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# AN OSTEOLOGICAL ANALYSIS OF SOCIAL ORGANIZATION AT THE CARTER RANCH PUEBLO, ARIZONA

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ABSTRACT: Patterns of social organization suggested by ceramic analysis for the Carter Ranch Pueblo in east-central Arizona are tested using osteological indicators. Longacre (1970) suggested that grave goods in the highly patterned cemetery at Carter Ranch Pueblo revealed the presence of two matrilocal residence units and a possible religious sodality. Twenty-five individuals recovered from the cemetery were evaluated for cranial discrete and metric traits to assess genetic relationships among the proposed units. No statistically significant differences suggestive of genetic structuring were present. Health patterns were also evaluated in one burial group with particularly elaborate graves. This group was suggested to represent a religious sodality, which may have brought privileged status to its members. Again, no consistent differences were found. Thus, the Carter Ranch population appears to represent a homogeneous gene pool with all members belonging to an essentially egalitarian society.

## INTRODUCTION

Inspired by the "new archaeology" of the early 1960's, many studies turned toward reconstruction of prehistoric social organization (e.g., Deetz, 1965; Hill, 1970; Whallon, 1968). One of the most prominent of these investigations was the attempt to address kinship and marital residence patterns at Carter Ranch Pueblo in east-central Arizona (Fig. 1; Longacre, 1964, 1970). Although its conclusions have been rejected by researchers for many reasons, including a failure to account for the effects of site formation processes (Schiffer, 1989) and poor temporal control (Dumond, 1977), Longacre's work has become a classic study frequently discussed in introductory anthropology and archaeology courses.

In his investigation, Longacre (1964, 1970) used ceramic design patterns to identify three "residence units" at Carter Ranch. The orientation of burials and grave goods recovered in the cemetery were evaluated to provide additional data to test the findings. Surprisingly, however, the human remains from the site have been analyzed only once, that being in a craniologic study by Skomp (1965). In the present paper, the biological information that this small skeletal series can provide concerning the patterns of social organization proposed by Longacre (1970) will be outlined.

In his study, Longacre (1970) suggested that a major reorganization of settlement patterns occurred about 1000 A.D. in the American Southwest in response to the

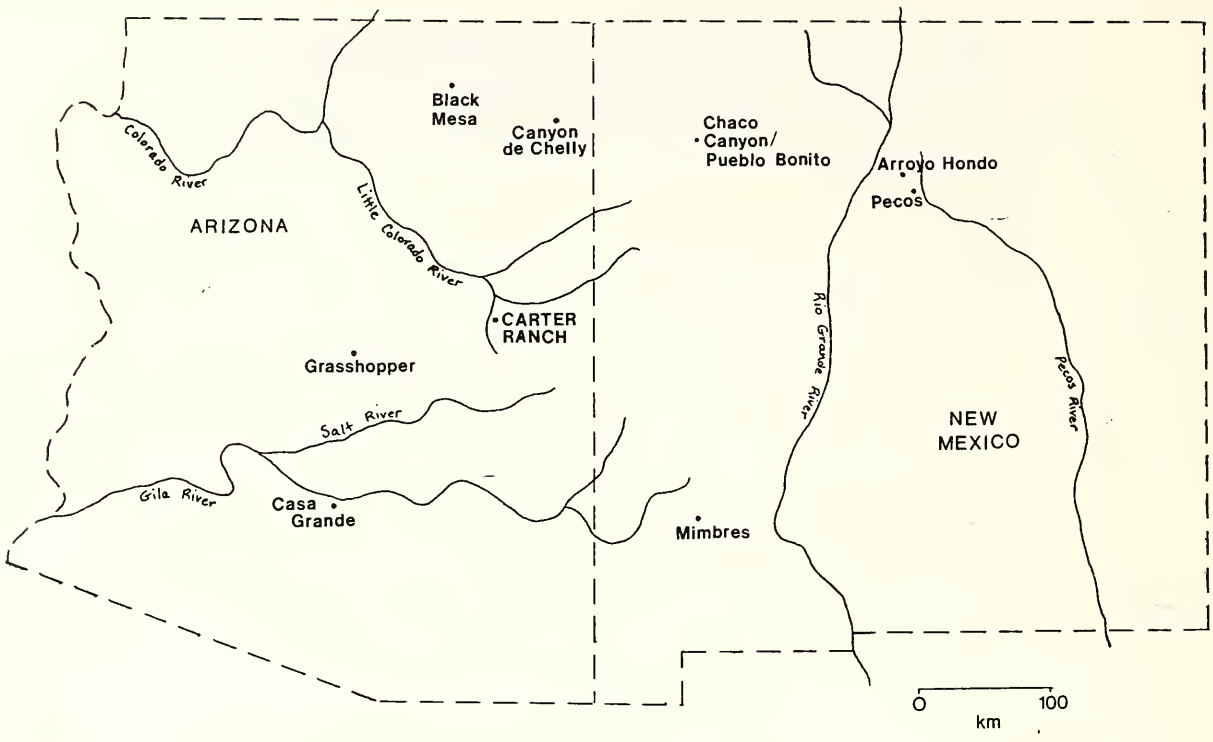


Figure 1. Location of Carter Ranch Pueblo and other major prehistoric Southwestern U.S. archaeological sites with analyzed skeletal series.

drier climatic conditions indicated by palynological remains (Schoenwetter, 1962). He proposed that the agriculturally-based inhabitants of the region responded to their more precarious existence with increased intercommunity cooperation. Several single residence units, which probably corresponded to extended kin groups, would coalesce to form large communities. Although weak kinship ties may have been present among the single residence units, religion likely served as the necessary integrative social force, as evidenced by the appearance of the Great Kivas around this time. This new settlement pattern survived for about 300 years (until approximately 1300 A.D.), when it, along with the Great Kivas, suddenly disappeared from the area.

While Longacre's proposed social organization was regional in perspective, he used intrasite data from the Carter Ranch Pueblo of eastern central Arizona to elaborate several portions of his analysis. The site, located in the Little Colorado River Valley (Fig. 1), consists of 39 rooms in a U-shaped block along with two kivas and one Great Kiva (Martin, *et al.,* 1964). Ceramic analysis suggests that Carter Ranch lies in the Anasazi-Mogollon cultural transitional area proposed by Danson (1957). Dating of the site has proven somewhat inconclusive, especially concerning length of occupation, but the best estimate from dendrochronology is 1100 A.D. to 1225 A.D. (Longacre, 1970).

Longacre (1970) used ceramic design frequencies to infer social organization at the site. Under the assumption that design patterns are passed exclusively from mother to daughter, he suggested that the inhabitants at Carter Ranch represent at least two, and possibly three, social units practicing matrilocal residence. Certain design constellations were closely associated with specific room blocks at the site, which probably represented residence areas. Each residence area was in turn associated with a kiva.

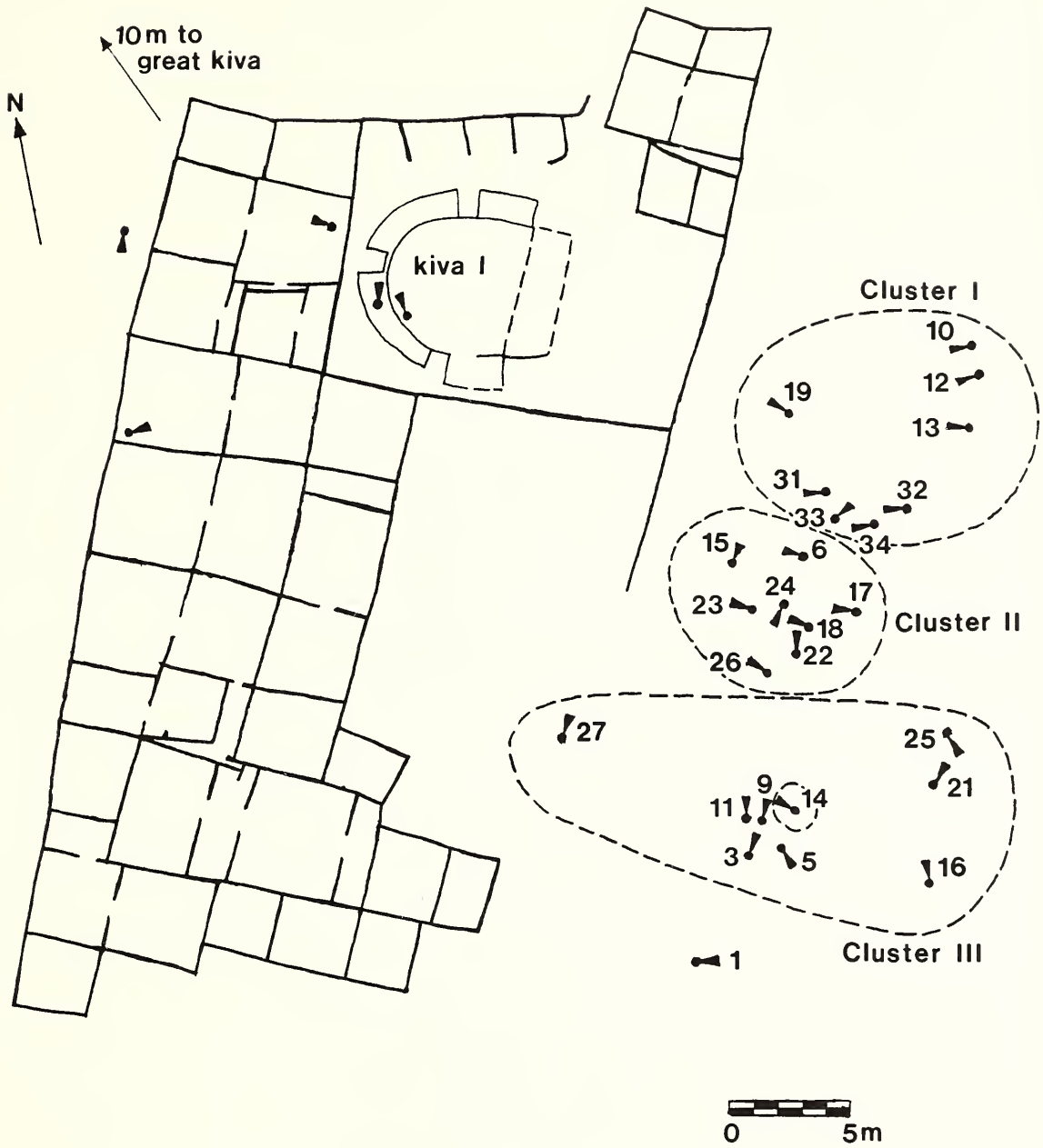


Figure 2. Map of Carter Ranch Pueblo, including burial clusters outlined by Longacre ( 1970; adapted from Martin, *et al.* ( 1964 )).

Perhaps the most interesting portion of his analysis was the suggestion that at least two of the residence units had separate disposal areas for their dead. Longacre (1970) found the cemetery to be highly patterned into three spatially distinct clusters that could be separated on the basis of orientation and affiliated grave goods. Those individuals in the northernmost group (Cluster I) tend to lie north-south (Fig. 2), and their burial pottery was associated with the ceramic design constellation of the northern block of rooms. In contrast, those buried in the southernmost group (Cluster III) tend to lie east-west (Fig. 2), and their burial pottery was associated with the ceramic design constellation of the southern block of rooms. The middle cluster (Cluster II) contained individuals oriented in both directions, and the designs on the ceramic grave goods were associated with constellations in both sets of room blocks, although they were more strongly affiliated with those of the northern block. A possible third residence unit, which was likely a splinter group of the residence unit in the southern end of the cemetery, may have buried its dead in the northeastern part of the site.

The middle cluster is also unique in that its burial accompaniments are far more elaborate than those of the northern or southern burial groups. Its members are generally interred with more vessels than are those of the other clusters, but more importantly, nearly all of the ceremonial goods recovered at the site are contained among the middle cluster's grave goods. Longacre (1970) also reported that most members of this cluster were males, thereby suggesting that ritual activity was a male domain. The mixed nature of burial orientation and ceramic design constellations led him to further conclude that the middle group of burials may represent a religious sodality that contained representatives from each of the two residence units.

Although Longacre (1970) relied upon ceramic evidence, comparison of biological indicators gained from skeletal analysis of the human remains in the cemetery at Carter Ranch can potentially reveal information about social relationships among the burial clusters, especially concerning intermarriage. If the clusters represent meaningful genetic divisions, then we will expect to see structuring of the data in this regard. Among the factors that might structure the data would be the presence of endogamous moieties (Longacre, 1970) or intermarrying moieties in which individuals were returned to the natal group for burial (Eggan, 1950). Other possible factors include chronological variation and the presence of separate ethnic groups.

Questions involving comparison of gene frequencies have been successfully investigated in small prehistoric populations using both osteometric and discrete trait data (e.g., Corruccini, 1972; Jantz, 1970; Lane and Sublett, 1972; Mackey, 1980). Since neither source of data is entirely free from environmental influences or from the effects of age/sex variation (Corruccini, 1976), several researchers have suggested that their combined use in studies provides the most reliable results (Corruccini, 1974; Rightmire, 1972).

The skeletal remains at Carter Ranch also offer the opportunity to investigate the social status of the middle cluster. Longacre (1970) suggested that those who participated in ritual activities represented an achieved status elite. These individuals may have enjoyed greater access to resources during adulthood and had lesser work demands placed upon them. Such differences potentially could be reflected in skeletal indicators.

## MATERIALS AND METHODS

The 25 individuals recovered in the eastern trash area of the Carter Ranch site provided the sample for the present study. Use of standard sex indicators (Stewart, 1979) revealed a nearly even sex distribution with ten females and eleven males among the 21 adults (Table 1). Only four juveniles, all age two or under, were present. Among adults, eight individuals died before age 35, whereas thirteen survived to at least that age. There was no evidence for variation in sex or age distribution by burial cluster.

In order to assess genetic relationships among those buried in the Carter Ranch cemetery, craniometric and discrete traits were observed. Dental morphological traits could not be included, since teeth in the series were generally too worn. Only adults were evaluated to minimize the effects of age on trait distribution. Individuals were placed in two separate sets of groupings for analysis. The first set maintained the burial clusters outlined by Longacre (1970) with maximum sample sizes for the northern, middle, and southern groups being eight, six, and seven, respectively. The second set attempted to recreate the two residence units by assigning those in the middle cluster to either the northern or southern unit on the basis of burial orientation. Those lying east-west were included with the northern residence unit, whereas those lying north-south were included with the southern unit. Maximum sample sizes for the northern and southern residence units constituted in this way were eleven and ten, respectively.

Fifteen cranial discrete traits (Table 2) were evaluated, and bilateral traits were scored as present, if an individual had the trait on at least one side. Ossenberg (1970) has suggested that cranial deformation can affect the presence/absence of certain discrete traits, but since all skulls in the series displayed some degree of lambdoidal flattening, it can only be assumed that the effects of deformation will be unimportant. The chi-square measure of association was used to analyze the cranial discrete data, since sample sizes were very small. Frequencies for each discrete trait were compared using the chi-square test of association. First, frequencies between the three clusters were tested in a pair-wise fashion. Second, frequencies between the northern and southern clusters (with the members of the middle cluster reassigned to them) were tested. At least five individuals in each group had to be scorable for the trait for the test to be run.

Genetic relationships in the Carter Ranch series were also analyzed using ten craniometric observations (Table 3). Since the skulls were deformed, all observations involved measurements taken only around the face and mandible in order to minimize bias resulting from deformation. Sample sizes were maximized for each grouping by combining male and female measurements for each dimension after they had been standardized by sex. The craniometric data were statistically evaluated in the same fashion as the discrete trait data except that the Mann-Whitney difference of means test was used. Again, at least five individuals per group had to have the dimension measurable for the test to be run.

In order to investigate whether the middle cluster enjoyed better health as a result of their special status within the community, several skeletal indicators reflecting adult health status were evaluated in the Carter Ranch series. These included: 1) arthritis, which is a degenerative condition of the joints; 2) dental lesions, which can

Table 1. The Carter Ranch Series - sex, age, orientation, burial goods, and cluster assignment (adapted from Longacre (1970); items in parenthesis are additional burial goods discussed in Martin, *et al.* (1964)).

| Burial Number | Sex* L | Sex* C | Age | Orientation | Associated Burial Goods |
|---|---|---|---|---|---|
| | | | Burial Cluster I | | |
| 10 | -- | M | 20-34 | | disturbed (medicine cylinder?) |
| 12 | M | F | 21-34 | E-W | 2 vessels |
| 13 | M | M | 35-49 | E-W | 1 effigy handle |
| 19 | M | F | 21-34 | E-W | 3 vessels, mat, red loincloth |
| 31 | M | F | 35-49 | E-W | 6 vessels, sandstone slabs |
| 32 | F | F | 35-49 | E-W | no associated goods |
| 33 | M | M | 35-49 | N-S | 3 vessels |
| 34 | M | M | 35-49 | N-S | 5 vessels |
| | | | Burial Cluster II | | |
| 6 | M | M? | 21-24 | E-W | 3 vessels, weaving tools, bracelet |
| 15 | M | F | 50+ | N-S | 7 vessels, bracelet, necklace, loincloth |
| 17 | M | F | 21-34 | E-W | 4 vessels, 2 bracelets, mats, basketry, white cylindrical beads |
| 18 | M&F | J&J | infant | E-W | 2 vessels, bracelet on male |
| 22 | M | F ? | 35-49 | N-S | 6 vessels |
| 23 | J | J | infant | E-W | 2 vessels, white cylindrical beads, necklace with bone ring pendant |
| 24 | M | F | 35-49 | N-S | 4 vessels, mat |
| 26 | M | M | 35-49 | E-W | 3 vessels, 2 grooved bone awls, 10 turquoise pendants, foot of clawed animal |
| | | | Burial Cluster III | | |
| 3 | M | M | 35-49 | N-S | 7 vessels, 1 notched sherd, 1 awl |
| 5 | F | F | 35-49 | N-S | no associated goods |
| 9 | M | M | 35-49 | N-S | 4 vessels ( jar, pitcher, bowls), bow guard, antler club, turritella shell pendants, lump of turquoise |
| 11 | F | M ? | 21-34 | N-S | 1 vessel |

| | | | | | |
|---|---|---|---|---|---|
| 16 | M | F | 21-34 | N-S | 4 vessels, 1 projectile point |
| 21 | F | M | 35-49 | N-S | hematite plug, chalcedony table ( possibly use as" tinkler" ) |
| 25 | J | J | infant | N-S | 1 large sherd |
| 27 | J | M? | 21-34 | N-S | 3 vessels, 1 awl |

* L = Assignments listed in Longacre ( 1970 ).
C = Assignments made by Cook after laboratory analysis.

include caries or abscesses in the surrounding bone; 3) porotic hyperostosis, which is porosities on the cranial vault that indicate presence of anemia at some point during life; 4) periosteal reactions, both cranial and postcranial, which can result from a number of infectious agents, either localized or systemic; and 5) trauma. The Carter Ranch remains were sufficiently complete for most individuals to be examined for all indicators. Data were analyzed by sex and cluster.

## RESULTS

As may be seen in Tables 2 and 3, neither form of analysis detected differences among the various burial disposal areas. None of the discrete traits was significantly different in the comparisons between the two residence units. Even those traits that are less commonly seen in skeletal remains, such as double anterior condylar canal, accessory infraorbital foramen, pharyngeal fossa, or third molar agenesis, failed to group so as to suggest familial relationships. The craniometric observations did produce some significant results, but the number did not exceed that expected to occur by chance alone. Thus, the hypothesis that there was genetic structuring within the populations represented by the burial clusters in the Carter Ranch cemetery was not supported.

Overall, the series shows moderate levels of most health indicators compared to those seen in other Southwestern groups (Bennett, 1973; Hooton, 1930; Palkovich, 1980; Table 4). As would be expected, older individuals were more frequently affected by arthritis, but the condition also showed a markedly higher rate in males, a finding not so easily explained. When the health indicators are considered by cluster, no distinctive pattern emerges. Cluster II does have somewhat lower rates of cranial periosteal lesions and trauma, but otherwise it is quite similar to Clusters I and III for the rest of the pathologies and conditions. Thus, the data only very mildly support that the middle group enjoyed a more favorable health status.

## DISCUSSION

While the small sample sizes involved in the present study obviously did not provide the optimal testing conditions to evaluate genetic differences among populations, both the cranial discrete trait and craniometric analyses consistently failed to support the hypothesis outlined by Longacre (1970) that at least two residence units are present at Carter Ranch. Similarly, analysis of pathological and nutritional indicators

Table 2. Frequencies of cranial discrete traits and the results of Mann-Whitney testing for heterogeneity between residence units by sex.

| Trait | Population | | Statistical Differences by Unit | by Cluster | | |
|---|---|---|---|---|---|---|
| | N | Freq. | | I-II | II-III | I-III |
| Highest nuchel line present | 19 | .368 | ns | ns | ns | ns |
| Ossicle at lambda present | 15 | .133 | ns | ns | ns | ns |
| Wormian bones present | 15 | .600 | ns | ns | ns | ns |
| Parietal foramen present | 17 | .765 | ns | ns | ns | ns |
| Tympanic dehiscence present | 20 | .300 | ns | ns | ns | ns |
| Mastoid foramen present | 18 | .944 | ns | ns | ns | ns |
| Mastoid foramen exsutural | 18 | .667 | ns | ns | ns | ns |
| Palatine torus present | 16 | .437 | ns | ns | ns | ns |
| Anterior condylar canal double | 15 | .467 | ns | ns | ns | ns |
| Supraorbital foramen complete | 19 | .474 | ns | ns | ns | ns |
| Assesssory infraorbital foramen present | 15 | .200 | ns | - | - | ns |
| Frontal notch present | 19 | .684 | ns | ns | ns | ns |
| Infraorbital foramen sutural | 16 | .625 | ns | ns | ns | ns |
| Supraorbital nortch / foramen multiple | 19 | .474 | ns | ns | ns | ns |
| Mandibular torus present | 16 | .250 | ns | ns | ns | ns |

ns = Nonsignificant at $p < 0.10$.

shows that they are not consistent in suggesting that members of the middle cluster enjoyed better health as adults than other members of the population.

Other factors further call Longacre's analysis of the Carter Ranch cemetery into question. First, although the site map suggests that the burials do form small groupings, the three large clusters described by Longacre (1970) are not readily recognizable (Fig. 2). For example, Burials 31 to 34 are assigned to Cluster I but appear to be spatially closer to Cluster II (Fig. 2). Additionally, Burial 14, located amidst individuals assigned to Cluster III, was not included by Longacre (1970) in his analysis. This neonate raises additional questions, since the orientation of the individual was E-W in a group otherwise oriented N-S.

Table 3. Craniometric means and results of chi-square analysis for heterogeneity between residence unit by sex.

| Trait | Males | | Females | | Statistical Differences by | by Cluster | | |
|---|---|---|---|---|---|---|---|---|
| | N | Mean | N | Mean | Unit | I-II | I-III | I-III |
| Minimum frontal diameter | 9 | 93.22 (4.38) | 7 | 92.14 (3.34) | ns | ns | ns | ns |
| Orbital height | 6 | 35.00 (2.61) | 7 | 34.42 (1.90) | ns | - | - | - |
| Orbital breadth | 6 | 41.33 (1.51) | 7 | 39.57 (1.13) | ns | - | - | - |
| Interorbital diameter | 6 | 16.67 (1.37) | 7 | 17.5 (1.38) | ns | - | - | - |
| Condylar symphyseal length | 6 | 106.67 (3.56) | 7 | 100.00 (4.08) | ns | ns | ns | ns |
| Alveolar height | 7 | 29.86 (2.61) | 6 | 29.00 (2.89) | ns | - | - | - |
| Biorbital breadth | 8 | 94.29 (4.19) | 6 | 92.00 (4.24) | ns | - | * | ns |
| Minimal nasal breadth | 8 | 13.38 (0.47) | 7 | 12.71 (0.66) | ns | - | - | ns |
| Ascending ramus height | 7 | 70.14 (4.22) | 8 | 63.33 (4.06) | ns | ns | ns | * |
| Ascending ramus breadth | 8 | 34.1 (2.67) | 10 | 32.60 (3.27) | ns | ns | ns | ns |

* = $p < 0.10$.
ns = Nonsignificant at $p < 0.10$.
- = Not statistically compared, because the sample size was less than 5.

Second, the suggestion of status differentiation by cluster, namely that members of Cluster II represent a male religious sodality, may be challenged. Longacre (1970) relied on two lines of support: the unusual sex distribution compared to the other clusters as well as the richness and the near exclusivity of all ceremonial goods with its members. When the laboratory sex assignments are used, however, the cluster is seen to include two males, four females, and two infants.

Additionally, extremely elaborate burials are found in other clusters besides the middle one. Burial 9, one of the two most impressive burials at the site, is grouped with Cluster III. This individual was sufficiently noteworthy for the site report, which otherwise had few references about specific burials, to state that "the objects that accompany this individual ... seem to suggest he had been an important figure in the

Table 4. Frequencies of pathologies by sex cluster.

| | By Sex | | by Cluster | | |
|---|---|---|---|---|---|
| | M | F | I | II | III |
| Maximum N | 10 | 11 | 8 | 6 | 6 |
| Cranial periosteal lesions | .600 | .400 | .286 | .167 | .429 |
| Postcranial periosteal lesions | .500 | .600 | . 429 | .400 | .625 |
| Cribra orbitalia | .000 | .200 | .000 | .333 | .000 |
| Dental lesions ( except caries ) | .800 | .778 | 1.000 | .800 | .833 |
| Arthritis | .723 | .375 | .625 | .400 | .667 |
| Trauma | .300 | .181 | .375 | .000 | .333 |

pueblo" (Rinaldo, 1964: 95). Burial 21, also in Cluster III, was found with a small cylindrical object of hematite as well as a highly polished colorful tablet of petrified wood near the pelvis. Rinaldo (1964: 81) notes that while the artifacts do not appear to have been a costume, they might have been "part of a fetish or charm kit". Finally, all three individuals (Burials 19, 31, and 34) recovered with polychrome pottery were found in Cluster I.

## CONCLUSIONS

Although the skeletal sample from Carter Ranch is quite small, it nonetheless provides an independent source of data to test many of the propositions of Longacre's classic reconstruction of postmarital residence patterns at the site (Longacre, 1970). Analysis of skeletal indicators in the remains failed to distinguish the presence of any sort of genetic structuring among members of the cemetery, particularly concerning the two residence units suggested by ceramic analysis. Similarly, the health patterns of the various clusters outlined by Longacre (1970) were remarkably similar, thereby failing to support the possibility that members of the middle cluster, who were proposed to be representatives of a religious elite, enjoyed privileges that resulted in better health. From the perspective of the human remains, Carter Ranch appears to have been homogeneous in distribution and egalitarian in status.

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