Bioarchaeology of Life and Death in Colonial South America: Systemic Stress, Adaptation, and Ethnogenesis in the Lambayeque Valley, Peru AD 900-1750

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The last 10,000 years witnessed a handful of major transformations of the human species – the most recent, global, and violent of which was contact between Native Americans and Europeans. Contact was long envisioned as a deterministic process: indigenous peoples contracted European diseases, catastrophic demographic collapse ensued, and native cultures disintegrated. Recently, bioarchaeologists in North and Central America have fundamentally shifted the issue of contact towards the dynamism surrounding native biology and adaptation among the survivors of contact and their descendants. The purpose of this research is to unite the often separate investigations of human skeletal remains and the archaeology of burial to understand the biological and cultural effects of European contact, conquest, and colonization in Peru. This work aims to establish the first empirical, holistic, and humanized understanding of contact in terms of biological and cultural consequences in the historic Central Andes.

BIOCULTURAL BACKGROUND

Bioarchaeology is an emerging discipline which bridges archaeology and physical anthropology in the study of human remains, with the goal to reconstruct past human behaviors and societies through the study of patterns of disease, diet, physical activity, and genetic interactions encoded in human skeletal and dental biology (Larsen, 1997). Over the last two decades, bioarchaeological studies have revealed indigenous depopulation and increased morbidity were relatively unavoidable outcomes of contact, yet the timing, mode, and tempo of

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these phenomena were remarkably diverse (e.g., Baker and Kealhoffer, 1996; Larsen and Milner, 1994; Verano and Ubelaker, 1992). Postcontact Spanish Florida is by far the best studied region, and multiple lines of evidence reveal increased indigenous biological stress, dietary change, genetic transformation, and ultimately cultural collapse (Larsen et al., 2001, 2001). Descriptive surveys of postcontact burial patterns illustrate apparent cultural transformations by indigenous peoples buried in the Christian style under churches in Spanish Florida and Belize (Cohen et al., 1997; Larsen et al., 2001).

The arid Lambayeque Valley Complex on the northern north coast of Peru (Fig. 1) was a center of independent and influential pre-Hispanic cultures since at least 1500 BC, home to the well-known Moche state (AD 100-750) and the Sicán theocracy (AD 900-1150) before playing a major role in the expansion of the Chimú and Inka empires (Shimada, 1994, 2000). Much of the local late pre-Hispanic people were descendants of the Moche forming a distinctive Mochica ethnic group. A multitude of material reflections of Mochica ethnic identity are observed in art and technological styles along with highly conservative burial patterns (Klaus 2003).

Spanish invasion in 1532 initiated profound changes in the Central Andes. An incomplete ethnohistory of colonial Lambayeque has been patched together from a variety of historic sources, legal documents, municipal records, and other reports, revealing insights on Spanish efforts to control and transform Mochica culture, which include nearly complete socioeconomic disarticulation, religious conversion, poverty, political powerlessness, and negative environmental transformations (Ramírez, 1996).

HYPOTHESES

Given this background, four hypotheses are tested: (1) the Mochica of the Lambayeque Valley experienced elevated biological stress due to Spanish colonialism; (2) postcontact

Mochica diets became less varied and nutritious with less access to higher-quality foods; (3) depopulation, always assumed but never tested, resulted in substantial loss of genetic diversity as demographic collapse literally removed from genes from the gene pool, and; (4) Colonial Mochica burials reflect conversion and adoption of Catholic rituals.

MATERIALS AND METHODS

Materials. Excavation and data collection since 2003 generated a comparative pre-Hispanic skeletal sample spanning A.D. 900-1750. Proceeding from a diversity of nine archaeological sites, these 255 skeletons together encompass all known social and ethnic diversity in the late pre-Hispanic population. The postcontact sample was excavated by the author as part of the first bioarchaeological study of postcontact Peru in Mórrope, Lambayeque. This sample of 862 individuals spans AD 1536-1751, and also appears to be a biologically representative sample of Colonial Mochica individuals (Fig. 2).

Systemic Biological Stress. Systemic stress is defined as any disturbance that disrupts the physiological balance of an individual in specific and empirically observable ways and can be measured through the study of complementary skeletal characteristics and pathological conditions (Huss-Ashmore et al. 1982) (Fig. 3). First, linear enamel hypoplasias are a reflection of stress during infancy and childhood, linked to conditions of infection, inadequate nutrition, and weanling diarrhea (Goodman and Rose 1990). Linear enamel hypoplasias are bands of improperly mineralized enamel produced by the disruption of amelogenesis, or tooth crown formation. Second, porotic hyperostosis lesions form during childhood under conditions of iron deficiency anemia as the red blood cell producing marrow in the roof of the eye orbits and cranial vault expand. These conditions can involve synergisms between inadequate diet, poor iron absorption, parasitism, and gastrointestinal infections, and infection (Blom et al. 2005;

Larsen and Sering, 2005; Sullivan, 2005). Third, growth is often considered one of the most direct windows on biological stress, as children of lower socioeconomic and nutritional status often experience depress growth. The cumulative record of growth contained in the length of childrens' femora can be extrapolated to calculate growth velocity (Lovejoy et al., 1990). Fourth, chronic non-specific periosteal lesions of infectious origin were examined, and represent a baseline to measure and interpret health, nutritional adequacy, and immune function.

Dietary Change. Oral health is highly useful to reconstruct diet in past populations (Larsen 1997). Dental decay is strongly linked to the amount of carbohydrates in a diet. Dental caries is a chronic disease condition caused by the progressive demineralization of tooth enamel by acid-producing oral bacteria as they consume dietary sugars. Advanced dental caries often lead to tooth loss, and antemortem tooth loss patterns are of additional insight on diet.

Depopulation. Of all the physical traits of the human skeleton, teeth most strongly reflect their underlying genetic components (Scott and Turner, 1997). To assess demographic collapse via population genetic diversity, 16 measurements per individual were made on the eight polar teeth (first incisor, canine, third premolar, and first molar) which are under the strongest degree of genetic control. These data were then subjected to standard population genetic analyses to estimate genetic heterogeneity and patterns of gene flow.

Cultural Conversion. Cross-culturally, complex societies tend to encode a variety of qualitative features in burial patterns that are reflections of social organization, economy, and ideology (Parker Pearson, 2000). Postcontact indigenous culture was examined through the study of mortuary pattern variables such as the location of the body and other spatial characteristics, cardinal orientation of the body, limb positioning, and the use of grave goods.

ANALYTICAL PROCEDURES

Following the estimation of age-at-death from each individual based on skeletal and dental maturity using the multivariate summary age technique (Buikstra and Ubelaker, 1994; Lovejoy et al., 1985), odds ratios were calculated, which are perhaps the best quantitative epidemiological tool to compare disease rates in two populations (Waldron, 1994). Oral health conditions were examined using a *G*-test, a more conservative version of the *chi*-square metric well suited to such continuous variables (Sokal and Rohlf, 1981). Population genetic analyses were accomplished using an R (or relationship) matrix, which estimates a population's F_{ST} (a measure of genetic diversity) and patterns of gene flow from observed and expected expressions of genetic variance (Relethford and Blangero, 1990).

RESULTS

The results indicate a significant decrease in linear enamel hypoplasia prevalence which falls 1.84 times in the postcontact population ($p< 0.05$). Evidence of porotic hyperostosis increases significantly in the postcontact sample 1.56 times ($p< 0.05$). Postcontact periosteal infection increases sharply 4.9 times ($p< 0.01$). Subadult femoral growth velocity appears higher in postcontact subadults at age two, but among children at age 5, 10, and 12, growth velocity in the postcontact group is consistently depressed when compared to the same precontact age cohorts. Overall prevalence of dental caries are does not change, but a very strong pattern of increased postcontact antemortem tooth loss ($p< 0.0001$) is observed. R-matrix analysis indicates an unambiguous change in population genetic heterogeneity from a relatively diverse late pre-Hispanic population ($F_{ST} = 0.041$) to a far less variable postcontact population ($F_{ST} = 0.009$).

In the cemetery of San Pedro de Mórrope, bodies were placed within in wooden plank coffins adorned with copper tack decorations forming Christian crosses (Fig. 4). Many of the

dead were dressed in European garments. Precontact usage of grave goods was fully terminated. Yet, contrasting with the Spanish doctrine, burials at Mórrope were not aligned on an east-west axis, but instead on a north-south axis. Red-dyed textiles were placed on the faces of the dead in at least 60 cases (Fig. 5). In Catholic mortuary practices, the dead were to rest undisturbed until the Second Coming. In at least half of the 322 burials, intentional, repetitive, and ritualized alteration of burials involved opening coffins and graves for removal of skulls and long bones (Fig. 6). Elsewhere in the Chapel, secondary burials of mostly skulls and long bones were found, while skulls and long bones were added to accompany new burials.

DISCUSSION AND INTERPRETATIONS

In many respects, this initial study of European contact in Peru points to similar increases of indigenous morbidity and chronic biological stress as in Spanish Florida: iron deficiency anemia increased, as did skeletal infection while subadult growth velocity experienced overall depression (Larsen, et al. 2002). The prevalence of linear enamel hypoplasias decreased, but given this setting, probably does not represent improved health. The disease environment of children in Colonial Peru shifted from survivable forms of late pre-Hispanic acute stress to high-mortality stress during the postcontact era. In other words, smallpox and influenza may have killed a large number of affected children before they could recover and form hypoplasias. Dietary change also appears to have transpired. As advanced dental caries is the most likely cause of tooth loss in postcontact Mórrope, increased consumption of carbohydrates in the Mochica diet is evident. These indications together shed light on some of the biological consequences of social inequality and the status of indigenous peoples in a colonial setting. A synergism between inadequate nutrition, economic barriers blocking access to resources, and social discrimination directly impacted the amount of bioavailable iron and other nutrients in the

diet, the speed at which children grew, and drove chronic disease processes of periostitis and dental caries. Ill health is seen as a consequence of poverty.

Population genetic structures seem to confirm depopulation by the significant drop of genetic variation from the late pre-Hispanic (F_{ST} = 0.041) to postcontact eras (F_{ST} = 0.009). This interpretation is misleading. Ethnohistoric documents point to the Lambayeque region's large precontact population and postcontact economic potential buffered it from demographic freefall. Here, population fell by about 40 percent before demographic rebound was initiated in the 1620s (Cook, 1981). The source of this genetic transformation appears to be revealed by the observations of gene flow, or residuals, calculated from the R matrix (Fig. 7). During the Early/Middle Colonial period at Mórrope, the population is characterized by a residual value of + 1.165, which indicates a high degree of gene flow throughout the region. Under such conditions, populations hybridize. Variation decreases as mates are exchanged and their descendants come to share the same, common genetic material.

A different kind of hybridization is apparent in the postcontact mortuary record. Interwoven with the Spanish Catholic mortuary patterns practiced in Mórrope were features of traditional mortuary rituals that can be traced back on the north coast to at least 1500 B.C. Orientation of the dead on a north-south axis was one such element that continued to be reproduced. Pre-Hispanic precedent for red face cloths is the practice of painting the face of the dead with mercuric hematite, or cinnabar, and may have involved equally long-lived symbolism involving "life force" or rebirth. The patterns of living-dead interaction, involving the manipulation and reburial of skulls and long bones, are indistinguishable from those practiced on the north coast and central coast of Peru since at least the Moche era (Shimada et al., in press). These actions appear tied to Andean conceptions of the power of the deceased – the dead were

powerful beings that were the source of new life on earth (Salomon 1995). Ritual manipulation of human remains was a manner by which the living attempted to harness and direct that power (Klaus and Tam, in press 1).

Under conditions of elevated biological and social stress, evidence of Mochica biological hybridization and religious syncretism with Spanish Catholic rituals appears to reflect a process called ethnogenesis. Ethnogenesis is a valuable concept, not merely a label for the emergence of a new kind of culture. Ethnogenesis embodies a social and political struggle to create the one of key the foundations of society– an enduring group identity – in contexts of radical change and discontinuity (Hill 1996:1). Ethnogenesis involves a "reflexive awareness on the part of social actors of their ability to make situational and more lasting adjustment to social orderings…and an ability to understand that ordering as it is situated in larger, more encompassing spatiotemporal orders that include others who are socially different" (Hill 1988: 7). In this way, the genetic and burial pattern signatures suggest the deployment of creative new configurations of Mochica consciousness and perceptions of themselves under extremely stressful and unprecedented conditions of the colonial reality.

Population genetic transformation and the widening of local mating networks probably could not have been enforced by the Spanish nor was it part of their colonial policy or agenda. The Mochica themselves seem to have forged a regional hybrid biocultural coalition amongst themselves – a strategy that aimed ensure the survival of "the group" (Stojanowski 2005). In order to accomplish this, the boundaries of the traditional social organizational unit, the pre-Hispanic endogamous *parcialidad*, the boundaries of which would have been deconstructed as the definition of "the group" was widened as the very perception of group membership changed along with Mochica "practical consciousness" Giddens (1979); inherited tooth sizes are a

reflection of consciousness and perceptions of identity. This process of biological hybridization was probably very rapid, and was completed within the first 100 years or so following contact; the Middle/Late Colonial population at Mórrope is characterized by a strongly negative amount of external gene flow (residual = -2.214) and represents conditions where the population became more isolated and observed genetic homogenization could not have occurred.

Reproduction of pre-Hispanic funerary behaviors in this Catholic church may be seen as a form of symbolic resistance and reaction against an invading foreign power's attempt to transform a long-lived and pervasive Mochica cultural identity. The same activities would have also ensured the survival of elements of pre-Hispanic identity by inserting Mochica rituals into Catholic mortuary practices. Yet, resistance and identity conservation are a more outward manifestation of ethnogenesis as well. This process appears to represent a cultural hybridization between Andean and Spanish mortuary patterns and religious culture. Given the observation that biological hybridization appears in the Early/Middle Colonial Period, it is significant that hybrid burial patterns bloom in the Middle/Late Colonial mortuary record at Mórrope. Colonial Mochica ethnogenesis can be seen as a two-stage process: the first stage involved a widening of Mochica mating networks with the region and biological homogenization resulted. Once complete, a second stage took over as cultural hybridization with Spanish culture and religion unfolded. Ethnogenesis can be seen as a creative and dynamic attempt to "fashion an understanding and gain conceptual mastery over, a changing world" (Comaroff and Comaroff 1991:31). Colonial Mochica ethnogenesis was the result of an active reexamination of former values, together with the development of new concepts about the world that indeed received European input, but ultimately, is the product of indigenous minds (*sensu* Graham 1998:29).

CONCLUSION

In conclusion, Lambayeque, Peru did not experience a stereotypical postcontact disaster. This initial bioarchaeological study of contact in the Central Peruvian Andes tells the story of a group of Andean people, who, despite unprecedented biological stress, adapted to the Colonial reality through ethnogenesis: the creation of a new kind of people and a new kind of society, grounded in a process of local biological hybridization paralleled by cultural hybridization with European customs and religion.

Methodologically, this study unites sources of anthropological information traditionally treated as separate domains of investigation – bioarchaeology and mortuary archaeology. It takes a novel approach in its examination of health stress, genetic transformations, and identity in terms of biosocial and cultural conditions that shape consciousness and the *perceptive* changes that drive ethnogenesis. This underscores a new theoretical and methodological movement as defined by Sofaer (2006) and Gowland and Knüsel (2006) who advocate an integration of skeletal biological data with the study of mortuary contexts, which for historical and philosophical reasons, have long been treated as falsely dichotomous and separate sources of data. Instead, the human skeleton and its mortuary context can be seen as a unified 'datum point' of cultural reality in which to understand overlapping biological and material manifestations in relation to the social, environmental, economic, and historic records. In the end, this case study of biological and social impacts of Spanish contact and colonization on the north coast of Peru operationalizes a new configuration of theory and method in the study of burials to create dynamic, holistic, and humanized reconstructions of the past.

ACKNOWLEDGMENTS

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LITERATURE CITED

Baker BJ, Kealhoffer L, editors. 1996a. Bioarchaeology of Native American adaptation in the Spanish borderlands. Gainesville: University Press of Florida.

Blom, DE, Buikstra JE, Keng L, Tomczak PD, Shoreman E, Stevens-Tuttle D. 2005. Anemia and childhood mortality: latitudinal patterning along the coast of pre-Columbian Peru. Am J Phys Anthrop 127:152-169.

Buikstra JE and Ubelaker DH. 1994. Standards for data collection from human skeletal remains. Fayetteville: Arkansas Archaeological Survey Research Series No. 44.

Cohen MN, O'Connor K, Danforth M, Jacobi K, Armstrong C. 1997. Archaeology and osteology of the Tipu site. In Whittington SL, Reed DM, editors. Bones of the Maya: studies of ancient skeletons. Washington D.C.: Smithsonian Institution Press. p 78-86.

Comaroff J, Comaroff JL. 1991. Of revelation and revolution: Christianity, colonialism, and consciousness in South Africa, Vol. 1. Chicago: University of Chicago Press.

Cook ND. 1981. Demographic collapse: Indian Peru, 1520-1620. Cambridge: Cambridge University Press.

Giddens A. 1979. Central problems in social theory. Berkeley: University of California Press

Goodman AH, Rose JC. 1991. Dental enamel hypoplasias as indicators of nutritional status. In Kelley M, Larsen CS, editors. Advances in dental anthropology. New York: Wiley-Liss. p 279-293.

Gowland R, Knüsel C. 2006. Introduction. In Gowland R, Knüsel C, editors. Social Archaeology of Funerary Remains. Oxford: Oxbow. p ix-xiv.

Graham E. 1998. Mission archaeology. Ann Rev Anthropol 27: 25-62

Hill J, editor. 1988. Rethinking History and Myth: Indigenous South American Perspectives on the Past. Urbana: University of Illinois Press

Hill J. 1996. Introduction. In Hill J, editor. *History, power, and identity: ethnogenesis in the Americas, 1492-1992*. Iowa City: University of Iowa Press. p 1-19

Huss-Ashmore R, Goodman AH, Armelagos GJ. 1982. Nutritional inference from paleopathology. In Schiffer MB, editor. Advances in archaeological method and theory. New York: Academic Press. p 395-474.

Klaus HD. 2003. Life and death at Huaca Sialupe: the mortuary archaeology of a Middle Sicán community, north coast of Peru. MA thesis. Illinois: Department of Anthropology, Southern Illinois University.

Klaus HD, Tam ME. In press. Surviving contact: biological transformation, burial, and ethnogenesis in the Colonial Lambayeque Valley, north coast Peru. In Knudson KJ, Stojanowski CM, editors. Bioarchaeology and identity in the Americas. Gainesville: University of Florida Press.

Larsen CS. 1997. Bioarchaeology: interpreting behavior from the human skeleton. Cambridge, UK: Cambridge University Press.

Larsen CS, Sering SE. 2000. Inferring iron deficiency anemia from human skeletal remains: the case of the Georgia Bight. In Lambert PM, editor. Bioarchaeological studies of life in the age of agriculture: A view from the southeast. Tuscaloosa: University of Alabama Press. p 116-133.

Larsen CS, Milner GR, editors. 1994. In the wake of contact: biological responses to conquest. New York: Wiley-Liss.

Larsen CS, Griffin MC, Hutchinson DL, Noble VE, Norr L, Pastor RF, Ruff CB, Russell KF, Schoeninger MJ, Schultz M, Simpson SW, Teaford MF. 2001. Frontiers of contact: bioarchaeology of Spanish Florida. J World Prehist 15: 69-123.

Larsen CS, Crosby AW, Griffin MC, Hutchinson DL, Ruff CB; Russell KF, Schoeninger MJ, Sering E, Simpson SW, Takás JL, Teaford MF. 2002. A biohistory of the Georgia Bight: the agricultural transition and the impact of European contact. In Steckel RH, Rose JC, editors. The backbone of history: health and nutrition in the Western Hemisphere. Cambridge, UK: Cambridge University Press. p 406-439.

Lovejoy CO, Meindl RS, Mensforth RP, Barton TJ. 1985b. Multifactorial determination of skeletal age at death: A method and blind tests of its accuracy. Am J Phys Anthropol 68:1-14.

Lovejoy CO, Russell KF, Harrison ML. 1990. Long bone growth velocity in the Libben population. Am J Hum Biol 2:533-541.

Parker Pearson M.2000. The archaeology of death and burial. Austin: University of Texas Press.

Ramírez SR. 1996. The world upside down: cross-cultural contact and conflict in sixteenth-century Peru. Stanford: Stanford University Press

Relethford JH, Blangero J. 1990. Detection of differential gene flow from patterns of quantitative variation. Hum Biol 62: 5-25.

Salomon F 1995. "The Beautiful Grandparents": Andean ancestor shrines and mortuary ritual as seen through Colonial records." In Dillehay TD. Tombs for the living: Andean mortuary practices. Washington D.C.: Dumbarton Oaks. p 315-353.

Scott GR, Turner CG II. 1997. The anthropology of modern human teeth. Cambridge, UK: Cambridge University Press.

Shimada I. 1994. Pampa Grande and the Mochica culture. Austin: University of Texas Press.

Shimada I. 2000. The late prehispanic costal societies. In Laurencich Minelli L, editor. The Inca world: the development of pre-Columbian Peru, AD 1000-1534. Norman: University of Oklahoma Press. p 49-110

Shimada I, Klaus HD, Segura R, Matsumoto G. in press. Living with the dead: conception and treatment of the dead on the central and north coast of Peru. In Shimada I, editor. Between the Living and the Dead: Cross-Disciplinary and Diachronic Perspectives, Volume 1: Andes. Tucson: University of Arizona Press.

Soafer JR. 2006. The body as material culture: a theoretical osteoarchaeology. Cambridge, UK: Cambridge University Press

Sokal RR, Rohlf FJ. 1995. Biometry: the principles and practice of statistics in biological research. New York: W.H. Freeman.

Stojanowski CM. 2005. The bioarchaeology of identity in Spanish Florida: social and evolutionary transformation before, during, and after demographic collapse. Am Anthropol 107: 417-431

Sullivan A. 2005. Prevalence and etiology of acquired anemia in Medieval York, England. Am J. Phys Anthropol 128: 252-272.

Verano JW, Ubelaker DH, editors. 1992. Disease and demography in the Americas. Washington D.C.: Smithsonian Institution Press.

Waldron T. 1994. Counting the dead: the epidemiology of skeletal populations. Chinchester: Wiley and Sons.

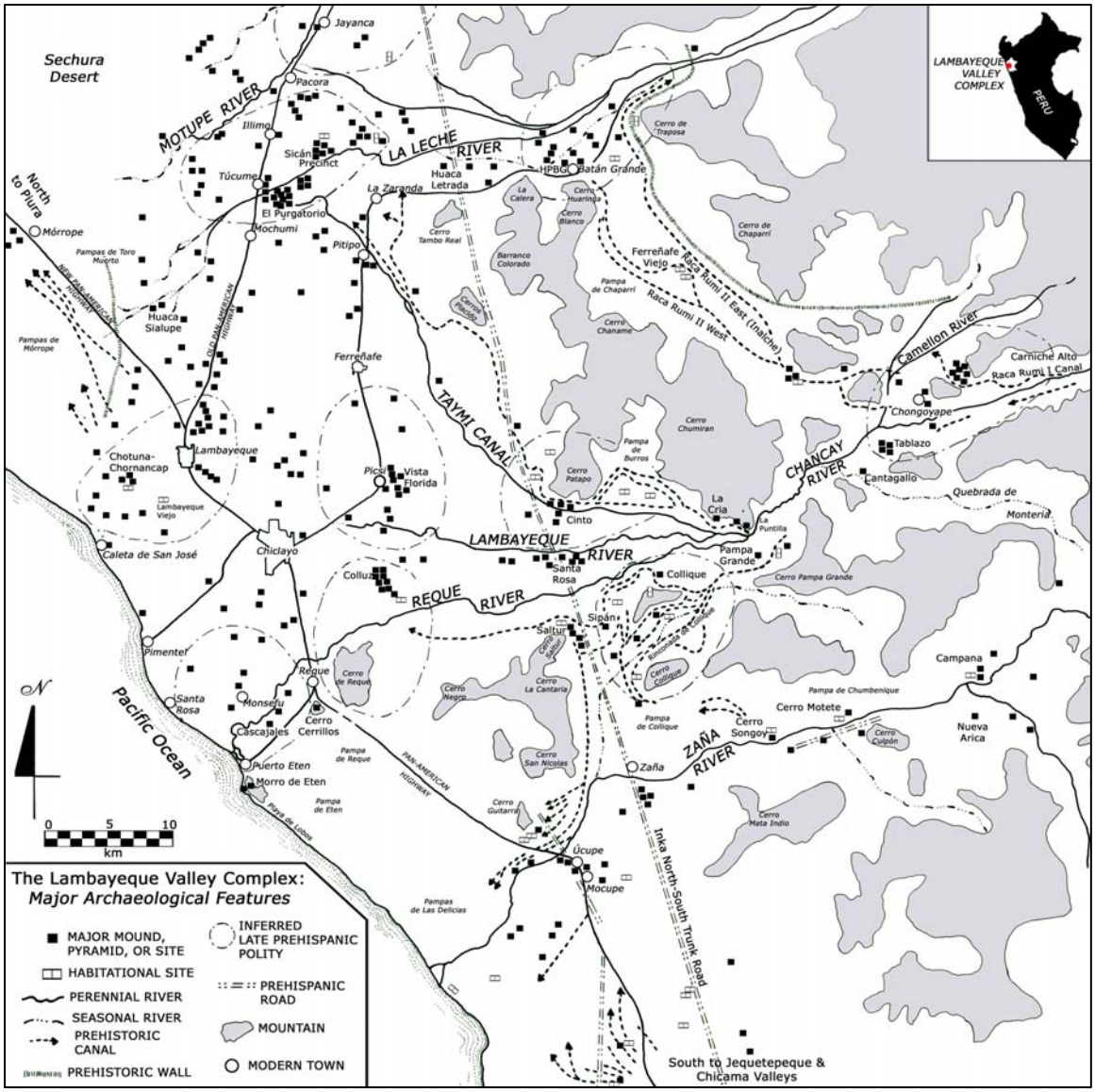

Figure 1: The Lambayeque Valley Complex. Redrawn by Haagen Klaus from Shimada (1994a:58, Figure 3.15) and based on an unpublished map by Paul Kosok in the possession of the late Richard P. Schaedel. Mórrope is located on the northwest corner of the Lambayeque Valley Complex, just on the southern margin of the Sechura desert.

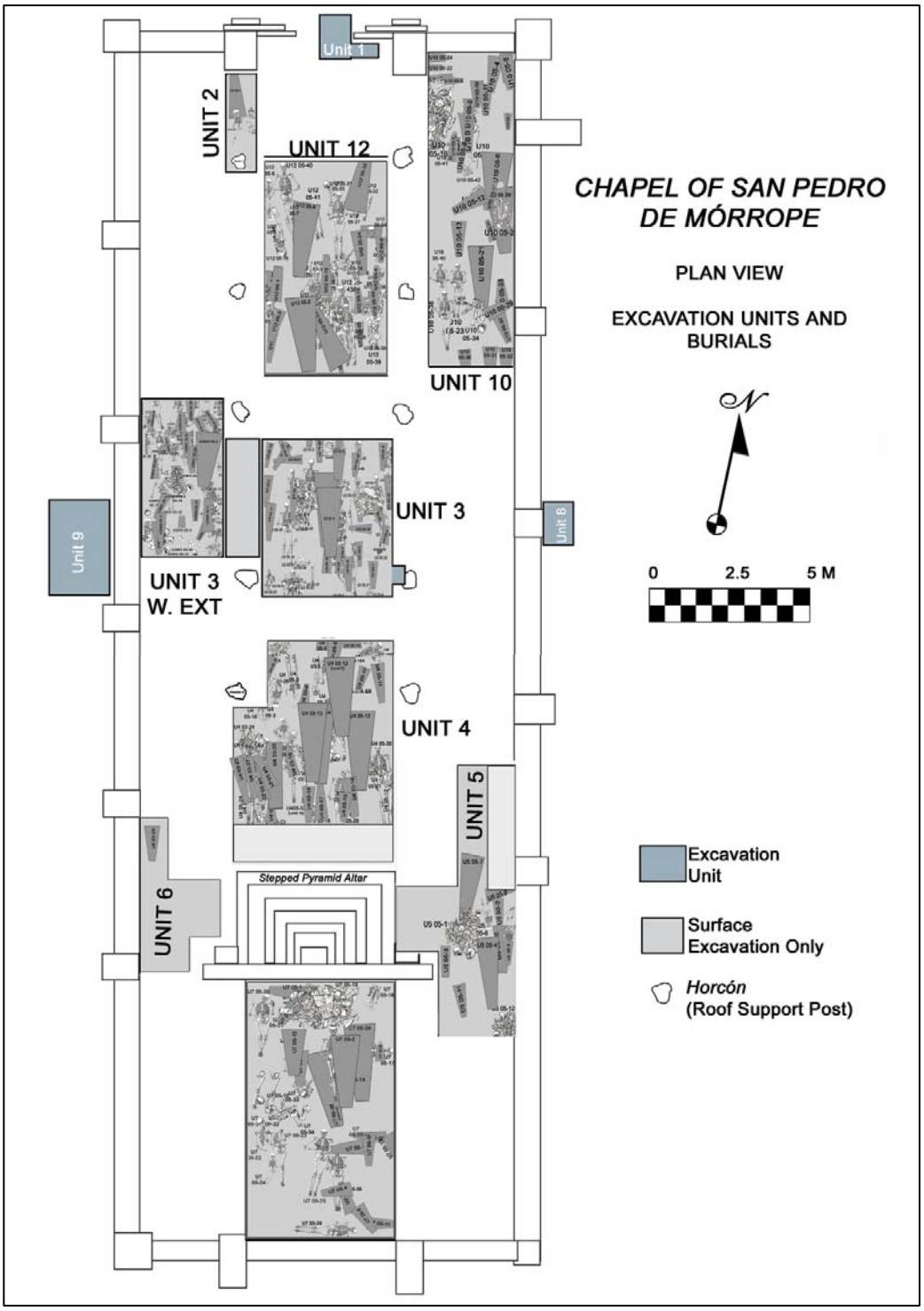

Figure 2: Plan view of the Chapel of San Pedro de Mórrope, Mórrope, Lambayeque. Excavation units locations and burials are shown here. Illustration: Haagen Klaus.

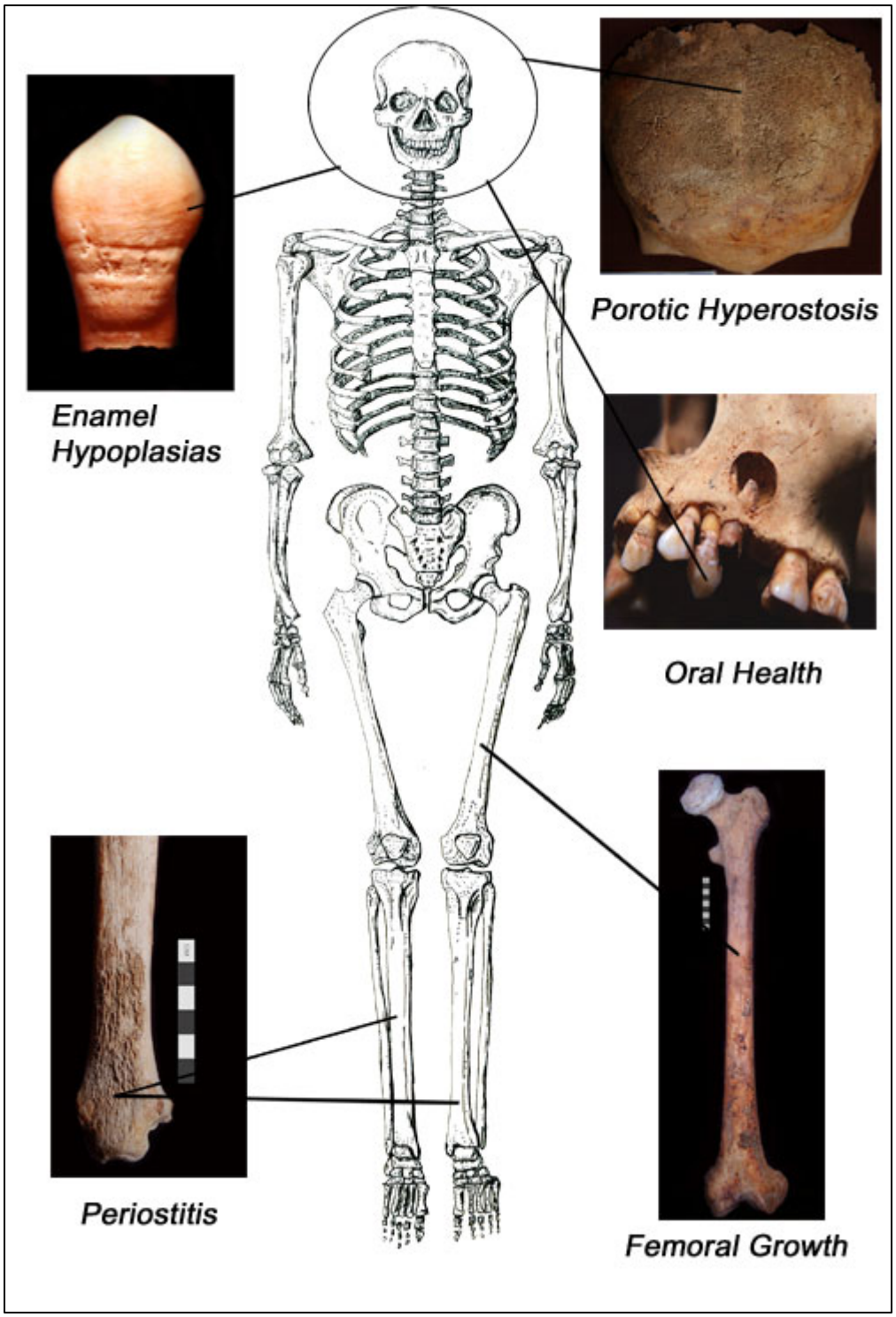

Figure 3: Skeletal pathological conditions and characteristics used to reconstruct patterns of biological stress and diet in the late pre-Hispanic and postcontact Lambayeque Valley. Illustration and photos: Haagen Klaus.

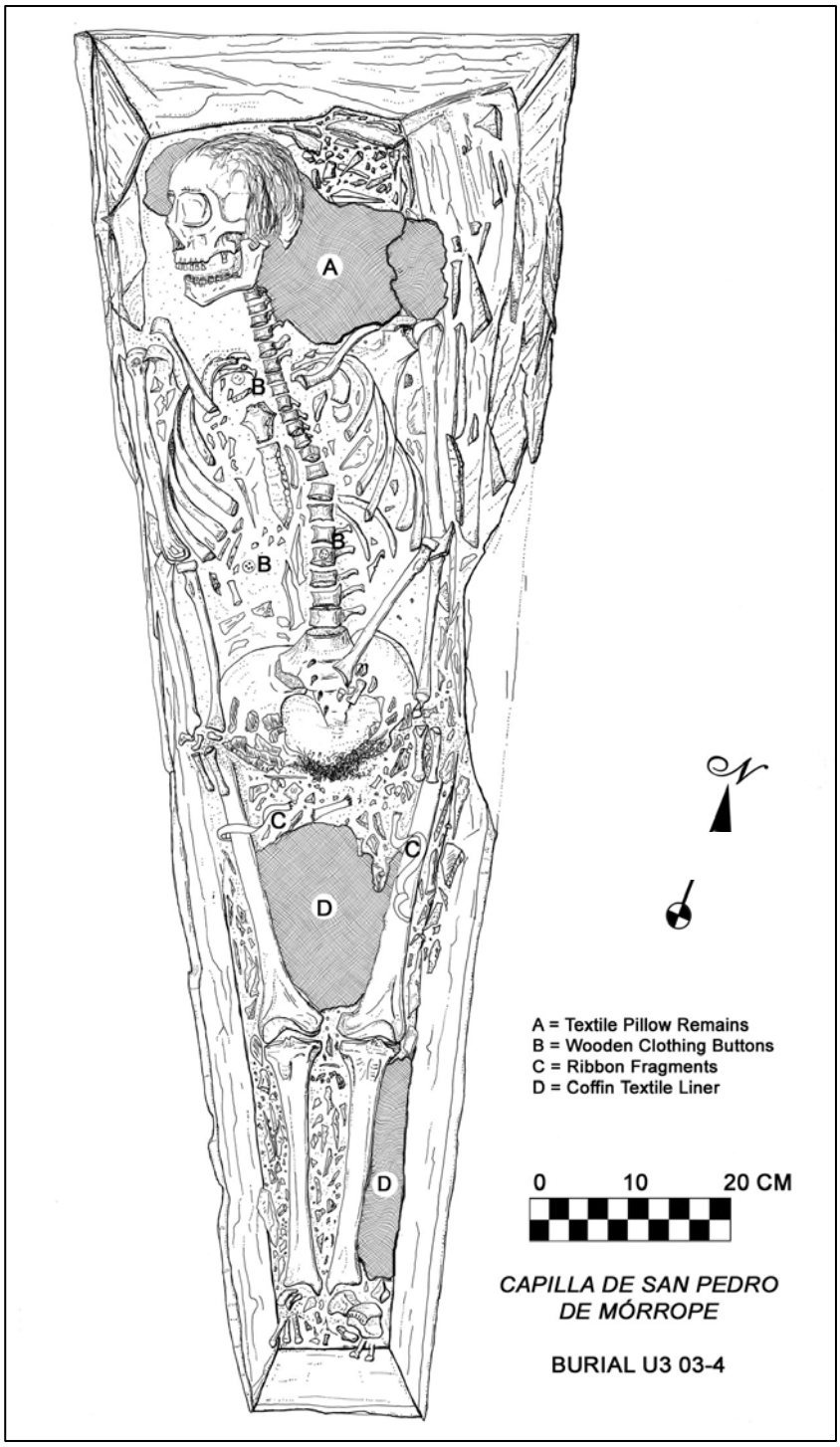

Figure 4: Burial U3 03-4, a typical Middle/Late Colonial burial at the Chapel of San Pedro de Mórrope and exemplifies a superficial expression of Spanish Catholic mortuary customs. However, the body is on a north-south axis, and like 94 percent of the other Colonial Mórrope burials, reproduces a 2,500 year-old Mochica burial tradition. Drawing: Haagen Klaus.

Figure 5: Red face cloths placed on the faces of the dead before burial. Textile appears to have been colored with an organic dye. Burial U3WX 05-2 (A) and Burial U12 05-12 (B). Photos: Haagen Klaus.

Figure 6: Altered burials.
6a: Burial U705-9, (missing coffin lid) which had been accessed and the child's head, hands, and lower limbs removed.
6b Headless burials U405-29 and -30, illustrating the repetitive pattern of skull removal.
6c: Burial U505-1: a large secondary burial compositionally dominated by crania and long bones.
6d: Burial U705-2. Following the interment of the primary burial (old adult female), the coffin was opened (lid missing), and her skull and both arms removed. Subsequently, the crania and long bones of at least four other individuals were added and was reburied.

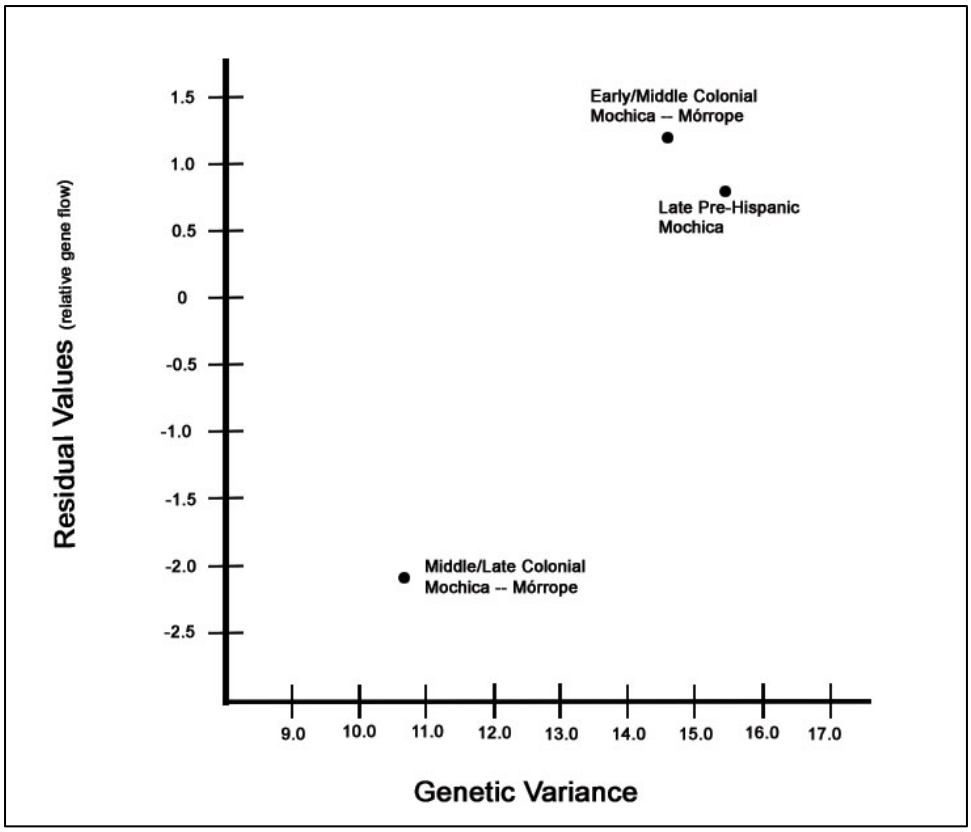

Figure 7: Comparison of observed mean genetic variance and external gene flow based on the analysis of inherited tooth sizes. The Early/Middle Colonial Mochica experienced the greatest amount of average extralocal gene flow, which produced a far more homogenous Middle/Late Colonial period population marked by the lowest degree of genetic diversity and a below average intake of genes from outside sources.