Windover: An overview

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Zusammenfassung

Windover: Ein Überblick

Windover ist ein 72oo Radiokarbonjahre (unkorrigiert) alter Bestattungsteich. Menschliche Bestattungen sind bei wenigen Fundstellen in Mittelflorida intentionell in kleinen Teichen vorgenommen worden, die fast optimale Erhaltungsbedingungen nicht nur von Skelettmaterial, sondern auch von einer erstaunlichen Vielfalt an normalerweise vergänglichen Artefakten aus organischen Materialien ermöglicht haben. Die Fundstelle [Windover] enthielt mindestens 168 Individuen, gleichmäßig verteilt auf Männer, Frauen, Erwachsene und Nicht-Erwachsene. Ungewöhnlich wegen der Erhaltung, aber ohne Zweifel weit verbreitet, waren die Reste von einem Flaschenkürbis (Lagenaria siceraria), der einer der ältesten Belege von Flaschenkürbissen nördlich von Mexiko ist. Der für diese frühe Zeit ungewöhnlich große Friedhof bietet eine fast einzigartige Möglichkeit für paläodemographische, Isotopen- und paläopathologische Studien über prähistorische Lebensweisen sowie zur Gesundheitssituation in dieser frühen, »quasi mesolithischen« Periode in der Neuen Welt. Der Bestand an handgewebten Stoffen ist eindrucksvoll und gibt Zeugnis von den hohen technischen Fähigkeiten der frühen Populationen, die wegen der ansonsten schlechten Konservierung in den meisten Bodenverhältnissen kaum erwartet wurden. Der Bestand an Holz-, Knochen-, Zahn- und Geweihgeräten, erforscht mit diversen multidisziplinären Strategien, unterstreicht die Bedeutung von Feuchtstandorten für die Kenntnisgewinnung über die Vergangenheit.

Summary

Windover is a 72oo radiocarbon year BP (uncorrected) mortuary pond. Human burials in a few central Florida sites were intentionally placed in small ponds which provided near optimum preservation of not only the skeletal material but an amazing array of normally perishable organic artifacts. The site contains an MNI of 168 individuals, evenly divided between males, females, adults and subadults. Unusual because of preservation, but no doubt widely distributed were the remains of a bottle gourd (Lagenaria siceraria) which is one of the earliest reports of bottle gourds north of Mexico. The unusually large cemetery (for its early time) provides an almost unique opportunity for paleodemographic, isotopic, paleopathological study of prehistoric lifeways and health in this early ›quasi-Mesolithic‹ period in the New World. The inventory of handwoven fabrics is striking and are witness to the technological sophistication of early groups which, because of poor preservation in most terrestrial contexts, is unappreciated. The wooden, bone, dentary and antler tool inventory couple with a diverse multidisciplinary research strategy highlights the importance of wet sites in informing us of the past.

Background

The Windover site (8BR246) was discovered during construction in the spring of 1982 (Fig. 1). The property owners (EKS, Inc.) contacted FSU and ultimately paid for the first radiocarbon dates and the first field season's well point and heavy equipment expenses. The Florida Legislature funded three years of field work and one year of laboratory work as a result of legislative contacts and high visibility of the project. Without the landowner's (EKS, Inc.) interest and support the project would not have been possible. Supplemental funds from the Ford Foundation, Jesse H. Ball DuPont Memorial Fund, and the dozens of volunteers who helped in a myriad of ways during the three field seasons (August – December of 1984, 1985 and 1986) were critical in the success of the project. Most recently (December 2o13) the site was purchased by a national organization dedicated to the preservation and protection of important archaeological sites (The Archaeological Conservancy; http://www.archaeologicalconservancy.org).

The site is located in east central Florida, now 27 km due west of the Atlantic margin of the north end of Cape Canaveral. The site was discovered in the course of demucking a small pond in preparation for road construction of Windover Way. The construction goal was to remove enough of the unstable peat to infill with sand and then construct a hard surface road over the margin of the pond. In this process two things became apparent. First, the peat was deeper than the 1 – 2 m deposits typical of central and south Florida. Secondly, and most importantly, was the discovery of a scattering of cranial and postcranial material. It was determined not to be of forensic interest and Florida State University anthropology faculty (G.H. Doran and R.C. Dailey) were ultimately contacted and Doran began preparing a research proposal at the landowner's (EKS, Inc.) request.

Fig. 1 Backhoe clearing/demucking for road construction brought to the surface some of the Windover individuals. There are no other indicators of an archaeological site of this antiquity in the area.

An emphasis on the New World, particularly North American archaeology, is provided in this paper. Most readers of this volume will be infinitely more familiar with the European archaeological framework and hopefully this effort will provide a context for comparison that will be useful.

Cultural and archaeological setting

All radiocarbon dates on artifacts and human bones provide a date between 81oo and 69oo ^{14}C years BP (Doran 2oo2) with a median date on artifacts and bone of 741o ^{14}C years BP. In the three field seasons (August – December of 1984, 1985 and 1986) a minimum of 168 individuals were recovered, with 75 of these being fundamentally intact and articulated, some with accompanying burial goods (Fig. 2). In the south-eastern United States (and most of North America if not the entire western hemisphere) such traditions fall into what is referred to as an Archaic archaeological tradition or some rough equivalent (Desert Archaic, etc. – Fagan 2oo5). Groups in this period were comprised of small populations with high mobility whose subsistence pattern is clearly hunting-gathering-fishing. At Windover, we see minimal, if any, evidence of marine resource exploitation, though a nearby small estuary system may have been exploited. There is no evidence of ceramic technology nor of especially large sedentary populations (Anderson/Gillam 2ooo) for at least another 3ooo years. Additionally, there is no significant evidence of ›agriculture‹ for several thousand years in the eastern United States (Bense 1994). In fact, in much of Florida, from Windover south, there is no real evidence of agriculture until the historic period. The Archaic follows immediately upon the Paleoindian tradition which is marked, perhaps too exclusively, by at least occasional megafauna exploitation (Webb 2oo6) and is contemporaneous with many groups categorized as Mesolithic in the European nomenclature. The artifact inventory from Windover includes, bone, dentition, antler and wooden tools, and an almost unique (for its time, diversity, and quality of preservation) inventory of hand woven fabrics (Adovasio et al. 2oo1; Andrews et al. 2oo2; Doran 2oo2) as well as one of the earliest North American examples of a ›semi-domesticate‹ bottle gourd, ***Lagenaria siceraria***, the white flowered bottle gourd (Doran et al. 199o).

In the New World, samples/sites with burial inventories containing more than 2o individuals dating to this early time period are very rare. In a 2oo7 tabulation of North American skeletal samples (n=493o6 individuals – sample inventory and descriptions provided in Doran 2oo2 and Doran/Stojanowski 2o12 – Buckeye Knoll reports available online in their entirety – http://counciloftexasarcheologists.org/?page_id=27) there were only 5o sites containing skeletal material older than Windover (741o mean ^{14}C date) in North America. Only ten of those contained more than a single interment with a total inventory of 1o8 individuals. The largest inventory in this rather rarified group was 28 (Doran 2oo2). Clearly, the large size of the Windover sample is striking. The geographically and chronologically restricted bur-

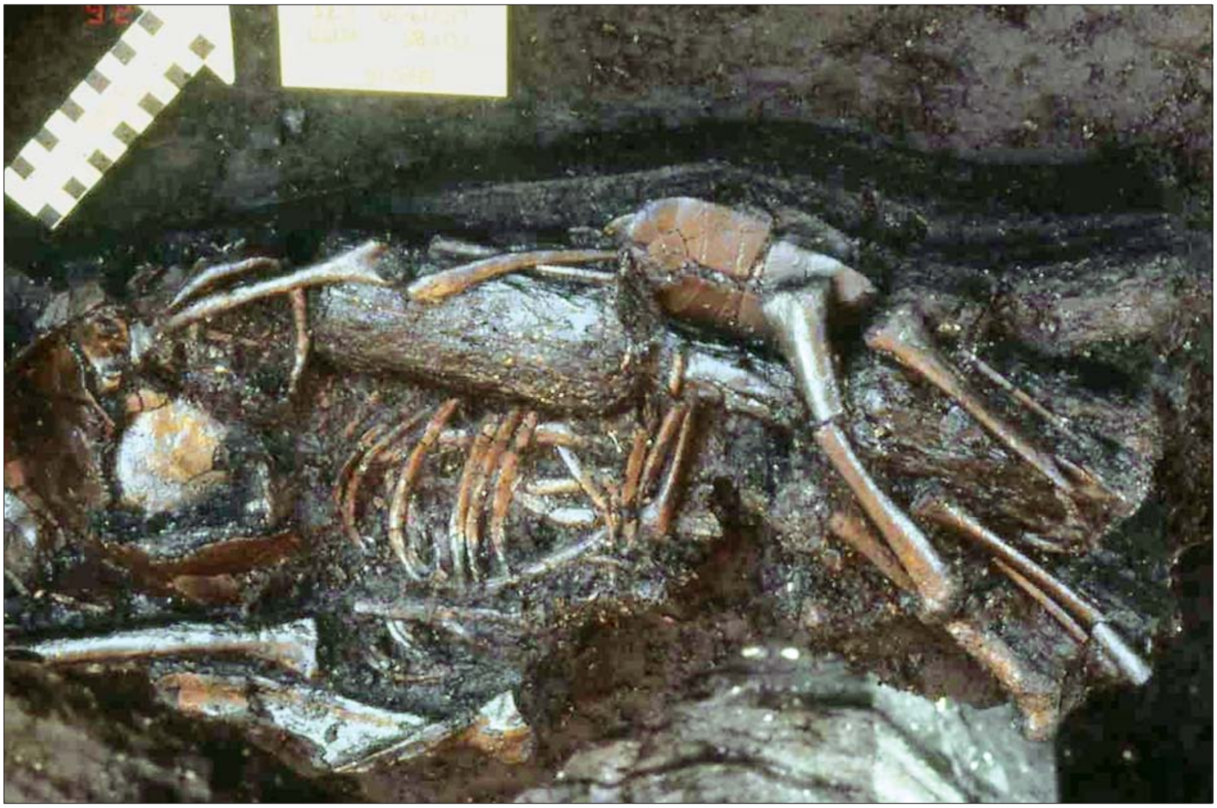

Fig. 2 This subadult (4 years of age) was accompanied with a large muller/pestle made from live oak heart wood, a turtle shell carapace, bone tools, 4o drilled palmetto seed beads.

ial tradition of interring bodies in small ponds (with developing peat deposits) provided near optimal preservation of the organic material. Wet sites such as this provide excellent preservation which can be attributed to the peat chemistry (nearly neutral), perennial saturation, and anaerobic conditions (Stone et al. 199o; Hauswirth et al. 1991). When compared to the rest of North America, and the New World in general (with a few exceptions), these early (pre-6ooo ^{14}C years BP) samples are small in number and often very poorly preserved. Other collections such as Buckeye Knoll (the third largest North American collection older than 6ooo ^{14}C years BP – Ricklis et al. 2o12; Doran/Stojanowski 2o12) exhibits more typical preservation problems with extreme fragmentation and deterioration. Regardless of geographic location, with increased antiquity, fewer skeletal remains survive, and thus limit the depth of analysis researchers are able to perform. This combination of small sample sizes, inherent problems with sampling and preservation, and often wide geographic distributions, present a multitude of challenges. That being said, these collections do provide our only real window on human biology for these early epochs.

A cursory review of European Mesolithic samples indicates that the array and density of burial goods is far greater in the European realm than in the North American samples. As far as we can tell, there are simply no early New World individuals which contain such stunning burial inventories as those from Arene Candide (Francalacci 1989), Bad Dürrenberg (Porr/Alt 2oo6), and many of the other sites discussed in this volume. Burial artifact inventories in the European Mesolithic are much more elaborate and diverse than anything we see in the New World (Fig. 3). The simplest interpretation is that the much deeper chronological presence of humans, their relatives, and ancestors hasled to a greater cultural diversity and complexity reflected in burial inventories in the Old World.

As suggested earlier, the vast majority of burials in North America older than Windover are typically single burials with limited artifact inventories. The solitary nature of most of the early burials is one indication of the relatively small populations and their mobile nature. That is not to say there are not remarkable exceptions to these generalizations and the Indian Knoll site in Kentucky (n=1234, 53o4 ^{14}C years BP uncorrected; Johnston 1961; Webb 1946) comes immediately to mind as does Buckeye Knoll (Ricklis et al. 2o12). Indian Knoll, Buckeye Knoll, Windover, and a few other early sites support the argument than in some places, ›unique‹ combinations of resources, terrain, and environment, lead to exceptions to these generalizations in terms of burial numbers and artifact inventories accompanying the dead.

In the Early Archaic the environment around Windover was different than it is today. This is an area of low relief and any small ridge or hammock 4 m above sea level or greater is considered a high elevation. The site lies in what is still an environmental transitional zone between milder tropical climates of south Florida and the slightly more temperate zone to the north. Physically the site is nearly equidistant between two major aquatic resources. The St. Johns River, a major

Fig. 3 This was the most elaborate burial inventory at Windover (Burial 9o). It is a double burial of an 11-year-old subadult (probably male) with a neonate in a bag between the legs. Clearly the loss of two individuals at the same time would have been tragic in these early small communities.

Fig. 4 Drilled and undrilled shark teeth (several species) indicates some attention was paid to estuarine resources. Shark's teeth provided important cutting tools in this chert poor environment.

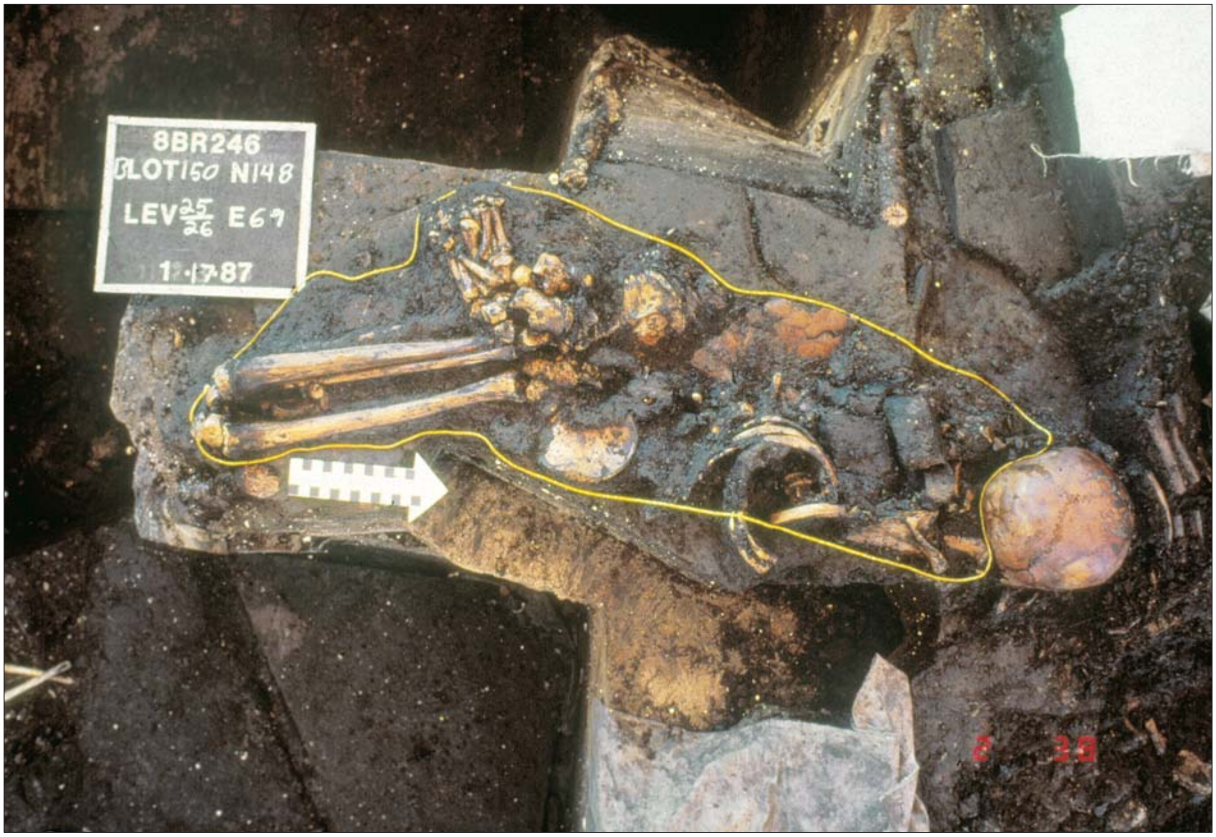

Fig. 5 Most burials were flexed on their left side with their heads to the west. This burial shows the nearly intact bottle gourd toward the back of the individual and shows several cut stakes that would have helped hold the body in position.

Florida river emptying 230 km north of the site near Jacksonville, Florida, is a mere 5 km west-south-west of the site. The Indian River lagoon/estuary system is due east of the site and also only 5 km away. At the time of occupation, the area was drier and many have likened it more to the modern African savannah than the semi-tropical swamp land modern visitors to Disney World (75 km west-south-west of Windover) experience when visiting central Florida (see multiple chapters in Doran 2002 for pollen, peat and vegetation reconstructions). Based on shore line reconstructions and our ongoing research at Cape Canaveral, marine resources would have been substantially further east than they are today, perhaps as much as 60 km east of the site. There is little evidence of a significant marine orientation but the estuarine resources of the smaller Indian River lagoon would have been tapped and is indicated by the presence of a small number of shark tooth cutting tools and two Busycon shells (all marine or estuarine species) as well as isotopic analysis results (Fig. 4). The fact that the site is located at the point where the St. Johns and the Indian River are closest to each other has not escaped our attention and was likely an important consideration in prehistoric times as well. It is easy to propose (but we have little if any real basis of identifying a territory formally) that the pond may have been near the center of the foraging area of these peoples and could have acted as an anchor around which foraging, fishing, and hunting activities took place. While freshwater resources are today abundant with thousands of small ponds scattered across the landscape, at the time of occupation, many of these would not have held water except perhaps seasonally. None the less, the juxtaposition and density of resources must have been an attractive feature even though our knowledge of the Windover people is restricted to this special purpose cemetery area. No habitations dating to this interval have been identified, though massive changes to the area have taken place in the last 100 years making habitation site identification difficult. In central Florida the few sites that do date to this period are often ephemeral, diffuse, low artifacts density scatters.

As noted earlier, the site was found accidentally by road construction. The pond held perhaps 1 – 2 m of water with some seasonal fluctuation. There was absolutely no hint of a site and had it not been for the excavation of the peat and the entombing burials, the site would not have been discovered. The only known location for such burials is in central and south Florida and only four other charnel pond sites (all slightly more recent) have been discovered – Bay West, Republic Groves, Ryder Pond, and Warm Mineral Springs (outflow area – Doran 2002). There is no discernable pattern to their placement, nor have there been any predictive models developed to explain what seems to be a random distribution in a landscape. There are literally tens of thousands of small ponds that, except for the burials, could be carbon copies of the Windover pond. Without the help of the developer and an excellent wellpoint dewatering system (Thompson Pump and Manufacturing, Port Orange, Florida) excavations would not have been possible (Doran/Dickel 2002).

Fig. 6 The corner of a piece of Windover fabric (SS 517) shows great craftsmanship. Hand woven textiles of this diversity and complexity are rarely preserved but were probably part of all New World craft inventories. All organic materials from Windover underwent stabilization and conservation treatments to ensure their survival. Success was not assured and this specimen did not survive intact.

Fig. 7 Bird bone tubes, some incised, were only found with female burials. The antler ›plummet‹ was of undetermined use but is testament to the expertise in tool manufacture.

There are alternatives to the wellpointing strategy we used and each wet site situation has to be addressed and include issues of were the water is coming from, how much there is, potential excavation depths, and duration of excavation season (Doran 2013).

From observations of the intact burials it appears the standard procedure was to wade into the shallow margins of the pond, perhaps to midcalf depth, scrape back some of the loose peat, place the body into the depression and then, with pine stakes, sometimes driven through fabric wraps, pin the body to the bottom of the pond. At Windover most of the 101 adult sexed burials were flexed (95 %) on their left side (87 %) and 64 % were oriented with their heads to the west (Dickel 2002; Fig. 5). Of the intact subadults, 45 % had fabric while only 24 % of the adults had fabrics preserved with the burials (Fig. 6). Among the female burials 30 % had fabric preserved and only 20 % of the males were recovered with fabrics. Only 15 % of the adult intact burials had one or more bone or antler tools, with males (17 %) having them more frequently than female burials (5 %). About 50 % of all bone and antler tools were found with males, however when females or subadults had them, more were found per burial. Only females were found with polished bone pins, hollow based curved antler punches, bird bone tubes, or drilled fish vertebrae (Fig. 7). Only males had carnivore radius tools and atlatl parts. Animal teeth were found with both males and females without any clear preference except that Canid teeth were found only with males. Analysis of the wooden tools (Newsom 2002; Adovasio et al. 2002) clearly emphasized the importance of wood in the material culture industry of these early populations but comparisons are sparse given that the bulk of such materials rarely survive outside of wet site situations. The presumption is that the importance of normally perishable items far outweighed the importance of lithics and that neither fabrics nor bone, antler, and wood tools were unusual but dominated the material culture inventory. Others involved in wet site investigations have also noted the importance of perishable materials in all traditional cultures and their true dominance is only revealed when preservation provides that unique window.

Fig. 8 Deer metapodial tools like these were probably part of the weaving tool kit.

Fabrics and wood

In the third field season as intact burials were encountered, 87 fabric and cordage specimens of hand woven fabrics were uncovered in 37 separate burials representing 67 separate and once complete items. Some of the bone tools in particular appear to be part of the weaving tool kit (Fig. 8). The fabrics are the largest, most diverse and complex set of perishable textiles of this antiquity, certainly in the south-eastern United States and perhaps in the New World (Adovasio et al. 2001). The wood and textiles were conserved at the University of Pittsburg and Mercyhurst College under the supervision of J. Adovasio (Andrews et al. 2002). Collectively the items represent four types of close twining, one type of open twining, and one type of flexible plaiting, and constitute an unparalleled collection of fabric, bags, and mats. The most likely species used in the manufacture of these items is the cabbage palmetto (*Sabal sp.*) which provides abundant long and strong fibers. These items are sophisticated examples of a perishable industry seldom glimpsed at this time depth. They are not the oldest such materials, but they represent a diversity and technical virtuosity in manufacture heretofore undocumented in the New World. Some of the construction techniques observed are apparently lost through time and a narrower spectrum of twining approaches are documented in later, often more fragmentary materials from other sites in the New World.

Clearly, our knowledge of these technologies is limited due to preservation. There is no doubt that fabrics were wide spread if not absolutely ubiquitous, but they simply disappear in most sites. On some of the specimens, and on some burials without fabrics, a thin ephemeral ›smear‹ or coating could be observed (Fig. 9) and may represent poorly preserved, but none-the-less recognizable collagenous residues that may be tanned hides (Hyland/Anderson 2002). To envision early populations as strictly hide-clad foragers fails to account for and appreciate the sophisticated nature of their material culture world. Clearly, stone tools don't tell the whole story. Adovasio and others, taking a global view, posit that textile production, while generally ›missed‹ in the archaeological record probably goes back to at least the Upper Paleolithic. What is observed at Windover hardly represents a new or evolving technology, but is an very old technological tradition brought into the New World from far older Paleolithic antecedents that is, more often than not, nearly invisible in the archaeological record (Adovasio et al. 1996; Soffer 2004).

Spatial patterning in a fabric's form and diversity led Adovasio et al. (2001) to suggest that the differences may be a reflection of lineage patterning in burial placement in the pond. Stojanowski and Schillaci (2006) came to the same conclusion when they looked at spatial pattering of dental variables within the pond. Multiple lines of evidence suggest a patrilocal postmarital residence pattern (Tomczak/Powell 2003). They observed greater variability in females (those who are moving into the group from other nonresident populations) than in males who are, in this model, residentially more stable. It has been argued that of all the technologies, the fabric industry is one of the most sensitive to individual and cultural traditions and can reflect distinct familial/lineage/population traditions. On a ›global‹ basis, females tend to be the primary producers of hand-woven fabrics such as those found at Windover.

Like fabrics, the wooden artifacts, are rarely preserved in the archaeological record. At Windover wooden, often sharpened, debarked pine stakes were recovered with burials (some of which represent recycled spear shaft segments). Other wooden items include parts of spring-snare traps, a wooden bowl, and pestle or muller (Fig. 2).

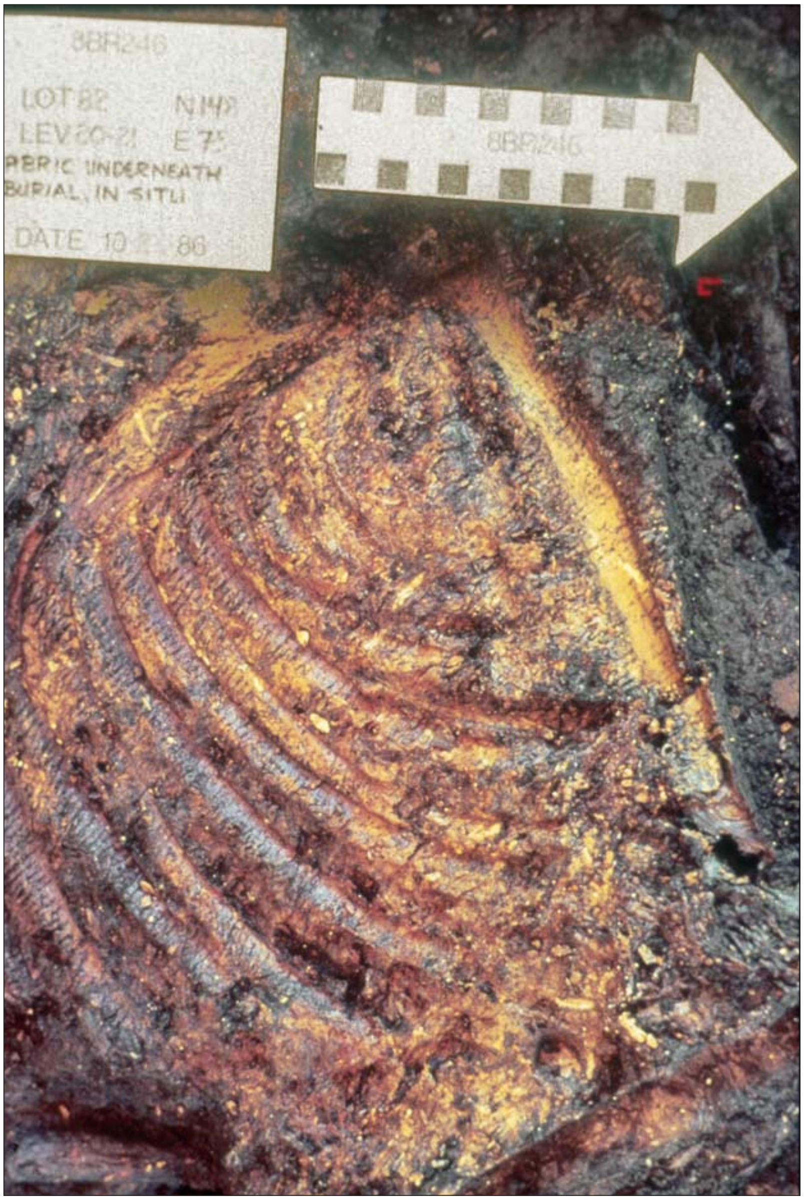

Fig. 9 Upon removal of the humeri and ribs the burial was underlain by one of the largest pieces of fabric recovered from Windover. Covering much of the fabric material was a thin smear of tan/pink material that had molecular features similar to collagen bonds.

These rare archaeological conditions allow us to appreciate the care made in choosing the types of wood, and even the parts of the tree selected for specific types of tools. The manufacture of wooden tools is no doubt older than textile production and probably antedates even lithic technology (Adovasio et al. 2001; Newsom 2002). Wet sites all around the world, provide remarkable windows into what is a surprising level of technical and artistic sophistication with a far greater time depth (Croes et al. 2005; Gilliland 1975; Dillehay 1997).

Geologically, this is a chert/flint poor area and few stone items were recovered. One distal biface tip, four complete bifaces, and one thinning flake constitute the entire Windover lithic inventory (Fig. 10). All these items came from the Panasofkee quarry cluster some 143 km west-north-west of the site. Clearly lithics were scarce commodities and were only found with male burials, or in the case of one biface, with a subadult, which might be an indicator that the individual was a male (Fig. 3). Dickel's analysis (2002) provides a more in depth analysis of the distribution of these materials and Penders's (2002) provides details of bone and antler tool morphology and metrics (Fig. 11). Hamlin (2001) provides a broader comparison of the implications of the distribution of materials by age and sex and argues that there were no strong gender differences in the overall distribution of materials. For some indicators of health, the differences can also be fairly subtle.

Our inferences of seasonality follow a relatively traditional reconstruction positing that these groups moved back and forth from inland and coastal areas. However, given the proximity to both these resources at this narrowest point between the St. Johns and Indian River lagoon systems, it is reasonable to assume a lessened need for substantial movement compared to other groups in other Florida east coast areas. The presence of the bottle gourd within the cemetery also points in the same direction (Doran et al. 1990).

Fig. 10 Lithics were scarce in this part of Florida and this is 100% of the bifacially worked materials. The only other stone item is a single biface thinning flake. Bone, antler, wood, fabric and dentary tools dominate the material cultural inventory.

Fig. 11 Ulna from deer (left half of image), felid (bobcat, top right) and canid (bottom right) were used for weaving and probably some bone and wood work.

From what we can tell bottle gourds fall into the category of ›semi-domesticates‹ and appear to require some degree of human attention for propagation and survival. Seasonal use of the cemetery seems strongest in late summer through fall based on the analysis of gut contents from a series of burials (Newsom 2002). These facts argue for a more restricted seasonal round than might be characteristic of other early hunting-gathering-fishing groups.

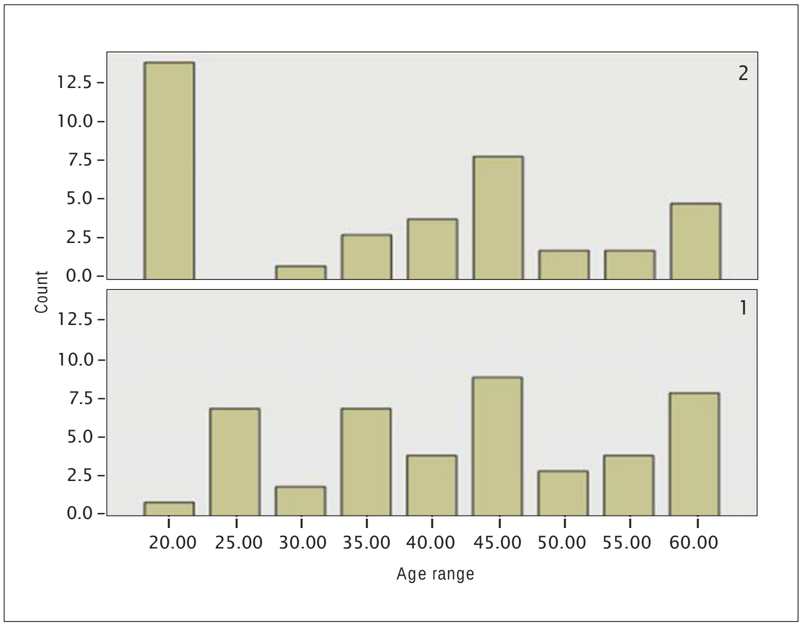

Fig. 12 Windover adult age distribution (males = 1 top histogram, females – 2 bottom histogram. Age assessments were based on pubic symphysis morphology, cranial suture development, and dental attrition.

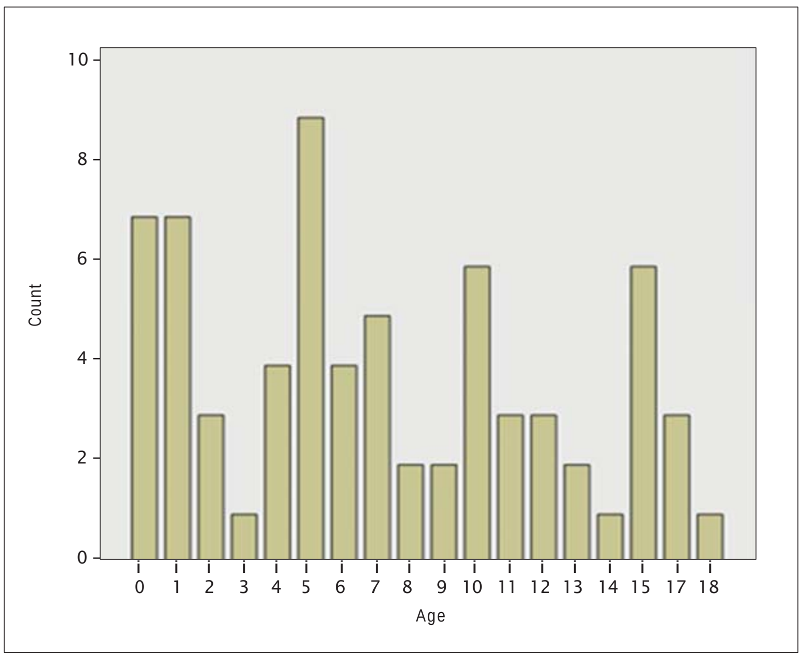

Fig. 13 Windover subadult age distribution. Age assessments based on epiphyseal union and dental maturation. Approximately half the sample was less than 20 ages and neonates were represented.

Age and sex profile

The Windover skeletal collection consists of a minimum number of 168 individuals (48 males, 47 females, four unsexed adults and 69 subadults; Fig. 12 and 13). Among these individuals, approximately 89 crania (29 female, 34 male, and 26 subadults) were preserved enough for data extraction regarding dental non-metrics and metrics as well as indicators of nutritional stress such as, linear enamel hypoplasias, and overall dental health (Fashing 2008; Miyar 2012; Wentz et al. 2006). The age distribution of Windover includes members from all age categories from neonates to 60+ years of age. A regression based on dental attrition suggests that a few individuals may have lived to the late 70s.

Dentition

Dental attrition among the Windover population is heavy and increases with age. This suggests a constant level of wear throughout an individual's lifetime. Little difference in rates of degrees of attrition is found males and females. Mandibular attrition is more extreme in the mandible than in the maxilla. Multiple patterns are present and include interproximal grooving, lingual wear on anterior teeth, and a previously undocumented pattern on posterior teeth termed lingual root wear (Miyar 2012). The overall levels of crowding and attrition seen in the Windover population are most likely due to non-masticatory cultural practices that are unique to this society (op. cit.). Dental processing of plant fibers used in the production of fabrics presents a reasonable interpretation for at least some types and degrees of dental attrition, particularly in the anterior dentition.

A variety of dental anomalies can be found in the Windover population. Based on the research of K. Miyar (2012), close to half of the available Windover sample (n=89) exhibits dental crowding, with the majority of these expressing severe forms. Young adults and juveniles, particularly males, exhibit the most severe versions of this condition. Compared to other hunter-gatherer samples, Windover exhibits a remarkably high level of crowding that is more often seen in ›stressed‹ agricultural groups (op. cit.).

Other dental features observed in Windover are worth noting. There is a single example of a Uto-Aztecan premolar. The Uto-Aztecan premolar at Windover (Burial 265) is the oldest documented case of UAP currently reported anywhere in the world (Johnson et al. 2011; Miyar 2012). An extreme manifestation of the tuburculum dentale trait, known as a talonid cusp (Turner 1998), is also present in Windover (Fig. 14) and is also seen in the Buckeye Knoll population. Three cases are documented in Windover and are the oldest recorded cases in the New World (Stojanowski et al. 2010; Miyar 2012). Additional dental variants include polydontia, impaction, agenesis, concrescence, germination, and premolar rotation (Miyar 2012). In total the individuals in this collection express a combination of dental traits and pathologies, some of which are common to many prehistoric hunter-gatherers from the south-eastern United States, while others separate Windover as a distinct group, unlike any prehistoric population found thus far.

Publications by Stojanowski, Johnson and others provide a global perspective on the distribution of talonid cusps which are only one of many low frequency ›oddities‹ that may help track population movements and geospatial and chronological origins (Stojanowski/Johnson 2011; Johnson et al. 2011).

Bioarchaeology is hardly static and new approaches are constantly being developed, which can be a consideration to those attempting to compile larger regional, pan-continental, databases. A measure that, in our opinion, has great promise, are cingulum, or neck dimensions rather than crown dimensions. However, recording both, rather than one versus the other, has advantages. Obviously, in many samples with significant dental wear, crown dimensions can be dramatically modified by attrition, leaving diminished statistical robusticity. Doran and Stojanowski (2012) found that Hillson et al.' s (2005) approach to dental dimensions is most appropriate in groups that exhibit substantial dental attrition, significantly impacting the incidence of measurable crown dimensions. As has often been noted, earlier populations tend to have larger dentition and this is certainly the case of the Windover adults. Compared to a large database of dental metrics (and post-cranial metrics) lumped into 1000 year intervals (with Windover being the oldest subsample) they are demonstrably larger than most of the more recent samples. This conclusion is emphasized in the tooth-by-tooth discussion of the Buckeye Knoll material (Doran/Stojanowski 2012).

The number of caries, abscesses, and tooth loss are as expected of a prehistoric hunter-gatherer group. A total of 68 carious lesions have been identified in the Windover

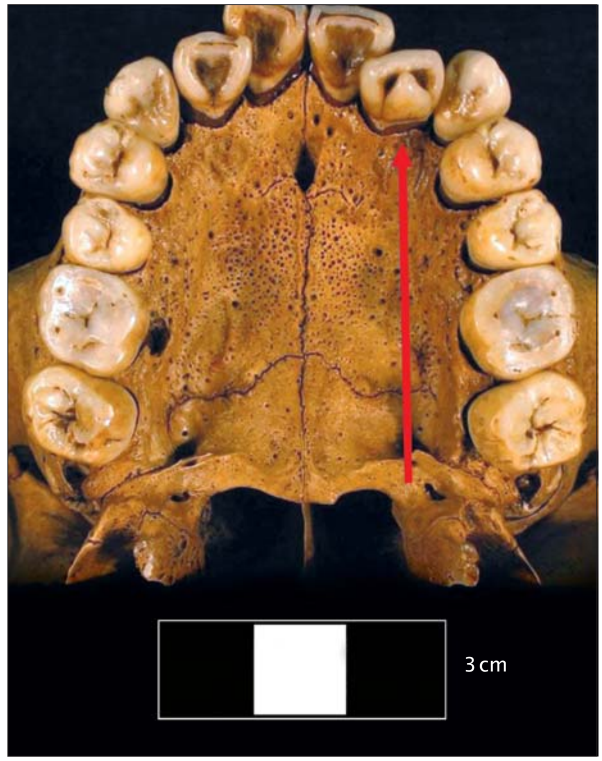

Fig. 14 The expression of rare dental trait like this talonid is one of several traits that help set some of the early New World populations apart from later groups.

population, the majority of which are in young-middle aged individual' s posterior dentition. The extreme dental wear, and presumed low level consumption of ›sugars‹ probably accounts for the relatively low caries incidence. Dental abscesses increase in number and severity as age advances. A total of 148 abscesses are present among the population and most of them are found among middle to old aged males with approximately equal incidence in the mandible and maxilla. Females exhibit slightly more abscesses in the mandible compared to the maxilla.

Fashing' s (2008) study of periodontal disease found the Windover population incidence rate was lower than other quasi-contemporaneous samples (like Republic Groves – an additional charnel pond). Later groups, following the same subsistence strategy, sometimes see periodontal disease in 90 % of the adult population. The presence and severity of periodontal disease in Windover is clearly associated with age, as none of the 10 – 19 year olds exhibit the problem. Virtually all individuals older than 50 years exhibited some degree of periodontal diseases (Fashing 2008).

Metabolic stress

Approximately 25 % of the total Windover population exhibits linear enamel hypoplasias. Incidence in males and females is similar (respectively 2.7 and 2.6 lines per person) in terms of count. Here, maxillary canine incidence counts were statistically significant. Individuals who died before 20 years of age had higher rates than those who survived past 20. Age of formation clusters around 3.58 years in the

Fig. 15 This blowout fracture of the orbit and other injuries are testament to interpersonal conflict. The vast major of injuries point toward accidents resulting from an active lifestyle and not intentional violence.

Fig. 16 This well healed cranial fracture was one of only a few clear indicators of interpersonal violence. It is hard to imagine how this injury could have resulted from an accident.

mandible and 2.85 in the maxilla and are not statistically different between males and females. Interpretation within samples, across age groups and between sexes, can be complex and is even more challenging across samples where data is collected in different manners (Berbesque/Doran 2008), though it is a strategy that has promise if we are interested in informative comparative approaches. Many later populations have much higher LEH rates than observed at Windover and are generally taken to indicate increased levels of developmental stress.

Cribra orbitalia can be found in approximately 27.2 % of the Windover population (Doran 2007) and porotic hyperostosis was found in approximately 41.6 % of the population (27 females and 18 males). Hyperostosis was found across age groups including young, middle, and old aged individuals. It is also exhibited in all sections of the skull including the frontal, parietals, and occipital. There are slightly more cases of hyperostosis found in the parietals of both males and females than in other areas of the cranium. The rate of malnutrition and anemia within Windover is relatively low in comparison to later period hunter-gatherer and agricultural groups included in the Western Hemisphere database (Steckel/Rose 2002).

Fractures and infections (osteomyelitis, periostitis and thalassemia)

Examining the frequency of fractures within the Windover collection aids in the recreation of lifeways. Out of the entire collection, a total of 122 fractures were observed. This frequency is slightly higher than the average for contemporaneous hunter-gatherer populations. The fracture locations range from the arms to the feet, hands, legs, skull, and thorax. The vast majority of fractures (50 %) can be found in the thorax (particularly the ribs and vertebrae). This is followed with decreasing frequency with the arms (particularly the ulna), the skull, the hand, the leg, and the foot. Adult males and females are generally similar with no significant differences between locations of fractures. Subadults are largely missing from this type of injury and we only observed five subadult fractures. The highest risk group are those in the middle-age range (40s). They represent upwards of 30 % of all fractures (Doran 2007; Wentz et al. 2006). With only a few exceptions, the fractures appear to be attributed to falls. It is easy to speculate that many of the arm, rib and hand fractures could be related to falls associated with climbing in and out of dugout canoes. While, no dugouts were found at Windover, Florida has the world's largest collection of prehistoric dugouts with some that are over 6000 ^{14}C years old (Wheeler et al. 2003) and were presumably used by the Windover people.

As noted, most of the fractures can be explained by falls though several notable exceptions point toward interpersonal conflict. One 47-year-old male exhibits a classic healed ›blow-out fracture‹ of the orbit presumably from a blow(s) to the face (Dickel et al. 1989) along with other injuries indicating interpersonal violence (Fig. 15). A second individual, also a male, 41 years of age, shows a well healed parietal depression fracture that almost certainly is the result of blunt force

Fig. 17 A deer antler tine projectile point deeply embedded in the illium of this adult male was a clear indication of interpersonal violence.

Fig. 18 Spina bifi a occulta was found in several individuals but this case ultimately led to extensive skeletal problems and ultimately an early death.

Fig. 19 Tibia of the individual with spina bifi a showing the extensive infection leading to the loss of the distal end and foot.

trauma to the back of the head (Fig. 16). The third individual making a strong argument for intentional interpersonal violence is even more distinct. This 29-year-old male has a deer antler tine projectile point embedded in the dorsal part of the illium (Fig. 17). The angle is such that he was most likely lying prone on the ground when he was impaled. There is also a perimortem crushing injury to the margin of the illium. These injuries would be painful but would not be fatal. The skeleton is virtually complete except for the crania and the first three cervical vertebrae. This evidence suggests he was first speared and then decapitated.

Six cases of osteomyelitis have been found among the Windover individuals: two adult females of advanced age, one individual of unknown sex, and three subadult individuals. One of these individuals, a subadult (approximately 15 years of age), exhibits a significant case of spina bifida occulta that probably precipitated a variety of complications (osteomyelitis, complete lower tibia and foot loss, etc. – Dickel/Doran 1989). This midline failure, and ultimately other biological complications associated with it (Fig. 18 and 19), would have resulted in a slow persistent physical deterioration lasting several years (op. cit.). It is hard to envision a group being able to provide sufficient care if they were as highly mobile as traditional models have proposed.

Periostitis is not uncommon (27 % of the Windover sample exhibits some form of periosteal reaction) but the inci-

Fig. 20 Foreshortened, prematurely fused humeri of this individual (lengths are equivalent to the radius and ulna) and other skeletal features are osteologically associated with thalassemia in archaeological and clinical settings. If accurate, this may be the only such case reported in North America.

dence is lower than in many later populations (Rothschild et al. 2011). Reactions were observed in 23 adult females, 19 adult males, and 28 subadults and are more common in the lower limbs. The presence of this condition is more common in the eastern US and is essentially nonexistent in early populations west across the Gulf Coast and onto the mid-continental plains. Rothschild et al. (2011) argue the chrono-spatial differences could reflect different and distinct, evolutionary, migratory, and exposure histories.

While there have been few if any skeletal reports of thalassemia in prehistoric Native American populations, among the individuals from Windover there is a single potential case of the disease. A 22-year-old female (Burial 76) exhibits bilateral foreshortening of the humeri with indications of premature epiphyseal fusion. The proximal aspects of both humeri are medio-laterally compressed (Fig. 20). The gleno-humeral joint surfaces exhibit medial deformation, and the internal distribution of bone shows expansion of the medullary cavity with increased cancellous bone growth (anemia). These characteristics are reported as indicators of thalassemia in both clinical and archaeological contexts (Hershkovitz et al. 1991; Kacki et al. 2013). Alternate diagnoses such as congenital dislocation or injuries during child birth are also possibilities but fail to account for the full set of characteristics shown, particularly the presence of anemic boney responses. This female may represent the oldest reported case of thalassemia from a native North American skeletal population.

Osteoarthritis

Osteoarthritis is by far the most common pathology found at Windover (Smith 2004). It is found in nearly every movable joint of the body to varying degrees and sometimes shows differences between males and females. Smith utilized the methodology of Bridges (1991) grading scale to assess the degree of degenerative disease at Windover. Smith found that the majority of adult males and females exhibit moderate to advanced levels of degenerations associated with the vertebrae and the arms.

The cervical, thoracic, and lumbar vertebrae found at Windover represent the greatest overall number of bones within the population (gross totals). They also exhibit the most consistent osteoarthritis involvement in this population. In both sexes, the stages of arthritic deterioration are correlated with advanced age in virtually all joint complexes. The cervical vertebrae of adult males and females do not vary greatly in their overall percentages of grade 1 (slight osteophyte activity and lipping), 2 (moderate lipping and porosity), and 3 (severe lipping, porosity, and eburnation) arthritis. Thoracic vertebrae, however, shows a greater percentage of females exhibiting advanced grade 2 and 3 arthritis when compared to males. In addition, an increased number of young adults have grade 2 and 3 arthritis at this location. Among the lumbar vertebrae of males the greatest percentages occur with grade 1 reactions, particularly in older individuals. However females show a dramatic increase in grade 3 lumbar degeneration (42 % of the cases) with advanced age (Smith 2oo4).

The upper limb bones of the Windover collection also indicate dramatic levels of osteoarthritis. Degeneration of the bones in the wrist joint is highest with grade 1 and decrease in severity with grade 2 and 3. No significant differences are found between male and female expression. However, more females are free of wrist involvement. Examination of the elbow complex resulted in the largest percentage of individuals exhibiting grade 2 degeneration (48 % of the males, 4o % of the females). The shoulder complex of males is evenly spaced in terms of percentages across the differing grades. Females on the other hand, have a disproportionately large percentage (24 % of the females with arthritis) of grade 3 shoulder arthritis (Smith 2oo4). It is not unreasonable to envision dugout canoe paddling and perhaps net pulling and throwing as contributing factors to these kinds of osteoarthritic changes.

The majority of males and females show no degenerative changes in knee and ankle. Of those that do show signs of arthritis (more frequently in males), the vast majority only express minimal (grade 1) indicators with slight osteophyte activity and lipping, perhaps indicating more paddling than walking. This is particularly true with the hip joints of males (5o % express grade 1 degeneration). Of the individuals with grades 2 and grade 3 degeneration of the hip, knee, and ankle, the frequencies are greatly reduced as degeneration worsens and the presence of advanced degeneration is more associated with age than anything else (Smith 2oo4).

Ancient DNA analysis

Preservation, compared to many sites of this antiquity, was excellent. In fact, 91 of the crania contained relatively intact (though shrunken) brain masses, some with preserved macro- and micro-details (Doran et al. 1986). Several samples of brain tissue were submitted for DNA analysis with tantalizing possibilities, however, it has not been as informative as we had hoped. Bone and tooth samples have also been submitted to multiple labs over the years. It is safe to say that while the passage of time has allowed for the remarkable preservation of bone, antler, wood, and fabrics, it has been far more destructive to genetic material. Some of the work clearly indicates expected affiliations with extant Amerinidian types (Hauswirth 1994; Lawlor et al. 1991), while some haplotype morphs (potential X ?) are less commonly identified in living New World populations, but are clearly ›native‹ morphs and not European introductions (Malhi/Smith 2oo2). Multiple labs have continued to try to improve DNA extraction and biomolecule extraction on Windover bone (Smith et al. 2oo2). Most recently, E. Willersleve' s lab in Copenhagen met with some of the same problems. Most identifiable DNA was largely exogenous (mold, bacteria, plant etc.). With continued advances in technology, perhaps these problems will be overcome but for the moment the information return has been less than stellar. Chemical changes in base sequences seem to be particularly harsh in this kind of setting though other biomolecules have been identified (Kemp et al. 2oo6). There have also been problems with recovery of DNA from the Windover Lagenaria specimens and canid teeth. The difficulty is more generic than specific to a particular type of material. To us, the take home message is ›You never know if DNA will survive but if you don' t submit sample you will never know‹ ! The potential information return is tremendous even if it does not always work. There is still much to learn about the idiosyncratic survival of biomolecules and predictive statements can be problematic.

Broad comparisons

The synthesis of early skeletal samples provided in the Buckeye Knoll report (Doran/Stojanowski 2o12; and online – see above) provides some summary interpretations of a broad nature pertinent to the Windover discussion. Windover individuals tend to be shifted toward larger femur dimensions compared to later populations. Another way of saying this, is there are increasingly smaller individuals in later time periods (Fig. 21). This can be most simply illustrated by an examination of femur dimensions by time period. Some of this data was extracted from the laudable effort of Steckel and Rose (2oo2) to provide some consistent view of health on New World populations. They place a heavy reliance on stature dimensions, but stature formulae continue to be refined, becoming more population and sex specific, and reports of stature comparisons will vary. Femur dimensions, provide the basis for many of these calculations and are the base datapoints and thus are presented here. Individuals, driven by their own research interests and needs have similarly compiled elements of what might be considered regional osteometric databases (dental, cranial, post cranial, demographic, etc.) but aggregation across broader lines is the next logical step.

Steckel and Larson (Global History of Health Webpage – Ohio State University – http://global.sbs.ohio-state.edu/) are attempting to do the same thing with European skeletal samples. No one will argue it is a slow, tedious and frustrating process (differences in dimensions, methodology, reporting variability, not to mention differences in sex and age assessment, etc.). The fact that large, compiled, shared databases have not been a central part of our analytical effort, is, perhaps, a reflection of idiosyncratic research goals and is something that should be addressed if we are to continue to talk about long term and geospatial trends in human metrics, morphometrics, and health (Stojanowski et al. 2o13). The compilations envisioned by the Global History of Health Project(s) (GHHP) have much to recommend. Such compilations may be messy and inherently challenging but that does not negate their importance.

Table 1 provides adult sexed maximum femur dimensions (left were possible, replaced by right if lefts not available) for all Native Americans in the Western Hemisphere database combined with the FSU post-cranial data we have collected (see Doran/Stojanowski 2o12 for additional similar comparisons – only adult sexed individuals).

Femur dimensions (Fig. 21) show the unevenness of chronological coverage and dramatic increase in relatively recent samples (here anything less than 1ooo years old is considered recent). Later populations clearly show more

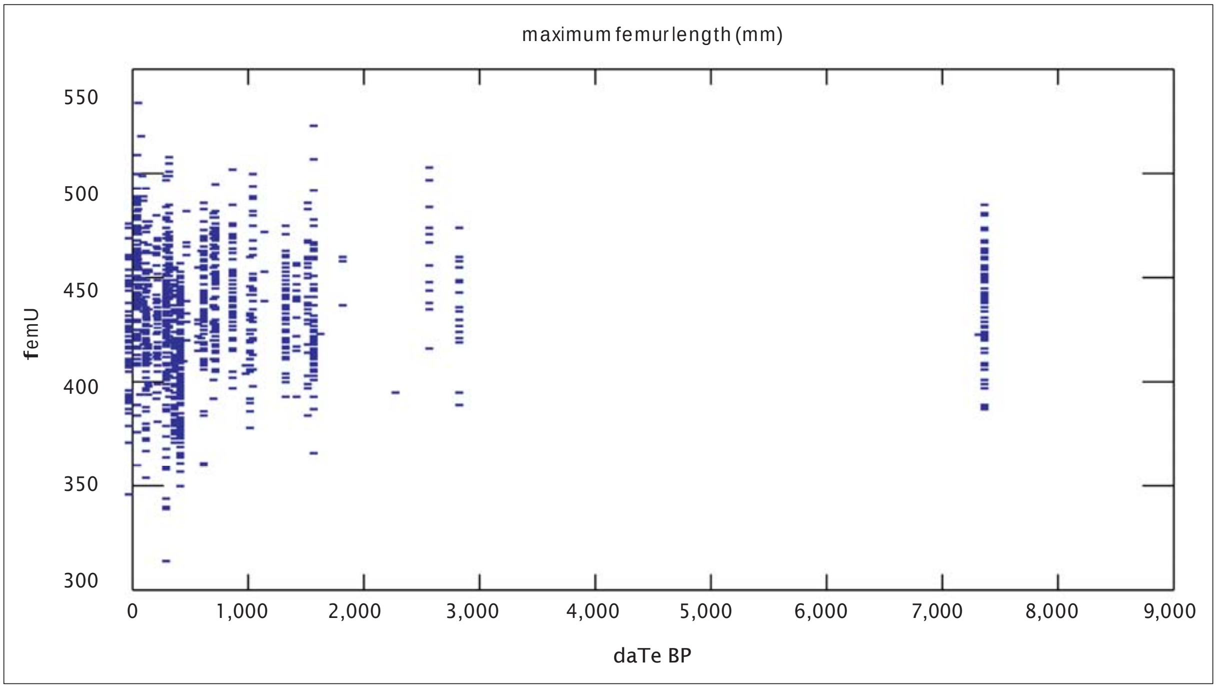

Fig. 21 Maximum femur length (mm) – males and females combined by time interval (years before present, uncorrected, n= 1072).

Maximum Femur Length (mm)

subsample	n	mean	median	s.e.m.	minimum	maximum
Total male sample*	324	452	453	1.327	369	524
Total female sample*	311	419	419	1.229	340	485
Windover males	23	453.6	455	4.24	407	486
Windover females	19	419	425	4.532	388	451

Tab. 1 Maximum femur length (mm) showing median values tend to be larger for the Windover individuals. There are also substantially higher numbers of smaller individuals in later time periods.

individuals with reduced femur dimensions compared to Windover (about 50 % male and 50 % female). In the later epochs there are only a small number of individuals substantially taller (by inference of femur length) than in the earlier Windover sample. It is easy to argue impacts of agriculture, increased population density, reduction in diet breadth, greater seasonal shortages, endemic infections, parasitic infections, and other factors may be causal agents. Clearly the GHHP is on the right track in compiling larger and more informative data sets.

In another cross-cultural study, Thomas (2011) examined the levels of upper limb asymmetry among the archaic hunter-gatherer populations of Windover, Indian Knoll (Kentucky), and the Pickwick Basin (Alabama) with that of the agricultural Moundville population. The Windover sample exhibits many typical differences expected of hunter-gatherer populations and in general, the Archaic samples were found to be more asymmetrical than the Mississippians. In particular, the Archaic males exhibited greater diaphyseal asymmetry while the females expressed greater length and radial articulation asymmetry. On average the male morphology reflects more asymmetrical use of the right arm (with emphasis on the upper arm and ulna) whereas female morphology reflects the performance behaviors involving use of both arms (perhaps from paddling), although the radii of females exhibit large amounts of asymmetry in the external and cross-sectional dimensions. The agricultural Mississippians are far more symmetrical in nature compared to the Archaic groups. The females have an increase in symmetry and robusticity while the males maintain more asymmetrical values relative to their Archaic counterparts (Thomas 2011).

That being said, the Windover population does stand out in comparison to the other Archaic hunter-gatherers when compared to the Moundville population. The Windover adults exhibited fewer significant differences with the Mississippians than with Pickwick Basin or Indian Knoll samples. Windover was more often misidentified in a discriminant analysis as Mississippian (and vice versa) than with any other sample due to the overall lower levels of asymmetry seen at Windover. The subsistence variable that separates Windover from the other two Archaic populations is the lack of evidence for shellfish and large mammal usage. The Indian Knoll and Pickwick Basin sites share these variables in common. They are well known for their shellfish and white tailed deer exploitation and the remains resemble each other in their asymmetrical patterns. Indian Knoll is by far the most asymmetrical sample in this study for males, females, and subadults. Pickwick Basin is only slightly less asymmetrical than Indian Knoll, with Windover and Moundville being the least. Subsistence alone is not a simple or accurate criterion for categorizing prehistoric populations. Habitual activities that influence the robusticity and asymmetry of the population must be taken into account when recreating past lifeways. For the Windover population, exploitation of riverine resources and small mammals has led to a general lack of asymmetry of the upper limbs compared to other more traditional archaic hunter-gatherer (atlatl dominant) cultures (Thomas 2o11).

Diet inferences through isotopic data

Isotopic analysis of bone collagen provides a ^{13}C value of –15.6‰ (Tuross et al. 1994) which is indicative of a diet primarily focused on riverine aquatic resources (St. Johns River) with some estuarine input (Indian River lagoon system – as evidence by several Busycon shells and multiple sharks teeth). Comparisons to other Florida sites (Harris Creek/Tick Island) with appropriate corrections for fraction, and differences in analysis methodology (bone versus dentition) supports this perspective (Quinn et al. 2oo8). Evidence of differences in male and female isotopic data (and thus diet) is minimal. Later, after sea level rise stabilizes in the area and the proximity of marine resources is nearer, much clearer evidence of an intensive marine focus increases dramatically both in terms of the number and increasing size of shell middens after 6ooo BP. Our recent work on Cape Canaveral ties this event to the oldest, most westerly beach ridge formation on the cape which has an OSL date of 6ooo BP. There may have been earlier marine exploitation in the area but it is invisible at this point in time.

Conclusions

In general, if there was an overarching assessment of health it would be that these early populations in Florida were robust, physically active individuals that tended to be on the ›larger‹ size compared to many later populations. Individual assessments of stress vis-à-vis skeletal indicators are difficult to compile, but in general, these people were relatively healthy compared to many later groups. This is especially true for those that made the shift toward agriculture and the concomitant changes that go along with this monumental evolutionary adjustment in lifestyles.

There is little evidence of significant health differences between males and females. Individual percentages of involvement of various health indicators do exist but compared to many later groups, they are rather subtle and hardly seem profound. There is, as always, some evidence of biological stress, possibly related to a reduced mobility and slightly greater sedentism than is typical of most hunter-gatherer-fishers. In time, with improved methodology and more consistent cross-sample reporting it should be easier to identify and understand long term and localized changes in human adaptive success. When contemplating the human experience over thousands of years it must always be remembered that all adjustments are local. Just because people are following similar subsistence and social organization patterns, local conditions and local decisions will have profound impacts on the outcomes.

To paraphrase a borrowed idea, ›There are hunter-gatherers and then there are hunter-gatherers‹, to us implying that, the range of variability in any simple subsistence, demographic experience categorization may be highly variable, and we are just beginning to make inroads into understanding the dynamics of those interactions.

When earlier North American populations are compared to later groups (for which we have much more information – more sites, larger samples, better preservation, etc.) several things are consistently observed. At a glance the older samples in the Western Hemisphere ›look different‹ from later more ›classic‹ Native American/Amerindian groups and the whole colonization process of the Western Hemisphere appears far more complex than earlier simplistic models (Eggers et al. 2o11; Perez et al. 2oo9). With respect to Windover, this pattern is consistent and multiple hypotheses are possible – different founding lineages, extinction of lineages, colonization from different directions, different migration routes, isolation, in-place chronospatial evolution, bottlenecks, etc. The answers are hardly clear, but increasingly the questions are becoming more focused and more informative. Their story is, in and of itself important, if we are to truly understand the last great human colonization saga. Material cultural inventories play a role in unraveling these stories but the people themselves are the real key to understanding what happened. No one ever said it would be easy but it certainly is interesting!

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