A REASSESSMENT OF MATRILOCALITY IN CHACOAN CULTURE

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Recent research presented in American Antiquity (66:36–46) proposed that the prehistoric Puebloan communities of Chaco Canyon in the American Southwest conformed to a matrilocal pattern of postmarital residence. The inference of matrilocality at Chaco Canyon was based on the assumption that a number of the most likely modern descendants of the Chacoans are matrilocal, including the present-day Zuni and Hopi Indians, and that the household floor area had increased to a level indicative of female-based residence. The present study assesses these two important assumptions using biological and architectural data. Our results indicate the assumptions needed to infer matrilocal residence at Chaco Canyon might not be satisfied. The biological evidence indicates close relationships with both matrilocal and bilocal present-day populations, while the architectural evidence is more consistent with a male-based pattern of postmarital residence. Limitations to the study of postmarital residence at archaeological sites are discussed.

La reciente investigación presentada en la revista American Antiquity (2000, 66:36–46) propuso que los pueblos indígenas prehistóricos del Cañón de Chaco en el suroeste de los Estados Unidos de América conformaron a un patrón matrilocal en cuanto a la residencia postmatrimonial. La inferencia de la matrilocidad en el Cañón de Chaco se basó en la suposición de que una cantidad de los probables descendientes modernos del pueblo Chaco son matrilocales, incluyendo los indígenas modernos Zuni y Hopi, y también que las dimensiones de las unidades domésticas se habían aumentado a un nivel indicativo de una residencia matrilocal. Este estudio analiza las dos suposiciones usando datos biológicos y arquitectónicos. Nuestros resultados indican que probablemente no sostienen las suposiciones requeridas para inferir la residencia matrilocal en el Cañón de Chaco y que la evidencia biológica indica una relación cercana entre los indígenas modernos matrilocal y bilocal. También, la evidencia arquitectónica es más compatible con el modelo patrilocal con respecto a la residencia postmatrimonial. Se discuten las limitaciones de estudio de la residencia postmatrimonial en cuanto a los sitios arqueológicos.

Despite the reported limitations (see Allen and Richardson 1971; Dumond 1977; Lischka 1975) of the “anthropological archaeology” of the 1960s and 70s (e.g., Hill 1966, 1970; Longacre 1964a, 1964b, 1966; also see Longacre 2000 for review), investigating patterns of postmarital residence at prehistoric sites remains an important yet difficult task. The value of such research stems from the significance of social organization in structuring relations both within and among regional communities (Eggan 1950). Socioeconomic, religious, and biosocial interactions are all facilitated and influenced by the networks provided by social organization. As one aspect of social organization, postmarital residence serves to integrate communities by incorporating outside members from within a regional network. Integration is essential for developing and

maintaining trade networks, defense alliances, and even regional stability, as well as promoting solidarity within potentially diverse communities.

In a recent *American Antiquity* article, Peter Peregrine (2001) develops a provocative model for explaining the organization of production within Chacoan culture (ca. A.D. 870–1130) based on matrilocality. The main thesis of Peregrine’s work is that Chacoan society was a corporate-oriented polity fostered by the evolution of matrilocal residence in a marginal environment. A female-based pattern of postmarital residence provided the social structure that allowed women to develop stable agricultural communities while the men took part in long-distance trade and raw material procurement (Peregrine 2001:43). Matrilocality in conjunction with corporate political strategies led to the eventual develop-

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ment of large-scale communities where leaders stressed "cooperative activities aimed at mutual support and group survival. . . ." (Peregrine 2001:40). Subsistence production—primarily agricultural—was organized around female work groups composed of individual matrilineal, while in-marriage males would be involved in the production of crafts and tools, perhaps in association with fraternal work or craft "co-ops" (Peregrine 2001:40).

Although it was not the primary objective of Peregrine's study to demonstrate that the prehistoric communities of Chacoan society were matrilineal, he does present evidence in support of this conclusion. In addition to representing the foundation of his thesis regarding the development of a corporate-oriented polity in Chacoan culture, Peregrine's assertion that Chacoan social structure was organized around female-based residence and kin structure has potential implications for understanding the development of regional complexity in the San Juan Basin during the Pueblo II period.

The author's conclusion that the Pueblo I and Pueblo II period residents of Chaco Canyon developed a female-based system of postmarital residence is based on two assumptions: 1) a number of the most likely descendants of the Chacoans are matrilineal, such as the Hopi and Zuni people, and 2) the living area of typical Chacoan family units, or households, was greater than 100 m². The author reasons that because a number of the most likely descendants of the Chacoans are matrilineal and because the domestic living area at Chaco Canyon pueblos was comparatively larger than preceding Basketmaker communities, Chacoan culture was likely matrilineal. The purpose of the present research is to assess Peregrine's assertion of matrilineality at Chaco by examining these two important assumptions.

The Descendants of Chaco Canyon: A Biological Perspective

Identifying the living descendants of Chacoan culture involves the use of multiple lines of evidence such as the oral history of living groups (see Dongoske et al. 1997; Naranjo 1995 for discussion), as well as archaeological, linguistic, and biological evidence. As such, estimating the affiliation of present-day groups with prehistoric cultures or communities can be problematic. This question is perhaps even more difficult when estimating affiliation with the Chacoans, who may have been ethnically, biologi-

cally, and perhaps linguistically diverse (see Akins 1986; Akins and Schellberg 1984; Judd 1954; Schillaci et al. 2001; Vivian 1989, 1990).

Although the ethnic diversity of prehistoric communities is difficult or impossible to reconstruct, and the language(s) spoken at these communities is unknowable, biological diversity and affiliation can be estimated. Previous biologically based research on Chaco Canyon skeletal samples indicates that the diversity of communities within the canyon was relatively high with two distinct populations buried at Pueblo Bonito (Akins 1986; Schillaci et al. 2001). Corresponding differences in material culture for these two populations have also been proposed (i.e., Judd 1954; but see Vivian 1956). In addition, these two distinct populations seem to have separate affinities with non-Chacoan communities outside the canyon (Schillaci et al. 2001).

Domestic Space

Previous efforts to estimate population levels for both Chaco Canyon as a whole, and for individual sites within the canyon, illustrate the difficulties of defining domestic living space or households (Bernardini 1999; Windes 1984). This problem is particularly acute when defining household space within the great houses but is also a concern when dealing with small houses such as 29SJ633 and 29SJ629 (McKenna and Truell 1986). Generally speaking, domestic floor features such as hearths, as well as the pattern of interior and exterior doorways, have been used to define domestic living rooms (Bernardini 1999; Windes 1984; also see Lekson 1986). Estimating accurately the number of occupants or the number of domestic units or households of a pueblo remains a challenge.

Household living-floor area is a potentially useful predictor of postmarital residence patterns (Ember 1973) and has been used to infer residence patterns of prehistoric Pueblo Indian communities (e.g., James 1994; Peregrine 2001). Using two random samples of patrilineal ($n = 18$, $n = 10$) and matrilineal ($n = 4$, $n = 5$) societies described in the Human Relations Area Files and the *Ethnographic Atlas* (Murdock 1967), Ember (1973) showed that matrilineal societies almost always had household living-floor areas exceeding 550–600 ft² (51.12–55.77 m²). The mean living-floor areas for the matrilineal samples were 868 and 1,236 ft² (80.68 and 114.89 m²), while the two patrilineal samples had

mean living-floor areas of 232 and 326 ft² (21.56 and 30.30 m²).

In a similar study, Divale (1977), using additional data in conjunction with data presented by Ember (1973), reported mean floor areas with 95 percent confidence intervals (CI) for samples of matrilocal ($n = 23$, mean = 175.0 m², 95 percent CI = 79.2–270.8 m²) and patrilocal societies ($n = 38$, mean = 28.6 m², 95 percent CI = 14.5–42.7 m²). Based on these findings, Divale (1977:114) states, “any [archaeological] site that had an average [living] floor area within two standard errors of 175.0 m² (from 79.2 m² to 270.8 m²) could be inferred to have had matrilocal residence, and the inference would be correct 95 percent of the time.” The author goes on to point out, however, that floor area alone should not be used as the sole index of residence (Divale 1977:114).

Although Peregrine (2001:38) states that his inferences of matrilocality at Chaco are based on previous work by Ember (1973), and that Ember’s (1973) findings suggest that patrilocal societies “tend to have dwellings that are less than 60 square meters in floor area, while matrilocal societies tend to have dwellings larger than 100 square meters in total floor area,” his method of inference is not entirely consistent with that presented by Ember (1973). We can not find anywhere in Ember’s (1973) article where the author states that patrilocal societies have total living-floor areas of less than 60 m², while matrilocal societies have total living-floor areas greater than 100 m². Ember (1973:180) does state, however, that “if the *living* floor area of the average house is greater than 550–600 ft², residence is likely to have been matrilocal; and if the average *living* floor area is less than 550–600 ft², residence is likely to have been patrilocal” (emphasis added). When converted to the metric scale, Ember’s cut-off for inferring matrilocality is 51.12 to 55.77 m². For the purposes of this paper, we evaluated Peregrine’s assumptions regarding living floor area using his quoted figures of less than 60 m² for patrilocal societies and greater than 100 m² for matrilocal societies.

In addition to this potential discrepancy regarding floor area, Peregrine’s method of inference is potentially inconsistent with that presented by Ember (1973) with respect to how living floor area is calculated. For example, Ember (1973:178) states, “If the apparently average house contained more than 1 room or level, the areas thereof were summed. (In a Pueblo-like situation, where 1 household left off and

another began could be recognized on the basis of double walls.) Storage and special cooking areas, if any, were not counted.” It seems clear from this statement that Ember’s method for calculating household area does not include storage space, which often represents a considerable proportion of the floor area at typical prehistoric Pueblo households. Based on Peregrine’s (2001:38) description of room-block sizes at two Chacoan pueblos (i.e., 29SJ629 and 29SJ633), it appears he used the *total* floor area within these pueblos, including storage area, for inferring postmarital residence.¹ Furthermore, it is also clear that Ember’s (1973) methodology is based on households, not “dwellings,” as described by Peregrine (2001:38). We assume Peregrine’s use of the total floor area for inferring residence is based on Ember’s (1973:178) parenthetical statement that Pueblo Indian households are defined based on the pattern of double walls.

Although Ember (1973) is explicit about the use of double walls for defining households in Pueblo Indian structures, this method is not typically used by researchers of prehistoric Puebloan architecture.² Despite the difficulties in defining households at prehistoric Pueblo Indian sites, there is general consensus among Southwestern archaeologists that domestic room suites probably represent households. Domestic room suites are typically composed of a large living room with two or three abutting storage rooms. There are numerous examples in the archaeological literature of the use of domestic room suites for defining households at prehistoric pueblos both within Chaco Canyon (e.g., Bernardini 1999; Lekson 1986; Truell 1992; Vivian 1990; Windes 1993) and elsewhere in the Southwest (e.g., Crown and Kohler 1994; Hegmon 1994; Lightfoot et al. 1993).

Methods

Analysis of Biological Data

In order to evaluate the implicit assumption that the Hopi and Zuni are the most likely descendants of the Chacoans, we conducted a model-free biodistance analysis (Relethford and Lees 1982) using five craniofacial variables. Quantitative traits of the craniofacial skeleton are moderately heritable (Devor 1987; McHenry and Giles 1971; Hiernaux 1963; Osborne and DeGeorge 1959; Susanne 1977) and have been used extensively in the analysis of between-group minimum genetic variation (e.g., Akins 1986; Cor-

Table 1. List of Sites with Skeletal Samples Used in the Analysis of Biological Variation.

Sites	Sample Size	Period	Occupation	Source
Pueblo Bonito (north)	15	PII-PIII	A.D. 860-1129	Windes and Ford 1996
Pueblo Bonito (west)	12	PII-PIII	A.D. 860-1129	Windes and Ford 1996
Fajada Area (Chaco Canyon)				
29SJ299	4	PII	A.D. 800-1000	McKenna 1986
29SJ1360	2	PII	A.D. 850-1030	McKenna 1984
Be 51/53 (Chaco Canyon)	5	PII-PIII	A.D. 1050-1150	Truell 1986
Village of the Great Kivas	6	PII	A.D. 1000-1225	Adler 1996
Hawikku	23	PIV-H	A.D. 1300-1680	Woodbury 1979
Valdez Phase ^a	7	PIII	A.D. 1100-1225	Boyer 1994
Pot Creek	8	PIII-PIV	A.D. 1250-1320	Adler 1996
Picuris	6	PIV-H	A.D. 1250-	Brown 1979
Rio Grande Developmental ^b	5	PII-PIII	A.D. 600-1250	Wendorf and Reed 1955
Pindi	9	PII-PIV	A.D. 1000-1400	Adler 1996
Puye	56	PIV-PH	A.D. 1325-1600	Orcutt 1999
Sapawe	13	PIV-PH	A.D. 1300-1550	Adler 1996
Tsankawi	7	PIV-PH	A.D. 1325-1600	Orcutt 1999

Note: PII, Pueblo II period; PIII, Pueblo III period; PIV, Pueblo IV period; PH, Protohistoric; H, Historic.

^aComposite sample including individuals from TA-47, LA 53680, LA 53683.

^bComposite grouping of Rio Grande Developmental period site samples including individuals from LA 742, LA 391, and LA 265.

ruccini 1972; Droessler 1981; Howells 1973; Jantz 1997; Powell and Neves 1999; Relethford 1994; Steadman 2001; also see Buikstra et al. 1990 for review). We pooled data previously collected by one of us (see Schillaci et al. 2001) with data provided by the National Park Service, Chaco Archives, originally collected by N. Akins (see Akins 1986). Only those measurements taken using the same published protocol (Bass 1995) were included in this analysis. Measurement variables included upper facial height, nasal height, nasal breadth, left orbital height, and left orbital breadth. Analysis was restricted to facial dimensions in order to avoid the potential influences of artificial cranial deformation (cradle-boarding). Only relatively complete crania were measured, and because of sample-size restrictions, we were unable to examine sex-specific minimum genetic relationships among sites. Skeletal samples from great-house and small-house communities within Chaco Canyon, as well as contemporary and later communities outside Chaco Canyon, were included in this study (Tables 1 and 2).

Measurement data were size-adjusted using a Q-mode transformation prior to calculating minimum genetic distances by dividing each observation by that individual's geometric mean for all five variables (Darroch and Mosimann 1985; Mosimann 1970; Powell and Neves 1999). The resulting size-free shape variables are a more accurate representation of an individual's genetic make-up and are less sus-

ceptible to environmental influence (Jantz 1997). Size-adjustment has the added benefit of allowing males and females to be pooled, increasing sample sizes.

Biological distances between sites were generated using RMET 4.0, a quantitative genetics software package made available by Dr. J. Relethford. All distances were adjusted to correct for potential bias resulting from small sample sizes. These minimum genetic relationships are presented graphically using principal coordinate ordination of the scaled eigenvectors from the genetic relationship (**R**) matrix (see Relethford and Blangero 1990; Relethford et al. 1997 for detailed description of calculations), as well as by dendrograms generated from average-linkage cluster analysis of bias-corrected minimum genetic distances. Physical proximity between sites on the principal coordinate plot is interpreted as being roughly proportional to genetic relatedness. Dendrograms generated by average-linkage cluster analysis describe minimum genetic similarities among sites; they *do not* necessarily describe ancestor/descendant relationships.

Analysis of Architectural Data

The relevant literature was reviewed to gather information on domestic floor space at small-house sites in Chaco Canyon in order to evaluate the assumption that Chacoan domestic living units exceeded 100 m² indicating matrilineal residence (see Pere-

Table 2. Site Sample Information.

Sites	Location	Cultural Affiliation
Pueblo Bonito (north)	San Juan Basin, N.M. ^a	Chaco Culture
Pueblo Bonito (west)	San Juan Basin, N.M.	Chaco Culture
Fajada Area (Chaco Canyon)	San Juan Basin, N.M.	Chaco Culture
29SJ299	San Juan Basin, N.M.	Chaco Culture
29SJ1360	San Juan Basin, N.M.	Chaco Culture
Bc 51/53 (Chaco Canyon)	San Juan Basin, N.M.	Chaco Culture
Village of the Great Kivas	Zuni Area, N.M.	Chaco Culture
Hawikku	Zuni Area, N.M.	Ancestral Zuni
Valdez Phase ^b	Taos Valley, N.M.	Puebloan
Pot Creek	Taos Valley, N.M.	Ancestral Tiwa
Picuris	Taos Area, N.M.	Northern Tiwa
Rio Grande Developmental ^c	Northern Rio Grande	Puebloan
Pindi	Northern Rio Grande	Ancestral Tanoan ^d
Puye	Northern Rio Grande	Ancestral Tewa
Sapawe	Northern Rio Grande	Ancestral Tewa
Tsankawi	Northern Rio Grande	Ancestral Tewa

^aThe San Juan Basin is located in northeastern New Mexico and southwestern Colorado.

^bComposite sample including crania from TA-47, LA 53680, LA 53683.

^cComposite grouping of Rio Grande Developmental Period site samples including individuals from LA 742, LA 391, and LA 265.

^dTanoan is a language group consisting of Tewa, Tiwa, Towa, and Tano languages.

grine 2001). In particular, the sites mentioned by Peregrine (i.e., 29SJ629 and 29SJ633) as illustrating the shift to larger living areas were examined in greater detail through qualitative analysis of site plan-view maps. We defined household space using room suites (see above), not the total floor area as did Peregrine (2001). Because it is sometimes difficult to distinguish between domestic and storage rooms, we included the calculated or estimated floor areas for storage rooms in our estimates of household floor area. We want to emphasize that because we included storage rooms, our estimates of household living areas should be considered overestimates.

Results

Biological Analysis

The estimated minimum genetic distances between sites are presented in Table 3. A review of these distances reveals that the Chacoan samples included in this analysis were not most closely aligned with the ancestral Zuni site of Hawikku, as expected based on Peregrine's assumption. This condition is illustrated graphically both by principal coordinate ordination and cluster analysis (Figures 1 and 2).

The principal coordinate ordination of the first two scaled eigenvectors reveals a diversity in biological relationships for the Chacoan population samples.

The west population of Pueblo Bonito³ has a closer genetic relationship with the northern Rio Grande Pueblo IV-protolhistoric period community of Puye (ca. A.D. 1325–1600)—considered ancestral to the present-day patrilocal/bilocal Tewa Indians of Santa Clara Pueblo—than with any other sample included in our analysis (Figure 1). This interpretation is consistent with the numerical distance values presented in Table 3. Proximity to Hawikku on this plot does indicate, however, a relatively close relationship between the west population of Pueblo Bonito and this ancestral Zuni site. Proximity of Puye to Hawikku suggests considerable direct or indirect gene flow between these two largely contemporaneous communities probably during the Pueblo IV Period (A.D. 1300–1450).

The north population of Pueblo Bonito shows a marginal relationship with Rio Grande Developmental period (A.D. 600–1250) and Taos area Valdez Phase (A.D. 1100–1225) composite samples, while the composite sample from the Fajada area in Chaco Canyon plots closely with the ancestral Tewa site of Tsankawi (cluster 3 on Figures 1 and 2). Surprisingly, the composite sample from Bc 51 and Bc 53 plots most closely to the historic northern Tiwa pueblo of Picuris (cluster 1). It is important to note, however, that some of the Bc skeletal sample might originate from a later Mesa Verde occupation of Chaco Canyon

Table 3. Bias-Corrected Minimum Genetic Distances.

	Pueblo Bonito (west)	Pueblo Bonito (north)	Fajada	Bc 51/53
V. of the G. Kiva ^a	.1070 (.131)	.6033 (.244)	.3753 (.243)	.0851 (.180)
Rio Grande Dev. ^b	.3298 (.201)	.5845 (.260)	.3483 (.253)	.5087 (.305)
Valdez	.0592 (.106)	.1361 (.136)	.2222 (.196)	.3379 (.239)
Pot Creek	.0000 (.076)	.5664 (.214)	.2239 (.188)	.1150 (.172)
Picuris	.1074 (.131)	.4131 (.210)	.8546 (.334)	.0000 (.121)
Pindi	.0969 (.104)	.4653 (.189)	.7848 (.290)	.0712 (.152)
Sapawe	.1988 (.113)	.4276 (.163)	.8236 (.275)	.0243 (.122)
Tsankawi	.1834 (.166)	.8064 (.297)	.0000 (.095)	.7216 (.348)
Puye	.0000 (.029)	.3793 (.119)	.3242 (.159)	.2259 (.155)
Hawikku	.0216 (.053)	.4306 (.143)	.2826 (.164)	.1024 (.134)
Chaco Canyon				
Bonito ^c	.0000	.3394 (.143)	.2761 (.173)	.3347 (.202)
Bonito ^d	.3394 (.143)	.0000	.9277 (.294)	.7365 (.285)
Fajada	.2761 (.173)	.9277 (.294)	.0000	.9074 (.362)
Bc 51/53	.3347 (.202)	.7365 (.286)	.9074 (.362)	.0000

Note: Negative distances were set to .0000; standard errors are listed in parentheses.

^aThe Village of the Great Kivas.

^bRio Grande Developmental.

^cPueblo Bonito west population.

^dPueblo Bonito north population.

based on associated mortuary ceramics consisting of Mesa Verde Black-on-white pottery (see Akins 1986).

The minimum genetic relationships presented by principal coordinate ordination are supported by the

results from cluster analysis of minimum genetic distances (Figure 2). The west population of Pueblo Bonito clusters (cluster 2) with the ancestral Tewa site of Puye (Naranjo 1995), which is inconsistent with what might be expected considering Peregrine's assumptions regarding who the most likely present-day descendants of Chacoan culture are. Also, the composite Fajada sample clusters with the ancestral Tewa site of Tsankawi (cluster 3).

Domestic Living Area

A review of the literature reveals a dearth of information on the floor area of households at Chaco Canyon sites. This is due primarily to the difficulties in defining households or domestic room suites at archaeological sites (see Truell 1986:310). Several researchers have attempted to define households or domestic room suites within roomblocks as a means for estimating population size, but these reports do not present data on household floor area (e.g., Bernardini 1999; Lekson 1986; Windes 1984). Domestic room suites are described for the small sites at Chaco Canyon (McKenna and Truell 1986), and although data on room-suite floor area are not provided, area for domestic rooms as well as the average number of rooms per suite are reported.

Domestic room suites or households are thought to be generally composed of one or two domestic rooms and two or three adjacent storage rooms, as

Figure 1. Principal coordinate ordination of the first two eigenvectors derived from the minimum genetic relationship (R) matrix. Eigenvectors are scaled by the square-root of the corresponding eigenvalue. Site samples are connected using a minimum spanning tree. Groupings identified with average linkage clustering are identified numerically (see Figure 2). Site names and descriptions are described in Tables 1 and 2.

Figure 2. Dendrogram from average linkage cluster analysis of bias-corrected minimum genetic distances. Clusters are numbered arbitrarily. "Rio Grande" refers to the composite grouping of Rio Grande Developmental site samples, "V. of the Great Kivas" refers to the Village of the Great Kivas.

determined by interior doorways and domestic floor features (Bernardini 1999; Lekson 1986; McKenna and Truell 1986). In a publication describing small-site architecture at Chaco Canyon, Truell (1986: 271, Table 2.34) reports that the average floor area for domestic rooms from the mid-tenth to early-eleventh century A.D. was 6.92 m^2 . The average domestic room area decreased slightly to 6.58 m^2 during the early-to-mid-eleventh century A.D. The author also reports that during the eleventh century A.D., small-site domestic-suite sizes vary from two to six rooms with an average of 3.8 rooms (Truell 1986:282). Using these data, we estimated that during the period from the mid-tenth to the mid-eleventh centuries A.D., domestic room suites varied in area from $13.8\text{--}41.5 \text{ m}^2$, with an average of 26.3 m^2 (i.e., $3.8 \times 6.92 = 26.3 \text{ m}^2$). This estimate assumes all room areas within suites were equal to the average floor area of domestic rooms (6.92 m^2). Because the aver-

age floor area of storage rooms is less than that of domestic rooms ($5.10 < 6.92 \text{ m}^2$), according to Truell (1986:Table 2.35) we are likely overestimating household floor area. These estimates would seem to indicate household area, as defined by the floor area of domestic suites, was considerably less than 100 m^2 as would be expected according to Peregrine (2001) if these communities were matrilineal. It is important to consider, however, that many of these domestic room suites had associated ramadas that were probably used for domestic activities (see McKenna and Truell 1986). The average floor area of ramadas at small sites ranged from $5.04\text{--}15.62 \text{ m}^2$ (Truell 1986). By including the upper range estimate for ramada floor area, the range of overall household floor area increases to $29.42\text{--}57.12 \text{ m}^2$, with an average of 41.92 m^2 . This, of course, assumes that every household had one associated ramada used as domestic living area. These estimates are still considerably

Figure 3. Plan-view map of 29SJ629 (from Truell [1986:Figure A98b]; courtesy of the National Park Service). Rooms are numbered R2 – R8. Room No. 9 is adjacent to the east wall of R8. Labeled features include FP, Fire Pit; HP, Heating Pit; MB, Mealing Bin; BC, Bell-shaped Cist.

less than the 100 m² needed to infer matrilineal residence according to Peregrine (2001).

Peregrine (2001) gives two examples of Pueblo II period (A.D. 900–1100) habitation sites (29SJ629 and 29SJ633) that exhibit floor areas greater than earlier Basketmaker pit structures, which average approximately 15 m². The author reports (2001:38) an area of 70 m² for 29SJ629 and over 300 m² for 29SJ633, indicating that “[C]learly dwelling size increased in a manner consistent with matrilineality.” Our review of the plan-view maps provided in Truell (1986) suggests that multiple households are prob-

ably present at these sites. For example, the floor plan of 29SJ629 shows a “J”-shaped room block with eight rooms and two adjacent pit structures (Figure 3). Rooms 5, 6, and 7, and Pithouse 2 were constructed around A.D. 875–925, with construction of Pithouse 3 and Rooms 3, 4, 8, and 9 occurring between A.D. 925–1000 (Mathien 2001: Figure 1). Although internal doorways are not visible, the presence of multiple habitation pit structures, the total number of above-ground rooms ($n=8$), and the number of indoor rooms with hearths and other domestic features all suggest more than one family unit

Figure 4. Plan-view map of 29SJ633. (Map taken from Truell [1986: Figure A.116]; courtesy of the National Park Service.) Rooms are numbered R2 – R13. Labeled features include FP, Fire Pit; SB, Storage Bin.

might have occupied this pueblo, with potentially two domestic suites present (for example: suite 1 = Pit-house 2, Rooms 2, 3, and 4, and suite 2 = Pit-house 3, and Rooms 5–9). Our observation of multiple households at 29SJ629 agrees with that presented by Windes (1993:401), who states that the “[t]wo coeval habitation rooms and dual meal-making basins, associated with different areas of the site, indicate that 29SJ629 was occupied by two families or residential units.”

When the floor area for all surface rooms is added to the floor area of the two habitation pit-structures (see McKenna 1986: Table 1.18), the total interior floor area for 29SJ629 is approximately 81.54 m². This estimate increases to 116.09 m² when the floor area under the plaza-facing ramada(s) is included (see Figure 3). If we assume that the total floor area at 29SJ629 was divided equally between the two households, the estimated floor area for each household would be 58.05 m², which is considerably less than 100 m² threshold for inferring matrilineal residence. This estimate is, however, less than 60 m², a condition more consistent with patrilineal residence according to Peregrine’s (2001) method of inference.

A similar condition is observed at 29SJ633, with

13 rooms present and two kivas (Figure 4). Using the scaled plan-view map in Truell (1986), we calculated a total walled-room floor area of 104.86 m², which is less than 35 percent of the estimate reported by Peregrine (2001:38). Because this site was only partially excavated, it is impossible to estimate accurately the area under outside ramadas, which would likely increase the living area considerably. In addition, it is difficult to estimate the number of domestic living suites or households without data on exterior and interior doorways. However, if we use the estimate provided by Truell (1986) of 3.8 for the average number of rooms in a domestic room suite, it seems likely that there was more than one household at this site. If we estimate that there were three households, this would result in 34.95 m² of floor area per household. This estimate increases to 50.57 m² if we incorporate the upper range estimate of ramada floor area (i.e., 15.62 m²). It is critical to consider, however, that not all 13 rooms were occupied contemporaneously (see Mathien 1991), and that it is difficult to determine the number of households present at any given time. Despite this limitation, it seems unlikely that there was ever more than 100 m² of living area for any one household at 29SJ633.

Discussion

Assumption 1: The Likely Descendants of Chacoans are Matrilocal

The results of our analyses suggest the assumption made by Peregrine regarding the most likely descendants of Chaco Canyon might not be warranted. Several of the Chacoan population samples included in our analysis show a closer minimum genetic relationship with ancestral Tanoan (bilateral/bilocal) populations than with ancestral Zuni populations. These results are consistent with findings presented elsewhere regarding the genetic relationships of Chacoan populations with ancestral Tewa communities in the Rio Grande Valley (see Schillaci et al. 2001). Because the present-day Tewa are largely bilocal (Ortiz 1969; Ware 2001), our findings do not support Peregrine's assertion from ethnographic analogy that the Chacoan communities were matrilocal. We do not mean to imply, however, that our results indicating a close genetic relationship between the Chacoans and the ancestral bilocal Tewa should be interpreted to represent evidence that the Chacoans were bilocal. These results instead suggest that Chacoan populations exhibit considerable genetic similarity with both ancestral matrilocal and bilocal Pueblo Indian groups.

Assumption 2: The Domestic Living Area of Pueblo Period Chacoan Communities Exceeds 100 m²

There is little support in the literature for the assumption that the domestic living area of Pueblo II period Chacoan communities exceeded 100 m², indicative of matrilocal postmarital residence. Moreover, the two architectural examples presented by Peregrine in support of his hypothesis of matrilocality at Chaco Canyon likely did not consist of households with floor areas greater than 100 m². While it is well established that domestic floor areas had increased substantially from the preceding Basketmaker III period, this increase falls short of floor areas reported for matrilocal societies (cf. Divale 1977; Ember 1973; Peregrine 2001). Furthermore, increases in floor area have been attributed to other social phenomena potentially independent of postmarital residence such as population aggregation and population density (Crown and Kohler 1994; Dohm 1990).

While it is possible that any given room block or pueblo is comprised of related matrilineal/matrilocal

households, or room suites—implicit in Peregrine's (2001) argument—it is impossible to determine this using architectural data, and as such, there is no a priori basis for designating an entire roomblock or pueblo as belonging to a single matriline and its resident males. In fact, ethnographic data presented by Crown and Kohler (1994) suggest small communities with fewer than 100–199 people, such as 29SJ633 and 29SJ629, tend to have smaller nuclear families rather than extended families often seen in matrilocal societies.

Reevaluation of Chacoan Social Organization

Based on the findings presented here, there seems to be insufficient evidence to support the assumptions needed to infer matrilocal residence for Chacoan communities. Ironically, the architectural data indicate that household space (i.e., a single domestic room suite) at Chaco was likely less than 60 m², a pattern according to Peregrine (2001:38) more consistent with patrilocal residence. Our estimate of 41.92 m² per household at Chaco Canyon small sites is also less than the cut-off for inferring matrilocal residence presented by Ember (1973) (i.e., 51.12 m²). These observations based on architectural data, in conjunction with the biological data indicating strong Chacoan ancestry for both ancestral matrilocal and bilocal populations, suggest the assertion made by Peregrine that the prehistoric communities of Chaco Canyon likely conformed to a socially prescribed pattern of matrilocal residence might not be warranted, a conclusion consistent with previous research (see Schillaci and Stojanowski 2000).

Limitations to Both Studies

We want to stress that our findings do not indicate that the Zuni are not the descendants of the Chacoans. To the contrary, there seems to be strong biological evidence of considerable Chacoan ancestry for the ancestral Zuni at Hawikku based on the principal coordinate ordination of minimum genetic relationships presented earlier (see also Schillaci et al. 2001). We wish only to demonstrate that it is not necessarily reasonable to assume that the Zuni and the Hopi⁴ are the most *likely* descendants of the Chacoans. Our results seem to indicate that there is a large degree of Chacoan ancestry for Tewa-speaking groups in the northern Rio Grande region of New Mexico, as well as for the Zuni Indians to the south. More than likely, the prehistoric populations of Chaco Canyon are

ancestral to a number of modern matrilineal and patrilineal Pueblo Indian populations, suggesting the assignment of prehistoric residence patterns based on presumed or even quantitatively estimated affiliation with modern populations is problematic.

Similarly, we do not mean to suggest that there was not an increase in household floor area from Basketmaker to Pueblo I/II occupations of Chaco Canyon.⁵ We merely suggest that there is no architectural evidence to support the assumption that household floor area was greater than 100 m², and that the observed floor area is more consistent with a male-based pattern of postmarital residence (i.e., < 60 m²). We did not, nor did Peregrine (2001), consider household area at great houses. With so many great houses present within Chaco Canyon, this is a potentially important limitation to both studies.

With regard to our analysis of architectural data, as well as that of Peregrine's, we would like to point out that estimating accurately household floor area is difficult due to factors such as multiple construction and occupation sequences of roomblocks, as well as room reuse and remodeling (see Cameron 1999). Also, it is often difficult or even impossible to determine if rooftop space was used as domestic living area, which should be included in household floor-area estimates. As such, the potential for estimating social organization accurately relying solely on architectural data might often be limited (see Divale 1977:114).

It is also important to consider the potential for diversity or complexity in social organization at Chaco Canyon. For example, the results of an analysis of architecture and social organization at the present-day Hopi community of Orayvi (Cameron 1999) indicate variability in household structure with 50 percent of the household types designated as nuclear families and only 24 percent as extended families (matrilocal) (see Cameron 1999:Table 2). Cameron (1999:220) explains that although matrifocal extended families were the ideal condition at Orayvi, it was not the most common household type. Interestingly, these differences in household types within the community were not reflected in the mean floor area per house (see Cameron 1999: Table 3).

In addition, matrilocality at one or two communities does not indicate a region-wide practice of female-based residence. If Chacoan culture was ethnically diverse, which remains a possibility, then it is important to consider that different groups prac-

ticed different forms of social organization. The study presented here, as well as Peregrine's, is limited by using average living-floor areas or by examining only a few sites in detail. In order to examine more fully the potential for diversity in organization, more sites within the canyon, as well as regional outlier communities, should be examined. A more comprehensive study, however, would still be subject to the same limitations described earlier.

Conclusions

Regardless of what might be gleaned from observed patterns of production at Chaco, the biological and architectural data do not seem to support the notion that the prehistoric communities of Chaco Canyon conformed to a socially prescribed system of female-based postmarital residence. Instead, we propose that these communities were likely not matrilineal. This proposition is more consistent with the observation that household floor areas at Chaco are similar to ethnohistoric and present-day patrilineal cultures worldwide. Furthermore, our analysis of biological data indicate prehistoric Chacoan populations have strong genetic relationships with both ancestral bilocal and matrilineal Puebloan cultures. This finding calls into question the efficacy of inferring prehistoric social organization using ethnographic analogy with perceived or estimated descendant groups.

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- idence patterns. We found in the literature only one example (Pot Creek Pueblo) of systematic use of double walls (see Wetherington 1968). Furthermore, room construction and abandonment sequences at prehistoric pueblos were often complex. Interpreting patterns of double-wall placements independent of this consideration might not yield architectural units meaningful for defining households.
3. The potential difference in function between great-house and small-house sites is a subject of ongoing debate (see Bustard 1999; Lekson 1986 for review). We believe that based on the presence of domestic floor features in a number of rooms, Pueblo Bonito served a residential function for, at the very least, a small resident population. We included the population samples from Pueblo Bonito in our analysis because there is no empirical basis for excluding these samples as being entirely nonresidential.
4. Because we were unable to include craniometric data from ancestral Hopi sites in our study due to the lack of published data, and to NAGPRA-related museum collections access concerns, we could not assess the magnitude of the minimum genetic relationship between the Chaco Canyon sites samples described here and the present-day Hopi. As such, it is possible that present-day or ancestral Hopi groups have a closer ancestor-descendant relationship with Chacoan communities than the Tewa groups described here. Despite this possibility, however, the strong contribution by Chacoan populations (whether direct or indirect) to Tewa ancestry is apparent and, therefore, calls into question the assertion that the Hopi and the Zuni are the most likely descendants of the Chacoans. In other terms, the Chacoans are likely ancestral to multiple present-day groups.
5. It is important to mention that the pithouse-to-pueblo transition and concomitant increase in structure size may have been a consequence of reduced seasonal mobility and a greater reliance on maize agriculture. Year-round occupation allowed greater investment in more permanent structures including larger living and storage areas. With fluctuating environmental conditions, an increased reliance on maize agriculture might have promoted overproduction with an emphasis on storage (Hegmon 1996; Kohler and Van West 1996). If this model is accurate, the observed increase in "dwelling" (Peregrine 2001:38) size was primarily a product of increased storage area, not living area, and, therefore, may, or may not reflect a transition to multifamily organization.

Notes

1. Peregrine's method of inference may be more consistent with the method presented by Divale (1977:114) than with the methods outlined in Ember (1973).

2. The use of double walls for defining households at prehistoric pueblos is not well described in the archaeological literature and is likely problematic for several reasons. Based on our review of the relevant literature, space, domestic or otherwise, within prehistoric pueblos was rarely constructed using double walls, irrespective of presumed postmarital res-

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