Bioarchaeological Investigations of Pre-State Life at Cerro Oreja

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The Moche of north coastal Peru were one of the earliest New World societies to develop a state socio-political organization. The Southern Moche State (A.D. 200-800) was a centralized hierarchical society that controlled the Moche Valley as well as valleys to the north and south. Prior to the establishment of the state, a series of less hierarchical organizations were present in the valley. Irrigation agriculture has often been cited as central to the development of the Moche State. To test this assertion, I examined 751 individuals recovered from the largest cemetery at the site of Cerro Oreja. Although the most important occupation of Cerro Oreja was during the Gallinazo period (A.D. 1-200), many individuals were interred here during the earlier Salinar period (400 -1 B.C.). Consequently, the Cerro Oreja collection holds the key to understanding the development of one of the earliest and most extensive states in the Americas. Of the 751 individuals I examined, this analysis is based on 61 Salinar and 320 Gallinazo individuals. Site stratigraphy allowed for the Gallinazo burials to be divided into three sub-phases: Pre-Structural (n = 142), Structural (n = 109), and Post-Structural (n = 69). Each individual was examined for the presence of dental caries, periodontal disease, abscesses, and ante-mortem tooth loss, as an increase in the prevalence of these dental conditions indicates an increase in the consumption of staple agricultural crops. My analysis shows that, while increased agricultural production and access to coca were important loci of pre-state social and political change, gender was the central axis along which these changes occurred. By expanding existing gender differences, Moche elites created the social hierarchies that came to characterize the state.

Los moche de la costa norte del Perú fueron una de las primeras sociedades del Nuevo Mundo en desarrollar una organización socio-política estatal. El Estado Moche Sureño (200-800 d.C.) fue una sociedad jerárquica centralizada que controló el valle de Moche y otros valles al norte y al sur. Anterior al establecimiento del Estado, una serie de organizaciones menos jerarquizadas estuvieron presentes en el valle. La agricultura por irrigación ha sido frecuentemente considerada como pieza central en el desarrollo de este Estado. Para comprobar esta afirmación he examinado 751 individuos recuperados del cementerio más grande de la época situado en Cerro Oreja. A pesar que la ocupación más importante en el Cerro Oreja corresponde al período Gallinazo (1-200 d.C.), muchos individuos fueron enterrados aquí durante el período Salinar (400-1 a.C.). De esta manera, la colección del Cerro Oreja nos brinda la clave para entender el desarrollo de uno de los más tempranos y extensos estados en América. De los 751 individuos examinados, se incluyen en el presente análisis 61 individuos que pertenecen al período Salinar, 142 de la fase Gallinazo-Pre-Estructura, 109 de la fase Gallinazo-Estructura y 69 de la fase Gallinazo Post-Estructura. Cada individuo fue examinado considerando la presencia de caries dentales, enfermedad periodontal, abscesos y pérdida ante-mortem de dientes, ya que un incremento en la presencia de estas condiciones dentales indica un incremento en el consumo de recursos agrícolas. El presente análisis muestra que, mientras el incremento en la producción agrícola y el acceso a hojas de coca fueron importantes factores de cambios sociales y políticos pre-estatales, el género fue el eje central donde estos cambios ocurrieron. Mediante la expansión de las diferencias de género existentes, la elite mochica creó jerarquías sociales que caracterizaron al Estado.

The Moche of north coastal Peru were among the earliest New World societies to develop a bureaucratic state organization (Billman 1999: 132; Moseley 1992: 147). The Southern Moche State (A.D. 200–800) was a centralized hierarchical society that controlled the entire Moche Valley and perhaps valleys to the north and south. Moche elites marshaled their economic resources to build large public works, such as roads and monumental ceremonial structures (Hastings and Moseley 1975; Moseley 1975), and to dramatically increase arable land through canal construction (Moseley and Deeds 1982). Elites also amassed great personal wealth, as indicated by archaeological excavations of wealthy tombs (Alva and Donnan 1993; Donnan and Castillo 1992). To exert their influence, elites used ideological power manifested in public rituals held at large monuments and iconography that supported state ideologies. Physical power, in the form of warfare, conquest, and sacrifice, was also

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Table 1. Moche Valley cultural periods and work projects.

central to elite control (Bawden 1996; Billman 1996; Bourget 1996, 2001; Shimada 1978; Verano 2001).

Prior to the establishment of the state, societies in the valley were organized in less hierarchical political structures (Billman 1997, 1999, Brennan 1980; Topic 1982; Topic and Topic 1978). It was the people of these societies who first opened the desert lands of the Moche Valley to agriculture. Construction of the valley-wide canal system that enabled agricultural production began during the Cupisnique phase (1800–400 B.C.), when approximately 4,200 m^3 of canals were built, irrigating 4,100 hectares. This system was expanded by approximately 60,000 m^3 during the Salinar phase (400–1 B.C.), allowing for the cultivation of 6,750 to 7,300 hectares. During the Gallinazo and Early Moche phases (A.D. 1–400), no new land appears to have been brought under cultivation. Later, the Moche State doubled agricultural production through the irrigation of 12,550 to 13,200 hectares (Billman 2002: 380) (table 1). This dramatic increase in agricultural production has led researchers to suggest that in Peru, as elsewhere, irrigation played a central role in state development (Carneiro 1970: 204; Haas 1987: 33; Moseley 1992: 176). This is because staple crops could be produced on a grand scale in irrigated fields, creating storable surpluses. By controlling these stores, elites financed their state building activities (D'Altroy and Earle 1985: 88; Earle 1997: 71). Because increased agricultural production is reflected in an increase in the consumption of agricultural products, the link between irrigation and state development can be tested by tracking prehistoric changes in diet. To this end, I examined individuals who lived during the Salinar and Gallinazo phases, just prior to and during the beginnings of state formation, for evidence of increased prevalence of dental pathological conditions. An increase in these conditions indicates an increase in the consumption of starchy and/or sugary agricultural products. An advantage of using biological rather then ethnobotanical data to chart consumption is that these data are linked to specific individuals for whom sex, age-at-death, and status information are known. This allowed me not only to examine changes in agricultural production, but also to specify whom these changes affected, and thus link changes in social roles, particularly gender roles, to changes in political organization.

The Sample

The remains I examined were excavated by Sr. José Carcelen and the Instituto Nacional de Cultura (INC) from the largest cemetery encountered during the 1994 salvage excavations at the site of Cerro Oreja (figure 1). Cerro Oreja, located at the neck of the Moche Valley, was the largest urban center in the valley during the Gallinazo phase (Billman 1999: 152). Gallinazo phase people used the irrigated valley bottom for agricultural production, and constructed their homes on small terraces they built on the steep lower slopes of Cerro Oreja. This zone of occupation stretches for two kilometers along the base of the

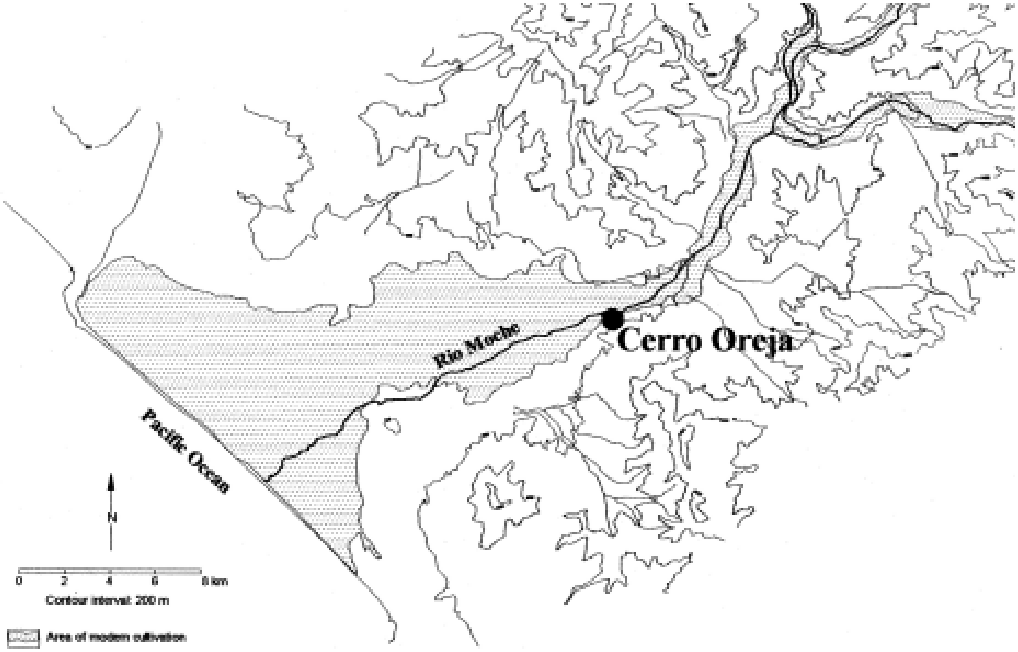

Figure 1. Map of Cerro Oreja.

mountain. Domestic structures were generally small and constructed from cane and mud; however, some people lived in larger masonry compounds. Above the domestic zone, a ceremonial adobe brick *huaca* was constructed on a flat terrace carved from the mountain. Located below the residences were three cemeteries, with a large masonry wall separating the homes of the living from those of the dead (Billman 1996: 239-242).

The depositional history of the cemetery area is complex. Before the landscape was modified by the residents of Cerro Oreja, the cemetery area was a depression. During the Cupisnique, Salinar, and Gallinazo phases, people excavated graves within this depression. Sometime during the Gallinazo phase, the residents filled the depression, capping the cemetery. After this event, people built structures to house the dead, and burials were excavated into the fill debris within the structures. Later, these mortuary structures were themselves buried, and on this new surface the residents of Cerro Oreja built domestic structures. During this period, the dead were buried under house floors. Much later, during the Chimu phase, a canal was constructed over the cemetery. Although Carcelen could use only ceramic styles and the presence of pigments to separate burials into phases, site stratigraphy allowed him to divide the Gallinazo interments into early, middle, and late periods, which are termed the Pre-structural, Structural, and Post-structural, respectively (José Carcelen, personal communication 1999).

A total of 909 burials were excavated. Of these, I have examined 681 burials, from which the remains of 751 individuals were recovered. Among these are individuals who lived during the Cupisnique, Salinar, Gallinazo, Moche, and Chimu phases. The vast majority of the burials (91 percent) date to the Salinar and Gallinazo phases. The analysis I present here will therefore be confined to these burials. This sample includes 61 Salinar, 142 Pre-Structural Gallinazo, 109 Structural Gallinazo, and 69 Post-Structural Gallinazo individuals (figure 2).

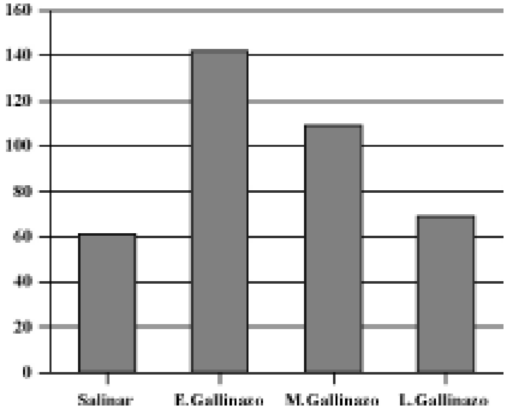

Figure 2. Study sample by phase.

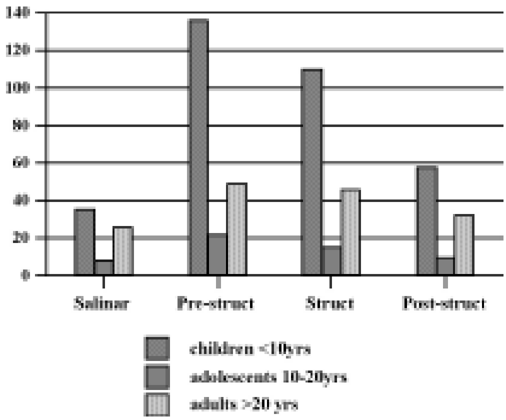

Figure 3. Age-at-death profile.

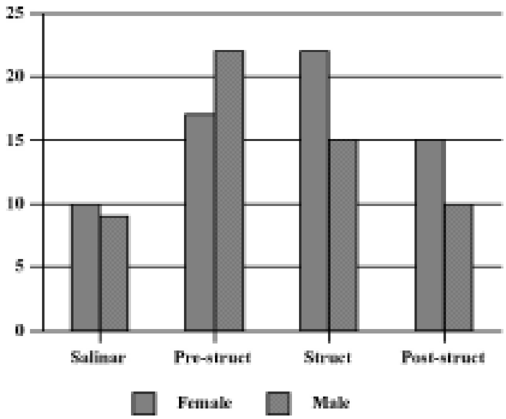

Figure 4. Sex identification profile.

Demographic Data

Age-at-death and sex estimations were made as a joint effort by the members of the Cerro Oreja Bioarchaeology Project, which is co-directed by Dr. Patricia Lambert of Utah State University and Dr. Brian Billman of the University of North Carolina at Chapel Hill. During the summer field seasons of 1999, 2000, and 2001, I worked with Dr. Lambert and Bonnie Yoshida, a graduate student at the University of California at Santa Barbara, to make age-at-death and sex estimations for 243 individuals. During an extended research season, Yoshida estimated the age-at-death and sex of an additional 183 individuals. In 2003, I examined these individuals as well as the remains of 324 additional individuals. Our age-at-death and sex estimations were made following Buikstra and Ubelaker's *Standards for Data Collection from Human Skeletal Remains* (1994). We primarily based subadult age estimates on tooth formation and eruption (White 1991). Skeletal development and fusion (Buikstra and Ubelaker 1994; Fazekas and Kósa 1978; Johnston 1962) were used in estimating the age-at-death of fetuses and infants, as well as for individuals whose dentition was not preserved. Adult ages were estimated based on combined morphological changes at the pubic symphysis and auricular surface, and also on cranial suture closure (as presented in Buikstra and Ubelaker 1994). Occasionally, sternal rib ends were sufficiently preserved to be used in age assessments (see Bass 1987). We assigned individuals a mean age and an error estimate. Errors ranged from several months for well-preserved children to as much as 15 years for fragmentary adults. When adult remains were too fragmentary to be assigned a mean age, we grouped them according to their minimum possible age at the time of their death. These individuals fell into five different categories: at least 18, 20, 30, 40, and 50 years.

To provide a straightforward view of population structure, I have pooled the sample into three categories: children (under 10 years at the time of death), adolescents (10-20 years), and adults (over 20 years) (figure 3). A clear trend in these data is the changing percentage of children. The Salinar phase sample has the smallest percentage of children relative to adolescents and adults, while the Pre-Structural Gallinazo contains the largest. Childhood mortality in pre-modern societies is not an indicator of population health, but rather of population growth. The faster a population is growing, the higher the birth rates, and thus the larger the percentage of children who die from common childhood illnesses (Larsen 1997: 338). The small number of children dating to the Salinar phase suggests that children were buried elsewhere during this period. Because the number of child remains recovered from Gallinazo phases approximates infant mortality in non-industrialized societies (Coale and Demeny 1966: 75, 85), these remains can inform us about population change. These data suggest that the greatest growth in population at Cerro Oreja occurred during the Pre-Structural Gallinazo phase. Population growth then slowed during the Structural and Post-Structural phases.

Sex estimation of adults was established using the Phenice Method and qualitative observations of pelvic morphology, such as relative size of the greater sciatic notch, length of the pubic ramus, and width of the subpubic angle (Buikstra and Ubelaker 1994). We also considered cranial morphology and robusticity when sexing adults (Buikstra and Ubelaker 1994; White 1991). If the os pubis was extremely fragmentary or absent, we used metric data from the femora, tibiae, and humeri to support cranial sex identifications (Dittrick and Suchey 1986; Iscan and Miller-Shaivitz 1984). Not all individuals could be assigned to a sex with the same degree of certainty. To incorporate our varying error, we employed a four-tier system to rank our estimations: female/male, probable female/male, possible female/male, and unidentified. In this study, I consider individuals in the first two categories as sexed, and others as unidentified.

Women generally outnumbered men in the collection (figure 4). This is not uncommon, as adult men often die away from home, and therefore their remains are not interred with those of their families. However, the Pre-Structural phase does not follow this pattern. Instead, men are more common. Though it is not yet clear how this pattern should be interpreted, I would suggest that some women might have been buried elsewhere during this period.

Dental Data

In addition to demographic data, I also collected information pertaining to the following dental pathological conditions: dental caries, dental abscesses, periodontal disease, and antemortem tooth loss. Dental carious lesions (cavities) are areas of localized destruction of tooth enamel caused by the acidic waste products of bacteria (Larsen 1997: 65; Ortner and Putschar 1981: 438) (figure 5). The type of foods people eat is the most important factor in caries formation. Diets high in carbohydrates and sugars promote dental cavitation because they provide food for bacteria (Goodman *et al.* 1984: 36-37; Larsen *et al.* 1991; Ortner and Putschar 1981: 438). Sticky, starchy foods are particularly cariogenic. Other factors also help create an oral environment suitable for caries. Tooth morphology is the most important among these (Larsen 1997: 65). Small grooves and fissures on the surface of premolars and molars provide a protected environment for bacteria. These teeth are therefore more prone to caries than incisors or canines. If left untreated, carious lesions will completely destroy tooth enamel. This allows bacteria to infect the living part of the tooth. Eventually, this infection spreads to the bone, creating an abscess (Hillson 1996: 285) (figure 6).

Periodontal disease is a process by which the bone surrounding a tooth becomes porous (figure 7). This is the result of long-term gingivitis, a chronic inflammation of the gums (Clarke and Hirsch 1991; Larsen 1997: 77). Gingivitis can be triggered by irritants such as bacterial activity and the presence of dental plaque (Ortner and Putschar 1981: 442). Both abscess and periodontal disease eventually destroy the bone such that it can no longer support the tooth root, and the tooth is lost (Ortner and Putschar 1981: 443) (figure 8).

Because these four conditions —dental caries, dental abscesses, periodontal disease, and antemortem tooth loss— reflect oral health, their frequencies generally change in similar ways. By charting oral health, we are able to estimate the importance of staple crops in a person's diet, as these foods are generally very high in carbohydrates. It is important to note that the consequences of poor oral health

Figure 5. Carious lesions.

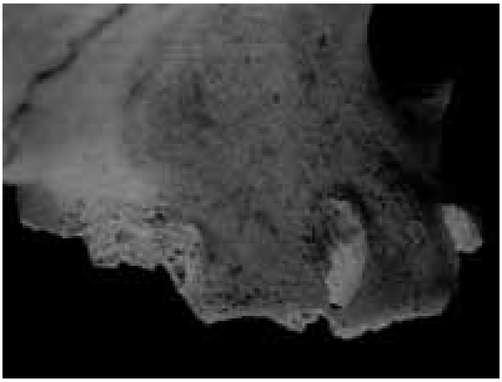

Figure 6. Dental abscess.

Figure 7. Periodontal disease.

Figure 8. Antemortem tooth loss.

were far more severe before the development of dentistry. Untreated dental pathological conditions affect the quality and quantity of food that a person can eat. Furthermore, infections such as periodontal disease and dental abscesses decrease a person's ability to fight-off other infections. The result is a decrease in overall health and work capacity. In addition, the bacteria that cause dental abscesses can spread to the blood supply, causing death.

I analyzed the dental pathological data using logistic regression. The model I used was programmed into SAS software with the help of Chris Wiesen, staff statistician for the Odum Institute at the University of North Carolina, Chapel Hill. A log-linear model simultaneously explores the complex relationships between a categorical independent variable, in this case the presence or absence of a dental condition, and any number of numeric and/or categorical dependent variables (table 2). This type of analysis allows us to maintain the links between dental observations and other individual information, like sex and age-at-death, while calculating population frequencies. This makes it possible to conduct a small-scale analysis that can articulate with larger-scale questions. In addition, a log-linear model also allows us to see interaction among dependant variables, such as sex and age-at-death.

Results and Interpretations

Grave goods can be used as a marker of social status because the investment families make into the construction of the graves of their deceased and the items they bury with them are affected by the family's access to wealth (Parker Pearson 1999: 84-85). Although the mortuary analysis of the Cerro Oreja cemetery is in its preliminary stages, information about the presence of grave goods is available. Using these data, I divided individuals into two status categories: those with grave goods and those without (figure 9). Throughout the Salinar and Gallinazo phases, there was a significant (p > .001) change in social status as indicated by the presence of grave goods. These data suggest that, through time, a smaller proportion of individuals of higher status were buried at Cerro Oreja. It is unclear if this pattern represents an overall decrease in access to grave good items, and thus an increase in the size of the lower class, or selective burial of lower class individuals in the cemetery. However, either possibility indicates social change along the axis of status.

Social status and wealth also affect a person's access to particular foods (Powell 1988: 15). In the Andes, elites have commanded better access to such foods as llama, deer, and fish (Bawden 1996: 288; Murra 1980: 49; Rostworowski 1988; Salomon 1986: 83, 95; Tomczak 2003), even though consumption of animal products is an important source of needed protein. I expected the observed increase in proportion of lower status individuals buried at Cerro Oreja to be reflected in an increase in the consumption of starchy agricultural products by the residents of the site. These products would have replaced animals in the diet of low status individuals. Surprisingly, I found no significant differences among status groups in rates of dental pathological conditions. This suggests that the diet of high status and low status individuals was similar through the period of study. In other words, any status differences that did exist were not expressed in people's daily consumption patterns. Because proper nutrition is of central importance to an individual's health, their ability to work, and the fulfillment of social obligations, diet is directly related to social production and reproduction. Since access to important food items was not restricted based on social status, I suggest that status was not the most important axis of inequality before and during the development of the Moche State. However, the data do not suggest that all people were equal, but rather that inequality occurred along gender lines.

Phase	Estimated Dates	Cultural Horizon	New Canals Excavated	Ceremonial Architecture
Middle Moche	AD 400–700	Early Intermediate Period	312,000 m^3	416,000 m^3
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Cupisnique	1800–400 BC	Initial Period–Early Horizon	42,000 m^3	1,291,000 m^3

Table 2. Logistic regression.

The clearest example of gender differences can be seen in the frequencies of carious lesions. Female adult carious lesion rates increased through time, a trend that is significant (p = 0.008) (figure 10). However, temporal variation in male carious lesion rates is not significant (p = 0.490), and shows no clear pattern. Differences between females and males are significant in the Structural and Post-Structural Gallinazo phases (p = 0.005 and 0.029, respectively). The number of carious deciduous teeth among children generally increased through time (figure 11). Although this pattern is not statistically significant (p = 0.268), it suggests that children consumed staple crops in increasing amounts over time.

Carious lesion rates suggest that, among adult females, and to a lesser extent among children, carbohydrate consumption increased through time. Although dental caries formation is influenced by several factors, the most important is the consumption of cariogenic foods, such as potatoes or maize. The data therefore seem to support the hypothesis that reliance on agricultural foods increased throughout the study period, and therefore that an intensification of agricultural production was central to the development of the Moche State. However, adult male consumption does not follow this pattern. Rather, they consumed fewer starchy staple crops than did women and children and consumed them at levels that did not change over time. If the diets of males did not increasingly become focused on carbohydrates (such as field crops), then they must have retained a stable balance of plant and animal foods. An increasingly different female and child diet compared to the stable diet of males suggests increasingly differentiated gender roles.

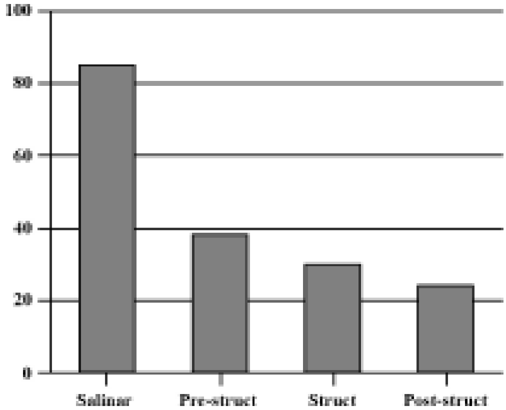

Figure 9. Percentage of high status individuals by phase.

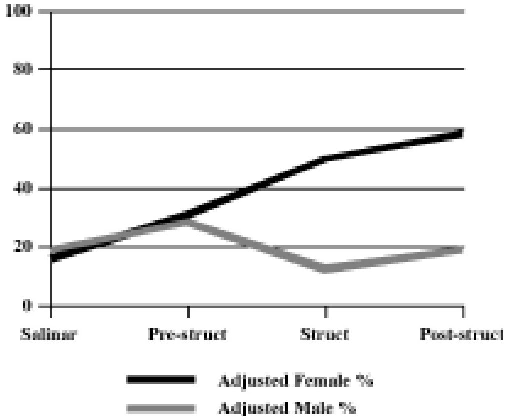

Figure 10. Adult carious lesion rates by phase.

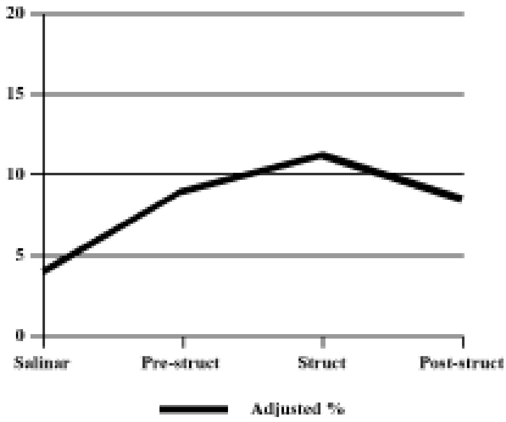

Figure 11. Sub-adult carious lesion rates by phase.

What kinds of changes in gender roles might have resulted in such different diets? As a point of comparison, I offer the Inka state's policy of *mit'a* labor, in which men were required to work on large-scale, state-sponsored projects (Rowe 1946: 268-269). While taking part in such work parties, laborers were supplied with specialized foodstuffs. Similarly, the substantial investment in public construction in the Moche Valley throughout the study period would certainly have required elites to marshal and supply a sizable work force (table 1). Therefore, I suggest that the men of Cerro Oreja were being increasingly drafted by the elite into similar work parties where they were provisioned with, or offered as an enticement, meat or marine resources. Meanwhile,women and children continued to tend agricultural fields and consume the staple crops they produced, creating divergent diets.

Adult periodontal disease rates changed over time for both females (p = 0.238) and males (p = 0.087). Rates increased from the Salinar to the Pre-Structural Gallinazo phase, and then fell from the Pre-Structural to the Structural Gallinazo phase (figure 12). Throughout these periods, female rates are higher than those of males. The female and male patterns dramatically diverge in the Post-Structural Gallinazo phase, when there is a significant increase in periodontal disease among males (p = 0.029), but female rates continue to fall.

Periodontal disease rates do not follow the same patterns as carious lesion rates. This suggests that periodontal disease in the Cerro Oreja sample is not as closely linked to the consumption of agricultural food sources as are carious lesion rates. This finding is unusual because, as I mentioned before, all dental pathological conditions are the result of poor oral health, and changes in their frequency generally follow similar patterns.

To understand this pattern, I examined how other items that people put into their mouths can affect the oral environment. In particular, I investigated coca leaf chewing, because of the long history of its use in the area (Allen 1988; Rostworowski 1988). Because of the stimulant qualities of coca and the corrosive nature of the lime with which coca leaves are chewed, this activity is associated with periodontal disease, and the development of carious lesions in the subsequently exposed tooth roots (Indriati 1997; Indriati and Buikstra 2001; Langsjoen 1996). Unfortunately, the condition of the Cerro Oreja skeletal collection resulted in the fragmentation of many tooth roots, so the rate of root lesions could not be compared to that of crown lesions. Such a comparison could have provided support for my interpretation. However, archaeological investigations in the Moche Valley provide information relevant to the question of coca use.

Billman (1996: 264, 1997: 301) has identified an in-migration of highland people into the Moche Valley during the beginning of the Gallinazo phase, based on the appearance of sites dominated by highland ceramics. What is particularly salient to this discussion is that the region in which these highland sites were located includes the few areas where coca can be grown in the Moche Valley. Highlander occupations of these areas may have resulted in reduced access to and use of coca by local residents, as the decrease in periodontal disease from the Pre-Structural to Structural Gallinazo phase indicates. Billman found that these distinctive highland sites were abandoned by the end of the Gallinazo phase.

In the Post-Structural Gallinazo phase, coca may again have been available to valley residents. However, increasing gender differences, particularly in labor, resulted in its use by men not women. Because coca chewing increases work capacity (Plowman 1986: 8), this may be another example of elites provisioning men as they labored on construction projects. On the other hand, Moche elites may have offered coca as a payment to common men for their work, rather than as a provision for conscripted laborers. Given coca's ritual importance, people may have been willing participants in construction projects if such work provided them access to coca.

Dental abscessing and antemortem tooth loss rates display no clear temporal pattern (figures 13 and 14). Because these are not primary conditions, but are the result of untreated dental caries and periodontal disease, this lack of temporally patterned variation may be the result of an «averaging» of the effects of primary pathological conditions. I suggest that the lack of pattern in these indicators further supports my interpretation of the carious lesion and

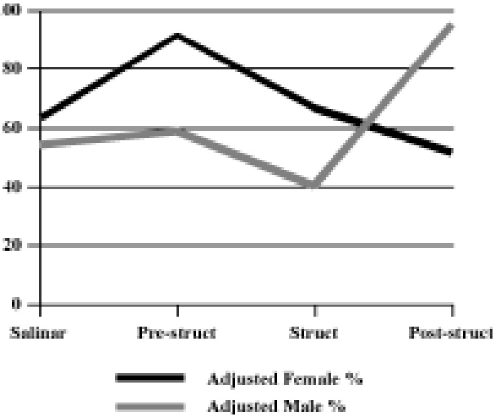

Figure 12. Adult periodontal disease rates by phase.

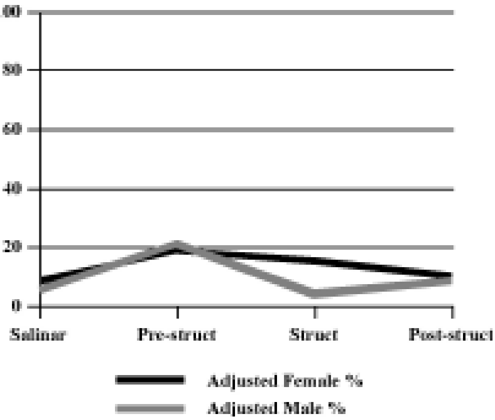

Figure 13. Adult dental abscess rates by phase.

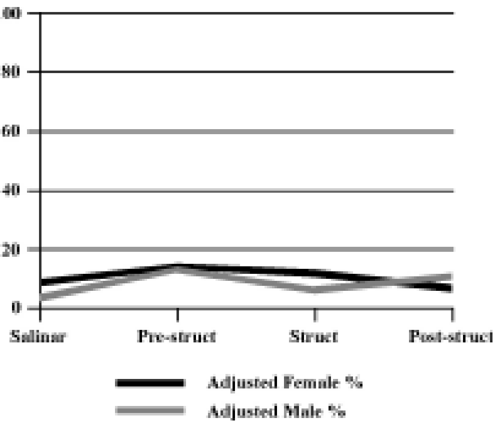

Figure 14. Adult antemortem tooth loss rates by phase.

Figure 15. Generalized dental wear.

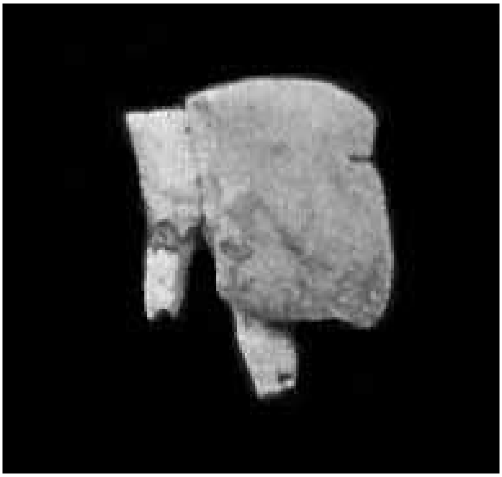

Figure 16. Dental calculus.

periodontal disease data. If abscesses and tooth loss followed the pattern of change of one of the two primary conditions, I would assume that the condition with the divergent pattern was an outlier, because all dental pathological conditions are generally correlated. Since poor preservation can make some conditions difficult to diagnose, I would have discarded the divergent data. However, the «averaging» effect seen here is exactly what one would expect if carious lesion and periodontal disease patterns did in fact indicate staple consumption and coca use, respectively.

Conclusions

I tested the hypothesis that the development of the Moche State was linked to an intensification of irrigation agriculture and correlated with an increase in the consumption of starchy staple crops. My analysis suggests that women and children did consume these agricultural products in increasing amounts throughout the period leading up to and during the development of the Moche State. These findings seem to confirm the test hypothesis.

However, there are a few complications to this seemingly simple interpretation. Men's diets remained consistent, while those of women and children changed through time. The data also suggest that women's and men's use of coca varied over time in significantly different ways. As I noted above, status does not seem to have been important in determining diet or access to coca during this time. This finding stands in dramatic contrast to what we know about the importance of status differences during the height of the state's power. It seems that in the periods preceding the Moche State, gender was the more important factor in determining diet and coca use. Moreover, this gender differentiation implies a dramatic transformation in labor organization in the Moche Valley.

Future Research

In addition to data relating to dental pathological conditions, I also collected data on dental wear, dental chipping, calculus, and bone chemistry. Dental wear (Smith 1984) and chipping (Milner and Larsen 1991) data are non-pathological results of tooth use (figure 15). As foods of different consistencies and levels of grit affect the frequencies of these conditions, I anticipate that these data will further support the gendered patterns in diet I have suggested.

Dental calculus is calcified plaque (figure 16). Microplant remains such as phytoliths, pollen, and starch granules can be preserved in *calculus* (Fox and Perez-Perez 1994; Reinhard *et al.* 2001). Preliminary results from this analysis suggest that manioc, not Andean tubers or maize, was the most important starch in the diet. Additionally, I hope that coca phytoliths will be recovered to support my interpretation of periodontal disease.

Bone chemistry samples that I collected are being tested for proportions of carbon and nitrogen stable isotopes. These proportions are informative because they can be used to trace the consumption of maize relative to other plants, marine resources relative to terrestrial resources, and diets high in protein (Schoeninger and Moore 1992: 358-261; Schwarcz and Schoeninger 1991: 302-305). Again, it is my hope that these data will-provide additional support for my interpretations, or highlight previously unseen variations, as well as elucidate the role of *chicha* in *mit'a* labor.

Although my analysis has provided us with much information about life in the Moche Valley before the development of the Moche State, it also raises many questions. More detailed analysis of grave goods is needed. When this information is made available, I will incorporate it into my skeletal analysis. I anticipate that a more detailed picture of the effects of status on diet and health will emerge from this research. The continuing efforts of paleoethnobotanists and other archaeologists working in the area will certainly provide basic information that, when coupled with skeletal data, will tell us more about agricultural practices in the valley. Additionally, I hope to extend the time depth of my research. The examination of Moche phase burials will make clear when status became the central component of life in the valley, and how gender intersected with status. Finally, a systematic survey of Cerro Oreja is needed, and when complete will not doubt clarify (and perhaps change) my very preliminary understanding of the demography and social organization of the site.

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