CASE REPORT

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Osteological Individuality Indicative of Migrant Citrus Laboring

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ABSTRACT: Particular features of a skeleton discovered near Dade City, Florida, are consistent with the stresses of a life of migrant citrus laboring. In particular, unusual aspects of the right shoulder skeleton are not manifested bilaterally. Ethnographic data, radiographs from a living citrus worker, and the police investigation also support the hypothesis that these remains were derived from an individual who spent significant time as a citrus fruit picker.

KEYWORDS: forensic anthropology, human identification, musculoskeletal system, migrant labor, osteological individuality, enthesopathy

Perhaps the most challenging aspect of forensic anthropology is to discern individual personal characteristics from a set of skeletonized human remains. One aspect of this task is the determination of an individual's primary occupation from sets of features of the skeleton and dentition. Occupations which involve an element of physical stress may leave skeletal evidence of that activity; Kennedy [*1*] and Angel and Caldwell [*2*] have published studies of forensic science cases involving osteological manifestations of occupational stress. Dutour's [*3*] research focused on activity induced enthesopathies during the Neolithic. Merbs [*4*] has published an entire monograph which focuses on activity induced osteological pathologies in an historic Canadian aboriginal skeletal series.

Case Report

The virtually complete skeleton of an adult human was discovered in a drainage ditch on the outskirts of Dade City, Florida, in 1981. A few personal effects and a complete set of men's clothing were found in association with the skeleton. Standard forensic anthropology examination of the remains suggested that they were derived from a male individual aged in his fifties at death. The initial gender determination was made on the basis of morphological criteria summarized by Stewart [*5*]. Among the masculine features were pronounced supra-

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orbital tori and mastoid processes, a square mental eminence, convex ischiopubic rami, no pubic ventral arc, and narrow greater sciatic notches of the ilia. The age estimate was based upon analysis of the costal chondral junctures of the fourth ribs (assuming Caucasian ethnicity) [*6*] and the pubic symphysis [*7*].

Living stature was estimated to be approximately 175 cm, based upon the length of the right femur and the work of Trotter [*8*]. Racial ancestry of the remains is uncertain. Discriminant function analysis of the skull [*9*] yielded a value of 89.24, virtually the sectioning point between black and white males. Discriminant function analysis of the pelvis and femur [*10*] yielded a +99% probability that the remains were derived from a white. However, several features of the skull suggest a degree of African or Afro-American ancestry. The skull is moderately prognathic, and the posterior rami of the mandible [*11*] are inverted. The nasal bones are not particularly salient, and the inferior nasal aperture is not well-defined. Skull base height, a measure of health status [*12*], is 12.5 mm.

The postcranial skeleton is replete with interesting features. In particular, the left shoulder skeleton is remarkable; the right shoulder skeleton also manifests unusual features. Aspects of the left shoulder skeleton which are not present in the right shoulder skeleton include an unfused Os acromiale (the pre-acromion [*13*]), a noticeably larger acromial portion of the scapular spine, an enthesopathy on the coracoid process at the point of attachment of the trapezoid ligament, and a larger and misshapen lateral aspect of the clavicle, in particular where m. deltoideus originates (Fig. 1). A large clavicular facet is present on the right acromion; no such feature is present on the left scapula. There are distinct bilaterally distributed articular facets immediately medial to the glenoid tubercles.

The superior appendages feature moderately well-developed humeral deltoid tuberosities, slight flattening of the humeral heads, moderately well-developed supinator crests of the ulnae, and arthritic lipping of radial heads and distal articular surfaces of the ulnae. Right ribs 9 to 11 display evidence of long healed fractures, probably incurred simultaneously. The same may be true of fractures of left ribs 7 and 8. While C4 and C5 manifest slight arthritic lipping, the centra of C6 and C7 are remarkable in that regard. There is evidence of modest lumbar/sacral arthritis and suggestions that the disks between L3 and L4 and L4 and L5 had slipped. Tibial tuberosities are moderately well developed, and there are distinct squatting facets [*14*] on the distal-most portions of the anterior surfaces of the tibiae. A peculiar extension of the left superior articular surface of the left tibia is present; this portion of the right tibia is not present for study. That individual also suffered from acute periodontal disease;

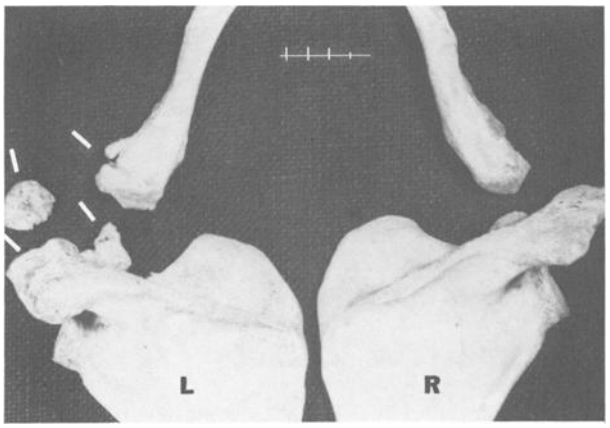

FIG. 1—*Scapulae and clavicals; arrows indicate areas of bilateral assymetry. Scale is in centimetres.*

all incisors were lost premortem. There is no evidence of any dental work, and the first molars display Phase 1 crown wear, according to Brothwell's typology [*15*].

Discussion

The unusual osteological individuality manifested in this skeleton is completely consistent with a lifetime of moderate to pronounced occupational stress; in particular specific individual skeletal features are consistent with prolonged occupational stress associated with citrus harvesting. The articular facets in the supraglenoid area of the scapulae (Fig. 2) suggest that the arms were habitually abducted over the level of the shoulder. The slight flattening of the humeral heads adjacent to the area of the greater tuberosities also suggests such an activity. The pronunciation of the deltoid tuberosities is consistent with this postural condition. Lipping on the radial heads and distal articular facets of the ulnae, and the size of the supinator crests, suggest that pronation and supination were also part of the regular occupational activity. These activities are clearly identifiable with picking citrus fruit. Indeed, the primary economic reliance of the Dade City area is the citrus industry.

The lipping of the centra of C6 and C7 may well be the result of the regular extension of the neck and head dorsally, in order to view fruit above one's head. The atypical nature of the left shoulder skeleton in comparison with that of the right shoulder is likely the result of specific extra stress placed upon that portion of the anatomy. Ethnographic evidence (film narration and depiction) [*16*] indicates that migrant citrus harvesters typically carry the long, heavy ladders on their left shoulder and suspend the bag that holds the fruit over that shoulder as well. A full bag of citrus fruit weighs approximately 90 lbs (40 kg). Ethnographic evidence in the form of film narration [*16*] also indicates that such bone fractures as those in the ribs of this skeleton are not infrequent among citrus workers.

The enthesopathy on the coracoid process of the left scapula is especially interesting, since it occurs where the trapezius muscle inserts. This may well be ascribed to the exceptional stress which results from rotation of the scapula when the left arm is picking fruit and the left shoulder is further burdened by the weight of the bag.

The other osteological peculiarity of this skeleton apparently directly associated with activities incurred as a result of regular seasonal citrus harvesting are the squatting facets present in the distal tibiae. These apparently result from frequent flexion of the foot upon

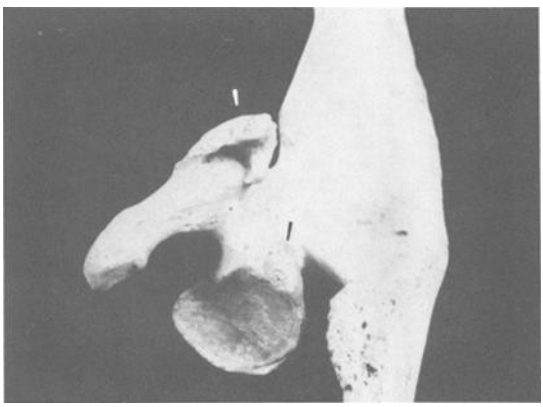

FIG. 2—*Overhead lateral view of left scapula. Arrows indicate coracoid enthesopathy and supraglenoid articular facet. Distortion of glenoid fossa is due to lighting and angle of photograph. Articular facet is actual size.*

the foreleg. This kind of postural orientation is in all likelihood associated with standing on and climbing up and down ladders, especially when some of that activity involves a full bag of fruit.

The unusually small skull base height (12.5 mm) of this individual suggests a deprived economic background [*12*]. Migrant workers, especially as children, suffer from poor nutrition [*17*], and also typically lie outside the mainstream of modern health care [*18*].

To evaluate further our hypothesis that such osteological phenomena could have resulted from citrus harvesting, we procured four sets of radiographs (three on a prospective basis) from citrus harvesters who sought health services at the West Orange Family Health Center in Apopka, Florida. One set of X-rays manifested an enthesopathy on the right coracoid process (Fig. 3) similar in morphology and location to the one on the skeleton under discussion. The radiologist who interpreted the X-rays for us indicated that he had never seen such a growth in the thousands of shoulder radiographs which he had studied; he also indicated that he had never studied shoulder radiographs from a migrant worker, to the best of his knowledge and memory.[3]

Note that the kinds of activities which citrus harvesters routinely perform as a result of their occupation differ in many fundamental ways from the activities of migrant farmworkers engaged in harvesting other crops. Most migrant harvesting activities do not involve work on a ladder; very few involve the suspension of such heavy bags from the body. In fact, almost all other migrant harvesting activities (save apples, plums, and so forth) are entirely terrestrial in nature. Also worthy of mention is that the majority (55.5%) of migrant laborers in south central Florida are Hispanic [*19*]. However, the term Hispanic represents Cubans, Central Americans, Puerto Ricans, and Mexicans, which may explain the problems we encountered in estimating the ethnic ancestry of this skeleton.

Several months before the discovery of the remains, an individual fitting the description suggested from the above forensic anthropology analysis disappeared from the very vicinity where the skeleton was found. In fact, the clothes associated with the skeleton were in many respects identical to those he typically wore, according to one person familiar with him.

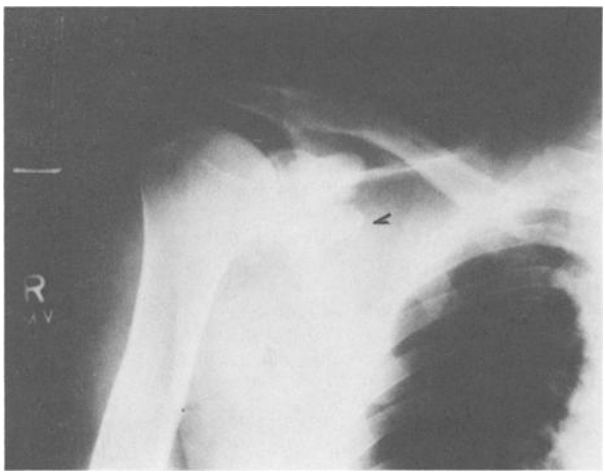

FIG. 3—*Radiograph of right shoulder of adult male citrus worker in his fifties. Arrow indicates coracoid enthesopathy.*

[3]Stentzler, S., 1986, personal communication.

The police report indicates that the missing person was a "hobo" who picked fruit occasionally. He was a white male (with possible Indian ancestry, according to someone personally familiar with him) who was 5 ft 9 in. to 5 ft 10 in. (175 to 177 cm) tall, of thin wiry build, and in his fifties. He had a thick, funny-looking nose, dark skin, and brown eyes. He walked with a slight stoop and had obvious arthritis. Furthermore, he was reportedly soon to travel to North Carolina. North Carolina is a part of the migrant stream traditionally followed by Florida citrus harvesters [*15*]. Unfortunately, to date, neither the missing individual nor any health records related to him have been located, despite considerable effort to do so. That is also consistent with our hypothesis, for reasons regarding migrant health care which were noted earlier.

Conclusion

In our opinion, it is probable that the remains described above were derived from the missing individual. The hypothesis that the remains were derived from someone regularly engaged in citrus harvesting is supported by a variety of unusual osteological features. Unfortunately, it is not possible to prove that contention. Certainly, there is a great need and desire for a better understanding of the kinds of osteological manifestations that may be associated with different occupations and lifestyles. Such research would best be conducted by interdisciplinary teams comprising forensic anthropologists, radiologists, and forensic pathologists, among others.

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