

# Yawslike Disease Processes in a Louisiana Shell Mound Population

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## Introduction

Human skeletal remains have been recovered from prehistoric and early historic sites in Louisiana with some degree of regularity for the past 75 years and on an irregular basis for the last 300 years. During his explorations of aboriginal sites throughout the Lower Mississippi River Valley, Moore<sup>1,2,3</sup> made a special effort to collect skeletal specimens for shipment to the US National Museum at the Smithsonian Institution. A less well-known fact is that he also collected pathological specimens for shipment to the Army Medical Museum at Walter Reed Hospital in Washington, DC. An unfortunate aspect of the Moore recovery technique, however, was the practice of discarding unwanted bones, which introduced an implicit selection bias in the National Museum cranial series from Louisiana that Hrdlička<sup>4,5,6</sup> subsequently studied. Whether or not Moore selected specific samples of pathological bone for the Medical Museum is not known.

We have little definitive data on the prehistoric inhabitants in many areas of Louisiana. The combination of climate and soil factors, that is, rain, heat, and poor drainage of clayey silted soils, is not conducive to skeletal preservation. For example, a total of 1,175 human burials were exposed during the excavation of the Crooks Site, of the Marksville (Middle Woodland) cultural period, but few burials were pre-

served sufficiently for further study of them.<sup>7</sup> In the past, much of Louisiana was a level flood plain with active and abandoned river courses, bayoux, and swamps as dominant topographic features. Slight elevations of land which formed as natural levees along streams were used as habitation sites (usually a "mound" construction) by the prehistoric peoples. Skeletal preservation in the Gulf coastal shell mounds is better than at other kinds of sites because water percolates through the strata of the mound rapidly, at least to the level of the water table which in low-lying areas is rather high.

In addition to preservation problems, the recovery of human burials from archaeological sites in Louisiana, and the mid-South region in general, is an onerous task for the field worker. He or she is frequently confronted with burials that intrude through burials of previous inhabitants at the site. Bones of different individuals are commingled, fragmented, or lost. Apparently many prehistoric groups in the Louisiana area had a ritual surrounding death and burial which often included defleshing the skeleton (using natural means or particular cultural techniques), letting the bones dry, breaking the bones, and interring the bone "bundle." Subsequent activities at the site, from prehistoric through contemporary times, scattered many bones from their original placement. It is from this scrambled bony matrix that the field-worker attempts to sort out individual burials, all too frequently an impossible task. Comparable problems are encountered by the physical anthropologist who attempts to analyze the fragmentary human bones for information on the number, sex and ages of individuals recovered from the

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site, their state of health, and any factors that permit inferences to be drawn of their cultural activities.

#### Materials and Methods

This report focuses on the human skeletal material that was recovered from the Morton Shell Mound (16IB3) on Weeks Island in Iberia Parish (Fig 1). The site was excavated by personnel from the Louisiana State University Museum of Anthropology, and there seems to have been a fairly complete recovery of the human remains; at least there is more

bone for analysis than from most prehistoric sites in the state. For the most part, the Morton Shell Mound bones are broken, but basic preservation of the fragments is good, permitting a broad range of data to be collected from them. Given the field technique of cataloging the bones, and the fragmentary condition and missing sections of the bones, no reconstructions were attempted; however, those restrictions did not obviate a detailed analysis being made of them.

According to the archaeological field notes and burial records from the site, partial remains of 49

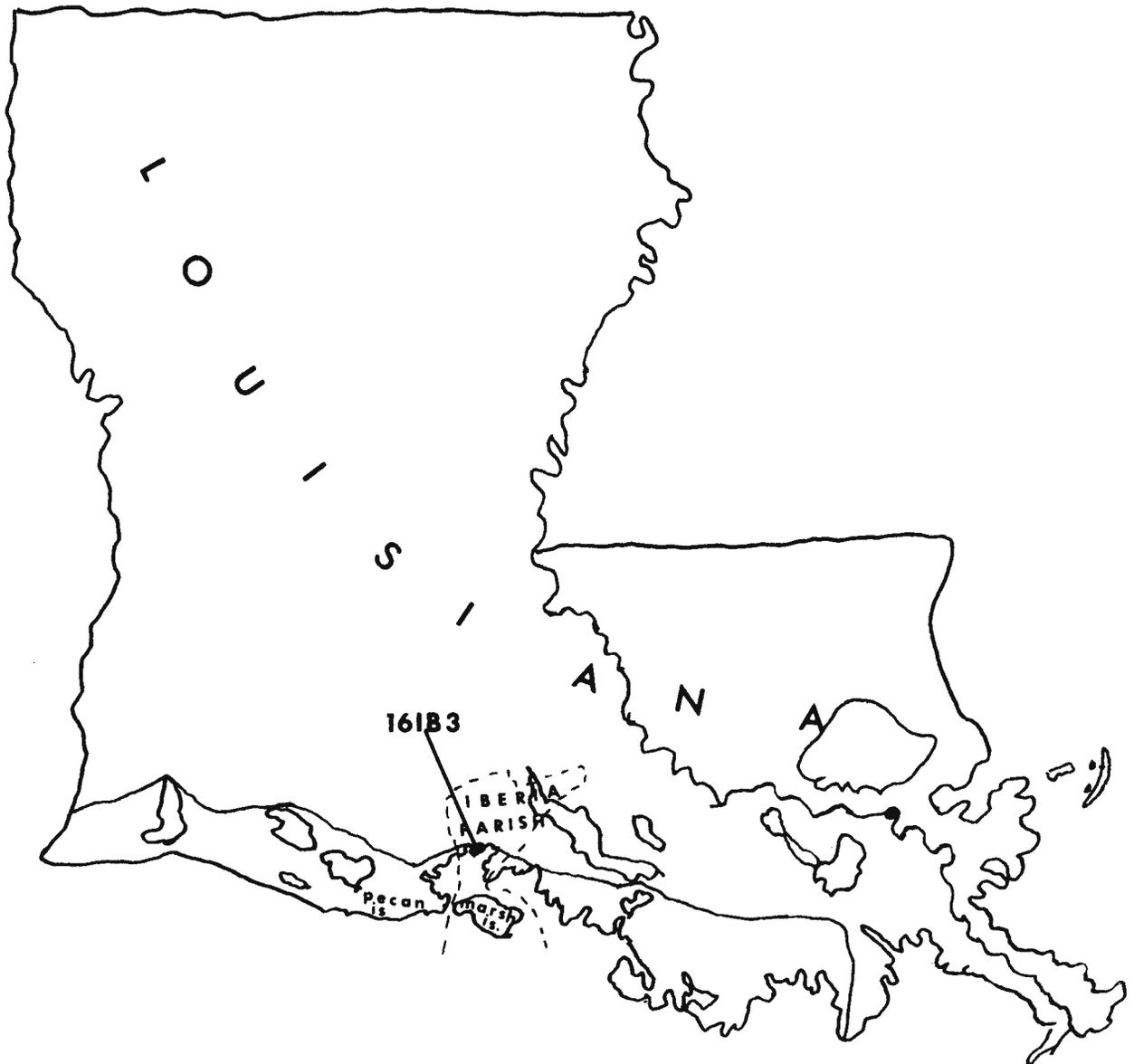


Fig 1—Map of location of Morton Shell Mound, Weeks Island, Iberia Parish, Louisiana.



Fig 2—Bone fragmentation, catalog no. 2379, containing 906 fragments. Typical assemblage of human bone fragments from Morton Shell Mound, Iberia Parish, Louisiana.

individuals were recovered from 15 “burials.” Approximately 24,900 human bone fragments, ranging from single, isolated, modified (incised) fragments to groupings of 1,000 fragments, were recovered from the site, cleaned in the Louisiana State University laboratory, placed in 51 boxes (containing a total of 207 sacks of bones), and submitted to me for examination. At first glance, the task of extracting data on the physical morphology, age and sex ranges, and probable health conditions of the people appeared remote. The extensive fragmentation of the bones (Fig 2) precluded anthropometric studies, and the absence of catalog numbers on most fragments negated mixing fragments from different sacks in an attempt to match up or reconstruct various bone parts.

An alternative method of examining the bone fragments and evaluating the number of individuals represented by them was used. The contents of each sack were sorted out and examined for information on the number of individuals, their age, sex, and bone condition, for example, the absence, presence, extent and kind of pathology, and break patterns and soil destruction of the bone. The distribution of the fragments in the site (the square and stratigraphic depth) were carefully noted in the event that bones of particular individuals could be sorted out.

A number of pertinent biocultural points emerged during the tabulation of the bone fragments, but only those points pertinent to the topic of this report will be emphasized here. First, the fragmentation of the bones was not the result of poor soil drainage but of intentional breakage that was a part of the cultural ritual surrounding the burial of the

people who died at the site. Figure 3 illustrates the breakage pattern of the bones. The long bones of the body were broken in specific, almost ritualistic, ways; most fragments are less than 90 mm in length. It is rare for a bone not to have been broken; even small bones of the hands and feet, and of infants, were broken. Second, the intentional fragmentation of the bones revealed various stages of endosteal pathologies that would have gone unnoticed if the bones had been complete because the periosteum was not modified.

The analysis of the bone fragments revealed that the Morton Shell Mound skeletal series consists of the incomplete remains of at least 275 individuals and possibly as many as 313 individuals. The bones are from fetuses, infants, children, adolescents, and adults of both sexes. (The Table gives the numbers in each age category.) Osseous pathology is found in all age categories except the fetuses.

#### Description of Pathology

The pathology of the Morton Shell Mound is particularly interesting to me because its physical manifestation does not resemble disease processes that I have encountered in other geographic areas in the eastern United States, or even in the Deep South, east of the Mississippi river.

The bone fragments of adults exhibit the most deleterious structural changes, but some shaft fragments of children and adolescents also show preliminary (stage A) modifications in the endosteal configuration of the bones; the progressive stages of bone destruction are illustrated in Figures 4 and 5. The



Fig 3—Catalog no. 1985, containing 631 fragments. When bones are sorted out according to their bodily location, the manner in which they were broken appears to follow a definite pattern.

endosteal surface of the medullary cavity, that is, the endosteal circumferential lamellae, is the first part of a bone shaft to show an alteration from the normal layering of reticular cells lining the wall of the bone marrow cavity. Initially, in stage A, an increased rate of endosteal cellular formation overruns the normal pace of cellular resorption and produces an irregularly-formed secondary endosteal layer. As modification continues in that portion of the bone, the dense surface layer of the periosteum is altered by a secondary layer of periosteal bone which is deposited more rapidly than it can be removed by osteoclastic action, stage B; during some periods of this destructive process, the surfaces of long bone shafts give the classic appearance of periostitis. Stage C represents the point at which secondary and tertiary sheaths of bone (now becoming sclerotic in appearance) are deposited on the periosteal and endosteal surfaces with concomitant circumferential enlargement (swelling) of the bone in the area of disturbance. It is suspected that during the latter part of stage B, or in the early part of stage C, the diploë cells of the cranial vault begin to proliferate. In stage D, spongy endosteal bone is filling the medullary cavity; the formation and deposition of periosteal bone is rampant; the spongy diploë of the vault is three or four times its normal thickness and has filled the frontal sinuses (in one fragment, the sphenoidal sinus is also filled with spongy bone); and some maxillary sinuses are nearly obliterated with the spongy bone material. Even the resorption process of maxillary and mandibular alveolar bone following tooth loss includes the erratic patterning of prolific deposition and incommensurate resorption of spongy bone. Stage E signifies advanced bone transfiguration and is found only in mature adults; it is an arbitrary marker that may crosscut other stages of the disease process in different regions of the skeleton. In this advanced stage, the pathology apparently has spread into many parts of the skeleton; the scarcity of some skeletal parts, for example, vertebrae, precludes the inclusion of the entire skeleton. Many fragments of tibia, femur, humerus, radius, and ulna contain fistulae from the medullary cavity through the periosteal surface; some of the larger fragments have multiple openings along the bone through which diseased matter passed to the surface of the body. Open sinus drainage lesions are also found on the clavicle, and on temporal, maxillary, and zygomatic fragments, and small craterlike lesions, healed and unhealed, occur on several vault fragments from different individuals. It is probable,

TABLE  
Morton Shell Mound Population  
Estimates of age, sex and incidence of pathology\*

Age and Sex Categories	Minimum** N	Maximum** N	Pathology minimum N/N maximum
Fetus (5-8 fetal months of age)	7	12	0
Infant (Newborn to 2 yrs of age)	14	19	1/2
Child (2 yrs to 11 yrs of age)	25	27	2/4
Adolescent (11 yrs to 17 yrs of age)	28	34	3/5
Adult Female (18 yrs to 65 yrs of age)	83	90	17/26
Adult Male (18 yrs to 65 yrs of age)	105	111	21/35
Adult (Age and sex indeterminant)	13	20	2/5
POPULATION TOTALS	275	313	46/77

\* Parameters for age categories are arbitrary boundaries; assignment of sex is based on pronounced sexual dimorphism in the standard traits used for sexing skeletons; figures in pathology category are very conservative estimates.

\*\* Minimum totals are based on the medial section of mandible except for fetuses for whom left ilia were used. Maximum totals include some bone fragments from other parts of the body; see text for specific bones.

although not confirmed, that the disease process accelerated the periodontal and alveolar pathology of both the maxillae and mandibles. Such destructive dental pathology is rarely encountered in populations of comparable temporal periods, that is, AD 700 to AD 1100, in the lower Mississippi Valley.

### Discussion

When the pathology of the Morton Shell Mound people is scrutinized with regard to its overt expression, degree of severity, pattern of dispersion through the skeletal system, and its differential affection of children and adults, the factors seem to point to a particular causal agent, that is, the treponemal infection or disease called yaws. However, a

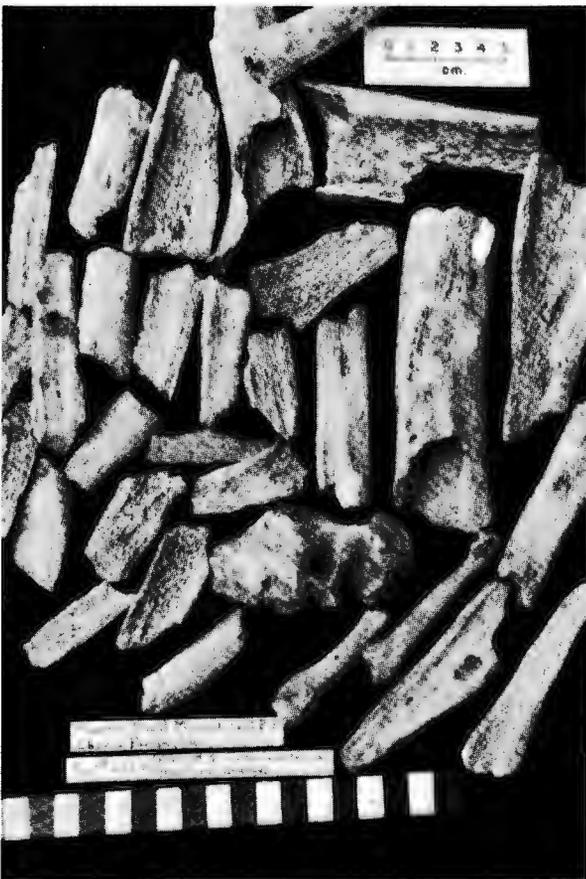
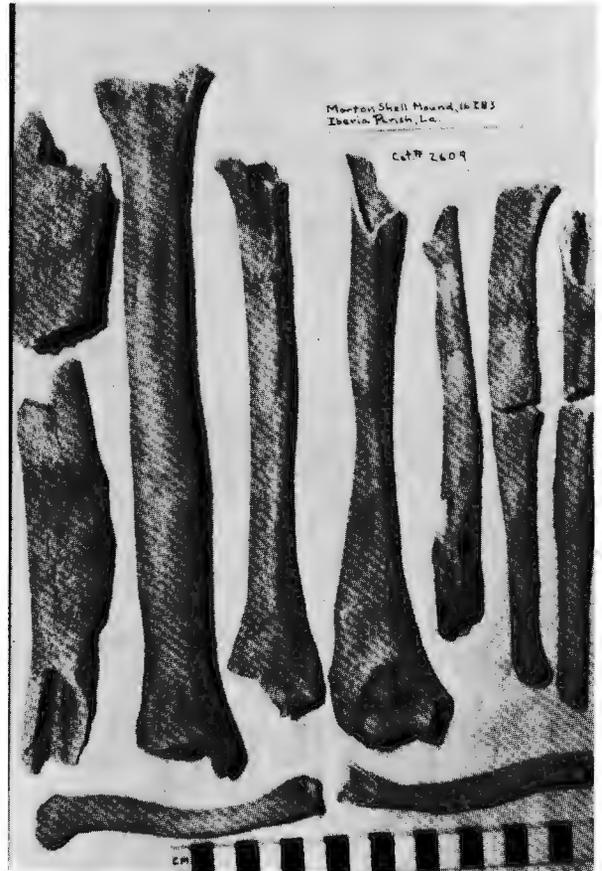
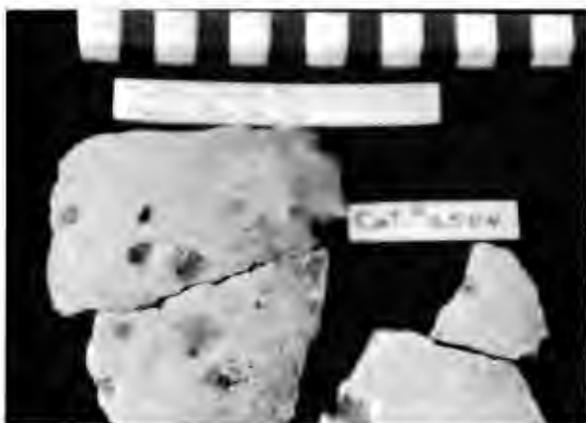


Fig 4—Pathological manifestations in the Morton Shell Mound Population. Figures show increasing severity of the disease. (*Top left*) Stage A. Endosteal and metaphyseal cellular change in immature individual. (*Top right*) Stage B. Enlargement of diaphyses, apposition of periosteal bone, and continuing change of endosteum. (*Bottom left*) Stage C. Formation of suppurative cloacae; gradual obliteration of medullary cavity; and extensive cortical remodeling. (*Bottom right*) Stage D. Numerous cloacae, sclerotic periosteum, and closure of medullary cavity with coarse spongiosa in long bones of many individuals.

Fig 5—Pathological manifestations in the Morton Shell Mound Population (continued). (Top left) Stage E, i. Destruction and remodelling of limb bones. (Top right) Stage E, ii. Obliteration of frontal sinuses; increased vascularization of inner table of vault; enlargement of diploë. (Bottom left) Stage E, iii. Localized lesions of outer vault table.



syphilitic cause is not to be discounted. I offer the yaws diagnosis for the disease symptoms, after examining and eliminating possible alternative diagnoses, even though it is thought that yaws was not present in North America during aboriginal times.<sup>8,9,10</sup>

The disease process in the Morton Shell Mound series exhibits more distinctive aspects of yaws than of other infections; a brief review of the Morton pathology will elucidate points of similarity. The initial symptoms of the disease seem to appear in the bloodstream of children, adolescents, or very young adults, thus affecting the hematopoietic regions of the skeleton. Destruction of periosteal and endosteal bone is more intensive and extensive than that resulting from periostitis or osteomyelitis. Not only are the shafts of long bones affected by the disease, but the spongy (cancellous) bone in the distal and proximal ends of long bones is also modified, as are the medial and proximal spongiosa of the clavicles. A few frag-

ments of broken and rehealed bones (femur and ribs) exhibit an abnormal profuseness of reparative bone. In contrast to periostitis, which tends to be most severe in the tibia and fibula, the Morton disease process works on the humerus, radius, and ulna to the same degree that it affects the bones of the legs; even phalanges of the hands and feet are afflicted. Nearly all parts of the skull exhibit some evidence of pathology. Lesions of the cranial vault extend from the outer table into the enlarged diploë; there is increased vascularization of the inner vault table, obliteration of frontal, sphenoidal, and maxillary sinuses, and interference with the regularity of periodontal destruction. Whether or not the pathology contributed to the formation of the sporadically-occurring bony nodules on various bones cannot be established; however, the apposition of irregularly-shaped bony spicules along lines of tendinous and ligamentous attachments (such as linea aspera, deltoid tuberosity, and nuchal lines) seems to be linked to the severity of the pathology, as does the lateral torsion of the humerus at the deltoid tuberosity and the anterior bowing of the tibial shaft.

If the diseased fragments from the Morton Shell Mound are examined individually, some of them may resemble bones with syphilitic osteitis (or with osseous syphilitic lesions); when the fragments are examined in context, that is, coming from members of the Morton Shell Mound population and not as a single fragment divorced from a sociocultural group, a diagnosis of syphilis cannot be substantiated. Endemic syphilis (nonvenereal), however, more closely resembles the Morton disease than the venereal forms. For example, the saber-shin tibiae and the

diaphyseal osteomyelitis could indicate a diagnosis of congenital syphilis, but the Morton people do not have the dental stigmata (Hutchinson teeth, mulberry molars), among other traits of late congenital syphilis. The Morton people's disease persists in an individual beyond the usual time period (around 15 years) of early congenital syphilis. The low frequency of the disease in children and adolescents and the absence of cranial vault sequestra make it unlikely that venereal syphilis is the causal agent.<sup>10,11</sup>

The manner in which endemic syphilis and yaws affect bone is so similar that the two are often distinguished by their geographical distribution, that is, yaws is found in hot, humid areas of the world, and endemic syphilis is found in warm, arid ones. Both treponemal infections are acquired during childhood but can persist into adulthood. Neither of the infections tends to affect the cranial vault except for localized lesions which in yaws do not extend into the inner table. Yaws and endemic syphilis both affect the tibia (producing a saber-shin form), fibula, radius, ulna, phalanges, and clavicle. Some differences between the infections do occur in bone modification of phalanges and in the involvement of the metacarpals in yaws.<sup>10</sup>

Although there are many similarities in the manifestation of yaws and endemic syphilis, I believe that the disease processes in the Morton Shell Mound skeletons more closely resemble yaws than endemic syphilis. Lesions on the frontal and parietal bones of the Morton people are small, shallow, craterlike lesions that involve only the outer table with small intrusions into the diploë. Whether or not there is destruction of the nasal and palatal areas of the Morton people's crania is unknown because those fragments were not present (or were not recovered) in the site; however, some maxilla and zygoma fragments show bone remodeling with suppurative cloacae from the maxillary sinuses anteriorly to the face; temporal fragments from some adults show a destructive change of the auditory meatus and the surrounding bone. Gummatous osteomyelitis is evident in fragments of the clavicle, ribs, and the long bones, especially the humerus, femur, and tibia. In the adult bones of the hands and feet, the phalanges are affected more severely than other bones; some phalanges are enlarged considerably, especially in the shaft area, and occasionally there are necrotic perforations through the cortical bone. Some of the carpal bones are misshapen from subperiosteal deposi-

tion of bone to the point that precise bone identification is uncertain.

The teeth of the Morton Shell Mound people do not contain the abnormalities that are characteristic of syphilis, that is, fissures in incisor enamel, mulberry molars, and so forth. Taurodontism is prevalent among some adolescents and many adults, especially among older adults; all teeth, incisors through molars, exhibit the condition. It is possible that the trait is an example of pseudotaurodontism because there seems to be an unusually high positive correlation between the taurodont condition and alveolar pathology.

### Conclusions

The disease that afflicted the Morton Shell Mound people does not seem to be widespread among the prehistoric peoples of Louisiana according to many archaeological reports.<sup>7,12-16</sup> However, in his report on the Pecan Island sites, Collins<sup>16</sup> noted that at the Veasey site some long bones showed "lesions apparently produced by syphilis," and at the Morgan site there were "long bones showing evidence of syphilis." Skeletons at the Copell Site (Tchefuncte culture) showed no pathology. The Veasey and Morgan sites are also shell mounds, located on the Gulf Coast slightly southwest of the Morton site, and are of the same cultural manifestation as the Morton site, that is, the Troyville-Coles Creek culture. Ford<sup>17</sup> reported on a site containing the Troyville-Coles Creek culture some distance northeast of the Morton Shell Mound and, although "a number of bones were scattered in no apparent order," no statements were made about skeletal pathology; it is recorded, however, that the skeletal material was rather poorly preserved. Thus, it appears that the treponemal infection was not characteristic of all people who had the Troyville-Coles Creek culture but only those groups who inhabited the low-lying mounds of the Gulf Coast. This combination of factors suggests that the physical environment played a role in sustaining the infection among the people.

The presence of a treponemal infection in the Morton population undoubtedly would undermine the health of the population in general and would have a crippling effect upon the individuals (especially adults) in whom the infection was reaching advanced stages (tertiary yaws). The infection may have been a primary cause of some deaths and a secondary, indirect factor contributing to other unre-

lated illnesses and deaths by weakening the immunological defenses of affected individuals. Muscular stress patterns on many of the bone fragments suggest functional activity during periods of pathologic bone remodeling. A disease such as yaws not only attacks the skeletal structure but also produces open draining sores in the skin, a factor that predisposes the diseased individual to secondary infections. Thus, the Morton Shell Mound skeletal series, like all burial populations, reflects many of the biological as well as cultural elements that had significant meaning to the people during their lifetime.

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