2

Health and Lifestyle in Georgia and Florida

Agricultural Origins and Intensification in Regional Perspective

CLARK SPENCER LARSEN, DALE L. HUTCHINSON, CHRISTOPHER M. STOJANOWSKI, MATTHEW A. WILLIAMSON, MARK C. GRIFFIN, SCOTT W. SIMPSON, CHRISTOPHER B. RUFF, MARGARET J. SCHOENINGER, LYNETTE NORR, MARK F. TEAFORD, ELIZABETH MONAHAN DRISCOLL, CHRISTOPHER W. SCHMIDT, AND TIFFINY A. TUNG

Some 1,300 miles of coastline on the Atlantic Ocean and Gulf of Mexico dominate the ecology of modern-day Georgia and Florida, providing earlier foragers and later farmers with a remarkable variety of marine resources, including fish and shellfish along with terrestrial animals and plants. Terrestrial resources in the interior are similar to those of the coast.

We describe two major transitions: the advent of maize agriculture and the influence of European contact. For purposes of comparison, we divide the skeletal series into early and late prehistoric and early and late contact periods. Prehistorically, cultural and social development in most of the area was part of the post–1000 BP, pan-Mississippian florescence (see, for example, Hally 1994; Hally and Rudolph 1986; Hally and Langford 1988; Bense 1994; King 2003) and was linked closely with the adoption of maize farming.

The Skeletal Record in Georgia and Florida

The results discussed in this chapter combine published studies and new data. We focus on three regions: (1) Atlantic coastal Georgia and Florida, colonized by Spain; (2) upland Georgia; and (3) central and southern Florida.

Data for the populations of region 1 (the prehistoric and historic-era Guale) are relatively complete. The record is also robust for northern Florida, for the region of the panhandle occupied by the Apalachee, and for the eastern panhandle and the northeast portion of the peninsula occupied by the Timucua. For purposes of analysis, we subdivide region 1 samples into seven groups: coastal Georgia early prehistoric (2400–1000 BP), Florida early prehistoric (2000–1000 BP), coastal Georgia late prehistoric (1000 BP–AD 1550), Florida

Table 2.1. Skeletal Samples from Georgia and Florida

Subregion/Group/Site	Location	Cultural Association
Subregion 1: Coastal Georgia, Coastal Plain (Inland) Georgia, and Northern Florida		
Georgia Early Prehistoric (2400–1000 BP)		
Deptford site	inland Georgia	Guale
Indian Kings Tomb	inland Georgia	Guale
Cedar Grove Mound A	inland Georgia	Guale
Cedar Grove Mound B	inland Georgia	Guale
Cedar Grove Mound C	inland Georgia	Guale
Walthour (CH 11)	coastal Georgia	Guale
McLeod Mound	coastal Georgia	Guale
Seaside Mound I	coastal Georgia	Guale
Seaside Mound II	coastal Georgia	Guale
Cunningham Mound C	coastal Georgia	Guale
Cunningham Mound D	coastal Georgia	Guale
Cunningham Mound E	coastal Georgia	Guale
South New Ground Mound	coastal Georgia	Guale
Evelyn Plantation	inland Georgia	Guale
Sea Island Mound	coastal Georgia	Guale/Mocama
Airport site	coastal Georgia	Guale/Mocama
Cannons Point	coastal Georgia	Guale/Mocama
Charlie King Mound	coastal Georgia	Guale/Mocama
Florida Early Prehistoric (AD 0–1000)		
Nichols	coastal Florida	Apalachee
Melton Mounds	inland Florida	Timucua
McKeithen Mounds	inland Florida	Timucua
Cross Creek Mound	inland Florida	Timucua
Wacahoota Mound	inland Florida	Timucua
Henderson Mound	inland Florida	Timucua
Mayport Mound	coastal Florida	Timucua
Georgia Late Prehistoric (AD 1000–1550)		
Irene Burial Mound	inland Georgia	Guale
Irene Large Mound	inland Georgia	Guale
Irene Mortuary	inland Georgia	Guale
Deptford Mound	inland Georgia	Guale
Red Knoll	inland Georgia	Guale
Skidaway Mitigation 3	coastal Georgia	Guale
Groves Creek	coastal Georgia	Guale
Johns Mound	coastal Georgia	Guale
Marys Mound	coastal Georgia	Guale
Southend Mound I	coastal Georgia	Guale
Southend Mound II	coastal Georgia	Guale
North End Mound	coastal Georgia	Guale/Mocama
Low Mound, Shell Bluff	coastal Georgia	Guale/Mocama
Townsend Mound	coastal Georgia	Guale
Norman Mound	coastal Georgia	Guale
Lewis Creek	inland Georgia	Guale/Mocama
Seven Mile Bend	inland Georgia	Guale
Little Pine Island	coastal Georgia	Guale
Red Bird Creek	coastal Georgia	Guale/Mocama
Oatland Mound	coastal Georgia	Guale/Mocama

continued

Table 2.1.—*Continued*

Subregion/Group/Site	Location	Cultural Association
Kent Mound	coastal Georgia	Guale/Mocama
Martinez Test B	coastal Georgia	Guale/Mocama
Indian Field	coastal Georgia	Guale/Mocama
Taylor Mound	coastal Georgia	Guale/Mocama
Couper Field	coastal Georgia	Guale/Mocama
Florida Late Prehistoric (AD 1200–1500)		
Lake Jackson	inland Florida	Apalachee
Waddell's Mill Pond	inland Florida	Apalachee
Leslie Mound	inland Florida	Timucua
Goodman Mound	coastal Florida	Timucua
Browne Mound	coastal Florida	Timucua
Holy Spirit Church	coastal Florida	Timucua
Georgia Early Mission (AD 1600–1680)		
Pine Harbor	coastal Georgia	Guale
Santa Catalina de Guale	coastal Georgia	Guale
Florida Early Mission (AD 1600–1680)		
Ossuary at Santa Catalina	coastal Florida	Timucua
Santa Maria de Yamasee	coastal Florida	Yamasee
San Martín de Timucua	inland Florida	Timucua
San Pedro de Patale	inland Florida	Apalachee
Snow Beach	coastal Florida	Apalachee
Florida Late Mission (AD 1680–1700)		
San Luis de Apalachee	inland Florida	Apalachee
Santa Catalina de Amelia	coastal Florida	Guale
Subregion 2: Upland Georgia		
Upland Georgia Late Prehistoric (AD 1200–1540)		
Etowah	upland Georgia	Creek
Leake	upland Georgia	Creek
Stamp Creek	upland Georgia	Creek
King	upland Georgia	Creek
Baxter	upland Georgia	Creek
Sixtoe	upland Georgia	Creek
Bell Field	upland Georgia	Creek
Little Egypt	upland Georgia	Creek
Pott's Track	upland Georgia	Creek
Chauga	upland Georgia	Creek
Draw Bridge	upland Georgia	Creek
Shinholser	upland Georgia	Creek
Long Swamp	upland Georgia	Creek
Wilbanks	upland Georgia	Creek
Dyar	upland Georgia	Creek
Cold Springs	upland Georgia	Creek
Ogeltree	upland Georgia	Creek
Shaky Pot	upland Georgia	Creek
Tugalo	upland Georgia	Creek
Park	upland Georgia	Creek
Avery	upland Georgia	Creek

continued

Table 2.1.—*Continued*

Subregion/Group/Site	Location	Cultural Association
Subregion 3: Central and Southern Florida		
Florida Early Prehistoric (pre-AD 1000)		
Buck Key	coastal Florida	Calusa
Casey Key	coastal Florida	Calusa
Galt Island	coastal Florida	Calusa
Horr's Island	coastal Florida	Calusa
Palmer	coastal Florida	Manasota
Perico Island	coastal Florida	Manasota
Pine Island	coastal Florida	Calusa
Useppa Island	coastal Florida	Calusa
Florida Late Prehistoric (AD 1000–1600)		
Aqui Esta	coastal Florida	Manasota
Horr's Island (Blue Hill Mound)	coastal Florida	Calusa
Safety Harbor	coastal Florida	Safety Harbor
Tatham Mound	inland Florida	Safety Harbor
Tierra Verde	coastal Florida	Safety Harbor
Weeki Watchee	coastal Florida	Safety Harbor

late prehistoric (1000 BP–AD 1500), Georgia early mission (AD 1600–1680), Florida early mission (AD 1600–1680), and Florida late mission (AD 1680–1700). Data are derived from nearly all archaeological sites (Larsen 1982; Larsen and Griffin et al. 2001; Larsen et al. 2002).

Region 2 (interior upland Georgia) is represented by late prehistoric and early contact period agriculturalists circa 800 BP through AD 1540. This region, unlike the coastal area, was not missionized and thus did not experience an agricultural intensification (Williamson 1998, 2000).

Region 3 comprises central and southern peninsular Florida with late prehistoric and contact period foragers. Most data for region 3 are from the Gulf coast (Hutchinson 2004).

Region 1: Coastal Georgia and Northern Florida

DIET AND TOOTH USE

Stable isotope variation

Carbon and nitrogen stable isotope ratios show clear subregional variation (Hutchinson et al. 1998; Larsen and Hutchinson et al. 2001). Before 1000 BP, there is a uniform pattern of relatively negative $\delta^{13}C$ values and positive $\delta^{15}N$ values, reflecting diets based on wild plants and animals and, for coastal populations, significant marine diets. After 1000 BP, however, regional differences in isotopic signatures begin to emerge. In coastal Georgia and the western panhandle of Florida, there is a general trend toward less negative $\delta^{13}C$ values and some reduction in $\delta^{15}N$ values, representing the adoption of maize and a decline in marine foods.

After contact, the picture changes. In the Guale missions of coastal Georgia (and, later, northern Florida), the appearance of less negative $\delta^{13}C$ values and less positive $\delta^{15}N$ values compared to earlier populations in the same region suggests an increased commitment to maize and a further decline in the use of marine foods.

All Florida mission populations adopted a maize-based diet. The nonmission samples from the Snow Beach site on coastal panhandle Florida dating to the seventeenth century AD show a maize signature, albeit with a significant marine component (Magoon et al. 2001). The convergence in diet across the region, as expressed in stable isotope values, indicates the impact of colonization and the mission systems. Populations that had been foragers adopted agriculture, and farmers intensified their commitment to agriculture. However, the adoption of agriculture occurred later in northern Florida than in coastal and interior Georgia.

Dental microwear

Occlusal microwear on maxillary central incisors and first molars of prehistoric and contact-era populations reveals several trends (Teaford 1991; Teaford et al. 2001). First, populations living inland, regardless of time or location, have more and smaller microwear features (pits and scratches) than populations living on the Atlantic coast, primarily reflecting soil composition (sandy on the coast, clay in the interior). Second, microwear on molars is more homogeneous prehistorically than in the historic period groups, probably as a result of a shift in food preparation (Teaford et al. 2001). Alternatively, the greater heterogeneity of features in the historic period (such as variable scratch orientation) might reflect the shift to some type of maize-based amorphous mush. In this case, the homogeneous orientation of scratches in the prehistoric molars probably reflects the need for more precise occlusion for chewing foods tougher than those of later periods.

HEALTH AND STRESS

Dental caries

Dental caries provides complementary evidence for the dietary transition. For maize agriculturalists, dental caries is a sensitive indicator of carbohydrate consumption. Prior to 1000 BP, caries frequency (in terms of the percentage of teeth affected) throughout the region is about 1 percent (Table 2.2). Only in the Apalachee area are dental caries common. All other Florida sites display

Table 2.2. Dental Caries in Coastal Georgia and Northern Florida

	Total[a]		**Female**		**Male**	
Region/Group	%	(*n*)	%	(*n*)	%	(*n*)
Georgia Early Prehistoric	1.2	(2,479)	1.1	(1,034)	0.3	(638)
Florida Early Prehistoric	0.8	(854)	9.1	(22)	7.3	(41)
Georgia Late Prehistoric	9.6	(5,984)	12.8	(2,405)	8.3	(1,931)
Florida Late Prehistoric	1.3	(866)	6.0	(50)	4.2	(119)
Georgia Early Mission	7.6	(4,466)	11.0	(598)	14.9	(441)
Florida Early Mission	7.4	(2,162)	8.3	(542)	4.4	(568)
Florida Late Mission	24.4	(2,378)	21.1	(606)	21.4	(754)

[a] Juveniles and unsexed and sexed adults.

no carious lesions. The Georgia coastal region shows a significant increase in dental caries after 1000 BP. In both Florida and Georgia, caries are common in the early mission period. A great deal of variation in caries frequency evidently existed during the late mission period (a low of 4.6 percent at San Luis de Apalachee to a high of 34.2 percent at Santa Catalina de Amelia).

Porotic hyperostosis and cribra orbitalia

All prehistoric sites in coastal Georgia and northern Florida display a low prevalence of porotic hyperostosis and cribra orbitalia (Table 2.3). In coastal Georgia, agriculture brought no change. In contrast, the frequency of PH and CO increased in postcontact mission groups in both areas. In this setting, the probable cause is iron-deficiency anemia (Schultz, Larsen, and Kreutz 2001). The shift in diet may have been a factor. Common to all settings in the contact period was an increased commitment to agriculture and a decline in the range of foods eaten. On the coast, there was a reduction in the consumption of marine food. However, the lack of increase in pathology with the appearance of maize agriculture in coastal Georgia suggests a more complex picture.

Table 2.3. Porotic Hyperostosis for Individuals in Coastal Georgia and Northern Florida

	Total[a]		**Juvenile[b]**		**Female**		**Male**	
Region/Group	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)
Georgia Early Prehistoric	0.0	(113)	0.0	(13)	0.0	(42)	0.0	(35)
Florida Early Prehistoric	0.0	(12)	0.0	(0)	0.0	(2)	0.0	(8)
Georgia Late Prehistoric	3.3	(308)	0.0	(33)	2.4	(123)	5.7	(88)
Florida Late Prehistoric	0.0	(13)	0.0	(0)	0.0	(2)	0.0	(6)
Georgia Early Mission	9.4	(32)	0.0	(5)	15.4	(13)	8.3	(12)
Florida Early Mission	28.4	(102)	23.1	(13)	15.0	(20)	31.3	(16)
Florida Late Mission	21.1	(90)	50.0	(18)	11.4	(35)	11.4	(35)

[a] Juveniles and unsexed and sexed adults.

[b] Individuals less than 10 years of age.

Table 2.4. Periosteal Reactions for Tibiae for Coastal Georgia and Northern Florida

	Total[a]		Female		Male	
Region/Group	%	(*n*)	%	(*n*)	%	(*n*)
Georgia Early Prehistoric	9.5	(126)	4.3	(47)	9.3	(32)
Florida Early Prehistoric	30.0	(20)	100.0	(2)	0.0	(2)
Georgia Late Prehistoric	19.8	(331)	24.1	(133)	23.6	(93)
Florida Late Prehistoric	37.9	(29)	37.5	(8)	27.3	(11)
Georgia Early Mission	15.4	(36)	14.3	(7)	23.1	(13)
Florida Early Mission	16.1	(236)	16.7	(36)	17.4	(46)
Florida Late Mission	59.3	(96)	65.7	(35)	70.0	(36)

[a] Juveniles and unsexed and sexed adults.

Infectious disease

Analysis of periosteal reactions shows clear patterns of variation (Table 2.4). In Georgia, there is an increase in these lesions, from about 10 percent to 20 percent of tibiae from foragers to farmers. In Florida, there are much higher frequencies—30 percent and 38 percent—in the early and late prehistoric groups, indicating that something other than agriculture may explain the high levels of infection. Most of the lesions are localized, but some individuals have treponemal lesions.

In the Georgia and Florida early mission samples, the frequencies are also relatively high, although not as high as in the late prehistoric period. The highest frequency is in the Santa Catalina population on Amelia Island (nearly 60 percent). Our overall impression is that infection, nonspecific and specific, is much more prevalent in the Florida portion of this region.

Enamel defects (hypoplasias and Wilson bands)

Several trends emerge from the comparison of frequency and width of enamel hypoplasias (Hutchinson and Larsen 2001; Simpson 2001). Georgia populations have generally a higher frequency of defects per tooth than Florida populations, suggesting regional variation in physiological stress perhaps related to the earlier development of agriculture in Georgia than in Florida. In contrast, the frequency of enamel hypoplasias per individual is greater in Florida than in Georgia. Thus, broadly speaking, fewer individuals are affected in Georgia than Florida, but the individuals that are affected in Georgia exhibit more stress episodes than those in Florida. In temporal perspective, enamel defects do not increase in frequency. Rather, there is a decline in the number of individuals affected or only slight increases for the adoption of agriculture during the mission era in Florida. However, in both Georgia and Florida, the late mission period shows a sharp rise in the number of individuals affected, reflecting declining health, of which agricultural intensification was likely one factor.

Table 2.5. D_{30+}/D_{5+} Fertility Ratio for Coastal Georgia and Northern Florida

Region/Group	D_{30+}	D_{5+}	D_{30+}/D_{5+}
Georgia Early Prehistoric	58	153	.3790
Florida Early Prehistoric	23	75	.3067
Georgia Late Prehistoric	98	280	.3500
Florida Late Prehistoric	29	47	.6170
Georgia Early Mission	83	294	.2823
Florida Early Mission	65	193	.3368
Florida Late Mission	94	190	.4947

Frequency changes in Wilson bands (accentuated striae of Retzius) show a rise in the percentage of individuals affected by stress when the preagricultural late prehistoric populations are compared to the agricultural mission samples in Florida (Simpson 2001), reflecting the impact of dietary change and general deterioration of health.

DEMOGRAPHY AND THE DIETARY TRANSITION

The ratio of D_{30+}/D_{5+}, a general indicator of population growth and fertility (Buikstra et al. 1986), reveals evidence of demographic change (Table 2.5). The Georgia early and late prehistoric, Florida early prehistoric, Georgia early mission, and Florida early mission values fall within a relatively narrow range of .2823 to .3790. The differences among these five groups are not statistically significant. The other two groups are quite different, however. The ratio is relatively high in the Florida late prehistoric (.6170), but that reflects a probable sample bias—only two samples are represented, the number of individuals is small, and the samples are dominated by older adults. The seventh sample, the Florida late mission series, has a relatively high ratio. This sample comprises two sites, with a relatively low ratio for San Luis de Apalachee (.2632) and a very high ratio for Santa Catalina on Amelia Island (.7263). We regard the high ratio as reflecting a very low birth rate in a stressed setting involving relatively more disease and population disruption at the end of the mission era. We interpret the low ratio (reflecting a relatively large number of juveniles and small number of older adults) as indicating a highly viable population, consuming plant domesticates but also a significant amount of animal foods including cattle. The zooarchaeological and historical evidence indicates a significant presence of meat in the diets of the San Luis inhabitants (Reitz 1993). The low caries prevalence is consistent with this conclusion. Unfortunately, only one individual had sufficiently preserved collagen for stable isotope analysis. But that person had relatively negative $\delta^{13}C$ values, consistent with a diet involving low maize consumption.

ACTIVITY AND LIFESTYLE

With the shift to agriculture, a decline in osteoarthritis is evident, followed by a marked increase in the (Guale) mission population from Amelia Island (Larsen and Ruff 1994; Larsen et al. 1996; Larsen 1998).

Analysis of cross-sectional geometric properties parallels the osteoarthritis results. Like osteoarthritis, bone strength (J, which measures overall loading of the bone) and workload decline among early Georgia agriculturalists (Ruff and Larsen 2001). There is no evidence of body size differences (based on femur and humerus length). The overall similarity of the series in Georgia and Florida indicates that the changes in bone strength are real and not influenced by body size (see Ruff and Larsen 2001).

During the early mission period, bone strength increased in the Georgia population, albeit not to the level of the prehistoric foragers. Agricultural intensification, related to the Spanish demand for labor, increased the workload. The mission-era bone strength measures are generally higher than the Georgia late prehistoric samples.

SEX DIFFERENCES IN HEALTH AND LIFESTYLE IN COASTAL GEORGIA AND NORTHERN FLORIDA

The prevalence of dental caries, periosteal reactions, and osteoarthritis among males and females provides insight into patterns of health and lifestyle in the adoption and intensification of agriculture. First, for nearly all groups, carious lesions are more prevalent in females than in males (Table 2.2), suggesting that females were consuming greater amounts of carbohydrates, except in early mission period coastal Georgia samples (Santa Catalina de Guale). The latter may simply reflect small samples. Second, tibial periosteal reactions show a mixed picture of female-male differences (Table 2.4). Generally, males have somewhat greater frequencies for the prehistoric and historic-era Guale (coastal Georgia and Santa Catalina, Amelia Island; Larsen 1998). In non-Guale Florida samples, the differences are not significant. Finally, osteoarthritis is almost universally higher in adult males than in females.

Cross-sectional geometric properties of bones add insight into patterns of workload of men and women. In femur values of J, representing overall loading, there is a steady decline in sexual dimorphism, the biggest drop occurring in the foraging to farming transition in coastal Georgia, suggesting a decline in activity differences between men and women. The least dimorphism occurs in the latest Guale series (Santa Catalina, Amelia Island), indicating that activities involving the legs (walking and running) were virtually identical. We believe that these data reflect involvement of both men and women in agriculture in Spanish mission settings.

Region 2: Upland Georgia

This region was explored by Spaniards but was not colonized or missionized. Unlike the coastal zone, this region did not see an intensification of agriculture with contact. Skeletal remains from this area are all late prehistoric agriculturalists and early contact period peoples.

HEALTH AND STRESS

Patterns of health and disease between circa 800 BP and 1540 AD are described by Williamson (1998, 2000).

Dental caries

These upland groups display high frequencies of caries (9.9 percent), almost certainly reflecting maize agriculture. This frequency is considerably higher than the single early prehistoric sample from Stallings Island (3.9 percent) (Wilson 1997).

Infectious disease

Frequencies of periosteal reactions (13.0 percent of tibiae) in the Georgia uplands are intermediate between those of early and late prehistoric Georgia coastal groups. Several individuals in the Georgia upland samples have tibiae that show extensive remodeling and bowing, indicating the presence of treponematosis in late prehistory (Blakely 1980; Williamson 1998).

Porotic hyperostosis and cribra orbitalia

The Georgia upland samples reveal a low prevalence of porotic hyperostosis and cribra orbitalia, 4 percent (Williamson 1998, 2000) although this is slightly higher than at Etowah in northwestern Georgia (3.2 percent of 125, as reported by Blakely 1980) and the contemporary coastal samples. Apparently, iron-deficiency anemia was not common in upland or coastal Georgia.

Enamel defects

Hypoplasias are common in the Georgia uplands and show similar frequencies in the two regions (Williamson 1998, 2000), suggesting a common stress experience.

Osteoarthritis

Frequency of degeneration of articular joints (particularly the vertebral joints) in the Georgia uplands is generally greater than in the contemporary Georgia coastal populations (Williamson 2000). These differences, controlling for age, suggest that the upland populations experienced greater mechanical demand than coastal populations. Although specific differences in lifestyle are not clear, the data suggest that upland terrain provides the greater mechanical challenge, perhaps related to carrying loads up and down hilly terrain. These differences are consistent with the finding of greater cross-sectional geometric values in uplands than in flatlands in North America generally (Larsen et al. 1995; Ruff 1999; Williamson 1998, 2000), suggesting a common stress experience.

SEX DIFFERENCES IN HEALTH AND LIFESTYLE IN UPLAND GEORGIA

Comparison of sex differences in dental caries, periosteal reactions, and osteoarthritis in late prehistoric upland Georgia shows a pattern similar to that of late prehistoric coastal Georgia (Williamson 1998, 2000). Caries is significantly more common in females than in males, whereas periosteal reactions do not vary by sex. As in coastal Georgia, males have more osteoarthritis than females do.

In summary, the late prehistoric Georgia upland populations show health profiles (other than arthritis) similar to those from coastal Georgia of the same period.

Region 3: Central and Southern Florida

For virtually all of peninsular Florida, the increasing social complexity that characterizes the rest of the region was minimal or nonexistent. The skeletal samples are all from the very late prehistoric and contact period. Stable isotope analysis indicates that with the exception of the western and central panhandle region, native populations in the area north of Tampa Bay in Florida exploited wild plants and animals exclusively until the postcontact period, when they became partly agricultural. Southern populations (for example, Calusa and Manasota) relied on foraging for food throughout the entire record, never acquiring agriculture before or after European contact.

Evidence of health, lifestyle, and diet were limited until the last few years (Hutchinson 2004). The most comprehensively studied bioarchaeological record from peninsular Florida is from the Gulf coast (Hutchinson 2004).

DIET AND TOOTH USE

Stable isotope variation

Analyses of collagen and apatite carbonate for carbon and collagen for nitrogen show consistent regional dietary preferences (Hutchinson 2004). For coastal populations, $\delta^{13}C$ values from collagen are extremely positive and very different from those noted for the Atlantic coast (region 1) discussed above.

There were no C_4 plants in the diet. The signatures are attributable to consumption of predominantly marine resources. The $\delta^{13}C_{ca\text{-}co}$ values indicate a diet focused on marine resources with some terrestrial dietary items but not C_4 domesticated grasses (maize). Positive nitrogen values suggest intensive exploitation of marine species.

Individuals from the precontact stratum at Tatham Mound, on the interior freshwater Withlacoochee River on the Florida Gulf coast, have dietary signatures consistent with exploitation of freshwater fish and other lacustrine/riverine species, some terrestrial species, and limited or no C_4 grasses. Individuals from the contact-era stratum at Tatham Mound show a slight shift toward more positive carbon values, indicating the possible incorporation of some maize. Nitrogen values are consistent with the exploitation of freshwater species and terrestrial species.

Tooth microwear

Microwear on the occlusal surfaces of molars from the Palmer population shows many trends similar to those of region 1 above (Hutchinson 2004). The Palmer population shows the same wide scratches and deep pits as Atlantic coastal populations from Georgia, Florida, and North Carolina, probably reflecting the incorporation of sand with marine foods.

HEALTH AND STRESS

Dental caries

Carious lesions are infrequent in coastal populations in region 3, averaging only 1 percent of teeth affected (Hutchinson 2004). The precontact interior population from Tatham Mound has caries affecting 2 percent of teeth from precontact individuals and 4 percent of teeth from the contact period. The percentage of individuals affected by carious lesions presents a somewhat different comparison. Prior to 1000 BP, an average of 4 percent of adults have carious lesions, while 9 percent of individuals after 1000 BP are affected. The higher caries frequency in the interior contact period Tatham Mound sample and the stable isotope results (a slight positive increase in carbon values) both suggest the addition of maize agriculture after contact.

Porotic hyperostosis and cribra orbitalia

In this region, PH is common, ranging generally from 29 percent to 44 percent of individuals (Hutchinson 2004). Three populations—Tatham Mound precontact, Tatham Mound contact, and Weeki Watchee—have lower frequencies (1–11 percent) after 1000 BP that are more comparable with the populations of regions 1 and 2. A variety of circumstances can cause these lesions. Given the absence of maize as indicated by stable isotope analysis, we believe that a probable cause was intestinal parasitic infection from undercooked seafood.

Infectious disease

Proliferative responses (periosteal reactions and osteomyelitis) appear to increase from 6 percent in the Palmer sample to an average of 16 percent of individuals affected after 1000 BP (Hutchinson 2004). Higher frequencies have been reported prior to 1000 BP, however, at Manasota Key (18 percent; Dickel 1991). Many of the responses are localized, but many are extreme, completely altering portions of most of the bones affected. Medullary closure of long and short bones occurs in some cases. Stellate scarring of crania is common, suggesting the presence of treponemal infections. Hutchinson and coworkers (2005) have found that 2 percent of individuals from region 1 in prehistoric and protohistoric Florida had treponemal infections, suggesting that region 3 may have experienced relatively higher rates of treponematosis than region 1.

Enamel defects (hypoplasias)

There is no clear temporal trend for EH in this region (Hutchinson 2004). The prevalence appears to be somewhat lower for some populations after 1000 BP, but the range extends from 23 percent to 75 percent of individuals affected. The frequency of affected individuals increased following European contact, with Tatham Mound and Weeki Wachee populations exhibiting the two highest frequencies (57 percent and 75 percent, respectively) of the post–1000 BP groups, suggesting that the increase in physiological stress after contact came not only from agriculture but also from newly introduced stresses such as Old World diseases.

ACTIVITY AND LIFESTYLE (OSTEOARTHRITIS)

Osteoarthritis appears to be highest for the Palmer population prior to 1000 BP (Hutchinson 2004). Of the Palmer adults, 11 percent experienced osteoarthritis, as compared with the 4 percent of Tierra Verde and Tatham Mound populations, both living after 1000 BP. These differences may indicate the mechanical demand of the foraging life of the Palmer individuals, although stable isotope results indicate no difference in the diet between those living at Palmer and the coastal people of Tierra Verde.

SEX DIFFERENCES IN HEALTH AND LIFESTYLE IN CENTRAL AND SOUTHERN FLORIDA

Adult males and females show important differences in the frequency of caries, porotic hyperostosis, and enamel hypoplasia. Males tend to have more carious lesions than females do, unlike the pattern observed in regions 1 and

2. Males also have higher frequencies of PH and EH than females do. A possible explanation could be differences in diet, but stable isotope signatures do not fully support this interpretation. Carbon signatures for the Palmer and Tatham Mound skeletons, the two largest skeletal samples examined, are not significantly different. However, both populations show elevated nitrogen signatures for males as compared to females. Gender differences in proliferative lesions show no pattern.

In summary, populations that inhabited region 3 (peninsular Florida) prior to contact did not adopt maize agriculture, and their commitment to agriculture after the arrival of Europeans was relatively minor compared to that of coastal Georgia and northern Florida. For much of the peninsula, populations showed heavy reliance on marine foods. The peninsular Florida populations (as viewed from the Gulf coast) did not appear to experience the same increase in frequency of pathology as those that adopted agriculture. However, the common occurrence of treponemal infections and porotic hyperostosis indicates that these groups were not disease-free. The presence of treponemal infections resulted from life in tropical settings, where the pathogen thrives (Powell and Cook 2005).

Summary of Georgia and Florida

We have reviewed indicators of prehistoric and early historic-era health and lifestyle in the modern states of Georgia and Florida. In coastal Georgia and northern Florida, maize agriculture was introduced sometime around 1000 BP, accompanied by evidence for declining health that includes increased dental caries and periosteal reactions. Following the arrival of Europeans and the establishment of missions in the late sixteenth century, further declines in health are documented, involving an increase in PH and EH. Increased morbidity likely reflects an increased focus on agriculture and the arrival of Europeans, introducing new pathogens and other new problems. We believe that declining nutritional quality after contact was the leading factor in declining health. Both osteoarthritis and biomechanical analyses document a probable decline in workload with the transition to agriculture prior to contact, but with missionization, this trend reversed, reflecting labor exploitation. Region 2 shows a general pattern of health similar to the late prehistoric populations of region 1, including relatively high levels of infection.

Central and southern peninsular Florida (region 3) saw different temporal patterns in health and activity in comparison with regions 1 and 2, largely explained by the absence of agriculture. There has been some suggestion that maize agriculture was present in at least one prehistoric setting in southern peninsular Florida, at the Fort Center site in the south-central peninsula circa

1500–1000 BP (Sears 1982). If maize agriculture was practiced in this area of Florida, it was unique and short-lived (Milanich 1994). However, the prevalence of pathological conditions is quite low (2.7 percent of teeth are carious; 1.8 percent of bones have periosteal reactions; and 2.5 percent exhibit porotic hyperostosis; see Miller-Shaivitz and Iscan 1991).

The highest prevalence of pathological conditions in peninsular Florida tends to occur in later prehistoric contexts when population size was highest. This suggests that population size (and degree of sedentism) were highly influential in determining quality of life and health among these populations. This is also a pattern that emerges in late Archaic upland Georgia groups living prior to the adoption of maize agriculture. That is, in the late Archaic Stallings Island samples, there are elevated levels of porotic hyperostosis and periosteal reactions (Wilson 1997), higher than in earlier samples and similar to the levels found among agricultural groups in late prehistory. For example, 26.3 percent (10/38) of crania have porotic hyperostosis (Wilson 1997). This pattern of elevated morbidity appears to be associated with a period of earlier prehistory when foraging groups lived a somewhat more sedentary lifestyle, concomitant with an increase in population size. The groups were clearly not agricultural, an assumption supported by relatively low dental caries prevalence (3.9 percent of teeth affected).

In conclusion, isotopic evidence indicates that the Georgia and Florida region experienced a shift from foraging to farming. This dietary transition was accompanied by a decline in health and an alteration in lifestyle. The change in health was the result of both dietary change and nutritional decline, indirectly related to population size and density. Whenever population increased, whether in upland Georgia in early prehistory or in coastal Georgia and Gulf coast Florida in later prehistory, skeletal morbidity increased. Agriculture played a direct—but not exclusive role—in explaining the changes in health and lifestyle that we document in this chapter.

Acknowledgments

This research was funded by grants from the National Science Foundation, the St. Catherines Island Foundation, and the National Endowment for the Humanities. We thank David Hurst Thomas, Jerald T. Milanich, Douglas H. Ubelaker, and Bonnie G. McEwan for the collaborations in the different settings discussed in this chapter, St. Catherines Island (Georgia), Amelia Island (Florida), and Mission San Luis de Apalachee (Florida), respectively.

Ancient Health

Skeletal Indicators of Agricultural and Economic Intensification

Edited by Mark Nathan Cohen
and Gillian M. M. Crane-Kramer

University Press of Florida
Gainesville/Tallahassee/Tampa/Boca Raton
Pensacola/Orlando/Miami/Jacksonville/Ft. Myers/Sarasota

2007

Contents

List of Figures ix
List of Tables xiii
Foreword xix
Preface xxi
List of Abbreviations xxiii

Introduction 1
Mark Nathan Cohen

1. Maize and Mississippians in the American Midwest: Twenty Years Later 10
Della Collins Cook
2. Health and Lifestyle in Georgia and Florida: Agricultural Origins and Intensification in Regional Perspective 20
Clark Spencer Larsen, Dale L. Hutchinson, Christopher M. Stojanowski, Matthew A. Williamson, Mark C. Griffin, Scott W. Simpson, Christopher B. Ruff, Margaret J. Schoeninger, Lynette Norr, Mark F. Teaford, Elizabeth Monahan Driscoll, Christopher W. Schmidt, and Tiffiny A. Tung
3. A Brief Continental View from Windover 35
Glen H. Doran
4. Outer Coast Foragers and Inner Coast Farmers in Late Prehistoric North Carolina 52
Dale L. Hutchinson, Lynette Norr, and Mark F. Teaford
5. Health and the Transition to Horticulture in the South-Central United States 65
Marie Elaine Danforth, Keith P. Jacobi, Gabriel D. Wrobel, and Sara Glassman
6. From Early Village to Regional Center in Mesoamerica: An Investigation of Lifestyles and Health 80
Lourdes Márquez Morfín and Rebecca Storey
7. Skeletal Biology of the Central Peruvian Coast: Consequences of Changing Population Density and Progressive Dependence on Maize Agriculture 92
Ekaterina A. Pechenkina, Joseph A. Vradenburg, Robert A. Benfer Jr., and Julie F. Farnum
8. The Adoption of Agriculture among Northern Chile Populations in the Azapa Valley, 9000–1000 BP 113
Marta P. Alfonso, Vivien G. Standen, and M. Victoria Castro

9. Population Plasticity in Southern Scandinavia: From Oysters and Fish to Gruel and Meat 130
Pia Bennike and Verner Alexandersen

10. The Impact of Economic Intensification and Social Complexity on Human Health in Britain from 6000 BP (Neolithic) and the Introduction of Farming to the Mid-Nineteenth Century AD 149
Charlotte Roberts and Margaret Cox

11. What Can Pathology Say about the Mesolithic and Late Neolithic/Chalcolithic Communities? The Portuguese Case 164
Eugénia Cunha, Cláudia Umbelino, Ana Maria Silva, and Francisca Cardoso

12. The Political Ecology of Health in Bahrain 176
Judith Littleton

13. Skeletal and Dental Health and Subsistence Change in the United Arab Emirates 190
Soren Blau

14. Ancestors and Inheritors: A Bioanthropological Perspective on the Transition to Agropastoralism in the Southern Levant 207
Patricia Smith and Liora Kolska Horwitz

15. The Health of Foragers: People of the Later Stone Age, Southern Africa 223
Susan Pfeiffer

16. Climate, Subsistence, and Health in Prehistoric India: The Biological Impact of a Short-Term Subsistence Shift 237
John R. Lukacs

17. Iron-Deficiency Anemia in Early Mongolian Nomads 250
Naran Bazarsad

18. Diet and Health in the Neolithic of the Wei and Middle Yellow River Basins, Northern China 255
Ekaterina A. Pechenkina, Robert A. Benfer Jr., and Xiaolin Ma

19. Prehistoric Dietary Transitions in Tropical Southeast Asia: Stable Isotope and Dental Caries Evidence from Two Sites in Malaysia 273
John Krigbaum

20. Population Health from the Bronze to the Iron Age in the Mun River Valley, Northeastern Thailand 286
Kate Domett and Nancy Tayles

21. Biological Consequences of Sedentism: Agricultural Intensification in Northeastern Thailand 300
Michele Toomay Douglas and Michael Pietrusewsky

22. Editors' Summation 320
Mark Nathan Cohen and Gillian M. M. Crane-Kramer

Appendix 345
References 349
List of Contributors 411
Index 417