

Osteobiography of a High-status Burial from the Lower Río Verde Valley of Oaxaca, Mexico

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ABSTRACT This paper presents the osteobiography of an individual from an early complex society who was clearly of "special" social status but was not classified a ruling elite. Our case derives from a unique burial found at the small site of Yugüe, located in the lower Río Verde valley on the Pacific coast of Oaxaca, Mexico. Burial 14-Individual 16 (B14-I16) dates to the late Terminal Formative Period (CE 100–250), an era of regional political centralization and concomitant social inequality. B14-I16 was interred with several valuable grave offerings. A plaster-backed pyrite mirror was found below his mandible, and his left hand held an elaborately incised flute made from a deer femur. The flute is the only object of its kind known for all of Terminal Formative Mesoamerica. Drawing on the physicality of inequality, we employ osteobiography to assess the social hierarchy. Although B14-I16 was clearly an individual of unusual status in the context of Yugüe, he was not immune from the biological assaults that affected people of less distinguished social position at this time. Like his contemporaries of all social statuses, he suffered ill health in the years during which he was weaned. However, a longer weaning period and access to additional resources may have positioned him to endure later illness better than others in this population. Passing the critical transition period at age 6 ½, a time when many children died in this burial site, his adolescent health was better than that of others in this population. Although B14-I16 did have adult responsibilities, he didn't engage in the kinds of physical labour that marked the skeletons of others. The placement of Burial B14-I16 in the middle tiers of the lower Río Verde valley's ancient social hierarchy provides insight into issues of inequality and status on an individual scale. Copyright © 2008 John Wiley & Sons, Ltd.

Key words: osteobiography; bioarchaeology; Oaxaca; Mexico; dentition; hypoplasias; pathology; status

Introduction

Inequality in ancient societies is a topic most easily examined at its extremes: the elaborate and often monumental tombs of rulers and nobles are easily identified when contrasted with the modest

burials of commoners. Those who inhabited the diffuse middle area of ancient social hierarchies, however, are far more difficult to identify and study. In the Western hemisphere, where many Precolumbian stratified societies were either non- or minimally-literate, detailed analysis of inequality and hierarchy relies largely on extrapolation from early European accounts, or the handful of cases where sufficient indigenous writing exists in order to step beyond a simple elite/non-elite dichotomy. Despite these limitations, scholars

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have been able to demonstrate the complex and multifaceted character of Precolumbian social hierarchies for later groups such as the Aztec, Inka, Postclassic Mixtec, and Classic Period Maya. However, the nature of inequality and hierarchy in earlier complex societies remains less well understood. The 'middle ground' of social hierarchies in early cases is particularly challenging to examine, given the limits of archaeological and osteological evidence and the lack of written records or appropriate ethnographic and historical analogies.

To better understand the nuances of hierarchy in ancient societies where writing is limited or absent, many lines of evidence must be employed to provide a detailed picture of inequality as a lived experience. This paper presents the osteobiography of a single individual from an early complex society who was clearly of 'special' social status but was not a member of the ruling elite. Following current anthropological thought, osteobiography is the close examination of an individual's life and death as evidenced by human skeletal remains: a life history as revealed through the analysis of osteological evidence. With its focus on individual lives, osteobiography makes it possible to determine how social and environmental differences impinged on human health and affected everyday life at a very small scale. Such fine-grained information is invaluable for considering middle-ground social strata because people inhabiting these positions in ancient hierarchies have received considerably less attention from scholars. Concentrating on specific individuals, and comparing these individuals to the wider contemporary population, makes it possible to interpret how status may have affected health and lived experience for people who were neither ruling elites nor commoners.

Osteoarchaeology is a particularly effective means of examining status and social hierarchies because both are strongly implicated in individual and population health. A number of recent studies have focused on biocultural relationships, including the relationship between social status, disease processes, and one's ability to recover from environmental pressures, cultural or otherwise (Walker, 1986; Goodman *et al.*, 1988; Cucina & Iscan, 1997; Pechenkina & Delgado, 2006). Some have even used pathology and burial type to make

determinations of ascribed or inherited status (Hodges, 1987; Cucina & Iscan, 1997). Competition for resources – and a person's access to, and control of, those resources – may enable some individuals either to avoid biological assaults or to overcome them, where others might succumb. Additionally, the daily life of individuals or entire segments of society are affected by position within a social hierarchy. As Pechenkina & Delgado (2006: 218) observed, 'disparities in the amount of physical labor performed and contrasts in daily routine among individuals of unequal status likewise contribute to systematic health differences within a stratified community'. Thus, inequality engenders osteologically observable differences in individuals' health and physical condition.

Drawing on the physicality of inequality, we employ osteobiography to assess the social hierarchy of an early complex society in Precolumbian Mesoamerica. A single burial was read from a forensic perspective and then interpreted using the site and the burial context as evidence for the individual's status in life and death. Scientific determination of the individual's sex, age and health, when resituated with contemporary burials and archaeological evidence, demonstrate that the remains represent a life of particular significance within one ancient community. Our case derives from a unique burial found at the small site of Yugüe, located in the lower Río Verde Valley on the Pacific coast of Oaxaca, Mexico (Figure 1) (Barber, 2005). Burial 14-Individual 16 (B14-I16) dates to the late Terminal Formative Period (CE 100–250), which was an era of regional political centralisation and concomitant social inequality in coastal Oaxaca (Barber, 2005; Joyce, 2006, 2008). Because Individual 16 was buried in a community cemetery at a small site, this individual was probably not a member of the regional ruling elite who would have lived at the lower Verde Valley's much larger ancient political capital, Río Viejo. Indeed, when compared with contemporary tombs and interments from other parts of Oaxaca and Mesoamerica, the Yugüe burial is relatively modest (*cf.* Caso, 1932; Caso & Bernal, 1952; Miller, 1995; Winter, 1995). B14-I16 thus provides an ideal case for considering the everyday experience of social hierarchy for those people who were neither rulers nor commoners.

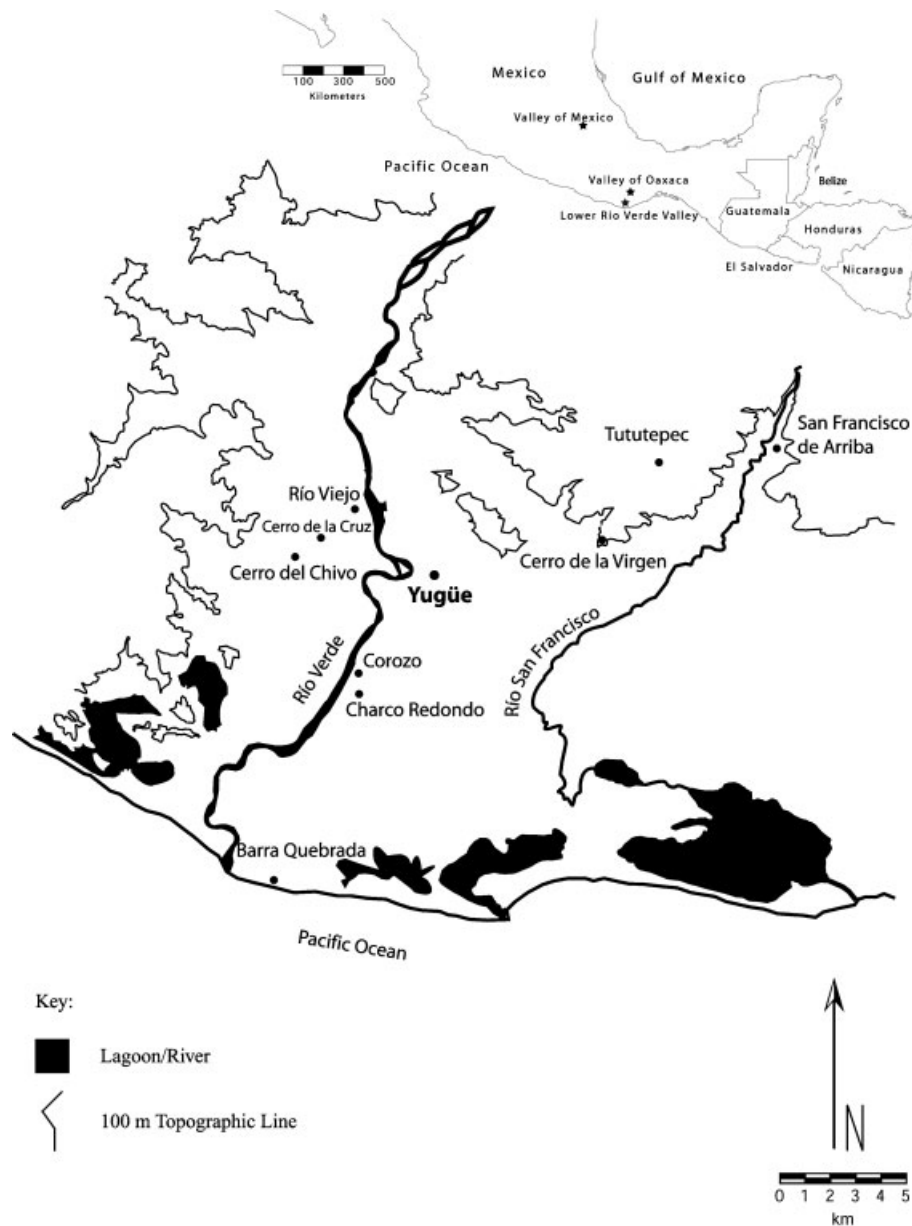


Figure 1. Map of the lower Río Verde Valley, Mexico, with the study location.

Archaeological context

Yügüe is a 9.75 hectare site located on the floodplain of the Río Verde. The core of the site is a 10 m high monumental platform, first constructed around 150 BCE, that supported domestic and ceremonial architecture (Joyce, 1999; Barber,

2005). Yügüe was occupied continuously from the late Middle Formative Period (700–400 BCE) until the late Terminal Formative Period, after which time it was abandoned for nearly a millennium. During the Terminal Formative Period (150 BCE–CE 250), Yügüe was a small site within a regional polity that was politically centred

around the 250 ha site of Río Viejo (Joyce, 2003, 2006).

The summit of the Yugüe platform supported a public ceremonial space that, in its final iteration, consisted of an elevated area of nearly 1500 m² created by the placement of massive earth and stone retaining walls (Barber, 2005). This area was used for community burials throughout the Terminal Formative Period; no fewer than 53 individuals have been documented for this area of the site, while no burials have been recovered elsewhere (Joyce, 1999; Barber, 2005). B14-I16, the focus of this study, was part of a temporally and spatially distinct cemetery dating to the late Terminal Formative Period.

The cemetery contained at least 44 individuals, densely packed into an area of less than 7 m² (Figure 2). Only three individuals were fully articulated; the rest had been disturbed by the placement of later burials, and some may have been secondary burials. Individuals' ages within the cemetery ranged from neonate to elderly adult. In general, adults were buried in an extended position, placed on their right side with their head to the west. Juveniles were placed perpendicular to the adults, lying on their left side with their head to the south. There were some exceptions to this pattern, particularly among individuals that had been severely disturbed by subsequent interments.

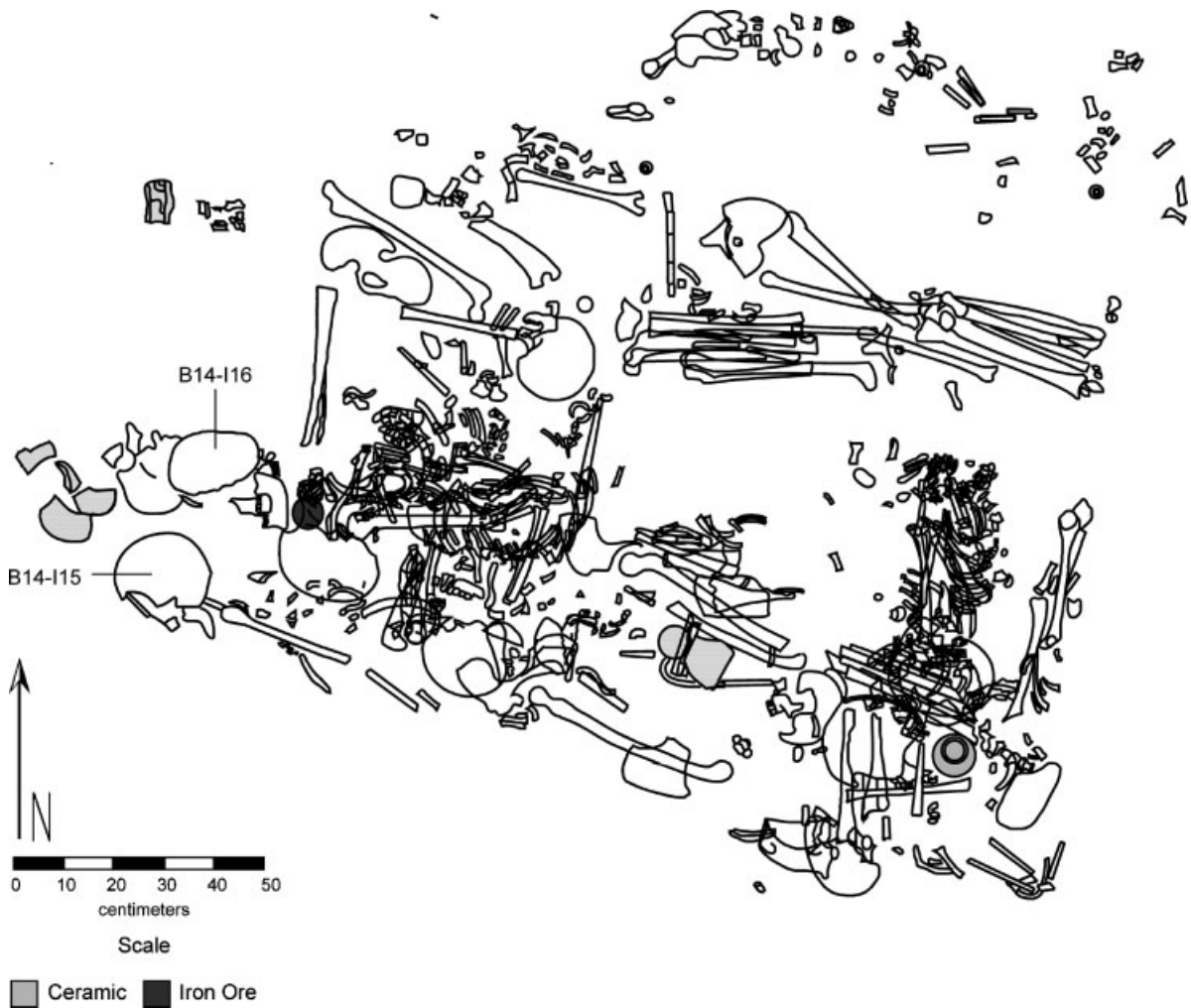


Figure 2. Map of the skeletal material found in the Yugüe cemetery.

Materials and methods

Recovery and analysis of human skeletons from Yugué

Preservation of human remains from the late Terminal Formative cemetery was consistently poor due to both cultural and natural factors. The site's ancient inhabitants intensively used and reused the same small area for interment, which resulted in the disarticulation of some skeletons, the partial destruction and removal of others, and the commingling of individuals in all instances. In addition, the surrounding matrix had a high clay content that created a layer of cementum on the bones, which proved extremely difficult to remove without damaging their surfaces. The upper layers of the cemetery were close to the modern ground surface, exposing the bones to seasonal wetting and drying. The combination of seasonal moisture changes, clay-based soils, compaction from nearly 2000 years of human activity, and the practice of interring individuals on their sides resulted in severe plastic distortion of crania and pelvises. The cranium of Individual 16, for instance, was distorted medio-laterally through these natural processes from its full size to a width of approximately 5–7 cm. To maintain the integrity of badly cracked bones and to protect bone surfaces from rapid desiccation, most were removed from the ground in blocks of earth, or pedestals, to be fully excavated in the field laboratory.

The taphonomy created particular challenges for the study of Individual 16. The clay-based cementum could only be removed through a time-consuming application of acetone over small areas. Although all bones present were brushed with acetone and water to some extent, only whole elements and those portions of selected elements deemed essential for analysis received a complete cleaning. Such elements included: the skull and dentition in their entirety, the pelvic girdle, long bones, and joint surfaces. This process was necessary in order to observe the degree of suture and epiphyses closure, dental enamel, and any bony changes. When possible, reconstruction of fragmentary elements took place to aid in description and analysis.

Following standard methodology, ageing of this individual was carried out through obser-

vation of developmental changes affecting suture closure, dental development, and diaphysis and epiphyseal union (White, 1991; Buikstra & Ubelaker, 1994; Ubelaker, 1999). Due to taphonomic processes, techniques such as observation of changes in the symphyseal faces of the pubic symphysis or of the auricular surfaces of the right and left innominates were not viable. The sex of this individual was determined visually using cranial and innominate morphology, as well as overall body size (White, 1991; Buikstra & Ubelaker, 1994; Bass, 1995). Ageing and sexing techniques for Individual 16 will be explained in greater detail in the Results section. Anthropometric measurements were limited for this individual, again due to its fragmentary condition. Pathological analysis of the dentition was carried out both through standard scoring of size and placement of caries, dental attrition, and physical measurements of linear enamel hypoplasias. Bony changes to the crania and post-crania were recorded using the guidelines defined by Buikstra & Ubelaker (1994). All pathological changes identified during analysis were recorded.

Archaeological assessment of social status

The initial interpretation of Individual 16 as a person of special status was derived from field documentation of archaeological context and laboratory observation of associated artefacts. Individual 16 not only differed from others in the late Terminal Formative cemetery, but also from other individuals buried elsewhere at the site and across the valley. Following the general pattern of the cemetery, Individual 16 was interred as an adult: on his right side with his head to the west (Figure 3). Special care was taken to keep this individual's remains intact for some time after his death. His was one of the three fully-articulated skeletons in the cemetery – despite the subsequent interment of six individuals above his torso and lower limbs (Barber, 2005). Individual 16 was also unusual because he was interred with several valuable grave offerings. A plaster-backed pyrite mirror was found just below his mandible, and in his left hand he held an elaborately incised flute made from a deer femur (Figure 4). The flute and pectoral interred with Individual 16 are

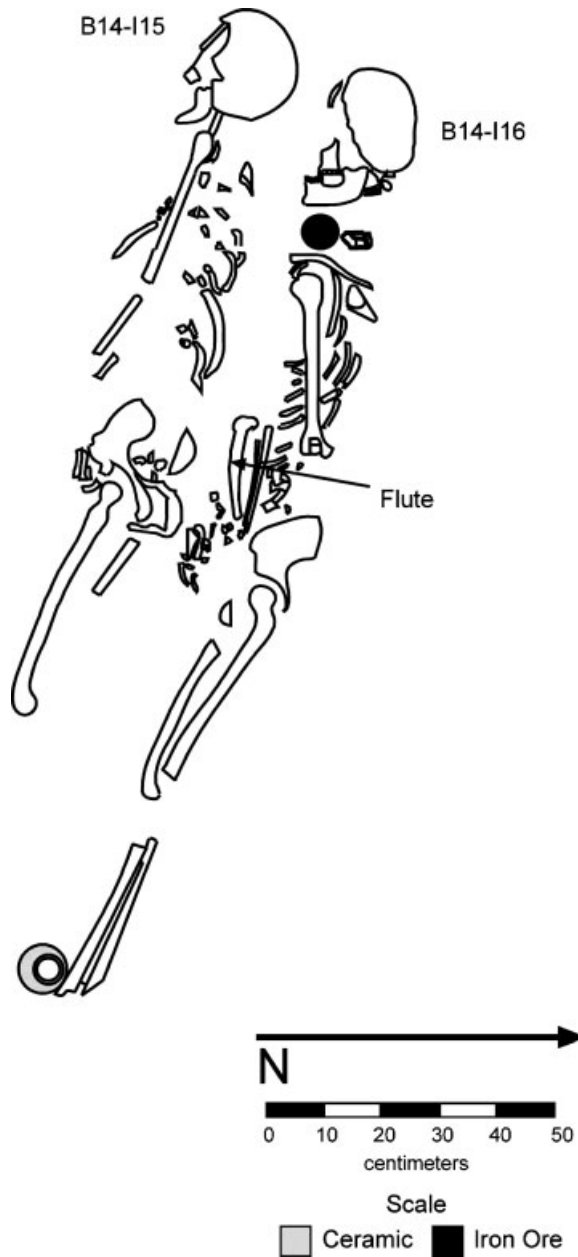


Figure 3. Close-up view of Burial 14-Individual 16.

among the most elaborate and valuable objects ever recovered from an archaeological context in the lower Río Verde Valley. Neither pyrite nor the limestone necessary for plaster occur naturally in the lower Verde, indicating that the raw materials for this object were imported, possibly from the sierra to the north. The flute, meanwhile, is the only object of its kind known for all

of Terminal Formative Mesoamerica (Barber, 2007).

Taken together, the treatment of this individual both during and after his interment indicates that he was of higher status than the other individuals in the cemetery. The grave goods included with this interment are the most elaborate currently known for the Precolumbian Period in the region. He was buried with two very unusual and valuable items, one of which was produced with imported raw materials. Furthermore, mirrors were symbols of leadership and elite status across Mesoamerica throughout the Precolumbian era (Schele & Miller, 1986; Taube, 2002; Miller & Martin, 2004). In addition, the craftsmanship of the flute is remarkable: both the incising and the production of a musical instrument would have required specialised knowledge. Beyond the artefacts themselves, the fact that Individual 16 was left intact suggests that Yugué's ancient residents took particular care of his remains long after his death. The placement of six later burials resulted in the disturbance of other individuals in the tightly-packed cemetery, but Individual 16 was left completely intact. Indeed, his was the most complete skeleton in the entire burial sample from Yugué.

Comparison with contemporary interments elsewhere in Oaxaca indicate that Individual 16 was most likely a local or 'intermediate' elite (see Elson & Covey, 2006), who was neither a ruler nor a commoner. While B14-I16 currently is among the most elaborate known for the lower Verde region, there are no contemporary burials or tombs from Río Viejo, the major political centre closest to Yugué. Terminal Formative Period high-status interments from the Valley of Oaxaca include several tombs that were far more elaborate than the burial of Individual 16. Tomb 77, from an outlying barrio of the site of Monte Albán, contained a massive anthropomorphic urn, dozens of ceramic vessels, carved shell ornaments, and an incised animal bone (Caso, 1935). The interiors of some Terminal Formative tombs from the Valley of Oaxaca were also painted with polychrome frescoes (Acosta, 1965), evidence that considerable resources were invested in the burial of high-status individuals at this time. Tombs were also in use in the Mixteca Alta region of Oaxaca. Although the few



Figure 4. Flute interred with Individual 16. This figure is available in colour online at www.interscience.wiley.com/journal/oa.

stone tombs known were looted in antiquity, one beneath a residence at the site of Huamelulpan nonetheless contained two skeletons and nine vessels (Gaxiola Gonzalez, 1984). Compared with contemporary interments at major political centres elsewhere in Oaxaca, the burial of Individual 16 does not appear to have been as elaborate. This individual was not interred in a tomb, an architectural feature that requires considerable labour investment and was widely employed in Terminal Formative Mesoamerica for rulers and individuals of very high status. Furthermore, the grave goods associated with this individual, while valuable, were relatively few in number.

Results

Age and sex

Based on cranial and postcranial morphology, Individual 16 was male aged 15–17 years at the time of his death. Compared with other reconstructable crania from the Yügüe collection, Individual 16's skull is more robust, with large mastoid processes extending well below the auditory meatus, prominent supraorbital margins and glabella, and a strong square mental eminence. The skull is large with marked rugosity on the muscle attachment sites. The temporal and squamosal lines are well developed. Despite the large amount of *post mortem* damage to the inno-

minates, features were identified and described with partial reconstruction of the left side. The left innominate is robust with a long ischium. The acetabulum is large (White, 1991), measuring 49.78 mm in width, and is directed laterally. While the pubic bones are missing, the remaining features, including overall size and placement of the acetabulum, and the shape of the greater sciatic notch, indicate a male.

Three regions of the skeleton were used to age this individual: the skull, the dentition, and the postcrania. All observable cranial sutures were open ectocranially, both on the vault and the lateral portions. Taphonomic process actually worked in our favour for ageing this individual using dentition. As is common in archaeological specimens, the dentition had the greatest preservation. However, the alveolar bone was crushed in a way that allowed observation of the tooth roots, particularly of the molars, while still holding the dentition *in situ*. The dentition has only slight blunt wear. The first and second molars, maxillary and mandibular, are fully erupted. The first molars have root complete with apex two-thirds closed. The second molars are root apex $\frac{1}{2}$ complete. The third molars are erupting with root $\frac{1}{2}$ complete. The dentition alone places this individual between 15.1–16.3 years of age at death (Moorees *et al.*, 1963a,b; Buikstra & Ubelaker, 1994). Also present is a partially fused iliac crest (Figure 5). The initial fusion begins around age 14 and continues until cessation by the age of 23 (Bass, 1995). The

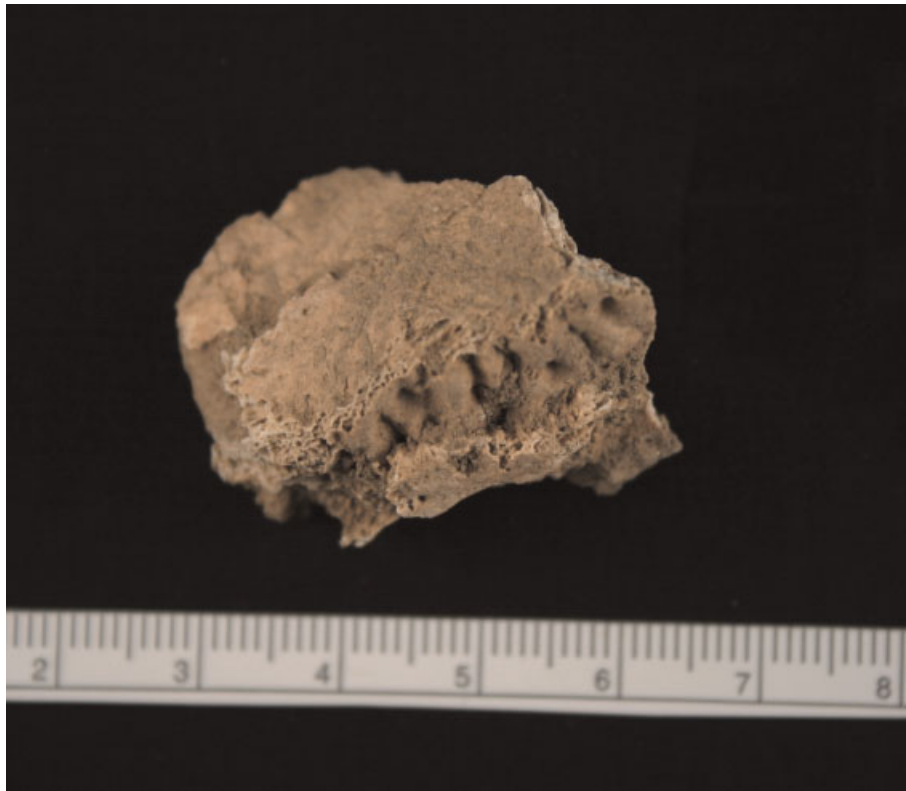


Figure 5. The partially fused iliac crest of Individual 16. (Photo: Angela Berg Collins). This figure is available in colour online at www.interscience.wiley.com/journal/oa.

ischial tuberosity is partially fused (ages 16–20), as well as the right femoral head (ages 14–19) (Scheuer & Black, 2000). The right calcaneus appears unfused. According to Scheuer & Black (2000: 463) the calcaneus epiphysis fuses around puberty (12–16) and is not obliterated until the age of 18–20 in males. The fact that the epiphysis is not obliterated clearly places this individual under the age of 18. A fragment of a posterior lumbar spine is only partially fused. Scheuer & Black (2000) note that the spinous processes commence fusion after puberty and up to the age of 24; Bass (1995) places it at less than 18 years of age. Taking all elements together, the age range can be narrowed to place this individual between 15 and 17 years of age at death.

Pathological analysis

Observations of disease processes provide evidence for an individual's daily life and environment. These can include: natural degenerative

phenomena, occupational stress, trauma, nutrition, and systemic health. In cases where bone preservation is poor, occurrence rates of dental pathologies can be particularly valuable. Pathologies such as caries, abscesses, hypoplasias, alveolar resorption and dental attrition can help to determine aspects of diet, and may also serve as a gauge of overall health (Goodman & Martin, 2002). Previous research has shown that occurrence rates for these conditions will vary among populations based on differences in subsistence economy, as well as that of local flora and fauna (Larsen, 1995). Occupational stress and cultural traditions can also be observed in the dentition (Ubelaker, 1969; Schulz, 1977; Molnar, 2008). Wear patterns outside of the normal plane of wear, rapid attrition rates, polishing, and interproximal and occlusal grooves, can all be assessed for different forms of occupational stress.

Dental analysis of Individual 16 found no dental disease present. Dental attrition is minimal, as would be expected for a younger



Figure 6. Teeth from Individual 16 showing linear enamel hypoplasia (LEH). (Photo: Angela Berg Collins). This figure is available in colour online at www.interscience.wiley.com/journal/oa.

individual, and follows a normal plane of wear. There are no carious lesions on the tooth crowns or roots; the alveolar bone is healthy with no alveolar resorption, and no calculus build-up, unlike others in the population. The only indication of biological stress for this individual is in the form of linear enamel hypoplasias (LEH) (Figure 6).

Enamel hypoplasias are defects in the enamel tooth crown induced by systemic stress during tooth formation. A permanent record of health disturbances both *in utero* and during childhood, enamel defects are caused by disease (such as scurvy, rickets or measles), infections, fevers, gastrointestinal disorders (such as chronic diarrhoea), malnutrition, premature birth, anaemia, and, in some instances, from inherited factors or trauma. Dental hypoplasias formed on deciduous dentition *in utero* are also an indirect indicator of the mother's health status (Goodman & Armelagos, 1988; Goodman & Rose, 1990: 59–110; Blakey *et al.*, 1994; Hillson, 1996; Cucina & Iscan,

1997; Rankin-Hill, 1997; Wright, 2006). Determination as to when such disruptions in enamel formation took place are carried out by measuring from the cemento-enamel junction (CEJ), to the occlusal/superior border of the linear enamel hypoplasias. These measurements, taken in mm using needle-nosed callipers, are then used in a regression formula that calculates the age of onset for the said period of stress (Goodman & Rose, 1990).

Enamel hypoplasias are observable for B14-I16 in all dental fields except the third molars. Regression analysis (Goodman & Rose, 1990) of all the dentition exhibits episodes of biological stress ranging from 2 to 6.5 years of age, with a peak clustering of hypoplasias between the ages of 3 to 4 years – indicating more serious episodes at these times. While there is a total of 60 linear enamel hypoplasias among all the dentition present, the greatest number in the population, this is most likely due to the fact that B14-I16 is the most complete burial. A count of the total

number of episodes of stress on a single tooth, maxillary second incisor (I2), is five. With an additional period of stress evident in the second molars after the development of the incisors, this individual suffered six episodes of biological stress recorded in the enamel crowns. This number is the highest in the collection, again probably due to the fact that B14-I16 constitutes the most complete set of remains. On a final note, it should be pointed out that the early-stage and late-stage hypoplastic bands are narrow and shallow, indicating that – despite physiological differences between dentition – the early and late episodes of stress were not as severe, and would have had less of a negative affect on this individual. The developmental disruptions of greater severity appear between 3–4 years of age as determined by the greater width and depth of the hypoplastic bands (Cucina & Iscan, 1997). It would seem that, despite early stress during development due to weaning and periodic

adjustments to an adult diet, this individual was otherwise relatively healthy.

Allowing for severe *post mortem* processes, there is no evidence of trauma. This individual has robust muscle attachments areas, indicative of a male and consistent with his age (Weiss, 2007). However, repetitive overuse normally suggestive of heavy labour or occupational stress (Hawkey & Merbs, 1995; Robb, 1998) is not evident. The joint surfaces available for observation are the left clavicle, the left glenoid fossa, the left and right proximal and distal radius, the left proximal ulna, the left and right acetabulum, the right and left proximal femur, and the right proximal and distal tibia. All of the joint surfaces appear normal and healthy with no sign of premature joint degeneration (Figure 7). Neither the dentition nor the rest of the skeletal elements reflect any degree of occupational stress, degenerative disease, or pathological changes, other than the developmental stress reflected in the dentition.



Figure 7. Example of a healthy joint surface from Individual 16, with some change due to taphonomic processes. (Photo: Angela Berg Collins). This figure is available in colour online at www.interscience.wiley.com/journal/oa.

Summary

Based on osteological analysis, Individual 16 was an adolescent male who did not suffer any strong biological demands during development. Cause of death is unknown. There were no disease processes in place at the time of death severe enough to affect the bone, nor was there any visible trauma. Like many individuals in this population, there are dental indicators of stress at weaning. However, Individual 16 differed from many other individuals in this population in that he successfully survived and rebounded from these stresses, giving no later indicators of illness. Degenerative changes of both bones and teeth can begin at an early age if an individual is carrying out repetitive tasks (Mayes, 2001; Weiss, 2007). Because no such bony changes have taken place on the skeleton of this young man, we presume that he was not required to perform demanding, recurrent physical activity.

Discussion

Taken together, osteological and archaeological evidence provide significant insight not only into this individual's lived experience as a local elite at Yugüe, but also larger social processes in the Terminal Formative lower Rio Verde valley. Through a fortuitous combination of archaeological context and osteological data, it is possible to assess culturally embedded notions of adulthood through this burial. Reaching full biological development and being considered an adult from a cultural perspective are definitively different processes, although often considered as one and the same in modern Western society. Age, sex, grave goods and burial context demonstrate that Individual 16 had assumed the responsibilities of adulthood by at least late adolescence. From a physiological perspective, Individual 16 was not a fully developed adult when he died. His burial position, however, marked him as an adult. Individual 16's adult status, in itself, is not surprising: the cultural designation of adulthood would undoubtedly have come at an earlier age almost 2000 years ago, when life expectancy was much shorter (Larsen, 1997). Indeed, from a biological perspective Individual 16 would have been at or near

his prime reproductive years. However, his burial furniture demonstrates that this individual had a specific set of adult responsibilities. As one of us has discussed elsewhere (Barber, 2005), the mirror and flute interred with Individual 16 both had potent ritual associations in Mesoamerica. Mirrors were consistently associated with elites, and particularly rulers or decision-makers, in the Precolumbian era. The iconography of the flute, furthermore, reveals strong associations between the instrument and important natural forces such as wind and rain (Barber, 2007). Since Individual 16 was in possession of this object in death, it seems probable that he was responsible for playing the flute in life and thus for invoking these natural forces on behalf of Yugüe's inhabitants.

Dental indicators support the notion that Individual 16 may have inherited his responsibilities. Like others in the Terminal Formative cemetery, Individual 16 suffered from early biological stress as visible through linear enamel hypoplasias. All individuals in this population ($n = 13$) with utilisable dentition demonstrated stress at the age of weaning. The mean age of onset often reveals a pattern of overall population health and the commencement of what may be periodic stress, making it useful for intra- and inter-population comparisons (Goodman & Rose, 1990; Cucina & Iscan, 1997). At Yugüe, the mean age of onset for hypoplasias was 2.71 years of age (Melmed, 2006). That of Individual 16 was slightly higher, with an individual mean of 4.3 and initial onset of approximately 2 years of age. The difference may indicate that the duration of the weaning process lasted longer for this individual – a factor that could weigh heavily in favour of a person facing biological challenges yet to be overcome. It may also suggest that this individual was in a position of having greater accessibility to available resources, thereby influencing an earlier age of inclusion of food sources into the nutrient intake.

Weaning an infant from breast milk to the available dietary regime is a process, not a single event. The first enamel hypoplasias may be the result of the onset of weaning, followed by peaks in hypoplasia occurrence upon completion of the process. Post-weaning disturbances may be linked to seasonal variation of diet during the early

years. These seasonal variations can reflect disturbances that also affect adults in a population. Childhood diseases and high fevers can also create periods of cessation in enamel development (Blakey *et al.*, 1994; Hillson, 1996). Weaning not only directly affects ingestion of nutrients but also exposes individuals to new environmental insults directly through the food itself, increasing the potential for exposure to such things as parasites, bacteria and viruses (Kent, 1986; Reinhard, 1988). Methods of food preparation and processing may also play a role in exposure. Herring *et al.* (1998) found an indirect correlation between duration of weaning period and infant mortality. Skeletal and chemical analyses supported by historical documentation revealed a correlation between receiving nutrition from sustenance other than breast milk, and age of infant mortality. Likely weaned over a longer period, Individual 16 may have been better protected from some biological assaults than were other individuals in this population. It could be hypothesised that a lengthier delay in weaning indicates a lack of environmental or cultural factors that would encourage direct nutritional disengagement between mother and child.

Individual 16's special status may also be reflected in the fact that, once he was weaned, he suffered fewer biological assaults than others in this population. Two out of four adults whose third molars were present had a single hypoplastic band. Hypoplastic lines were absent from Individual 16's third maxillary and mandibular molars, indicating that severe incidences of biological stress did not take place during later dental development for this individual. However, a biological disturbance did cause linear enamel hypoplasias on the second molars at approximately 6 years of age. This final physiological disturbance, which Individual 16 overcame, coincides with a distinct age marker in this population. Following a normal demographic distribution, the highest number of individuals falls into the age categories of infant (22%) and middle and older adults (22.8%). Forty-one per cent of this collection ($n = 13/32$) were under the age of 7 years at death. Of this, 54% ($n = 7$) are infants (0–2), and 46% ($n = 6$) are aged 2–6.8 years of age at death. Out of this latter group, half ranged between 5.5 and 6.8 years of age at death.

This mortality pattern indicates a critical developmental point in the Terminal Formative Yügüe population. It was a demarcation line that, when successfully crossed, meant that an individual had a greater chance of surviving to adulthood. Individual 16 did recover from this final assault with no indication of later childhood disease – at least to the degree to which it can be recorded in bone. From the standpoint of skeletal anatomy this individual appears not to have suffered from any long-term biological assaults. Based on his dental health, Individual 16 was generally healthier than most individuals interred in the Terminal Formative Period cemetery: he enjoyed a prolonged weaning period, he survived the 6th and 7th years of his life, and he did not suffer any serious diseases in his later childhood and early adolescence.

Although Individual 16 had adult responsibilities, he was not engaged in repetitive, physically demanding tasks. Observations as to the degree of prominence of muscle attachment regions on bone are made and used in assessment of both sex (Owsley, personal communication) and mechanical activities (Hawkey & Merbs, 1995; Churchill & Morris, 1998; Robb, 1998; Wilczak, 1998; Weiss, 2007). While recent authors have offered alternative methodologies for assessing the degree of variation between and among populations in terms of tendon insertion points, all still agree that there is a pattern to be found. The skeletal morphology of Individual 16 reflects a person of greater muscle mass, and thus a male. However, there is no evidence of repetitive movement to the point of overuse, as would be seen in an individual with occupational stress (Robb, 1998). Degenerative joint disease (DJD) is a reaction of the joints to biomechanical stress and affects the joint surfaces and the circumferentially associated areas (Larsen, 1997; Ortner, 2003). While one would expect to see some degeneration exhibited on an older individual, research shows that there is much variation between populations, and that such degenerative changes are not uncommon in older juveniles and young adults in pre-industrialised societies (Larsen, 1997). Although we did not observe degenerative changes for Individual 16, such changes were recorded in other adults in the Yügüe cemetery (Table 1). Eleven individuals were considered

Table 1. Skeletal pathology

Degree of skeletal pathology (dental not included)	
Slight	27.3% (<i>n</i> = 3)
Significant	18.2% (<i>n</i> = 2)
None	54.5% (<i>n</i> = 6)

Adapted from Melmed (2006).

feasible for observation. Despite severe taphonomic processes to all the skeletal material, 45% (*n* = 5) exhibited arthritic conditions (Melmed, 2006). Two of these were young adults (18–25), and three fell into the middle adult category (25–35), together indicating that there were other young adults in this cemetery with bony changes suggestive of repetitive overuse of joints, and therefore differences in behaviour (Table 2).

A final indication of Individual 16's health can be derived from observation of porotic hyperostosis in the Yugüe skeletal collection. Porotic hyperostosis is the expansion of diploë through the external skull vault. It may be symptomatic of several different diseases and health conditions, but is most often associated with anaemia (Walker, 1986; Stuart-Macadam, 1992; Ortner, 2003). Iron deficiency anaemia may itself be a secondary indicator of even more severe health problems (Stuart-Macadam, 1992). Of the Yugüe sample, 18% (*n* = 2) had identifiable porotic hyperostosis. Given the degree of *post mortem* destruction to many of the skulls, this number

Table 2. Age and sex of cemetery population

		Burials %	<i>n</i>
<i>Age categories</i>			
Infant	0–1	17.1%	4
Child	1–4	8.6%	3
Pre-adolescent	4–12	11.4%	4
Adolescent	12–18	2.9%	1
Young adult	18–25	2.9%	1
Middle adult	25–35	11.4%	4
Old adult	35–50	11.4%	4
Indeterminate adult	18+	34.2%	12
<i>Sex</i>			
Female		25.7%	
Male		5.7%	
Indeterminate		68.6%	

Adapted from Melmed (2006).

may be higher, but we are unable to confirm this. Nevertheless, Individual 16 was not among this group, reinforcing his positive health status.

In carrying out skeletal analysis, we often focus on pathological change and disease. However, the absence of pathology and other disease processes is an important commentary on the health and lifestyle of a person. While Individual 16 did combat a series of childhood illnesses, he recovered with no further assaults severe enough to be recorded in the dentition or other skeletal anatomy. As has been suggested in other studies (i.e. Pechenkina & Delgado, 2006), we surmise that this individual had access to resources – such as surplus food – to supplement potential seasonal variations in subsistence. An extended weaning period may also have supported a successful recovery. Additionally, this young adult male did not exhibit any degenerative changes indicative of repetitive actions on the joint surfaces. His age may have acted as a buffer from any of the bony changes that are often recorded with overuse from occupational stress. However, an exaggeration of muscle insertion points on the bone, which reflects the muscle mass it supports, would also be expected if he were engaged in heavy physical labour, and is not present with this individual.

Conclusion

Osteobiography enables consideration of larger social phenomena as they were experienced by a single individual. Placed as he was in the middle tiers of the lower Río Verde Valley's ancient social hierarchy, Individual 16 provides considerable insight into the realities of inequality and status at an individual scale. Although Individual 16 was clearly a person of unusual status in the context of Yugüe, he was not immune from the biological assaults that affected people of less distinguished social position at this time. Like his contemporaries of all social statuses, he suffered ill health in the years during which he was weaned. However, a longer weaning period and access to additional resources may have positioned him to endure later illness better than others in this population. Passing the critical transition period at age 6, a time when many

children died, his health as an older juvenile and adolescent was better than that of others in this population. And although B14-I16 did have adult responsibilities, he was not engaged in the kinds of physical labour that marked the skeletons of others in the cemetery.

Future studies

We still have many questions still to be answered about the people of Yügüe. What were the relationships between individuals interred within the mounds? Additionally, what were the relationships between the population at Yügüe and other populations in the lower Río Verde Valley, as well as the Valley of Oaxaca? Future studies to be carried out on the skeletal material, such as DNA analysis, may reveal a direct relationship of this individual, B14-I16, to others interred in the cemetery. Additional bone chemistry studies, such as isotope and strontium analysis, may provide further evidence of growth and development of this individual, as well as other individuals in this population. Further research may yield information regarding relationships of these individuals in the cemetery under study to individuals at an alternative location, such as the highlands of Oaxaca, and may provide evidence of population immigration patterns to Yügüe.

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