F19)

Spanning the area between Cist 3 on the west and rock alignment F31 on the east is a well-constructed, clay-surfaced pavement measuring 2 by 1 m (Figure 6.32). The pavement lies 95 cm above the floor of Cist 3. It is dish-shaped, sloping towards the center on all four sides and forming a basin 10 cm deep. It is defined on the north by two 1.5 thick slabs which stand 18 cm above the prepared clay floor and align with the north wall of Cist 3. On the northwest, two floor slabs overhang the edge of Cist 3 where its wall slabs had been removed.

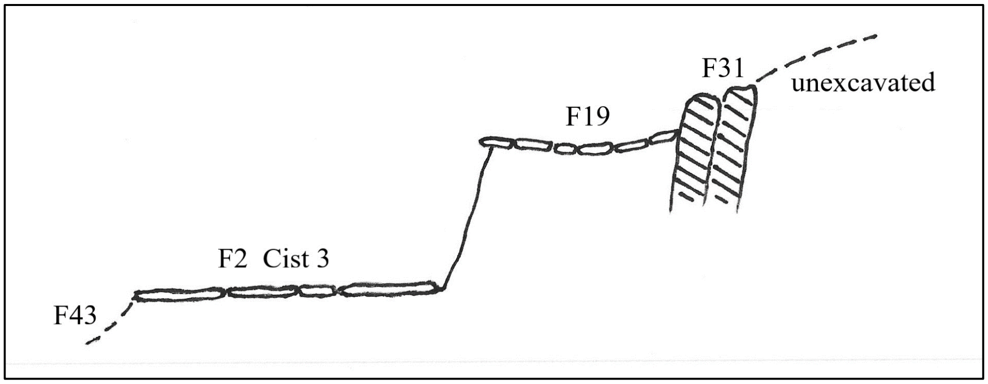

Figure 6.33: Profile view of Cist 3, F19 pavement, and F31 uprights.

On the southwest corner, the floor slabs are supported by the remaining three courses of the Cist 3 upper masonry wall. This superposition is clear evidence that the pavement was constructed after Cist 3. It does, however, raise the question of how the slabs were removed without disturbing the overhanging pavement (see Figure 6.33).

The subfloor of F19 is constructed of very thin 1 to 2 cm thick slabs covered with a 2 to 3 cm layer of clay. While well-constructed, the slabs are not chinked and sealed in the fashion of the adjoining cist subfloor. On the southeast there is a 40 cm wide gap that is a possible entryway. A metate fragment lay on the floor of the compartment. Overlying the floor surface is a deposit of up to 15 cm of tan and red structural clay that may represent roof fall. It seems likely that the pavement and Cist 3 were contemporary, and that the cist was constructed first.

Unlike the F27 connecting pavement found in the west segment, this feature might be considered a special-use compartment that linked two existing structures to form a block of three or more rooms. Pollen and macrofloral analysis shed little light on what that function might have been. Pollen samples were taken from beneath the metate fragment and by scraping the clay surface of the feature. Similar to other samples on site, they suggested the presence of maize, bee weed, grass, and cheno-ams. Also of note is the recovery of three apparent long bone awls and one long bone fragment with possible cut marks.

F31 Alignment/Uprights

This feature is a rock alignment consisting of a series of elongated rocks abutting the east side of the F19 connecting pavement/compartment described above. It suggested the presence of an additional cist, but this possibility was not explored. The largest upright stone measures 58 cm by 25 cm by 8 cm thick.

Supporting the idea of a continuation of the alignment to the east are several isolated uprights extending about 5 m meters upslope. On the north, an isolated slab upright 2 m east of the F19 pavement aligns with its north wall. Projecting out from the south edge of F19 about 4 m are additional uprights that continue the alignment on the south.

F37 Surface and F40 Hearth Profile

F37 is a use surface with an unlined central hearth (F40) that extends 3.5 m southeast from Cist 3. It originates about 30 cm south of the cist at or just below the cist's upper masonry wall. It was exposed only in profile along the road cut and was not excavated. The surface is essentially a contact between the red sand substrate (F13) and overlying cultural and natural deposits. The cultural deposit is 40 cm deep on the north and thins to 20 cm on the south. It consists of lenses of tan structural clay, aeolian sand, slope wash, ash mixed with sherds, and a flaked cobble fragment. Upper deposits are similar but are primarily composed of slope wash and non-cultural overburden.

F43 Soil Contact/Fill Unit

This partially excavated feature lies entirely within the east side of the roadbed. It was the final feature to be dealt with in the attempt to understand the relationship between the east and west segments of the site. It is a soil contact/fill unit consisting of a pocket of mottled cultural fill overlaid by a variable lens of tan structural clay and clean sand. It was apparently bounded on the west by sterile red clay. Vertically, its east edge lies a few cm below the Cist 3 floor separated by the red substrate; horizontally, it lies only a few cm west of the truncated cist. Both relationships suggest that the feature preceded the construction of Cist 3, although this is not certain. Given its apparent level of origin beneath Cist 3, it appears that the road grader only removed a few cm of its uppermost fill.

F43 was explored by excavating two 50 cm-wide trenches at right angles to each other. One was excavated along the edge of the road exposing a curving 2.5 m soil contact a few cm beneath the road surface. In plan view, the red sandy native clay and trashy fill forms a crisp, gently curving contact not unlike that described for Rooms 1 and 2. Projected, the curve would encompass an area about 4 m in diameter. It comes within a few cm of Cist 3’s floor. At a right angle, extending west from Cist 3, a second trench displayed a series of deposits that originated just beneath Cist 3. The fill is about 20 cm deep and included a lower level of charcoal mottled sand, structural clay, and a pocket of sterile red clay and sand extending to the roadbed.

Table 6.1: Road Kill Radiocarbon Dates

Provenience	*Dated Material*	*Conventional Age BP*	$\delta^{13}C$ ‰	*95 Percent Probability*	*Median Probability*	*Lab No.*
FS 96, F8 Floor (Cist 2)	Charcoal	2010 ±40	-20.9	BC 119-111 AD	AD 5	Beta-167439
FS 184 F40 Hearth in F37 Profile	Charcoal	1910 ±40	-23.2	AD 20-222	AD 129	Beta-167440
FS 71, F11 Fill, Qy Room 2	Charred Material	1540 ±80	-25	AD 348-643	AD 518	Beta-167437
Room 1 FS-205 F21 Hearth Upper Fill	Charcoal	1480 ±60	-25	AD 440-652	AD586	Beta-167441
Room 1 FS-204 F21 Hearth Lower Fill	Charcoal	1400 ±80	-25	AD 475-816	AD 641	Beta-167442
FS-214 F41 Pit Fill, Room 2	Charcoal	1400 ±60	-25	AD 554-768	AD 639	Beta-167444
F25 Hearth in F11 Room 2	Maize	1340 ±40	-10.3 AMS	AD 623-771	AD 685	Beta-179631
FS-105 F25 Hearth Room 2	Charcoal	1330 ±80	-25	AD 588-885	AD 715	Beta-167438
F21 Hearth in F15 Room 1	Maize	1300 ±40	-11.6 AMS	AD 660-826	AD 724	Beta-179632
F12 Isolated Hearth	Maize	1300 ±40	-10.9 AMS	AD 659-827	AD 724	Beta-179633
F40 Hearth in F37 Profile	Maize	1230 ±40	-10.8	AD 681-896	AD 800	Beta-179630
FS-153 F35 Cist 1 Upper Fill	Charcoal	1210 ±70	-25	AD 676-982	AD 821	Beta-167443
Calibrations were generated using the R Package and the Intcal20 radiocarbon calibration curve (Reimer et al. 2020).						

Chapter 7
Excavation Discussion

All of the excavated features at Road Kill appear to be resting on the F13 sterile red clay substrate. Elsewhere in the drainage, a similar deposit was identified that predates BC 1800 and was called the “pre-Anasazi” alluvium (Rigsby and Kulp 1995; McFadden 2012). The origin and distribution of this deposit in the drainage is not known but it could be a reliable horizon marker for future investigations.

Two lines of evidence suggest the possibility of an occupation prior to the sequence of events that resulted in the cist alignment: (1) the location of undefined features “behind” the front-oriented cist alignment, and (2) the two Basketmaker II radiocarbon dates of Cal. BC 119-111 AD (Beta-167439) and Cal. AD 20-222 (Beta-167440). These dates are 500-600 years or more earlier than the main occupation, and it’s unlikely they were the result of burning “old” firewood.

The initial round of radiocarbon dates taken on charcoal suggested a 95% probability of a site occupation within a 250-year span. Temporal control over the features was enhanced by a second round of AMS dates on maize remains that were obtained from the macrobotanical analysis. This second suite of AMS dates narrowed the site chronology to a temporal span of about 150 years.

The series of storage cists and their associated residential rooms appear to have been constructed with a linear, front-oriented layout - a tradition that the later occupants continued. There is clear evidence that they were constructed in sequence, they were not the result of a single building episode, and they were not occupied simultaneously.

The ceramic evidence conforms well to the radiocarbon dates. There were a few Basketmaker III rim sherds and Mesquite Black-on-white designs, whereas the majority of painted sherds were Washington Black-on-gray sherds (Pueblo I). A few St George Black-on-gray “transitional” designs were identified by McPeek (this volume), one of which was very similar to a sherd recovered at the Park Wash Site.

West Segment

A case can be made that Cist 2 and Room 2 were constructed first. The associated Room 2 residence was likely constructed shortly after Cist 2 to form a storage-habitation “suite.” Two radiocarbon dates from the Room 2 hearth, one on composite charcoal and the other on maize remains, returned radiocarbon dates of Cal. AD 588-885 (Beta167438) and Cal. AD 623-771 (Beta-179631), respectively, suggesting a late Basketmaker III or early Pueblo I occupation. A third date on charcoal from the fill (presumably from structural material) returned a date of Cal. AD 348-743 (Beta-167437). Although no date is available for the actual construction or use of Cist 2, other than the anomalous Basketmaker II date mentioned earlier, its upper fill indicates continued site activity after its collapse.

Two radiocarbon dates were also obtained from the hearth in Room 1. Charcoal yielded a rather early date of Cal. AD 440-652 (Beta-167441), which might reflect the burning of "old wood." An assay on maize, deemed to be more reliable, returned a date of Cal. AD 660-826 (Beta-179632) with a median probability only marginally later than those from Room 2.

The relatively late date for Cist 1 was from charcoal in its upper midden-like fill (F35). A date of Cal. AD 676-982 (Beta 167443) coincides well with a date of Cal. 681-896 (Beta-179630) from the F40 hearth visible in the F37 profile in the west segment. The deposition of trash and numerous artifacts into Cist 1 during a later use episode on the east segment is a reasonable possibility.

East Segment

Virtually all evidence for features between the east and west roomblock segments was cut away by road maintenance activities. What existed prior is unknown, although a portion of Cist 3 remained. The cist was similar in construction to Cist 1 and Cist 2. It was deep, slab-lined, had a clay pavement over a flagstone subfloor, and had masonry upper walls. It showed evidence of having incorporated material from an earlier occupation, as well as having had a slab taken from its back wall for use elsewhere on the site. Cist 3 also appears to have had an associated habitation on its southern side. This feature, the F37 surface, was visible in profile but was not excavated. A radiocarbon date of Cal. AD 20-232 (Beta-167440) from the centrally located associated hearth F40 is probably "old wood" or displaced wood. A second AMS date on maize yielded a date of Cal AD 681-896 (Beta-179630), which is one the most recent dates on the site.

The F19 pavement extending off the east end of Cist 3 is nearly identical to the connecting F27 pavement between Cist 1 and Cist 2. This pavement abuts apparent masonry (F31), suggesting another storage feature is connected to Cist 3 A rock alignment and additional uprights farther upslope also suggest the presence of an additional cist to the east.

South of the cist alignment, maize remnants from the F12 hearth/activity area returned a date of Cal. AD 659-827 (Beta-179633), which associates best with an identical date from the hearth in Room 1.

Bridging the Gap

It is interesting that Room 1 and Room 2, both residential, were burned, possibly at the same time. At any rate, household artifacts remained on the floors, perhaps buried by debris but never retrieved. Accidents happen, in which case an attempt to retrieve the artifacts might be expected. It is also possible they were burned on purpose at the time of abandonment to "seal" the departure and ensure that they would no longer be inhabited. Our thesis of episodic use with expectations of returning likely had behavioral consequences that will be explored in the concluding chapters.

The connecting pavements between cists are very similar to the "paved partitions" on the Little Man 1 site in the St George Basin (Dalley and McFadden 1988). These features clearly establish contemporary use of the cists connected by the pavements, although it is still possible, even probable, that the cists themselves were constructed at different times. Little Man 1 is similar to Road Kill in many regards: It is linear, it is about the same size, and the cists are of similar construction, although the Little Man 1 cists are much shallower. Little Man 1 dated to about AD 800-900, only slightly later than Road Kill. Light ramadas fronted the cist alignment and a pit house was believed to have been constructed late in the sequence but never occupied. Washington Black-on-gray ceramics occurred, but St. George Black-on-gray predominated. Pueblo I jar rims were present, but they were outnumbered by fully everted Early Pueblo II forms. This suggested a terminal date for the site after AD 900, somewhat later than Road Kill.

The use history for Little Man 1 is dramatically shorter than that proposed for Road Kill. Four years of occupation were suggested as a minimum necessary to account for the site construction sequence of six storage units (two of which were refloored), a pit house, and three outdoor hearths. Artifacts were comparatively sparse. Only 536 sherds were identified, supporting a short period of use. Little Man 1 was interpreted as an "agricultural station" that eventually took on a more permanent nature (Dalley and McFadden 1988:72). Residential mobility among similar sites was suggested as a defining settlement pattern in the St. George Basin. Initial storage features were constructed near an agricultural plot and were enhanced by full-time habitations if warranted by successful agriculture. It was unclear how long the intervals between occupations were, and whether the same individuals were involved in resettlement.

The Road Kill alignment was about 25 m long. Essentially, the connecting pavements were a means of joining individual storage cists into a continuous roomblock even if some of the individual units had fallen into disuse. This accretional process of roomblock formation remained a feature of Virgin Puebloan architecture until at least the end of the Early Pueblo II period (AD 1050).

The west segment of Road Kill was used most intensively around AD 700. The cist type conforms well with the progression from Basketmaker III-style cists that were deep, circular, and slab-lined to shallower, oval cists with a collar of masonry perhaps standing as high as the pit was deep. After the cists were constructed, connecting pavements, possibly actual compartments, created an alignment of contiguous, but still individually constructed, storage units.

Occupational Scenarios

It appears that the cists and adjacent residential rooms represent suites occupied by a nuclear-family-sized group. Each of the storage cists had a volume adequate to sustain a family of five for a full year (as we discuss further in the concluding chapters). The jacal rooms could have been seasonally occupied during warm weather, but cold-weather occupation would have required construction of a pit house, which was not identified at Road Kill. The question at hand is whether the suites were occupied simultaneously or in sequence. At least two occupation scenarios can be described, each with different social and organizational implications.

In one scenario, the east and west segments (remnants) are temporally distinct occupations with a hiatus of about 100 years. During late Basketmaker III times, Cist 1, Room 1, Cist 2, and Room 2 were occupied simultaneously and represent a co-residential group of perhaps two families. Later, during the Pueblo I period, there is evidence for a similar suite consisting of Cist 3 and a habitation room, as evidenced by the F37 profile. Adjoining it on the east is the F19 pavement and a probable cist to the east represented by the F31 rock alignment. Immediately to the south is an open and level area with the potential for an adjoining habitation room, thus forming an additional storage and residential suite.

In terms of social organization, each storage-habitation suite fulfilled the annual requirements of a nuclear family. If we consider multiple suites as being simultaneously occupied, this might be taken as evidence for an extended family living together for a period, although perhaps not continuously. Family exigencies might leave one suite vacant even while another was occupied; in fact, the size and nature of each household probably varied over time. If so, the nature of the artifact assemblage probably did, as well. The suites may have been individual household "property," although the connecting pavements might indicate stored resources were held in common. This might also apply to the extramural hearth/activity area.

An alternative scenario is that the overall alignment represents an occupational sequence of storage/habitation suites built over time that were occupied by a single household at any given time. In this scenario, the Cist 2 - Room 2 suite was constructed first. Cist 1, and subsequently the connecting pavement, were added to the storage alignment later. Room 2 burned and was abandoned. Room 1 was then constructed and modified at least once and eventually burned with a full complement of household tools on the floor. A similar scenario may account for the east segment structures.

Both scenarios result in the formation of a more-or-less continuous alignment of connected storage rooms, a sort of proto roomblock. The absence of one or more pit houses is problematic. The question of seasonal use versus year-around occupation remains open.

Episode 1 Occupational Sequence

The earliest features encountered on site include F9, F43, F48, and possibly F44. None of these remnants were fully explored but they were exposed to the north and east of the cist alignment. They originated at about the same level just beneath the surface of the roadbed and possibly were cut by the excavation of the cists. Two Basketmaker II-age radiocarbon dates on charcoal from the

F40 hearth and from the floor of Cist 2 are viewed as aberrant "old wood" but they are conceivably the result of an earlier Basketmaker II occupation. Basketmaker era dates, however, are known from other early Puebloan sites on the Grand Staircase, suggesting a possibility of earlier occupations.

Episode 2 Occupational Sequence

After a hiatus of unknown length, construction on the cist alignment commenced. The relationship between the suites is unclear, but it is assumed that the cists and residences were constructed separately but at about the same time. It seems likely that the Cist2/Room2 suite was constructed first. This was apparently followed shortly after by the construction of Cist 1/Room 1. Room 1 appears to have undergone at least one renovation. At some point, Cist 1 fell into disuse, its upper walls collapsed, and midden-like fill accumulated. A late radiocarbon date suggests the origin of this F4 deposit might have been a result of renewed occupation of the east segment.

Whether Rooms 1 and 2 were abutted by a common wall (therefore contemporary) or if Room 2 cut into the collapsed wall of Room 1 (therefore succeeding it) could not be determined. It seems reasonable to assume they were individual "suites," at least for a time. We can say with some certainty, however, that Cists 1 and 2 were in use at the same time given the connecting pavement. We cannot know, however, whether they remained operative after Room 1 and Room 2 were abandoned. The abandonment of fully functional cists in favor of constructing new ones is problematic.

The F44 surface originating at about the same level as Cist 2 is best described as appended to it, rather than cut by it. In this regard, it is similar to the connecting pavements, although what else it was appended to, if anything, could not be determined.

Episode 3 Occupational Sequence

The square corners of Cist 3 suggest a rectangular style that appears in Early Pueblo II times. This feature is associated with occupational surface F37 and its hearth, F40, which dated to about AD 690-890. Based on the relationship of the surface with Cist 3, its level of origin, the presence of a central hearth, and its size, we assume it also represents a cist-residence suite.

Extending east from Cist 3 is a pavement (F19) that abuts the F31 rock alignment. The F31 rock alignment compares well with the upper masonry walls of all three excavated cists. If this is so, the F19 pavement represents a convincing connecting surface and a continuation of the cist alignment.

Slabs removed from the lower wall of Cist 3 indicate that construction activity was taking place that postdates the use of Cist 3. Rock and slab upright alignments extend an additional 5 m to the east and there is good evidence of yet additional construction upslope. This is also the case downslope to the west of Cist 1 where uprights suggest a continuation of the alignment farther west. In all, there is evidence the alignment extended 25 m, of which about

15 m were investigated.

Future Research Recommendations

The Road Kill excavations were an exercise in describing site structure based on the remnants of key site features. They were excavated and described in anticipation that additional work would be pursued at some point in the future, either for research or additional mitigation. Overall, the established grid encompasses the excavated roomblock. Three or four additional cists would be expected, along with light structures to the front, extramural hearths, and if past experience applies, a pit house or two. Datum stakes will allow for the reestablishment of the grid system for reopening excavation units, exploratory trenching, and auger probing in the future. Road Kill is also well suited for employing remote sensing techniques to identify buried features.

This report considers Road Kill in light of other limited excavations in the Kitchen Corral drainage, such as the Park Wash site (42KA4280) and the Vermilion Cliffs Project sites (42KA2584 and 42KA2594) discussed earlier. Additional work on those sites might be considered appropriate as part of a more comprehensive program of investigating the Early Pueblo Period.

Recommendations specific to Road Kill include:

- Explore the F31 rock alignment to determine if it represents a deep storage cist/room that expands the structural alignment to the east.
- Explore the remaining deposits east of the F37 profile to determine the extent of the surface.
- Investigate the potential for a light habitation room or rooms to the south of F31.
- Investigate the possibility of one or more pit houses in the deep alluvium to the southwest.
- Determine whether there are additional cists and habitation rooms to the west of Cist 1.
- Determine the depth, nature and extent of the F13 substrate to see if it represents “pre-Anasazi alluvium” described at the Arroyo Site’s Archaic level (see McFadden 2000, 2012).

The Road Kill data would be complemented by additional investigations at the Park Wash site and others. Investigations there could include:

- Determine whether there are additional features on 42KA2584, perhaps using remote sensing techniques for subterranean pit house and storage features.
- Reopen F1 in Test Unit 8 on 42KA2594 to determine if it functioned as a storage cist (with a sealed floor) or a habitation as originally proposed.
- Additional geomorphological and alluvial studies of Kitchen Corral Wash deposits could determine the nature and tempo of down-cutting and aggrading events using

radiocarbon dating, optically simulated luminescence, thermo-luminescence, and tree-ring dating methods, expanding on the earlier work of Hereford (1986), Dernbach (1992), and Kulp (1995).

Chapter 8

Ceramics

By R. Roger McPeek

A total of 1,483 potsherds were collected from the Road Kill site (42KA4859) during the excavations described above. Each sherd was cleaned, bagged, and assigned a field specimen number, and each was labeled according to its feature number and vertical and horizontal contexts. They were then accessioned into the Archaeological Repository at Southern Utah University.

Analysis of the sherds entailed noting surface treatment and examining fresh breaks using a binocular microscope with variable 10-45X power to determine the ceramic wares and types. The classification of wares and types was based on Colton (1952) and aided by the consensus derived at the 2007 Museum of Northern Arizona Virgin Ceramic Conference (Lyneis and Hays-Gilpin 2008). This conference brought much needed clarity to the typing of Virgin Puebloan ceramics (McPeek 2025).

Classification at the ware level was of interest to determine the ratio of Shinarump Series to Tusayan Virgin Series ceramics. Tusayan White Ware and Tusayan Gray Ware, Virgin Series, are ubiquitous in the region and were produced over a broad area. Virgin Series is especially common west of Kanab Creek, whereas the percentage of Shinarump Series increases east of Kanab Creek and was likely produced in that general area.

Design styles and the degree of rim eversion on plain gray jars were noted as temporal indicators. The temporally sensitive white ware designs on the bowls and the mild degree of rim eversion on plain gray jars were generally consistent with radiocarbon dates from the site. None were useful in determining the construction history of the architectural features. While most of the assemblage is consistent with a Pueblo I designation (ca. AD 700-900), a few earlier and later sherds hint that a longer time frame might be represented.

Gray Ware

Of the five wares identified in the Virgin Puebloan region, Moapa, Shivwits and Logandale were not present at Road Kill. All plain gray ware sherds were determined to be either North Creek Gray (the undecorated, non-corrugated type of Tusayan Gray Ware, Virgin Series) or Shinarump Plain (the undecorated, non-corrugated type of Shinarump Series). The distinction between the two wares can at times be difficult, or a challenge sometimes referred to as the “Shinarump Problem” (Lyneis 1998).

Both wares are primarily tempered with quartz sand. There are, however, visual differences that can be ascribed to the higher iron content in the clay of the Shinarump Series, leading to attributes such as a very dark to purplish coloration, vitrification, and intriguing surface and subsurface red oxidation or mineral melting that is sometimes visible under magnification and even with visual inspection. Large white cement-coated quartz grains or sand aggregates are frequently visible to the naked eye on the surface of the sherd and in cross section. North Creek examples tended to be a lighter gray color without any of these attributes. In both cases, the size and angularity of the sand varied.

Of the 1,483 sherds, all but 64 were plain gray. Of the 1,419 plain gray sherds, 27% were determined to be consistent with Shinarump Plain and 73% with North Creek Gray. Some of the North Creek and Shinarump sherds contained scant amounts of what appeared to be crushed basalt. One sherd contained mica, which is a component of Snake Valley Gray, a Fremont ceramic type, although no conclusion was drawn about the origin of this sherd since basalt and various minerals occasionally find their way into the temper depending on the temper source. No corrugated sherds were observed.

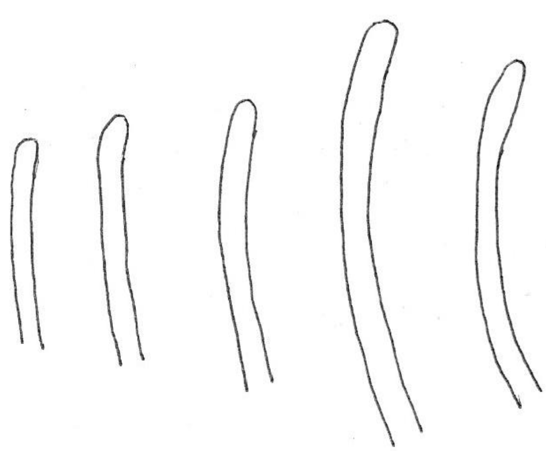

Figure 8.1: Basketmaker III through Pueblo I Jar Rims. Both Virgin Series and Shinarump Gray Ware are represented.

Fifty-five rim sherds were identified, of which two thirds were plain gray jar rims. All the jar rims showed very little rim eversion (Figure 8.1) and were a mix of North Creek Gray and Shinarump Plain. The bowl rim sherds were all Tusayan Gray or White Ware, Virgin Series. Twenty-four of the undecorated sherds had residual fugitive red on the exterior surface.

A single modified sherd in the collection had been ground to a rectangular shape and measured 1.4 by 2.5 cm. Identified as Shinarump Plain, it had apparently been fired in such a way that the exterior surface was exposed to an oxidizing atmosphere and fired red. The interior was exposed to less oxygen, or a reducing atmosphere, and it fired gray. It may have functioned as a tool, decorative item, or gaming piece. Two unmodified body sherds, both from jars, were similarly fired.

White Ware

Sixty-four of the 1483 sherds (~4%) were painted and all were classified as Tusayan White Ware, Virgin Series (Figure 8.2). No Shinarump White Ware sherds were identified in the assemblage. All the decorated sherds had a light gray paste and quartz sand temper. None were slipped. The breakdown by types is as follows:

- <u>Mesquite Black-on-gray</u> ~8% (Figure 8.2a).
- <u>Washington Black-on-gray</u> ~25% (Figure 8.2c and Figure 8.2d).
- <u>Too small for definite classification</u> ~64%, but all contained design elements consistent with Mesquite

Figure 8.2a:

Body Sherd, approx. 3x6 cm. Mesquite Black-on-gray

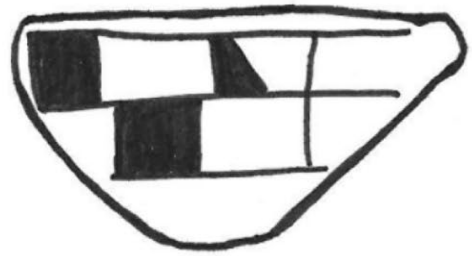

Figure 8.2b

Rim Sherd, approx. 3x5 cm. Tusayan White Ware, "Transitional" Black-on-gray (Washington to St George B/g)

Figure 8.2c

Rim Sherd, approx. 8x8 cm. Washington Black-on-gray

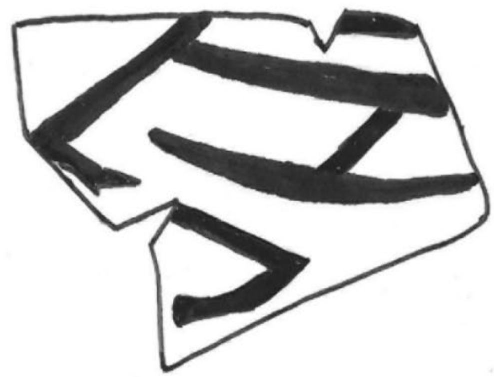

Figure. 8.2d

Body Sherd, approx. 2.5x5 cm. Washington Black-on-gray

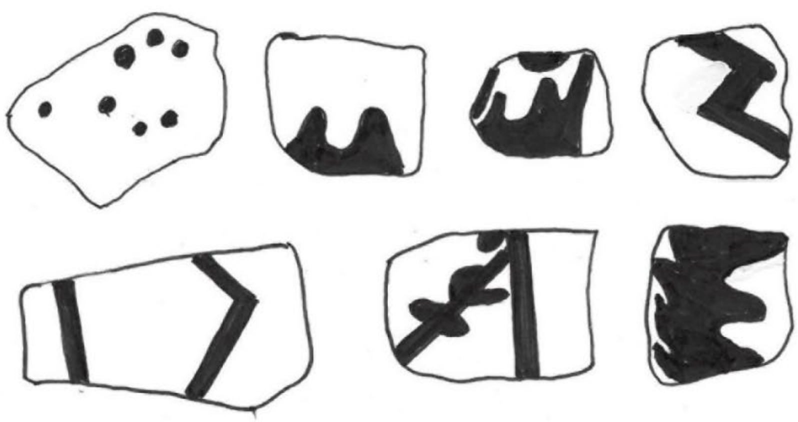

Figure 8.2e Representative small sherds with elements compatible with or suggestive of Mesquite Black-on-gray and/or Washington Black-on-gray.

Figure 8.2: Representative Painted Sherds at Road Kill site (42KA4859).

Black-on-gray or Washington Black-on-gray (Figure 8.2e).

- Transitional" (Figure 8.2b) or Other Unidentified ~3%.

Stylistically the Basketmaker III type Mesquite Black-on-gray and the Early Pueblo II type St. George Black-on-gray resemble Lino Black-on-white and Black Mesa Black-on-white of the Kayenta Series, respectively.

However, the Virgin Series Pueblo I type, Washington Black-on-gray, bears little resemblance to the Pueblo I Kayenta Series Kana-a Black-on-white (Lyneis 2008:15).

In some cases, distinguishing Mesquite Black-on-gray from Washington Black-on-gray can be problematic. Narrow 3 mm to 4 mm lines with floating dots are certainly characteristic of the former, but one might also see parallel lines with outward facing triangles and triangular forms with lobular appendages. This latter attribute can overlap with the Washington style that includes scalloped triangles, triangles with ticks, or fringes. This type also includes stepped lines, double ticked lines, and wavy and zigzag lines (Thompson 1986:351; Lyneis 2008:12).

The sherd in Figure 8.2c appears to be almost identical to ones at the Park Wash site (Perry 2000), a nearby Basketmaker III-Pueblo I site, and also to sherds at 42KA6293 (Hagopian 2013), a habitation site along Kanab Creek 2.5 miles north of Kanab. This latter site had a layout similar to Road Kill and an occupation that spanned the Basketmaker III, Pueblo I, and Early Pueblo II periods. The design in Figure 8.2c is geometric and runs along the rim with occasional areas filled in with solid squares. The Road Kill sherd also contains an incomplete square or flagging reminiscent of Washington Black-on-gray (Thompson 2004:52).

Hagopian (2013) identified the sherd at 42KA6293 as St. George Black-on-gray, whereas Perry identified the Park Wash sherd as "St. George transitional." The design elements on these sherds are more suggestive of St. George Black-on-gray than earlier Mesquite or Washington Black-on-gray, but the lines are too thin for standard St. George Black-on-gray. These sherds are not typical of the St. George Black-on-gray seen elsewhere in the Virgin Puebloan area. Perhaps the term "transitional" is appropriate.

Red Ware

As is often the case on early Virgin Puebloan sites, there were minimal red wares. Only a single small, undecorated San Juan Red Ware sherd, identified primarily by its temper, was present in the lower fill of Cist 1. It is worth noting that the initial field identification of another red ware sherd was subsequently identified as Washington Black-on-gray after cleaning (Figure 2d).

Conclusions

Ceramic cross-dating of 42KA4859 suggests a Basketmaker III-Pueblo I time frame consistent with the radiocarbon dates for the excavated features. The total lack of corrugated ceramics suggests a time frame prior to AD 1050. Minimal rim eversion on plain gray jar rims is compatible with both the Basketmaker III and Pueblo I periods.

The ratio of Mesquite Black-on-gray sherds (small) to Washington Black-on-gray sherds (high) are also consistent this these periods. No Shinarump White Ware was present on the Road Kill site. This is consistent with the absence of known Shinarump White Ware prior to Early Pueblo II times. The single true red ware sherd was San Juan Red Ware, production of which commenced during Pueblo I times. It is the earliest red ware found in the Virgin Puebloan region (Allison 2008:21; Lyneis 1999:8).

The sherds with lighter paste (North Creek Gray) outnumber the darker Shinarump Gray Ware nearly 3-to-1 overall, with a higher ratio of Shinarump on the east segment. Most rims, based on curvature, appear to represent cooking vessels rather than storage containers.

While utility wares were a mix of the North Creek Gray and locally made Shinarump Plain Gray, all painted bowls were Tusayan White Ware, Virgin Series, that were potentially imported from elsewhere. Light pastes were clearly preferred for bowls with painted designs. Jar production involved less selective clays.

The decorated sherds on the Road Kill site are strikingly similar to those on the nearby Park Wash site (42KA4280), with a preponderance of Washington Black-on-gray and a few Mesquite Black-on-gray sherds, as well as an identical St. George "transitional" design. Perry suggested that pottery was locally produced at Park Wash based on the presence of "…worked sherds, flakes, grinding tools and stored temper," the latter stored in a vessel (Perry 2000:48). It is tempting to speculate that some of the Road Kill pottery could have been produced at the Park Wash site.

All sherds recovered from the Road Kill site are cataloged below in Table 8.1, Table 8.2 and Table 8.3 by provenience and ceramic type.

Table 8.1: West Segment

Feature	North Creek Gray	Mesquite (M)/ Washington (W)	"Transitional"	Unidentified B/G	Shinarump Gray	San Juan Red Ware
Cist 1 (F26 fill)	18	1 W			2	1
F35 fill	5				3	
Floor contact	-					
Pavement (F27)	3			1	5	
Cist 2 (F8)					1	
Upper fill	4					
Floor contact	1					
Room 1 (F15)						
Upper fill	48			2	5	
Floor contact	2					
Hearth (F21)	3				1	
F20	2				5	
F28	4				1	
F33	12	1 M			2	
F34	-					
F39	-					
Room 2 (F11)	-					
Upper fill (F3)	96	3 W		4	18	
Floor contact	16	2 W			10	
F22 floor pit	10			2	8	
F25 hearth	3	1 W				
F38	8			5		
F41 fill	6	1 W			2	
F41 floor cont.		1 W				
F42 floor pit	-					
F45 bin	1					
Ex. hearth (F12)	9	1 W			1	
F3	2	2 W			2	
F5 trench	31	2M, 1W			12	
F44	7				1	
F46 occ. surface	111			5	27	
F5 0-30cm	32			3	9	
F5 30-50cm	22	2 M		1	12	
F48	5					
Grid Unit T-5	9				2	
S-7	10				-	
Q-8	9				4	
S-9	7				3	
S-6	59				13	
Q-7	8				2	
U-5	2				-	
U-7	13		1	2	5	
O-12	15			2	6	
P10	20	1 W			10	
T6	24			2	9	
S5	20	1 W			6	
U8	8	1 W			3	
P7	4					
V6	17				1	
T9	6					
T7	16				4	
S8	13				1	
T8	8			2	9	
U9	2					
Totals	**731**	**21**	**1**	**31**	**205**	**1**

Table 8.2: East Segment

Feature	North Creek Gray	Washington/ Mesquite B/G	"Transitional"	Unidentified B/G	Shinarump Gray	San Juan Red Ware
Cist 3 (F2)	-					
Upper fill	73				48	
Lower fill	14				13	
Clean up	25			1	17	
Floor contact	5				2	
Pavement (F19) 0-10cm	11				7	
10-20cm	27				13	
"Room 3" (F37)	24	1 W			22	
Hearth (F40)	6					
F31 alignment	-					
F43 fill	23			2	8	
F47 (F12 assoc.)	67			1	23	
Grid Unit H-2					1	
H-3	2				1	
H-5	6				2	
Totals, east seg.	**283**	**1 W**	**0**	**4**	**157**	

Table 8.3: No Provenience & Totals

	North Creek Gray	Washington/ Mesquite B/G	"Transitional"	Unidentified B/G	Shinarump Gray	San Juan Red Ware
No Provenance						
FS-1 cleanup	**11**			**3**	**3**	
FS -272 No prov	**15**			**3**	**13**	
Totals, all prov.	**1040**	**22**	**1**	**41**	**378**	**1**

Chapter 9
Lithic Artifacts
By Barbara W. Frank

Flaked-Stone Artifacts

Excavations at the Road Kill Site yielded a total of 413 pieces of modified and unmodified stone. Some 96 pieces, or 23% of the collection, were classified as tools. A tool was identified by the presence of intentional flaking meant to modify the shape of the object, or by the presence of use-wear marks caused by varying types of cultural manipulation. The remaining 317 pieces in the collection (77%) were classified as forms of flaking refuse and raw material. All pieces were initially classified by material type and then examined with a 20X binocular microscope for evidence of use or other cultural manipulation. Full discussions of topological divisions and waste flake classification are included in the following section, followed by a description of the lithics from each feature.

A lithic material typology was devised to evaluate possible correlations between tool categories and material types, and to examine raw material procurement strategies. The artifacts were divided into material types, including chert, petrified wood, sandstone, quartzite, and basalt. The cherts were further subdivided into types based on color and/or opaqueness, and designated types C1, C2, C3, etc. Type C1 is a local variety, as it occurs in the Chinle Formation. Sources of this material, also referred to as jasper, are exposed primarily along the base of the Vermilion Cliffs in the immediate area (Walling et al. 1986; Walling and Thompson 1986, 1988; Dalley and McFadden 1988; Frank 1997). The definitions of each of these material types are shown in Table 9.1.

The lithic tools were divided into two basic categories (Tables 9.2 and 9.3). The first group of tools were those manufactured by flaking to the desired form, which consisted of 22 artifacts (23%), while the second group of 74 pieces (77%) consisted of tools which were formed by incidental use. Projectile points, bifaces, preforms, drills, gravers, and some scrapers were included in the first category. Utilized flakes, edge pounders, cores, cobbles, and flake scrapers, pounding stones, and hammerstones comprise the second group. All tools were classified according to traditional typologies (Walling et al. 1986; Walling and Thompson 1986; Dalley and McFadden 1988; Frank 1997), and by the identification of morphological and visible functional attributes. Minerals and a single piece of turquoise are also included in this summary.

Definitions and Descriptions

Projectile points are those artifacts that have been bifacially modified to a preconceived stylistic design. These forms generally exhibit two basic elements. The first is a large blade which

Table 9.1: Lithic Material Type Definitions

C1 -	This chert material may be colored any combination of red, yellow, black, translucent gray or opaque white. The most prevalent colors are red, yellow, and translucent grays. This material type is most commonly called jasper, and there are local sources along the Vermilion Cliffs, occurring in the Chinle Formation. This was the dominant material at this site.
C2 -	This opaque variety includes grays, white, and white/gray types.
C3 -	This variety is made up of white and white/gray kinds.
C4 -	This is an opaque variety made up of pink, gray/yellow, gray/brown, pink/gray/black, pink/gray/white, and a grays/black/dark red types.
C5 -	This is an opaque deep yellow variety, which may come from the Escalante area.
C6 -	This variety of chert is made up a white/gray/pink kind.
C7 -	This variety of chert is made up of a grays/black type.
B -	This designation is made up of gray fine- grained and black vesicular basalt. These materials would have been available in volcanic outcrops surrounding the project area.
IO -	This designation refers to a dense heavy deep red to red-brown material composed of iron ore.
LS -	This material is a fine-grained gray or tan, lithographic limestone which is sufficiently silicified to exhibit a conchoidal fracture. It is much softer than the available chert materials, and it was not used for tools requiring elaborate knapping. This material is available in the local Quaternary gravels.
PW -	This material is a fine to coarse grained petrified wood, primarily white and brown in color, but also including black, red, and orange. It is found locally within both the Shinarump and Petrified Forest Members of the Chinle Formation.
Q -	Quartzite is found in the form of cobbles throughout the local Quaternary gravels. It varies widely in color, including gray, brown, yellow, and purple varieties. Quartzite cobbles would have been locally available in alluvial deposits.
SS -	This designation refers to fine- to coarse-grained sandstone, varying widely in color and composition. This material is locally available.
T-	Travertine is a limestone formed around mineral springs, and it is a white, tan, and/or cream in color. Artifacts made of this material have been found in the Virgin Puebloan region.

is the piercing portion of the implement; the second is a hafting element which takes the form of a basal stem or modification of the blade base. The two major forms of projectile points are dart points and arrow points. These are distinguished largely on the basis of size and stylistic differences. Arrow points, in addition, can be distinguished by the presence of pressure retouch flaking, low edge-angle range, and their relative thinness. The noted difference between dart points and arrow points, however, does not necessarily imply that they do

Table 9.2: Modified Flaked Stone Tool Summary.

Tool	Complete	Fragment
Rose Spring Corner-notched arrow point	3	0
Parowan Basal-notched arrow point	3	0
Basal-notched, straight stemmed arrow point	2	0
Straight stemmed, shouldered arrow point	1	0
Corner-notched, stemmed arrow point	1	0
Footed stem, shouldered arrow point	0	1
Arrow point stem	0	1
Arrow point blade	0	1
Biface	1	0
Biface tip	0	2
Biface fragment	0	1
Hafted graver	2	0
Graver	1	0
Scraper	1	0
Eccentric	1	0

not overlap.

Six diagnostic arrow points, three Rose Spring Corner-notched and three

Parowan Basal-notched, were found at this site. In addition, there were seven indeterminate points: two basal-notched, one corner-notched stemmed, one straight-stemmed shouldered example, and two stemmed base fragments and an arrow point blade fragment.

Rose Spring Corner-notched points, part of the Rosegate Series, are generally slender with parallel side or expanding stems. The Rose Spring variant is apparently the earliest arrow point in the region, dating from ca. AD 300-500 through AD 950, and in the Grand Staircase region they are associated with Basketmaker III and Pueblo I occupations (Holmer and Weder 1980; Walling et al. 1986). Three Rose Spring Corner-notched arrow points were distinguished in the lithic collection from this site (Table 9.4).

Parowan Basal-notched points generally assume the form of a narrow, equilateral triangle. Two notches are flaked in the straight base to form a small stem. The notches may be either parallel sided or rounded, but they are generally parallel to the long axis of the point (Holmer and Weder 1980). On the Colorado Plateau and in the Virgin Anasazi region, this type dates between AD 950 and 1150, and within the Virgin Anasazi area they are the predominant type during the Pueblo II period (Holmer and Weder 1980; Walling et al. 1986). Three Parowan Basal-notched projectile points were recovered from this site. All three were constructed of locally available C1 chert. Two are complete specimens and one is fragmentary (see Table 9.4).

Four non-diagnostic arrow points and three fragments were recovered from this site. The generally complete

Table 9.3: Unmodified Tools, Raw Materials, & Minerals.

Tool	Count
Pounding Stone	1
Pounding Stone/Abrading Stone	1
Cobble Scrapers	4
Cobble Scraper/Edge Grinder	1
Flake Scrapers	5
Core Scrapers	3
Utilized Flakes	59
Raw Material	3
Minerals	4
Turquoise	1

Table 9.4: Diagnostic Arrow Points

Rose Spring Corner-Notched Arrow Points			
Provenience	**Material**	**Dimensions (length x width x thickness in cm)**	**Characteristics**
M13 Surface of road	Type C1 chert	2.12 x 1.18 (shoulders) .07-.21	Straight stem with extending shoulder tangs, one broken off. Tip broken off, bifacially worked and thinned, with exterior flake surface partially extant. Unifacial and bifacial use wear along the laterals, and unifacial use wear at the tip.
T9 0-10 cm	Type C2 chert	2.16 x 1.16 (tang & shoulders) .03-.31	Straight stem with slightly extending shoulder tangs, primarily on one side. Shoulders slightly offset on convergent laterals. Impact fracture at the tip, bifacially worked and thinned. Minimal unifacial use wear along blade lateral with no associated tang
3 m above road cut E side of road, 50 m No of 42KA4859	Type C1 chert	2.21 x 1.3 (shoulders) .02-.37	Straight stem with extending tangs, tip is missing, bifacially worked and thinned, interior surface extant, unifacial and bifacial use wear along the whole length of the laterals, and unifacial use wear at the tip
Parowan Basalt-Notched Arrow Points			
Provenience	**Material**	**Dimensions (length x width x thickness in cm)**	**Characteristics**
Unit S6 (high F15 fill?) 10-20 cm	Type C1 chert	2.97 x 1.25 (tangs) .01-.36	Long triangular blade, convergent and slightly serrate laterals. Extending tangs same length as short straight stem. Bifacial retouch along the laterals.
U8? 0-10 cm	Type C1 chert	2.9 x 1.35 (tangs), .01-.28	Complete specimen, short extending tangs, not as long as the small straight stem. Flake curvature extant, and interior surface retouched along the edges, with face intact. Some unifacial use wear along the laterals, and edge rounding at the tip and on associated laterals
F12W/in F47 M12 Grid 7 cm deep	Type C1 chert	3.31 x .95 (shoulders) > .01-.22	Partial specimen, one basal notch and extending tang extant, with a triangular blade and convergent laterals

specimens include two basal-notched stemmed specimens, a shouldered, stra ight stemmed example, and a corner-notched, stemmed tool. The arrow point fragments consisted of two basal portions and one blade element. The basal examples include a corner-notched, stemmed element, and a footed stem fragment (see Table 9.5 for details)

Table 9.5: Non-Diagnostic Arrow Points

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
F2 J2-J3 Grid 0-20 cm	Basal-notched, straight stem; Type C1 chert	1.57 x 1.88 (shoulders/tangs), .01-.09	A flake with bifacial retouch along the laterals, with impact fracture at the tip. Asymmetrical triangular blade with convergent laterals. Slight flake curvature and original flake faces extant. Small straight stem with slight basal/corner-notching and extending tangs.
F8 fill Q4 0-10 cm	Basal-notched, straight stem; Type C1 chert	1.75 x 1.16 (shoulders/tangs), .01-.28	Irregularly shaped tool. Irregular blade laterals, one generally convergent, and one with a concave irregularity. Basal notched with an extending straight stem and extending tangs. Bifacially worked but not completely thinned.
F38 fill	Straight stemmed, shouldered; Type C4 chert	4.68 x .8 (shoulders), .01-.17	Complete tool, lacking the blade tip and a basal stem corner. Bifacially worked and thinned, with bifacial retouch along the convergent laterals of the thin triangular blade. Short angled shoulders and a short straight stem.
F11 fill, F8 Grid 0-10 cm	Corner-notched, straight stemmed; Type C1 chert	2.42 x 1.35 (shoulders), .05-.23	A largely complete, bifacially worked and thinned tool. The blade tip and straight stem base have broken off. Slight corner notching and slightly tanged shoulders. Triangular blade with convergent laterals.
Q7 0-10 cm	Shouldered, footed basal stem fragment; Type C1 chert	2.15 x 1.22 (shoulders), .05-.36	Crudely worked lower blade and stem element. Upwardly angled shoulders with no tangs. Triangular blade with one convergent and one straightly convergent lateral. Unifacial retouch along the blade laterals. Extended and small footed base.
F8 fill P3 & P4 units, Level I	Stemmed arrow point base fragment; Type C1 chert	1.52 x .96 (shoulders), .04-.26	Small lower blade and stem element. Blade has straightly convergent laterals and straight shoulders. A slightly expanding straight stem. Bifacially worked and generally thinned.
F11 0-10 cm	Projectile point blade; Type C1 chert	2.94 x 1.19, .01-.24	About 3/4s of a triangular blade element. Bifacially worked and thinned. Broken diagonally across the lower blade.

Bifaces are those artifacts which exhibit hard hammer, soft hammer, and pressure flaking on both surfaces of flakes that have, in most instances, been struck from prepared cores. One complete biface, two biface tip fragments, and a bifacially worked lateral edge fragment were distinguished.

The complete biface was constructed of

heat-treated type C1 chert, and it was recovered from the N ½ of the F22 fill. It was lanceolate shaped with slightly excurvate laterals, and a short straight stem element forming slightly sloping shoulders. It measured 3.27 cm long by a maximum of 1.12 cm wide along the blade, and from .07 to .52 cm thick. This tool was bifacially worked, but not completely thinned. The laterals exhibited a minimal amount of unifacial use wear near the tip.

Two wider biface tips comprised of type C2 chert were recovered from this site. The first was primarily worked on the exterior flake surface, with unifacial flaking along the flake margins on the interior surface. It exhibits one excurvate and one convergent lateral, and a flat tip. The laterals exhibit bifacial retouch and a little unifacial use wear on both near the break. Incomplete, it measured 1.08 cm long by a maximum of .9 cm wide, and from .02 to .19 cm thick. It was recovered from the F37 "floor" hearth F40 fill, Grid 7 & 8. The second tip fragment was recovered from F46/P11 Grid, 0-5 cm. It had an acute tip, with one convergent and one excurvate lateral. The exterior surface had been completely worked, and the interior was only minimally modified, similar to the previously described tip fragment. Both laterals exhibited unifacial use wear on opposite surfaces, with more wear evident on the convergent lateral. Incomplete, it measured 1.4 cm long by a maximum of 1.16 cm wide, and from .01 to .13 cm thick.

The final bifacially worked artifact was a thin sliver of a type C1 chert specimen. It measured 1.45 cm long by .41 cm wide and .35 cm thick, and it was recovered from F11 fill, Q6 Grid, 0-10 cm.

Gravers are generally simple flake tools that take the form of a small, naturally formed projection that has been unifacially or bifacially retouched and used in either a rotary or linear motion. Two hafted, projectile point-shaped gravers and one flake graver were recovered.

The first hafted graver had the morphology of a small, generally corner-notched, straight-stemmed, slightly shoulder tanged specimen and it was type C2 chert. It had a short, wide blade element with one convergent lateral forming a utilized tip. Heavy unifacial use wear was evident along the laterals on the same surface, along with some edge rounding at the tip. It measured 1.26 cm long by 1.03 cm wide at the shoulder tangs, and from .04 to .22 cm thick. It was recovered from O 12, 0-5 cm. The second hafted graver was constricted of type C1 chert, and it was recovered from Grid S7(?), 10-20 cm. Morphologically it resembled a small basal-notched projectile point with a short straight stem and an asymmetrical tip adjacent to a convergent lateral. The tool had been minimally bifacially worked but displayed both unifacial and bifacial use wear along the tip, as well as some unifacial use wear along the lower laterals. It measured 2.97 cm long by 1.25 cm wide at the shoulder tangs, and from .01 to .36 cm thick.

A large secondary type C3 chert flake exhibited unifacial work on the dorsal surface forming a 45º edge lateral leading up to a natural projection which was used as a graver. The projection has unifacial use wear along the associated laterals, which extends down the worked edge. It also exhibits edge rounding and some unifacial use wear along the tip. It was recovered from U7, 0-10 cm, and it measured 5.17 cm long by 2.84 cm wide and 1.42 cm thick.

A ***scraper*** is defined as a flake that has had one or more edges modified by unifacial or bifacial pressure retouch, to achieve a steep edge angle. Either use retouch and/or polish may be present along the edge. One broken interior type C1 chert flake scraper was recovered from the F19 slab surface. It exhibited both unifacial and bifacial work along the use edges. The use edges displayed heavy unifacial and bifacial use wear, as well as some crushing along two contiguous steep-to-acute edges. It measured 3.51 cm long by 3.06 cm wide and a maximum of 1.56 cm thick.

One ***eccentric*** artifact resembles morphologically a projectile point in that it has a stem, and it has been notched. It is made of a polished piece of heat-treated Type C2 chert. The elongated, generally triangular 5 cm long upper blade has two sets of crude notches along its margins on its upper half. The entire artifact measures 5.64 cm long. The off-center, irregular, generally straight stem element was formed by unifacial retouch along the laterals on opposite surfaces. The blade itself ranges from 1.01 cm wide at the blunted tip to 2.06 cm wide at the generally straight shoulders. The notches along the upper 2.5 cm of the blade have also been formed by unifacial flaking on the opposite surfaces of each side. The upper set were slightly concave and the lower two were more angular. The entire artifact appears to have been polished, including the rounded lateral edges, and then the notches and stem were formed by unifacial retouch.

Pounding stones are usually small, hand-held cobbles or cobble fragments. In general, it is their more sporadic use pattern on the utilized stone that distinguishes them from true hammerstones. They were probably used for the same purposes as hammerstones including pounding and crushing hard materials, or for the crushing of pigments, ceramic temper, or minerals.

Two pounding stones, both of cylindrical pieces of sandstone, were distinguished in the collection from this site. The one recovered from the west end of F8 under slabs, Level 1-2 contact, was a palm-sized cylindrically shaped stone, slightly bulbous at one end, which had been ground around most of the surface. The ends had been pounded. It measured 6.05 cm long by 4.81 cm wide and 4.51 cm thick. The second tool was generally similar to the previously discussed tool in that it was a wide cylindrical tool which exhibited pounding at the ends, although the wide end displayed heavier use. Both ends had been pecked and pounded, and the body had been abraded with two smoothly ground surfaces suggesting some use as an abrading stone. It measured 7.43 cm long by 8.5 cm wide and a maximum of 6.3 cm thick. It was recovered from F22 N ½ fill, sherds on top of ground stone.

Cobble and core scrapers are fairly large, hand-held artifacts that were used as crude scrapers. Some of these artifacts exhibit rough, hard-hammer flaking, both unifacial and bifacial, used to form the working edge, while others simply reflect use of a fortuitous edge. The flake scrapers are simply unmodified flakes that have been used as scrapers without any distinguishable modification.

Five cobble scrapers, five flake scrapers

Table 9.6: Cobble, Core & Flake Scrapers

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
Cobble Scrapers			
F5 South 1x1 m to So. of F6 Grid R7, Surface	IO	7.45 x 7.73 5.06	Unmodified, moderately used cobble fragment. Broken edges used.
F11 in Q8, Floor Contact	Q	5.66 x 10.58 5.31	Cobble mid-section fragment. Broken 45° edge moderately used. Originally part of an abrading stone.
F19 Floor Contact (SE corner)	Q	9.41 x 10.81 3.72	Cobble lateral fragment, minimal use along a broken, convex 45° edge.
T8 10-20 cm	Q	7.24 x 5.96 4.85	Smaller cobble fragment, a few flakes removed to form 60-90° use edge.
O12 Unit 0-5 cm	Q	9.56 x 7.92 3.32	Hand sized cobble fragment used as a scraper along a 45-60° straight edge. Also used as an edge grinder along a shorter edge. Associated cortex with both use edges shows evidence of abrasion.
Core Scrapers			
F36, F26	C3	4.42 x 4.54 2.01	Uni-directional core remnant, used along steep 45-90° edges.
T7 0-10 cm	C1	4.75 x 4.57 3.33	Multi-directional core remnant, minimal use along three steep edges.
T8 10-20 cm	C1	3.03 x 2.73 2.49	Small core remnant, unifacial use wear and crushing along a 90° edge.
Flake Scrapers			
Initial cleaning W side of road, Surface	Q	5.9 x 5.2 2.9	Flake or fragment. Moderate unifacial use wear along a 30° edge.
F2, J2-J3, 20-30 cm	Q	6.74 x 4.77 2.18	Larger primary flake. A broken, acute edge exhibits some use.
F2 Clay floor	Q	4.95 x 8.08 1.4	Primary flake. Acute edge with minimal unifacial use wear and abrasion along associated cortex surface.
F44 fill	Q	6.05 x 8.87 2.31	Flake with hard hammer flaking extant along much of the edge forming 45-80° use edge. Associated cortex surface also smoothly abraded.
F44, Q2 unit, 0-10 cm	Q	7.53 x 7.28 1.62	Broken flake or fragment. Scalloped, convex use edge. Associated cortex surface smoothly abraded.

and three core scrapers were recovered from this site, and relevant information concerning each tool is summarized in Table 9.6. Nine of these 13 tools were quartzite, while the core scrapers were comprised of chert varieties, and one cobble scraper was iron ore. Eleven of the tools were made of locally available materials, quartzite, and type C1 chert, in line with their generally expedient nature. In addition, one cobble scraper had been suitable for further manufacturing been used as an edge grinder, and one was originally part of an abrading stone.

Utilized flakes are principally flakes which have been struck from cores and were either not purposes or suitable for further manufacturing purposes or were struck for incidental usage. These flakes exhibit use wear along one or more edges, suggesting that they were used for cutting hard materials such as bone or wood. Additional forms of use wear including bifacial retouch, crushing, edge grinding and rounding, and wear polish.

A total of 59 utilized flakes were distinguished within the lithic collection from this site. Most of them (n=52) were composed of the locally available type C1 chert, four were type C2 chert, and the remaining three were made of type C4 chert, petrified wood, and quartzite. Most of the type C1 chert tools consisted of secondary flakes (n=24) and broken interior flakes (n=23). Overall, most of these tools (n=44) exhibited unifacial use wear along acute to steep edges. Eight had both unifacial and bifacial use wear, six were used as gravers, and one was used as a scraper.

In general, lithic waste materials (debitage) dominate recovered artifacts from Virgin Puebloan sites. The debris includes biface flakes, core flakes, core shatter flakes, and unidentified flakes. The two former categories of debitage include those flakes with identifiable striking platforms, while the latter two categories lack these distinctive features.

Primary flakes are those that are removed during initial core reduction and preparation activities, and exhibit cortex on the dorsal surface. The striking platforms are unfaceted, and occasionally the dorsal surfaces are partially faceted from prior flake removal and/or core preparation. Secondary flakes are those that are removed from a core. They exhibit unfaceted platforms and they often show high platform angles. These flakes may exhibit cortex or faceted dorsal surfaces from prior flake removal and/or core preparation.

Tertiary flakes are defined as those removed during the manufacture of bifacially modified artifacts. These flakes exhibit faceted striking platforms with an acute angle on the dorsal surface. The platform may also exhibit a lip on the ventral side, and edge grinding, developed during the preparation for flake removal, along the platform edge. The dorsal surface of these flakes is also faceted from prior flake removal. Core shatter flakes are those angular pieces of stone which are removed during core reduction. Broken interior flakes are pieces of debitage that are lacking any identifiable platform. The majority of these flakes are interior flakes exhibiting faceted dorsal surfaces from prior flake removal.

A total of 316 pieces of lithic debitage were recovered from this site in almost all contexts. Slightly more than half of the debris (n=171, 54%) was comprised of type C1 chert, followed by quartzite (n=114, 36%), both locally available. The remaining collection consisted of type C3 chert with 15 (5%), type C2 chert with 7 (2%), type C4 chert with 5 (1.5%), type C5 chert with 2 (0.6%), and types C6 and C7 chert with one flake each (0.3 %).

In terms of flaking stages, secondary and broken interior flakes made up 32% (n=106) and 36% (n=113) of the collection, followed by core shatter flakes at 15.5% (n=49) and tertiary flakes at 11% (36). Only 4% (n=12) of the collection is composed of primary flakes, and 11 of these were made of locally available type C1 chert and quartzite.

Raw material consisted of a small hand-sized piece of type C7 chert recovered from F11, O5 Grid, Floor Contact, extreme corner. Two tabular pieces of iron ore were collected from this site. The cortex surfaces are smooth, but no actual abrasion was noted. One was from Unit S6-20 cm to F15 surface (or F13 natural grid), and one was from U9, 0-10 cm.

Four minerals, pieces of pigmented stone, and an unmodified fragment of turquoise were found at the site. The turquoise fragment, which measured .74 cm by .62 cm and 0.25 cm thick, was recovered from F11 fill P7 Grid, 0-10 cm. This fragment is mostly matrix material, and the turquoise itself is blue-green in color that is different from that which makes up the pendant (see Ground Stone section).

The four mineral/stone fragments include two pieces of pigmented sandstone. One was a small blueish piece of sandstone, which had been ground flat and smooth on one surface. It measured .48 cm long by .28 cm wide and .05 cm thick, and it was recovered from F11, Q7. The second piece was a dull green segment which appears to have broken off of a larger piece. One surface has been smoothly abraded, and it measured .42 cm long by .26 cm wide and .01 cm thick. It was recovered from the E ½ of F26, F35 fill.

The third specimen consisted of tiny malachite fragments in a matrix of loose sand. The sample was collected from F11 fill, F8 Grid, 0-10 cm. The final mineral was generally yellow and was found in a sandstone/silt matrix. The small pebble had been ground flat and smooth on one surface. It measured 1 cm by .89 cm, and it was recovered from F35 fill in F26.

In summary, this small site contains a wide variety of flaked-stone lithic tools, although in limited numbers, which reflects the limited area of excavation in association with the structural/storage units.

Ground Stone Tools

A total of 122 pieces of ground stone, ground stone fragments, and miscellaneous stone artifacts were recovered from excavations at the Road Kill Site. The artifacts were categorized into types based on each specimen's morphological and technological attributes. These attributes were identified through macroscopic examination, low-power magnification, and use of a 20X binocular microscope. In addition, artifact classification and

Table 9.7: Ground Stone Tools

Tool Types	Complete	Fragment
Metates-Basin	1	4
Grinding Slabs	0	1
Manos	3	6
Abrading Stones	10	8
Polishing Stones	3	1
Mauls	2	1
Edge Grinders	43	1
Disks	2	2
Modified Stones	3	0
Spheres	2	0
Ground Stone Fragments	0	5
Pipe	1	0
Bead Blank	1	0
Bead Fragment	0	1
Pendant	1	0
Miscellaneous	3	0

description were directed by the typology devised by Woodbury (1954). Principle artifact types (Table 9.7) include metates, a grinding platform, manos, mauls, abrading tools, polishing stones, edge grinders, modified stone, and other miscellaneous categories (see Table 9.1 for ground stone material type definitions). A full discussion of topological divisions is included in the following section, along with descriptions of the recovered ground stone artifacts.

Metates. Trough and basin metates are defined as stone slabs on which food materials have been ground in a back-and-forth motion, which in turn forms an ovoid to rectangular basin or trough in the surface of the stone. The utilized stone is frequently modified by pecking or grinding, while the grinding area is initially prepared by pecking to form an abrasive use surface. Once the basin has been ground smooth, it is re-pecked to maintain its abrasive qualities. A trough metate differs from an enclosed basin metate, as the trough is open or adjacent to one end of the utilized slab.

One complete basin/trough metate and four fragments were recovered from this site. The one complete specimen was collected from the surface of F18. It was a large open-ended basin metate, which has been extensively modified. It is 48 cm long by 38 cm wide and 6 cm thick. The well-developed basin averaged 23 cm wide, and it appears to have been constructed of local sandstone.

The four metate fragments were all made of sandstone, and three represent portions of open-ended basin metates (Figure 9.1). One "no provenience" artifact was the corner fragment of an open-ended basin, part of a tabular metate. The extant lateral edge had been pecked and abraded, and it measured 14.7 cm long by 17.2 cm wide, and was 3.13 cm thick. The second no provenience fragment was a small portion of an open-ended basin. It was 14.75 cm long, 13.2 cm wide, and 6.1 cm thick, and it exhibited evidence of pecking and grinding. The third fragment was a portion of the lateral edge and a piece of the use-basin of a larger metate. It had been modified on the use-surface by pecking and grinding, but much of the artifact is covered with calcium carbonate. It measured 14.5 cm long, 17.1 cm wide, and 3.35 cm thick, and the basin was a maximum of 0.6 cm deep. It was recovered from F19 lower fill to 10 cm above remnant on/in roof fall (10 cm-floor). The final metate fragment was incorporated into the construction of P16, and it was the largest of the fragments. It consisted of the lower corner and a well-defined use basin, with an intact, modified lateral edge. The deep basin portion had been pecked and smoothly ground, and it was quite thin toward the central portion where it appears to have broken through. It measured 23.5 cm long and 21 cm wide, and from 1.1 to 5.9 cm thick; the basin was a maximum of 5.2 cm deep.

Grinding Slabs. Grinding slabs are defined as tabular rocks which exhibit grinding on a surface but lack the pecking and re-pecking which forms the abrasive trough on metates. Consequently, a well-defined basin rarely forms on the use-surface, although occasionally a slight concavity may exist. Grinding slabs are also distinguished by their relative thinness and more complete utilization of the upper surface. The lack of pecking in the use area suggests that a less abrasive surface was desired, possibly for crushing softer materials.

One grinding platform fragment was recovered from F15 floor contact, SW of F28. It was composed of a tabular piece of sandstone, and both surfaces have been ground. It measured 8.2 cm by 9 cm and 3.95 cm thick.

Manos. Manos are generally tabular pieces of stone which are held in the hand(s) and used in a reciprocal motion on a processing/preparation platform, such as a metate or grinding slab. They are used for processing plants, other food materials, and minerals. Manos are either one- or two-handed, modified or unmodified tabular stones or cobbles, which have been either unifacially or bifacially used. Modification generally refers to the shape of the stone, including rough unifacial and bifacial hard-hammer flaking, pecking and/or abrading along the lateral and end margins. Occasionally, notches were pecked along the laterals to aid in holding the stone. For most of the specimens, the use surface was initially pecked so that it was abrasive. Re-pecking also occurs on some specimens to maintain the abrasive surface after continued use has ground the surface smooth. Naturally coarse or vesicular stones, such as sandstone, basalt, or diorite, were also generally used to minimize the need for continual use modification.

Figure 9.1: View of large trough metate in Room 1 (in situ). Stone maul is in the background.

Table 9.8: Mano Fragments

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
U 7 0-10 cm	B	16.25 x 9.4 5.25	About 3/4s of the original tool. One or two hand, modified, unifacial. Finger grooves along the laterals, pecked and abraded.
F2 clean up, K3 Grid	SS	10.6 x 8.6 6.2	End portion, about half of the original tool. One or two hand, modified, unifacial, leading-following (L-F) laterals, flat use surface.
F11 Floor, O7 Grid, floor contact	SS	8.81 x 11.01 3.72	End portion, about half of the original tool. One or two hand, modified, unifacial, L-F laterals. Also used as is, as a one hand tool.
Exp. of F46 & F47 exploratory units, Grid O11 0-52 cm	SS	10.51 x 8.78 2.63	End portion, about half of the original tool. One hand, modified, unifacial, L-F laterals, flat use surface.
Grid P10, road surface-10 cm	SS	11.4 x 8.49 2.27	End portion, about half of the original tool. One hand, modified, unifacial, L-F laterals, flat use surface.
H5 Grid, outside/south of F19, 10-20 cm	SS	9.53 x 3.98 2.1	Fragment of an end portion. Minimally modified, unifacial.

Further, the use of a particular form of mano on basin metates and/or grinding slabs tends to form specific and associated wear patterns. In general, use on a flat surface produces a flat use surface on the mano, while use within a basin often causes beveling of the ends. End-to-end beveling more frequently occurs on larger, tabular manos, as the smaller cobbles fit within the basins and beveling does not occur.

Three manos and six mano fragments were recovered from this site. The complete manos include two of sandstone and one made of a quartzite/sandstone material. The latter was a one hand, cobble tool which had been minimally modified and used unifacially. It measured 13.25 cm long by 9.2 cm wide and 4.24 cm thick. It was recovered from the N8 road surface. The second specimen is a large two-hand, heavy mano which had been completely modified by pecking and abrading. The ends have been heavily battered. The use-surface is generally flat, and it measures 17.3 cm long by 10 cm wide and 4.8 cm thick. It was recovered from F28, as was the next tool. The final tool was composed of a cobble half which has been completely modified and bifacially used. The lateral and use surfaces have been pecked and abraded, and the use surfaces have been ground flat. It was a one-hand tool, and it measured 13.5 cm long by 6.26 cm wide and 4.67 cm thick. The six fragments represented primarily unifacially used tools, with five made of sandstone and one of basalt. Table 9.8 summarizes the data collected on these tools.

Abrading Stones. These artifacts are made of abrasive stones, which are worn due to their use on a variety of materials. They may have been used for shaping wood or bone, or for smoothing stone objects such as axes, mauls, metates, manos, or even building stone. In general, three classes of abrading stone - unifacial, bifacial, and multi-facial are observed.

A total of 10 complete specimens and eight fragments comprise the abrading stones recovered from this site. Sixteen were made of quartzite and two, one

Table 9.9: Abrading Stones

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
Initial cleaning, W side of road, Surface	Q	8.3 x 5.4 3.31	Cobble, one hand, unifacial.
F2 J2-J3 Grid, floor fill	Q	5.64 x 4.11	Smaller pebble, one hand, unifacial, minimally modified, leading-following (L-F) laterals.
F2 J2-J3 Grid, floor fill	Q	7.04 x 4.73 2.52	Larger pebble, one hand, unifacial, minimally modified.
F11 in Q8, floor contact	Q	12.6 x 9.4 3.39	Cobble, one hand, unifacial, modified.
F26 floor contact, 5 cm +/-	Q	11.3 x 8.97 8.31	Cobble, one hand, heavy, unifacial.
S9 Grid 0-10 cm	Q	7.96 x 4.44 3.59	Cobble, one hand, unifacial. One end used as a pounding stone.
U6 10-20 cm	Q	7.89 x 4.94 2.52	Cobble, one hand, unifacial. Pounding on one end corner.
U6 10-20 cm	Q	7.52 x 5.81 3.18	Cobble, one hand, unifacial. Pounding on one end corner.
F46 exp. unit, Q11 Grid, road surface	Q	2.56 x 2.14 1.92	Small pebble, unifacial. Pounding on one end corner.
F46 exp. unit Q10 Grid, road-10 cm	SS	15.5 x 6.75 5.13	Irregular rectangle, one hand, unifacial, used both lengthwise and widthwise, minimally modified.

complete tool and one fragment, were made of sandstone. All the tools were unifacially used, and half of the complete and fragmentary specimens exhibited some evidence of modification. All complete tools were also one-handed tools (Table 9.9 and Table 9.10).

Polishing Stones. Woodbury (1954:96-

Table 9.10: Abrading Stone Fragments

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
F5 0-10 cm	SS	3.86 x 5.23 2.77	Mid-section, one hand, unifacial, modified.
F15 floor contact, SW of F28	Q	10.2 x 9.6 6.84	End portion, one hand, heavy, unifacial, modified.
F11 floor contact	Q	8.31 x 8.56 5.12	Lateral fragment, unifacial.
F22 N ½ fill (see "B" on profile	Q	10 x 9.1 5.29	End portion, half of original tool, unifacial, modified.
T8 0-10 cm	Q	7.74 x 7.91 6.59	Cobble end portion, unifacial. Broken edge used as an edge grinder.
U9 0-10 cm	Q	8.25 x 4.97 5.34	Cobble end portion, unifacial. Pounding on one end corner.
U7 Grid , 10-20 cm	Q	4.83 x 2.72 2.36	Cobble corner fragment, unifacial, minimally modified.
T9 10-20 cm	Q	2.87 x 5.96 2.92	Cobble lateral fragment, unifacial.

Table 9.11: Polishing Stone & Fragments

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
F11 fill Q6 Grid 0-10 cm	Q	2.11 x 1.77 1.23	Small pebble. Flat and smoothly abraded use surface.
F8 fill in F5, 10-20 cm	Q	2.4 x 1.76 1.09	Small pebble. Flat and smoothly abraded use surface.
F2 Upper fill	Q	2.53 x 1.97 1.34	Small pebble. Surface on lateral smoothly abraded.
F2 (J2-J3), 0-20 cm	Q	2.69 x 4.97 2.18	Half of pebble. Use surface flat and smoothly abraded, leading-following laterals.

97) defines these artifacts as generally small, water-worn stones with one or more nearly flat use surfaces which exhibit fine striations or are highly polished. These stones are usually unmodified, and the use motion appears to be perpendicular to their lengths. They are frequently composed of quartzite, and they ma y have been used to smooth pottery, clay floors, or to grind pigments.

Three polishing pebbles and one polishing stone fragment, all composed of quartzite, were recovered from this site. The complete tools were all small finger-held tools that exhibited flat and smooth use surfaces. They were all unmodified and unifacially used. See Table 9.11 for a summary of these artifacts.

Figure 9.2: Maul (in situ) in Cist 1.

Mauls. Two mauls and one maul fragment were recovered during the excavations at the Road Kill site (Figure 9.2). The first specimen was a large handheld sandstone cobble, which may have originally been used as an abrading stone. A pecked and partially ground groove ranging from 1.8 to 2.3 cm wide and about .3 cm deep was extant around the tool. The utilized end made up about two-thirds of the tool, and one edge had been pecked/pounded flat. The overall tool measured 11.6 cm long by a maximum of 9.9 cm wide and 7.71 cm thick. It was recovered from the F11 north wall floor contact.

The second largely complete tool was broken on the use-end, and it was made of sandstone. It was recovered from F26 resting on top of F36 in F35. The pecked and smoothly abraded encircling groove measured an average of 1.9 cm wide and .5 cm deep, and the overall tool measured 12.7 cm long by 9.63 to 10.11 cm wide. The butt end narrows, although it is generally quite heavy, and it has been completely ground. The extant portion of the use end exhibits heavy use, in the form of battering, and it appears that it may have broken a few times. Overall, this was a well-used tool.

The final maul fragment was also composed of sandstone, and it was recovered from T8. The original tool had broken lengthwise, and most of the butt end has split off. The intact surfaces of the tool had been pecked and abraded, although not completely smoothly ground. The use end is wider than the butt, and the extant laterals have also been pecked and ground. The encircling groove has been pecked and smoothly ground, and it is narrower than either end. It measures from 1.3 to 7.8 cm wide, while the overall tool measures 14.1 cm long by 5.8 to 8.8 cm wide, and 5.77 cm thick. The ends were somewhat squarish in shape, and the use end appears to have been wider than the butt.

Edge Grinders. Edge grinders are generally cobbles and cobble fragments small enough to be held in the hand that exhibit a distinctly flattened edge created by purposeful grinding. The nature of the ground edge indicates that these tools were used on a flat, abrasive surface, probably a grinding platform. These artifacts could have been used for processing seeds and grinding pigments and/or pottery temper.

A total of 43 edge grinders and one edge grinder fragment were recovered from excavations at the Road Kill site (Table 9.12), making it the most prevalent ground stone tool type. Three of these tools were flakes, while the remainder were composed of cobble fragments. One had also been used as an edge pounder, and one exhibited additional use as a cobble scraper. In addition, 17 quartzite flakes removed during edge grinding tool use, were found at this site.

Spheres. One sphere and one natural concretion were recovered. The sphere was composed of quartzite, and it was recovered from Grid H2 prior to F19 definition. It was a largely unmodified palm-sized pebble. It appears to have been smoothly abraded, and it measured 4.32 cm by 3.98 cm and 3.12 cm thick. The natural sandstone concretion may have been abraded, but it was not particularly evident. It was recovered from the F2 clean-up in K3 Grid (surface?), and it measured 1.8 cm by 1.92 cm and 1.35 cm thick.

Ground Stone Fragments. Five ground stone fragments were found here. They were all composed of sandstone, and information on these artifacts is summarized in Table 9.13 above. Three had been unifacially ground and two had been bifacially ground. One appears to have been part of a larger grinding platform, and one may have been part of a shaped disk.

Pipe. A pipe made of travertine was recovered from F35 fill in F26 (Figure 9.3). It is smoothly ground, cone shaped, and telescoping. It measures 5.06 cm long, and the diameter ranges from 1.19 cm at the mouth to 2.28 cm at the bowl. Both the interior (slightly concave) and exterior (convex) surfaces have been smoothly abraded, and there appears to have been some flaking around the bowl. The bowl itself averages 1.04 cm in diameter, and the mouthpiece hole is an average of 0.26 cm in diameter. The artifact has been biconically drilled. The bowl contained an intact deposit.

Chemical analysis of the deposit identified the primary alkaloids present as caffeine and theobromine, which is consistent with cacao. The organic

Figure 9.3: Side view (top) and narrow end view (bottom) of pipe from F35 fill in F26.

contents of the pipe, presumably dottle, were compared to the results obtained from the pipe itself. A fragment of a second pipe found in the same deposit in Cist 1 was analyzed to compare with the results of the complete pipe. A positive comparison of the residue confirmed the results of the first analysis.

However, Patricia Crown of the University of New Mexico, a specialist in organic residues, observed, "Looking at the chromatograms, it seems just as likely that it is Ilex vomitoria, which was apparently sometimes smoked historically by tribes in the Southeast. The lack of a theophylline peak and the high caffeine peak makes it seem a strong possibility. We had samples that suggested the use of ilex rather than cacao in our large NSF study" (Crown, personal communication, January 16, 2024).

Walter Fertig, a former GSENM botanist now with Washington State University in Pullman (personal communication, January 26, 2024) observed that cacao was historically placed in its own family but has recently been moved into the Malvaceae family. There are numerous species in our study area in this family, including Sphaeralcea, which was identified in the float sample from F37 (F40 hearth) associated with the habitation adjacent to F2/Cist 3. It remains unknown how this and other species in this family might compare chemically with cacao or Ilex. This is a potentially relevant avenue of future research.

Bead Blank, Bead Fragment, and Pendant. A broken stone bead, an apparent stone bead blank, and a turquoise pendant were recovered from this site. A type C4 chert stone bead fragment, which had broken longitudinally, was recovered from F26 N ½ fill, Grid U3 and U4, from partial suspect and disturbed fill (0-20 cm). It had a narrower end edge that had been smoothly ground, while the opposite end edge is thicker and only partially ground. The interior surface had been smoothly ground and abraded. It measured 2.27 cm long by 2.12 cm wide, and it ranged from 0.42 to 1.2 cm thick.

A stone bead blank, also composed of type C4 chert, was recovered from Unit S5 (20 cm to F13/F15 surface). It was a generally tabular piece, with flat to slightly convex lateral edges. One surface had been completely abraded f

Table 9.12: Edge Grinders

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
Initial cleaning W side of road surface	Q, cobble mid-section	3.8 x 6.8 6.9	Two original cobble lateral ends used. 45º and 90º use edges, unmodified, moderate use.
F2 Clean-up, K3 Grid	Q, cobble end fragment	8.7 x 7.6 3.7	60º to 90º use edges, unmodified, limited use.
F2 Clean-up, K3 Grid	Q, cobble end fragment	8 x 5.2 7	Multiple use edges, unmodified, moderate use. One edge used as a scraper, and one corner edge as a pounding stone.
F2 J2-J3 20-30 cm	Q, cobble fragment	6.3 x 7.85 2.27	80º use edge, unmodified, moderate use.
F2 Lower fill	Q, cobble fragment	5.7 x 5.2 4.44	Use along several 40º to 70º use edges, unmodified, moderate use.
F5 So. 1x1 m, to south of F6, Grid R7 Surface?	Q, cobble lateral fragment	6.91 x 6.04 4.28	Use on two 45º edges, modified, moderate use.
F8 Fill, Q3 Grid-on floor	Q, cobble fragment	9.3 x 7.7 5.04	Use on a 50º to 60º edge, unmodified, heavy use.
F8 East end-on floor	Q, cobble lateral fragment	9.87 x 7.27 6.05	Use along 60º edges, unmodified, heavy use.
F11 0-10 cm	Q, cobble fragment	8.28 x 6.91 4.13	Use along several 45º to 60º edges, modified by unifacial flaking along use edges, heavy use.
F11 0-10 cm	Q, cobble end fragment	8.24 x 7.47 4.83	Several 90º use edges, unmodified, heavy use.
F11 0-10 cm	Q, cobble half	9.8 x 6.97 2.53	25º use edge, modified, minimal use. Originally part of an abrading stone.
F11 in Q8, 0-10 cm	Q, cobble fragment	6.33 x 7.41 3.92	Use along several 60º to 90º edges, unmodified, heavy use.
F11, P8 Grid, 0-10 cm	Q, cobble fragment	5.85 x 6.18 3.62	Use along several 45º to 60º edges, unmodified, moderate use.
F15 Floor contact SW of F28	Q, cobble end fragment	8.62 x 11.8 5.64	Use along a 90º edge, unmodified, heavy use.
F2 cist, floor contact	Q, cobble lateral fragment	8.1 x 4.78 3.7	30º use edge, unmodified, heavy use.
F20 assoc. clean-up to west	Q, cobble fragment	7.18 x 5.35 4.77	Use on several 50º to 60º edges, unmodified, heavy use. One end used as a pounding stone.
F22 see "A" on profile	Q, cobble fragment	8.1 x 8.34 4.65	Use on 30º edge, unmodified, minimal to moderate use.
F26 fill N ½ exploratory 0-35 cm	Q, cobble fragment	8.32 x 5.9 3	Use on 45º and 80º use edges, unmodified, moderate to heavy use.

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
F26 fill N ½ exploratory 0-35 cm	Q, cobble missing one end	8.66 x 7.72 3.53	30º use edge, unmodified, heavy use.
F26 Upper Fill 40 cm. S ½ below slab top 3 base of upper fill	LS, cobble missing one end	9.43 x 7.17 4.66	One 80º to 90º use edge, modified, minimal use.
F26 floor contact, +/- 5 cm	Q, larger secondary flake	2.58 x 6.42 5.83	80º use edge, minimal to moderate use.
F27 Fill	Q, cobble fragment	8.89 x 8.55 3.62	Two use edges, 30º to 45º and 45º to 60º, some modification, moderate use.
F33 fill (N corner pit) F15	Q, smaller cobble fragment	6.16 x 4.16 4.24	90º use edges, unmodified, heavy use.
F35 Fill in F26 N ½ (lying on F36 fill)	Q, cobble end fragment	8.84 x 9.88 5.53	One 75º to 90º use edge, unmodified, minimal use.
F37 “floor” 2 & hearth F40 fill, Stratum 6, grid lines 7 & 8	Q, smaller cobble end and lateral fragment	5.32 x 8.24 5.07	One 45º use edge, unmodified, minimal use.
F41 Fill	Q, cobble end and lateral fragment	6.53 x 7.22 4.35	One 50º to 60º use edge, modified, heavy use.
F44 Fill	Q, cobble mid-section fragment	6.57 x 9.87 3.17	Two use edges, 30º and 90º, some modification, minimal to heavy use.
Unit S5 – 20 cm to F13/F15, Surface	Q, cobble fragment, part of the lateral	3.65 x 8.33 4.93	Use on two edges, 80º and 45º, unmodified, heavy use. One edge used as an edge pounder.
Unit S6 – 20 cm-F15 surface (or F13 natural grid)	Q, cobble fragment	4.66 x 7.45 4.83	Use on several edges, 90º, unmodified, heavy use.
S9 Grid 0-10 cm	Q, smaller cobble fragment	2.86 x 8.22 3.31	90º use edges, unmodified, moderate use.
20 cm to F13/F15 surface	Q, cobble end and lateral fragment	8.03 x 6.77 4.57	90º use edge, modified, heavy use. Possibly originally used as an abrading stone.
T5 10-20 cm	Q, smaller cobble fragment	3.34 x 8.65 4.44	90º and 45º to 60º use edges, unmodified, moderate use.
T5 10-20 cm	Q, smaller cobble fragment	7.55 x 5.53 3.32	50º to 60º use edge, unmodified, heavy use.

Provenience	Material	Dimensions (length x width x thickness in cm)	Characteristics
T5 0-10 cm	Q, larger cobble fragment	10.06 x 10.19 6.3	90º and 45º use edges, unmodified, heavy use.
T9 0-10 cm	Q, smaller cobble lateral fragment	6.28 x 3.31 6.51	Several use edges, unmodified, minimally used.
T9 0-10 cm	Q, cobble end fragment	3.34 x 9.61 3.84	90º use edge, unmodified, minimal use.
Grid U5 (mainly PH soil) 0-10 cm	Q, rectangular cobble	10.03 x 7.93 3.28	45º use edges, one more heavily used, unmodified, minimal to heavy use
U7 0-10 cm	Q, cobble fragment	3.79 x 8.55 5.61	90º use edge, unmodified, heavy use.
U8 0-10 cm	Q, primary flake	7.29 x 4.56 1.71	Use along a thick acute edge, moderate use.
U8 0-10 cm	Q, cobble fragment	5.44 x 5.57 2.16	Use along a 60º edge, unmodified, heavy use.
U9 0-10 cm	Q, cobble lateral fragment	7.09 x 6.71 4.72	80º use edge, minimal modification, heavy use.
F46 exp unit P11 Grid 0-5 cm	Q, heavy cobble corner fragment	7.7 x 10.2 6.9	90º use edges, unmodified, minimal use.
F46 exp unit P11 Grid 0-5 cm	Q, small cobble lateral fragment	2.68 x 4.66 2.42	90º use edge, unmodified, minimal use.
F48 Clay surface-native soil Unit Q2	Q, cobble flake	7.76 x 5.96 2.48	Flake edge grinder, 45º use edge, heavy use. Possibly used as a scraper.
O12 Unit surface exp. 0-5 cm	Q, cobble fragment	8.24 x 7.91 2.94	45º to 60º use edge, unmodified, minimal use.
F46 exp. unit Q11 Grid, road surface	Q, cobble fragment	6.78 x 5.02 4.86	90º use edges, unmodified, moderate to heavy use. Also used as a pounding stone.
F46 exp. unit Q10 Grid, road-10 cm	Q, cobble fragment	3.55 x 4.31 3.23	Tool fragment. 90º use edges, unmodified, heavy use.

Table 9.13: Ground Stone Fragments

Provenience	Utilized material	Dimensions (length x width x thickness in cm)	Use/Characteristics
T9 0-10 cm	SS	7.36 x 5.63 2.64	Unifacially abraded, quite smooth, finely abrasive
F22 N ½ fill	SS	13.3 x 5.55 3.13	Tabular fragment, unifacially abraded, smoothly ground, entire surface ground. Possibly part of a larger grinding platform.
U6 10-20 cm	SS	11.2 x 8.9 1.63	Tabular fragment, bifacially ground, one surface more smoothly then the other, extant edge battered/flaked.
U6 0-10 cm	SS	5.53 x 4.94 .91	Smaller, irregular fragment, unifacially ground. Possible disk fragment.
F43 fill, Grid Unit M1 (1x1) Road to 20 cm	SS	6.62 x 3.39 2.92	Bifacially ground fragment, one surface flatter than the other.

flat, while the other was angled, and somewhat less ground. It measures 1.41 cm by 1.46 cm, and it ranges from 0.16 to 0.48 cm thick.

The pendant was composed of a light-to-medium blue turquoise, which exhibited some impurities and veins. It was generally triangular shaped, slightly askew, leaning at the narrow top. A unironically drilled hole commenced through the narrow end. The entire artifact had been smoothly ground flat on one surface, while the other was slightly rounded, as were the corners and laterals edges. It measured 1.87 cm long by 0.53 to 1.32 cm wide, and from 0.26 to 0.47 cm thick. It was recovered from Unit S5 (10-20 cm).

Miscellaneous. Three pieces of tabular dull red iron ore were found at this site. Although their exact function is unknown, they were brought to the site. The largest was a tabular piece of iron ore from Grid U8 (0-10 cm). It measured 12.3 cm long by 9.8 cm wide and 1.23 cm thick, and one surface was completely obscured by calcium carbonate. The second specimen was recovered from Unit S6, 20 cm to F15 surface (or F13 natural grid). It may have been abraded on a part of one surface, and it measured 11.9 cm by 9.2 cm and 1.43 cm thick. The final piece exhibits a smooth surface that exhibits a slight sheen. It measured 7.8 cm by 7.4 cm and 1.56 cm thick. It was from U9 at 0-10 cm.

Chapter 10
Plants and Animals

In this chapter, Matthew Zweifel discusses a relatively small amount of faunal materials he analyzed from Road Kill. The macrobotanical evidence and pollen remains were analyzed by Katherine Puseman and Linda Scott Cummings (see Appendix A). The following is a summary prepared by Doug McFadden from the original Puseman and Cummings analysis.

Faunal Analysis

The recovered faunal remains from Road Kill consists of a small collection of skeletal element fragments, very few complete elements (n=61), and one marine shell bead (see Table 10.1). Almost all of the apparent cultural bone (tools) consists of small fragments in significantly weathered conditions. The single shell bead was *Olivella* spp. Bone considered non-cultural consisted of rodent long bones (n=5) and were believed to be intrusive in the overall sediments at this site due to their general rarity and lack of apparent processing or burning.

Unmodified bone determined to be of a cultural nature includes fragments in the artiodactyl (deer/sheep/antelope) size class (n=41), rabbit (n=12), and avian (n=1). Due to the small size of the fragments and poor preservation, species of the larger size class could not be positively identified, although most appear to be long bone fragments, with one or two small flat bone fragments (probably skull, scapula, or innominate fragments). Rabbit bones were infrequent and fragmentary but likely represent *Sylvilagus* (cottontail). Recovered elements consist of long bone fragments (n=8), one calcaneus, one odontoid process from the axis vertebra, one skull fragment bearing an articulating surface, and one scapula fragment.

Avian remains consist of one long bone fragment identified as avian by internal bracing structure. Species identification was not possible but likely represents a bird in the sage grouse size class. Also, the field notes indicate an egg shell fragment was recovered from F2/Cist 3, but it was not described further, and the sample was apparently lost.

Culturally modified bones from this site consist of five long bone fragments sharpened at one end for use as an awl or a similar tool (Figure 10.1). These are again small fragments of what would probably have been larger tools. Similar awls recovered at nearby sites were often made from the metapodial bones of cervids, but due to the small and fragmentary nature of pieces from Road Kill, lack of articulating surfaces, and poor preservation, the sharpened bone artifacts from this site could be identified only as having originated from an animal in the deer/sheep/pronghorn size class. Few of the Road Kill bone fragments were suitable for production of awl-like tools, and only one long bone fragment

Figure 10.1: Artiodactyl long bones with apparent awl modification (left to right), artifact numbers 4790-137, -204, -299, -305a, -305b, and shell bead 4790-82. Note the poor preservation of the bone elements.

of the appropriate size had not been so modified. The relatively large number of tools represented within the suitable size and skeletal element types in this collection may suggest the importance of such elements for production of awls, or for the importance of awls as an artifact type. Three other small fragments in the modified bone category bore possible cut marks.

Only one small lagomorph fragment appeared burned as if from cooking and processing, while all the fragments of the deer size class appear to have been highly processed (broken and/or split), with spiral fractures readily apparent on several specimens. This is consistent with processing for tasks such as cooking and marrow extraction. The other rabbit bone fragments appear to have been highly processed, or fragmented due to post-depositional processes.

Most of the faunal remains were recovered from the three cists (F26, F8, and F2) and from the F19 inter-cist pavement between Cist 3 (F2) and the probable unexcavated cist east of Cist 3 (F31). This is likely due primarily due to two factors: location and preservation. A total of only five bone fragments were recovered from the two rooms. Usually, refuse locations, such as the abandoned cists that apparently became trash pits, as well as more substantial middens, are prime locations for a variety of artifacts, as well as faunal and botanical remains. A total of only seven small fragments were recovered from the two rooms. Room 2 was located largely within the roadbed, and there was scant undisturbed fill left due to decades of road use and maintenance. It is entirely possible that other small bone fragments were "road killed" to the point that they were reduced to such small pieces that they passed through the ¼" mesh screens and were unrecognizable to the excavators. This does not, however, address the lack of remains from Room 1.

Remains in hearth contexts were offered slightly more protection by their presence in shallow depressions, likely leading to better preservation. These were collected in bulk as part of the hearth fill. As such, they were not subject to screening where small rodent bones might have been missed as they passed through the ¼-inch mesh. At the nearby Park Wash site (42KA4280), numerous rodent bones were found in hearth contexts and apparently contributed significantly to the diet at that site (Chapin-Pyritz 2000).

A small amount of burned bone was recovered in the Road Kill fill and hearth float samples, but this material was not available for analysis (see Table 10.2). However, due to the nearby location of the Park Wash site and its similar age range, it is probably not a stretch to use the Park Wash faunal analysis of small mammal hearth remains as a proxy for this analysis. As such, the Road Kill faunal hearth remains could represent food items. Noted in the Park Wash rodent remains were Merriam's kangaroo rat, rock squirrel, woodrat, members of the family Cricetidae, and Harris ground squirrel or antelope squirrel. Any or all of these may be represented at Road Kill as well. It is unlikely that there are any faunal geographic distribution differences between Road Kill and Park Wash, and due to the age similarities between the two sites, climatic differences in rodent populations would also be unlikely.

Based on data provided in the floatation results (see Table 10.2), 28% (n=35) of the recovered charred bone fragments were less than 1 mm in size, while 72% (n=90) were larger than 1 mm. This analysis is based on quantities provided in the flotation report, and it should be noted that in many instances small quantities were simply described as "few" or "very few." These entries, including both size classes of uncharred remains and whole elements, were not used in that discussion. The smallest size class would likely not have been identifiable to species but might have been to size class (for example, kangaroo rat vs rock squirrel). In any event, the presence of charred rodent remains from the hearth fill samples likely represent meal items, but the near lack of complete elements ("very few") noted at Road Kill is a departure from the collection of complete elements from Park Wash.

It is probable that remains of the larger animals, such as artiodactyls, as well as the lagomorphs, represent animals hunted and killed for consumption and, at least with the artiodactyls, for hides and tool materials. Rodents in the squirrel size class would also have been readily available food items and could have been taken in a purposeful manner (hunted) or taken opportunistically while protecting crops or stored foods such as maize or beans. Smaller rodents, such as kangaroo rats, were probably taken primarily on an opportunistic basis. In any event, mammals both very small and large were a significant and important part of the overall diet both at Road Kill and the nearby Park Wash.

Of interest is the presence of some 12 bone fragments recovered during the exposure of the F19 pavement between Cist 3 and the unexcavated cist immediately to the east (F31). These include small fragments of deer-sized animals but also include three long bone fragments apparently sharpened for use as awls or similar tools. If indeed this pavement was a covered work area, perhaps even walled and roofed (see F19 description), this may indicate an area where awls were used. If left on the floor following use and after the site was abandoned, they may represent an *in situ* artifact cluster. It is also possible that they represent site use following the abandonment of Rooms 1 and 2 and might post-date the use of Cist 3 (F2). All fragments in the F19 location exhibited the same poor state of preservation, as did the balance of the faunal remains from this site.

Despite the small sample size, there is good information regarding the use of faunal resources at this site. At the least, the site occupants were making use of large and small mammals as well as a moderate-sized avian species, and they were processing these skeletal elements to a significant degree, breaking them into small pieces, likely for marrow extraction. The single pneumatic bird bone would not have provided marrow, but the relatively light construction of this bird skeletal element would allow for easy breakage. The medium-sized mammal remains may represent mule deer (*Odocoilues hemionus*), mountain sheep (*Ovis canadensis*), or pronghorn (*Antilocapra americanus*). At the nearby Pueblo II-III Arroyo site (42KA3976), all three species were identified, with both mountain sheep and pronghorn outnumbering mule deer (Nauta 2012), perhaps signifying their greater importance.

Closer to Road Kill, the faunal remains at the nearby Park Wash site (42KA4280), a Basketmaker III-Pueblo I period site, included rodents as an important source of animal protein, followed by artiodactyls (mule deer and mountain sheep) and lagomorphs (both rabbits and hares) (Chapin-Pyritz 2000). Analysis at that site benefitted from both a larger and better-preserved faunal assemblage. Several awls made from deer or mountain sheep metapodials were recovered at Park Wash. The awls recovered at Road Kill were in a poor state of preservation and could not be positively identified as to skeletal element. It is highly likely that these also were crafted from split metapodials, as this was a common practice at many prehistoric sites.

Sample numbers are perhaps too small for a meaningful analysis of Minimum Number of Individuals (MNI). All remains in the deer-sized class could represent one individual, although this is not likely considering their dispersal across the site and features. The same could be said for the rabbit remains, as well, although differential preservation suggests at least two individuals. Using the Number of Identified Specimens (NISP) figures (see Table 10.1) and applying Arakawa's artiodactyl-lagomorph index (Arakawa et al. 2013) to arrive at an A-L value provides a value of 0.773 for the Road Kill site artiodactyl and lagomorph remains. This is in very close agreement with the mean A-L value for Ancestral Puebloan sites in the Grand Staircase area of .772 (McFadden 2016: Table 27), suggesting that despite the small sample size the representation of artiodactyl versus lagomorph food values is probably accurate.

The single avian bone provides an MNI and NISP of one. There are no remains that might contribute to an indication of seasonality. The poor preservation of most remains may indicate some degree of exposure prior to being buried in site sediments, or more recent exposure due to road maintenance activities. There was a lack of a substantial midden deposit, at least in the excavation area. However, this excavation was limited to the roadbed and immediately adjacent impacted features, and large portions of this site have not been investigated. A more profitable midden accumulation and set of faunal remains could be present elsewhere.

The single shell bead recovered was made from the gastropod *Olivella* spp., and has had both ends apparently ground off, presumably to allow stringing for a necklace type of ornamentation. It appears to be highly polished, probably from use wear. Similar artifacts were not documented at either the nearby Park Wash or Arroyo sites, although three modified shell artifacts were noted at the Dead Raven site (42KA2667) but were described as *Glycymeris* spp. (Walling and Thompson 2004). Two *Olivella* shell beads were recovered in surface context at Hog Canyon Dune (52Ka2574), a multi component site dating from Basketmaker II times through Pueblo I and possibly into Pueblo II times (Schleisman and Nielson 1988). Helton noted some 20 Olivella shell beads at two sites near Hilldale, Utah, ranging from Basketmaker to late Pueblo times (Helton 1998). Similar artifacts have also been recovered at other Basketmaker and Ancestral Puebloan sites in the region. It is interesting that an *Olivella* bead was recovered here but not during other extensive Kitchen Corral Canyon excavations.

In summary, the faunal remains from the Road Kill site demonstrate a similar use of faunal resources as other local Ancestral Puebloan sites. Evidence at this site suggests a heavier reliance on deer-sized artiodactyls than on leporids, but such faunal use emphasis is expressed differently from site to site. At the Arroyo and Dead Raven sites, leporids and artiodactyls are both well represented, and there is also a significant presence of turkey remains. Turkeys were also present at the Kanab Site (Emslie 1981), and at two southern Utah University field school sites in the Grand Staircase. The single avian bone from Road Kill is a central long bone shaft fragment that could not be positively identified but could represent turkey.

At the Park Wash site there is evidence of cooking small rodents, an attribute that was also present at the Road Kill site. It should be recognized that the sample size is small, and a larger sample might well reflect a different or wider emphasis

Table 10.1: Faunal Remains by Type and Provenience

No. 4790-	FS No.	Feature No.	Location	Ungulate	Rodent	Rabbit	Avian	Non-ID	Shell	Comments	Modified
10	3	F 2	Cist 3	1						Small frag	
18	25	F 2	Cist 3	1						Tiny frag	
25	50	F 2	Cist 3	1						Very small frag	
53	112	F 2	Cist 3			1				Long bone frag	
28	51	F 2	Cist 3			1				Small frag of rabbit skull with articulating surface, possible cut mark	1
48	74	F 2	Cist 3	1						Modification: possible faint cut mark on long bone fragment, 30 x 23mm	1
82	48	F8, 5	Cist 2						1	Small shell bead, ends removed for threading, very smooth (use wear); *Olivella* spp., 8.5mm L x 5.8mm Dia.	1
74	15	F 8	Cist 2					1		Very small frag, burned/processed	
77	none	F 8	Cist 2			1				Odontoid process, rabbit axis vert.	
83	48	F 8	Cist 2		1					Humerus	
93	58	F 8	Cist 2	1						Small frag	
99	83	F 8	Cist 2			1				Long bone frag	
117	147	F 8	Cist 2	1		2				Long bone frags	
137	26	F 11	Room 2	1						Modification: apparent awl tip, sharpened, very weathered, 75 x 13mm	1
143	39	F11	floor	1		1				1 large mammal long bone frag, 1 rabbit long bone frag	
154	72	F11	Q7, 0-10 cm	5						Long, narrow "splinters", highly weathered	
169	156	F11	floor contact	2		1				2 small rib frags (deer?), one incomplete long bone shaft, c.f. *Sylvilagus.*	
283	116	F 11, 38	Room 2 large pot rest	2	2					2 large mammal long bone frags (small), probable femur or humerus.	
318	none	F 15, 13	Room 1			1				Long bone frag	
358	113	F 15, 13	Room 1	1						Small frag	

No. 4790-	FS No.	Feature No.	Location	Ungulate	Rodent	Rabbit	Avian	Non-ID	Shell	Comments	Modified
194	128	F 19	Cist 3 inter-cist pavement	2						Small frags	
204	221	F 19	Cist 3 inter-cist pavement	3						Modification: large frag appears to have been sharpened to a point, possible awl tip fragment, 28 x 15mm; small frag (non-ID) with cut marks, 16 x 8mm; both are large mammal long bone frags. 1 unmodified frag very small, non-ID.	2
305	203	F 19	Cist 3 inter-cist pavement floor contact	2						Modification: 305a, large mammal long bone fragment with minimally sharpened point, 79 x 14 mm; 305b, large mammal long bone fragment, well-defined sharp point, 45 x 9mm	2
196	125	F 19	Cist 3 pavement	1						Small frag	
304	203	F 19	Cist 3 pavement	3						2 very small frags, one large (largest in collection, about 9 cm)	
216	199	F 19	Cist 3 pavement	1						Possible rib fragment	
232	220	F 22	Room 2 vault	1		1				Calcaneus	
258	200	F 26	Cist 1				1			Probable sage grouse/small turkey-sized, w/inner struts	
269	170	F 26, 36	Cist 1 stcr fill			1				Scapula, *Sylvilagus*, well preserved	
272	178	F 37	profile cultural surface	2						2 small frags, differential preservation, one frag more weathered or more heavily processed	
280	177	F 37	profile	1	1					Pelvis or scapula frag	
424	258	F 43	fill			1				Long bone frag	
450	250	F 46	Q9, 0-5cm	1						Small, flat, possible skull or pelvis frag	
299	116	(none)	S5, 10-20cm	1						Modification: possible use wear on pointed end of long bone fragment (awl-like use but not heavily modified), 51 x 12mm	1

No. 4790-	FS No.	Feature No.	Location	Ungulate	Rodent	Rabbit	Avian	Non-ID	Shell	Comments	Modified
322	12	(none)	S7, 10-20cm	1						Small frag	
327	20	(none)	S8, 0-10cm	1						Small frag	
352	119	(none)	T5, 10-20cm	2	1					Very weathered large mammal long bone frag (now three frags, probably collected as one), probable femur.	
394	49	(none)	U4, 0-10cm	1						Probable distal end, tibia	
	Totals:			41	5	12	1	1	1		8 bone 1 shell

Table 10.2: Faunal Remains from Float Samples

Feature	Description	Charred Fragments <1mm	Charred Fragments >1 mm	Uncharred Fragments <1mm	Uncharred Fragments >1mm	Whole Elements
F28	Foor contact below dressed slab, F15 (Room 1)	1	13		few	
F15	Room 1 fill	1	7	few	few	
F21	Room 1 hearth	few				
F11	Room 2 fill	5	4		very few	very few
F25	Room 2 hearth	8	2	few	few	
F2	Cist 3		2			
F40	F37 hearth	16	1	few	few	
F19	F2/F31 Intercist pavement		8		few	
F12	Extramural hearth	4	53	few	few	
Totals		35+	90	few	few	very few

at this site. The presence of the single Olivella shell bead, while not uncommon across the larger Virgin Ancestral Puebloan area, is a first documentation of this sort in Kitchen Corral Canyon and shows that the site occupants were certainly connected with Ancestral Puebloan trading patterns that ranged all the way to the Pacific Coast.

Macrobotanical and Pollen Analysis

Macrobotanical and pollen analysis was conducted on 21 samples from a variety of contexts in order to assess the local prehistoric environment and identify potential economic species at the Road Kill site. The following offers observations within the context of our feature descriptions and interpretations. It also allows comparisons to paleobotanical data available from other early Puebloan sites along Kitchen Corral Wash.

The identification of economic types, both domesticated and native, was the primary objective of the analysis. A secondary consideration was characterization of the local environment and assessment of what storage and processing activities were being carried out and where they occurred. Bulk samples for macrobotanical analysis (13) and pollen samples (9) were taken from four different contexts: cist fill and floor surfaces, connecting cist surfaces, residential floor surfaces, and hearths.

Cists were consistently nearly devoid of botanicals as was expected, since macrobotanical remains are rarely preserved without being charred. A trace of maize pollen was recovered from the floor of Cist 1 (F26). Tasseling of maize occurs well before maturing of the crop and therefore pollen wouldn't be expected in storage cists (Heitman and Geib 2015). Additional trace amounts of maize pollen were also found in both residential Rooms 1 and 2. Traces of maize pollen were found in the F27 connecting compartment. Although beans produce little pollen, a small amount was recovered from Cist 1 (F26). Macro remains of *Phaseolus* were also found in the extramural hearth (F12).

As expected, hearths produced the greatest number and variety of economic plant species, as well as faunal material. Not only does charring preserve hearth contents, but food is prepared in and around them. Each of the three residential rooms, as well as the outdoor hearth, produced abundant evidence of maize. Beans occurred in both the Room 2 hearth (F25) and extramural hearth (F12). All four samples (upper and lower) also had native species including cheno-ams, indicating that a mix of native and domesticated species were being processed and eaten.

The presence of cattail (*Typha)* pollen at Road Kill is a comment on both the natural environment and possible use as food. It was also used for plaited basketry, mats, and perhaps as roofing materials. Although very limited, the presence of willow (*Salix)* pollen from the F27 connecting pavement also indicates a nearby riparian setting. Small amounts of cattail pollen were also recovered from the early pit house at the Park Wash site (Ahlstrom et al. 2000:98); in a Late Archaic context at the Arroyo site

(Cummings 2012), and site 42KA2584 where a small amount was recovered from the floor of a structure similar to those at Road Kill. The presence of these species indicates that some wetlands occurred in the drainage at least up until the Early Pueblo Period. At present, the nearest wetland is Nipple Lake some 15 kilometers to the northeast.

It is possible that these species identified at Road Kill indicate a local environment somewhat different than what is present today, likely with a higher water table making the Kitchen Corral drainage suitable for prehistoric farming. It is hard to imagine growing corn, beans, or squash in this area under present conditions.

In large measure, the left half of the pollen diagrams for all three excavated Kitchen Corral Wash sites represent background species consistent with one another and similar to today's environment: pinyon, juniper, sage brush, salt brush, and greasewood. Those on the right comprise many of the economically important types (Figures 10.2).

Cheno-am pollen was ubiquitous in samples from Road Kill, Park Wash, and the 42KA2584. Supporting the use of pigweed is Aikens' recovery of a jar of "amaranth" seed cached at the Pueblo I Parunuweap Knoll site (Aikens 1965). Along Kitchen Corral Wash, Dernbach (1992) and Kulp (1995) found charcoal in sediments that suggested prehistoric slash and burn agriculture. Whether the burning was purposeful or natural, fire is known to spur the growth of ruderals in pinyon-juniper settings with less than 25 cm of precipitation (see Sullivan and Mink 2018).

Maize pollen was present in eight of the nine processed pollen samples, and its charred remains were present in 11 of the 12 macrofloral samples examined from Road Kill. This leaves little question about the function of the site as a farmstead committed to agriculture (see Heitman and Geib 2015). Amaranth seed may have been either a staple harvested along with maize or relied on primarily during times of crop failure. Its tendency to grow in disturbed areas such as fields and residential complexes would have involved pulling it as a weed or collecting it if crop failure seemed imminent. Most likely both occurred given that the greens, as well as the seeds, are nutritious.

While maize pollen is consistently present, it is rarely found in quantity. As Heitman and Geib (2015) have pointed out, maize pollen is not easily introduced from fields into the context of a site. Depending on distance, wind direction, husking practices, preparation methods, and storage procedures its presence in any amount is significant.

In summary, native resources that might have been used, processed, and/or stored at Road Kill include a member of the mustard family, cheno-ams including goosefoot and saltbush, beeweed, juniper berries, a member of the lily family, grasses, lemonade berry, chokecherry, and cattail. While all were locally available in the Kitchen Corral drainage, harvesting them in large enough quantities to have an impact on caloric intake is questionable

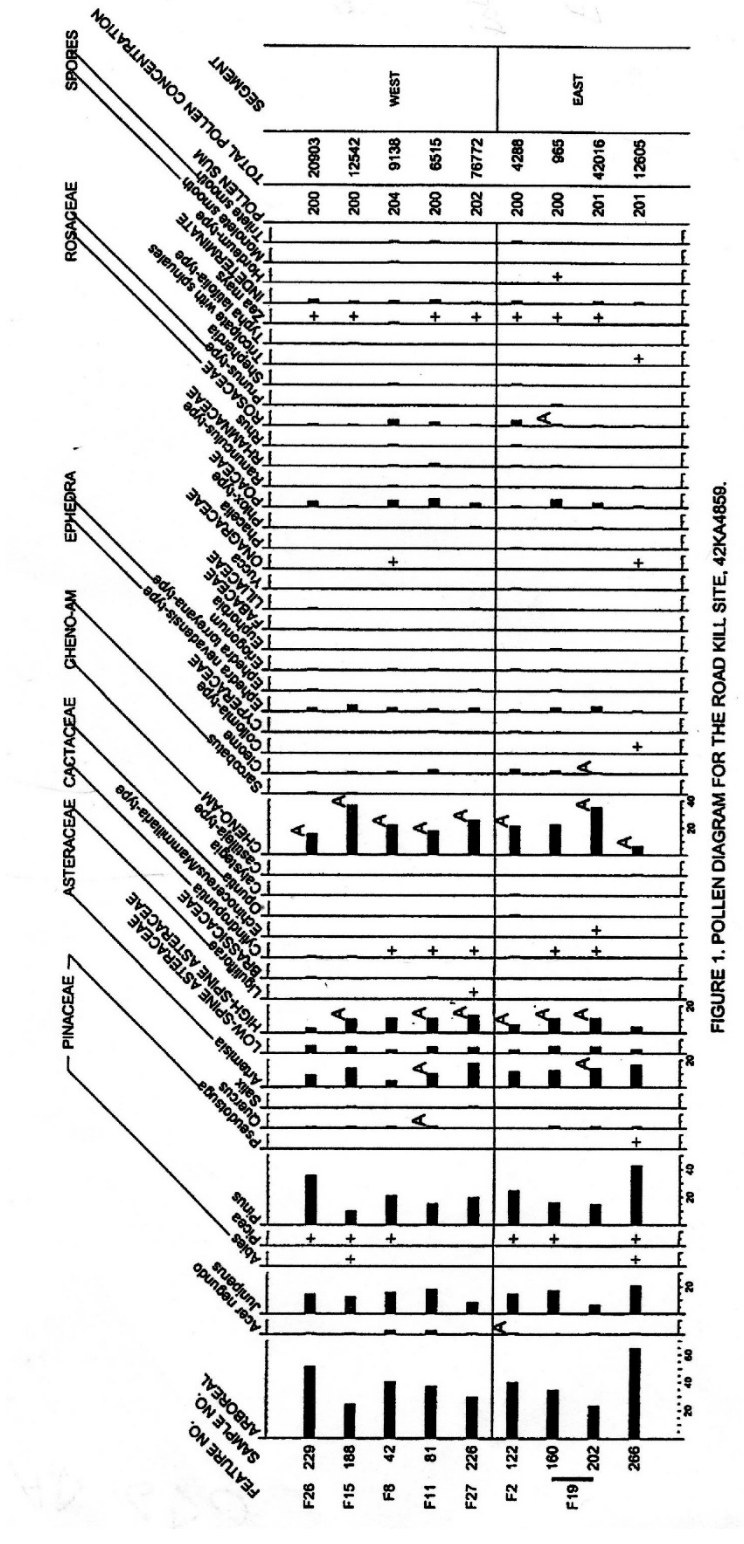

Figure 10.2: Road Kill site pollen diagram. From Cumming and Puseman's 2005 analysis.

Chapter 11

Site Structure, Settlement, and Subsistence

The following discussion considers a range of extant datasets from the archaeological record as it has accumulated, and observations on those that are most relevant to the human behavior that created/structured them. We examine the relationship between sedentism and mobility that seems central to Virgin Branch studies at the current time. As defined by O'Connell (1993:7) the term "site structure" is "the horizontal distribution of artifacts, faunal and floral remains, hearths, structures, and other features deposited at *about the same time* within an archaeological site." Maintaining a perspective of site structure that crosscuts both vertically and horizontally related features is a prerequisite for identifying diachronic or "sequent" site structure. Recognizing sequential occupation, or even changing intensities of occupation, on a given site is critical for understanding the nature of Virgin Branch mobility.

The excavation of random test pits is rarely a viable excavation strategy for assessing the nature of either vertical or horizontally related features on a site. There are few, if any, Virgin Branch habitation sites that would not benefit from an excavation strategy that considers these often-nuanced relationships. Unfortunately, most data from Kitchen Corral discussed earlier suffers from precisely that shortcoming. Road Kill is little more than a tested site lacking any full context of changing site structure over time.

At typical Virgin Branch residential sites, the relationship between features (i.e. cist or room alignments, pit structures, and discrete middens) are often visible from surface evidence alone. Occasionally, this takes the form of "horizontal stratification" of temporally discrete site components. Mitigation testing programs (like Road Kill and Park Wash) leave essential site elements unexplored. Deep test pits often encounter earlier features and deposits with little or no meaningful context. Understanding the relationship between the initial, informal features and subsequent formal features developed over time can be a challenging task.

While the initial site structure of Basketmaker III-Pueblo I occupations can be quite variable, we contend that similar functions and activities, mostly oriented towards farming, took place on most of them. The longer-lived a site, the more complex these relationships tend to become. This can make assessment of significance, testing, and determining the level of mitigation effort extremely challenging.

A primary task of the limited excavations on Road Kill was not only the description of spatial (both horizontal and vertical) and temporal relationships between its structural features, but to assess broader implications by considering the nature of their fill, and in turn, subsequent impacts to it, in order to assess the nature of later activities on site.

Settlement Patterning

At its simplest, settlement analysis is a matter of describing the range of site types in each area during a given bracket of time, and considering the relationships between them, as well as their environmental settings. This analysis assumes the Grand Staircase region is a suitable area where farming and foraging were organized to meet the subsistence needs of small family households. The Early Puebloan Period (EPP) is the temporal unit during which this tradition of settlement developed and took hold.

On the Grand Staircase, site types and their distributions are known from large intensive inventories reviewed earlier. The results of recent inventories of several thousand acres supports the findings of earlier surveys, including site types and their geographic distribution. Combined, the inventory data supports the conclusion that foraging took place throughout the Grand Staircase, albeit at different intensities, while farming was more restricted. Based on floral and faunal distributions, both activities could have been carried out efficiently from a single farmstead base.

From an inventory-oriented CRM perspective, patterns recognized in site structure must be reconciled with the settlement pattern of which they are a part. In turn, the interpretation of subsistence data is dependent on multiple variables including on-site contexts, sampling procedures, and preservation factors, as well as idiosyncratic situations and events. The following considers these variables in depth.

Subsistence Practices

Rather than simply considering pollen and paleobotanical analyses as proxy data for determining subsistence practices (e.g., Puseman et al. 2000), the following considers both native flora and fauna, as well as domesticates, in the context of site structure and settlement. In the view taken here, assertions of economic orientation and consequent inferences regarding the extent and type of mobility based on the recovered samples of floral and faunal remains, are semantic arguments. They are also subject to various forms of sampling error. There is little point to simply assert the Virgin populations practiced a “mixed” economy and therefore must have been mobile, or conversely, were “maize reliant,” “heavily dependent,” or “committed agriculturalists” and therefore sedentary. The following section examines the relationship between sedentism and mobility based on site structure and settlement data that are congruent with the subsistence record rather than derived from it.

It is generally accepted that a constant diet of only maize cannot provide the necessary nutrients to sustain a population over time. Sedentism also requires capturing a large amount of locally available calories, in this instance maize. In addition to maize and the ubiquitous presence of cheno-ams (pigweed or goosefoot) in the Grand Staircase diet was, in Pueblo I times, supplemented by beans, squash, turkey, pronghorn, mule deer, mountain sheep, elk, hares, and rabbits. In addition, the pollen and macrobotanical record documents many low-calorie-but-nutritious species that were gathered, processed, and consumed. This breadth of diet, while not always achieved, would have been envied by those in the more densely occupied regions of the Southwest.

Our argument for an agriculturally focused sedentary base, while largely predicated on site structure and settlement patterning, is also strongly influenced by the ubiquity of maize macrofloral remains and particularly the presence of maize pollen, which suggests that fields were nearby. As pointed out by Heitman and Geib (2015), maize pollen is not easily introduced to a site for a variety of reasons. The abundance of pollen from the ubiquitous cheno-am group of plants is more ambiguous. *Amaranthus* (pigweed) was not detected in flotation samples from Road Kill, and only a single charred *Chenopodium* (goosefoot) seed was identified in the macrofloral remains from F40 (hearth).

In terms of behavior, following Berry (1982), we consider the seasonally structured commitment to a schedule of field preparation, planting, maintenance, harvesting, drying, processing, and storing copious quantities of maize to have placed significant constraints on mobility. Equally important is the need to keep the surplus close, not only for consumption but also for protection. The local availability of virtually all native floral and faunal species suggests that mobility, beyond local forays from the primary agricultural site, would have been optional during most years.

Native Species and Their Contexts

The subsistence data presented earlier in its various forms and contexts strongly supports the primacy of a maize-based economy. Direct evidence of diet comes to us in several forms. Based on carbon isotope data, maize was an important part of most every meal (Martin 1999), while the analysis of coprolite samples from Antelope Cave reads like a recipe for a stew: maize, cheno-ams, dropseed flour, sunflower seeds, wolfberry fruit, prickly pear, and small mammal meat and bone (Reinhard et al. 2012). These species are found on or near most farmstead sites in the Kitchen Corral area. In fact, macrobotanical and pollen analyses from each of our admittedly small sample are at least congruent with the settings in which they were found.

Chapin-Pyritz (2000:118) pointed out that rodents at the Park Wash site were “the most plentiful sources of subsistence,” followed by bighorn sheep and mule deer. This observation was based on the considerable number of tiny rodent bones found in the Pueblo I pit house hearth. As Ahlstrom (2000) aptly pointed out, these remains described the “last meal or meals” occurring just prior to the site’s abandonment.

Our review of both macrofloral remains and pollen across our sample of excavated sites indicates that they are consistent with one another and with modern floral distributions, suggesting that only rarely, if ever, would it be necessary to forage beyond a day's walk. Proximity to big game was also favorable. Big horn sheep habitat occurs along the Vermilion Cliffs, pronghorn range is found in the open country to the south, and in some cases seasonal migration of the Paunsaugunt Plateau mule deer herds brought game close to the fields and sites themselves.

Following the aforementioned "last meal" logic, the contents of all four hearths excavated on Road Kill might be taken to indicate an optimal diet to the very end of their use. Each of the hearths contained corn, some beans, and burned bone fragments, as well as projectile points that suggest hunting large mammals.

While the subsistence record strongly indicates a reliance on maize and therefore a sedentary lifeway, we believe the architectural record is the best measure of the level of commitment to agriculture. We argue here that quantification of storage capacity and effort put into residential architecture are measures of sedentism. Regardless of the number and variety of native seeds obtained from macrobotanical samples, we would anticipate that metric tons of produce would have been harvested and stored.

Potential Food Sources

The lack of evidence for exploiting certain food resources reflects on the reliance on and reliability of the species that were consumed. While suffering from the shortcomings of "negative evidence," some foodstuffs were available but were apparently underutilized or not exploited at all. For example, evidence for the use of pine nuts, a high-calorie, protein-rich resource, is surprisingly rare. No cones or nuts were recovered at 42KA4280, 42KA2584, 42KA2594, or Road Kill, although *Pinus* bark scale, charcoal, and pollen were abundant at all of the sites. At 3,000 calories per pound (Cordell 1984:185), pine nuts would have been highly desirable. But with good yields occurring only once out of every seven years, they were probably not reliable. We would expect more evidence of them if they were an important foraged resource, especially given their bulk, flammability, and greater opportunity for preservation in hearths. In contrast, corncobs are also bulky and flammable, and they are regularly found in hearths.

The presence of oak (*Quercus*) is indicated by both pollen and charcoal on most sites, but there is no evidence of acorns in the macrobotanical remains. On the other hand, cattail (*Typha* sp.) pollen is present in small quantities on many if not most excavated sites, but cattail is rarely considered as a food source. Actual cattail botanical remains were recovered at the Jackson Flat sites (Roberts et al. 2022). Cattail is consistently present on the Kitchen Corral Canyon sites and Virgin Branch sites in general. Apart from being an indicator of nearby riparian areas, the male spikes and roots are edible. Seeps and springs along Kitchen Corral Wash were a possible source, and larger sources areas are Nipple Lake about 15 km to the northeast, Kanab Creek, Johnson Wash, and Johnson Lakes Canyon.

Saltbush (*Atriplex canesens)* is common on the modern floodplain, and while seeds are abundant, large and easy to harvest, only two were recovered from the Room 2 hearth (F25) on the Road Kill site. Also for consideration are wild potatoes (*Solanacea)*. This tuber (*Solanium jamesii)* was identified in the Escalante Valley at North Creek Shelter during the Pleistocene-Holocene Transition (Louderback and Pavlik 2017), as well as during historic times, and it deserves mention as a possible food source (see Pyne 2020 for a review). While pollen from the Solanacea (nightshade) family is common on Virgin Branch sites, it constitutes a very large and diverse number of species. *Solanacea* pollen is common on sites in the Kitchen Corral drainage from Archaic times through late Ancestral Puebloan times, but it is not found at Road Kill.

Animal Husbandry

A potentially significant addition to diet during the EPP was the domestic turkey. The amino acid tryptophan present in turkey would have at least ameliorated the deleterious effects of a maize-based diet (Matson 2016). Domesticated turkey bone (*Meleagris gallopavo*) was identified at the Kanab site by Emslie (1981) and turkey shell was recovered at 42KA6293 near Kanab (Nash 2013). None have been recovered, as yet, from Road Kill. A consequence of turkey husbandry is that it would have hampered mobility, particularly seasonal transhumance between farmsteads and foraging base camps (e.g., Fisher et al. 2013).

Canid remains were recovered at the Kanab site in a Pueblo I-Early Pueblo II context (Emslie 1981) and at the Arroyo site in a Late Puebloan context (Nauta 2012). Although dogs are potential sources of protein, the remains were articulated, and they were apparently interred as pets rather than consumed. The presence of domesticated dogs may have biased the faunal record in terms of quantity and quality of refuse bone (Martin 1997). The gnaw marks on scrap bone observed at the Park Wash site (Chapin-Pyritz 2000: Table7.2) suggest at least some of the faunal record may have been consumed by dogs. This is a taphonomic process worth pursuing in future research

Food Preparation Methods

Maize preparation methods can have a favorable impact on nutritional value (Matson 2016, Burrillo 2015). Processing maize with juniper ash or lime, so-called nixtamalization, is known to enhance nutritional values. It is a common process in Mesoamerica today, and burned limestone on aceramic farming sites is a Basketmaker II diagnostic on Cedar Mesa in southeastern Utah (Ellwood et al. 2013). Local evidence might provide insights. For example, the deep trough metate on the floor of Room 1 on Road Kill was made of limestone, allowing for the possibility of introducing calcite into ground meal during the milling process and mimicking the effect of boiling with limestone. The processing of maize in the Virgin Branch region has seldom been studied (but see Reinhard et al. 2012 for the presence of “maize flour” in coprolites from Antelope Cave).

Another line of inquiry into food preparation methods is the roasting pit. Unlike shallow hearths found both within rooms and in courtyards, roasting pits are deep, slab-lined pits consistently found in the open. Such features have been noted on Pueblo I sites in the St George Basin, where they might have been used to roast green corn. Eskenazi and Roberts (2010) excavated several on an open special use site in the St. George Basin. They recovered cholla, prickly pear, grass seeds, and cheno-am pollen, and they suggested that roasting cholla buds was a primary function.

Feature 4 at 42KA2594 in the Kitchen Corral drainage was a relatively deep, slab-lined exterior hearth similar to those observed in the St. George Basin. No seeds were recovered, but *Helianthus* (sunflower*),* *Cylindropuntia* (cholla cactus), and *Zea mays* (corn) pollen were identified (Westfall 1985). Cholla and opuntia are common in the Grand Staircase uplands, but these potential food sources are rarely reported.

Faunal Resources

Based on stable carbon and nitrogen isotope ratios, Martin (1999) has estimated that game made up less than 10% of the overall Virgin Branch diet. Similar values precluded distinguishing between big game (artiodactyls) and small game such as rabbits and hares (lagomorphs). A preference or elevated count of one over another might suggest different degrees of mobility in some circumstances. Other factors need to be considered, most significantly availability. Many farmsteads, including Road Kill, are found along big game corridors affecting their relative abundance during semiannual migrations from summer and winter ranges. Small game, such as rabbits and hares, have breeding cycles that affect their relative availability and hence their presence in the archaeological record at a given time.

It may be significant that nitrogen values from Grand Staircase individuals are generally higher than those from the St George Basin (see Martin 1999: Table 2). The recovery of faunal remains is higher in the uplands as well, suggesting differences in diet. That said, the variability of faunal remains on thoroughly excavated sites *within* each area can be significant. Faunal recovery was negligible at both 42KA325 along the Virgin River (Westfall et al. 2008) and Pinenut Site in the uplands of the Arizona Strip (Westfall 1987). In contrast, faunal remains at Bonanza Dune were abundant and diverse (Aikens 1965).

A common method of quantifying the relative importance of big game versus hares and rabbits is the Artiodactyl-Lagomorph Index (A-L). This is derived by dividing the number of identified specimens (NISP) of artiodactyls by the NISP of artiodactyls + lagomorphs (Arakawa et al. 2013). An index of 1.00 indicates 100% big game; as the index number decreases, lagomorphs become more important. Based on their index, roughly 50 rabbits would be needed to match the protein yield of a single deer.

Data provided in Arakawa et al. (2013: Table 2) indicates that the mean value for large Mesa Verde sites sampled in southwestern Colorado and small sites on the "western periphery" in southeastern Utah is .632. Values above this figure were taken to indicate that the those living at small sites to the west were procuring higher amounts of large game versus small game. For example, the Coombs site, the westernmost in their sample, had a very high index of .985. Cumulative data from six early Puebloan sites spanning the Grand Staircase range from .713 to .834 with a mean of .772 (McFadden 2016: Table 27). As suggested earlier, the meager faunal remains from Road Kill are likely skewed by the nature of the deposits excavated. Preservation and sampling error due to limited excavation are the likely factors that bias the faunal record. Big game was readily available and sought after on the Grand Staircase.

It has been suggested that arrow points support a focus on hunting big game rather than rabbits and hares (Arakawa et al. 2013:150). Small projectile point types and frequencies recovered at Road Kill are similar to those on more completely excavated sites where sizeable artiodactyls collections have been recovered (Nickens and Kvamme 1981; Nash 2013; Walling and Thompson 2004). Although little bone was recovered from Road Kill, the limited excavations did recover a dozen small arrow points in various contexts. Based on the positive correlation of arrow points with artiodactyl remains, we expect future excavations on the eastern Grand Staircase to yield additional evidence of big game hunting.

On the other end of the faunal spectrum, we suggest that consumption of rodents is actually an indication of sedentism. These were identified at the Park Wash site as ground squirrel, wood rat, and kangaroo rat that were likely attracted to stored food and discarded food remnants. Capturing them would have been a matter of protecting foodstuffs, consuming them simply as an expedient source of protein. Small snares would have been a probable means of trapping rodents attracted by domestic activities.

The abundance of modified bone on early sites such as awls, needles, and fleshers reflect on the availability and non-consumptive uses of artiodactyl bone. The process of bone tool manufacturing using deer metapodials was observed at both Dead Raven (Walling and Thompson 2004) and 42KA2147 (McFadden 2016). Both sites are found in Johnson Canyon along a major game corridor. Their occurrence on sites with otherwise low yields of bone reflects both bone preservation, the circumscribed areas of excavation, and their importance in the typical tool kit.

Diet Analyses

Direct evidence for actual diet comes from two sources: stable carbon isotope analysis of bone and coprolite data. Both methods suffer from individual bias where the samples may or may not be representative of the larger population.

Based on the isotopic analysis of samples spanning the St. George Basin and eastern Grand Staircase, Martin (1999) concluded that maize provided about 75% (+/- 10%) of annual calories. Such a diet would have resulted in deficiencies of lysine and tryptophan, resulting in dire health consequences if not offset by proteins of domestic turkey or wild game (Matson 2016). We too propose a dependence on maize on the Grand Staircase but note the consumption of meat was relatively high and oriented to readily available large game. Beans, recovered at both Road Kill and Dead Raven, would have provided additional protein. Turkey egg shell and carcass remains at the Kanab site suggests that turkey husbandry was practiced perhaps as early as Pueblo I times. Isotopic evidence has been used to demonstrate that turkeys were fed maize (Newbold et al. 2012.) While this analysis has not been reported in the Virgin Branch area, there is good potential to use it on curated collections. Isotope analysis *was* conducted on canid remains from the Arroyo Site indicating that dogs were ingesting maize in one form or another (Martin 1999).

Evidence of actual diet is found in coprolites from Antelope Cave, an intensely used early Puebloan rock shelter on the margins of the Grand Staircase physiographic province (Janetski 2017; Fisher et al. 2013). These indicated varied and healthy meals but “cannot be considered to represent a year-round diet” (Reinhard et al. 2012:509).

Less direct measures of diet are the macrobotanical and faunal samples from the four hearths excavated on Road Kill. Like the results of the coprolite analyses for Antelope Cave, Road Kill hearth contents reflect a varied and healthy diet.

- F21 hearth in F15. A few charred *Zea maize* cupule fragments.
- F25 hearth in Room 2 (F11). *Zea maize* kernels and cupules, *Brassicaceae* seeds (mustard family), Atriplex seed, *Phaseolus* (beans), *Chenopodium*, bone fragments.
- F40 in F37. *Zea maize* cupules and kernels, charred *Chenopodium* seed (goosefoot), charred bone.
- F12 exterior hearth. Zea *maize*, *Phaseolus* (beans), bone fragments.

The high level of maize in the Virgin Puebloan diet was combined with wild fauna and native floral resources. Some were stored, others eaten green. Beans, squash, and turkey would have resulted in a well-balanced diet. Some 80% or more of the diet was easily stored as dried maize, beans, and squash, as evidenced by the ubiquitous and large-volume storage structures (see McFadden 2016: Table 28 for volumes).

Estimates for reliance on maize vary widely. A statistical analysis of macrobotanicals from various sites in the St George Basin found that “...corn likely made up between 20 and 25% of the total diet of the [Ancestral Puebloan] residing along the Virgin River” (Murray and Polk 2008:58.) They go on to suggest that domestic crops “would have been used as a *supplement to a wild-resource-based diet”* (emphasis added). On the other extreme, carbon isotope results are said to indicate an “over dependence on maize” (Martin 1999). Others have used changing ratios of recovered native/domesticated species to imply different degrees and modes of mobility (Westfall 1985, 1987, Westfall et al. 2008). This is the crux of the subsistence argument – whether to accept the statistical analysis of botanicals recovered at face value or view these data within the larger context of overall site structure and settlement patterning.

Subsistence Practices and Settlement System Relationships

The overarching research theme on the Grand Staircase has been to document site occupational histories as evidenced by construction sequences, remodeling, superimpositioning, stratigraphic relationships, and ceramic variability. In the best circumstances, these relationships are supported by both radiocarbon and tree-ring dates, as well as ceramic cross-dating. The interpretation of surveyed sites is more nuanced but "multi-component sites" showing temporally sensitive sets of architectural styles and pottery types can often be discerned. This focus has served to highlight a key difference between settlement in the Virgin Puebloan area and that described for the Kayenta region – that is, the frequent long-term episodic occupation of individual sites occurring in a variety of arable settings and subareas (McFadden 1996, 1998). The significance of this patterning is how it relates to settlement-subsistence and particularly the related issue of residential mobility. Mobility and whether it was practiced on a seasonal, annual, or intermittent basis are critical to addressing local adaptation across the region.

Early Virgin Puebloan architectural sites on the Grand Staircase typically consist of two primary structure types: storage taking the form of either cists or shallow slab-paved rooms and pit house dwellings. A third type now apparent is a shallow, lightly constructed jacal structure with a hearth, often located south of the storage alignment, that was used on an occasional, seasonal, or even full-time basis. This layout is present in one form or another on virtually all investigated sites. This layout is widespread during the early Puebloan period in both the St. George Basin (Dalley and McFadden 1988; Walling et al. 1986) and the Grand Staircase (Simms et al. 2017). The discussion here focuses on excavated sites on the eastern Grand Staircase, mainly Road Kill, Dead Raven, and Park Wash.

In summary, our approach involves both synchronic and diachronic perspectives drawn from individual sites and settlement patterning based on distributional data. The synchronic view expands on the concept of "site structure," a useful ethnographically based concept describing behavior on a site that occurred at about the same time. Although quite variable, these are emergent sedentary sites that were focused on farming. Evidence for hunting and gathering is expected, but it was maize agriculture that structured the site and settlement patterning. Site size and formality are largely a measure of success and longevity.

In terms of site distribution, the interpretation that sites with jacal residences and storage units were outlying camps focused on native flora and fauna seems strained (e.g., Westfall 1985). Kitchen Corral was the focus of considerable farming activity during Basketmaker III and Pueblo I times but perhaps less so during Early Pueblo II times (such sites are documented in the nearby uplands). Interspersing limited activity sites with pueblos seems an unlikely strategy. Serial movement of small groups into new agricultural niches was the basis for expansion throughout the Southwest.

The diachronic aspects of this pattern are nicely illustrated by excavations at the Park Wash and Road Kill sites. Both have stratigraphically early occupations followed by the construction of a substantial roomblock in the case of Road Kill, and two superimposed pit houses at Park Wash. Road Kill's roomblock illustrates Gardiner Dalley's "site core" concept by demonstrating continued use and expansion over time.

"Survivals" as Explanation: Temporal Implications

Steward was quite explicit about the occurrence of Basketmaker III pottery and circular cist architecture on otherwise later sites. He considered them architectural and ceramic "survivals," or evidence that earlier forms continued to be constructed and used (Steward 1941:288). Two examples occur on sites only a short distance downstream from Road Kill. The developing thesis here, however, is that Steward was viewing evidence of temporally distinct occupations.

Judd also struggled with interpreting complex construction histories in Cottonwood Canyon. At what appeared to be a sequence of occupations, he noted "these several distinct types (of structures) are closely associated in Cave 4; the too-limited collections of cultural artifacts recovered during our excavations point unmistakably to continuous, through relatively brief, occupancy of the site by the same family groups" (1926: 111).

Similarly, Richard Thompson observed that plain gray pottery persisted into late Puebloan times, at the expense of corrugated types – a phenomenon he called "anachronistic associations" (Thompson 1979). On virtually all 500 sites he documented on the Kanab Plateau, ratios of plain gray to corrugated types remained extremely high (Thompson 1986:356). While it may well be that earlier pottery forms and styles *did* persist locally across the region, excavations on the Grand Staircase support a rather smooth progression of plain gray jar rims from slightly flared to everted during the EPP with a crisp break in their frequency when corrugated pottery was introduced.

What this means for using mixed early and late Pueblo II assemblages to identify a "Middle Pueblo II" transitional temporal period region-wide remains to be seen (Thompson 1986; Altschul and Fairley 1989:105; Lyneis 1992b:209). At this point a middle period on the Grand Staircase is not supported by the excavation data. That said, there is the possibility of differential acceptance of late pottery types and design elements, and the conservative persistence of early types across the region that might reflect a process of differential acceptance due to diverse types of social interaction. Demonstrating different rates of culture change across the region will require fine-grained local chronologies.

Site Structure and Settlement Patterning:

Implications for Subsistence Behavior

The earlier review of partially excavated sites in Kitchen Corral drainage and elsewhere on the Grand Staircase suggests that key features that we believe to be indications of sedentism - habitations, storage capability, and extramural hearth/activity areas - occur on all. These features are present on the Road Kill site, as well. A thorough analysis of settlement patterning demands that all types of sites be considered, and it follows that we need to consider both temporal and spatial relationships between them. In accord with our observations on the sequential occupation of individual sites, the site types identified in the Kitchen Corral drainage suggest that the sequence might involve a range of events: (1) the initial occupation and possibly temporary use of a promising agricultural locale, (2) an increasing storage capacity over time in accord with the success of harvests, (3) construction of additional, perhaps more substantial residences (pit houses) related to the duration of the occupation, and (4) repetition of the pattern due to cultural and/or natural cyclic causes. The history of occupation at Road Kill, as expressed in the archeological record, seems to accommodate all these behaviors.

Sequent Occupations

Aikens (1965) and Jennings (1978) described "sequent" occupations of pit houses and storage complexes at the Bonanza Dune site that inferred a form of residential mobility involving the repeated occupation of a particular site over time by the same or related group. Presumably vacating one principle residence involved moving to another *similar* one, thus the relationship between sedentism, mobility, and subsistence would have remained unchanged: a reliance on domesticates, supplemented by gathering of locally available native flora and fauna from a central base. The following discussion explores the implications for sequent occupation of farmsteads on the Grand Staircase.

Road Kill's site structure represents a sequence of events involving (1) an initial early and largely unexplored occupation of unknown nature, (2) construction of aligned dwelling-storage suites, (3) a period of abandonment or possibly minimal use, and (4) a series of construction events that built upon the earlier infrastructure by extending the existing roomblock. Many if not most excavated sites on the Grand Staircase display a similar sequence of occupational events indicating this pattern of site expansion was common during the EPP. While the pattern might represent just one of several adaptive tactics employed within the overall settlement system, it appears to be a common one.

Demonstrating periods of vacancy and where the occupants went, however, is problematic. In an alternative scenario, sequences of non-use have been described as shifting to a foraging strategy (Westfall et al. 2008) or even transhumance (Fisher et al. 2013). The burden of proof for these scenarios lies with the distributional data. We assume this would involve establishing long-term camps, possibly beyond the Grand Staircase physiographic region. Except for a few rock shelters (e.g., Antelope Cave, Rock Canyon Shelter), few such sites have been identified. Even if the population was periodically dependent on wild foods, we suggest that maintenance of a principle residential base within the farming zone would have been the preferred and efficient form of settlement.

The identification of causes for the sequent shifting behavior are crucial to understanding why they left and where they went. While each site needs to be considered in its own social and environmental context, climate is the common variable that affected all agriculturalists. On the Grand Staircase, higher elevations with greater precipitation and wetter settings would have been favored during a major drought that occurred from AD 750 - 900 (Gumerman 1988; Benson and Berry 2009). Some of the highest site densities on the Grand Staircase during this period occur at elevations of 1830-3,135 m (6,000-7,000 feet) on the benches above the East Fork of the Virgin River where annual modern precipitation is about 16 inches. However, similar EPP sites occur in the St. George Basin along the banks of the Virgin River at elevations under 915 m (3,000 feet) where precipitation is less than half that at the East Fork sites. Mobility between the two extremes may have been a viable tactic.

In the Kitchen Corral drainage, annual modern precipitation is closer to 11 inches, which is the generally accepted minimum for successful agriculture (Benson and Berry 2009). The majority of farmsteads appear to have been situated to take advantage of either alluvial outwash settings or border the larger drainages themselves. We suggest that at least some shifting was in response to local episodes of arroyo downcutting and subsequent lowering of the water table (Kulp and Rigsby 1996; Dernbach 1992; Hereford 1986). Subsequent aggrading episodes would have allowed the resumption of farming. It is apparent that one section of a single watercourse can be downcutting even while another is aggrading. Correlating occupational episodes with natural events represents a challenge for future multidisciplinary research.

Sequential Occupations

The construction of the Road Kill roomblock described earlier illustrates a sequence of construction unlikely to be wholly contemporary but rather separated by intervals of unknown length. This *horizontal* sequence is different from that at the nearby and essentially contemporaneous Park Wash site (Ahlstrom et al. 2000). There, limited excavations demonstrated a *vertical* sequence of superimposed pit houses, as well as evidence for an earlier occupation in the form of an underlying deposit. Cultural fill in the uppermost pit house indicated an even later occupation of the site. Both sites illustrate different site formation processes representing forms of sequent occupation.

A third example of sequent occupation involves multiple roomblocks. A cautionary example is the Dead Raven site (Walling and Thompson 2004). The excavated portion of this site, also located within a road bed, consisted of an accretionally constructed cist alignment fronted by a "light" surface room much like those at Road Kill, Bonanza Dune, and the Kanab site. The fact that Dead Raven Pit House 2 displays additional roomblock/cist alignments suggests that the northernmost pit house may not have been directly associated with the excavated roomblock. This possibility illustrates the difficulty of defining site structure through limited excavation. More likely, Pit House 2 was associated with a nearby unexcavated roomblock. Taken together, these features illustrate long-term but intermittent occupation of the site. Each of the occupational events described above represent the opportunities and challenges of describing site structure at a single point in time.

Recognizing Sequent Occupations and Abandonments

Two basic site formation processes reflect sequent occupation in the Kitchen Corral drainage: (1) spatial or horizontally patterning as apparent in the accretional construction of individual cists and extension of the alignment, and 2) superimposed residential structures and other features such as hearths that indicate discrete occupations. A third process is the refurbishing/reflooring of storage units and occasionally the construction of multiple floors which, to date, has been noted only in the St George Basin. It may be significant that residential structures were rarely remodeled (see Roberts et al. 2022 for exceptions).

In addition, the fill of pit houses, whether natural or cultural deposits, can reveal the nature of post-occupational events, as was the case at the Park Wash site. A more nuanced observation is the identification of recycled building stone from earlier structures, as well as the retirement of structures as evidenced by missing stone slabs. At Road Kill, the apparent recycling of tabular slabs is evidenced by their small "scrappy" appearance on the floor of Cist 3. Again, fill deposits all comment on the nature of activity that took place on site after the structure fell into disuse. These observations contribute to the development of a diachronic view of changing site structure over time that provides insight into our interest in recurrent site occupations.

Horizontal Relationships

The Road Kill site illustrates the nature of early roomblock development in the Virgin region very well. We assumed that the sequence of events that formed the site also reflects an important aspect of mobility that ultimately, in our paradigm, relates to subsistence practices.

Roomblock construction techniques comment on group size, organization, and construction history. Patterning inherent in roomblock construction is a useful trait to infer construction history. For example, the ladder or spinal technique of roomblock construction involved the initial laying out of two parallel walls and then partitioned them into rooms, suggesting a short, single episode construction period with implications for group size and organization (Cameron 1990, 1999). This form of construction appears during the Late Pueblo II period in the Kitchen Corral area. In contrast, during the EPP the cist/room alignments were constructed accretionally through the addition of individual units over time. This method also has implications for group size, social organization, and mobility.

An occupation spanning only two or three generations is often cited as the norm on Ancestral Puebloan sites (Cordell 1984; Bernadini 2005). Pit houses themselves have been estimated to have a useful life of about 25 years, or a single generation. At Road Kill, based on radiocarbon dates and ceramic styles, the overall length of time the roomblock was in use may have been as long as 100 years. If we assume that continuous farming was not reasonable over such an extended period, then some form of mobility between principle farmsteads likely occurred. The frequency and length of the occupational episodes and intervals between them is difficult to measure.

The Road Kill architectural evidence indicates a sequence of residential/storage units initially constructed on level ground and progressing upslope to the east at what presents an unusual, even awkward, stepped layout. Accretional roomblock construction is a key Virgin Puebloan attribute associated with, but not necessarily reflecting, some form of mobility. At its simplest, the construction sequence might reflect growth from a small nuclear family unit to a larger household or corporate group. While Suites 1 and 2 might well reflect this type of growth, Unit 3 built about 100 years later and separated by some distance clearly doesn't. What is clear is a parallel construction sequence roughly contemporary with these events took place at the Park Wash site located just a kilometer to the south of Road Kill (Ahlstrom et al. 2000).

Vertical Relationships

At the Park Wash site, two partially superimposed pit houses are clearly not contemporary and illustrate an unknown length of time between their use. The earlier deep Basketmaker III pit house was occupied for an unknown length of time before it eventually burned, collapsed, and subsequently filled with trash and natural deposits. This pit house was succeeded by the construction of a shallower Pueblo I-style pit house which partially overlaid the earlier one. The interval of time between these two occupations is speculative but probably a generation or two based on radiocarbon and tree-ring dates. In turn, the later pit house eventually fell into disuse and the process was repeated as evidenced by the deposition of cultural material by people living elsewhere on the site.

These two site formation processes, superimposed residences at Park Wash and accretional expansion of the roomblock at Road Kill, complement one another and illustrate very well aspects of the same sequent occupation phenomenon described at Bonanza Dune.

Normative Assumptions about Site Layouts, Style and Function

The regional literature is replete with examples of curvilinear C-shaped or crescent- shaped roomblocks whose layouts are offered as representing single-use occupations, such as ZNP-3 (Schroeder 1955), House 20 (Harry and Watson 2010), and the Mecca Site (Aikens 1966, Allison 1988). We caution that even if they appear in their final form to be a unified whole they should be considered as segments in a linear *chain of events*. Even so, it seems reasonable that crescent or C-shaped "styles" were the result of a mental template of how a site "should" develop over time, perhaps resulting in what amounted to a memorial for the occupants of a site where portions of it were known to have been constructed generations earlier and later fell into disuse.

To a very real extent, defining a pattern of sequential occupation depends on recognizing and considering time depth (construction history) rather than assuming a "normative" synchronic perspective based on what appears to be a unified whole. Exacerbating the possible misconception, particularly one based on surface observations alone, is the assignment of a site to a transitional temporal period on the assumption that seriation of pottery types reflects an actual temporal period such as "Middle Pueblo II." In too many cases, mixed ceramic assemblages are not recognized for what they represent: discrete temporal contexts. On the Grand Staircase dated design styles and jar rim profiles provide a sound basis for assigning temporal placement.

Implications and Expectations of Sequential Occupation

The purposeful reoccupation of residential sites described in the foregoing sections has a variety of implications that are less tangible than the architectural data but nonetheless deserve to be addressed. Social implications include household organization and size, community and intra-regional relationships, caching behavior and the reasons for it, burial practices, and land tenure.

The degree of sedentism is often framed in terms of the amount of effort and substance put into the construction of dwellings. Two types occur during the EPP: (1) lightly constructed wattle-and-daub structures suggesting short-term use, and (2) more substantial pit houses indicating a greater investment and decreased mobility. The question is whether substantial pit houses imply sedentism and lightly constructed surface structures are indicative of seasonal mobility.

A traditional measure of sedentism is midden accumulation. Potsherd tallies have been considered as proxies for occupational longevity (Dalley and McFadden 1988) and intensity of use (Westfall 1985, 1987) and therefore reflect on mobility and sedentism. Potsherd counts from most excavated EPP sites are generally low, suggesting that meager sherd accumulation rates are likely a result of persisting cist storage technology. Below are some of the behavioral implications we might consider that result from a practice of sequential site occupation.

Early Virgin Dwellings: Pit Houses and Jacal Structures

Unlike other areas of the Southwest where pit houses are considered temporary residences (Gilman 1983), they suggest permanence and stability in the Virgin Puebloan region. Early Virgin Puebloan pit houses are about 5 m in diameter and have benches with peripheral posts set into or against them. Formal floor features often include an arrangement of shallow, ovoid basins with clean sand, sometimes open but usually sealed. There are occasionally distinctive shouldered vaults, clay rimmed hearths, and a vent shaft/aperture on the southeast. These structures are remarkably uniform across both the Grand Staircase uplands and St. George Basin (see Aikens 1965; Bullard 1962; McFadden 2016; Nickens and Kvamme 1981; Schroeder 1955; Walling and Thompson 2004). Their similarity is one indication of close ties between the two areas during the EPP.

The identification of pit houses is often hampered by lack of surface evidence, as well as variable proximity to storage alignments. In most cases the most effective means of locating them is by trenching, particularly as surface depressions are rare. Sometimes they can be identified by stained fill on the site surface or by midden deposits where abandoned pit houses were used for discarded household trash.

Relatively permanent habitation structures are the hallmark of sedentism. The distribution and function of lightly constructed, wattle-and-daub structures or “wickiups” is relevant to the discussion of sedentism and mobility because of the implication that they are flimsy, impermanent, and therefore used on a seasonal basis. It is clear, however, that pit houses are the primary residences on the Grand Staircase throughout the entire Virgin Puebloan sequence from Basketmaker II to Pueblo III times. Styles and depth slowly changed over time, but they are the most common habitation on all residential sites.

Traditional benched pit houses were partially replaced in the St. George Basin at the end of the EPP by surface habitation rooms. Up until that time, pit houses and light surface rooms co-occurred, suggesting that they were used alternately on a seasonal basis for various activities. On the Grand Staircase, pit house and light habitation structures also co-occur throughout the occupational sequence. Road Kill was only partially excavated, and pit houses were not identified. But the presence of a pit house or two remains a good possibility. Future testing or remote sensing technology might identify them.

The occurrence of small “mini" pit houses deserves mention. To date, most have been identified in the St. George Basin, including the Reusch site and Three Mile Ruin (Aikens 1965), and Quail Creek (Walling et al. 1986). They are also found on the Grand Staircase. The earliest examples occur during the EPP at 42KA2147 (McFadden 2016), and there are excellent examples during the Late Pueblo II/Pueblo III at the Arroyo site in Kitchen Corral Canyon (McFadden 2012). The ephemeral use of apparent storage cists as dwellings was noted by

Judd (1926), who described evidence of a fire on the floor of what otherwise would be considered a cist in Cottonwood Canyon. Steward (1941) described a similar adobe "lodge" only 3 feet 7 inches in diameter with evidence of a fire on the floor. Their context and size suggest use by an individual or two, possibly in the absence of a larger site population.

Both the Park Wash and Road Kill sites are considered principle residence farmsteads. While each displays slab-lined storage features, the dwellings were quite different with two pit houses at Park Wash and the two surface wattle-and-daub structures at Road Kill. However, lightly constructed wattle-and-daub surface rooms, sometimes called "wickiups" (Landon 2010) or "light pit houses" (Simms et al. 2017), are common on both the Grand Staircase and in the St. George Basin.

A lightly constructed habitation was excavated at 42KA2584, and nearby 42KA2594 had a high probability of one or two (Westfall 1985). Their use as a habitation seems clear, but whether they represent an initial temporary residence, a warm weather residence with a cold weather pit house counterpart, a workroom or activity area, or some combination of all three is unknown. Simms et al. (2017) remarked on the similarity of the structure at the Weeping Juniper site (42KA4895) to those at foraging sites. In some ways, ramada/activity areas and light surface rooms overlap and may have had similar functions. Post impressions, occupation surfaces, rock alignments, hearths, and ground stone artifacts suggest relatively intense domestic activities. Of the two surface rooms on Road Kill, ground stone artifacts, bins, pits, and hearths indicate a variety of day-to-day activities and probably living quarters. At any rate, these types of surface structures are consistently present in one form or another on EPP sites across the region.

While the typical farmstead consists of both storage units and substantial habitations, several excavated sites in the region have not produced pit houses. They do, however, display ramadas, activity areas, and enclosures of some sort. Examples include Richard Thompson's roomblock on Little Creek Mountain (42WS1319), the Red Cliffs site (Dalley and McFadden 1985), the Hurricane Ridge site (Buck and Perry 1999), Parunuweap Knoll (Aikens 1965), Road Kill itself, and most recently site 42KA4896 near Seaman Wash (Simms et al. 2017). These non-occurrences are usually viewed as anomalies attributed to sampling error, essentially incomplete descriptions of site structure.

It is also possible, however, that the lack of formal residential rooms is a matter of occupational history: They simply had not been built yet. This raises the possibility that, in some situations, residences and storage facilities occurred on separate sites, although this seems unlikely. Our model for a typical construction sequence on a farmstead might begin with a temporary, lightly built habitation, essentially a field house, possibly accompanied by just a storage cist or two, and then expanded if the harvest was successful or abandoned if crops failed. A good example of such a site is Roland's Roost (42WS4145) on

Little Creek Mountain (Landon 2010).

Roomblock Layout and Construction Techniques

In a very real sense, the Road Kill cist alignment typifies the process of roomblock formation in the region. Its layout is the result of nearly 300 years of incremental change. During early Basketmaker III times, storage cists were deep, circular, and often nested in random clusters. Eventually, they were aligned but remained separate and became "front oriented" trending northeast-southwest with a pit house to the east-southeast. Over time, the cists were sometimes connected to intermediate pavements, as is the case at Road Kill. Eventually these storage units evolved into shallow rooms that were contiguous but still built one-by-one as demonstrated by abutted walls. This pattern of development was similar across both the St. George Basin and Grand Staircase regions. Consistent throughout the sequence was the construction of floors paved with sandstone slabs or cobbles and sealed with clay. This attribute is evidence of the persistence of cists as the primary mode of storage in both the Grand Staircase and St George Basin throughout the EPP.

The number of storage units in each alignment varies widely ranging from an initial two or three units to as many as fifteen (e.g. 42WS325, 42WS503, and 42WS3119). The ratio of storage units to habitations remains about the same over time, whereas the number of *active* dwellings seems to stay about the same. This suggests either an overall increase in storage capacity or that segments of the storage alignment fell into disuse.

The overall site layout at Road Kill is also similar to that found in both the St George Basin and elsewhere on the Grand Staircase during the EPP. The two cist alignments at Little Man 3 (42WS1349), a Basketmaker III/Pueblo I site located along the Virgin River, displayed adjoining shallow depressions with hearths that were interpreted as light structures (Dalley and McFadden 1988). Site 42WS404, a Pueblo I roomblock with a pit house, displayed a series of storage rooms, some with paved partitions like those at Road Kill, and notably an adjoining occupation surface with a series of outdoor firepits. A pit house on that site was lightly used, if at all, and may have been constructed considerably later than the cist alignment. The construction and configuration of the 42WS404 roomblock is very much like the one at the Road Kill site.

To summarize, the cist alignment/roomblock is considered the defining feature of a farmstead with the number of storage units a measure of agricultural success. The initial two or three storage units that served to supply a household might eventually have been expanded severalfold. While pit houses are common on farmsteads of all sizes, it is possible that light habitation structures preceded them as the initial residence. After the site was established, they could be supplemented by higher-investment pit houses suitable for use during the winter. Similar ramadas and light surface rooms, most useful during the warm season, continued to serve in combination with pit houses as habitation and activity areas.

Kin Groups, Mortuary Practices, and Land Tenure

The accretional construction method of room/cist alignments employed throughout the EPP might best accommodate small households likely representing a kin group centered on the nuclear family. In most cases, farmsteads consist of a single active pit house and a series of storage units. During the succeeding Late Pueblo II Period, courtyard unit pueblos appear on the eastern Grand staircase and Arizona Strip. Roomblocks were laid out using the "ladder" technique with parallel walls that were then partitioned into rooms that incorporated a predetermined number of residential and storage rooms. It is not clear, however, whether the earlier accretional method persisted as well. These L-shaped courtyard and plaza pueblos with two or three residential rooms were apparently laid out and planned to accommodate a larger group size, probably an extended family, and they were constructed over a short period of time.

The number of residential rooms and their size suggests that courtyard pueblos could serve an extended family as Lyneis (1986) has suggested. This change in architectural construction technique and layout is taken to suggest that significant changes in social organizational and perhaps settlement took place at the end of the EPP. The new mortuary practices that accompany these architectural changes may also signal not just a shift in norms but a change in settlement or land-use patterns.

The question of *who* reoccupied sites after variable periods of absence cannot be directly addressed, but a consideration of land tenure in early Virgin Puebloan society is clearly relevant to recurrent site occupations. Burial practices are a significant aspect of settlement. Few burials are known from the EPP on the Grand Staircase or the St. George Basin. This is in marked contrast to the succeeding Late Pueblo II Period when on-site burials are a strongly patterned aspect of settlement (see Lyneis 1992b). While this significant contrast occurred for reasons presently not understood, the absence of burials on early sites might suggest a usufruct system of land allocation whereby use of an unoccupied site and its adjacent fields was available to all. During the succeeding Late Pueblo II Period, when on-site burial was virtually the rule, formal interments in pit house fill and midden areas suggest nascent/incipient form of land tenure by a lineage or corporate group. Even then, the absence of burials within storage room complexes is conspicuous and consistent with the intention to use them in the future.

Things left Behind: Curation and Caching

In situ artifacts and tools as a subset of site structure are assumed to reflect a final glimpse of pre-abandonment activities. Whether their occurrence is purposeful or inadvertent is directly related to our concern with episodic occupations. The caching of artifacts is a behavior that can be related to mobility (periodic absences) and the expectation of returning to a specific site. Examples include the recovery of a jar of amaranth seed in the fill of a cist at the Parunuweap Knoll site (Aikens 1965). Buck and Perry (1999:489) reported a cache of six manos in the plaza area of 42WS3015 that were "incorporated into the rubble wall surrounding the site." A similar cache of manos was recovered at 42WS956, and a cache of metates was found at 42WS395 in the Quail Creek area. These occurrences suggest that absences from these sites were temporary and there were expectations of returning.

Large trough milling stones found *in situ* are a common occurrence during the EPP. This is not surprising, our sample of three averaged 28.1 kg suggesting they might be permanent "furniture" rather than portable artifacts. The depth of their troughs is a measure of intensity of use that reflects the time and volume of material processed on the sites where they were found. On the one hand, they were difficult to transport to a new venue, but on the other they could not be easily taken by someone else while the site was unoccupied. Clearly, "evacuation," to use Aikens' term, of a site required decisions about what to take and what to leave.

The considerable ground stone assemblages at both Road Kill (Room 1) and the Park Wash site (Basketmaker III pit house) suggest an expectation that they would be available upon return. To a lesser degree, this is true of manos, mauls, hoes, and axes. The three long bone awls located on the Road Kill F19 inter-cist pavement might also be an example of cached tools. As an avenue of research, the context of artifacts offers the opportunity for considering both the behavior of *leaving* and expectations of *returning* in terms of both artifacts and architecture.

Granaries are essentially caches in their own right. We note the close proximity to Road Kill of a granary (42KA4860) that also dates to the Pueblo I period. We can speculate that they represent long-term storage in the absence of their builders. While common during Pueblo I times, their role in the overall settlement pattern of the Grand Staircase deserves more attention.

Elsewhere in the region, granaries do suggest seasonal mobility with an intent to return. Numerous examples include early Fremont sites in the Escalante River drainage and remote granary sites on Fiftymile Mountain. These patterns are, however, viewed as very specialized adaptations to those areas. Isolated granaries also occur during the EPP in the upper Virgin River area (Parunuweap Canyon) that are admittedly difficult to reconcile with our model of residential mobility elsewhere on the Grand Staircase. Accounting for them in the context of local settlement remains a challenge.

Ceramic Production

The discrete distribution of ceramic wares across the Virgin Puebloan region was described earlier. Their relative frequencies offer a means of assessing both intraregional interaction and evidence of mobility or the lack thereof. On the eastern Grand Staircase, the presence of two distinct wares, Shinarump Gray Ware and White Ware and Tusayan-Virgin Series Gray Ware and White Ware, complicates this assessment. The following section discusses temporal and geographical distribution of these pottery types and the implications for what they might mean in terms of mobility (see Collette 2009 for a discussion of Shinarump pottery).

Household Production

R. Roger McPeek noted earlier the similarity of design elements on white ware between Road Kill and the nearby Park Wash sites, commenting on the possibility that some Road Kill pottery may have been produced there. This raises the question of who actually made the pottery and where. We and others (Wilson 1985; Perry 2000; Perry and Van Alfen 2012) consider at least the utility types were locally made. In support of local household production is a jar of temper found along with production tools on the bench of the Basketmaker III pit house at the Park Wash site (Perry 2000). Another is a severely warped vessel recovered at 42KA1796, another Basketmaker III site. Both can be taken as evidence for local pottery production. If this is the case, pottery production at the household level, and therefore on virtually every farmstead site, might account for the high degree of observed paste and temper variability.

In his analysis of the 798 sherds from the Vermilion Cliffs Project, Dean Wilson (1985) divided the assemblage into two groups: Shinarump and a catch-all "Virgin-Kayenta" category. His darker sherds, i.e. "Shinarump," consistently refired to a dark red and were considered locally made while the "Virgin-Kayenta," i.e. North Creek Gray, varied in color from buff to pink, yellow-red, and red. Wilson noted that this wide range might indicate a greater number of clay sources for what we typically call the Virgin Series (1985:117).

One potential implication of Wilson's observation is that Virgin Series clay sources may have been distributed over a wide geographic range co-extensive with the Grand Staircase and the St. George Basin. Shinarump pottery, on the other hand, is largely restricted to the area east of Kanab Creek. We assume that utilitarian grayware vessels were made from local clays and therefore that Shinarump Gray Ware was locally made. The origin of Virgin Series, however, is less secure. Determining whether it is locally made, originates elsewhere, or both, is central to our concern with residential mobility.

Sourcing clays is at the crux of the issue. Wilson's (1985) sherd refiring analysis suggested the possibility of multiple sources but had no way to determine where the clay originated. A neutron activation analysis (NAA) conducted at Pottery Knoll (42KA1568) found the compositional diversity of the Late Pueblo ceramic assemblage to be "extreme." The authors interpreted the two main reference groups and seven subgroups as representing different "production zones rather than specific production centers" (Larson et al.1996:233-234). They were also surprised that each group contained all formal sherd categories: black-on-white, plain, corrugated, red ware and

Figure 11.1: Petrified Forest Member of the Chinle Formation on the eastern Grand Staircase (note multiple vary-colored bands) Cay for Lyneis' firing experiment was collected from the lower pink band.

polychrome. They concluded this was evidence of "distant production centers." Because the analysis did not identify the sherds as to actual type or even ware, the findings are ambiguous. Even so, the study suggests that there may be multiple compositional signatures for both Virgin Series and Shinarump pottery.

An experimental open-air firing of local Chinle clays from a known source was conducted by Margaret Lyneis (2009; see Figure 11.1 above). A bowl was formed from a pink stratum of a variably colored Chinle Formation located at the head of Petrified Hollow Wash (Figure 11.2). At the same time Lyneis fired a tile (Figure 11.3) made of weathered purple Chinle clay from a deposit just east of Kanab. The results were quite different. The tile fired gray and shrank considerably (Figure 11.2). But the bowl produced a reasonable facsimile of Shinarump Red Ware (Figure 11.3). Clays from the same geologic formation but geographically separated can have quite different firing characteristics. This may be due, at least in part, to the variably colored strata of Chinle clay that can be found within the same vertical column, as well as mixed deposits at their base. The Moenkopi Formation underlying the Shinarump Conglomerate member of the Chinle offers a similar range of potential pottery clay sources. Together they offer suitable clays for the manufacture of both local utility and decorated pottery (see Adams 2001).

Additional Analysis

Perry described the pottery at the Park Wash site (3,530 sherds) as "local" but

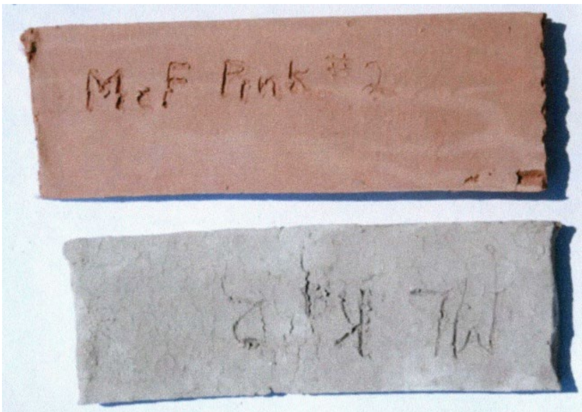

Figure 11.2: Margaret Lyneis' (2009) fired test tiles (in an oxidizing atmosphere) using Chinle clay from two sources: bottom, a purple exposure just east of Kanab and top, a pink band exposed 20 miles to the northeast (see Figure 11.3).

suspected that lighter pasted sherds were North Creek Gray (84%) and darker ones were Shinarump Gray (16%). Of significance, she noted that some of the lighter-colored sherds were vitrified, a characteristic more typical of Shinarump pottery. Painted design styles were comparable to Mesquite, Washington, and St. George "transitional" designs, but she suggested that they might be early versions of Shinarump White Ware. She also noted two sand-tempered red ware sherds. In our present ceramic chronology, Shinarump White Ware and Shinarump Red Ware don't appear until Late Pueblo II times.

McPeek's ceramic an alysis of the Road Kill pottery also broke the assemblage into two groups which he identified as Shinarump (75%) and North Creek (25%), also suggesting that the pottery originated from two discrete clay sources, one local (Shinarump) and one perhaps not (Virgin Series). Thompson encountered a similar division at Dead Raven with 53% assigned to Shinarump and 46% to Virgin Series (Walling and Thompson 2004). Margaret Lyneis had

Figure 11.3: Reasonable facsimile of a Shinarump Red bowl fired by Margaret Lyneis as part of her clay sourcing experiments (2009).

an opportunity to review the white wares and concurred they were Virgin Series. To the west of Kanab Creek, the Shinarump Series diminishes dramatically in frequency. Hagopian (2013) reported 2.3% Shinarump at 42KA6293, and the Kanab site yielded only 3.2% Shinarump (Nickens and Kvamme 1981). This is taken as a clear indication that the center of Shinarump manufacture was to the east of Kanab Creek during the EPP.

One explanation for the presence of two ceramic wares east of Kanab Creek is that some form of contact or population movement occurred with groups to the west where Virgin Series pottery dominates. A second possibility is that lighter colored Virgin Series pottery was favored for the application of painted designs and was produced locally. Thompson found only a single painted Shinarump sherd, a Black Mesa-style sherd that is an Early Pueblo II type, in the Dead Ra ven assemblage. None were found in the Road Kill collection. At this point it is safe to assume that nearly all early painted designs are Virgin Series and are therefore potentially trade items. Not all Virgin Series sherds are bowls, however. If we assume that utility vessels, mostly jars for cooking, are locally made, then we might expect them to be Shinarump Plain. This was not born out by Thompson's analysis at Dead Raven.

Thompson's analysis of ceramics at the Dead Raven site in Johnson Canyon is instructive: the ratio of Shinarump Series (53%) (n=3,016) and Virgin Series (47%) (n=2,632) was about the same as Road Kill, while nearly all white wares (n=57) were assigned to the Virgin Series. Thompson took pains to illustrate the everted jar rims which he considered "the hallmark of Pueblo II" in both the Grand Staircase and St George Basin (Walling and Thompson 2004:52). Of these utility vessels, 64% (n=29) were North Creek Gray and 36% (n=16) were Shinarump Plain. Although the overall ratio is reversed, their co-occurrence supports the local production of *both* Virgin and Shinarump gray wares.

Potentially the foregoing consideration allows for virtually *all* pottery to have been made locally on the eastern Grand Staircase, as we might expect for an essentially self-sufficient population. The high degree of gray ware variability may be a result from a combination of factors including: 1) the differential availability of light and dark firing clays, 2) simple household preferences, or 3) the transfer of pots along with people *between* sites as households shifted from one farmstead to another.

Ceramic Accumulation

It is a truism that pottery eventually accompanies all sedentary agricultural groups for cooking, water containers, and food storage in the Southwest. The quantity of potsherds on a given site has been used to estimate both the intensity of an occupation and its duration. However, in the Virgin Puebloan region observations on midden accumulation and actual sherd counts indicate that ceramic quantities are generally much lower than might be expected. If this is actually the case, ceramics or the lack of them become an interesting aspect of Virgin Puebloan site structure, suggesting that pottery was used differently here than elsewhere in the Southwest.

It has been observed for some time that the presence of storage vessels, and sherd counts in general, are consistently low on early Virgin Puebloan sites. Generally, this has been taken as an indication of short-duration occupations or seasonal use (Westfall 1987). A third possibility is that jars played only a minor role for storage because maize was stored, probably on-the-cob, in sealed storage structures from Basketmaker times until at least AD 1050.

Wilshusen (1986) has estimated that the annual requirement of shelled maize for a family of five would require 215 seven-liter vessels. While sherd counts don't get at this aspect of the data, we have suspected for some time that they rarely approach the number required for such a large number of vessels. In fact, sherd tallies are generally low in storage rooms and complete vessels have rarely been found in them (see Aikens 1965 for an interesting anomaly). Two of the three restorable jars on the floor of the Park Wash Basketmaker III pit house were cooking vessels, and the third was an olla (see McFadden 2016: Figure 48, 60). To pursue this observation, a trial analysis was conducted to estimate the number of vessels represented on a sample of excavated early Virgin Puebloan sites.

Ceramic Accumulation: A Crude but Illustrative Experiment

To address the relationship between sherd accumulations and actual vessel counts, as well as assess the storage jar capacity on Road Kill and EPP sites in general, a typical North Creek Gray jar found on the pit house floor at Little Man 2 (42WS1346) was selected as representative of the Early Pueblo II period (see Dalley and McFadden 1988: Figure 128a). The vessel is globular with a strongly everted rim. It measures 25 cm high, 25 cm in diameter with a 16 cm orifice, a circumference of 79 cm. and weighs 1,260 grams. The volume of the vessel is 6.25 liters. The absence of carbon residue suggested it was not used for cooking.

To determine the number of sherds necessary to represent a complete vessel, the average weight of a sherd had to be determined. The 42WS325 analysis provides useful metrics. The jar sherd count of 13,693 weighed 38,907 grams or 284 grams per 100 sherds. A second sample from a curated collection at Southern Utah University from 42WS3119 of 100 plain gray sherds weighed 343 grams, about 17% heavier. The mean weight of both samples combined is 314 grams per 100 sherds. Also noteworthy was Lyneis' surface collection at Main Ridge of 12,083 sherds with a total weight of 38,968 grams, providing an average sherd weight of 3.23 grams (Lyneis 1992b:37).

As a test case, the Little Man 2 vessel weight of 1260g was divided by 313g which equates to about 400 sherds per vessel. Total gray ware sherd count on site Little Man 2 was 5,494, which would represent about 14 vessels. Maximum total ceramic storage volume is 85.625 liters (13.7 x 6.25=85.625). Following Wilshusen (1986), the annual requirement of 1,505 liters of shelled maize per family per year, the maximum ceramic storage capacity on Little Man 2 is only a small fraction of that requirement. Since some sherds were from bowls and cooking vessels, jar storage capacity would have been reduced even more.

Clearly, the above measurements are gross estimates that can be refined, but determining overall jar sherd weight demonstrates a method with which storage volume in ceramic vessels can be estimated. Table 11.1 provides a sample from excavated early Puebloan sites in both the St George Basin and the Grand Staircase. While Table 11.1 is instructive, it is obviously not conclusive and clearly would benefit from refinements including a more precise average jar weight and volume measurements. The most significant bias, however, is excavation sampling error: 100% of the potsherds on a given site would not be recovered. Lack of control over depositional processes is another source of bias.

Future investigations should include sherd weights and functional attributes such as size, volume, rim form, and evidence of carbon residue. Water ollas, canteens, and particularly cooking vessels are likely to account for the majority of plain gray sherds recovered on most sites. The tentative conclusion of the foregoing analysis is that plain gray sherd accumulations are minimal, supporting our contention that storage in ceramic vessels was simply not an important practice during the early Puebloan period. The implication is that the bulk of foodstuffs were stored in sealed rooms and cists that *are* well-represented in the sample. The capacity of these "architectural vessels" clearly sufficed for the storage needs of a household on virtually all sites (see McFadden 2016: Table 28).

The context of storage jars is another consideration. Most restorable or whole vessels have been recovered from the floors of habitations. Few, if any, have actually been found in storage structures. An interesting exception is Pueblo I site Parunuweap Knoll (42WS200) where Aikens (1965) recovered a Pueblo I style gray ware jar containing Amaranthus seeds in the *fill* of a storage cist. Ben Wetherill reported a similar sealed jar containing corn kernels in the fill of ZNP-21 (Schroeder 1955). We might note that at 42WS325, the site with the highest gray ware sherd count in our sample, the vast majority were found in room fill contexts rather than in contact with floors.

The difficulties of sampling error aside, and the inherent problem negative evidence, we have little means of evaluating our contention other than comparing sherd frequencies outside the Virgin Puebloan region where it is accepted that ceramic jars were used for storage. An example from Black Mesa is considered here.

Black Mesa Site Layout and Storage Comparisons

Robert Euler, while visiting an early Virgin Puebloan site excavated by Richard Thompson's field school on Little Creek Mountain, declared "this site could easily be on Black Mesa" (personal recollection). The following considers how subtle differences in material culture and site structure might reflect adaptive behavior. In this section we explore those similarities further.

Black Mesa site D:11:2030 (Christenson and Parry 1985), dates primarily to the ninth century but its occupation may have spanned as many as 200 years. In many respects it appears similar to Red Cliffs and Road Kill sites, although it has three pit structures not yet demonstrated on those sites. The site was divided into three roomblocks with associated pit structures and a large midden to the

east. The layout consisted of approximately 24 storage rooms with associated jacal rooms forming household units not unlike the Road Kill suites. The authors described the jacal structures as warm season habitations/workrooms, and they assumed the pit houses were winter quarters. Lacking are the connecting pavements between cists found at Road Kill. The ratio of storage rooms to pit houses is about 8:1. Jacal habitations are associated with two or three storerooms. While some storerooms had partial slab pavements, most did not.

Accretional construction of roomblocks, as evidenced by abutted rather than bonded walls, is apparent in most but not all cases. Overall, the comparison between Virgin Puebloan and Black Mesa layouts is quite good. In marked contrast, however, most storerooms are not sealed with a paved subfloor. Also striking, the site sherd count was 44,061, compared to Red Cliffs, which was excavated to about the same extent, that yielded a count of only 4,800 grayware sherds - a difference of about 10 to 1.

Taken at face value, Table 11.1 offers little support for large-volume storage of shelled maize in ceramic vessels in the Virgin Puebloan region. It indicates that even on sites occupied over many decades that ceramics recovered do not represent enough storage volume to sustain a household for even a single year. This is especially so if we assume that most of the plain vessels were used for cooking and water storage. In contrast, the average volume of individual cists during this period is typically more than sufficient for this purpose and frequently enough for multi-year requirements (see McFadden 2016: Table 28). The following section considers the implications and potential adaptive advantage of *not* using ceramic vessels to store foodstuffs.

Adaptive Advantages of Maize Storage in Cists

Ethnographic data have documented foraging ranges up to around 8 km from a base camp (Kelly 1992:46). Surely the foraging ranges were highly variable, but a more cogent observation (and one relevant to our concerns) is that "foragers move when the returns of logistical forays from the current camp drop below those to be expected from another camp, after allowing for the cost of moving" (Kelly 1992:47). We suggest this observation also applies to agriculturalists whose fields were becoming degraded or soils depleted in some way. Employing cists for storage, rather than transporting or leaving behind potentially hundreds of ceramic storage containers would have reduced the "cost of moving" considerably.

In addition, storage in "architectural vessels" would have at least allowed for the possibility of surpluses remaining on the cob and negated the need to dry and shell the maize before it was stored in jars. Extremely fine amaranth seed would have been a different story, and its storage in ceramic vessels has been documented (Aikens 1965). This could have been the case for seed corn and dry beans, as well.

Compared with contemporary sites in the Kayenta region, such as Black Mesa, the early Puebloan sherd counts are exceptionally low (about 10%), suggesting that maize was stored, probably on the cob, along with other bulky foodstuffs, initially in cists and eventually in cist-like sealed rooms. This Basketmaker technique continued at

Table 11.1: Ceramic Accumulations as Estimates for Storage Capacity

Site	Period	Sherd count	% plain	Estimated total weight (3.13g per sherd)	Total volume (liters)	Potential storage vessels (6.25 liter)
Hurricane Ridge	BMIII/PI	7,804 total 7,320 plain,	94	22,911g	113.66	18.2
South Creek (42WS1712)	Early PII	1,391 total, 1,245 plain	90	3,397g	16.9	2.7
Little Man 1 (42WS404)	Pueblo I/II	536 total, 491 plain	92	1,536	7.6	1.22
Little Man 2 (42WS1346)	Early PII	6,068 total, 5,494 plain	90	17,196	85.3	13.65
Little Man 3 (42WS1349)	BMIII/PI	2,578 total, 2,258 plain	88	7068	35.06	5.61
Little Man 4 (42WS1348)	Early PII	133 total, 128 plain	96	401	-	0.32
Red Cliffs (42WS404)	PI/Early PII	5,521total, 4,804 plain	87	15037	74.59	11.93
Bonanza Dune (42KA1076)	Early-Late PII	11,367total, 8,051 plain, 1,810 corr.	87	25200	125.1	20
Sand Hill (42KA1060)	Early-Late PII	3,627 total, 3,556 plain, 71 corr.	98	11130	55.21	8.83
Kanab Canyon (42KA6293)	PI-Early PII	3413 total, 3,240 plain	95	10141	50.3	8.05
Kanab Site (42KA1969)	PI Early PII	11,209 total, 9,863 plain	88	30871	153.13	24.5
Dead Raven (42KA2667)	Early PII	5,728 total, 5,390 plain	94	16871	84.22	13.4
Park Wash	BMIII-PI	3,530 total, 3,392 plain	96	10617	52.66	8.43
Road Kill	BMIII-PI	1,483 total, 1,427 plain	96	4467	22.3	3.54
42WS325	BMIII-Early PII	16,975 total, 13,799 plain	81	38907 (actual)	215.6	34.5
Road Runner	BMIII	3,213 total, 3,211 plain	99.9	10050	49.85	7.98
Average	-	-	92 Percent	-	-	11.43

Note: Estimated total gray ware sherd weight divided by 1260g was used to determine the number of jars. Whole or refitted vessels are not included in the analysis. Hagopian (2013) reported that of a total of 7,732 sherds only 3,420 were large enough to be analyzed for site 42KA6293. The total number of jar sherds is used here.

least until AD 1050, and there is considerable architectural evidence that the practice may have persisted into late Pueblo II and Pueblo III times. For example, at the nearby Arroyo site both storage Rooms 1 and 2 had paved floors (McFadden 2012); the floor of Room 1 atPottery Knoll was lined with sandstone slabs (Morley 1993) and a large amount of maize and cheno-ams on this surface.

The large number of cob fragments recovered there suggested that the corn was being stored on the cob (Martin 1995).

This raises the question of why this method of storage persisted in the Virgin Puebloan region while it was largely replaced by storage in ceramic vessels elsewhere by Pueblo I times. In terms of behavior, what adaptive advantage was there for the continued use of cists instead of replacing them with ceramic vessels? Or conversely, what advantage was there to *not* relying on jars for storage?

Ceramic storage vessels are heavy, fragile, relatively expensive to produce, require numbers in the hundreds, and are simply not an efficient method of transporting grain for a periodically mobile population. For example, the Tarahumara carry 20 kg sacks of unshelled dried maize when necessary (Hard and Merrill 1992:612). Storage in jars also requires the maize cobs be shelled or milled after a period of drying. Portability of small amounts and the ability to securely seal their contents are the main advantages of ceramic storage vessels. Wilshusen (1986) estimated that 215 vessels, each holding seven liters of shelled maize, would suffice to store the average family of five's annual maize requirement (1500 liters). For a residentially mobile group, either the vessels would have to be transported to the new residence (a considerable task) or left behind, which would require yet another set to be made. Leaving the vessels unattended at an unoccupied farmstead might have invited theft.

We believe the labor investment of obtaining and processing the raw clay, forming the vessels, and fuel wood consumption to fire the vessels exceeded the “cost” of constructing a storage unit of comparable volume. This would be especially true if cists only needed to be refurbished or if on-site construction stone and mortar could be recycled. While the meager ceramic accumulations on Virgin Puebloan sites are not conclusive, they support the notion that cists and carefully sealed semi-subterranean rooms were the primary means of preserving bulky surplus foodstuffs throughout the EPP.

It follows that while potsherd frequencies are useful for a number of analyses, low numbers do not necessarily indicate short-term occupations nor mobility, but rather are the result of a very specific behavior. The option of either transporting hundreds of storage vessels between sites or manufacturing hundreds of new ones would not be efficient. In this light, the refurbishment of existing storage cist infrastructure and construction of new units might be considered an adaptive response to residential mobility between farmsteads.

Projectile Point Frequencies

Projectile point frequencies have been used as means of quantifying prey choices (Arakawa et al. 2013). By Basketmaker III times, the atlatl and dart had largely been replaced by the bow and arrow. Assuming that arrow points were used primarily for hunting big game, their frequencies would seem to complement the analysis of artiodactyl faunal remains. In most cases, small stemmed points at early Puebloan sites have been recovered from the floors and benches of pit houses and in the fill of hearths. Virtually all small early points (Rose Spring, Abajo/Trumbull, and Parowan Basal-notched) are some variation of a stemmed point, and arrow points are common occurrences on virtually all agriculturally oriented habitation sites. We might expect their spatial distribution to provide some insight into where the hunting took place.

A review of isolated occurrences of projectile points on recently conducted intensive inventories both on the Skutumpah Terrace foraging zone and the arable zone below the Vermilion Cliffs found minimal evidence to support hunting during the Puebloan period. Of 72 identifiable points found in both areas, Elko Series dart points were dominant with stemmed arrow points accounting for only 11% (n=8). Hunting in these areas occurred as early as Paleoindian times, followed by substantial Archaic activity, and most recently Numic foragers. But there is less evidence for hunting during the intensively occupied Puebloan periods.

Although faunal remains recovered at Road Kill were minimal, excavations at the nearby Arroyo site demonstrated that deer, sheep and antelope were present in good numbers prehistorically. It seems likely that these species would have been available to their ancestors, as well. If we assume that projectile points were primarily for hunting big game, the question then becomes where did they hunt? One possibility, although beyond the scope of this report, is the mule deer winter ranges on the north and west slopes of the Kaibab Plateau.

There are two other potential explanations. At least some Elko Corner-notched dart points might actually have been used for hunting by Ancestral Puebloans. Persistence of the atlatl beyond Basketmaker II into Puebloan times was suggested by Van Pool (2006) and to an extent supported by surveys on the Kaibab Plateau (McFadden 2016; McFadden and Keller 2007). That said, while Elko Series points occasionally are found on early Puebloan sites, their frequencies are always very low.

A second explanation worth considering is that Kitchen Corral Canyon itself served as a game corridor, limiting the need for hunting forays away from the farmsteads. This would largely have been limited to the spring and the late fall/early winter when the Paunsaugunt mule deer moved between their winter and summer ranges.

Storage Expectations and Observations

Quantification of storage volume as a measure of demonstrating reliance on maize was initiated in the Virgin Puebloan area on the Little Man project (Dalley and McFadden 1988). Sites excavated by this project included Basketmaker III, Pueblo I, and Early Pueblo II occupations. Following Wilshusen's estimate of 43 bushels (1.5 cubic meters) of shelled maize necessary to sustain a family of five for one year, cists were more than adequate to fulfill storage requirements. Pit houses on each site met the basic shelter requirements for a family of five. Ramada and/or jacal structures present on most have since been demonstrated to be a defining trait of residential farmsteads, not only in the St. George Basin but in the uplands. Storage capacity for a sample of residential sites on the Grand Staircase demonstrate that virtually all exceed the minimal requirement of a nuclear family (see McFadden 2016: Table 28, 169).

Road Kill Cists 1 and 2 were estimated to have a volume of over 3 cubic meters each. Assuming storage on the cob requires about twice the storage volume of shelled maize, this would still have been sufficient for a year's supply of maize on the cob or two years if shelled. Further assuming an annual yield of about 10 bushels per acre (Nash 2013; see also Barlow 2002 for a discussion of yields for "shifting cultivation" systems), a minimum of about 10 acres would have been sufficient to produce 50 bushels of shelled maize. The alluvium in Park Wash adjacent to the Road Kill site could have easily provided fields large enough to produce those quantities. At this point, the Park Wash canyon floor is about 100 m wide allowing for about one field acre per 50 m along the wash. Although it is beyond the scope of this report, estimates of arable fields available to contemporaneous sites along the wash would be an interesting measure of carrying capacity.

What is not always clear is whether the individual cists that comprise alignments or roomblocks that experienced expansion over time were simultaneously open and functional. There is evidence that on certain large sites, such as Red Cliffs (Roomblock A) with 15 storage units, only a few units were used at any given time (Dalley and McFadden 1985). This was the case at the close of the final occupation, but we cannot know the status of each cist over the entire span of the occupation. While we assume that only two or three were necessary for a nuclear family, there was at least potential to increase storage capacity by re- commissioning inactive cists.

While it is apparent that additional dwellings correlate with an increase in storage capacity, thus maintaining a 3-1 ratio, there is evidence that the number of *functioning* dwellings on a site may actually decrease. If this is the case, the additional dwelling/storage unit "suites" do not necessarily indicate population growth but rather expansion of the roomblock. An interesting implication is that, over time, as multi-year storage capacity became increasingly available, it may have facilitated what Martin (1999:508) called a "periodic overdependence on maize."

Dwellings as Measures of Occupational Duration

Aikens' work at Bonanza Dune provides an exceptional example of superimposed sequences of occupation and a consideration of the intervals between them. Unfortunately, there was little evidence for determining the duration of each occupation and even less for the length of the intervals between them. Clean blow sand on the floors, a preponderance of plain gray sherds on the floors, and a common pit house style indicated, however, that the sequence occurred within the 350 years of the EPP.

We have characterized storage architecture as long-term, multigenerational infrastructure. In contrast, domestic dwellings were relatively short-term structures built and occupied by a household and used for the duration of an occupational episode. There is little evidence for remodeling or reconstruction of Virgin Puebloan pit houses. Cameron (1990) provides a useful synopsis of the literature discussing the longevity of pit structures in the Southwest and the reasons they might have been abandoned. Estimates range from 10 or 15 years to 25 years or more. While we should be cautious about assumptions of use-life that may not be applicable to our region, the number of domestic habitations and the length of their use are critical to our understanding of the timing of "sequent occupations" in the study area.

It is significant that there is little evidence of pit house remodeling or reconstruction documented in the Virgin Puebloan region. This is clearly at odds with storage infrastructure. The dwellings identified on Road Kill are much less substantial wattle-and-daub surface structures. A potentially significant attribute is that, like pit structures, they too stand alone and are not incorporated into the storage alignment. While the useful life of a surface dwelling was certainly much shorter than a pit house, at this point making a distinction between the type of dwelling is probably unwarranted. As exposed by our limited excavations, Road Kill has two dwellings, good evidence for a third, and the potential for at least one more upslope fronting the unexcavated cists. There is also the possibility of subterranean pit houses to the south. The relatively short-term use of individual habitations, compared to the apparent long-term use of their associated storage components, is an interesting contrast that should be the best measure of the duration of each occupational episode.

Transition from Foraging to Farming

The origin of agriculture on the Grand Staircase has yet to be resolved. Some favor "an in-migration of farming populations" (Berry 1982, Janetski 2017; Roberts et al. 2022). If so, we might ask, were attendant aspects of culture also adopted wholesale? These would include material culture items, symbolism, interment practices, planting strategies and techniques. There are, in fact, similarities with the Four Corners material culture record by about AD 200, but also some significant differences. It seems doubtful that an immigrant population could so quickly adapt the full range of subsistence options and their timing unless they were assimilated into an existing population. Favored here (but not yet demonstrated) is the presence of an indigenous Archaic population that accepted and fostered the practice of maize farming. The length of time it took for the economic transition, in effect the local "agricultural revolution," to be accomplished is another matter entirely.

A pre-agricultural foraging camp might look much like the Archaic component of the Arroyo site located south of Road Kill (McFadden 1996, 2012). The foraging "base camp" underlying a substantial pueblo suggests that reliance on a native subsistence base in the Kitchen Corral drainage was entirely possible. The exposure in profile of a shallow wickiup-like habitation structure, not unlike those found on Road Kill and other early Puebloan sites, indicates relative permanence. The proximity to both floral and faunal resources, local springs, apparent riparian areas suggested by the presence of cattail (Typha) pollen, and a moderate climate at about 1,675 m (5,500 feet) could have provided a well-situated, semi-permanent base camp. With the introduction of cultigens and a means of storing surplus, to the extent harvests were successful, sedentary farming would have been achievable.

The Archaic level at the Arroyo site dated to about 1700 BC (McFadden 2012). It is tempting to reverse the recent interest in Puebloan intense use of pigweed and amaranth (Sullivan and Mink 2018) and project their significance to an Archaic origin. Rather than considering cheno-ams as "weedy" ruderals accompanying the practice of agriculture, the Archaic predecessors living in a relatively substantial dwelling appear to have been gathering and processing this resource well before the introduction of agriculture. This may have eventually predisposed indigenous populations to then incorporate true domesticates into their subsistence strategy.

The earliest reported radiocarbon dated maize now appears to be about 1000 BC associated with a bell-shaped storage pit and pit house hearth at the Eagles Watch site (42KA6165) at Jackson Flat (Roberts et al. 2022). Whether the Jackson Flat sites represent the beginning of widespread, systematic agriculture in the region is not known. Demonstrating the presence of non-farming Archaic foragers during the 800-year gap between the earliest evidence of agriculture and the well-established Basketmaker II occupation is a challenge for future research.

At present, the wide-spread occurrence of Gypsum Series projectile points and Barrier Canyon rock art styles are the only real tangible evidence for a Late Archaic presence. It is interesting to note, however, that Walling-Frank (1998) found Gypsum points at a Basketmaker II site near Hildale. This raises the question of whether an indigenous Late Archaic population may have co-existed with immigrant farmers, or whether agriculture took hold almost immediately after the introduction of maize.

By the early centuries of the common era most watersheds across the Grand Staircase held Basketmaker II sites that were succeeded by a continuous sequence of Puebloan occupations. Basketmaker II era radiocarbon dates are common on early Puebloan period sites (see Spangler and Zweifel 2021). This suggests that Basketmaker II occupations may have pre-staged subsequent dry-farming by Ancestral Puebloans in the uplands. By Basketmaker III times, agricultural sites are widely dispersed in dry farming, sub-irrigated, and outwash locales, setting the stage for the EPP tradition.

The long and continuous history of occupation in the Kitchen Corral drainage and the eastern Grand Staircase (and each of the major Virgin Puebloan subareas for that matter) seems to be the exception to most regions of the Southwest. It is a pattern at odds with recent descriptions of Puebloan population movement as one of "serial" migration from one site to another (Bernadini 2015). As Cordell (1984:325) and others have pointed out "...single sites throughout the Southwest were rarely occupied for more than one or two human generations." Virgin Puebloan settlement on the Grand Staircase and the St George Basin frequently, even typically, exceeded this span. We might modify Cordell's observation to say it was the occupational *episodes* that were rarely longer than a generation or two.

Chapter 12

Integrating Subsistence, Site Structure, and Settlement

Long sequences of occupation are known in many Ancestral Puebloan regions of the Southwest, but they are isolated and rarely span the entire Formative Period. What makes the Virgin Puebloan region, and particularly the Grand Staircase subarea, stand out is that lengthy occupational sequences occur in a diverse range of agricultural settings, at about the same time, and on the same sites. The following attempts to reconcile the internal structure of sites, their distribution, and the varied sources of subsistence data with this observation. The possible motivations, as well as implications for this form of mobility, are explored. We conclude that each of these datasets is congruent with a pattern of recurrent occupation that played an integral role in forming the archaeological record during the Early Puebloan Period (EPP).

Sequential occupation of a farmstead describes a tendency to return periodically as social and/or environmental conditions warranted. While it is a common practice on the Grand Staircase, some of the best examples are from excavated sites in the St. George Basin. In both locations, the frequency of those changing conditions probably varied considerably over time. The limited excavations at the Road Kill and Park Wash sites allow for a time span as short as a generation or two. On other sites, reoccupation may have operated on the scale of hundreds of years (e.g., evidence of Basketmaker III occupations on otherwise late Puebloan sites). These long-term reoccupations may have been in sync with climate regimes rather than the short-term “weather” events that we suggest drove mobility during the EPP. A similar pattern occurs in the St. George Basin where radiocarbon dates have documented site occupations spanning hundreds of years are common. It is apparent that each occupation involved the recurrent use of a place and often the very infrastructure and resources that formed the site. Whether it was actual kinfolk who were responsible for these sequences is not known, but some form of social identity with the prior occupants seems assured.

Subsistence

The single most contentious, or at least cited, issue in Virgin Branch archaeology is subsistence practices: To what degree were the Virgin Puebloans invested, dependent, reliant, or committed to agriculture? Positions range from foraging that supplemented agriculture (Westfall 1985, 1987), to agriculture that supplemented foraging (Murray and Polk 2008), to the extreme that a mixed subsistence economy was never practiced at all for any length of time (Martin 1999). Most settle for a “mixed” subsistence economy and leave it at that (e.g., Baker and Billat 1992; Allison 1990, Talbot and Richens 2009, Janetski 2017). Our focus has not been on subsistence per se, but on puzzling out how and why such variability exists.

As is widely held in the Southwest, no indigenous society is totally dependent on domesticated crops alone. The relevant question then is how diet and mobility relate to each other and under what circumstances. We agree with Westfall et al. (2008) that understanding the degree and nature of mobility is key to addressing subsistence practices but reject the inference that the presence of native species necessarily indicates extensive foraging and the need for distant base camps to support foraging. Our approach to addressing the question of mobility has been to take a close look at individual site structure, site frequencies and distribution patterns, and *then* consider subsistence data in its different forms, and especially, contexts. Over the course of the EPP, particularly during years of crop failure when the farm essentially became a foraging base camp, we would expect the amounts and diversity of native macrobotanical and faunal remains to vary according to local circumstances.

There is good evidence for use of cheno-ams in the Kitchen Corral drainage over the entire span of its known occupation. *Chenopodium* sp. seed and cheno-am pollen were recovered nearby in the Archaic pit house at the Arroyo site dated to 1800 BC. Both *Amaranthus* sp. (pigweed) and *Chenopodium* sp. (goosefoot) were recovered in the overlying Late Pueblo features (Martin 2012). A large amount of *Chenopodium* sp. was recovered farther downstream at 42KA2662, also in a Late Pueblo II context. Clearly these ruderals were available and at least occasionally used during EPP times.

Maize and cheno-ams that inevitably accompany farming activities were ubiquitous components of the Virgin Branch diet on the Grand Staircase, apparently on the order of 80% of caloric intake (Martin 2012). When supplemented by beans, turkey, eggs, and seasonally available native floral and faunal resources, a well-balanced diet was entirely achievable if not always realized. Wild food was generally available locally and would have required only short forays from the site, at most a day's walk, perhaps ranging to higher elevations.

The Grand Staircase region provides a series of stepped environmental zones that correlate well with site distributions. Architectural sites occur on the lower elevations from 1,525-2,135 m (5,000-7000 feet), and limited activity sites and camps dominate the terraces above 2,135 m (7,000 feet). While limited activity sites are interspersed with farmsteads in the lower zone, there is virtually no evidence of agriculture among the upper foraging-oriented sites. This is taken to indicate that foraging among the farming sites was always an option, while farming in foraging zones was not. This distribution pattern suggests that the agricultural zone alone had the potential to provide the bulk of both native species and domesticates. Our thesis then assumes that much, or even most, foraging activity took place *among* the habitation sites themselves. While forays to higher elevations were apparently less common, the topography of cliffs and terraces enhanced proximity not only of biodiversity through abrupt changes in elevation but geological resources as well, such as tool stone, building stone, and pottery clay and temper. Most important, topographical variability offered a variety of natural attributes important for agriculture, including soil types, length of growing season, precipitation amounts, cold air drainage patterns, aspect, and field types and settings.

The Farm as Field House

A key association supporting the importance of agriculture and the function of architectural sites is the consistent proximity of storage/habitation sites to arable settings – what we might call the "farm as field house" pattern during the EPP. Recognition of this association also provides insight into which environmental settings were suitable for agriculture at a given point in time. To the extent there were multiple occupations on a site, the tempo of both use episodes and environmental change that prompted them might be estimated.

In contrast, other areas in the eastern Virgin region, such as the western slopes of the Kaibab Plateau, are known to have as many as two or three dispersed ephemeral field structures for each small pueblo habitation (McFadden 2004; McFadden and Keller 2007). Although these structures occur in much more stable settings, as evidenced by intact check dams, an additional advantage to maximizing field size would have been minimizing risk of damage to fields which, in turn, would promote residential stability. This was not the case on the Grand Staircase where fields were often concentrated along a single, highly vulnerable drainage subject to being downcut and degraded. Still, determining the overall costs and benefits of moving would have been a highly variable and complex calculation (Hard and Merrill 1992).

Site Infrastructure

The persistence of cist technology with deep, sealed, slab-lined storage units beyond the Basketmaker era on the Grand Staircase and the St. George Basin is the single most consistent adaptive trait of the EPP. The key attributes are large volume, durability, and the ability to be quickly refurbished. Along with the lack of evidence for storage in ceramic vessels discussed earlier, large volume storage in permanent structures has been presented as supporting evidence for a strong commitment to agriculture, as well as an attribute that reduced the cost of moving from one farmstead to another.

While storage alignments are persistent infrastructure, EPP pit house dwellings show little evidence of having been rebuilt and were typically abandoned after a single use. Superimposed pit houses or construction in new locations were both common occurrences. Several studies of pit house longevity in the Southwest suggest they were occupied for less than generation (see Cameron 1990, Cordell 1984). Presumably, more ephemeral jacal surface dwellings such as those at Road Kill and other Virgin sites, would have had an even shorter use life. For these reasons, dating dwellings, especially pit houses, may offer the most reliable means of measuring the duration of occupations and the intervals between them.

Building on the Past

The expansion of storage units during the EPP was an accretional process. Whether the individual cists were active or not, they were the infrastructure that was expanded upon. What seems clear is that on sites that experience roomblock expansion over time there is at least an increase of *potential* storage capacity. It is also apparent that increases in capacity are often not coequal with a corresponding increase in the number of dwellings. It seems reasonable that substantial cists that had fallen into disuse would have been refurbished on an as-needed basis. This presents the possibility that multi-year storage capacity was potentially available during bumper crop years and perhaps corresponds with what has been called "an overdependence" on maize (Martin 1999:508). At any rate, it may be worthwhile to consider the implications of over-production as it is to focus on the dire consequences of catastrophic crop failure.

While the subsistence record demonstrates the relative importance of maize in Virgin Puebloan diet, thereby suggesting a sedentary lifeway, it is the architectural record that informs us about the level of commitment to agriculture. We have suggested that it is the quantification of storage capacity, and the care and effort put into constructing it, along with attendant residential dwellings, that is the strongest indication of year-around "sedentary" occupations. While the analysis of macrobotanical samples can demonstrate the range of diversity for prehistoric diet, it has not been very effective at addressing the key species desired or the quantities obtained. On the other hand, the capability of storing metric tons of produce strongly indicates at least the *expectation* of large harvests.

On the Grand Staircase, and specifically along Kitchen Corral Wash, it has been proposed that it was the inherent instability of the landform and settings within it favored for agriculture that best account for periodic movement between different locales and individual sites within them. Evidence for alternating downcutting and aggrading events and channel incision of the wash and its tributaries is abundant in the Kitchen Corral drainage and across much of the Grand Staircase. Prehistorically both short-term (intra-generational) and long-term (multi-generational) occupational episodes are evident. In our view, the tempo for each was likely a response to high frequency weather events that impacted agriculture.

Maize Storage

If the preservation of surplus crops is considered a requirement of sedentism, storage capacity becomes an essential measure of the degree of commitment to agriculture. The sherd accumulation study presented earlier, although tentative, strongly suggests that ceramic vessels were not an important means of storage during the EPP. Storage in sealed cists is, however, sufficient on virtually all sites to sustain a core household for a year and often longer.

Storage volume also directly addresses the question of whether sites were occupied year-round. To paraphrase the adage, home is not only where the hearth is, but where the larder is. It seems unlikely that large volumes of maize would be transported from one residential farmstead to another used for winter occupation. At any rate, such sites have not been identified in nonarable settings.

Group Size and Organization

In terms of social organization, successful sites might be expected to display increases in population size beyond the nuclear family but rarely, if ever, beyond the extended family. Truly large sites are known to occur in the region, but few have been verified to represent actual population aggregates. A case in point is the Early Pueblo II Mecca site located on one of the lower terraces of the Grand Staircase that consists of a series of very large early Puebloan sites with at least one consisting of 80 to 100 rooms that was described as a sizeable, aggregated community (Allison 1988; Lyneis 1986). These sites are actually made up of a series individual (separately constructed) courtyard layouts, each of which were accretionally constructed household units identical to those found individually across the region. Whether they truly represent large population aggregations or are a product of accretional construction over time has yet to be demonstrated.

From a diachronic perspective, the simultaneous occupation of roomblock suites on extensive sites of this size (and complexity) have yet to be verified by excavation. Doing so would not only require determining the construction history of each individual room block but the temporal relationship between them. In the absence of integrating structures such as kivas, actual community space is difficult to demonstrate.

Dense population aggregates would have had economic carrying capacity issues, as well. An aspect of population aggregation rarely addressed is the productive capacity of the local setting. For example, the aforementioned 100 rooms at the Mecca site might represent as many as 25 or 30 households. At about 10 acres of field per household, 250-300 acres would be required to sustain the population. In this specific case, however, the setting adjacent to these sites may well have provided that capability. Sandy, low gradient slopes and basins apparently resistant to arroyo downcutting may well have provided that capability during climate regimes with adequate precipitation.

Assuming typical field-pueblo proximity, there is little evidence for sites of this size, nor cultivation on this scale, elsewhere on the Grand Staircase. Nor are there any good indications of an extensive field house system which occurred prior to the succeeding Late Pueblo II period. While the presence of Moapa Gray Ware suggests a social connection with the Mount Trumbull area, the dominance of Virgin Series supports a primary connection with our Grand Staircase study area. Temporally, if the Virgin Series jar rim forms and painted design styles are consistent with the existing ceramic chronology, the maximum span of the Mecca site occupation could have exceeded 150 years (AD 900-1050).

The caution offered here is that room counts based on surface evidence alone are not a reliable measure of either site population or social complexity but they often *are* a good measure of a site's occupational duration.

Shifting Cultivation

Hard and Merrill (1992: 616) have argued that "Different mobility strategies represent alternative solutions to the problem of bringing people and resources together in space and time." We have suggested that the key resource sought on the Grand Staircase were agriculturally productive fields, and that a form of shifting cultivation was the result. Different mobility strategies may have been employed at different times and places. Clearly, the varied settings of the region fostered different responses while maintaining a common material culture "tradition" during the EPP.

The pattern of mobility emerging on the Grand Staircase as represented by site structure suggests a behavior of vacating a site only to return at a later time. It accords well with Aikens' (1965) and Jennings (1978) observations of multiple sequent occupations at Bonanza Dune. The term raises the obvious questions of why they left and where did they go between the occupational episodes. We have suggested that a viable tactic was that they simply moved to similar sites that were successful in the past and where more favorable conditions for agriculture currently prevailed.

Local Weather in the Context of Regional Climate

Expectations of farming success coupled with the reality of potential failure are an integral part of any (successful) adaptive behavior. A practice of shifting cultivation accommodated both possibilities and accounts as the underlying cause for the sequential occupation pattern on the Grand Staircase. It follows that the timing and tempo of moves between fields was driven by the basic requirements of farming. Because erosion is endemic to much of the Grand Staircase, cut-and-fill cycles are the most likely cause and may have driven mobility at times when the combination of severe local weather events and outwash farming techniques were disastrous.

Changing climate regimes are obvious long-term cycles that had an impact on settlement in the long run (Dean et al. 1985; Benson and Berry 2009; Larson et al.1996). The responses we propose are local, high frequency processes (< 25 years), and the tempo gauged to annual and essentially random weather events rather than major climate regime change (low frequency processes > 25 years). We propose that EPP Grand Staircase settlement was not a response to climate per se but rather represents a behavior that successfully dealt with short-term and localized "weather" events and their impacts to fields. Benson and Berry (2009:109) have proposed that options in response to drought on a regional level included lateral moves outside the area of drought to unoccupied arable lands and moves to cooler, wetter high elevations. The Grand Staircase setting provided similar mobility options but on a smaller scale.

We assume that the scale, form, and timing of residential mobility is closely correlated with environmental conditions and consequently climate (Dean et al. 1985; Gumerman 1988; Larson et al. 1996; Benson and Berry 2009). The EPP corresponds closely with high temporal variability, low effective moisture, and hydrologic fluctuations that affected ground water levels that would have impacted agriculture. In contrast, it has been proposed here that Virgin movement between sites and their agricultural settings was not simply a response to climate extremes such as “megadroughts,” but was itself an accommodation to the vagaries of short-term “weather.” It is interesting to note that the end of the EPP coincides with the onset of a wet period favorable for agriculture that occurred between AD 1045 and 1129 (Benson and Berry 2009).

On the level of individual sites, it may well be the chaotic exigencies of “weather” rather than long-term climate cycles that drove mobility. Most of the diverse settings farmed on the Grand Staircase - dry farming, sub-irrigated reaches along live streams, and alluvial outwash settings that range in elevation from 1,525 m (5,000 feet) to just over 2,135 m (7,000 feet) - have sites representing all, or at least most Puebloan periods. It is improbable that the occupation of all these settings was both simultaneous and continuous over the long run. To the extent we can project sequent site occupations for these very different settings in the region we must assume that the causes varied, as well. While climate cycles offer an obvious means of considering long-term change, the tempo of sequent occupations during the EPP was driven by local conditions in a variety of settings on a highly variable time scale.

The Sedentism versus Mobility Paradox

While subsistence, settlement, and site structure are discrete datasets, they are related in complex ways. Considered together they allow us to describe behavior quite accurately. Mobility, while not visible in the archaeological record, is one of the common links between them. We have demonstrated that Virgin Puebloan settlement patterns reflect the ways, and suggest the means, that “connected people with their food sources” (Hard and Merrill 1992). Our assessment of individual site structure suggests this connection was an intermittent one between similar sites that occurred in settings capable of producing both cultigens and desirable native species.

Others have taken the opposite tact, suggesting that subsistence data, taken as the ratio of domesticated to native species, can be used as a proxy for assessing the degree of a group’s mobility (Cummings and Puseman 1996: D-112). While suggestive, this approach cannot account for the range of possible settlement options in any given environmental setting. In the approach taken here, subsistence data in its various forms are considered in the *contex*t of overall settlement and site structure, rather than as a means of determining it.

Traditionally, mobility infers a shift in subsistence from one economic setting to another. In the Virgin Puebloan region that has typically meant moving from an agricultural site to a foraging one (Fisher et al. 2013; Westfall 1985; Janetski 2017). In contrast, it has been argued here that pueblos, closely associated with arable fields, were year-round “field houses” that also functioned as “base camps” for foraging. During the span of a given occupational episode these sites can be considered sedentary. Departing one field house for a similar one and then returning at some point in the future is essentially a sequence of sedentary occupations driven by a practice of shifting cultivation.

In contrast, “serial” occupation - the movement of farmers from one area to a new uninhabited one, assumes that portions of the landscape were unoccupied and available for settlement. By Basket maker III/ Pueblo I times the full range of arable settings on the Grand Staircase had been occupied which effectively ended expansion. This appears to be the case in the other Virgin Puebloan regions as well.

Mobile Farmers on the Grand Staircase

Various forms of mobility have been proposed ranging from forging sites (Fisher et al. 2013; Westfall 1985) to outlying satellite farms in the uplands (Westfall 1987), hot desert farms along the Virgin River, and upland foraging sites (Westfall et al. 2008). Since all zones were simultaneously occupied, some sort of exchange system between them also could have occurred (Heide 1982:150).

Another scenario proposed by Richard Thompson, one that is in accord with the findings presented here, is the possibility of movement between farmsteads along the perennial streams of the St. George Basin and upland farmsteads. As pointed out earlier, the material culture of the two different environmental zones is remarkably similar during the early period (with the notable exception of Shinarump pottery to the far east). Sequentially occupied sites in both areas are well documented. Apart from exchange, we can expand our model to include mobility between the live water settings of the basin and precipitation dependent uplands bordering it.

Transhumance of sizable groups between farms and foraging sites (Fisher et al. 2017) seems not to be an adequate explanation during the EPP in part because one group’s foraging “hinterland” might well impinge on another’s agricultural base land. Apart from a few rock shelters on the margin of the St. George Basin (Janetski 2017), we simply have not identified the number of intensely occupied foraging sites necessary to correspond with the hundreds of farmsteads on the Grand Staircase to support this form of mobility. Site distribution patterns do, however, allow for co-residential groups to have moved between arable sites and settings. As a special form of transhumance, movement between the cold desert upland plateaus and the hot desert St George Basin merits further investigation.

On a regional level, the material culture similarities of the Lowland Virgin River area and the Mount Trumbull/Uinkaret uplands present a similar situation, suggesting some form of "long-term economic linkage" (Lyneis 1995:230). Although shifting cultivation and consequent sequential occupation has not been proposed for those areas, the movement of small groups between the uplands and lowlands, in accord with the actual farming conditions each was experiencing, might well account for the material cultural similarities between the two areas.

Returning to the Grand Staircase, downcutting of washes and channel incising, combined with the floodwater farming methods, may have been one of the more significant causes of sequential settlement on the uniquely vulnerable geomorphology of the Grand Staircase. If this was the case, other settings such as Mount Trumbull, the Kanab Plateau, and the Kaibab Plateau may have been unaffected, offering an attractive option. We, as have others (Lyneis 1995), assume that Virgin Puebloan adaptations were shaped and constrained by their local settings, but individuals or small groups might participate in more than one adaptive response during their lifetime.

Structured activities that strongly encouraged a sedentary way of life ranged from maintenance and tending of fields, harvesting crops, and drying the harvest and storing it. Pottery production was likely a winter activity, whereas husbandry of turkeys would have encouraged a year-around presence. Short logistical forays to hunt and gather could be carried out by small groups or individuals as required on a year-around basis. In large measure, this was made possible by the physiographic diversity of the Grand Staircase and the serendipitous coincidence of native resources and arable settings. In essence, the principle habitation site served as both a base camp for foraging and a field house for agriculture. Departing such a site for a similar one and then returning at some point stresses what we are actually proposing is *a sequence of sedentary occupations* driven by the practice of shifting cultivation practices.

Settlement and Site Structure

The continuum of site complexity, while essentially a site structure issue, has significant implications for settlement as well. Previous interpretations have asserted that small, short-term occupations represent seasonally occupied foraging sites rather than farmsteads or, as in the case of the Pinenut site, an agricultural outlier tethered to a central pueblo (Westfall 1987; see also Chapin-Pyritz's 2000 interpretation of Park Wash faunal data).

The juxtaposition of suitable field settings and sedentary farmsteads is an important association linking sequent occupation and the practice of shifting cultivation. Assuming the proximity of most habitation sites to fields, the "farmstead as field house" pattern also allows for some insight into the farming techniques employed during any given period. While periodic shifting among fields could simply be attributed to a practice of fallowing due to field exhaustion, more likely moving was prompted by the nature of the field system itself. In sandy upland settings, inadequate soil moisture may have made dry farming untenable, especially during the critical germination period. Fields located on floodplains along perennial streams would have periodically been subjected to flooding and channel incising. But over large expanses of the eastern Grand Staircase, periodic moving was just as likely the result of floodwater runoff farming techniques. Combined with an inherently unstable landform subject to down-cutting of the ephemeral drainages that watered the fields (see Figure 12.1), temporary abandonment would have been likely until an aggrading regime resumed. Shifting cultivation matched to the tempo of local conditions and consequently sequential settlement, would have been a reasonable response to all these situations.

An alternative explanation that has been proposed for small "hinterland" sites is that they were used on a seasonal basis and were actually tethered to larger permanent pueblos - a scenario proposed for the Pinenut site and the Vermilion Cliffs Project sites (Westfall 1985:195, 1987:182-83). Demonstrating this type of settlement, however, would require the identification of principle sites in addition to the seasonally used outliers and contrasting them in some fashion. To date, few candidates for such sites have been identified.

The Mecca site described earlier has the potential to represent one such site

Figure 12.1: A typical example of a down-cutting episode within a high site density farming (slope wash) locale below the Vermilion Cliffs. View of channel looking downstream (left). View of knickpoint looking upstream (right). Note that the setting upstream remain

during Early Pueblo II times but its relationship to seasonally occupied outliers remains to be demonstrated. Perhaps as significant is that the Mecca site and other large sites nearby were constructed accretionally, possibly by household units but not obviously built or occupied simultaneously. Conceivably, it was periodically populated by multiple extended families, and it represents a scaled up version of sequential occupation.

The Limits of Expansion:
No Place to Go Except Where You've Been

By early Puebloan times, the availability of an arable and unoccupied landscape to pioneer was constrained by geographic, environmental, and demographic factors. The option to reoccupy sites and settings would have become increasingly important over time as populations expanded. For at least some, there was no place to go except where they had already been. The attempt here has been to account for the repeated occupation of primary farmsteads as a significant behavior on the Grand Staircase and perhaps elsewhere in the Virgin Puebloan region.

Settlement during the Grand Staircase EPP (AD 700-1050) involved a wide range of arable settings that due to differences in elevation, hydrology, precipitation, soil characteristics, and topography were not likely to have been farmed simultaneously nor continuously over that length of time. There are several reasons for this. First, at a given point in time it was unlikely they would have been equally productive. Second, continuous long-term occupation would have depleted soils, perhaps native flora and fauna, and natural resources such as firewood. Third, low population levels would have made their simultaneous occupation unnecessary, and the ability to move at will between them would have been an attractive option. As has often been pointed out, individual sites throughout the Southwest were rarely occupied for more than a generation or two (Cordell 1984:325). This is not the case over much of the Virgin Puebloan region where each *episode* of occupation might be that short but *overall* occupation frequently spanned much longer periods.

Early on, the impetus to reoccupy a known but unoccupied farmstead would have been appealing for practical reasons. The decision to return to a previously successful farmstead with known qualities would have been an intuitive choice rather than a "strategy." But to the extent the pattern is replicated in site structure, we suggest an increasingly systematic pattern rather than an idiosyncratic-individualistic one. Regardless, our review of the small sample of sites excavated to date indicates reoccupation was a common practice.

There could have been reasonable expectations that, under similar conditions, a farmstead might be successful once again, and its reoccupation over time may have provided a sense of place, social identity, even a mythic connection with the past. Eventually this form of persistence may have resulted in a shift in occupational status from a usufruct system where lands were open to all, to a tenured one, as evidenced by a shift in mortuary practices, during Late Pueblo II times.

Mobility Options on the Grand Staircase

Spanning some fifty miles from the Paria River on the east to the point at which the Virgin River enters the St. George Basin on the west, the Grand Staircase physiographic section encompasses a number of significant north-south trending drainages that bisect the cliff lines (Figure 12.2). The east-west trending cliff-lines range from just under 1,525 m (5,000 feet) on the Arizona Strip to over 2,745 m (9,000 feet) on the Paunsaugunt Plateau, over a north-south span of about 10 miles. The agricultural zone extends from the base of the lowest cliff-line to just over 7,000 feet, offering broad terraces ascending in elevation and intersected by the water courses.

Many have significant densities of agricultural sites. Not only does the topography, length of the growing season, precipitation patterns, and cold air drainage vary but because each bench and escarpment is composed of different geological formations the nature of their soils does as well.

Annual precipitation on the arable settings of the Grand Staircase ranges between 27.9 cm (11 inches) and 40.6 cm (16 inches) falling about equally between winter and summer months. The annual mean for the Paria River Basin is about 30.5 cm (12 inches) (Hereford 1986:295). Benson and Berry (2009:90) consider that summer rainfall of 15cm (6 inches) and annual precipitation of 30cm (11.8 inches) to represent the approximate lower limits for maize production. Because dry farming the lower elevations of the Grand Staircase was often marginal, the outwash settings along the base of the Vermilion Cliffs were extensively

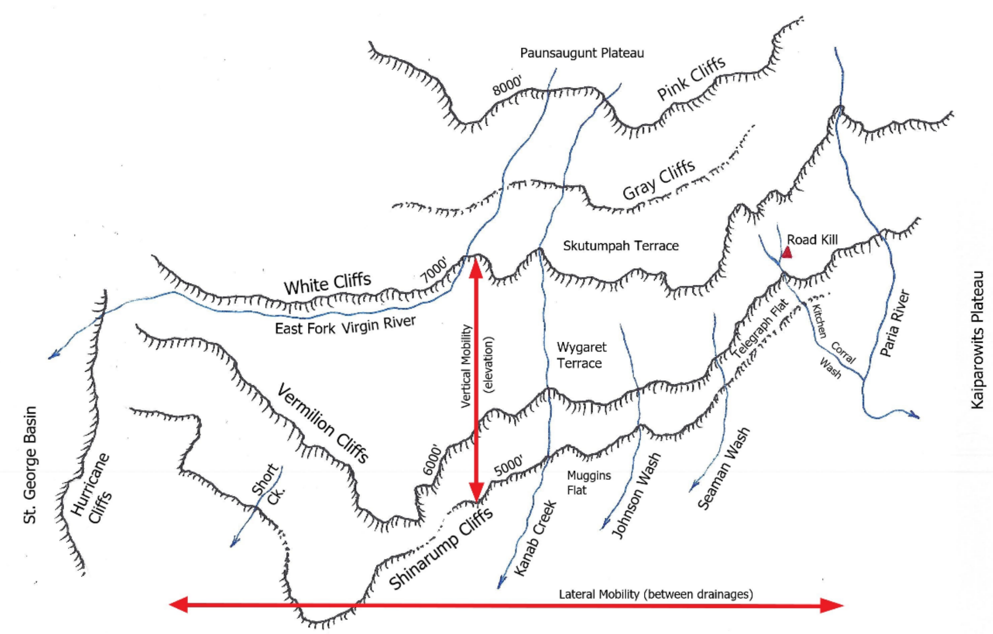

Figure 12.2: Schematic of Grand Staircase lateral and vertical mobility options by drainage basin and elevation. St. George Basin (left), Kanab Creek Basin (center), Paria River Basin (right).

exploited to enhance soil moisture. While productive, flood water farming periodically exposed fields to sudden and catastrophic downcutting events.

The terraces below the Pink Cliffs at 2,745 m (9,000 feet) elevation on the Paunsaugunt Plateau are generally within the Upper Sonoran life zone and are characterized by pinyon (*Pinus monophylla*) and juniper (*Juniper osteosperma*) woodlands. The understory varies according to elevation and includes a variety of shrubs, grasses, cacti, and forbs. Riparian communities likely occurred along the live streams and springs but there is little evidence for them other than cattail pollen. Below 1,525 m (5,000 feet) are the open expanses of grassland on the Arizona Strip. In large measure, the "agricultural zone," defined by adequate moisture on the low end and decreasing frost-free days on the upper end, ranges from about 1,525 m (5,000 feet) to just over 2,135 m (7,000 feet), largely coinciding with the distribution of pinyon and juniper woodlands. Prehistoric pollen and macro floral remains seem to conform well to present day types and distributions. Soil types and characteristics (e.g. moisture retention capability) are variable and may be one of the better predictors of agricultural potential, although this topic has received little attention to date.

Large game included mule deer (*Odocoileus hemionus*), big horn sheep (*Ovis canadensis*), elk (*Cervus canadensis*), and pronghorn (*Antilocapra americana*). Cottontail (*Sylvilagus* sp.) and jackrabbits (*Lepus californicus*) and a variety of small rodents were also common. All species were locally available to one extent or another, and on occasion deer migration corridors may have brought herds close to habitation sites. In many cases the farm fields and crops may have drawn various game species practically to the "front door" of the residences.

In addition to varied farming opportunities, each terrace offered different geological resources including Moenkopi tabular sandstone found along the base of the Shinarump Cliffs suitable for building slab-lined cists, quality stone for flaked stone tools such as petrified wood and chert from the Petrified Forest member of the Chinle below the Vermilion Cliffs, and Shinarump Conglomerate favored for both manos and metates found in the Shinarump Cliffs. The Chinle and Moenkopi Formations that span the physiographic section also offer good potential as sources for pottery clay and temper (Adams 2001).

Three drainage basins flowing to the Colorado River span the Grand Staircase. From east to west, they include the Paria River, which includes the extensive Kitchen Corral Wash drainage; Kanab Creek which controls Cottonwood Canyon, Johnson Wash, Seaman Wash and Petrified Hollow; and the East and North Forks of the Virgin River whose confluence is near the south edge of Zion National Park.

Clearly, each of the watersheds, and especially their minor tributaries, had very different hydraulic regimes that may have had asynchronous impacts on fields during a given weather cycle. Given a downcutting episode, their tributaries may well have impacted upland farming through headward entrenchment or "knickpoint" erosion, (see Webb et al. 1991). The hydraulic histories of the Kanab Creek basin including Johnson Canyon and by extension Seaman and Petrified Hollow Washes may have varied significantly from the Paria River basin (Hereford 1986; Webb et al. 1991). Virtually all of the stream courses on the Grand Staircase offer opportunities to correlate hydraulic histories with settlement (see Naylor 1996, Smith 1990, Webb et al. 1991, Rigsby and Kulp 1994, Hereford 1986).

While the drainages serve to define arable locales and the possibility of population movement between them, the distribution of sites corresponds not only with the water courses themselves but also with the dry farming and slope wash settings that lie between them where site densities are often higher. Each tread of the staircase offered a unique arable niche staggered by elevation. By early Ancestral Puebloan times, habitation sites are known along each of the significant drainages, demonstrating population movement laterally across the "staircase" as well as on most of the terraces they bisect. In these various combinations of lateral and vertical mobility, the ability to shift between a range of agricultural options was maximized.

The Sequential Settlement Model

At some point, serial expansion of agriculturalists into a geographically limited and environmentally circumscribed agricultural zone reaches its limits and must stop. The reoccupation of existing sites then becomes a viable alternative. Serial expansion into new territory and sequential use of previously settled ones are two distinct forms of mobility, each with very different behavioral implications. Proposed here is that a practice of shifting agriculture, in tandem with movement between extant sites, accounts best for recurrent use of the primary agricultural sites on the Grand Staircase and perhaps beyond.

Aikens (1965) and Jennings (1978) described "sequent" occupation of a series of shallow pithouses and associated living surfaces at the Bonanza Dune site. Sequential settlement seems an appropriate description of these events as part of a widespread pattern of behavior. It describes a form of residential mobility involving year-around occupation of a principle farmstead but with repeated abandonment events and subsequent reoccupation by the same or culturally related group. As such, it is distinguished from a vertically or horizontally stratified site where temporal relationships between unrelated levels or features are foreign to one another or are unknown. In essence this model of behavior assumes that vacating one farmstead involved moving on to a similar one, thus maintaining the essential relationship between sedentism, mobility, and subsistence with year-around occupation of a farmstead and a reliance on domesticates supplemented by locally available native flora and fauna.

The underlying cause proposed for this form of mobility is shifting cultivation, a response, at least in part, to erosion and arroyo downcutting cycles endemic to the eastern Grand Staircase. We are open, however, to the probability that each of the three drainage basins – the Paria River, Kanab Creek, and the Virgin River may have had asynchronous hydraulic regimes that impacted settlement in different ways. While the correlation of local weather-related events with actual occupational sequences is difficult to demonstrate in the archaeological record, historic and modern observations of erosion events amply document the process.

Key advantages of periodic reoccupation would have included prior knowledge of fields known to be productive and under what conditions, as well as the availability of nearby foraging opportunities. Pre-existing infrastructure, consisting primarily of storage facilities, but also materials and caches, would have substantially reduced the cost of such a move. A possible consequence of repeated occupation was that over time a site might increasingly be associated with a single group or lineage. Based on mortuary practices, however, land use during the EPP appears to have been essentially open to all. In marked contrast, on-site burials became common during the succeeding Late Pueblo II Period.

Aikens' and Jennings' "sequent occupations" are descriptive events occurring on an individual site, but the "sequent settlement" model expands the observation to a pattern or tradition that emerged over time on a broader, community-wide scale. This is not to suggest that communities moved in mass but, dispersed as they were, it seems likely that individuals and small groups would make the decision to move independently of one another (cf. Bernardini 2005). Doing so might have extended the community even wider but in the process may have allowed for exploiting multiple farming niches simultaneously. If interaction was maintained it might even have allowed for reciprocal exchanges of surplus crops and goods when available.

As Aikens surmised for each of the occupations at Bonanza Dune, "leave-takings were orderly," and as we suggest, destinations were known. A shifting cultivation strategy, in most cases, would also have ensured arriving at a similar site in an "orderly" fashion. To the extent that sequential occupation of farmsteads can be demonstrated to occur in multiple arable settings on the Grand Staircase, the sequent settlement hypothesis will be supported.

Most considerations of subsistence and settlement proposed to date have assumed that Virgin Puebloan mobility was a response to crop failure and subsequently driven by the need to supplement diet with native foods. In this view establishing foraging base camps and even transhumance has been proposed. While it seems counterintuitive, we propose that it was the requirements of *agriculture* that drove mobility. On the Grand Staircase, the pueblo served as both the focus of horticulture as well as the base camp for foraging.

Summary and Conclusions

We have proposed that the inevitability of periodic agricultural shortfalls was recognized and, for the most part, successfully managed. While the effectiveness of the sequential settlement strategy was not always optimal, it appears to have been sufficient over the long run as up to 80% of the Virgin Puebloan diet calories came from domesticates. Whether it was optimal depended on the amount of animal protein - turkey, ungulates, rabbits, and hares - that could be procured. Native flora, especially pigweed and goosefoot, were a consistent component of diet over time, providing variety and essential nutrients. All sources may have varied significantly on an annual basis but apparently not over the life of an individual. The persistence of this adaptation over time and its geographical span is the ultimate measure of success for the sequential settlement strategy.

The early Ancestral Puebloan population on the Grand Staircase were settled agriculturalists as reliant on domesticates as their better known Kayenta neighbors to the east. Mobility, however, was the vehicle of their farming success rather than an indication of its failure. Whether this form of movement is technically "sedentary" is a moot point. We agree with Kelly (1992:60) that nobody is truly sedentary and that "people simply move in different ways." As considered here, Virgin Puebloan sedentism is simply the year-around occupation of a farmstead even though its location may change periodically.

A significant implication of sequential settlement is that we should expect a range or gradation of site size and complexity of farmsteads from minimal initial occupations and perhaps even failed attempts at farming at a given locale, to complex site structure on repeatedly occupied sites. Variability of site size in the Kitchen Corral drainage suggests that not all attempts at establishing farmsteads were equally successful. Based on our sample of excavation data from the drainage, one of the consequences of sequential occupation is that sites might be expected to represent a *continuum* of occupational intensity. While emergent farmsteads might be quite basic, over time we expect site structure to become increasingly complex. Such a range of site occupational intensity is consistent with shifting cultivation. In this view, the size and complexity of an architectural site is essentially a measure of harvest success over time. We should expect a range of site size and architectural complexity in accord with the length of its occupation. It follows that while some sites were truly abandoned after a short period (and appear of lesser consequence), all sites in such a continuum contribute to our understanding of overall settlement.

We have also suggested that due to differing local conditions all arable settings were not likely to have been simultaneously nor continuously occupied, at least to the same degree. Rather, we suggest that Virgin Puebloan settlement on the Grand Staircase was one of shifting between optimal niches over short spans of time giving the *perception* of continuous occupation. On much of the eastern Grand Staircase, we have suggested that fields damaged by downcutting, erosion, and subsequent lowering of the water table were among the primary causes of evacuation of a site.

Reoccupation of favored sites and locales offered additional advantages beyond a regenerated landscape. They were pre-positioned in settings known to be optimal, had a preexisting infrastructure of sturdy storage architecture, and construction materials available to recycle. In some settings, renewed firewood sources may have been a consideration as well. With each occupation the construction history of a site, expanding from an initial "core," became more complex. It follows that the size and complexity of these farmstead pueblos is in some measure a result of where it falls in the overall occupational sequence.

Proponents of a truly "mixed" subsistence regime generally assume that foraging implies a relatively high degree of mobility in order to obtain sufficient native flora and fauna. The most extreme form of mobility involving all or most of a locality's population, is seasonal transhumance (Fisher et al. 2013). Demonstrating such annual population shifts demands identifying the origin of the population, the resources they sought, and their location. Presumably the presence of pottery would be the primary means of linkage but also of determining the temporal period(s) involved and an indication of the intensity of a base camp's use. Essential for demonstrating such a strategy, however, is quantification: matching the sheer number of annual occupational episodes occurring over hundreds of years on such base camps with the literally hundreds of farmsteads that have been documented.

Paradoxically we argue that it was the reliance on agriculture - a hallmark of sedentism - that drove Virgin Puebloan mobility. Most of the natural settings intensively occupied on the Grand Staircase were suitable for both farming and foraging. A key stimulus that fostered residential mobility between farmsteads was the inherent instability of the landscape and the inevitable degrading of fields. Shifting among residences then is taken as tantamount to a practice of "shifting agriculture" linked to decisions of where best to plant. Foraging success within and among the various agricultural settings may or may not have co-varied with such moves but would have supplemented diet to one degree or another depending on local circumstances.

More than 25,000 sites have been recorded in Kane, Garfield, and Washington counties over the past 50 years, not counting the eastern Arizona Strip. While admittedly a biased sample, it is nonetheless a large one. Nearly 50% of all sites in Utah are listed as "Puebloan" (Leeflang 2016). We would expect that all main site types would have been identified in our study area. But evidence for large base camps used for foraging on a seasonal basis has not been identified in any significant number. Apart from short-term, logistical activity areas and camps, most Ancestral Puebloan sites are farmsteads with site structure that falls somewhere along the continuum of occupational intensity we have described.

It is unlikely that all of the agricultural and foraging tactics and strategies that were possible on the Grand Staircase have been explored here, but a pattern of reoccupation of existing sites is clearly one of them. The "sequential settlement" model is congruent with the internal structure of most excavated sites, the subsistence data associated with them, and their distribution. Recognition of new site types and distribution patterns would provide evidence that the model needs modification or that it is one of several in a mosaic of adaptive tactics yet to be discerned. For now, mobile farmers practicing shifting cultivation among multiple sites best accounts for each of the three key datasets.

It is beyond the scope of this study to extend this form of mobility beyond the Grand Staircase. But is has potential to explain cultural similarities across a regional context *between* Virgin Puebloan regions such as the uplands of the Uinkaret Plateau and the lower Virgin River drainage, and the relationship between the St. George Basin and its surrounding uplands. Parallels in site structure between these two major Virgin Puebloan landscapes during the EPP offer the possibility of alternating between live water farming and precipitation-based agriculture.

The EPP, characterized by a pan-regional, centuries-long tradition, effectively ends sometime after AD 1050 when an influx of Late Pueblo II, Kayenta-influenced traits appear (Aikens 1966, Lyneis 1995, McFadden 2016). These horizon markers include corrugated pottery, new black-on-white design styles (Sosi and Dogoszhi Black-on-white), Tsegi Orange Ware, evidence of cotton pollen and seed accompanied by a proliferation of spindle whorls, Bull Creek projectile points, and a novel geometric rock art style.

The simultaneous introduction of linear and L-shaped roomblocks and pueblos constructed as "units" rather than accretionally, along with deep kiva-like masonry pit structures, have significant implications for social organization. The abrupt appearance of this suite of traits on the Grand Staircase suggests population movement, perhaps with local demographic and adaptive consequences. Regionwide, a combination of population movement and diffusion of ideas might best account for various degrees and different ways that Virgin Puebloan populations incorporated the new material culture traits into their traditional lifeway.

To conclude, the conservative nature of Virgin Puebloan material culture and settlement during the EPP spanning 350 years or more, is not only an indication of relative isolation but also of stability, internal equilibrium, and participation in a common tradition across the Grand Staircase and St. George Basin. Population levels were modest and grew slowly, social complexity remained basic, and intraregional relationships, while not complex, merit more attention than they have been given. Significantly, agricultural adaptations were generally successful - a notable achievement during an era known for climate instability. In large measure their success is attributed to the ability to shift among arable settings and periodically reoccupy existing farmsteads. Sometime between AD 1050 and 1100, perhaps coinciding with a short period of climate *favorable* for agriculture, the abrupt material culture changes that define the Late Pueblo II Period mark the end of the EPP.

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Appendix A

POLLEN AND MACROFLORAL ANALYSIS FOR THE ROAD KILL SITE, 42KA4859, UTAH

POLLEN AND MACROFLORAL ANALYSIS FOR THE ROAD KILL SITE, 42KA4859, UTAH

By

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Paleo Research Institute Technical Report 02-80

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INTRODUCTION

Samples from the Road Kill site, 42KA4859, in central Kane County, southern Utah, were sampled for pollen and macrofloral remains. This site is a medium-sized Puebloan farmstead with a single linear alignment of storage cists with associated habitation rooms. Occupation appears to have been episodic, based on the complex construction for the alignment combined with evidence for recycling of construction materials and the abandonment of structures on site while use continued elsewhere (Doug McFadden, personal communication, August 2, 2002). Pollen and macrofloral analyses will be used to help address questions of subsistence and season of occupation.

METHODS

Pollen

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low. Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. The samples were rinsed until neutral by adding water, letting the samples stand for 2 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate was added to each sample once it reached neutrality, then the beaker was again filled with water and allowed to stand for 2 hours. The samples were again rinsed until neutral, filling the beakers only with water. This step was added to remove clay prior to heavy liquid separation. At this time the samples are dried then pulverized. Sodium polytungstate (density 2.1) was used for the flotation process. The samples were mixed with sodium polytungstate and centrifuged at 2000 rpm for 5 minutes to separate organic from inorganic remains. The supernatant containing pollen and organic remains is decanted. Sodium polytungstate is again added to the inorganic fraction to repeat the separation process. The supernatant is decanted into the same tube as the supernatant from the first separation. This supernatant is then centrifuged at 2000 rpm for 5 minutes to allow any silica remaining to be separated from the organics. Following this, the supernatant is decanted into a 50 ml conical tube and diluted with distilled water. These samples are centrifuged at 3000 rpm to concentrate the organic fraction in the bottom of the tube. After rinsing the pollen-rich organic fraction obtained by this separation, all samples received a short (10-15 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for 3 minutes to remove any extraneous organic matter.

A light microscope was used to count the pollen to a total of approximately 200 pollen grains at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible. Indeterminate pollen includes pollen grains that are folded, mutilated, and otherwise distorted beyond recognition. These grains are included in the total pollen count, as they are part of the pollen record.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and can be interpreted to represent pollen dispersal over short distances or the introduction of portions of the plant represented into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram. A plus (+) on the pollen diagram indicates that the pollen type was observed outside the regular count while scanning the remainder of the microscope slide. Pollen diagrams are produced using Tilia, which was developed by Dr. Eric Grimm of the Illinois State Museum. Pollen concentrations are calculated in Tilia using the quantity of sample processed, the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted.

Macrofloral

The macrofloral samples were floated using a modification of the procedures outlined by Matthews (1979). Each sample was added to approximately 3 gallons of water, then stirred until a strong vortex formed. The floating material (light fraction) was poured through a 150 micron mesh sieve. Additional water was added and the process repeated until all floating material was removed from the sample (a minimum of 5 times). The material which remained in the bottom (heavy fraction) was poured through a 0.5 mm mesh screen. The floated portions were allowed to dry.

The light fractions were weighed, then passed through a series of graduated screens (US Standard Sieves with 2 mm, 1 mm, 0.5 mm and 0.25 mm openings) to separate charcoal debris and to initially sort the remains. The contents of each screen then were examined. Charcoal pieces larger than 2 mm, 1 mm, or 0.5 mm in diameter were separated from the rest of the light fraction and the total charcoal weighed. A representative sample of these charcoal pieces was broken to expose a fresh cross-section and examined under a binocular microscope at a magnification of 70x. The weights of each charcoal type within the representative sample also were recorded. The material which remained in the 2 mm, 1 mm, 0.5 mm, and 0.25 mm sieves was scanned under a binocular stereo microscope at a magnification of 10x, with some identifications requiring magnifications of up to 70x. The material which passed through the 0.25 mm screen was not examined. The heavy fractions were scanned at a magnification of 2x for the presence of botanic remains.

Remains from the light and heavy fractions were recorded as charred and/or uncharred, whole and/or fragments. The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules. Macrofloral remains are identified using manuals (Martin and Barkley 1973; Musil 1978; Schopmeyer 1974) and by comparison with modern and archaeological references.

Samples from archaeological sites commonly contain both charred and uncharred remains. Many ethnobotanists use the basic rule that unless there is a specific reason to believe otherwise, only charred remains will be considered prehistoric (Minnis 1981:147). Minnis (1981:147) states that it is "improbable that many prehistoric seeds survive uncharred through common archaeological time spans." Few seeds live longer than a century, and most live for a much shorter period of time (Harrington 1972; Justice and Bass 1978; Quick 1961). It is presumed that once seeds have died, decomposing organisms act to decay the seeds. Sites in caves, water-logged areas, and in very arid areas, however, can contain uncharred prehistoric remains. Interpretation of uncharred seeds to represent presence in the prehistoric record is considered on a sample-by-sample basis. Extraordinary conditions for preservation are required.

ETHNOBOTAIC REVIEW

It is a commonly accepted practice in archaeological studies to reference ethnological (historic) plant uses as indicators of possible or even probable plant uses in prehistoric times. It gives evidence of the exploitation, in historic times, of numerous plants, both by broad categories, such as greens, seeds, roots, and tubers, etc. and by specific example, i.e., seeds parched and ground into meal which was formed into cakes and fried in grease. Repetitive evidence of the exploitation of resources indicates a widespread utilization and strengthens the possibility that the same or similar resources were used in prehistoric times. Ethnographic sources do document that with some plants the historic use was developed and carried from the past. A plant with medicinal qualities very likely was discovered in prehistoric times and the usage persisted into historic times. There is, however, likely to have been a loss of knowledge concerning the utilization of plant resources as cultures moved from subsistence to agricultural economies and/or were introduced to European foods during the historic period. The ethnobotanic literature serves only as a guide indicating that the potential for utilization existed in prehistoric times--not as conclusive evidence that the resources were used. Pollen and macrofloral remains, when compared with the material culture (artifacts and features) recovered by the archaeologists, become indicators of use. Pollen and macrofloral analyses identified remains of plants that might have been important food items for the various occupants of this site. These plants will be discussed in the following paragraphs in order to provide an ethnobotanic background for discussing the remains.

Native Plants

Brassicaceae (Mustard family)

Several members of the *Brassicaceae* (mustard) family, such as *Capsella* (shepherd's purse), *Descurainia* (Tansy-mustard), and *Lepidium* (pepperweed), are noted to have been exploited for their greens and seeds. Young plants can be eaten raw or cooked as potherbs. Tilford (1997:158) notes that "the raw or cooked greens of young plants are highly nutritious, containing considerable amounts of trace minerals and vitamins A, B, and C." The parched and ground seeds were used to make a flour, thicken soup, and to make pinole. Brassicaceae seeds begin to ripen in early summer, and some species are available into the fall. Seeds of this family also are known to stimulate production of digestive juices in the stomach and aid in digestion. *Capsella* is useful for stopping internal or external bleeding (Fernald 1950; Harrington 1967; Kirk 1975; Sweet 1976:56; Tilford 1997:158).

Cheno-ams

Cheno-ams are a group of plants that include *Amaranthus* (pigweed) and members of the Chenopodiaceae (goosefoot) family, such as *Atriplex* (saltbush), *Chenopodium* (goosefoot), *Monolepis* (povertyweed), *Sarcobatus* (greasewood), and *Suaeda* (seepweed). These plants are weedy annuals or perennials, often growing in disturbed areas such as cultivated fields and site vicinities. Plants were exploited for both their greens and seeds. Leaves can be eaten fresh or cooked as greens, either alone or with other foods. The greens are most tender in the spring when young but can be used at any time. Seeds can be eaten raw, but most often they were ground into a meal and used to make a variety of mushes and cakes. The seeds usually are noted to have been parched prior to grinding. Various parts of the Cheno-am plants are noted to have been gathered from early spring (greens) through the fall (seeds) (Harrington 1967; Kearney and Peebles 1960; Kirk 1975; Sweet 1976; Tilford 1997).

Atriplex (Saltbush)

Atriplex (saltbush) occurs as both an annual herb and a perennial shrub. The leaves and young shoots have a salty taste and can be used as a seasoning. Saltbush twigs were boiled or baked with meat. Wood ashes were used to color cornmeal and as a substitute for baking powder. A poultice of the chewed plant was applied to ant, bee, and wasp sting swellings. *A. canescens* (four-wing saltbush) was used for stomach pain or as an emetic. Dried leaves were used as a snuff for nose trouble, and a poultice of the warm, pulverized root was applied to toothaches. The dried tops also were used to make a tea for treating nausea and vomiting from the flu, as well as for breaking fevers. *Atriplex* seeds are very nutritious and can be ground into a meal, mixed with water and drunk as a beverage, or mixed with some other meal and used as flour. The seeds do not ripen until mid-fall and can remain on the shrubs throughout the winter into the next growing season. *Atriplex* leaves, twigs, and blossoms yielded a bright yellow dye. *Atriplex* is a native that is found widely scattered throughout the western United States in waste places and fields, growing in arid, alkaline, or saline soils (Bryan and Young 1978:32; Kearney and Peebles 1960:255; Kirk 1975:59; Moerman 1986:85-86; Moore 1990:29; Muenscher 1987:180; Weiner 1972:75).

***Chenopodium* (Goosefoot)**

Chenopodium seeds are noted to have been important resources for native groups. Seeds most often were parched and ground into a flour. Chenopodium leaves are rich in vitamin C and were eaten to treat stomachaches and to prevent scurvy. Chenopodium also is rich in calcium and vitamin A. Leaf poultices were applied to burns, and a tea made from the whole plant was used to treat diarrhea. Chenopodium is a weedy annual capable of producing large quantities of seeds that can be harvested in the late summer and fall. Chenopodium commonly is found in cultivated fields, waste places, open woods or thickets, and on stony hills. It is an opportunistic weed, often establishing itself rapidly in disturbed areas (Angier 1986:191-193; Fernald 1950:592-596; Kirk 1975:56-57; Krochmal and Krochmal 1978:66-67; Martin 1972; Moore 1990:42; Sweet 1976:48).

Cleome (Beeweed)

Cleome (beeweed, bee plant) is a weedy plant that grows in disturbed areas. This plant is noted to have been allowed to grow in gardens with cultivated plants. *Cleome* was used both as a food and a pottery paint. The young plants were usually gathered and boiled as potherbs from spring until mid-summer. The seeds also can be gathered and ground into meal, although utilization as a potherb appears to have been more common. The seeds ripen in the late summer and fall. Both the young and older plants can be gathered and the entire plant boiled down to a thick, black, fluid residue. This fluid is then dried and made into cakes, which keep for an indefinite period. The cakes can be reconstituted by soaking them in water for use as a dye or pottery paint, or fried in grease to be eaten. *Cleome* is found in sagebrush areas and in the more arid forests throughout the West (Harrington 1967:72; Kirk 1975:33).

Juniperus (Juniper)

Juniperus (juniper) are evergreen plants that range from shrubs to medium-sized trees. The berries were a commonly exploited resource for both food and medicine. Juniper berries were collected in the late summer and fall. Berries could be eaten fresh or dried and stored for winter use. Dried berries were pounded into a meal that was used to make mushes and cakes. Roasted berries were ground and used to make a beverage similar to coffee. Northern Utes rubbed juniper berries on a metate to separate the seeds from the pulp, which was then eaten fresh or dried (Smith 1974). Juniper berries also were used to flavor meat. Juniper was used by native groups in many ways to treat a variety of ailments. Juniper leaves are high in vitamins E and C and were used to make an "all purpose" medicinal tea, commonly used to treat coughs and colds. Juniper trees also provided many utilitarian resources. Wood was used as fuel and construction material. Bows and arrows were made from juniper wood, and juniper pitch was used to fasten feathers to arrow shafts. Juniper bark was used as tinder, to line babies' cradleboards, and to line pits were dried fruits were stored. A brown dye was obtained from the bark, berries, and leaves. Seeds also were strung as beads. Juniper trees are common on dry, rocky or sandy slopes, often in association with pinyon pine (*Pinus edulis* or *Pinus monophylla*) (Albee *et al*. 1988:224-225; Chamberlin 1964:372; Fowler 1989:63; Gallagher 1977:88-90; Kirk 1975:19-20; Tilford 1997:226).

Liliaceae (Lily Family)

Several native members of the *Liliaceae* (lily) family were important resources for prehistoric peoples in the Southwest. Wild onions (*Allium*) were consumed raw, used as flavoring, or preserved for future use (Beaglehole 1937:69; Cushing 1920:227; Nequatewa 1943:20; Robbins *et al*. 1916 53,110; Whiting 1939:70). *Brodiaea capitata* (*Dichelostemma pulchellum*) is a close relative of the onion. All species of *Brodiaea* produce edible, bulb-like underground stems. The small bulbs can be eaten raw or cooked, and are noted to taste best when roasted in hot ashes. *Brodiaea* are perennial herbs in fields, meadows, dry ground, open ground, and/or moist soils (Castetter and Underhill 1935:18 in Gallagher 1977:69; Kearney and Peeble 1960:182; Kirk 1975:173; Medsger 1966:197). *Calochortus* (sego lily) roots were frequently eaten raw, and the seeds and flowers ground to make "yellow pollen" (Colton 1974:297; Whiting 1939:70). Southwest Indians are reported to have used the caudex (thickened base) and young shoots of *Nolina microcarpa* (beargrass, sacahuista) in the same way that the corresponding parts of yucca and agave were used (Kearney and Peebles 1960:189; Kirk 1975:281). *Yucca* (yucca, soapweed) buds, flowers, and flower stalks were eaten raw or boiled, and the flower stalks were roasted like agave. *Y. baccata* (banana yucca) produces a fleshy fruit that was eaten raw or roasted, and fruits also were dried and ground into a meal or stored for future use. A fermented beverage also was made from the fruits. Young *Y. glauca* seed pods are slightly sweet and were boiled and eaten. Yucca seeds also were used as food. Yucca roots contain saponin, and peeled roots were pounded with cold water to produce suds that were used for washing. Stevenson (1915:83) notes that yucca suds were used by all Indians of the Southwest for washing hair and cleaning wool garments and blankets. Fiber from yucca leaves was used to make cloth, sandals, baskets, mats, and rope. Leaves also were used to make brushes for painting pottery and decorating a variety of objects (Bryan and Young 1940:13; Kearney and Peebles 1960:185; Stevenson 1915:72-73, 78-79, 82-83).

Poaceae (Grass Family)

Members of the *Poaceae* (grass) family, such as *Oryzopsis* (Indian ricegrass) and *Sporobolus* (dropseed) have been widely used as a food resource. Grass grains were normally parched and ground into a meal to make various mushes and cakes. Several species of grass contain hairs (awns) that were singed off by exposing the seeds to flame. Young shoots and leaves were cooked as greens. Roots were eaten raw, roasted, or dried and ground into a flour. Grass also is reported to have been used as a floor covering, tinder, basketry material, and to make brushes and brooms. Grass seeds ripen from spring to fall, depending on the species, providing a long-term available resource (Chamberlin 1964:372; Harrington 1967:322; Kirk 1975:177-190).

Prunus (Cherry)

The *Prunus* group contains both wild cherries and plums that grow as shrubs or small trees. The fruits are drupes with a bony pit enclosing the seed. All species produce edible fruits, but some are more bitter than others. Cherries were eaten raw, cooked, or dried for future use. Wild cherry leaves and pits contain cyanide, but cooking destroys this acid. Cherry plants are thornless. *P. virginiana* (chokecherry) was an especially important wild cherry. Native groups ate the astringent fruits raw or dried them for future use. Leaves were used as an emetic. A tea was made from the bark to treat fevers, and the bark or root boiled for stomach inflammations. A cold infusion of the dried fruit also was used for stomachaches. *Prunus* shrubs often form thickets and can be found on hillsides, in canyons, and along streams (Angell 1981:44-48; Bryan and Young 1978:55; Elmore 1976:142-143; Kirk 1975:95-97; Moerman 1986:377; Moore 1990:27).

Rhus (Squawbush, Skunkbush, Sumac)

Rhus (skunkbush, squawbush) berries are noted to have been used by several Native American groups. *Rhus trilobata*, *R. glabra*, and *R. integrifolia* all have edible berries that were eaten both green and when ripe, either raw or cooked. Berries sometimes were pounded into cakes that were sun-dried for future use. Berries also were dried whole and ground. Berries ripen in September, then dry and remain on the bushes throughout the winter. *R. trilobata* and *R. typhina* (staghorn sumac) berries were used to make a drink similar to lemonade (Angell 1981; Harrington 1967:261; Kirk 1975:116).

Typha (Cattail)

Typha (cattail) are perennial marsh or aquatic plants with creeping rhizomes. This plant is a rich source of nutrients. Indian groups are noted to have used various parts of the cattail plant through-out the year. In the spring, young shoots were peeled and the inner portion eaten raw or cooked as potherbs. During the summer, young flowers stalks were taken out of their sheaths and cooked. Flowers were eaten alone or added as a flavoring or thickening for other foods. Pollen-producing flowers and the pollen itself were collected and used as flour, either alone or mixed with other meal. In the fall, the rootstalks were collected, the outer peel removed, and the white inner cores of almost pure starch were eaten raw, boiled, baked, or dried and ground into flour. Cattail roots were richer in starch during the fall. Cattail starch flour is noted to be similar in quantities of fats, proteins, and carbohydrates to flour from rice and corn. The seed-like fruits also were collected and eaten in the fall. Indian groups are noted to process these "seeds" by burning off the bristles. The seeds were then parched and could be more easily rubbed off the spike. The slightly astringent flower heads were sometimes used to relieve diarrhea and other digestive disorders. Cattail down was used as dressing for wounds and padding in cradleboards. Leaves and stems were used for weaving mats. Cattails are found in marshy habitats in or near swamps, ponds, sloughs, and edges of streams (Harrington 1967:220-224; Kirk 1975:171, Sweet 1976:8; Tilford 1997:28-29).

Cultigens

Phaseolus (Bean)

Phaseolus includes many varieties of domesticated beans, including *P. vulgaris* (common bean), *P. lunatus* (lima bean), *P. acutifolius var. latifolius* (tepary bean), and *P. coccineus* (runner bean). *Phaseolus* is believed to have first come under cultivation about 6000 B.C. in Central and South America. Beans were largely cultivated in the Southwest and are listed as a staple food of the historic Pueblo peoples. Beans could be eaten when green and immature, but often were dried and stored for future use, both in the pod and shelled. Dried beans most often were boiled until soft and then eaten as is or fried. Crushed boiled beans can be mixed with mush and wrapped in corn husks, and beans can be added to meat stews (Heiser 1990:124-126; McGee 1984:251-262; Robbins et al. 1916; 100; Stevenson 1915:69-70; Whiting 1939:80-82).

Zea mays (Maize, Corn)

Zea mays (maize, corn) has been an important New World cultigen, originating from a wild grass called teosinte. At the time of European contact, Heiser (1990:89) notes that "maize was the most widely grown plant in the Americas, extending from southern Canada to southern South America, growing at sea level in some places and at elevations higher than eleven thousand feet in others." Maize has long been a staple of the Southwest inhabitants, and charred maize is found in almost every cliffhouse in the Southwest (Stevenson 1915:73). Maize is by far the most common remain in Anasazi coprolitic material from Basketmaker III to Pueblo times (Clary 1983; Minnis n.d.; Moore 1978; Scott 1979; Stiger 1977; Williams-Dean 1986; Williams-Dean and Bryant 1975). Maize can show great variability in kernel color, size, and shape; in ear size and shape; and in maturation time. Five types of maize exist, characterized by a different endosperm composition. Pop and flint corn have a hard starch and a high protein content. Flour corn has a soft starch and little protein. Dent corn has a localized deposit of soft starch on top of a hard starch that leaves a depression or dent in the top of the dried kernels. Sweet corn stores more sugar than starch. Innumerable ways of preparing maize exist. Green corn was eaten raw or boiled. Mature ears were eaten roasted or wrapped in corn husks and boiled. The kernels were popped, parched, boiled, or ground and made into a meal. Kernels also were soaked in *Juniperus* (juniper) wood ashes and made into hominy. Cornmeal can be colored with *Atriplex* (saltbush) ashes. Black corn is used as a dye for basketry and textiles and as a body paint. Maize can be husked immediately upon harvesting. Clean husks were saved for smoking and other uses, such as wrapping food. Corn also was sometimes shelled prior to storage. Ears were allowed to dry on the roof, and ristras of maize were hung inside from the roof (Heiser 1990:89-98; Mangelsdorf 1974; McGee 1984:240-242; Stevenson 1915;73-6).

Charcoal

Charcoal recovered from archaeological samples most often represents use of that type of wood as fuel; however, several trees and shrubs had utilitarian and medicinal uses as well. The presence of charcoal indicates that the trees and shrubs represented were present at the time of occupation. If these resources were present and collected as fuel, it also is possible that they were exploited for other purposes as well. The following paragraphs discuss plants represented only by charcoal in the macrofloral record.

Amelanchier (Serviceberry)

Amelanchier (serviceberry) are small trees or shrubs that all produce edible berries which are typically purple, but also can be red, blue, or black. Berries can be eaten raw, cooked, or dried, and can be used like blueberries. American Indians drank a bark tea to expel worms, and used it to bathe children with worms (Foster and Duke 1990:290). *Amelanchier* shrubs have been used for wildlife habitats, watersheds, shelterbelts, and as ornamentals. They often are found growing in recently burned or newly populated clearings, in disturbed areas, in woods, thickets, prairies, swamps, and along streams and roads (Angell 1981:150-152; Fernald 1950:760; Kirk 1975:97-98; Peterson 1977:220).

Artemisia (Sagebrush)

The seeds of *Artemisia* (sagebrush) can be eaten raw, or dried and pounded into a meal to make pinole. Seeds can be harvested from July to September. The leaves can be roasted and added to other foods as a flavoring. The leaves also were used to cover berries and food preserved in caches. *Artemisia* often was used medicinally. A tea made from the leaves was used to treat colds, sore eyes, stomach troubles and many other ailments, and as a hair tonic. *Artemisia* was also an important ceremonial plant, used as an incense to drive away evil powers. Sagebrush bark sometimes was used to make clothes and stockings. *Artemisia* ranges in size from herbaceous plants to large, woody shrubs and is found in arid habitats throughout the West (Chamberlin 1964:362-363; Kirk 1975:141-142; Smith 1974:70).

Chrysothamnus (Rabbitbrush)

Chrysothamnus (rabbitbrush) is a densely-branched shrub with a variety of species, sub-species and varieties. Rabbitbrush was one of the prescribed fuels for use in kivas, and the wood was used to make arrows and baskets. A yellow dye can be obtained from the flowers, while the green bark yields a green dye. *Chrysothamnus* are native shrubs found in sandy soil, dry rocky slopes cliff edges, plains, hills, alkaline soils, and dry mesas in salt desert shrub, shadscale, sagebrush, creosote bush, pinyon-juniper, mountain brush, aspen, and conifer communities (Albee et al. 1988:57-59; Elmore 1976:80-81; Shields 1984:71; Vines 1990:985-989).

Fraxinus (Ash)

Fraxinus (ash) was utilized for a variety of medicinal purposes. Native peoples used a bud tea to treat snakebite. A strong leaf tea was given to women after childbirth. Chewed bark was applied to sores as a poultice. The sap from some species of ash was used to make a dark bitter sugar. *F. anomala* (singleleaf ash) is a native shrub or small tree in Utah found in creosite bush to pinyon-juniper communities at elevations of 910-2610 feet (Albee *et al*. 1988:380; Krochmal and Krochmal 1978:104; Petrides and Petrides 1992:80).

Pinus (Pine)

Pinus (pine) trees were utilized for a variety of purposes. The seeds of most pines are edible, although some are better than others. The inner bark can be mashed and formed into cakes or dried and made into flour. The inner bark also was used to make poultices and bandages. An inner bark tea and pine pitch were used as an expectorant. Pine pitch was used to draw out slivers and infections and was spread on sores and inflammations as a salve. The pitch was heated and used to treat pneumonia, rheumatism, muscular sores, and insect bites. Pine pitch also was used to waterproof baskets. Pine needles are rich in vitamins A and C and were brewed into a medicinal tea. The fumes emitted from heated needles were breathed in to treat back pain. Buds were chewed to treat sore throats and steeped in water to make a laxative tea (Angier 1986:195-196; Moore 1982:126; Peterson 1977:166). Pine wood also was used for fuel and construction material. Pine was valued as a wood source because the pitch in the wood would readily start the wood burning, even if it was wet (Gallagher 1977:113). Travois and tipi poles were made from Pinus contorta (lodgepole pine), as well as back-rest poles and bed supports. Pine wood also could be used to make babies' cradles (Smith 1974:102).

Pinus edulis (pinyon pine) nuts were one of the most important and widely used native foods. Nuts were harvested in the fall or early winter and a bumper crop occurs approximately every seven years. Nuts were eaten raw or roasted. One method of roasting pinyon nuts involved putting nuts and coals in a basket and shaking it. Whole cones were sometimes collected and heated to open the scales and release the seeds.

Nuts were roasted in preparation for storage or for being ground into a flour. Ground pinyon nuts were added to corn meal or used to thicken soup, to make cakes, formed into balls, or to make a paste similar to peanut butter. Pinyon nuts are high in thiamine, riboflavin, niacin, protein, and fat. A pound of nuts contains more than 3000 calories (Colton 1974:347; Gallagher 1977:37-39; Harrington 1967:323-325; Niethammer 1974:47-49).

Quercus (Oak)

Quercus (oak) are deciduous or evergreen shrubs to large trees, and the various species are widespread throughout the United States. All species of *Quercus* produce edible acorns, although the presence of tannin results in varying degrees of bitterness. White oak acorns are generally less bitter than black oak (including red oak) acorns. The acorns of *Q. gambelii* (Gambel oak, Rocky Mountain white oak) are noted to be the least bitter of all; sometimes they are able to be eaten fresh. Other species of acorn are palatable only after the bitter taste has been removed. Acorns are noted to have been utilized by native peoples in the Southwest. Acorns were gathered, shelled, roasted, and ground into a meal. The ground meal most often was leached with water in various ways to remove the bitter taste. Wood ashes could be used like lye in the leaching process. The ground meal was used alone or mixed with cornmeal to make mush, thicken soup, or make breads and cakes. Acorn meal also could be mixed with meat or animal fat. Oak wood was used for a variety of utilitarian purposes including making bows, arrows, rabbitsticks, digging sticks, clubs, and other utensils. Oak wood is strong and hard, and it was valued as firewood because a large piece of oak would burn slowly all night long. Oak bark was the principal source of tanning materials. *Q. gambelii* is a native tree or shrub dominant over large areas of Utah. It is a major component of the mountain brush community and can be found in sagebrush to aspen, pinyon-juniper, and ponderosa pine communities. *Q. turbinella* (turbinella live oak) and *Q. undulata* (wavyleaf oak) are native shrubs or small trees in desert shrub communities of Utah (Albee *et al.* 1988:314-315; Elmore 1976:23; Gallagher 1977:113; Harrington 1967:239-241; Kirk 1975:104-106; Vines 1990:162).

DISCUSSION

Site 42KA4859 is located on the canyon floor near the eastern edge of the Grand Staircase Section of the Colorado Plateau in south-central Utah. The site is situated at the base of the canyon slope and extends out onto the alluvium of Park Wash, a dry tributary to Kitchen Corral Wash and subsequently, the Paria River. Local vegetation is dominated by a pinyon (*Pinus edulis*) and juniper (*Juniperus osteosperma*) woodland with single leaf ash (*Fraxinus anomala*), Mormon tea (*Ephedra viridis*), roundleaf buffaloberry (*Shepherdia rotundifolia*), squawbush (*Rhus aromatica/Rhus trilobata*), and Utah serviceberry (*Amelanchier utahensis*). The canyon floor is primarily sagebrush (*Artemsia*) and warm season grasses (*Poaceae*). No native riparian species are noted in the wash.

The site consists of what appears to be a formally arranged alignment of slab-lined storage cists, each with a lightly constructed, shallow residential room immediately to its south. Despite the formal layout of the alignment, it does not appear that all of the features were in use at the same time. One extramural hearth (Feature 12) was located to the south and is not directly associated with the alignment. The alignment is bisected by the Kitchen Corral road.

West Segment

Feature 26 in the west segment is believed to have been constructed first. It is a deep, oval-shaped, slab-lined storage cist with a prepared clay floor and masonry upper walls. The upper fill appears to be the result of dumping debris into the feature after it fell into disuse. This upper midden fill yielded a calibrated radiocarbon date of 670-990 A.D. (Beta-167443), reflecting a Pueblo I occupation (Table 1). Pollen sample 229 was scraped from the prepared clay floor of the storage cist (Table 2). This sample was dominated by *Pinus* pollen (Figure 1, Table 3). Recovery of the large quantity of *Pinus* pollen and a moderate quantity of *Juniperus* pollen reflect the local pinyon/juniper woodland. Recovery of a small quantity of *Quercus* pollen represents oak, probably Gambel=s oak, growing in the pinyon/juniper woodland. The presence of a small quantity of *Acer negundo* pollen suggests that boxelder grew along a nearby drainage. A small quantity of *Picea* pollen, noted while scanning the microscope slide, is probably present through long distance transport from a montane vegetation community at higher elevation. Moderate to moderately small quantities of *Artemisia*, Low-spine and High-spine Asteraceae, Cheno-am, and Poaceae pollen reflect local sagebrush, various members of the sunflower family, Cheno-ams, and grasses. Recovery of small quantities of Brassicaceae, *Cylindropuntia*, *Sarcobatus*, *Ephedra*, *Eriogonum*, Fabaceae, and Rosaceae pollen probably represent other members of the local vegetation community such as members of the mustard family, cholla, greasewood, ephedra, wild buckwheat, a member of the legume family, and a member of the rose family. Recovery of small quantities of *Cleome* and Liliaceae pollen might reflect storing beeweed and a member of the lily family in this storage cyst. Recovery of a small quantity of *Zea mays* pollen while scanning this sample suggests that maize also was stored in this pit.

Feature 15 is a shallow residential structure immediately south of Feature 26. This structure is believed to have been constructed shortly after Feature 26 to form a storage-habitation Aunit.@ Feature 15 was cut by the adjacent Feature 11 room and contained a rebuilt hearth (Feature 21). Two radiocarbon dates on charcoal from the hearth suggest a Basketmaker III age of about A.D. 600-650. Macrofloral sample 188/189 was collected from floor contact beneath a dressed slab (Feature 28) lying on the irregular floor in the eastern portion of Feature 15. Pollen sample 188 was extracted from the bulk sample and yielded a much larger quantity of Cheno-am pollen than was observed in sample 229 from Feature 26 and larger than that noted in most other samples from this site. This suggests that Cheno-am seeds might have been processed or ground in this area. Pollen representing local vegetation, including the sparse pinyon/juniper woodland, include *Pinus*, *Juniperus*, *Quercus*, *Artemisia*, Low-spine and High-spine Asteraceae, and various other pollen types observed in small quantities. Recovery of *Acer negundo* and *Salix* pollen represent growth of boxelder and willow in a nearby drainage. Presence of small quantities of *Abies* and *Picea* pollen while scanning indicates long distance transport from a montane vegetation community. In addition to the large quantity of Cheno-am pollen noted in this sample, small quantities of *Cleome*, *Typha*, and *Zea mays* pollen might reflect food processing activities. Cooked and dried *Cleome* (beeweed) greens might have been ground, and both cattail and maize also could have been ground in this area.

The macrofloral record from sample 188/189 contained three charred Chenopodium seed fragments, suggesting that goosefoot seeds were processed in this structure (Table 4, Table 5) and that the processing probably included parching. Two charred Cheno-am perisperm fragments from seeds that have lost their diagnostic outer seed coat most likely also represent goosefoot seeds. One charred possible *Oryzopsis* caryopsis (seed) fragment suggests that ricegrass seeds were processed. One small, tear-drop shaped seed (Unidentified T) might also represent seed processing activities. Recovery of charred *Zea mays* cupule and kernel fragments indicates that cultivated maize was used. Corn cobs probably were burned as fuel. Pieces of charred, vitrified tissue might represent charcoal or other plant tissue too vitrified for identification. Vitrified material has a shiny, glassy appearance due to fusion by heat. Recovery of several *Pinus* bark scale fragments reflects pine branches that were burned. Three uncharred *Juniperus* leaf fragments and numerous uncharred rootlets represent modern plants at the site. The charcoal record contained pieces of *Artemisia*, *Juniperus*, *Pinus edulis*, vitrified *Pinus*, and *Pinus* charcoal not identified to species, indicating that sagebrush, juniper, and pine wood (including pinyon pine) was burned. The *Pinus* charcoal not identified to species exhibited a cross-section morphology that was clearly identifiable as pine; however, the characteristics used to determine species were more obscure and not clearly definable. Therefore, identification was left at the genus level. This charcoal might also represent pinyon pine, although other species of pine cannot be ruled out. The sample contained one charred bone fragment and a few uncharred bone fragments, suggesting that meat was processed in the structure. Two ceramic sherds, several lithic flakes, and a moderate amount of rock/gravel also were present. A few insect chitin fragments and worm casts note minimal subsurface disturbance from insect and earthworm activity.

Macrofloral sample 151 was taken from floor fill and the floor of Feature 15 sitting on top of natural alluvium (Feature 13). This sample contained several charred *Zea mays* cupule fragments and a few charred *Zea mays* kernel fragments, again indicating that maize was processed in this structure and that corn cobs probably were burned as fuel. Recovery of a few charred *Pinus* bark scale fragments and a moderate amount of *Pinus* charcoal indicate that pine wood also was burned. Smaller amounts of *Artemisia*, *Chrysothamnus*, *Fraxinus*, *Juniperus*, and *Quercus* charcoal reflect sagebrush, rabbitbrush, ash, juniper, and oak wood that was burned. A few charred and uncharred bone fragments indicate meat processing activities. Recovery of several insect chitin fragments reflects some subsurface disturbance from insect activity. The sample also contained six lithic flakes, a moderate amount of rootlets from modern plants, and a small amount of rock/gravel.

Feature 21 is the rebuilt hearth in Feature 15. Macrofloral sample 187 from the lower hearth fill yielded a few charred *Zea mays* cupule fragments, suggesting that maize was processed and/or use of corn cobs as fuel. A few charred *Pinus* bark scale fragments and pieces of charred, vitrified tissue also were present. Recovery of numerous uncharred *Helianthus* seeds and seed fragments indicates that wild sunflowers are growing near this area and might represent an animal seed cache. A variety of charcoal types were present in this sample, dominated by *Pinus edulis*. Smaller amounts of *Artemisia*, *Chrysothamnus*, *Juniperus*, and *Pinus* charcoal also were recovered, indicating use of sagebrush, rabbitbrush, and juniper wood, in addition to pinyon pine, as fuel. Again, some of the pine charcoal could not be identified to species. A few small charred bone fragments suggest that meat was processed and bones discarded in the feature. Other non-floral remains include three ceramic sherds, five lithic flakes, several insect chitin fragments, a snail shell, and a small amount of rock/gravel.

Feature 8 is a deep, oval-shaped, slab-lined masonry cist that appears to have been constructed next in the sequence. Charcoal from the floor contact was submitted for radiocarbon analysis; however, the calibrated date of B.C. 10 was rejected as Aold wood.@ The floor was lined with sandstone slabs, chinked with spalls, and sealed with several centimeters of clay. The clay lapped up the walls and possibly once lined the entire feature. Pollen sample 42 was scraped from the clay floor surface. This sample displayed pollen typical of the local vegetation including *Juniperus*, *Pinus*, *Artemisia*, Low-spine and High-spine Asteraceae, *Cylindropuntia*, Cheno-am, *Ephedra*, Poaceae, *Ranunculus*-type, Rhamnaceae, Rosaceae, and *Shepherdia*. In addition, recovery of small quantities of *Cleome*, *Rhus*, and possibly *Shepherdia* pollen might reflect storing native resources including beeweed, squawberry (lemonadeberry), and buffaloberry. The Poaceae pollen frequency was slightly elevated, which might reflect storing or processing grass seeds or even use of grass mats. In addition, *Zea mays* pollen was recorded inside the pollen count in this sample, indicating that maize also was stored in this cist. Alternatively, some of this pollen might have entered the cist as a result of food processing activities in the vicinity of this feature.

Floor fill from Feature 8 was collected as macrofloral sample 100. This sample contained two charred Cheno-am perisperm fragments, suggesting that Cheno-am seeds were processed. Four charred probable *Juniperus* seed fragments might reflect use of juniper berries and/or seeds. Alternatively, these seed fragments might represent berries that were adhering to juniper branches burned as fuel. Six charred *Zea mays* cupule fragments and a charred *Zea mays* kernel fragment indicate processing of cultivated maize and probably use of corn cobs as fuel. Small fragments of *Artemisia*, *Fraxinus*, *Juniperus*, and *Pinus* charcoal, as well as charred *Pinus* bark scale fragments, indicate that sagebrush, ash, juniper, and pine wood were burned as fuel. Recovery of charcoal from this cist suggests that a fire had been built in this feature or that the fill examined does not represent the use of this feature as a storage cist. The sample also yielded a few small fragments of charred vitrified tissue, one lithic flake, a small amount of rock/gravel, a few snail shells, numerous uncharred rootlets from modern plants, and a moderate amount of sclerotia.

Feature 11 is the shallow residential structure with a formal hearth and several subfloor pits adjacent to Feature 26. Feature 11 was slightly superimposed over Feature 15. Charcoal from the structure floor and the formal hearth dated to the Basketmaker III period (Table 1). Macrofloral sample 81/183 contains fill from the floor contact to 5 cm above the floor. Pollen sample 81 was removed from the bulk sample and exhibits a pollen record typical of others at this site. Once again recovery of small quantities of *Cleome* and *Zea mays* pollen probably reflects food processing activities in this structure. Recovery of a slightly elevated quantity of Poaceae pollen indicates the possibility that grass seeds might have been processed or grass mats might have been used.

The macrofloral record from sample 81/183 contained several charred *Zea mays* cupule fragments and a charred kernel fragment, reflecting use and probably processing of cultivated maize in the structure. Small fragments of *Amelanchier*, *Artemisia*, *Atriplex*, *Fraxinus*, *Juniperus*, *Pinus*, and charcoal too vitrified for identification indicate that serviceberry, sagebrush, saltbush, ash, juniper, and pine wood were burned. A few charred *Pinus* bark scale fragments also reflect pine wood that burned. Recovery of a few charred termite fecal pellets suggests that some of the burned wood contained termites. Four fragments of charred vitrified tissue might represent charcoal or other plant tissue too vitrified for identification. A few charred and uncharred bone fragments reflect meat processing activities in the structure. Several lithic flakes, a small amount of rock/gravel, a few snail shell fragments, and a moderate amount of uncharred rootlets from modern plants complete the record.

Feature 25 is the formal hearth near the center of Feature 11. Macrofloral sample 103/108 was recovered from fill in the north half of the feature and contained several charred *Zea mays* cupule fragments and four charred kernel fragments. Maize might have been processed in this hearth and/or corn cobs burned as fuel. Several charred *Pinus* bark scale fragments reflect pine wood that was burned. Recovery of *Artemisia*, *Chrysothamnus*, *Juniperus*, *Pinus edulis*, and *Quercus* charcoal indicate use of sagebrush, rabbitbrush, juniper, pinyon pine, and oak wood as fuel. A few charred and uncharred bone fragments reflect meat processing activities. The sample also contained several pieces of charred vitrified tissue, a moderate amount of uncharred rootlets from modern plants, ten lithic flakes, a few insect chitin fragments, and a small amount of rock/gravel.

Macrofloral sample 186 was collected from fill in the bottom, west half of Feature 25. This sample contained a variety of charred remains. Recovery of five charred

Brassicaceae seed fragments, two charred *Atriplex* seeds, and a charred *Chenopodium* seed suggest that a member of the mustard family, saltbush, and goosefoot seeds were processed. One charred Cheno-am seed had expanded and distorted during the charring process, suggesting that the seed had burned while fresh with a high moisture content. Two charred *Phaseolus* cotyledon fragments, nineteen charred *Zea mays* cupule fragments, and eleven charred *Zea mays* kernel fragments indicate use and/or processing of cultivated beans and maize. An abundance of *Pinus edulis* charcoal and several charred *Pinus* bark scale fragments reflect burning pinyon pine wood. A smaller amount of *Artemisia* and *Juniperus* charcoal also note use of sagebrush and juniper as fuelwoods. A few charred bone fragments reflect meat processing, and seven small flakes indicate lithic-related activities in the structure. Several insect chitin fragments, a moderate amount of rock/gravel, and a few uncharred rootlets from modern plants also were present.

Feature 27 is a paved activity area between Features 26 and 8 that strongly suggests their contemporaneity. It was constructed of a slab subfloor covered with clay. Pollen sample 226 was scraped from the clay floor and yielded a pollen record somewhat similar to that Features 26 and 8. Differences occur in the quantities of *Artemisia* and Cheno-am pollen, which are larger in sample 226 from Feature 27 than in either of the other two features, as well as the presence of *Salix* pollen only in sample 226 from Feature 27. It is interesting to note that *Cleome* pollen was absent from this sample, although *Zea mays* was observed. In addition, Liliaceae pollen was noted in both this sample and also in sample 229 from Feature 26. Recovery of Liliaceae pollen in these two samples that appear to be linked temporarily and spatially improves the likelihood that a member of the lily family was processed or used in these areas. These Liliaceae pollen grains more closely resemble *Calochortus* than *Allium* or *Brodiaea*. Certainly they are not large enough to represent *Yucca*.

East Segment

Feature 2 was the remnant of a deep, slab-lined, rectangular masonry storage room on the east side of the road. A portion of the feature had been cut away by the road. The lower walls and floor were lined with sandstone slabs, and the floor was covered with clay. Use of one large, dressed wall slab suggests that material was incorporated from an earlier occupation. A slab also appears to have been taken from the back wall of the feature, suggesting abandonment and subsequent occupation elsewhere on the site. Pollen sample 122 was scraped from the clay floor of the feature. This sample was similar to that of other features at this site, indicating relatively stable vegetation during occupation. Noteworthy elements of the pollen record include small quantities of *Cylindropuntia* and *Opuntia* pollen representing local cholla and prickly pear cactus that were available for exploitation. Recovery of small quantities of *Cleome* and *Zea mays* pollen probably represents storing beeweed and maize in this room. Recovery of a small quantity of *Rhus* pollen might reflect collection and storing lemonade berry. Alternatively, it might merely reflect the presence of this resource in the local vegetation.

Macrofloral sample 145 represents fill from Feature 2. Small fragments of *Artemisia*, *Atriplex*, *Juniperus*, and *Pinus* charcoal, as well as a few charred *Pinus* bark scale fragments, suggest that sagebrush, saltbush, juniper, and pine wood were burned as fuel. Three charred vitrified tissue fragments might also reflect charcoal or other plant tissue too vitrified for identification. Two uncharred *Juniperus* leaf fragments and numerous uncharred rootlets represent modern plants. Non-floral remains include two uncharred bone fragments, an eggshell fragment, a few insect chitin fragments, and a moderate amount of rock/gravel.

Feature 2 also appears to have had an associated residence to the south, Feature 37. This structure was visible in profile but was not excavated. Feature 40 is an ash pit/hearth remnant within Feature 37. A radiocarbon date of 90 A.D. for charcoal from Feature 40 is considered to be the result of "old wood" Macrofloral sample 171 was taken from the ash pit/hearth fill and yielded one charred *Chenopodium* seed fragment, suggesting that goosefoot seeds were processed. Several charred *Zea mays* cupule fragments and two charred kernel fragments indicate use of maize cobs as fuel and possibly cooking maize. Charcoal was dominated by *Artemisia* and *Juniperus*, with smaller amounts of *Amelanchier*, *Pinus*, and *Pinus edulis* charcoal present. The sample also contained a few charred *Pinus* bark scale fragments, several pieces of charred vitrified tissue, and uncharred remains from modern plants. Non-floral remains in this sample include charred and uncharred bone fragments, five ceramic sherds, a projectile point base, seven lithic flakes, and a small amount of rock/gravel. Recovery of several insect chitin fragments and a moderate amount of worm casts suggests some subsurface disturbance from insect and earthworm activity.

Feature 19 is a shallow, dish-shaped surface that extends off the east end of Feature 2 and abuts a possible structure to the east, suggesting that another storage feature is connected to the Feature 2 cist. Additional slabs upslope reinforce this possibility. This surface was constructed of small fragments of sandstone overlaid by clay. Pollen sample 160 was removed from fill beneath a metate on the surface. The pollen record was similar to that of other features at this site. Important elements of the pollen record include recovery of small quantities of *Cleome* and *Zea mays* pollen that probably represent economic activity or perhaps storage of beeweed and maize. In addition, recovery of a small quantity of *Prunus*-type pollen might reflect the presence of chokecherry trees in the drainages or perhaps collection and use or storage of chokecherries in this feature. The Poaceae pollen frequency was slightly elevated in this sample, signaling the possibility that grass seeds might have been processed or stored and/or that grass mats might have been used.

A scrape from the clay floor of the surface was examined as pollen sample 202. This sample exhibited an elevated Cheno-am pollen frequency, suggesting that Cheno-ams might have been processed or stored in this area. Once again, *Cleome* and *Zea mays* pollen were observed in small quantities suggesting that beeweed and maize also were processed and/or stored in this area.

Floor fill from the surface was examined as macrofloral sample 192. Recovery of one charred *Zea mays* cupule fragment reflects use of cultivated maize and possibly burning corn cobs as fuel. Very small fragments of *Artemisia*, conifer, *Juniperus*, *Pinus*, and unidentified hardwood charcoal, as well as two charred *Pinus* bark scale fragments, probably reflect woods burned as fuel at the site. The sample also yielded a few uncharred bone fragments, two lithic flakes, several insect chitin fragments, a small amount of rock/gravel, a few worm casts, and a moderate amount of uncharred rootlets from modern plants.

Feature 12 was a slab-lined exterior hearth located in the road bed southeast of the alignment. Macrofloral sample 265 was recovered from fill 3 cm above the floor in the south half of the hearth. This sample contained two charred *Phaseolus* cotyledon fragments, seventeen charred *Zea mays* cupule fragments, and three charred *Zea mays* kernel fragments, indicating that cultivated beans and maize were processed in this hearth. Recovery of *Juniperus*, *Pinus*, *Pinus edulis*, and *Fraxinus* charcoal, as well as four charred *Pinus* bark scale fragments, indicate that juniper, pinyon pine, possibly another type of pine, and ash wood were burned as fuel. Charred termite fecal pellets suggest that some of the burned wood contained termites. Recovery of several charred vitrified tissue fragments might reflect charcoal or other plant tissue too vitrified for identification. One uncharred *Juniperus* leaf fragment and a moderate amount of uncharred rootlets represent modern plants. Charred and uncharred bone fragments suggest meat processing activities associated with this hearth. Three lithic flakes, two insect chitin fragments, and a moderate amount of rock/gravel complete the record.

Macrofloral sample 260/264 was taken from the hearth floor contact. Recovery of charred *Zea mays* cupule and kernel fragments again notes use of cultivated maize. *Artemisia* charcoal, *Juniperus* charcoal, *Pinus* charcoal, and several charred *Pinus* bark scale fragments indicate that sagebrush, juniper, and pine wood were burned. The sample also yielded uncharred one charred and several uncharred bone fragments, a ceramic sherd, eight lithic flakes, a few charred termite fecal pellets, a moderate amount of rock/gravel, a few snail shells, and uncharred remains from modern plants.

Park Wash

Pollen sample 266 represents a contact of dense tan clay and overlying sand about one meter below the present ground surface from the bank of Park Wash, about 100 meters north of the site. This sample was collected in an attempt to identify the stratum associated with agriculture. Pollen recovered from this sample is different from that noted at the Road Kill Site in the recovery of larger quantities of *Juniperus* and *Pinus* pollen, as well as the reduction in Cheno-am pollen. In addition, *Cylindropuntia* and *Opuntia* both were absent, as was *Cleome* pollen. Most significantly, no *Zea mays* pollen was observed while scanning this sample. This sample does not appear to represent an agricultural area. The absence of *Zea mays* pollen in this sample does not rule out the possibility of use of this general area for agriculture. It is possible that other samples collected in the general vicinity might yield *Zea mays* pollen.

SUMMARY AND CONCLUSIONS

Pollen and macrofloral analysis of samples from the Road Kill site, 42KA4859, yielded a variety of remains representing food resources utilized by the prehistoric occupants of this site. Maize and common beans both were available to the occupants of this site and might have been grown in agricultural fields nearby. Maize appears to have been an important resource for the occupants of this site, since maize pollen was found in eight of the nine pollen samples and charred maize remains were present in 11 of the 12 macrofloral samples examined (Table 6). Native resources that might have been used, processed, and/or stored at this site include a member of the mustard family, Cheno-ams including goosefoot and saltbush, beeweed, juniper berries, a member of the lily family, grasses, lemonadeberry, chokecherry, and cattail. If these resources were used and not merely present in the local vegetation, one could argue for either year-round occupation of the site or episodic occupations during different times of the year. The pollen record at this site was not derived from protected proveniences that would have been open to receive pollen rain only during use, then sealed until the next use; therefore it represents pollen accumulation during the entire growing season. The pollen record provides an excellent record of resources available for exploitation in the vicinity of this site. Local sagebrush, juniper, and pine were the most common woods burned as fuel. Woods burned less frequently include serviceberry, saltbush, rabbitbrush, ash, and oak. In addition, maize cobs also appear to have been burned as fuel. The pollen and macrofloral records indicate that during occupation, local vegetation communities were fairly similar to those of today, including sparse pinyon/juniper woodland, sagebrush, various members of the sunflower family, cholla and prickly pear cactus, ephedra, grasses, and a variety of shrubby and herbaceous plants. Drainages supported at least boxelder, willow, and ash.

Table 1: Radiocarbon dates from the Road Kill Site, 42KA4859

Feature No.	Feature Description	Radiocarbon Date
26	Deep, oval-shaped, slab-lined storage cist with masonry upper walls (date from upper midden fill)	670-990 A.D. (Beta 167443) 790 A.D. - F35
21	Rebuilt hearth in a shallow residential structure (F15) adjacent to F26	Upper fill - 600 A.D. 430-660 A.D. (Beta 167441) Lower fill - 650 A.D. 530-780 A.D. (Beta 167442)
8	Deep, oval shaped, slab-lined masonry cist.	BC 10 (“old wood”)
11	Shallow residential structure with a formal hearth and several sub-floor pits adjacent to F8	540 A.D.
25	Formal hearth in F11	580-880 A.D. (Beta 167438) 680 A.D.
40	Ash pit in a shallow residential room (F37) immediately south of a deep, slab-lined, rectangular masonry storage room/cist remnant (F2)	90 A.D.

Table 2: Provenience data for samples from the Road Kill Site, 42KA4859

Sample No.	Depth (cmbs)	Feature No.	Provenience/Description	Analysis
229		F26	Scrape from the clay floor of a deep, oval-shaped, slab-lined storage cist with masonry upper walls	Pollen
188		F15	Floor contact beneath a dressed slab (F28) in a shallow residential structure with a rebuilt hearth adjacent to F26	Pollen
188/ 189		F15	Floor contact beneath a dressed slab (F28) in a shallow residential structure with a rebuilt hearth adjacent to F26	Macrofloral
151		F15	Floor fill and floor of residential structure (F15) sitting on top of natural alluvial soil (F13)	Macrofloral
187		F21 in F15	Lower fill from the rebuilt hearth in F15	Macrofloral
42		F8	Scrape from the clay floor of a deep, oval-shaped, slab-lined masonry cist	Pollen
100		F8	Floor fill from a deep, oval-shaped, slab-lined masonry cist	Macrofloral
81		F11	Fill from the floor contact to 5 cm above the floor in a shallow residential structure with a formal hearth and several sub-floor pits adjacent to F8	Pollen
81/183		F11	Fill from the floor contact to 5 cm above the floor in a shallow residential structure with a formal hearth and several sub-floor pits adjacent to F8	Macrofloral
103/ 108		F25 in F11	Fill from the north half of the formal hearth in F11	Macrofloral
186		F25 in F11	Fill from the bottom, west half of the formal hearth in F11	Macrofloral
226		F27	Scrape from the clay floor of a paved activity area between F8 and F26	Pollen
122		F2	Scrape from the clay floor of a deep, slab-lined, rectangular masonry storage room/cist remnant	Pollen
145		F2	Fill from a deep, slab-lined, rectangular masonry storage room/cist remnant	Macrofloral
171		F40 in F37	Fill from an ash pit/hearth remnant (F40) within a shallow residential room (F37) adjacent to F2	Macrofloral
160		F19	Fill beneath a metate on a shallow, dish-shaped surface extending off the east end of F2 and abutting a possible structure to the east; surface constructed of small sandstone fragments overlaid by clay	Pollen
202		F19	Scrape from the clay floor of the shallow, dish-shaped surface extending off the east end of F2	Pollen
192		F19	Floor fill from the shallow, dish-shaped surface extending off the east end of F2	Macrofloral
265		F12	Fill from 3 cm above floor contact in the south half of a slab-lined exterior hearth located in the road bed southeast of the storage cist and habitation room alignment	Macrofloral
260/ 264		F12	Floor contact from the slab-lined exterior hearth located in the road bed southeast of the storage cist and habitation room alignment	Macrofloral
266	ca. 1 m		Contact of dense tan clay and overlying sand from the bank of Park Wash about 100 m north of the site; collected in an attempt to identify the stratum associated with agriculture	Pollen

Table 3: Pollen types observed in samples from the Road Kill Site, 42KA4859

Scientific Name	Common Name
ARBOREAL POLLEN:	
Acer	Maple
Juniperus	Juniper
Pinaceae:	Pine family
Abies	Fir
Picea	Spruce
Pinus	Pine
Pseudotsuga	Douglas fir
Quercus	Oak
Salix	Willow
NON-ARBOREAL POLLEN:	
Asteraceae:	Sunflower family
Artemisia	Sagebrush
Low-spine	Includes ragweed, cocklebur, etc.
High-spine	Includes aster, rabbitbrush, snakeweed, sunflower, etc.
Liguliflorae	Includes dandelion and chicory
Brassicaceae	Mustard family
Cactaceae:	Cactus family
Cylindropuntia	Cholla cactus
Echinocereus/Mammillaria-type	Hedgehog, Pincushion cactus
Opuntia	Prickly pear cactus
Calystegia	Wild morning glory
Castilleja-type	Indian paint brush
Cheno-am	Includes amaranth and pigweed family
Sarcobatus	Greasewood
Cleome	Beeweed
Cyperaceae	Sedge family
Ephedra nevadensis-type	Mormon tea
Ephedra torreyena-type	Mormon tea
Eriogonum	Wild buckwheat
Euphorbia	Spurge
Fabaceae	Bean or Legume family
Liliaceae:	Lily family
Yucca	Yucca
Onagraceae	Evening primrose family
Phacelia	Phacelia
Phlox	Phlox
Poaceae	Grass family
Ranunculaceae	Buttercup family
Rhamnaceae	Buckthorn family
Rhus	Sumac
Rosaceae:	Rose family
Prunus	American plum, chokecherry
Shepherdia	Buffaloberry

Scientific Name	Common Name
Typha latifolia	Cattail
Zea mays	Maize, Corn
Indeterminate	Too badly deteriorated to identify
STARCHES:	
Hordeum-type	
SPORES:	
Monolete	Fern
Trilete	Fern

Table 4: Macrofloral remains from the Road Kill Site, 42KA4859

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
188/ 189	Liters Floated						3.20 L
F28 in F15	Light Fraction Weight						68.58 g
	FLORAL REMAINS:						
	Cheno-am	Perisperm		2			
	Chenopodium	Seed		3			
	cf. *Oryzopsis*	Caryopsis		1			
	Pinus	Bark scale		32			0.58 g
	Zea mays	Cupule	1	28			0.10 g
	Zea mays	Kernel		3			0.01 g
	Unidentified T	Seed	1				
	Vitrified tissue			7			0.01 g
	Juniperus	Leaf				3	
	Rootlets					X	Numerous
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						2.75 g
	Artemisia	Charcoal		14			0.13 g
	Juniperus	Charcoal		17			0.51 g
	Pinus	Charcoal		13			0.46 g
	Pinus - vitrified	Charcoal		1			0.02 g
	Pinus edulis	Charcoal		2			0.07 g
	NON-FLORAL REMAINS:						
	Bone ≥ 1mm			1		13	
	Bone < 1mm					X	Few
	Ceramic sherd					2	
	Flake					21	
	Rock/Gravel					X	Moderate
	Insect	Chitin				16	
	Worm casts				X	X	Few
151	Liters Floated						2.70 L
F15 on F13	Light Fraction Weight						26.57 g
	FLORAL REMAINS:						
	Pinus ≥ 2mm	Bark scale		4			0.01 g
	Pinus < 2mm	Bark scale		X			Few
	Zea mays	Cupule		52			0.20 g
	Zea mays	Kernel		6			<0.01 g
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.96 g
	Artemisia	Charcoal		5			0.05 g
	Chrysothamnus	Charcoal		2			0.04 g
	Fraxinus	Charcoal		1			<0.01 g
	Juniperus	Charcoal		7			0.10 g
	Pinus	Charcoal		14			0.27 g
	Quercus	Charcoal		1			<0.01 g
	NON-FLORAL REMAINS:						
	Bone ≥ 1mm			1		7	
	Bone < 1mm			X		X	Few
	Flake					6	
	Insect	Chitin				25	
	Rock/Gravel					X	Few
187	Liters Floated						2.30 L
Feature 21	Light Fraction Weight						14.45 g
	FLORAL REMAINS:						

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	Pinus < 2mm	Barkscale		X			Few
Feature 21	*Zea mays*	Cupule		5			<0.01 g
	Vitrified tissue			3			<0.01 g
	Helianthus	Seed			238*	464*	
	Rootlets					X	Moderate
187	CHARCOAL/WOOD:						
Feature 21	Total charcoal ≥ 2 mm						1.18 g
	Artemisia	Charcoal		8			0.07 g
	Chrysothamnus	Charcoal		2			0.03 g
	Juniperus	Charcoal		7			0.09 g
	Pinus	Charcoal		4			0.02 g
	Pinus edulis	Charcoal		18			0.34 g
	Unidentifiable - vitrified	Charcoal		1			<0.01 g
	NON-FLORAL REMAINS:						
	Bone ≤ 1mm only			X			Few
	Ceramic sherd					3	
	Flake					5	
	Insect	Chitin				91*	
	Rock/Gravel					X	Few
	Snail shell					1	
100	Liters Floated						2.30 L
Feature 8	Light Fraction Weight						14.68g
	FLORAL REMAINS:						
	Cheno-am	Perisperm		2			
	cf. *Juniperus*	Seed		4			<0.01 g
	Pinus ≥ 2mm	Bark scale		8			0.01 g
	Zea mays	Cupule		6			0.01 g
	Zea mays	Kernel		1			<0.01 g
	Vitrified tissue			8			<0.01 g
	Rootlets					X	Numerous
	Sclerotia			X		X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.11 g
	Artemisia	Charcoal		2			<0.01 g
	Fraxinus	Charcoal		4			0.01 g
	Juniperus	Charcoal		8			0.06 g
	Pinus	Charcoal		2			0.01 g
100	NON-FLORAL REMAINS:						
Feature 8	Flake					1	
	Rock/Gravel					X	Few
	Snail shell					X	Few
81/183	Liters Floated						1.60 L
Feature 11	Light Fraction Weight						8.65 g
	FLORAL REMAINS:						
	Pinus	Bark scale		5			0.02 g
	Zea mays	Cupule		21			0.06 g
	Zea mays	Kernel		1			<0.01 g
	Vitrified tissue			4			
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.31 g
	Amelanchier	Charcoal		3			0.02 g
	Artemisia	Charcoal		8			0.02 g
	Atriplex	Charcoal		1			0.01 g

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	Fraxinus	Charcoal		1			0.01 g
Feature 11	*Juniperus*	Charcoal		8			0.07 g
	Pinus	Charcoal		2			0.01 g
	Unidentified - vitrified	Charcoal		3			<0.01 g
	NON-FLORAL REMAINS:						
	Bone ≥ 1mm			5		4	
	Bone < 1mm				X	X	Very few
	Flake					15	
	Insect	Chitin				24	
	Rock/Gravel					X	Few
	Snail shell					X	Few
	Termite fecal pellet			X			Few
103/ 108	Liters Floated						2.60 L
Feature 25	Light Fraction Weight						34.06 g
	FLORAL REMAINS:						
	Pinus ≥ 2mm	Bark scale		29			0.06 g
	Pinus < 2mm	Bark scale		X			Moderate
	Zea mays	Cupule		15			0.02 g
	Zea mays	Kernel		4			0.02 g
	Vitrified tissue			12			<0.01 g
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						2.66 g
	Artemisia	Charcoal		15			0.16 g
	Chrysothamnus	Charcoal		10			0.27 g
	Juniperus	Charcoal		8			0.36 g
	Pinus edulis	Charcoal		1			0.01 g
	Quercus	Charcoal		1			0.02 g
	NON-FLORAL REMAINS:						
	Bone ≥ 1mm			2		2	
	Bone < 1mm			X		X	Few
	Flake					10	
	Insect	Chitin				9	
	Rock/Gravel					X	Few
186	Liters Floated						3.30 L
Feature 25	Light Fraction Weight						113.58 g
	FLORAL REMAINS:						
	Brassicaceae	Seed		5			
	Cheno-am - expanded	Seed	1				
	Atriplex	Seed	2				
	Chenopodium	Seed	1				
	Phaseolus	Cotyledon		2			0.03 g
	Pinus ≥ 2mm	Bark scale		13			
	Pinus < 2mm	Bark scale		X			Few
	Zea mays	Cupule		19			0.06 g
	Zea mays	Kernel		11			0.02 g
	Rootlets					X	Few
186	CHARCOAL/WOOD:						
Feature 25	Total charcoal ≥ 2 mm						9.10 g
	Artemisia	Charcoal		11			0.13 g
	Juniperus	Charcoal		2			0.13 g
	Pinus edulis	Charcoal		27			1.82 g

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	NON-FLORAL REMAINS:						
Feature 25	Bone ≥ 1mm			6			
	Bone < 1mm			X			Very few
	Flake					7	
	Insect	Chitin				22	
	Rock/Gravel					X	Moderate
145	Liters Floated						3.10 L
Feature 2	Light Fraction Weight						19.05 g
	FLORAL REMAINS:						
	Pinus ≥ 1mm	Bark scale		11			
	Pinus < 1mm	Bark scale		X			Few
	Vitrified tissue			3			<0.01 g
	Juniperus	Leaf				2	
	Rootlets					X	Numerous
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.07 g
	Artemisia	Charcoal		3			<0.01 g
	Atriplex	Charcoal		1			<0.01 g
	Juniperus	Charcoal		8			0.01 g
	Pinus	Charcoal		8			0.01 g
	NON-FLORAL REMAINS:						
	Bone					2	
	Eggshell					1	
	Insect	Chitin				13	
	Rock/Gravel					X	Moderate
171	Liters Floated						1.50 L
Feature 40	Light Fraction Weight						24.27 g
	FLORAL REMAINS:						
	Chenopodium	Seed		1			
	Pinus ≥ 2mm	Bark scale		2			<0.01 g
	Pinus < 2mm	Bark scale		X			Few
	Zea mays	Cupule		27			0.08 g
	Zea mays	Kernel		2			<0.01 g
	Vitrified tissue			33			0.11 g
	Juniperus	Leaf				2	
	Sphaeralcea	Seed			1		
	Rootlets					X	Numerous
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						2.57 g
	Amelanchier	Charcoal					0.03 g
	Artemisia	Charcoal		13			0.13 g
	Juniperus	Charcoal		10			0.40 g
	Pinus	Charcoal		2			0.03 g
	Pinus edulis	Charcoal		4			0.32 g
	NON-FLORAL REMAINS:						
	Bone ≥ 1mm			16		1	
	Bone < 1mm			X		X	Few
	Ceramic sherd					5	
	Flake					7	
	Insect	Chitin				32	
	Projectile point base					1	
	Rock/Gravel					X	Few
	Worm casts				X	X	Moderate
192	Liters Floated						0.60 L

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
Feature 19	Light Fraction Weight						3.41 g
Feature 19	FLORAL REMAINS:						
	Pinus ≥ 1mm	Bark scale		2			<0.01 g
	Zea mays	Cupule		1			<0.01 g
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 1 mm						0.01 g
	Artemisia	Charcoal		3			<0.01 g
	Conifer	Charcoal		2			<0.01 g
	Juniperus	Charcoal		3			<0.01 g
	Pinus	Charcoal		2			<0.01 g
	Unidentified hardwood	Charcoal		2			<0.01 g
	NON-FLORAL REMAINS:						
	Bone ≥ 1mm					8	
	Bone < 1mm					X	Few
	Flake					2	
	Insect	Chitin				25	
	Rock/Gravel					X	Few
	Worm casts					X	Few
265	Liters Floated						2.40 L
Feature 12	Light Fraction Weight						11.47 g
	FLORAL REMAINS:						
	cf. *Phaseolus*	Cotyledon		2			<0.01 g
	Pinus	Barkscale		4			
	Zea mays	Cupule		17			0.05 g
	Zea mays	Kernel		3			<0.01 g
	Vitrified tissue			17			0.04 g
	Juniperus	Leaf				1	
	Rootlets					X	Moderate
265	CHARCOAL/WOOD:						
Feature 12	Total charcoal ≥ 2 mm						0.40 g
	Fraxinus	Charcoal		1			<0.01 g
	Juniperus	Charcoal		12			0.08 g
	Pinus	Charcoal		10			0.07 g
	Pinus edulis	Charcoal		2			0.01 g
	NON-FLORAL REMAINS:						
	Bone ≥ 1mm			3		21	
	Bone < 1mm			X		X	Few
	Flake					3	
	Insect	Chitin				2	
	Termite fecal pellet		X	X			Few
	Rock/Gravel					X	Moderate
260/264	Liters Floated						3.10 L
Feature 12 in Feature 47	Light Fraction Weight						61.71 g
	FLORAL REMAINS:						
	Pinus ≥ 2mm	Bark scale		11			0.01 g
	Zea mays	Cupule		13			0.04 g
	Zea mays	Kernel		11			<0.01 g
	Juniperus	Leaf				1	
	Unidentified	Fruit				2	
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	Artemisia *Juniperus*	Charcoal Charcoal		1 19			0.02 g 0.20 g
	Pinus	Charcoal		5			0.05 g
260/264	NON-FLORAL REMAINS:						
Feature 12 in 47	Bone ≥ 1mm Bone < 1mm Ceramic sherd Flake Rock/Gravel Snail shell Termite fecal pellet		 X	1 X		32 X 1 8 X X	 Few Moderate Few Few
W = Whole, F = Fragment X = Presence noted in sample g = grams * = Estimated frequency							

Table 5: Index of macrofloral remains recovered from the Road Kill Site, 42KA4859

Scientific Name	Common Name
FLORAL REMAINS:	
Brassicaceae	Mustard family
Cheno-am	Includes goosefoot and amaranth families
Atriplex	Saltbush, Shadscale
Chenopodium	Goosefoot
Helianthus	Sunflower
Juniperus	Juniper
Oryzopsis	Indian rice grass
Pinus	Pine
Sphaeralcea	Globe mallow
Sclerotia	Resting structures of mycorrhizae fungi
CULTIGENS:	
Phaseolus	Bean
Zea mays	Maize, Corn
CHARCOAL/WOOD:	
Amelanchier	Juneberry, Serviceberry
Artemisia	Sagebrush
Atriplex	Saltbush, Shadscale
Chrysothamnus	Rabbitbrush
Conifer	Cone-bearing, gymnospermous trees and shrubs, mostly evergreens, including the pine, spruce, fir, juniper, cedar, yew, and cypress
Juniperus	Juniper
Pinus	Pine
Pinus edulis	Pinyon pine
Fraxinus	Ash
Quercus	Oak

Table 6: Ubiquity of Charred/Cultural remains from the Road Kill Site, 42KA4859

	TOTAL # %	F26, F15, F21 # %	F8, F11, F25 # %	F2, F40 # %	F12 # %	F19 # %
FLORAL REMAINS:						
Brassicaceae embryo	1 8%		1 25%			
Cheno-am perisperm	2 17%	1 33%	1 25%			
Cheno-am seed	1 8%		1 25%			
Atriplex seed	1 8%		1 25%			
Chenopodium seed	3 25%	1 33%	1 25%	1 50%		
cf. Juniperus seed	1 8%		1 25%			
cf. *Oryzopsis* caryopsis	1 8%	1 33%				
Phaseolus cotyledon	2 17%		1 25%		1 50%	
Zea mays cupule	11 92%	3 100%	4 100%	1 50%	2 100%	1 100%
Zea mays kernel	9 75%	2 67%	4 100%	1 50%	2 100%	
Pinus bark scale	12 100%	3 100%	4 100%	2 100%	2 100%	1 100%
Unidentified T seed	1 8%	1 33%				
Vitrified tissue	8 67%	2 67%	3 75%	2 100%	1 50%	
CHARCOAL:						
Amelanchier	2 17%		1 25%	1 50%		
Artemisia	11 92%	3 100%	4 100%	2 100%	1 50%	1 100%
Atriplex	2 17%		1 25%	1 50%		
Chrysothamnus	3 25%	2 67%	1 25%			
Conifer	1 8%					1 100%
Juniperus	12 100%	3 100%	4 100%	2 100%	2 100%	1 100%
Pinus	10 83%	3 100%	2 50%	2 100%	2 100%	1 100%
Pinus edulis	6 50%	2 67%	2 50%	1 50%	1 50%	
Pinus - vitrified	1 8%	1 33%				
Fraxinus	4 33%	1 33%	2 50%		1 50%	
Quercus	2 17%	1 33%	1 25%			
Unidentified hardwood	1 8%					1 100%
Unidentifiable - vitrified	2 17%	1 33%	1 25%			
NON-FLORAL REMAINS:						
Bone - charred	9 75%	3 100%	3 75%	1 50%	2 100%	
Bone - uncharred	9 75%	2 67%	2 50%	2 100%	2 100%	1 100%
Ceramic sherd	4 33%	2 67%		1 50%	1 50%	
Eggshell	1 8%			1 50%		
Flake	11 92%	3 100%	4 100%	1 50%	2 100%	1 100%
Termite fecal pellet - charred	3 25%		1 25%		2 100%	
Projectile point base	1 8%			1 50%		
TOTAL NUMBER OF SAMPLES	12	3	4	2	2	1

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