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## The bioarchaeology of the Cerro de la Cruz cemetery, Oaxaca, Mexico

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## ABSTRACT

This paper discusses preliminary bioarchaeological findings from the Late Formative cemetery at Cerro de la Cruz in the lower Río Verde Valley on the Pacific coast of Oaxaca. The Cerro de la Cruz cemetery has figured prominently in a long-running debate over the hypothesized conquest of the region by Monte Albán. We discuss the results of detailed bioarchaeological analyses of 25 individuals from Cerro de la Cruz, including 5 from the cemetery, in the context of an ongoing regional study. Although taphonomic processes complicate the analysis, the individuals from the cemetery do not reveal evidence of traumatic injuries consistent with warfare. Instead, the range of pathological conditions visible on the bones is consistent with broader regional patterns. Although the age profile of the cemetery is clearly biased toward adults, this pattern appears to be the result of cultural selection and not death in battle. We also discuss the migration implications of a strontium isotope analysis from individuals in the cemetery. We consider the Cerro de la Cruz cemetery in relation to four cemeteries discovered in the region that span the Late Formative to the Early Classic periods.

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## 1. Introduction

Over the past 20 years, archaeologists in Oaxaca have debated the nature and extent of Monte Albán's impact on surrounding regions during the later Formative period from 300 BCE to 250 CE (Fig. 1). In general, two models of Monte Albán's interregional impact have been proposed. Highland researchers have proposed that Monte Albán controlled a territorial empire through military conquest and colonization extending over 20,000 km<sup>2</sup> (e.g., Balkansky, 1998; Marcus and Flannery, 1996:206–207; Redmond and Spencer, 2006:377; Spencer, 2007). In contrast, researchers working on Oaxaca's Pacific coast question the nature and extent of Monte Albán's empire (Joyce, 2003, 2014; Levine, 2013; Workinger, 2013; Workinger and Joyce, 2009; Zeitlin and Joyce, 1999). Much of the debate has centered on the interpretation of data from the lower Río Verde Valley on Oaxaca's western Pacific coast, particularly a series of human burials from the Late Formative period site of Cerro de la Cruz. In this paper, we briefly review the debate and discuss the implications of bioarchaeological findings from Cerro de la Cruz. We observe that, although taphonomic processes complicate the analysis, the individuals do not reveal evidence of traumatic injuries consistent with warfare, nor do they show increased rates of biological stress often documented in populations experiencing interpersonal conflict. From a forensic archaeology perspective, the burial configuration at Cerro de la Cruz and the trauma analysis are outside

of the parameters for a mass grave resulting from larger violent conflict (Cabo et al., 2012; Haglund et al., 2011).

## 2. Background and methods

## 2.1. Archaeology

Cerro de la Cruz is a small Late Formative site covering 1.5 ha that is located on a hill in the floodplain (Joyce, 1994; Joyce et al., 1998). Excavations exposed portions of two terraces with stone retaining walls, as well as areas of the Late Formative ground surface. Four probable low-status residences characterized by stone foundations, earthen floors, burials, and small cooking features were exposed on the different occupational surfaces. On the upper terrace, however, the excavations uncovered an architectural complex including a granite flagstone patio surrounded by the stone foundations of five structures (Structures 1 to 5; Fig. 2). A dense concentration of burials was associated with Structure 1, the easternmost building exposed on the upper terrace, and it is these burials that are the focus of debate.

The remains of 49 bodies were interred beneath the uppermost two floors and alongside the foundation walls of Structure 1 (Fig. 3; Barber et al., 2013; Joyce et al., 1998). The initial burial analysis identified 14 male and 11 females; none were interred with offerings. The absence of offerings is not surprising since Cerro de la Cruz is a modest site with few indications of status differences; only 5% of the 86 Late Formative interments recovered from the entire site were accompanied by offerings. In contrast, at the 20 ha site of Río Viejo, 80% of the buried individuals had offerings, but all were modest, the most elaborate being a snail

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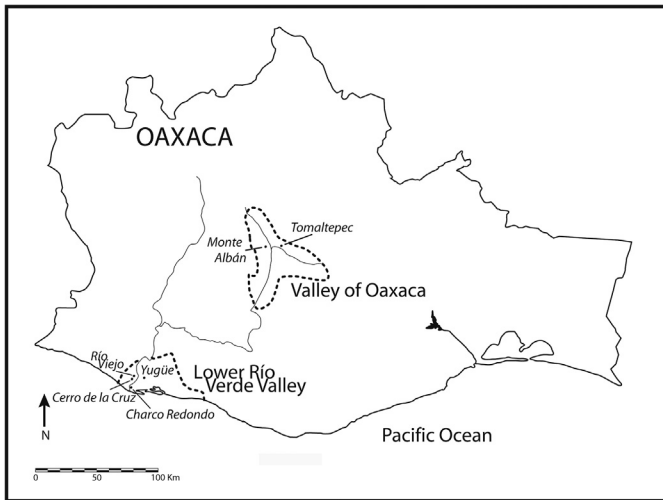


Fig. 1. Oaxaca showing regions and archaeological sites mentioned in the text.

shell necklace. In Structure 1 at Cerro de la Cruz, adults predominated, accounting for 42 (86%) of the individuals; the remaining 7 (14%) individuals were subadults. An additional 9 interments were recovered near the southwest corner of the flagstone patio and included 8 adults and one subadult. The relationship between these burials and those of Structure 1 are not clear, however. Elsewhere at Cerro de la Cruz burials exhibited a more normal age profile with infants and children predominate. We argue that the burials in Structure 1 at Cerro de la Cruz represent a communal cemetery (Joyce, 1994; Joyce et al., 1998) or mortuary domain, in that it was a culturally designated area with deliberate use and reuse over time, the placement in which was determined through social or ideological factors of the living (Wright, 2006). The cemetery represented the collective burial practices of a supradomestic social group within this community. Interment in the cemetery was restricted to individuals of a certain achieved status defined by age or unidentified life experiences accounting for the predominance of adults. A similar preponderance of adults was found at the Early Formative period cemetery at Tomaltepec in the Valley of Oaxaca (Whalen, 1981).

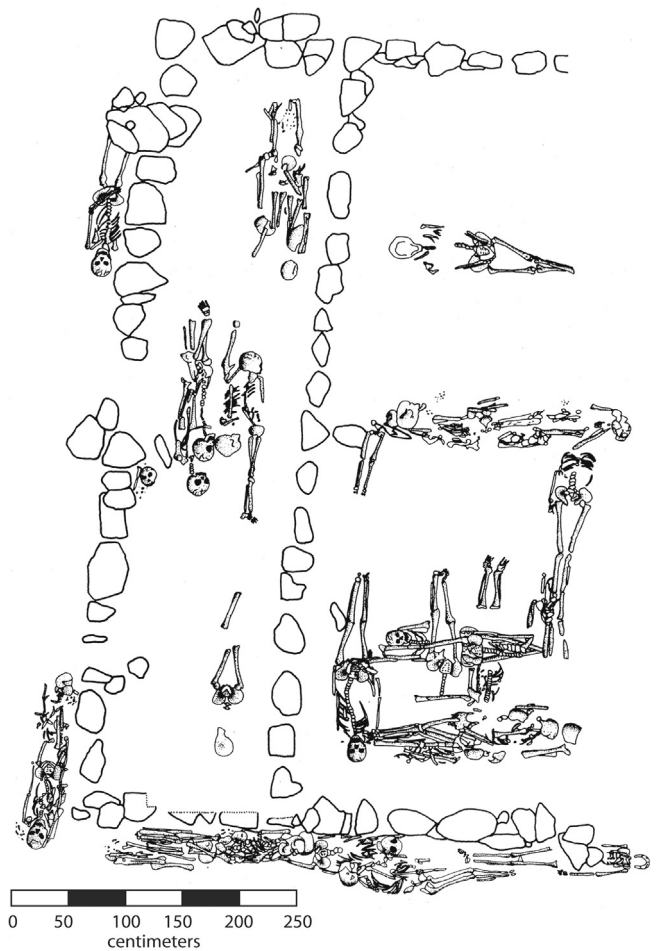


Fig. 3. The Structure 1 cemetery at Cerro de la Cruz (from Joyce, 1994: Fig. 9)

Proponents of the Monte Albán empire model offer an alternative interpretation of the Structure 1 burials. They argue that the Structure 1 burials represent the remains of a massacre and claim that the bodies

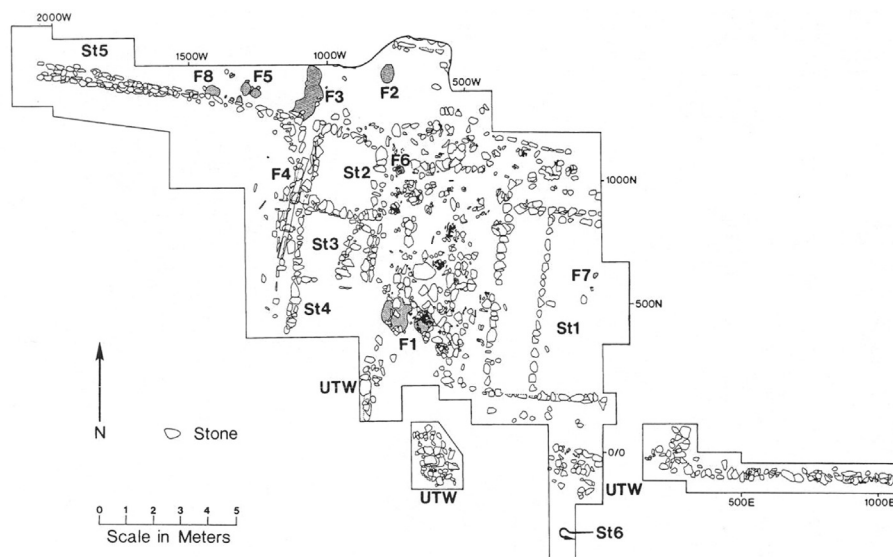


Fig. 2. The Upper Terrace at Cerro de la Cruz: St = structure; F = feature; UTW = upper terrace retaining wall (from Joyce, 1991: Fig. 5.2).

were still articulated and piled together in rooms without apparent disturbance (e.g., Balkansky, 1998; Spencer, 2007). This assertion, however, ignores the published data that show frequent instances of disturbance and disarticulation (Joyce, 1991, 1994; Joyce et al., 1998) a pattern observed elsewhere in the lower Rio Verde (Mayes and Barber, 2008). In fact, our published data show that the Structure 1 burials included articulated primary interments oriented within 10 degrees of cardinal directions, as well as disturbed and/or secondary burials. Frequent instances of later burials disturbing earlier ones, show that the cemetery was used over a significant period, probably several generations. For example, in Fig. 4, you can see later burials truncated by earlier ones. Stratigraphic evidence shows that there were between six and twenty-one separate burial events. Only two small test excavations penetrated beneath the upper two floors, so there remains a possibility that additional burials were interred beneath earlier floors as well. Joyce (1991:255) estimates that there was on average one adult interment in Structure 1 every 3.7 years, which supports the inference that this was a communal cemetery. Additionally, due to decomposition rates, mass fatalities require quick burial; here, the relationship to the structures, the planning and physical spacing of burials do not suggest a rushed context regarding burial type, location, and numbers involved (Cabo et al., 2012).

Spencer (2007:70–71) further claims that there is considerable evidence for burning associated with Structure 1 at Cerro de la Cruz that is consistent with destruction by fire. Three of the five building phases of Structure 1 have small patches of burned floor ranging from 0.3 to 1.5 m<sup>2</sup> (Joyce, 1991; Joyce et al., 1998). Small patches of burned floor such as these are not unusual in buildings from all time periods in the region. We view the burned floor areas on Structure 1 as resulting from cooking and/or the burning of incense during mortuary ceremonies and ritual feasting. Spencer (2007:70–71) furthermore misidentifies a large hearth intruding into the flagstone patio west of Structure 1 as a deposit of ash resulting from the burning of the building. The size of the hearth exceeds typical cooking features associated with residences, suggesting its association with communal feasting. Two middens excavated at the base of the terrace wall south of Structure 1 contained ash, charcoal, and charred maize along with a higher frequency of sherds from imported vessels (3.4% versus 0.4%) relative to typical contexts (Joyce, 1991). Structure 1 at Cerro de la Cruz and the granite flagstone patio are associated with three small storerooms and a possible residence. Instead of a massacre site, we interpret the patio, large hearth, storerooms, and cemetery as public areas where communal mortuary ceremonies and ritual feasting were practiced (Joyce, 1994).

The Cerro de la Cruz cemetery is part of a long tradition of cemetery burial in the lower Verde that differs from the household-focused burial

practices found in the Oaxaca highlands (Barber et al., 2013; Paul et al., 2013). Three other burial concentrations that we interpret as likely cemeteries have been discovered in the lower Verde region spanning the Late Formative to Early Classic. All of these burial concentrations were located in public spaces and/or public buildings, and, in three of the four cases, evidence for ritual feasting was also present. An early Terminal Formative burial concentration at Charco Redondo and an Early Classic one at the same site have not been sufficiently exposed to securely demonstrate that they were cemeteries, although the number and density of interments is strongly suggestive. At the site of Yugué, Barber (2005) excavated a late Terminal Formative cemetery located in a public building surrounded by evidence of ritual feasting and the emplacement of ceremonial offerings. The sample of human interments from the cemetery came from an excavated area of only 7 m<sup>2</sup>, yet yielded an MNI of 41 (Mayes and Barber, 2008).

In a recent article, Sherman et al. (2010:294) acknowledge that the evidence for sequential interment at Cerro de la Cruz contradicts the notion of a singular massacre event, but argue that violence may have occurred multiple times, and that the cemetery might still contain victims of a military conquest by Monte Albán. To evaluate this modification in the Monte Albán conquest argument, as well as the earlier argument that Structure 1 was a massacre site, we have begun a systematic bioarchaeological study of human interments in the region.

## 2.2. Bioarchaeology

Cranial trauma provides the best evidence of warfare and interpersonal conflict (Andrushko and Torres, 2011), whereas accidental trauma generally is focused on the post-crania of the skeleton (Torres-Rouff et al., 2006) and is associated with daily activities such as agriculture and travel through rough terrain (Standen and Arriaza, 2000; Torres-Rouff et al., 2006). Trauma type (blunt force, sharp force, and projectile), as well as its location on the skeleton and possible weapon style, may aid in determining the type of conflict. Crucial in this reconstruction is timing of trauma. Antemortem trauma can happen throughout life with either healed or healing bone at the time of death. Perimortem trauma is damage that occurs at or around the time of death with little to no visible sign of healing. With the former, the person recovers from the event and lives; with the latter, the individual does not heal, and presumably succumbs to the injury or others related to the event. When observed in large numbers, archaeologically, the latter is considered with the intent to kill. The former is considered an infliction of serious harm, but allows the individual to survive. This raises the question as to whether the engagement was warfare, conflict resolution through culturally accepted physical challenges, ritual, or a combination of them all. Researchers recognize that high rates of perimortem trauma are indicative of warfare. Healed antemortem trauma on the anterior and lateral portions of the skull result from face-to-face encounters. Whether from warfare, or negotiation of conflict through ritual violence, both are interpersonal violence, one with a greater intent to kill.

Studies on warfare and conflict from the Southwestern United States show that human skeletons exhibit both ante-and-perimortem traumas. Evidence of massacres at these sites includes perimortem processing of remains, and mass graves involving large numbers of individuals with evidence of perimortem trauma and hurried interment (Kuckelman et al., 2000; Hegmon et al., 2008). Hegmon et al. showed that social transformations and population movement were negotiated in a combination of ways across the Southwest, where an increase in violence did not have a direct relationship to an increase in health disparities or environmental change. However, hierarchy and differential access to resources were related to a population's ability to adapt to environmental change, with an indirect relationship to violence relating to intra and interpersonal conflict in competition for those resources.

Our goal for the Cerro de la Cruz skeletal sample is to test the following bioarchaeological hypotheses: 1) If Structure 1 was a massacre site, then its interments should exhibit significantly higher frequencies of

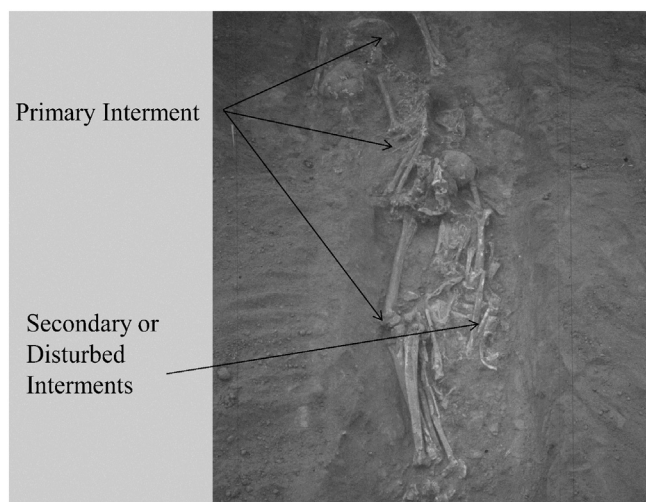


Fig. 4. Burials from the Structure 1 cemetery at Cerro de la Cruz.



traumatic wounds consistent with warfare than skeletal samples in other areas of the site and in the region as a whole; 2) If the lower Río Verde Valley was conquered by Monte Albán during the Late Formative, then rates of traumatic wounds consistent with warfare at Cerro de la Cruz would be significantly greater than those for other time periods. Our bioarchaeological data will also be considered in relation to the broader archaeological evidence. The results presented here are preliminary.

### 2.3. Methods

Basic bioarchaeological data on age and sex, along with a survey of obvious paleopathological and health indices, has been utilized on all human burials excavated in the region. The current study is more comprehensive regarding the osteological analysis and involves the systematic recording of evidence for traumatic wounds, pathological conditions, and taphonomic processes. Analysis was conducted on a structure-by-structure basis for both inter and intra site comparisons. While this is an ongoing process, to date, the pathological analysis of the Cerro de la Cruz sample includes 5 individuals from the Structure 1 cemetery along with 19 individuals associated with Structure 8, a residence on the Lower Terrace, and 2 individuals interred in Structure 9, a residence on the ground surface below the terraces. Sex was documented based on standard categories of skeletal morphology and anthropometric measurements. Age was determined through stages of tooth and skeletal development and degeneration (Schaefer et al., 2009; <https://osteoware.si.edu>). In the determination of age, sex, trauma, and pathology, sample size varies based on the available osteological data and skeletal elements present. The age and sex breakdown is as follows. Structures 8 and 9 are considered here together, and compared to Structure 1. From the lab analysis, both sexes are represented in the Structures 8 & 9 individuals, with 20% ( $n = 4$ ) female, 15% ( $n = 3$ ) male, and 65% ( $n = 13$ ) unknown; the high proportion of individuals of unknown sex is directly related to the high number of children in those structures. Structure 1 interments consist of 20% ( $n = 1$ ) female, 40% ( $n = 2$ ) male, and 40% ( $n = 2$ ) unknown. Age ranges were compressed into larger groups for general comparisons and were based on categories discussed in previous studies (Scheuer and Black, 2000; Mayes, 2016), child =  $\leq 13$ ; subadult = 14–18; and adult > 18. Children had the highest frequency at 60% ( $n = 12$ ) in Structures 8 & 9, followed by subadults at 20% ( $n = 4$ ) and adults 20% ( $n = 4$ ). In the burials from Structure 1, adults have the greatest representation at 80% ( $n = 4$ ) followed by subadults 20% ( $n = 1$ ). This difference between adult frequencies by structure is statistically significant [ $X^2 = 7.5$ , d.f. = 2;  $P < 0.05$  (0.023)]. Adults dominate the Structure 1 sample, while a more normal age profile is found in the other areas.

Paleopathological analysis of skeletal remains from the lower Río Verde Valley is complicated by severe taphonomic processes. The clayey sediments characteristic of most of the floodplain zone adhere to bone and create a cement-like coating that obscures surface features. A positive side-effect is that, once the sediment dries, it holds bones articulated in place. Another common problem is plastic distortion; bone is slowly warped, remodeled and crushed over time. The distortion is due to repeated wetting and drying from seasonal rains, combined with pressure from the weight of the heavy clayey and silty sediments of the region. The resultant crushing of bone makes identification of perimortem trauma more difficult, but does not mask antemortem trauma or disease processes. Taphonomic damage can also mirror perimortem trauma, requiring careful consideration of all possible processes that could affect the bone before and after death (Barber et al., 2013). However, it is analysis of the overall pattern that yields the most accurate assessment of the processes that took place (Ortner, 2003). For example, an observation on one individual has ribs with breaks that appear to be perimortem. But, a consideration of the overall pattern of breakage through a comprehensive examination of the skeleton shows that what seem to be perimortem fractures, are actually

post-mortem alterations with different stages of slow crushing over time.

Despite the taphonomic changes, traumatic defects to the bone, and pathological changes due to degeneration and infection, were described. All pathological changes identified during analysis were recorded (<https://osteoware.si.edu>, and Buikstra and Ubelaker, 1994) and include periostitis, osteomyelitis, cribra orbitalia, porotic hyperostosis, osteoarthritis and osteophytosis, linear enamel hypoplasia (LEH), and periodontal disease.

### 3. Results

The results of our paleopathological analysis show a low frequency of trauma and none that were the direct cause of death. In fact, none of the 5 individuals analyzed from the Structure 1 exhibited signs of traumatic injury. Trauma has only been observed in 6% ( $n = 1/18$ ) of the individuals analyzed from Structures 8 & 9. This difference was not statistically significant. The only definitive indication of trauma came from Structure 8. Burial 12-Individual 38 (abbreviated B12-I38; Fig. 5) was a female aged 28–44 years with a well-healed depression fracture on the left lateral/posterior parietal bone. The healed depression fracture must have been a serious injury as a hole that was present may either be from the original injury, a cloaca for the drainage of puss, or an enlargement of the foramen for the same purpose.

Periostitis was recorded in 10.5% ( $n = 2/19$ ) of the individuals from Structures 8 & 9, and 20% ( $n = 1/5$ ) of the individuals from Structure 1. Although often associated with osteomyelitis, it is also an independent condition. Periostitis, an infection to the outer sheath or membrane (periosteum) of bone which lays-down bone cells, is the result of either bacterial infection or localized trauma, and is not considered fatal. Non-specific periosteal reactions are common in the bioarchaeological record and can be discussed as a singular disease process, as well as part of a syndrome such as syphilis (Ortner and Putschar, 1985; Ortner, 2003). Skeletal elements most affected are the tibia and cranial vault, both of which are close to the skin surface. Dental and skeletal changes due to treponema infection in the lower Río Verde have been discussed elsewhere (Mayes et al., 2009, 2013). Periosteal reactions resulting from trauma are often documented with antemortem defects, although regular long-term insults from daily behaviors can also cause changes (Ortner and Putschar, 1985). The lack of antemortem defects, bilateral occurrence and its association with osteomyelitis in two of the three individuals in Cerro de la Cruz cemetery, indicate that trauma was likely not the causing factor. Osteomyelitis was documented in 5% ( $n = 1/19$ ) of the analyzed individuals from Structures 8 & 9, and 20% ( $n = 1/5$ ) of the individuals from Structure 1. Osteomyelitis, is a severe infection of the bone itself, and involves the periosteal and



Fig. 5. Burial 12-Individual 38 with antemortem blunt force trauma (photo by A. Mayes).

endosteal surfaces. A result of injury to the bone or skin, chronic osteomyelitis can continue for years, and lead to death if reaching the circulatory system, thereby spreading infection to other organs. As the infection continues, bone death may occur, while continued reactive bone is laid down. The infection produces pus that escapes through the soft tissue and a cloacal opening. Over time a bone within bone effect occurs, as new bone lays down over the original external cortical surface (Ortner and Putschar, 1985; Larsen, 1997). Osteomyelitis was observed in a robust adult male from Structure 1 (B28-I104) and on a female with a fractured skull from Structure 8 (B12-I38). In both cases the infection reached multiple skeletal elements.

Burial 12-Individual 38 is of particular interest as she is the only individual with documented trauma at Cerro de la Cruz. The evidence indicates chronic recurring osteomyelitis of both femurs (Fig. 6). The long-term bone remodeling, as well as bilateral involvement of the femurs, suggests that its cause was infectious. Healed and active bone remodeling indicates that she was fighting the disease at the time of death, and had been for some time. While it may or may not have been the cause of death, it would have created secondary problems that would have weakened her, allowing for other potential insults. B12-I38 also exhibited osteoarthritis in all observable joints, as well as osteophytosis with a particular emphasis on the cervical vertebra. Severe periodontal disease with antemortem tooth loss of all dentition except the left mandibular molars and second premolar was described. The occluding teeth had been missing long enough for calculus to adhere to the occlusal surfaces.

Porotic hyperostosis and cribra orbitalia, often considered a bony response to anemia, can be caused by nutritional stressors and is identified through changes to the outer table of the cranial vault bones caused by a hair-on-end orientation and expansion of the diploë through the cortical bone. A dietary explanation for porotic hyperostosis is broad as it encompasses malnutrition, food composition and absorption, particularly of grains such as maize, as well as parasitic infection and biological adaptation to fight off infection (Larsen, 1997; Ortner and Putschar, 1985; Ortner, 2003; Stuart-Macadam, 1992). Porotic hyperostosis was observed in 26% ( $n = 5/19$ ) of the individuals from Structures 8 & 9, and 40% ( $n = 2/5$ ) of those from Structure 1. This difference was not significant [ $X^2 = 0.35$ , d.f. = 1;  $P > 0.05$ ].

Linear enamel hypoplasias or LEH are bands, pits, or opacities in the tooth crown, which are permanent indicators of biological stress during development (Mayes, 2016). Examples of LEH denoting at least one period of stress were identified on 88% ( $n = 14/16$ ) of the individuals from Structures 8 & 9 as well as 100% ( $n = 4/4$ ) of the individuals from Structure 1; with a mean age of onset for the sample of 1.7. Periodontal disease was documented in both Structures 8 & 9 [19%,  $n = 3/16$ ] and Structure 1 [50%,  $n = 2/4$ ]. This difference is not statistically significant.

Osteoarthritis affects the bony joint surface through lipping, porosity, eburnation and polishing, and additive bone growth in varying degrees and can be the result of overuse, aging, and trauma. Osteophytosis involves similar bony changes, but specifically affects the vertebra and, therefore, can result in body compression and fusion. Osteoarthritis was present in 40% ( $n = 2/5$ ) of the individuals from Structure 1, and 36% ( $n = 5/14$ ) of the individuals from Structures 8 and 9. Osteophytosis was present in 16% ( $n = 3/19$ ) of the Structures 8 and 9 burials, and 60% ( $n = 3/5$ ) of those from Structure 1. This difference in frequency of osteophytosis is statistically significant [ $X^2 = 4.1$ , d.f. = 1;  $P < 0.05$  (0.042)]. The greater incidence of pathological conditions in the Structure 1 skeletons is undoubtedly a result of the significantly older average age of this sample compared to those of Structure 8. This is not surprising given the demographic emphasis of each burial area and the relationship between osteophytosis, periodontal disease and age.

#### 4. Discussion

The range of pathological conditions visible on the bones is consistent with broader regional patterns. For example, a similar set of pathologies was observed on skeletons from the late Terminal Formative Yugüe cemetery, although at generally lower frequencies, with 46% of individuals having pathological changes to the bone (Mayes and Barber, 2008; Melmed, 2006). Osteoarthritis is present in 18% of the individuals, with 27% recorded for osteophytosis, and 50% of the individuals having periodontal disease. Unlike Cerro de la Cruz, no incidences of periostitis, osteomyelitis, or bone infection were recorded. All of the adults with dentition exhibited at least one linear enamel hypoplasia, indicating that they had experienced and survived developmental stress. Porotic hyperostosis was recorded for 18%. The Cerro de la Cruz burials appeared, in general, to exhibit a higher incidence of infection and disease. It is likely these factors, rather than traumatic wounds suffered in battle, contributed to death. Like Cerro de la Cruz, there was no evidence that traumatic or fatal wounds were present in the Yugüe cemetery (Mayes and Barber, 2008). The political center of Rio Viejo (late Terminal Formative-Late Classic), which had both contemporaneous and later burials, showed statistically significant higher frequencies of osteoarthritis (82%  $n = 14/17$ ), osteophytosis (90%  $n = 9/10$ ), and periodontal disease (64%  $n = 9/14$ ). Trauma at Rio Viejo was recorded at a higher frequency (21%  $n = 4/19$ ) than Cerro de la Cruz, but was not statistically significant [ $X^2 = 2.76$ , d.f. = 1;  $P = 0.0961$ ].

In addition to the scarcity of traumatic injuries observable in the skeletal sample from Cerro de la Cruz, research has also addressed the possible presence of people from the Oaxacan highlands in the regional burial population. Since the Monte Albán imperialism model argues for a form of territorial imperialism where political administrators and military garrisons would have been installed in conquered regions, we would expect to see some highland Zapotecs interred in the region. One means of assessing the presence of foreigners comes from Alexander Christensen's (1998a, 1998b) study of biological distance using cranial non-metric traits and odontometric analyses. Christensen analyzed individuals from Late/Terminal Formative burials in the lower Verde region, including many of the Cerro de la Cruz burials, and found a significant divergence from populations in the Valley of Oaxaca, indicating minimal gene flow and arguing against the presence of large numbers of highland Zapotecs in the lower Verde. More recently, Sr isotope analysis was carried out on M2 and M3 molars from 14 individuals recovered in the lower Río Verde Valley. Sr isotopes can detect individuals who lived in other regions during childhood when their teeth were laying down enamel, in the case of M2s, typically between ages 4 and 13. The sample included 8 individuals recovered at Cerro de la Cruz including 6 from the Structure 1 cemetery, three of which are included in the current study, along with 3 Terminal Formative burials from Yugüe. Only one clear outlier was found an adult woman aged 25 to 35 years at death interred in the Structure 1 cemetery (Joyce et al., 2015). The



Fig. 6. B12-I38 femur with bone within bone affect from chronic infection (photo by A. Mayes).



remaining 7 all have similar signatures to both each other, as well as the site of Yugüe, indicating that they all were raised in the region.

## 5. Conclusion

Overall, the paleopathological evidence from the sample at Cerro de la Cruz does not support the hypothesis that the Structure 1 interments were the result of a massacre, or that death was commonly the result of battle. In fact, there was only one incidence of cranial trauma in the sample analyzed from Cerro de la Cruz, which was found on an adult female interred in a residence (Structure 8) and was not associated with the cemetery. Her injury was not on the anterior portion of the skull, as one would expect in interpersonal conflict, and it was well-healed signifying that the person lived long past the incident. Additionally, the periorbitis and osteomyelitis observed in the post-crania affected her lower limbs bilaterally and had no associated antemortem defects. Similar results were obtained from the later cemetery at Yugüe. Comparisons to Rio Viejo (late Terminal Formative–Late Classic interments) show that the incidence of trauma is lower at Cerro de la Cruz. Additionally, skeletal indicators of disease are low to moderate, with the highest rates being that of degenerative changes in the adult populations, and physiological disruptions during growth and development across all age classifications with a mean age of 1.7, likely due to stress during weaning as foreign bacteria is introduced along with food to the diet (Mayes, 2016).

Furthermore, the bioarchaeological data are consistent with regional archaeological data that have failed to find evidence for conquest and imperial administration of the region (Joyce, 2014; Joyce et al., 1998; Levine, 2013; Workinger, 2013; Workinger and Joyce, 2009). The data show no indications of mass graves, warfare, or conquest such as burned sites, settlement shifts into defensible piedmont locations, defensive walls, or evidence of Zapotec enclaves or administrative facilities. The region was home to impressive political centers by the later Formative that would have been formidable opponents to Zapotec expansion, with San Francisco de Arriba reaching 95 ha during the Late Formative, and Río Viejo growing to 225 ha by the early Terminal Formative (Joyce, 2010). In addition, the lower Verde lies 150 km southwest and about a week's hard travel through rugged mountains from Monte Albán, which would have created significant logistical challenges for imperial armies and administrators. Overall, the current bioarchaeological data, combined with the regional archaeological record, make it highly unlikely that the lower Río Verde Valley was conquered and incorporated into an empire centered at Monte Albán.

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