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# Hunchback Shelter: A Fremont Lithic Production Site in the Mineral Mountains of Eastern Utah

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*Hunchback Shelter (42BE751) is a small rockshelter in the northern Mineral Mountains, located less than 10 km. from one of the major obsidian sources in the eastern Great Basin. Excavation of the site yielded a large flaked lithic assemblage associated with occupations dating from the Late Archaic to the post-Formative Late Prehistoric period. The data suggest that the shelter functioned as a seasonal campsite that was heavily oriented toward biface production throughout its long occupational history. Based primarily on flaked lithics and secondarily on other lines of evidence, we hypothesize that the flaked stone tools and debitage associated with the Fremont occupations may represent the work of independent, part-time craft specialists.*

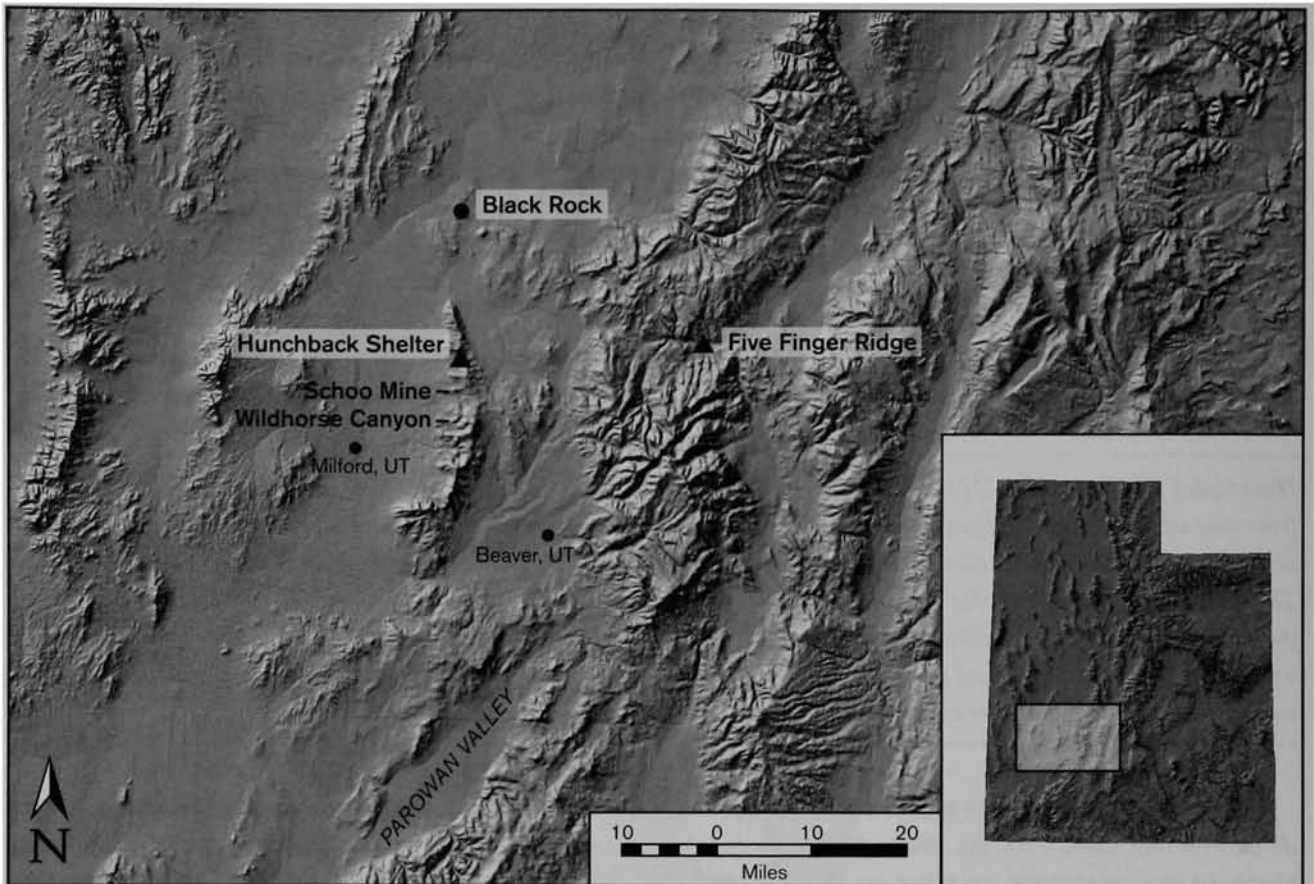
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**A** RCHAEOLOGISTS HAVE INVESTIGATED the Fremont culture for the better part of a century. Much of the literature relating to this research, particularly the published work, is dominated by reports of excavated villages or other structural habitation sites (e.g., Berry 1972; Dodd 1982; Gillin 1941; Janetski et al. 2000; Judd 1919, 1926; Madsen and Lindsay 1977; Marwitt 1970; Meighan et al. 1956; Steward 1931, 1933; Talbot et al. 2000; Taylor 1954; Wilde and Soper 1999). More recently, subsistence studies and research focusing on the variability of Fremont adaptations have come into vogue (e.g., Barlow 2002; Coltrain 1993; Coltrain and Leavitt 2002; Janetski 1997; Madsen and Simms 1998; Madsen and Schmitt 2005; Sharp 1989; Simms 1987, 1990, 1999; Smith 1992; Ugan 2005). In contrast, Fremont studies addressing issues other than subsistence, adaptive diversity, mobility, or the origins and demise of the Fremont are relatively few and far between (but see Hockett 1998 and Janetski 2002 for exceptions). Moreover, while Fremont sites representing aspects of settlement systems other than long-term habitation have been excavated, they are not as common in the published literature as village or pithouse sites.

Hunchback Shelter (42BE751), excavated during the data recovery phase of the Kern River 2003 Expansion

Pipeline project, is a non-structural, seasonal, Fremont campsite in the eastern Great Basin. In addition to yielding data suitable for the types of studies that many Fremont scholars have favored in recent years, the shelter also produced robust flaked lithic assemblages that have the potential to address a variety of research questions concerning the organization of lithic technology and aspects of Fremont social structure.

The goal of this article is to present a case for the existence of craft specialization during the Fremont period, as recognized in the flaked stone assemblage from Hunchback Shelter. The craft specialization hypothesis is based upon evidence for subtle changes in lithic technology that occurred between a period of time spanning the Terminal Archaic to early Formative period—conceptualized here as the “Archaic-Formative transition” (A-F Transition)—and the post-A.D. 650 Fremont period, herein referred to as Fremont (see Andrews and Greubel, this issue). The proposition is examined from the multiple perspectives of mobility, tool-type ratios, biface uniformity, segmentation and intensification of production, skill, and differential arrow point manufacturing methods. Based upon these lines of evidence, it is hypothesized that much of the lithic manufacturing that took place during the Fremont



**Figure 1.** Map showing the general locations of Hunchback Shelter (42BE751) and Five Finger Ridge, as well as the School Mine, Wildhorse Canyon, and Black Rock obsidian source areas.

occupations may have been the work of craft specialists. A model of logistical obsidian procurement by Fremont lithic craft specialists is offered. Data from the large, late Fremont village at Five Finger Ridge are discussed. These data provide evidence that some Fremont peoples in the region may have practiced an obsidian procurement strategy consistent with the craft specialization model proposed here.

### DESCRIPTION OF HUNCHBACK SHELTER

Hunchback Shelter is a low rockshelter near the northern end of the Mineral Mountains in Beaver County, Utah (Figs. 1–3). The southeast-facing shelter, the interior of which measures approximately 8 m. north-south by 9 m. east-west, is described in Greubel (2005) and Andrews and Greubel (this issue). The shelter deposits had suffered some vandalism prior to excavation, but overall were surprisingly intact.

The interior of Hunchback Shelter was fully excavated during the data recovery phase of the Kern River 2003 Expansion Pipeline project (Fig. 4). Sediments were screened through 1/4-inch mesh. The 64 m.<sup>2</sup> excavation yielded an impressive flaked lithic assemblage consisting of 2,547 flaked stone tools and over 75,000 pieces of debitage—99 percent of which is obsidian.

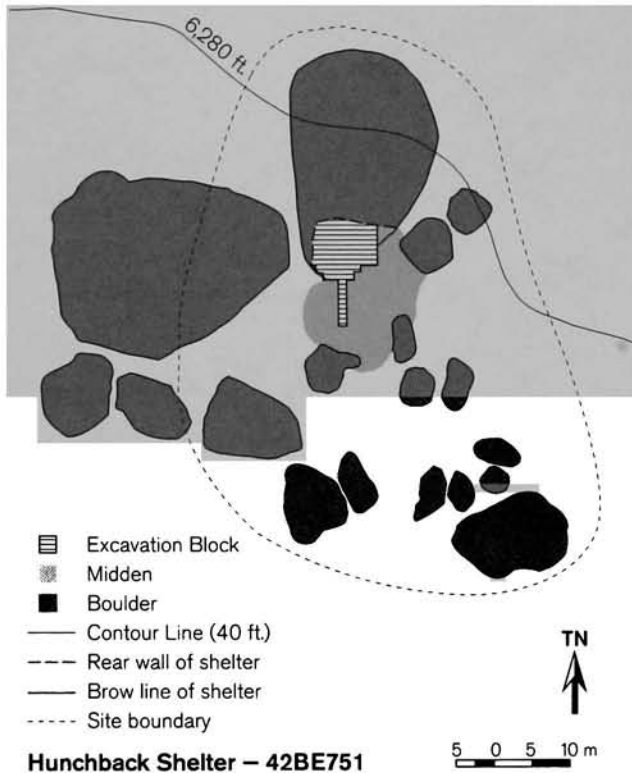
The shelter is less than 10 km. walking distance (about 7 air km.) from the School Mine obsidian source (Negro Mag Wash) and only a few kilometers farther (12 air km.) from the Wild Horse Canyon source (Fig. 1). These two outcrops form the most important source of toolstone-quality obsidian in the southeastern Great Basin. Early research into the geochemical makeup of Mineral Mountains obsidian suggested that material from School Mine could be distinguished from that of Wild Horse Canyon (e.g., Nelson and Holmes 1979; Nelson 1984). More recent analyses, however, indicate



**Figure 2. Hunchback Shelter, 42BE751, view to the southwest.**



**Figure 3. Long distance overview showing the setting of Hunchback Shelter (42BE751).**



**Figure 4. Plan map of Hunchback Shelter, showing the limits of the shelter interior, brow line, excavation block, and trench.**

that the glasses from these two outcrops are so similar that they “can be considered together as one geochemical source” (Hull and Bevill 1994). X-ray fluorescence analyses of non-archaeological obsidian samples collected by the senior author from the primary deposit in Negro Mag Wash, conducted as part of the obsidian study for the Kern River 2003 Expansion Project, confirm that Schoo Mine obsidian is geochemically the same as obsidian from Wild Horse Canyon (Craig Skinner, personal communication 2003).

#### *The Stratigraphy and Depositional History of Hunchback Shelter*

A composite, schematic, north-south stratigraphic profile of the shelter is shown in Figure 5. For detailed descriptions of the shelter’s stratigraphy and depositional history, see the technical excavation (Greubel 2005), and geomorphology reports (Eckerle et al. 2005). A brief discussion of these topics is appropriate here because they are relevant to the definition of components and to the integrity of the strata from

which the assemblages were recovered. Nineteen strata were defined, in addition to 10 fills within 5 pits. Seven cultural features were identified; Strata 13 and 11a are of special concern here.

Stratum 13 seems to have aggraded fairly rapidly during the Late Archaic and into the early Formative period—roughly, 1,500 B.C. into the early centuries A.D. The development of Stratum 13 was truncated by cultural excavation events (i.e., Pits 1–3) that resulted in the removal of this sediment from the western part of the shelter and its apparent redeposition in the area beneath the shelter brow, where it contributed to the formation of Stratum 11a. Following this apparently rapid succession of excavation events, the pedologic history of the shelter was dominated by the interstratifying and cultural reworking of sediments of geogenic, biogenic, and anthropogenic origin.

Component 3 mainly consisted of Stratum 11a, which was characterized by a considerable amount of cultural reworking. Component 4 comprised a number of strata that overlay Stratum 11a but which had been subjected to less reworking. Component 4 contexts, therefore, were more intact and contained fewer intrusive materials from earlier and later occupations.

### **HUNCHBACK ROCKSHELTER CULTURAL COMPONENTS**

Five cultural components were defined at Hunchback Shelter. Components at Hunchback Shelter are at once spatial, temporal, artifactual, and geomorphological entities, each encompassing multiple occupations spanning hundreds of years. This paper is concerned only with Components 3 and 4—the A-F Transition and Fremont components, respectively. Component 3—the A-F Transition—consists of an inseparable mixture of Terminal Archaic and early Formative occupations dating to the period ca. A.D. 100–650. Component 4 represents Fremont occupations dating between A.D. 650 and 1250. The dating of Components 3 and 4 is based on multiple radiocarbon assays.

The A-F Transition and Fremont components are described and summarized below. The interpretations regarding the nature of the occupations that make up each component are derived from the Hunchback Shelter excavation report (Greubel 2005). Readers desiring a

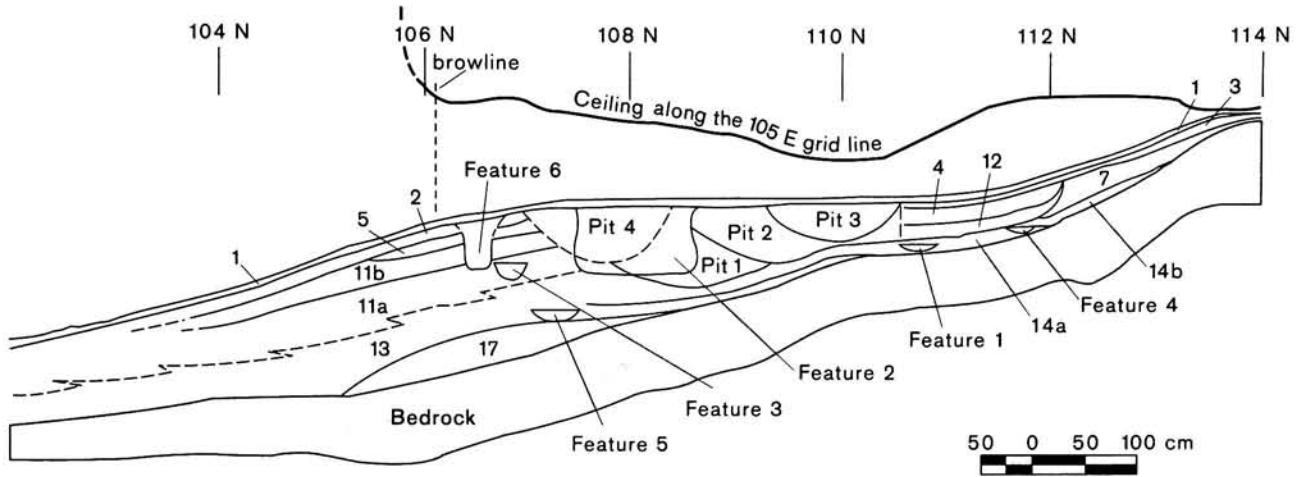


Figure 5. Composite, schematic, north-south stratigraphic profile of Hunchback Shelter, with key strata, features, and pits labeled.

more in-depth understanding of the data and analytical methods that underpin these interpretations are referred to the excavation report.

*A-F Transition (Component 3)*

The A-F Transition component represents an unknown number of occupations that took place between approximately A.D. 100 and 650, bridging the transition between the Terminal Archaic and early Formative periods. Proveniences associated with the A-F Transition occupations yielded 725 flaked stone tools and over 15,000 pieces of debitage, in addition to hammerstones,

groundstone implements, and other artifacts. Analyses of these materials suggest that the occupations were characterized by high residential mobility, a strong emphasis on obsidian procurement and biface manufacturing, and the use of the shelter as a seasonal residential base. In addition to the implications for mobility as represented by bifacial tool reduction (Kelly 1988), high mobility during these occupations may be indicated by the presence of obsidian from four different sources. A comparatively robust groundstone assemblage (see Table 1 and Figure 6) suggests a considerable use of floral resources.

Table 1

**FREQUENCIES AND PERCENTAGES OF LITHIC TOOL TYPES FROM THE A-F TRANSITION AND FREMONT COMPONENTS AT HUNCHBACK SHELTER**

Tool Type	A-F Transition		Fremont	
	Frequency	Percent	Frequency	Percent
Projectile Points	133	18	93	15
Knives	13	2	2	0
Drills	6	1	3	0
Other Bifaces	326	43	326	55
Formal Scrapers	11	1	7	1
Miscellaneous Flaked Stone Tools	2	0	6	1
Flake Tools	228	30	139	24
Hammerstones	7	1	7	1
Groundstone Tools	30	4	19	3
Total	756	100	602	100

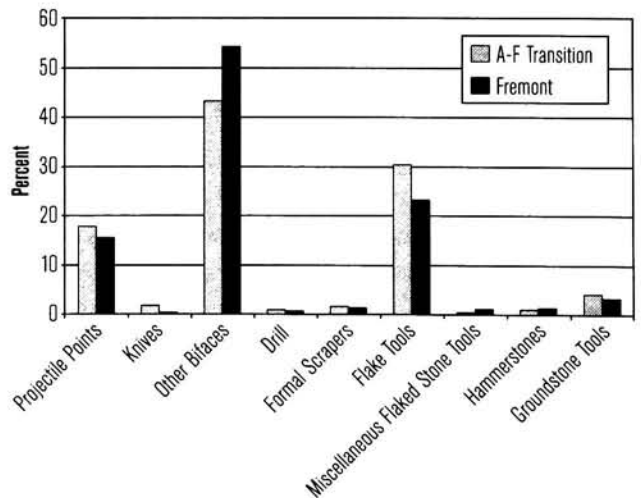


Figure 6. Bar chart showing percentages of lithic tool types from the A-F Transition (Component 3) and Fremont (Component 4) components at Hunchback Shelter.

Early in the A-F Transition period, the occupants enlarged their habitation space through the excavation of large pits in the western interior of the shelter. This investment of labor suggests that longer occupations and probably reoccupation were anticipated (Binford 1986; Kent 1992). Based on evidence for moderate amounts of cleaning and maintenance of site space, as well as the sheer quantity of lithic refuse, faunal remains, and fire-cracked rocks, some of the occupations were apparently relatively lengthy, probably on the order of several weeks. Obsidian procurement, although clearly of major importance during the A-F Transition occupations, was likely embedded within a transhumant settlement system (Seddon 2005).

#### *Fremont (Component 4)*

Component 4 represents an unknown number of occupations that took place during the Fremont period, after A.D. 650. Component 4 contexts yielded sixteen reliable radiocarbon dates with calibrated calendrical ranges spanning A.D. 650–1255,<sup>1</sup> including two dates on maize cobs and one on common reed (*Phragmites* sp.) (Greubel 2005:402–403). The ceramics recovered from the site are dominated by Snake Valley Gray but also include various other Fremont gray, corrugated, and black-on-white wares, as well as low quantities of unidentified brown wares and Virgin Anasazi wares. In addition to the ceramics, proveniences associated with the Fremont occupations yielded 577 flaked stone tools and nearly 13,000 pieces of debitage, as well as hammerstones, groundstone, ornaments, and perishable items including arrow shaft fragments and cordage.

The analysis of the Component 4 materials suggests that biface production was, as in earlier occupations, a major site activity (Greubel 2005). Occupations continued to be relatively short term and seasonal, as they were during earlier periods. The procurement and processing of floral and faunal resources, as in earlier times, was an important aspect of site function. However, Component 4 deviated from the basic pattern of high residential mobility established during the Late Archaic and which evidently continued with minor adjustments throughout the A-F Transition period. Collectively, the differences between Components 3 and 4 seem to indicate a shift in mobility during the Fremont period. The trend during the Fremont period seems to be toward

greater logistical use of the shelter (Greubel 2005). This is evidenced by multiple, albeit subtle, lines of evidence, which have been discussed in the accompanying article (Andrews and Greubel, this issue).

Mobility and site function during the Component 4 period was likely variable, but at least some of the occupations seem to have been logistically organized. We believe that the increase in logistical mobility during some Fremont-period occupations is linked to regional demographic developments; namely, the establishment of substantial residential sites in the region and an increase in sedentism enabled by a greater reliance on maize horticulture. Whereas the posited high residential mobility of the A-F Transition period assured that needed resources could be procured during the natural course of a seasonal round, a decrease in residential mobility during the Fremont period may have meant that many resources had to be obtained through logistical forays by special task groups. Substantial villages in the region whose populations may have exploited the Mineral Mountains logistically for obsidian and other resources include Baker Village (Wilde and Soper 1999), Garrison (Taylor 1954), Five Finger Ridge (Janetski et al. 2000; Talbot et al. 2000), Beaver (Judd 1926), Kanosh (Steward 1931, 1933), Marysville (Gillin 1941), and several sites in the Parowan Valley (Arnett 1998; Berry 1972; Dodd 1982; Judd 1919; Marwitt 1970; Meighan et al. 1956). These large residential sites, which range from approximately 30 to 120 km. distance from the major obsidian sources in the Mineral Mountains, were occupied during the latter half of the period defined for Component 4.

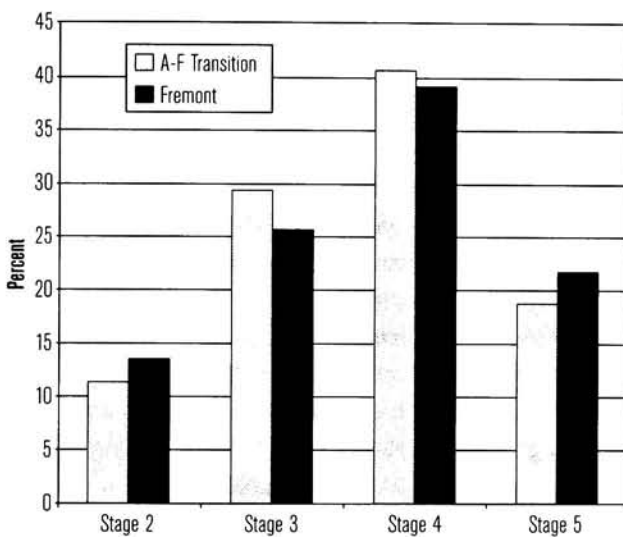
#### **FLAKED STONE ARTIFACTS FROM HUNCHBACK SHELTER**

Excavations at Hunchback Shelter resulted in the recovery of over 78,800 artifacts, 17,000 faunal specimens, and numerous floral specimens including maize cob fragments.<sup>2</sup> The majority of these materials are associated with Components 3 and 4—the A-F Transition and Fremont occupations, respectively. Flaked and groundstone tools from these components are summarized in Table 1 and Figure 6. Bifaces, categorized into stages following Callahan (1979), are summarized in Table 2 and Figure 7.

**Table 2**  
**STAGE DIAGNOSTIC BIFACES-IN-PROGRESS**  
**BY COMPONENT AND STAGE**

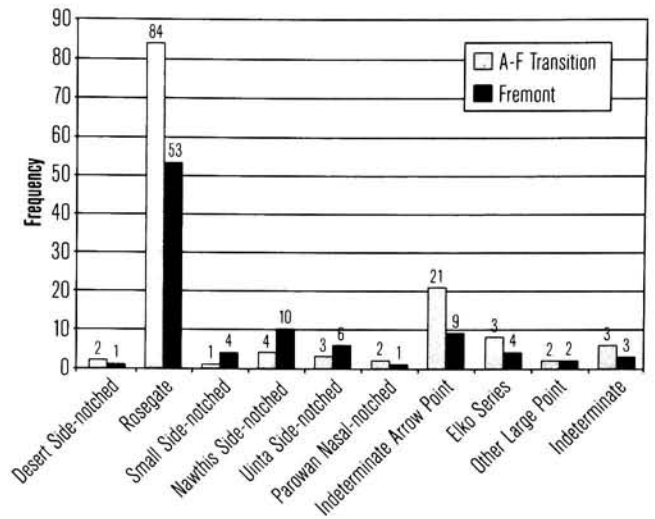
Component	Stage 2	Stage 3	Stage 4	Stage 5	Totals
A-F Transition	29 (11.3%)	75 (29.3%)	104 (40.6%)	48 (18.8%)	256 (100.0%)
Fremont	38 (13.5%)	72 (25.6%)	110 (39.1%)	61 (21.7%)	281 (99.9%)
Total	67 (12.5%)	147 (27.4%)	214 (39.9%)	109 (20.3%)	537 (100.1%)

Notes: Not including bifaces or biface fragments of indeterminate stage.  
Bifaces-in-progress = unfinished bifaces.



**Figure 7. Bar chart showing percentages of bifaces by stage from the A-F Transition (Component 3) and Fremont (Component 4) components at Hunchback Shelter.**

The projectile points recovered from Components 3 and 4 are summarized in Figure 8. Rosegate points (Holmer 1986:107; Thomas 1981:19) are the dominant type of projectile point recovered at Hunchback Shelter, accounting for 61 percent of the total number of points in Components 3 and 4. Arrow point types regarded as diagnostic of the late Formative period, including Nawthis Side-notched, Uinta Side-notched, and Parowan Basal-notched (Holmer 1986; Holmer and Weder 1980), compose 12 percent of the total from the two components. Large typed points that are potentially Archaic dart tips account for 7 percent of the total and are dominated by Elko series points. Some of the Archaic-type points that were recovered from contexts assigned to Formative-age components may have been mixed into these strata as a



**Figure 8. Bar chart showing frequencies of projectile points by type from the A-F Transition (Component 3) and Fremont (Component 4) components at Hunchback Shelter.**

**Table 3**  
**DEBITAGE COUNTS FROM THE A-F TRANSITION**  
**AND FREMONT COMPONENTS AT HUNCHBACK SHELTER**

Component	Total Debitage	Debitage Sample Analyzed
A-F Transition	15,495	1,844 (11.9%)
Fremont	12,915	1,622 (12.6%)
Total	28,410	3,466 (12.2%)

result of prehistoric cultural disturbances or bioturbation. Others exhibit cutting use wear that suggests they were reused or even manufactured as hafted knives. Some of the Archaic-type points in the A-F Transition component (Component 3) may reflect continued use of atlatl and dart technology concurrent with the bow and arrow.

Debitage frequencies from the A-F Transition (Component 3) and Fremont (Component 4) components at Hunchback Shelter are summarized in Table 3. Because of the large size of the Hunchback Shelter assemblage, a sampling approach to debitage analysis was adopted (see Greubel 2005:280–281). Table 3 lists the total amount of debitage recovered from each component as well as the number of flakes actually analyzed. Table 4 presents technological flake type frequencies and percentages for each component. These data clearly show the gross similarities between the lithic reduction regimes of the A-F Transition and Fremont periods.



**Table 4****TECHNOLOGICAL DEBITAGE TYPE DISTRIBUTIONS BY COMPONENT**

Component	Debris	Biface-thinning	Core-reduction	Indeterminate	Total
A-F Transition	8 (0.4%)	362 (19.6%)	188 (10.2%)	1,286 (69.8%)	1,844 (100.0%)
Fremont	9 (0.5%)	316 (19.5%)	180 (11.1%)	1,117 (68.9%)	1,622 (100.0%)
Total	17 (0.5%)	678 (19.6%)	368 (10.6%)	2,403 (69.3%)	3,466 (100.0%)

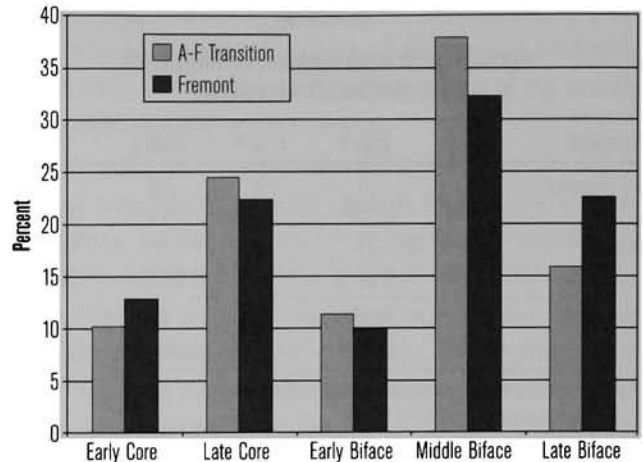
The percentages of technological flake types as shown in Table 4 clearly reflect the prevalence of biface manufacturing over core reduction at the rockshelter. It is also apparent that core reduction was conducted, though it was a minor aspect of the lithic reduction regime. Table 5 breaks the data down into more specific diagnostic categories, revealing differences between the components that are not apparent from the technological flake type frequencies shown in Table 4. These data are depicted graphically in Figure 9. In particular, the A-F Transition debitage contains higher percentages of late core, early biface, and middle biface debitage, compared to the Fremont material, which contains higher percentages of early core and late biface debitage. These differences, though seemingly small, are important in the context of the Fremont craft specialization hypothesis presented in the second part of this paper.

**Table 5****DIAGNOSTIC FLAKE DISTRIBUTIONS BY COMPONENT**

Component	Early Core	Late Core	Early Biface	Middle Biface	Late Biface	Total
A-F Transition	55 (10.3%)	131 (24.5%)	61 (11.4%)	203 (37.9%)	85 (15.9%)	535 (100.0%)
Fremont	61 (12.9%)	106 (22.4%)	47 (9.9%)	153 (32.2%)	107 (22.6%)	474 (100.0%)
Total	116 (11.5%)	237 (23.5%)	108 (10.7%)	356 (35.3%)	192 (19.0%)	1,009 (100.0%)

### LITHIC CRAFT SPECIALIZATION DURING THE FREMONT PERIOD

Subtle changes in lithic technology and mobility from the A-F Transition to the Fremont period inferred from the Hunchback Shelter data—discussed in Andrews and



**Figure 9.** Bar chart showing percentages of diagnostic debitage types in the A-F Transition (Component 3) and Fremont (Component 4) components at Hunchback Shelter.

Greubel, in this issue—provide the basis for a model of logistical obsidian procurement by Fremont lithic craft specialists. Before examining the evidence in support of this hypothesis, however, it is useful to consider the concept of craft specialization itself.

The history of craft specialization as an analytical concept in archaeology has been reviewed by Clark (1995). The concept has been a focus of numerous archaeological studies (e.g., Adams 1966; Brumfiel and Earle 1987; Childe 1930; Clark and Parry 1990; Clark 1995). However, studies suggesting that specialized production existed in small-scale prehistoric societies like the Fremont are rare. An exception is the American Southwest, where Anasazi pottery manufacture is sometimes discussed in the context of craft specialization (e.g., Mills and Crown 1995).

The idea that craft specialization existed in less complex past societies has not received widespread acceptance. This tendency may be due to a mistaken impression that specialized production is present only in relatively complex, socially stratified groups (Cross 1993). In fact, Clark and Parry (1990) have cited numerous examples of craft specialization in egalitarian societies gleaned from worldwide ethnographic studies. One recently published example that constitutes a useful analogy for Fremont craft specialization is Stout's study of stone adze makers in the village of Langda in Indonesian Irian Jaya (Stout 2002; see also Toth et al. 1992). In this particular case, a small group of skilled

craftsmen manufacture and supply adzes to a much larger community. The craft of adze making is semihereditary and requires a lengthy period of apprenticeship (Stout 2002). The organization of adze production in Langda has many elements that correspond to the posited organization of Fremont biface production.

The question of whether craft specialization could have been present in societies like the Fremont depends upon how the concept itself is defined. Existing definitions range from broad to relatively restrictive. At the more restrictive end of the scale is Costin, who said that craft specialization is a “permanent, and perhaps institutionalized production system in which producers depend on extra-household exchange relationships at least in part for their livelihood, and consumers depend on them for acquisition of goods they do not produce themselves” (Costin 1991:4).

At the broader end of the scale, Clark and Parry suggest that “craft specialization is production of alienable, durable goods for nondependent consumption” (Clark and Parry 1990:297). A few years later, Clark refined this definition by stating that the logical boundary line between specialized and non-specialized production should be drawn between “production for members of one’s own household versus production for others” (Clark 1995:279). Clark and Parry (1990:320) observed that craft specialization, as they define it, is “essentially ubiquitous” and “present in almost all societies.”

Cross’ (1993) study is explicitly concerned with specialized production in non-stratified societies. His definition is closer to Clark and Parry’s than Costin’s, broadly characterizing craft specialization as a situation in which a small segment of the population manufactures a relatively large portion of a given item or class of items (Cross 1993). Cross contends that specialist output in non-stratified societies is comparatively low and is often distributed through non-market mechanisms (Cross 1993:62). While Costin’s more restrictive definition cannot be ruled out as applying to the Fremont component at Hunchback Shelter, Clark and Parry’s—and especially Cross’s—broader, more inclusive definitions of craft specialization are more applicable to the Fremont case described in this paper. We will now discuss the various lines of evidence for the existence of Fremont craft specialization.

## THE EVIDENCE FOR FREMONT CRAFT SPECIALIZATION

A key criterion for identifying craft specialization in the archaeological record is some measure of consistency in workmanship (Clark 2003; Cross 1993:71; Stark 1985; Torrence 1986). Two measures are typically used. *Standardization* denotes the repetition of the same or similar value for a single attribute, such as length. *Uniformity*, in contrast, refers to the repetition of “sets of proportions or combinations of traits” within a population of artifacts (Cross 1993:71). The “consistent relationship between the width, length, and thickness” of bifaces constitutes one type of uniformity measure (Clark 2003:224–225). Uniformity is generally regarded as more appropriate and useful than standardization for measuring biface consistency because it addresses the proportions and shape of the artifact rather than focusing on a single variable (Clark and Parry 1990:224; Clark 2003; Cross 1993:71).

When measuring biface uniformity, some sort of multidimensional ratio is typically employed. Ideally, as suggested above, the ratio incorporates length, width, and thickness, requiring complete bifaces (Clark 2003; Cross 1993). Unfortunately, the use of only complete specimens would result in too small a sample for this study, since relatively few unbroken bifaces were recovered from Hunchback Shelter. Therefore, it is necessary to include broken artifacts to obtain a suitable sample size. For this reason, length is omitted and only width and thickness are used.

Following Clark (2003:225), compound coefficients of variation (CCV) have been generated from mean width/thickness ratios as a way to measure uniformity. The coefficient of variation (CV) equals 100 x standard deviation/mean. The compound aspect of the CV refers to the incorporation of multiple dimensions in the measurement (Clark 2003:225). Therefore, as used here, the CCV measures the overall uniformity of the relationship between width and thickness within a biface population. Assemblages that are largely the output of a low number of skillful knappers can be expected to exhibit greater uniformity (Clark 2003; Gunn 1975; Whittaker 1987).

The aim of this study, then, is to compare data from the Fremont assemblage thought to represent craft specialization with data from other biface assemblages.

The other assemblages may or may not represent specialist production, but they are considered appropriate for comparison because there is no reason to believe that they are partially or wholly the result of craft specialization. Accordingly, the mean width/thickness ratios, standard deviations, and compound coefficients of variation were calculated for late stage (stages 4 and 5) bifaces from the A-F Transition and Fremont components at Hunchback Shelter (Components 3 and 4), from the Fallen Eagle site (42BE1988), and from three sites in western Colorado. The Fallen Eagle site was chosen for comparison because it represents a post-A.D. 900 Fremont short-term habitation near the Mineral Mountains that yielded a substantial assemblage of obsidian bifaces (Stokes et al. 2001). The Colorado sites were chosen because they produced sizeable samples of late stage bifaces that were analyzed by the same individual who analyzed the Hunchback Shelter assemblage (Greubel 2001a, 2001b; Greubel and Cater 2001). Biface assemblages from sites in the southeastern Great Basin were sought, but—surprisingly—no published data were found that met all the necessary criteria. Five Finger Ridge has large biface assemblages broken down into stages comparable to those applied to the Hunchback bifaces, but biface thickness data are not available (Richard Talbot, personal communication 2004). Other sites in the region have substantial biface assemblages, but most have not been categorized into stages and, moreover, lack published metric data.

The results of the metric analysis are presented in Table 6. The Fremont bifaces from Hunchback Shelter exhibit the lowest compound coefficient of variation and, therefore, the greatest uniformity of this set of six biface assemblages. This tentatively supports the hypothesis that specialized production may be represented by the Fremont bifaces. The A-F Transition at Hunchback and one of the western Colorado sites, however, also yielded quite low compound coefficients of variation. The reason is unclear, but the results may indicate that the groups who produced the other assemblages with low CCVs also had some degree of specialization, or that these collections perhaps represent assemblages that were largely the output of a single individual. It is also possible that compound coefficients of variation based on width/thickness ratios are simply not a good measure of uniformity.

Because the CCV results are seemingly ambiguous, the significance of the differences between the assemblages was tested using an analysis of variance (ANOVA). The results, unfortunately, indicate no significant differences between the assemblages ( $F=1.04$ ,  $F$  crit = 2.25,  $p=0.39$ ). The CCV results presented in Table 6, while suggestive, cannot be demonstrated to be significant. Therefore, other lines of evidence were sought to make the argument.

The second criterion, proposed by Cross (1993) as demonstrating craft specialization in the manufacture of bifaces, is segmentation of the production process.

**Table 6**

**MEAN WIDTH/THICKNESS RATIOS, STANDARD DEVIATIONS, AND COMPOUND COEFFICIENTS OF VARIATION FOR LATE STAGE (STAGE 4–5) BIFACES FROM HUNCHBACK SHELTER AND SELECTED SITES IN UTAH AND COLORADO**

Sample Set	Mean Width/Thickness Ratio	STD of the Mean Width/Thickness Ratio	Variance (square of the STD of the Mean Width/Thickness Ratio)	Compound Coefficient of Variation (CCV) of the Mean Width/Thickness Ratio
Fremont Component, Hunchback Shelter (n=51)	4.58	0.96	0.92	20.96
A-F Transition Component, Hunchback Shelter (n=62)	4.34	0.93	0.86	21.43
Fallen Eagle Site (42BE1988), Post-A.D. 900 Fremont Component (N=27) (Stokes et al. 2001)	4.46	1.04	1.08	23.32
Simpson Wickiup Site (5SM2425, All Components) (n=26) (Greubel 2001a)	4.64	0.98	0.96	21.12
Schmidt Site (5MN4253, All Components) (n=15) (Greubel and Cater 2001)	4.43	1.06	1.12	23.93
Watershed Rockshelter (5ME213) Formative Components (n=30) (Greubel 2001b)	4.83	1.33	1.77	27.54

Note: The bifaces in this table from Hunchback Shelter and the Fallen Eagle Site are all obsidian.

Segmentation of the production continuum into stages and tasks denotes efficiency in the manufacture of many items at one time and is a characteristic of specialized production (Cross 1993). Cross (1993) implies that more than one individual may be involved in segmentation, but there is no particular reason why a single producer could not segment production across space. In contrast, non-specialized production is characterized by one or a few items being manufactured from beginning to end, frequently at a single location and typically by a single producer (Cross 1993).

The Fremont materials from Hunchback Shelter offer only a weak case for segmentation of production. The proportions of diagnostic flake types and staged bifaces from the Fremont component are not sufficiently different from those of the A-F Transition to demonstrate that Fremont production was more segmented. In a very broad sense, both periods exhibit segmentation of production. The initial edging of biface blanks was, apparently, mostly conducted at the quarry location. The middle to late stages of production were conducted at the rockshelter. The final stages—notching of arrow points and pressure-finishing of larger bifaces—were largely conducted elsewhere, presumably at the residential bases from which the knappers originated. At least three distinct production segments, therefore, might be inferred for both components.

The differences between the proportions of staged bifaces and diagnostic flake types from the A-F Transition to the Fremont period (depicted graphically in Figures 7 and 9, respectively) may speak more to the logistics of manufacture and transport than segmentation of production. Transportation costs impose constraints upon production. For a prehistoric knapper whose goal was to bring as many nearly finished bifaces as possible back to the village, the transportation of waste material still attached to the bifaces would be inefficient because it would unnecessarily increase the weight of the load while reducing the number of items that could be carried. Therefore, an efficient producer would tend to maximize load capacity by removing as much waste material from the manufactured item as possible (Metcalf and Barlow 1992). As seen in Figure 9, late stage biface thinning increased relative to earlier stages of biface production from the A-F Transition to the Fremont period. This trend is also seen, though not as markedly,

in the slight proportional increase in stage 5 bifaces from the Fremont component, as shown in Figure 7. While not necessarily supporting craft specialization, the tendency for intensification of late stage biface production during the Fremont occupations is consistent with a model of specialized producers concerned with transport costs.

Another measure of craft specialization, even in a part-time context, is skill (Andrews 2003; Cross 1993). The measurement of skill can be a difficult and often ambiguous endeavor (Clark 2003), but a simple approach might employ rates of breakage, as more practiced knappers would be expected to enjoy greater success by breaking fewer items during the manufacturing process (for a similar observation, see Andrews 2003). With this in mind, we can compare breakage rates as indicated by frequencies of complete bifacial implements in the A-F Transition vs. Fremont assemblages at Hunchback Shelter. Out of 326 bifaces-in-progress, the Fremont assemblage yielded 43 (13.2 percent) complete specimens, whereas the A-F Transition—coincidentally also with 326 total bifaces-in-progress—yielded only 29 (8.9 percent) complete bifaces. This might be taken as evidence that Fremont knappers broke fewer bifaces than their predecessors. Moreover, the A-F Transition component has a higher frequency of indeterminate bifaces than the Fremont component (21.5 percent compared with 13.8 percent, respectively). Bifaces were classed as “stage indeterminate” when they were so badly broken that stage could not be determined. Such serious breakage may also be a concomitant of lower skill levels. Taken together, these lines of evidence may reflect the overall greater skill of the Fremont knappers, which is consistent with the evidence for craft specialization in the production of bifaces during this period.

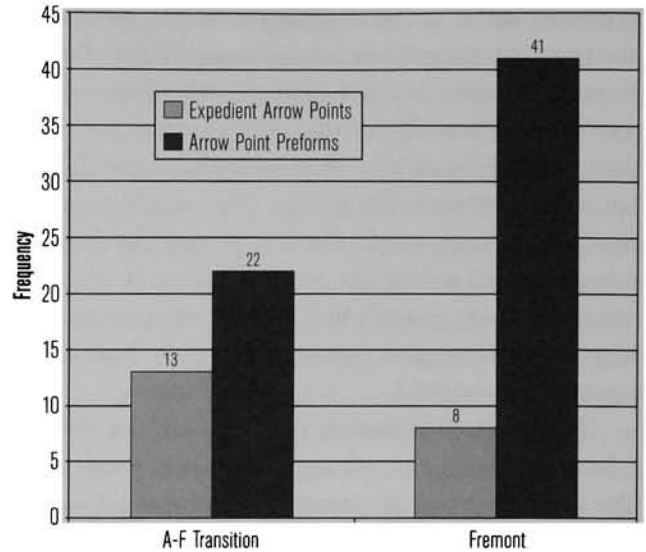
Another line of evidence reflecting possible craft specialization concerns arrow points and the evidence for two distinct methods of arrow point manufacture, the prevalence of which shifted through time. We refer to these as the expedient and preform methods. The expedient method involved first shaping the base and notches of a flake blank, then pressure-flaking the blade and tip if the basal shaping was successful. In contrast, the preform method involved the careful flaking of a finely shaped, ovate or subtriangular preform which was subsequently notched, possibly at a later time after being transported elsewhere. Points produced by the

expedient method frequently retain characteristics of the flakes they were made upon (including unflaked patches of the flake's dorsal or ventral surfaces or even a distinct curvature), whereas preform points are more symmetrical and are usually completely pressure-flaked on both surfaces. The ratio of point preforms to expediently made points rose from 1.7:1 during the A-F Transition occupations to 5.1:1 during the Fremont occupations. The frequencies of both types of artifacts in each component are shown in Figure 10. The increased prevalence of the preform method during the Fremont period may be a direct reflection of specialist production of arrow point preforms.

One final supporting line of evidence for the craft specialization hypothesis is, quite simply, the fact that biface production increased relative to other activities from the A-F Transition to the Fremont period at Hunchback Shelter. In Figure 6, the category "other bifaces" is composed primarily of items that represent production failures or perhaps unfinished bifaces that were lost or cached. As such, they reflect the manufacture of bifaces. The increased manufacture of unspecialized, unfinished bifaces during the Fremont period inferred by these data is consistent with "batch" production (Cross 1993:75) and, hence, the craft specialization model.

To summarize, several lines of evidence seem to collectively point toward a shift in biface production modes between the A-F Transition and Fremont components. We have interpreted that shift as possibly representing the development of specialized production at the site over a period of time spanning the Terminal Archaic to the end of the Fremont period. The evidence can be summed up as follows:

- Late stage Fremont bifaces exhibit slightly greater uniformity than those from the A-F Transition and at least one other site in the region.
- An increased emphasis on late stage biface manufacture is evident during the Fremont period, representing more intensive toolstone processing and possibly reflecting a concern for transport costs.
- Lower rates of biface breakage during the Fremont period may represent higher skill levels.



**Figure 10. Frequencies of expedient arrow points and arrow point preforms in the A-F Transition and Fremont components.**

- Expedient arrow point manufacture declined during the Fremont period but arrow point preform manufacture increased, suggesting the batch production of unfinished points intended for later use or exchange.
- Biface production in general increased during the Fremont period relative to the manufacture of specialized bifacial tools, suggesting batch production of unfinished, late stage bifaces.

#### *Context, Scale, and Intensity*

Thus far we have only discussed the evidence for the possible presence of specialized lithic production during the Fremont occupation of Hunchback Shelter. The logical next step is to consider the context, scale, and intensity of such production. Context refers to whether the producers were *independent* or *attached*. Independent specialists tend to produce utilitarian items for a "general market of potential customers" and for their own benefit (Costin 1991:11). In contrast, attached specialists typically produce luxury items or "wealth-generating goods" under the management or sponsorship of elite patrons (Costin 1991:11). As it is unlikely that elite classes existed in Fremont society, if Fremont lithic craft specialists existed they were almost

certainly independent producers (see Janetski and Talbot 2000:257 for a similar conclusion). Their products—late stage bifaces, arrow point preforms, and decorticated expedient flake cores—were essentially utilitarian items, the distribution of which was likely controlled by the producers themselves (Cross 1993).

Scale and intensity, which are addressed in most treatises on the subject (Feinman and Neitzel 1984), represent two important dimensions that relate to the organization of production (Costin 1991:Figure 1.4). Scale relates to the size of the production unit and the means by which new recruits are brought into the production system (Costin 1991:15). Variations in the size of the production unit can range from small-scale nuclear or extended family-based operations to large-scale manufactories. In the former, labor is recruited based on family ties, whereas in the latter it is often based on craftsman skill and the availability of a given worker. It has been suggested that the primary factor affecting the scale of production for independent specialists is the efficiency of the systems (Costin 1991:15).

Intensity relates to the amount of time producers invest in their craft (Costin 1991:16). This dimension is often governed by efficiency, risk, and scheduling. In terms of efficiency, intensity will increase as production becomes more routinized into a linear sequence of production. This condition applies regardless of whether a single worker is performing all tasks in sequence, or whether tasks are divided up among a group of workers. Risk is an especially important factor for independent specialists; they are often viewed as risk minimizers who invest in more than one economic pursuit. Usually, independent specialists are conceptualized as part-time agriculturalists as well as craftsmen who do not have to rely entirely on their craft as a means for making ends meet (Costin 1991:17; Brumfiel and Earle 1987; Hicks 1987). Scheduling ties into this concept because their craft investments must compete with the seasonal timing of agricultural activities. By definition, therefore, craft specialists minimizing risk by dividing their economic investments among multiple tasks are part-time craftsmen.

It can be seen that scale and intensity are closely linked not only to the economy but to social organization as well. Fremont social organization is not a topic that has received extensive discussion, but earlier researchers (e.g., Gunnerson 1969:156 and Sammons-Lohse 1981)

have tended to see little evidence for complexity in Fremont society. Most Fremont residential sites are relatively small farmsteads occupied by one to three households that probably reflect occupations by nuclear or extended families. A recent reassessment of this important issue by Janetski and Talbot (2000:262), however, concluded that “polities above the supra-family level existed in Fremont society,” at least at some of the larger villages in the Parowan and Sevier areas. They also assert (Janetski and Talbot 2000:257) that these more complex Fremont sites have yielded evidence for “emerging social differentiation” and an increasing concern with “social position and prestige.”

Despite the evidence for emerging social complexity at large, late Fremont village sites, it seems likely that most day-to-day decisions about subsistence, the acquisition of raw materials, and tool and craft manufacture were made at the household level. This establishes certain parameters for the scale and intensity of specialized lithic production. Thus, we might expect that our hypothetical Fremont specialists functioned in small, kin-based production units, recruiting members of their own extended families into the operation when necessary. Moreover, given the seasonal constraints of Fremont subsistence, it seems clear that craft specialization would perforce be part-time, embedded within a risk-minimizing annual schedule and probably combined with other activities such as hunting. Therefore, Fremont craft specialists, if they existed, were likely independent, family-based, part-time producers.

The goal of specialist production at Hunchback Shelter would seem to have been the manufacture of preform-stage knives and points, finished arrow points, and decorticated cores in quantities that appear to have exceeded the immediate needs of a few individuals. Within the context of emergent social differentiation and opportunities for enhanced prestige posited by Janetski and Talbot (2000), the motives of these Fremont lithic craft specialists were likely both economic and social. In addition to the probable barter value of the products in their own villages or with neighboring groups, finely made obsidian implements and prepared cores may have been given as gifts with the goal of creating or sustaining important interpersonal and economic relationships, garnering social advantage, or fulfilling social or ritual obligations (Cross 1993).

### *Hunchback Shelter Specialized Lithic Production in a Regional Context*

The shifts that occurred from the A-F Transition to the Fremont occupations suggest that at least some of the Fremont occupants of Hunchback Shelter had a different approach to flaked stone tool manufacture than their Terminal Archaic/early Formative predecessors. These differences may reflect the rise of part-time craft specialization in the context of an aggregated, more sedentary way of life, a greater emphasis on a horticulture-based economy, and increased logistical mobility. The Fremont people who (hypothetically) engaged in specialized lithic production may have come from one or more of the larger agricultural settlements in the region. Known village sites that have yielded Mineral Mountains obsidian include Baker Village (Wilde and Soper 1999) 120 km. to the northwest and Five Finger Ridge (Talbot et al. 2000) 45 km. to the east. Fremont village sites in the Parowan Valley (75 km. to the south) have also yielded obsidian artifacts (Berry 1972; Dodd 1982), some of which likely originated in the Mineral Mountains.

Five Finger Ridge is an especially interesting site in this regard. Over 30 percent ( $n=4,129$ ) of the debitage, 37 percent ( $n=233$ ) of the expedient flake tools, and nearly 65 percent ( $n=105$ ) of complete arrow points are made of obsidian from either the Mineral Mountains or Black Rock sources (Talbot et al. 2000: Tables 6.6, 6.23, and 6.28). These data indicate that obsidian was heavily favored for tool manufacture at this late Fremont village site. Obsidian from the Mineral Mountains, it seems, was especially prized. Out of 62 obsidian tools and debitage subjected to sourcing analyses from this late Fremont village, 61 percent were sourced to the Mineral Mountains (Talbot et al. 2000:396). Ninety percent of the sourced bifaces and 25 percent of the sourced finished tools (mostly projectile points) were made from Mineral Mountains obsidian (Talbot et al. 2000:396).

In addressing the patterns of obsidian use at Five Finger Ridge, the authors speculated that “work parties” may have visited obsidian quarries to obtain “large quarry blank cores and/or bifaces” (Talbot et al. 2000:340–341). The scenario described is essentially one involving specialized task groups, which is consistent with our model. One pithouse at Five Finger Ridge, Structure 13, yielded an unusually large quantity of obsidian artifacts, mostly debitage: 2,307 items, or nearly

98 percent of the artifacts from this structure, are obsidian. The authors suggest that this structure served as an “obsidian flaking work station” (Talbot et al. 2000:330). It is not inconceivable that the structure functioned as a workshop for craft specialists and, as such, may represent an example of the spatial segmentation of production as discussed by Cross (1993).

In addressing the lack of evidence for the extensive use of obsidian for expedient tool manufacture at the more distant Fremont site of Icicle Bench—evidence that is abundant at Five Finger Ridge—the authors suggested the possibility that “the residents of Five Finger Ridge controlled the collection and distribution of obsidian” (Talbot et al. 2000:348). We find this observation interesting. Some researchers (e.g., Costin 1991:14) have pointed out a correlation “among environmental diversity, territoriality, and independent specialization” (see also Brumfiel and Earle 1987 and Sanders 1956). In other words, the unequal distribution of a resource across the landscape may play a role in the evolution of specialized production with respect to that resource, with propinquity dictating control and more thorough exploitation. We are not necessarily suggesting that the work parties from Five Finger Ridge were the very same craft specialists who occupied Hunchback Shelter during the Fremont period—indeed, the chronology of the two sites does not favor this interpretation—only that the patterns evident at this large, late Fremont village are consistent with the model of logistical procurement and specialized production of obsidian bifaces and cores that we have proposed.

## CONCLUSIONS

This paper proposes that specialized production of obsidian bifacial implements and decorticated cores arose among some Fremont groups in the southeastern Great Basin during the period A.D. 650–1250. Multiple converging lines of evidence support this interpretation. Compared to earlier periods, the Fremont tool-makers increased production of bifaces in general but especially late stage bifaces and finely made projectile point preforms, produced late stage bifaces with slightly greater uniformity, decreased production of expediently made arrow points, and possessed slightly greater levels of knapping skill. We suggest that lithic craft specialization

came into existence in this region as a consequence of increased sedentism, population aggregation, and increased logistical mobility.

The differences between the A-F Transition and Fremont components seem to reflect important changes that took place during the Fremont period, sometime after A.D. 650 and perhaps during the seemingly most intensive period of occupation of the shelter from 900 to 1150. While there is evidence that mobility and site function during the late Formative period was variable, at least some of the occupations seem to have been logistically organized. One explanation for this is that a greater reliance on maize horticulture resulted in regional aggregation in the form of large residential sites, accompanied by a general increase in sedentism. Decreased residential mobility resulted in increased logistical mobility, which allowed the continued collection of resources that were formerly procured through residential moves (cf. Seddon's [2005] "re-supply" system). The sometimes subtle changes in mobility, lithic reduction strategies, and subsistence during the Fremont period do not in themselves demonstrate the presence of craft specialization, but they provide a context in which such institutions could arise.

Despite the impression seemingly held by many archaeologists that craft specialization could not have been present in groups with little or no social stratification, ethnographic studies have demonstrated otherwise (see Clark and Parry 1990). In particular, a recent study by Stout (2002) found that a small group of skilled craftsmen in the village of Langda in Indonesian Irian Jaya make and supply adzes to their larger community. The craftsmen engage in logistical trips to acquire the proper toolstone for the adzes (see Andrews and Greubel, this issue, for a brief description). The adze makers of Langda constitute a useful ethnographic analog for Fremont craft specialists.

The existence of Fremont lithic craft specialization as represented by a single large assemblage is presented in this paper as a hypothesis, one that we believe is worthy of continued examination. The evidence, while consistent with the existence of specialized production, is admittedly ambiguous. What is needed are numerous large assemblages of complete bifaces that might be characterized using the "Clark index"—a compound coefficient of variation that incorporates not only width

and thickness as used in this paper, but length as well (Cross 1993:71). The incorporation of the third dimensional variable may reduce ambiguity and impart more clarity to the process of identifying uniform assemblages, thereby allowing a researcher to attribute such assemblages to either specialist or non-specialist production with greater confidence. Alternatively, one might focus on a measure of uniformity that is independent of completeness and proportions altogether—such as some idiosyncratic aspect of manufacture—as it will always be problematic to procure assemblages of complete bifaces large enough to be statistically meaningful.

Perhaps it should not be regarded as surprising that craft specialization may have arisen among a semi-sedentary group practicing logistical acquisition of resources. Knappers had to obtain high quality toolstone one way or another. Changing mobility patterns created a situation that favored the intensification of tool production using high quality stone, thereby generating a surplus. The manufacturers may have quickly perceived that such a surplus might be used to their own social and economic advantage. The model of lithic craft specialization presented here attempts to place these developments within a framework of evolutionary and historical changes in subsistence, mobility, population, landscape use, and social behavior. We suggest that this scenario is both plausible and interesting enough to stimulate further research into the social implications of Fremont lithic reduction strategies.

## NOTES

<sup>1</sup>The calibrated ranges discussed in this article were generated using Calib Rev 5.0.1.

<sup>2</sup>Materials collected during excavations at site 42BE751 are curated at the College of Eastern Utah Prehistoric Museum in Price.

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## REFERENCES

- Adams, Robert McCormick  
1966 *The Evolution of Urban Society: Early Mesopotamia and Prehispanic Mexico*. Chicago: Aldine.
- Andrews, Bradford  
2003 Measuring Prehistoric Craftsman Skill: Contemplating Its Application to Mesoamerican Core-Blade Research. In *Mesoamerican Lithic Technology: Experimentation and Interpretation*, Kenneth G. Hirth, ed., pp. 208–219. Salt Lake City: University of Utah Press.
- Arnett, Abraham  
1998 The Parowan Site and Mortonson's Site: A Preliminary Summary. *Utah Archaeology* 11:69–78.
- Barlow, K. Renee  
2002 Predicting Maize Agriculture among the Fremont: An Economic Comparison of Farming and Foraging in the American Southwest. *American Antiquity* 67(1):65–88.
- Berry, Michael S.  
1972 *The Evans Site*. Special Report, Department of Anthropology. Salt Lake City: University of Utah.
- Binford, Lewis R.  
1986 Isolating the Transition to Cultural Adaptations: An Organizational Approach. In *Patterns and Processes in Later Pleistocene Hominid Evolution*, Erik Trinkaus, ed., pp. 18–41. Cambridge, England: Cambridge University Press.
- Brumfiel, Elizabeth, and Timothy Earle  
1987 Specialization, Exchange, and Complex Societies: An Introduction. In *Specialization, Exchange, and Complex Societies*, E. Brumfiel and T. Earle, eds., pp. 1–9. Cambridge, England: Cambridge University Press.
- Callahan, Errett  
1979 The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts. *Archaeology of Eastern North America* 7:1–180.
- Childe, V. Gordon  
1930 *The Bronze Age*. Cambridge, England: Cambridge University Press.
- Clark, John E.  
1995 Craft Specialization as an Archaeological Category. *Research in Economic Anthropology* 16:267–294. Greenwich, Connecticut: JAI Press.
- 2003 Craftmanship and Craft Specialization. In *Mesoamerican Lithic Technology: Experimentation and Interpretation*, Kenneth G. Hirth, ed., pp. 220–233. Salt Lake City: University of Utah Press.
- Clark, John E., and William J. Parry  
1990 Craft Specialization and Cultural Complexity. *Research in Economic Anthropology* 12:289–346. Greenwich, Connecticut: JAI Press.
- Coltrain, Joan Brenner  
1993 Fremont Corn Agriculture: A Pilot Stable Carbon Isotope Study. *Utah Archaeology* 6:49–55.
- Coltrain, Joan Brenner, and Steven W. Leavitt  
2002 Climate and Diet in Fremont Prehistory: Economic Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin. *American Antiquity* 67(3):453–485.
- Costin, Cathy  
1991 Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. *Archaeological Method and Theory* 3:1–56.
- Cross, John R.  
1993 Craft Specialization in Nonstratified Societies. *Research in Economic Anthropology* 14:61–84. Greenwich, Connecticut: JAI Press.
- Dodd, Walter A., Jr.  
1982 Final Year Excavations at the Evans Mound Site. *University of Utah Anthropological Papers* 106. Salt Lake City: University of Utah Press.
- Eckerle, William, Marissa Taddie, and Sasha Taddie  
2005 Geoarchaeological Assessment of the Utah Segment of the Kern River Pipeline Expansion. In *Kern River 2003 Expansion Project, Utah—Volume III: Pt 7, Appendix K*, pp. 2665–2871. MS on file at Alpine Archaeological Consultants, Inc. Montrose, Colorado: Alpine Archaeological Consultants, Inc.
- Feinman, Gary M., and Jill Neitzel  
1984 Too Many Types: An Overview of Prestate Societies in the Americas. In *Advances in Archaeological Method and Theory* 7, M. Schiffer, ed., pp. 39–102. New York: Academic Press, Inc.
- Gillin, John P.  
1941 Archaeological Investigations in Central Utah. *Papers of the Peabody Museum of American Archaeology and Ethnology* 17(2). Cambridge, Massachusetts: Harvard University.
- Greubel, Rand A.  
2001a Simpson Wickiup Site (5SM2425). In *The TransColorado Natural Gas Pipeline Archaeological Data Recovery Project, Western Colorado and Northwestern New Mexico*, Alan D. Reed, ed., pp. 24:1–237. MS on file at Alpine Archaeological Consultants, Inc. Montrose, Colorado: Alpine Archaeological Consultants, Inc.

- 2001b Watershed Rockshelter (5ME213). In *The TransColorado Natural Gas Pipeline Archaeological Data Recovery Project, Western Colorado and Northwestern New Mexico*, Alan D. Reed, ed., pp. 21:1–333. MS on file at Alpine Archaeological Consultants, Inc. Montrose, Colorado: Alpine Archaeological Consultants, Inc.
- 2005 Investigations at Hunchback Shelter (42BE751). In *The Kern River 2003 Expansion Project, Utah—Volume III, Prehistoric Excavated Sites and Discoveries, Part 2*, Alan D. Reed, Matthew T. Seddon, and Heather K. Stettler, eds., pp. 3:195–720. MS on file at Alpine Archaeological Consultants, Inc. Montrose, Colorado: Alpine Archaeological Consultants, Inc.
- Greubel, Rand A., and John D. Cater  
 2001 Schmidt Site (5MN4253). In *The TransColorado Natural Gas Pipeline Archaeological Data Recovery Project, Western Colorado and Northwestern New Mexico*, Alan D. Reed, ed., pp. 5:1–179. MS on file at Alpine Archaeological Consultants, Inc. Montrose, Colorado: Alpine Archaeological Consultants, Inc.
- Gunn, Joel  
 1975 Idiosyncratic Behavior in Chipping Style: Some Hypotheses and Preliminary Analysis. In *Lithic Technology: Making and Using Stone Tools*, Earl Swanson, ed., pp. 36–61. The Hague: Mouton Publishers.
- Gunnerson, James H.  
 1969 The Fremont Culture: A Study in Culture Dynamics on the Northern Anasazi Frontier. Including the Report of the Claflin-Emerson Expedition of the Peabody Museum. *Papers of the Peabody Museum of American Archaeology and Ethnology* 59(2). Cambridge, Massachusetts: Harvard University.
- Hicks, Frederick  
 1987 First Steps Towards a Market-Integrated Economy in Aztec Mexico. In *Early State Dynamics*, H. J. M. Claessen, ed., pp. 91–107. Leiden: E. J. Brill.
- Hockett, Brian S.  
 1998 Sociopolitical Meaning of Faunal Remains from Baker Village. *American Antiquity* 63(2):289–302.
- Holmer, Richard N.  
 1986 Common Projectile Points of the Intermountain West. In *Essays in Honor of Jesse D. Jennings*, Carol J. Condie and Don D. Fowler, eds., pp. 89–115. *University of Utah Anthropological Papers* 110. Salt Lake City: University of Utah Press.
- Holmer, Richard N., and D. G. Weder  
 1980 Common Post-Archaic Projectile Points of the Fremont Area. In *Fremont Perspectives*, David B. Madsen, ed., pp. 55–68. [*Antiquities Section Selected Papers* 16.] Salt Lake City: Utah State Historical Society.
- Hull, Kathleen L., and R. W. Bevil  
 1994 Obsidian Studies. In *Kern River Pipeline Cultural Resources Data Recovery Report: Utah*, W. Geoffrey Spaulding, ed. MS on file at Bureau of Land Management, Utah State Office. Las Vegas: Dames & Moore, Inc.
- Janetski, Joel C.  
 1997 Fremont Hunting and Resource Intensification in the Eastern Great Basin. *Journal of Archaeological Science* 24:1075–1088.
- 2002 Trade in Fremont Society: Contexts and Contrasts. *Journal of Anthropological Archaeology* 21:344–370.
- Janetski, Joel C., and Richard K. Talbot  
 2000 Fremont Social and Community Organization. In *Clear Creek Canyon Archaeological Project: Results and Synthesis*, by Joel C. Janetski, Richard K. Talbot, Deborah E. Newman, Lane D. Richens, and James D. Wilde, pp. 14:247–262. *Museum of Peoples and Cultures Occasional Papers* 7. Provo, Utah: Brigham Young University.
- Janetski, Joel C., Richard K. Talbot, Deborah E. Newman, Land D. Richens, and James D. Wilde  
 2000 Clear Creek Canyon Archaeological Project: Results and Synthesis. *Museum of Peoples and Cultures Occasional Papers* 7. Provo, Utah: Brigham Young University.
- Judd, Neil Merton  
 1919 Archaeological Investigations at Paragonah, Utah. *Smithsonian Institution Miscellaneous Collections* (70)3. Washington, D.C.: Smithsonian Institution.
- 1926 Archaeological Observations North of the Rio Colorado. *Bureau of American Ethnology Bulletins* 82. Washington, D.C.: Government Printing Office.
- Kelly, Robert L.  
 1988 The Three Sides of a Biface. *American Antiquity* 53(4):717–734.
- Kent, Susan  
 1992 Studying Variability in the Archaeological Record: An Ethnoarchaeological Model for Distinguishing Mobility Patterns. *American Antiquity* 57(4):635–660.
- Madsen, David B., and La Mar W. Lindsay  
 1977 Backhoe Village. *Antiquities Section Selected Papers* (4)12. Salt Lake City: Utah State Historical Society.
- Madsen, David B., and Steven R. Simms  
 1998 The Fremont Complex: A Behavioral Perspective. *Journal of World Prehistory* 12(3):255–336.
- Madsen, David B., and Dave N. Schmitt  
 2005 Buzz-Cut Dune and Fremont Foraging at the Margin of Horticulture. *University of Utah Anthropological Papers* 124. Salt Lake City: University of Utah Press.
- Marwitt, John P.  
 1970 Median Village and Fremont Culture Regional Variation. *University of Utah Anthropological Papers* 95. Salt Lake City: University of Utah Press.
- Meighan, Clement W., N. E. Coles, F. D. Davis, G. M. Greenwood, W. M. Harrison, and E. H. MacBain  
 1956 Archaeological Excavations in Iron County, Utah. *University of Utah Anthropological Papers* 25. Salt Lake City: University of Utah Press.

- Metcalf, Duncan, and K. Renee Barlow  
1992 A Model for Exploring the Optimal Trade-off between Field Processing and Transport. *American Anthropologist* 94(2):340–356.
- Mills, Barbara J., and Patricia L. Crown  
1995 *Ceramic Production in the American Southwest*. Tucson: The University of Arizona Press.
- Nelson, Fred W., Jr.  
1984 X-ray Fluorescence Analysis of Some Western North American Obsidians. In *Obsidian Studies in the Great Basin*, Richard E. Hughes, ed., pp. 27–62. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.
- Nelson, Fred W., Jr., and Richard D. Holmes  
1979 Trace Element Analysis of Obsidian Sources and Artifacts from Western Utah. *Antiquities Section Selected Papers* 6(15):65–80. Salt Lake City: Utah Division of State History.
- Sammons-Lohse, Dorothy  
1981 Households and Communities. In *Bull Creek*, Jesse D. Jennings and Dorothy Sammons-Lohse, eds., pp. 111–135. *University of Utah Anthropological Papers* 105. Salt Lake City: University of Utah Press.
- Sanders, William T.  
1956 The Central Mexican Symbiotic Region. In *Prehistoric Settlement Patterns in the New World*, G. R. Willey, ed., pp. 115–127. [Viking Fund Publications in Anthropology 23.] New York: Wenner-Gren Foundation for Anthropological Research.
- Seddon, Matthew T.  
2005 A Revised Model of Obsidian Procurement and Use in the Eastern Great Basin. In *The Kern River 2003 Expansion Project, Utah—Volume IV, Prehistoric Synthesis, Part 2*, Alan D. Reed, Matthew T. Seddon, and Heather K. Stettler, eds., pp. 35:687–707. MS on file at SWCA Environmental Consultants, Inc. Salt Lake City: SWCA Environmental Consultants, Inc.
- Sharp, Nancy D.  
1989 Redefining Fremont Subsistence. *Utah Archaeology* 2:19–31.
- Simms, Steven R.  
1987 New Evidence for Fremont Adaptive Diversity. *Journal of California and Great Basin Anthropology* 8:204–216.  
1990 Fremont Transitions. *Utah Archaeology* 3:1–18.  
1999 Farmers, Foragers, and Adaptive Diversity: The Great Salt Lake Wetlands Project. In *Prehistoric Lifeways in the Great Basin Wetlands: Bioarchaeological Reconstruction and Interpretation*, Brian E. Hemphill and Clark Spencer Larsen, eds., pp. 21–54. Salt Lake City: University of Utah Press.
- Smith, Craig S.  
1992 The Fremont: A View from Southwest Wyoming. *Utah Archaeology* 5:55–75.
- Stark, Barbara  
1985 Archaeological Identification of Pottery Production Locations: Ethnoarchaeological and Archaeological Data in Mesoamerica. In *Decoding Prehistoric Ceramics*, B. Nelson, ed., pp. 158–194. Carbondale: Southern Illinois University Press.
- Steward, Julian H.  
1931 Archaeological Discoveries at Kanosh in Utah. *El Palacio* 30(8):121–130.  
1933 Archaeological Problems of the Northern Periphery of the Southwest. *Bulletin* 5. Flagstaff: Museum of Northern Arizona.
- Stokes, Wendy L., Ken Lawrence, Matthew T. Seddon, Alan Hutchinson, Jason Bright, Sonia Hutmacher, Jim Hasbargen, Joshua S. Edwards, Scott B. Edmisten, Robert Herrmann, Trevor R. Lindland, Rachael Gruis, Jo'Etta Buckhouse, Krislyn Taite, James McMillan, and Thomas Sharp  
2001 The Fallen Eagle Site (42BE1988). In *History and Prehistory Along the San Pedro, Los Angeles, and Salt Lake Railroad: Results of Archaeological Investigations for the Level (3) Communications Fiber Optic Line from Salt Lake City, Utah to the Utah/Nevada Border. Volume V: Excavations at the Deep Stone Site (42Md866) and the Fallen Eagle Site (42Be1988)*, Matthew T. Seddon, Wendy L. Stokes, Ken Lawrence, and Krislyn Taite, eds., pp. 153–373. MS on file at Bureau of Land Management, Utah State Office. Salt Lake City: SWCA Environmental Consultants, Inc.
- Stout, Dietrich  
2002 Skill and Cognition in Stone Tool Production. *Current Anthropology* 43(5):693–722.
- Talbot, Richard K., Lane D. Richens, James D. Wilde, Joel C. Janetski, and Deborah E. Newman  
2000 Excavations at Five Finger Ridge, Clear Creek Canyon, Central Utah. *Museum of Peoples and Cultures Occasional Papers* 5. Provo, Utah: Brigham Young University.
- Taylor, Dee C.  
1954 The Garrison Site: A Report of Archeological Excavations in Snake Valley Nevada-Utah. *University of Utah Anthropological Papers* 16. Salt Lake City: University of Utah Press.
- Thomas, David Hurst  
1981 How to Classify the Projectile Points from Monitor Valley, Nevada. *Journal of California and Great Basin Anthropology* 3(1):7–43.
- Torrence, Robin  
1986 *Production and Exchange of Stone Tools: Prehistoric Obsidian in the Aegean*. Cambridge, England: Cambridge University Press.
- Toth, Nicholas, Desmond Clark, and Giancarlo Ligabue  
1992 The Last Stone Ax Makers. *Scientific American* 267(1):88–93.

Ugan, Andrew

2005 Climate, Bone Density, and Resource Depression: What is Driving Variation in Large and Small Game in Fremont Archaeofaunas? *Journal of Anthropological Archaeology* 24:227–251.

Whittaker, John C.

1987 Individual Variation as an Approach to Economic Organization: Projectile Points at Grasshopper Pueblo, Arizona. *Journal of Field Archaeology* 14(4):465–479.

Wilde, James D., and R.A. Soper

1999 Baker Village: Report of Excavations, 1990–1994. *Museum of Peoples and Cultures Technical Series* 99–12. Provo, Utah: Brigham Young University.



