PRELIMINARY PALYNOLOGICAL AND MACROBOTANICAL REPORT FOR THE LEISEY SHELL PITS, HILLSBOROUGH COUNTY, FLORIDA

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ABSTRACT

Two samples of bone- and shell-bearing sediment from the Leisey Shell Pit were analyzed palynologically, and eleven macrobotanical samples were analyzed. Palynological remains include *Pinus, Quercus, Carya,* Chenopodiaceae/Amaranthaceae, and *Liquidambar,* as well as grasses, composites, and very abundant dinoflagellate cysts. Macrobotanical remains show that species of *Pinus,* as well as *Quercus virginiana, Sabal palmetto,* and *Serenoa repens* inhabited the mainland near the Leisey site. The nature of the assemblage indicates that (1) the typical coastal plain vegetation from the nontropical portions of the southeastern U.S. may not have changed much over the last 1.0-1.5 million years, (2) the mainland vegetation probably consisted of mesic to xeric woodlands with scattered shrub wetlands along streams or near marshes, and (3) the sediment accumulated very near shore in shallow marine water. The latter conclusion is drawn from the fact that the Leisey pollen samples contain a coastal pollen assemblage which has been identified from a large number of southeastern Pleistocene sites. The taphonomy of the pollen assemblage thus corroborates that of the vertebrate and invertebrate fossils.

RESUMEN

Se analizaron palinológicamente dos muestras provenientes del depósito de conchuelas de Leisey que contenían huesos y conchas, siendo analizadas once muestras macrobotánicas. Los restos palinológicos incluyen *Pinus, Quercus, Carya,* Chenopodiaceae/Amaranthaceae y *Liquidambar,* como así también pastos, compuestas y abundantes caparazones de dinoflagelados. Los restos macrobotánicos

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muestran que especies de *Pinus*, así como también *Quercus virginiana, Sabal palmetto* y *Serenoa repens* habitaban el área continental cerca del sitio Leisey. La naturaleza de este ensamblaje indica que: (1) la vegetación de planicies costeras de áreas no tropicales del sureste de los Estados Unidos probablemente no ha cambiado mucho en los últimos 1.0 - 1.5 Millones de años; (2) la vegetación continental consistía probablemente de áreas de bosques mésicos a xéricos con humedales de matorrales esparcidos a lo largo de corrientes de agua o cerca de pantános; (3) el sedimento se acumuló muy cerca de la costa baja del mar. La última conclusión se desprende del hecho que las muestras de polen de Leisey contienen un ensamblaje de polen costero que se ha identificado desde un gran número de sitios pleistocénicos del sudeste. La tafonomía del ensamblaje de polen corrobora entonces la tafonomía de los fósiles vertebrados e invertebrados.

INTRODUCTION

Two samples of shell-bearing sediment from the Leisey Shell Pit were analyzed palynologically; eleven other samples were analyzed for their macrobotanical contents. Although all samples were randomly collected, the palynological samples came directly from the vertebrate-producing layer of Leisey Shell Pit sites 1A and 3A, while most of the macrobotanical remains came from organic-rich lenses in the lower shell bed (Bermont Formation) in Leisey pits 1 and 3 (see Morgan and Hulbert this volume). The sample of mineralized seeds originated from the Leisey 1A vertebrate site. All samples are assumed to be representative of Leisey generally. While further analyses would be desirable in order to determine the true nature of the paleobotany of the Leisey site, the data that we do have available are of sufficient value for this paper to be presented.

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METHODS OF INVESTIGATION

Palynological Remains

Two samples of silt- and clay-covered shells from the Leisey site were collected by Richard Hulbert and Gary Morgan and were given to FJR for analysis. Several hundred grams of each sample were put in a sieve, and the fine sediment was washed from the shells with distilled water. The sediment was processed further as follows:

1. It was covered with 10% HCL until all reaction ceased; this removed carbonates.
2. The residue was washed with distilled water, centrifuged, and covered with 52% HF for four days; this removed silicates.
3. The sample was then washed free of HF and boiled in 10% KOH for 10 minutes; this removed soluble humic substances.
4. The remaining sediment was washed free of soluble organic substances and mixed with a 50:50 mixture of distilled water and glycerine jelly.

Several slides were prepared from the glycerine jelly suspension of insoluble organic matter; enough residue was placed on each slide to cover an area of 22 x 22 mm. The residue is dark, richly organic, and composed of microscopic particles of many probable origins. The slides were observed at 400X magnification using a Jenaval research photomicroscope. Slides were systematically observed using a mechanical stage with X-Y movement. Pollen grains and dinoflagellate cysts were observed and counted until at least 200 identifiable pollen grains had been seen. The results were tabulated, and simple percentages of pollen taxa were computed. The extraordinarily abundant dinoflagellates were not figured into the pollen total, because identifying and quantifying cysts was not a goal of this investigation. A total of 220 pollen, including only 9 unknowns, was counted for the Leisey 1A sample, while 230 pollen, including 19 unknowns, were counted for the Leisey 3A sample.

Macrobotanical Remains

Preserved plant specimens were collected by members of the vertebrate and invertebrate paleontology sections of the Department of Natural Sciences, Florida Museum of Natural History. While these efforts did not include systematic collection of the macrobotanical remains, individual specimens or concentrations

of plant remains were collected as separate samples as they were encountered and recognized during excavation. Plant specimens consist of fragments of degraded wood, pine cones, and large seeds. They are variably preserved as waterlogged, humified remains, and as mineralized or charred specimens (Herendeen 1991). Pine cones and most wood specimens were found in dark highly organic lenses at Leisey Shell Pits 1 and 3 and were recovered in a degraded, waterlogged condition. A few wood specimens, particularly *Quercus*, may have undergone transformation from an originally waterlogged condition to charcoalified specimens (Herendeen 1991). The stratigraphic level at which these specimens were collected is well below the present water table. Seeds from the Leisey shell pits were recovered as mineralized specimens.

Waterlogged wood samples were prepared for anatomical characterization by thin-sectioning, while charred specimens were simply fractured. Cross, radial, and tangential sections were prepared for each specimen so as to provide the best view of internal structures. Thin-sections were mounted on glass slides and viewed under a compound microscope; fractured wood was viewed under a dissecting microscope. Identifications were made by using keys to anatomical structures (Record and Hess 1942-48; Wheeler et al. 1986) and by direct comparison with wood specimens in the comparative collection of the Florida Museum of Natural History. Cone and seed identifications also were made by comparison with specimens from the collection at the museum, by using pictoral guides to identification (Martin and Barkley 1961), and by using published morphometric data (Elias 1980). All identificaitons were carried to the lowest possible taxonomic level.

RESULTS

Palynological Analyses

Table 1 illustrates the relative abundances of the pollen identified from the Leisey samples; no spores of any kind were observed.

Many of the pine pollen, which ordinarily are vesiculate grains with two distinct hemispherical bladders, were broken into halves; during the counting process two halves were tallied as a single grain. Grains of other taxa were generally intact. The most abundant microfossils were not pollen or spores, but rather, the cysts of dinoflagellates. All the observed cysts were of the chorate type, i.e., minute armored spheres with branched tubular appendages. Many of the cysts were broken into halves, and the number of cyst fragments observed (607 in 1A, 321 in 3A) includes whole and half cysts. The total is not an accurate reflection of the number of individual dinoflagellates present in the

Table 1. Relative abundances of pollen in samples from Leisey Shell Pit 1A and 3A.

	Leisey 1A	Leisey 3A
Arecaceae (palms)	0.0	0.43
Carya (hickory/pecan)	6.4	0.0
Chenopodiaceae/Amaranthaceae (cheno-ams)	3.2	29.5
Compositae (asters and their kin)	1.8	3.9
Corylus (hazel)	1.8	1.3
Ericaceae (heaths)	0.0	0.87
Gramineae (grasses)	0.45	5.2
Liquidambar (sweet gum)	3.6	1.3
Myrica (wax myrtle)	1.4	0.87
Pinus (pine)	38.6	33.5
Quercus (oak)	36.4	11.7
Salix (willow)	0.0	0.87
Taxodium (cypress)	1.4	0.43
Umbelliferae (carrot and its kin)	0.0	0.43
Vitis (grape)	0.9	0.0
Unknowns	4.1	8.2

samples, but it is still an impressive figure. Among the many other samples FJR has observed from the Southeast, dinoflagellates usually are absent or number no more than 10 or 20 whole individuals.

Macrobotanical Analyses

Leisey Shell Pit 1

Sample 1: Twenty-five fragments of *Pinus* sp. All appear to have been derived from a single branch or section of stem.

Sample 2: Four fragments of *Pinus* sp. (probably diploxylon, the dentate or hard pine group that includes longleaf and all the southern hard or yellow pines). These fragments fit together as one original piece. The eccentric pith and presence of compression wood anatomy suggest that this was part of a branch or a leaning stem.

Sample 3: Six fragments of *Pinus* sp., probably also diploxylon.

Sample 4: Two whole *Pinus* sp. female cones with distinctly armed scale tips, indicative of the hard pine group (section diploxylon), but exclusive of red pine (*P. resinosa*) (Elias 1980). Cone measurements (mm) are in Table 2.

Sample 5: Five fragments of *Quercus virginiana* (live oak), branch or young stem. All fit together as one original piece.

Sample 6: Twenty-five fragments of *Quercus virginiana*, also originating as one piece.

Leisey Shell Pit 1A

Sample 1: Fifty-eight mineralized seeds of *Sabal palmetto* (cabbage palm), one mineralized seed of *Serenoa repens* (saw palmetto), and one mineralized, unidentified, round (6 mm diameter) seed/fruit/gall.

Table 2. Dimensions of cones in mm from Leisey Shell Pit 1, Sample 4.

	Whole cone length	Scale tip height	Scale tip maximum width
Cone 1	78.90	5.65	16.10
Cone 2	80.85	5.35	15.70
Cone 2		6.80	14.90

Leisey Shell Pit 3B

Sample 1: One fragment of *Pinus* sp. wood, section diploxylon.

Sample 2: Numerous small fragments of palm wood/stem tissue.

Sample 3: Several small wood fragments and one very large bole (trunk) section of live oak, *Quercus virginiana*.

Sample 4: Coniferous wood fragments, either *Juniperus* sp. (red cedar) or *Taxodium* (cypress). Some fragments have abundant axial parenchyma and may be root wood.

DISCUSSION

Palynological Data

The general characteristics of the Leisey pollen assemblages are what one might expect in samples that originated in a coastal plain area of the southeastern U.S. The abundance of *Pinus* and *Quercus* is an especially characteristic attribute. Both genera are common in the Southeast and include diverse species that inhabit upland and lowland sites. Pine and oak both produce copious amounts of pollen, and one expects to find it in virtually every sedimentary environment in the Southeast. The accessory woody taxa (*Carya*, *Liquidambar*, *Corylus*, and *Myrica*) are also typical southeastern forms. One can envision these pollen floras as representing an open plain with pine and oak scattered over the landscape; the other genera probably grew in edaphically moist areas near marshes or adjacent to streams, ponds, and lakes. The relatively low percentages of grass pollen (0.45% from 1A and 5.2% from 3A) might argue against an open plain reconstruction, except that grass usually seems to be underrepresented at coastal plain sites that are not actually marshes. There is simply not enough *Myrica* for the vegetation to have been shrub-swamp, and *Taxodium* is of such slight importance that freshwater arboreal swamps must have been absent as well.

The list of taxa from the Leisey site is, then, not particularly remarkable. It reflects the type of vegetation we have come to expect from the Southeast, but therein lies an interesting discovery. According to Hulbert and Morgan (1989) the Leisey Shell Pit fauna is between 1.0 and 1.5 million years old. The lowland hardwood vegetation just described evidently has been in place for at least that much time and suggests a great deal of ecological stability.

The most significant aspect of the Leisey pollen assemblages is what they tell us about the site of deposition. If the list of woody taxa is not particularly remarkable, their relative abundances and their association with composites, chenopods/amaranths, and dinoflagellates is. Recently, work has been completed on a large suite of Pleistocene samples from various locations along the Atlantic and Gulf coastal plains of the southeastern U.S. (Rich and Pirkle in press). As a result of that work, we have identified a distinct assemblage of pollen types, dinoflagellates, and associated inorganic sediment constituents that are indicative of deposition near coastal marshes or within estuaries. Oak and pine are always the most abundant types, but *Liquidambar* and *Carya* typically are present and usually comprise 1-3% of the pollen flora. These four genera of trees are always accompanied by a few percent each of composites and chenopods/amaranths. The pattern is reproducible again and again and has been found in coastal sediments of mixed terrestrial and marine origin from South Carolina to the

Florida panhandle. Oftentimes, shells or shell fragments also are present, but they need not be. It also is common to find minute framboids or cubic crystals of pyrite within the pollen grains. Apparently the pollen genera involved have accumulated in response to two things: (1) this is the type of vegetation that typically grows along the non-tropical portions of the southeastern coast of the U.S., and (2) a particular combination of aerodynamic and hydrodynamic conditions favors the deposition of these pollen types in very shallow, quiet, brackish or normal marine waters near the shore. The fact that most of the pine pollen were broken is suggestive of considerable transport of the grains. They may well have been carried to the site of deposition by streams and were then moved about by waves and the tide. Their large size and morphology make them more susceptible to breakage than the smaller, more durable grains of the other taxa. The presence of the dinoflagellate remains certainly adds credence to this depositional interpretation. Abundant dinoflagellates by themselves would indicate only marine conditions; the presence of the other taxa in the proportions shown in the Leisey samples tells us the sediments accumulated in shallow water close to the mainland. The dinoflagellate cysts were probably broken by the same turbulent conditions that fragmented the pine grains.

The implication that the coastal pollen assemblage carries for the taphonomy of the Leisey site vertebrate remains is worthy of note. Without any foreknowledge of the taphonomy and paleoecology of the Leisey site, as interpreted by Hulbert and Morgan (1989) and Pratt and Hulbert (this volume), we would have suggested precisely the kind of depositional scenario that they present, only our ideas would be based entirely on the pollen data. The one exception is that no mangrove pollen has been identified, and we would have chosen a warm-temperate or subtropical coast without the mangroves. The taphonomy of the vertebrate remains, mollusks, and pollen assemblage indicate the same type of environment of deposition. The Leisey site thus offers us a very rare opportunity to cross-check taphonomic interpretations drawn from quite different kinds of fossil remains.

Macrobotanical Data

The number of taxa represented in the macrobotanical collection is limited, but the identity of the wood and cone remains, particularly, agrees with what one might expect to find in sediments along the subtropical portions of the Florida coast (i.e. beyond the limits of the mangrove forest), and agrees with the palynological data. Pine, oak, and palms are common over much of Florida, and the abundance of their remains in the Leisey deposits is not surprising. There does not seem to be much doubt about the wood fragments or the palm seeds; the

cones, on the other hand, provide a point of debate. The Leisey cone lengths are too small for *Pinus palustris* (longleaf pine), which has cone lengths ranging from 152 mm to 254 mm. One consideration regarding the morphometric data is that the originally waterlogged Leisey cones were measured subsequent to their having dried during museum storage. Thus, some shrinkage may have occurred, and the Leisey cone measurements are probably less than they originally were; unfortunately, we do not know how much shrinkage took place. Even considering the amount of shrinkage that may have occurred, it is doubtful the Leisey cones would approach the dimensions noted above for *P. palustris*.

The cones are too long for *P. serotina* (pond pine), *P. glabra* (spruce pine), or *P. echinata* (shortleaf pine), all of which have cone lengths less than 64 mm. The closest cone-length similarities among eastern pines exist among *P. caribaea* (Caribbean pine, 50-152 mm), *P. elliottii* (slash pine, 76-152 mm), *P. taeda* (loblolly pine, 50-152 mm), *P. rigida* (pitch pine, 25-89 mm), *P. clausa* (sand pine, 50-89 mm), and *P. virginiana* (Virginia pine, 50-76 mm) (Elias 1980). Of these species, only *P. elliottii*, *P. taeda*, and *P. clausa* presently occur in Florida (Little 1978; Elias 1980), so these appear to be the most likely choices for the Leisey cones.

SUMMARY

Two samples of shell-bearing sediment and a number of wood, cone, and seed fossils from the Leisey Shell Pit were analyzed palynologically and macrobotanically. While additional data are necessary for a complete paleobotanical appraisal of the site, preliminary data show the following: (1) the pollen-producing vegetation that grew near the site of deposition (*Pinus, Quercus, Carya, Liquidambar, Myrica, Taxodium, Corylus*, Chenopodiaceae/Amaranthaceae, Graminaeae) was very much like what one now finds along the non-tropical portions of the coast of the southeastern U.S., (2) the macrobotanical remains, including live oak, hard pine, cabbage palm, and saw palmetto provide the impression that the mainland was covered with mesic to xeric woodland; wetland areas are indicated by the presence of the pollen of cypress, willow, and wax myrtle, which may have grown as riparian wetlands or as vegetation fringing ponds or marshes; and (3) the composition of the pollen assemblage, including the presence of abundant dinoflagellate cysts, suggests near-shore deposition in shallow, quiet brackish or normal marine water.

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