

Introduction

The analysis of light stable isotopes from archaeological human bone can be useful to address important questions in prehistoric research. Stable carbon and nitrogen isotope ratios, in particular, can provide evidence for the consumption of certain plants and can differentiate between the use of terrestrial and marine food resources. In this study, new isotopic data are evaluated for three prehistoric sites situated along the coast of Southeast Florida in the East Okeechobee Archaeological Area. Our goal is twofold. First, we aim to explore diachronic changes in prehistoric diet in this understudied region. Second, we correlate our new findings with ethnographic sources, which suggest differential access to food resources due to status-related differences between individuals.

This project analyzed sixteen human bone samples from three sites in the East Okeechobee Area: **Patrician** ([8PB99] Glades I/500 B.C.–A.D. 500), **Boca Weir Midden** ([8PB56] Glades II and III/A.D. 500–1513), and **Highland Beach Mound** ([8PB11] Glades II and III/A.D. 500–1513) (**Figure 1**). The latter two sites are situated within the Spanish River Complex, a large pre-contact aboriginal village (**Figures 2-4**). This new isotopic data are compared to previous isotopic results from the Belle Glade Mound ([8PB41] Glades I and II/A.D. 100-1000/1200), an inland Lake Okeechobee Archaeological Area site reported on by Ferdinando and Hilpert (2008).

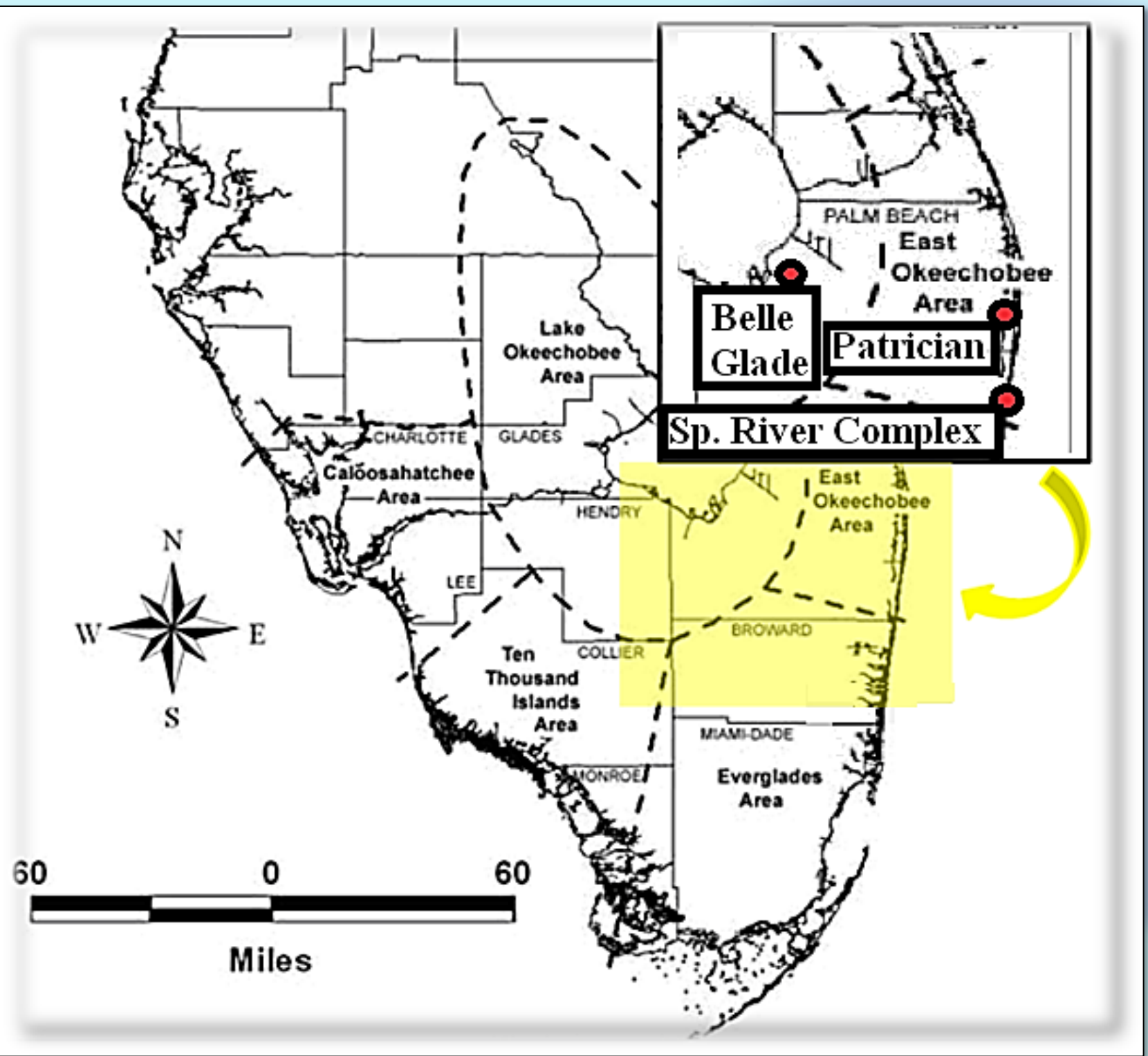


Figure 1. Archaeological Areas of South Florida  
\*Map courtesy of Ryan Wheeler, modified by the authors

Subsistence on the East Coast

The prehistoric people who lived in the East Okeechobee Area exploited food resources along the coasts of modern-day Palm Beach and Martin counties. Major settlements were located adjacent to the mouths of rivers, or along the banks of Lake Worth to capitalize on a diverse range of riverine, marine, and, to a lesser extent, terrestrial-based fauna (e.g., Ritchie et al. 1981; Card 1991; Wheeler et al. 2002b). Isotopic analysis has been underutilized in this area, however, in an early study İscan and colleagues (1989) used trace elements from human bone to infer broad patterns of diet, including the consumption of animal protein.

The ethnohistorical record of the Jeaga contains a wealth of information concerning the subsistence of Contact era inhabitants in the region. For instance, Jonathan Dickinson’s late seventeenth century Journal, includes references to the consumption of wild fruits including palm berries, seaside coco-plums, and sea grapes, along with copious quantities of fish (Andrews and Andrews 1985). Importantly, status-based differences in diet are also recognized. For example, Hann (2003) notes that certain foods may have been restricted to chiefs and high ranking individuals among the southern Florida tribes (e.g., turtle among the Tequesta and seals among the Indians of the Keys), and that there was “regular consumption of cacina...among the elite...of the east coast” (2003:72).

Stable Isotope Methods

Bone collagen was demineralized and purified following the modified Longin protocol outlined in Ambrose (1990). Purified bone collagen was frozen, freeze-dried (lyophilized), and stored in a desiccator at 25°C prior to analysis. Atomic and stable isotope ratios were analyzed on an isotope ratio mass spectrometer (IRMS) in UF Geological Sciences using a Carlo Erba NA1500 elemental analyzer and a Finnigan-MAT 252 with a ConFlo-II interface.

Bone apatite was prepared following protocols outlined in Koch et al. (1997). Freeze-dried samples were loaded into stainless steel boats and reacted in a common acid bath at 90°C. On-line water was cryogenically removed in a methanol slush and the mass of the evolved CO<sub>2</sub> gas was measured on a Micromass PRISM Series II IRMS.

Data are presented in standard delta notation as parts per thousand, or per mil (‰), with δ<sup>13</sup>C values measured relative to vPDB and δ<sup>15</sup>N values measured relative to AIR.

Stable Isotope Analysis of Samples from the East Okeechobee Area: A Preliminary Sketch of Paleodiet on the Southeast Florida Coast from 500 B.C.-A.D. 1513

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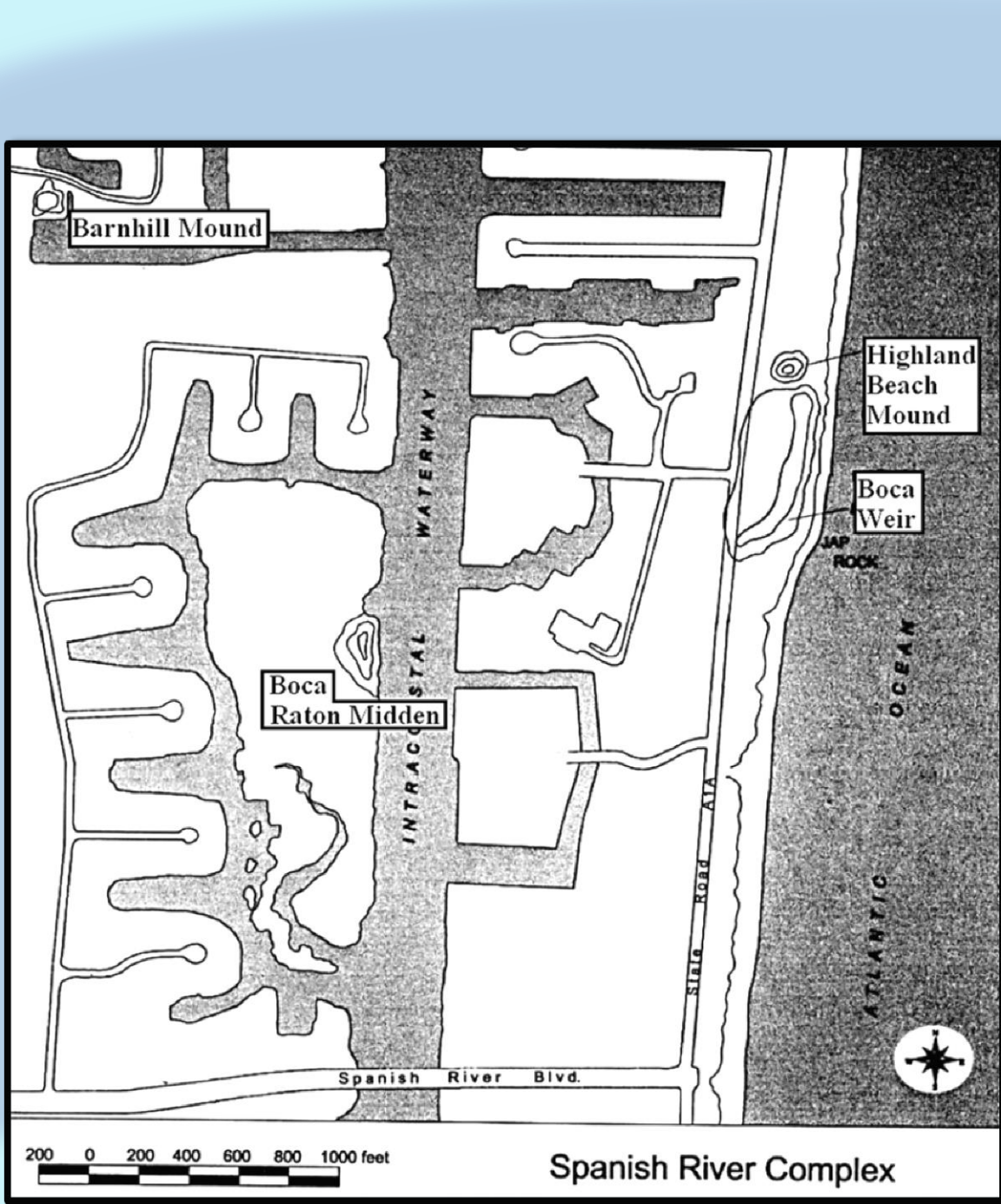


Figure 2. Spanish River Complex  
\*From Wheeler et al. 2002a, modified by the authors

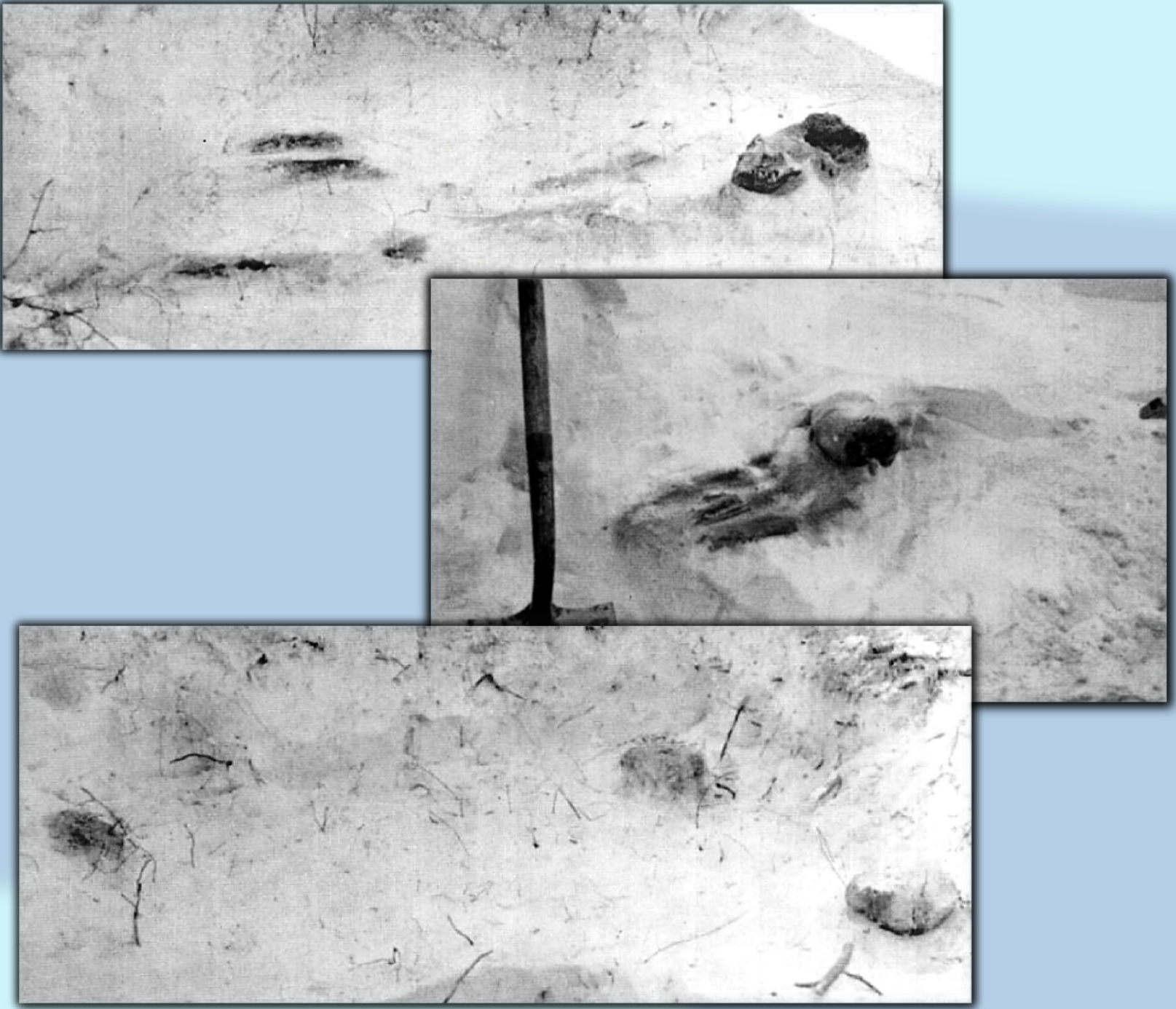


Figure 3. Primary, Secondary, and Isolated Skull Burials at the Barnhill Mound; similar to those at the Highland Beach Mound  
\*From Bullen 1957

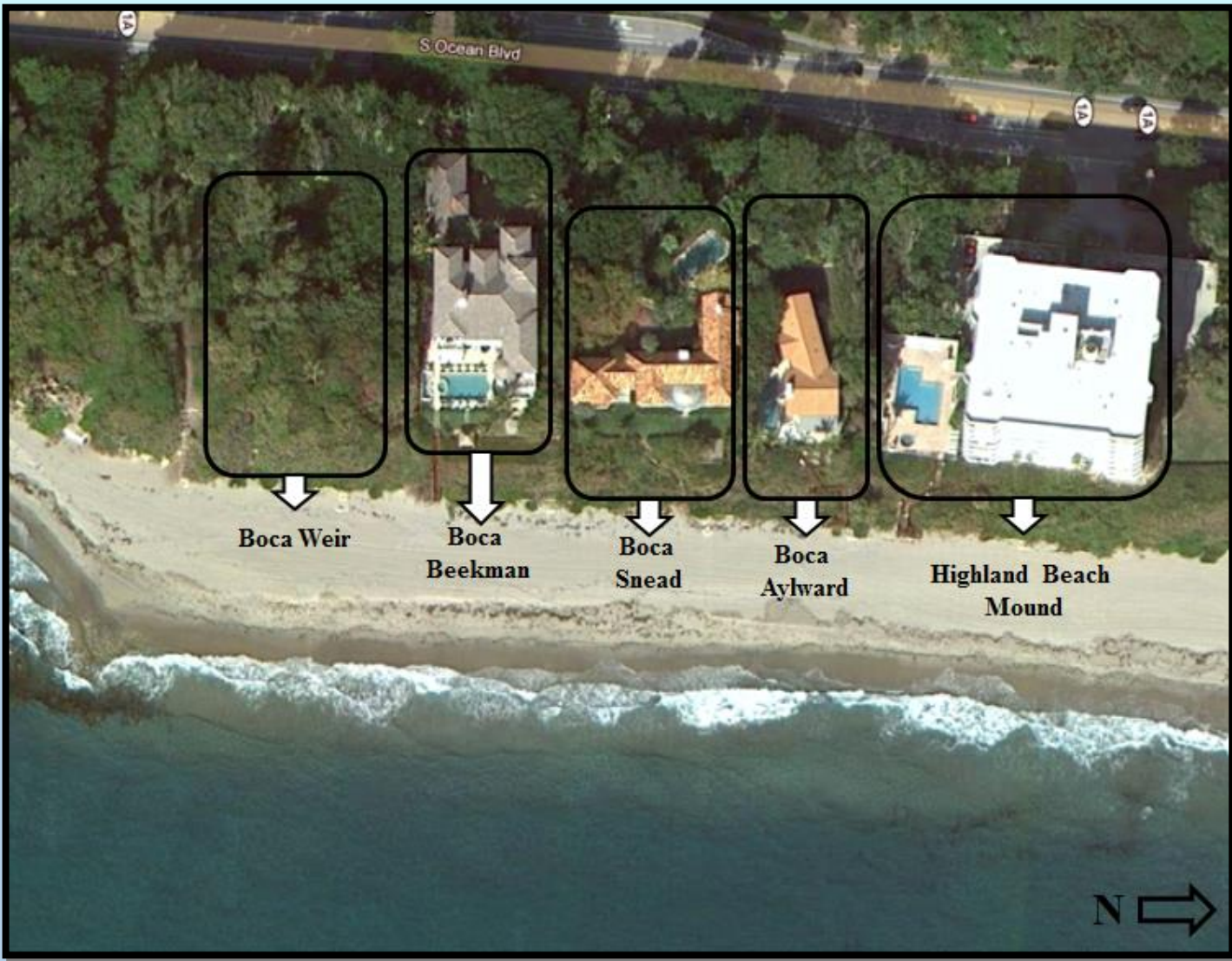


Figure 4. Barrier island portion of the Spanish River Complex, including the Highland Beach Mound and Boca Weir Midden  
\*Aerial image from Google Maps, modified by the authors

Results

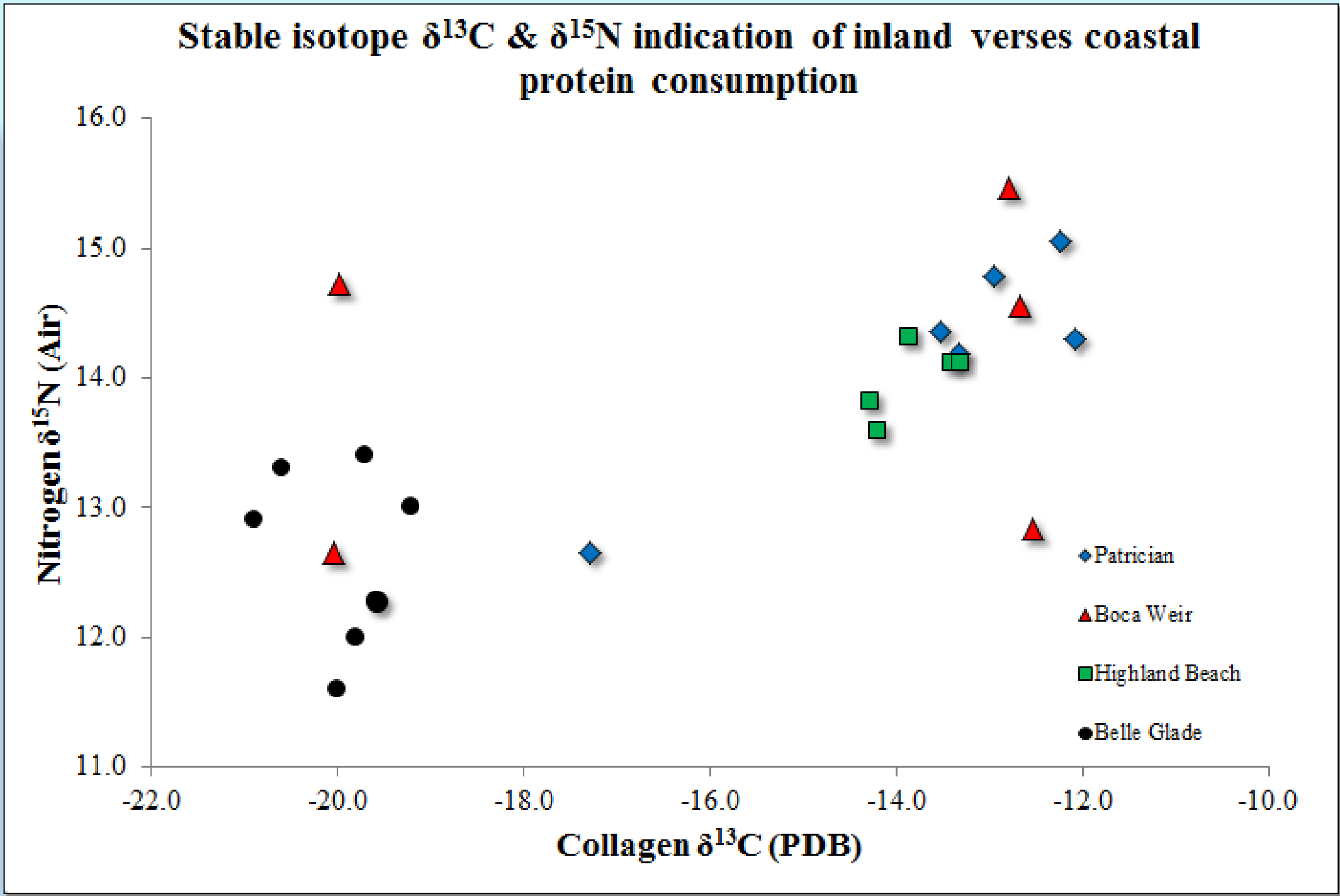


Figure 5. δ<sup>13</sup>C/δ<sup>15</sup>N Bivariate Plot

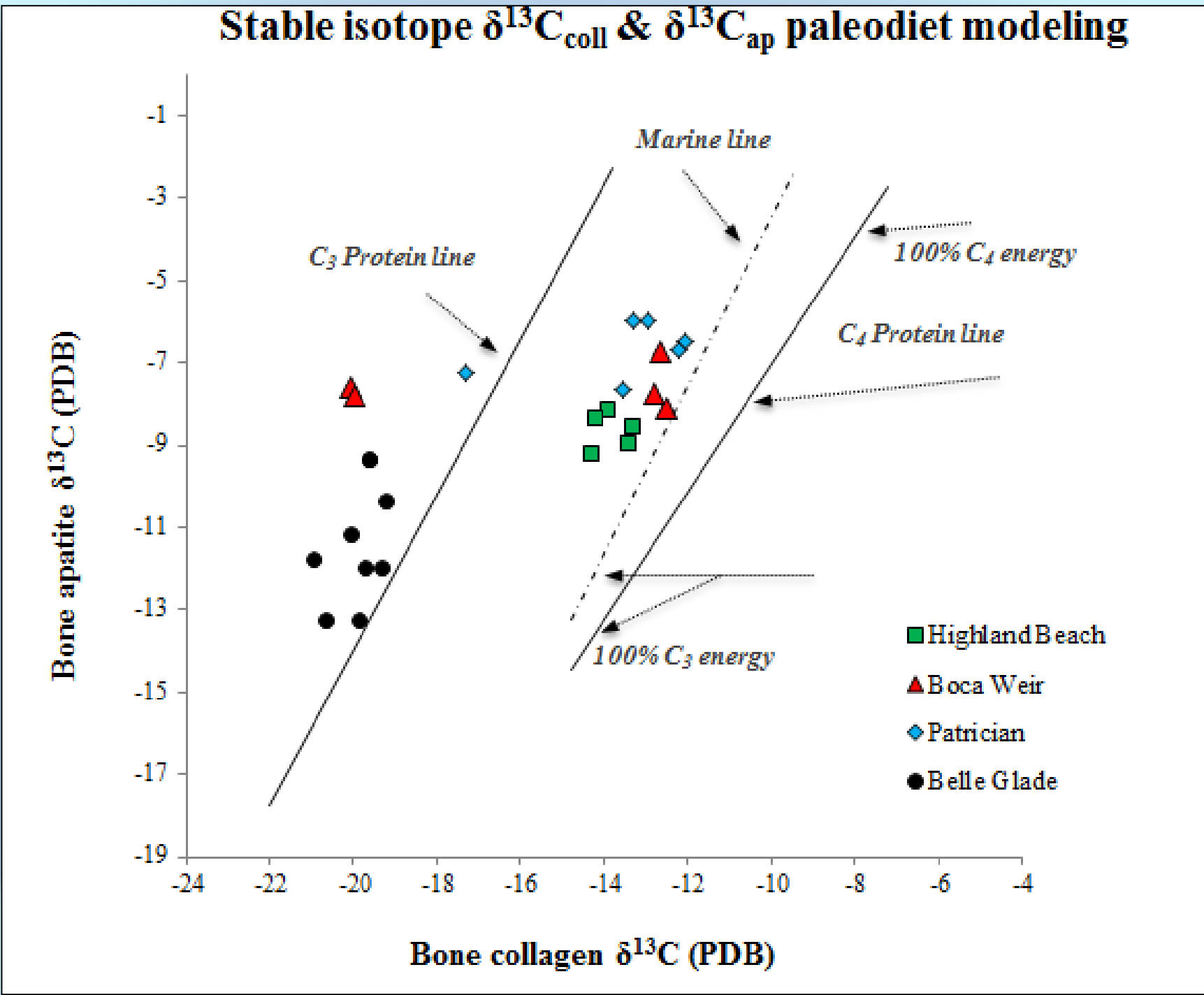


Figure 6. δ<sup>13</sup>C collagen and apatite plot (Kellner & Schoeninger 2007)

• EOA peoples consumed a coastal-style diet enriched by marine protein, a significant contrast (P < 0.01, student t-test) to the C<sub>3</sub> dominant isotopic signatures of the inland Belle Glade population.

• Three EOA samples have isotopic signatures similar to the inland diet of the Belle Glade population. This is strong evidence for migration between the interior and the coast during the pre-contact era.

• EOA Highland Beach samples present as a tight cluster, a contrast to the contemporary Boca Weir which are divided between inland and coastal isotopic signatures. The differential isotopic signatures provide compelling evidence of either differential, status-based, access to foods, or endogamous group selection.

Osteological Materials

Only adult bone was sampled in this study. Sex determination for the relatively complete primary burials from Patrician (N=6) followed methods outlined in Buikstra and Ubelaker (1994), specifically using the skull and/or pelvis. Rib bone samples were collected (1 male:5 females). The Spanish River Complex included both primary and secondary burials, making sex determination of some individuals more difficult. Long bone fragments of fibulae (N=5) were sampled from Boca Weir, with sex assessment (3 males:2 females) based on associated tibiae following methods described in Bass (1995). Long bone tibial fragments (N=5) were sampled from Highland Beach (3 males:2 females), again using Bass (1995) to determine sex.

Results Summary

The data from the Patrician, Boca Weir, and Highland Beach samples suggest a diet of freshwater and marine food resources supplemented local terrestrial fauna and C<sub>3</sub> plants (**Figures 5 and 6**). In combination, the results from d13Ccoll, d13Cap, and d15N support a broad spectrum diet with a significant marine component for the East Okeechobee Area population. These data, coupled with ethnohistorical sources and relevant faunal analyses support this contention. Nonetheless, the results indicate several other items of interest.

Although the majority of these samples demonstrate a largely coastal-based food regime, three individuals sampled show a more inland-based diet. One from Patrician and two from Boca Weir show depleted d13Ccoll values suggestive of greater consumption of freshwater/terrestrial fauna compared to marine/estuarine food resources. The lower d15N values observed in two of these cases also supports this contention, and underscores the likelihood of prehistoric movement between these different resource spheres in South Florida.

The close clustering of the five Highland Beach samples is also of interest. Several possible reasons might explain this pattern. First, the potentially higher-status population (cf. Ferdinando n.d.) buried in this mound may have had more regular access to select, and potentially preferential, food resources. This is especially evident when compared to the varied isotopic distribution at Boca Weir; a midden site also within the Spanish River Complex. Second, the practice of endogamous group selection for the Highland Beach group might also explain the close clustering of isotopic signatures. This again suggests potential differences in groups from the Spanish River Complex, whereby certain ones permitted outsiders (Boca Weir) while others (Highland Beach) did not. In combination, these interpretations suggest that the Highland Beach group may have retained exclusive privileges, including burial in the mound and access to select foods, and that they may have wished to preserve these privileges within their lineage.

There are also some temporal changes in diet among the East Okeechobee peoples. For example, smaller d13Cap-col spacing suggests reduced emphasis on terrestrial protein for the later samples from the Spanish River Complex when compared to individuals from the earlier Patrician. Additionally, the depleted d13C values (both collagen and apatite) suggests greater exploitation of all available aquatic resources by the later groups, rather than aquatic foods primarily from the ocean as indicated by the Patrician samples. One suggestion is that at Patrician, people principally utilized available marine and terrestrial resources, while the people at the Spanish River Complex accessed food resources within and perhaps beyond their local sphere, especially freshwater fish. Although speculative, increased population pressure in the East Okeechobee Area (cf. Ferdinando n.d.) might have stretched the available food resources, forcing many of the people of the Spanish River Complex to seek out previously underutilized foods. Indeed, scarcity may have instituted the previously discussed status-based access to food resources at this village complex.

References

Ambrose, Stanley H. 1990 Preparation and Characterization of Bone and Tooth Collagen for Isotopic Analysis. *Journal of Archaeological Science*. 17:431-531.

Andrews, Evangeline W. and Charles M. Andrews (eds.) 1985 Jonathan Dickinson, Jonathan Dickinson's Journal, or, God's Protecting Providence. Florida Classics Library Reprint: Port Salerno, Florida.

Bass, William M. 1995 Human Osteology A Laboratory and Field Manual, Fourth Edition. Special Publication No. 2 of the American Anthropological Society. Columbia, Missouri.

Buikstra, Jane E., and Douglas H. Ubelaker (eds.) 1994 Standards for Data Collection from Human Skeletal Remains. Third Printing. Arkansas Archaeological Survey Research Series No. 44. Arkansas Archaeological Survey, Fayetteville, Arkansas.

Bullen, Ripley P. 1957 The Barnhill Mound, Palm Beach County, Florida. *The Florida Anthropologist* 10:23-36.

Card, James E. 1991 Prehistoric Subsistence at the Singer Island Site (8PB219). M.A. Thesis, Florida State University, Tallahassee.

Ferdinando, Peter. n.d. Mortuary Practice in the East Okeechobee Archaeological Area: Tracking Indicators of Complexity and Hierarchy. Paper in preparation.

Ferdinando, Peter and Micheline Hilpert 2008 The Bioarchaeology of the 1975 Salvage Excavation of the Belle Glade Burial Mound (8PB41). Paper presented at the 60th annual meeting of the Florida Anthropological Society, Ybor City.

Hann, John H. 2003 Indians of Central and South Florida, 1513-1763. University Press of Florida: Gainesville, Florida.

İscan, Mehmet Y., Morton H. Kessel, and Susanna Martis 1989 Spectrographic Analysis of Trace Elements in Archaeological Skeletal Material from Florida: A Preliminary Report. *American Journal of Physical Anthropology* 79:483-488.

Kellner, Corina M. and Margaret J. Schoeninger 2007 A Simple Carbon Isotope Model for Reconstructing Prehistoric Human Diet. *American Journal of Physical Anthropology* 133:1112-1127.

Koch, Paul L., Noreen Tuross, and Marilyn L. Fogel 1997 The Effects of Sample Treatment and Diagenesis on the Isotopic Integrity of Carbonate in Biogenic Hydroxyapatite. *Journal of Archaeological Science* 24:417-429.

Ritchie, Thomas, Frank Morrison, and Clivia Morrison 1981 Salvage Excavations of the Patrician Shell Mound. *The Florida Anthropologist* 34:21-37.

Wheeler, Ryan J., Wm. Jerald Kennedy, and James P. Pepe 2002a The Spanish River Complex: A Preliminary Report. Paper in preparation.

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