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ST. PETERSBURG TIMES SITE, PINELLAS COUNTY, FLORIDA,  
WITH A BRIEF REVIEW OF FLORIDA BLANCAN FAUNAS

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**LATE PLIOCENE (LATE BLANCAN) VERTEBRATES FROM THE ST.  
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REVIEW OF FLORIDA BLANCAN FAUNAS**

GARY S. MORGAN<sup>1</sup> AND R. BRIAN RIDGWAY<sup>2</sup>

**ABSTRACT**

Thirty species of vertebrates are reported from the St. Petersburg Times Site, located about 10 kilometers inland from the Gulf of Mexico in Pinellas County, Florida. Freshwater forms predominate in the St. Petersburg Times fauna, with the most common species being the siren *Siren* cf. *S. lacertina*, the water snake *Nerodia* cf. *N. taxispilota*, the alligator snapping turtle *Macrolemys* cf. *M. temmincki*, and the pond turtle *Pseudemys platymarginata*. A quiet freshwater depositional environment such as a pond, marsh or swamp is indicated by both the composition of the vertebrate fauna and the dark, fine-grained, organic sediments. Four species of mammals diagnostic of the Blancan Land Mammal Age occur in the St. Petersburg Times fauna: the edentates *Glyptotherium* cf. *G. arizonae*, *Holmesina floridanus*, and *Megalonyx leptostomus*, and the hipparionine horse *Nannippus peninsulatus* (= *N. phlegon*). The association of *Nannippus* and the South American immigrants *Glyptotherium* and *Holmesina* is indicative of a late Blancan (late Pliocene) age. A large late Blancan vertebrate fauna from the Macaspphalt Shell Pit in Sarasota County, Florida is briefly discussed. The Macaspphalt vertebrate fauna is composed of over 80 species, including a mixture of estuarine, freshwater, and terrestrial taxa. The freshwater component dominates the fauna, in particular several species of fish, *Siren*, *Nerodia*, *Pseudemys platymarginata*, *Macrolemys*, and a diverse sample of aquatic birds. There are at least 12 species of mammals in the Macaspphalt fauna that are characteristic of the Blancan, including *Holmesina floridanus*, *Glossotherium chapadmalense*, *Megalonyx leptostomus*, *Neochoerus dichroplax*, *Sigmodon medius*, *Trigonictis macrodon*, and *Nannippus peninsulatus*. The occurrence of *Nannippus* with the South American immigrants *Glossotherium*, *Holmesina*, and *Neochoerus* indicates a late Blancan age. A review of the Florida Blancan confirms that all of best known faunas are late Blancan in age (between about 2.5 and 2.0 Ma). Most of these faunas record the association of *Nannippus peninsulatus*, a species that went extinct in the latest Pliocene about 2.2 Ma, and Neotropical immigrant edentates and rodents, two groups that first appeared in North America about 2.5 Ma as early participants in the Great American Faunal Interchange. Although still incompletely known, Florida Blancan sites sample a richer diversity of these South American interchange species than do Blancan faunas elsewhere in North America. Early and middle Blancan vertebrate faunas are as yet unknown from Florida.

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## INTRODUCTION

Vertebrate faunas of middle to late Pliocene (Blancan) age are surprisingly rare in the rich Late Cenozoic fossil record of Florida, while faunas representing the next older (Hemphillian) and next younger (Irvingtonian) Land Mammal Ages are relatively common. The only well known Blancan vertebrate faunas previously described from Florida (and for that matter from all of eastern North America) are Haile 15A in Alachua County and Santa Fe River 1 in Columbia County (Webb, 1974a; Robertson, 1976; Kurten and Anderson, 1980). In the present report we place on record two new late Blancan faunas from the southern Gulf Coast, namely the St. Petersburg Times Site in Pinellas County and the Macasphalt Shell Pit in Sarasota County. The St. Petersburg Times fauna is discussed in some detail, while only a summary is provided of work still in progress at the Macasphalt pit. In addition, we mention several other new sites that have produced Blancan mammals and briefly review all published Florida Blancan faunas. Figure 1 shows the location of the Blancan faunas presently known from Florida.

The fossils discussed in this paper are in the vertebrate paleontology collections of the Florida State Museum, University of Florida, Gainesville (catalogue numbers prefixed by UF) and the Florida Geological Survey, also housed at the Florida State Museum (catalogue numbers prefixed by UF/FGS). Abbreviations used throughout the text are as follows: millimeter (mm), meter (m), kilometer (km), and million years (Ma). All measurements are in mm. In dental descriptions P indicates premolar and M indicates molar, with superscripts designating uppers (e.g. P<sup>4</sup>) and subscripts designating lowers (e.g. M<sub>3</sub>). The preferred habitats of Florida amphibians and reptiles are taken from Ashton and Ashton (1981, 1985) and Conant (1975).

### ST. PETERSBURG TIMES SITE

The St. Petersburg Times Site was discovered in the summer of 1979 in a borrow pit being excavated for fill dirt during the construction of Interstate 275 through St. Petersburg, Pinellas County, Florida. Brian Ridgway collected fossils at the pit on three separate occasions, but there was insufficient time to conduct a full-scale excavation as the bone-bearing layer was submerged by rising water shortly after it was discovered. Neither a measured stratigraphic section, nor photographs are available for the site. Despite the fact that we were unable to screenwash the sediments, a large number of bones of small vertebrates were recovered suggesting that a much more diverse fauna may have been present.

The fossil site is located just east of the St. Petersburg Times building on 13th Avenue North at 31st Street North in downtown St. Petersburg, SW 1/4, NW 1/4, sec. 14, T31S, R16E, St. Petersburg 7.5 minute quadrangle (27°47'N, 82°41'W). The borrow pit in which the fossils were found is approximately 0.6 km long by 0.2 km wide and was dug to a depth of about 15 m below the present land surface, which is 14 m in elevation. The vertebrate fossils were collected from a 0.5 to 1.0 m thick layer of black sandy organic sediment located near the bottom of the pit some 12-15 m below the surface, near present sea level. Underlying the bone bed is a semi-indurated marine shell bed tentatively referred to the Pinecrest Beds on the basis of its molluscan fauna. The maximum thickness of this unit is unknown, but less than 1 m is exposed in the extreme bottom of the pit. Overlying the vertebrate unit and extending upward to the soil horizon is a layer of massive unfossiliferous sand approximately 10-12 m in thickness. When the fossils were discovered the pit was being pumped out, however, after the excavation for fill dirt ceased the pit was allowed to fill with water. The fossil-bearing horizon is presently more than 10 m underwater in what is now called Eagle Lake.

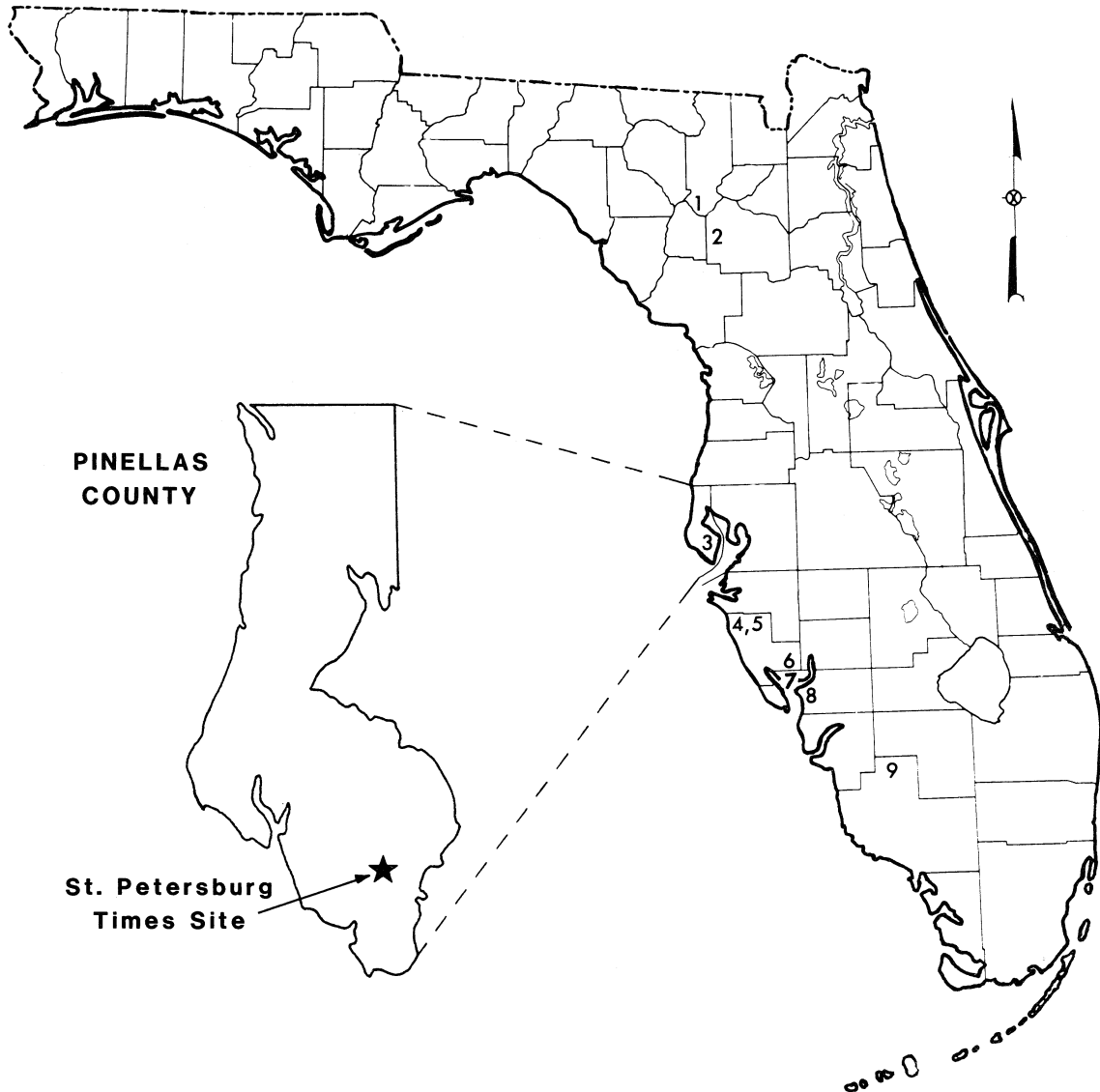


Figure 1. Map of Florida showing location of all published Blancan vertebrate faunas. The exact location of the St. Petersburg Times Site is shown on an enlarged map of Pinellas County. 1. Santa Fe River (including sites 1, 1A, 1B, 4A, 8A, and 15A), Columbia County; 2. Haile 15A, Alachua County; 3. St. Petersburg Times, Pinellas County; 4. Macaspalt Shell Pit, Sarasota County; 5. Sommers Pit, Sarasota County; 6. Bass Point Waterway 1 and Northport, Sarasota County; 7. Port Charlotte and El Jobean, Charlotte County; 8. Acline Shell Pit, Charlotte County; 9. Mule Pen Quarry, Collier County.

## SYSTEMATIC PALEONTOLOGY

CLASS OSTEICHTHYES  
ORDER SEMIONOTIFORMES  
FAMILY LEPISOSTEIDAE*Lepisosteus* sp.

REFERRED MATERIAL.--UF 95067, left suboperculum; UF 69663, partial left dentary; UF 69664, scale.

On the basis of fragmentary remains it is difficult to separate the four living species of gar (*Lepisosteus*) presently found in Florida. Although gar are abundant and well preserved in many Florida Late Cenozoic fossil sites, they have received little attention from paleontologists. Robertson (1976) recorded *Lepisosteus* from the late Blancan (late Pliocene) Haile 15A fauna. Gar inhabit streams, rivers and lakes in Florida, and several species are also found in brackish water.

ORDER SILURIFORMES  
FAMILY ICTALURIDAE*Ictalurus* sp.

REFERRED MATERIAL.--UF 69665, two pectoral spines.

These spines resemble those of *Ictalurus* and differ from the marine catfish *Bagre* and *Galeichthyes* by the presence of serrations along only one edge. Three species of *Ictalurus* now inhabit fresh and brackish waters in Florida. As with gar, catfish are common in many Florida Late Cenozoic sites. Robertson (1976) listed *Ictalurus* among the rich freshwater and estuarine fish fauna from Haile 15A.

CLASS AMPHIBIA  
ORDER ANURA  
FAMILY RANIDAE*Rana* sp.

REFERRED MATERIAL.--UF 69666, right exoccipital; UF 69667, left ilium; UF 69669, two vertebrae; UF 69668, tibio-fibula.

The ilium has been shown by previous workers (e.g. Holman, 1965) to be one of the most diagnostic elements in the frog skeleton. This ilium is from a large frog and is similar to large specimens of the bullfrog, *Rana catesbiana*. The exoccipital also resembles the posterior skull region of a large *Rana*. Several genera of frogs and toads are present at Haile 15A (Robertson, 1976) and in the late Blancan Macasphalt Shell Pit fauna.

ORDER URODELA  
FAMILY SIRENIDAE  
*Siren* cf. *S. lacertina* Linnaeus

REFERRED MATERIAL.--UF 69671, 68 vertebrae.

These vertebrae closely resemble those of *Siren lacertina*, the living greater siren. Their large size distinguishes them from the other two living species of sirens, *S. intermedia* and *Pseudobranchius striatus*, and from the four extinct species of Late Cenozoic sirens described from Florida by Goin and Auffenberg

(1955). Goin and Auffenberg considered the extinct species *S. simpsoni* from Haile 6A to be Pliocene in age, but this fauna is now regarded as late Miocene (early Hemphillian). *Siren* is also present in several early Pliocene (late Hemphillian) faunas from the Bone Valley Formation in Polk County, Haile 15A, and occurs in great numbers in the Macasphalt Shell Pit fauna. Sirens are totally aquatic amphibians found in freshwater streams, ponds, and lakes.

CLASS REPTILIA  
ORDER CHELONIA  
FAMILY TRIONYCHIDAE  
*Trionyx* sp.

REFERRED MATERIAL.--UF 69692, fragment of hyoplastron; UF 69693, humerus.

The plastral fragment is of little use in identification, except to note that it possesses the characteristic punctated sculpture of *Trionyx*. The humerus is very similar to that of a large individual of the common Florida softshell turtle, *Trionyx ferox*, particularly in the presence of a strong ectepicondylar groove. Roberston (1976) reported *Trionyx* from Haile 15A. Softshell turtles inhabit ponds, marshes, lakes, and slow-moving streams in Florida.

FAMILY KINOSTERNIDAE  
*Kinosternon* sp.

REFERRED MATERIAL.--UF 69691, left hyoplastron.

This specimen is most similar to the hyoplastron of the living striped mud turtle, *Kinosternon bauri*. Compared to *Sternotherus*, the hyoplastra of recent *Kinosternon* specimens and the fossil are deeper anteroposteriorly, have wider bridges, and better developed hinges. Robertson (1976) recognized *Kinosternon* from Haile 15A. Mud turtles prefer shallow freshwater habitats, particularly ponds, marshes, and swamps.

FAMILY CHELYDRIDAE  
*Macrolemys* cf. *M. temmincki* (Troost)

REFERRED MATERIAL.--UF 69683, right 3rd peripheral; UF 69684, right 4th peripheral; UF 69685, 69686, two left 4th or 5th peripherals; UF 69687, right 6th peripheral; UF 69688, right 7th peripheral; UF 69689, right 8th peripheral; UF 69690, left 10th peripheral.

The fossils differ from the common snapping turtle, *Chelydra serpentina*, but compare closely with a small individual of the alligator snapping turtle, *Macrolemys temmincki* in having the posterior peripherals more deeply notched, lacking a suture between the bridge peripherals and the costals (reflecting the presence of open fontanelles), and the absence of the costo-marginal sulcus on the bridge peripherals. A posterior peripheral of *Macrolemys* from the Times Site is shown in Figure 2A. Specimens of *Macrolemys* from this locality were compared to the extensive sample of the extinct species *M. auffenbergi* from the early Hemphillian McGehee Farm site in Alachua County (Dobie, 1968); however, most specimens of *M. auffenbergi* are from large individuals with thick shells, making comparisons with the Blancan fossils difficult. On the basis of their similarity to small individuals of *M. temmincki*, the St. Petersburg sample is tentatively referred to the living species.

Meylan (1984) reported *Macrolemys* from the late Blancan Santa Fe River 1 fauna and it is also common at Haile 15A. Hibbard (1963) recorded *M. temmincki* in the early Blancan Rexroad fauna from

Kansas. Although *Macrolemys* is now restricted in peninsular Florida to the region north of the Suwannee River, there are fossil records of the alligator snapping turtle from late Hemphillian, Blancan, and Irvingtonian sites in southern Florida. The St. Petersburg Times Site is almost 200 km south of the southernmost recent occurrence of *M. temmincki*. Alligator snapping turtles inhabit quiet freshwater habitats, especially larger rivers, swamps, and lakes.

FAMILY TESTUDINIDAE  
*Geochelone (Caudochelys) sp.*

REFERRED MATERIAL.--UF 69694, 3rd or 5th neural; UF 69695, five partial pleurals; UF 69694, right xiphiplastron.

These isolated shell elements are from a large species of the land tortoise *Geochelone* (subgenus *Caudochelys*), but are too fragmentary for a more specific identification. At least two individuals are represented, as the xiphiplastron is from a much smaller individual than the neural. Auffenberg (1963) recognized two large species of the land tortoise *Geochelone* from the Plio-Pleistocene of Florida: *G. crassiscutata* from the late Pleistocene (and now known from a large number of Irvingtonian faunas) and *G. hayi* from the early Pliocene Bone Valley Formation. Among other characters, Auffenberg differentiated these two species by the deeper, more acute xiphiplastral notch of *G. hayi*. Although the Times xiphiplastron more closely resembles *G. crassiscutata* in this character, a specific identification is not warranted without more complete material. *Geochelone (Caudochelys)* also occurs at Santa Fe 1 and the Macasphalt Shell Pit.

FAMILY EMYDIDAE  
*Terrapene cf. T. carolina* (Linnaeus)

REFERRED MATERIAL.--UF 69697, nuchal and fused right 1st peripheral; UF 69698, right 7th peripheral.

Only two carapace fragments from this site can be confidently referred to the box turtle *Terrapene*. The more complete specimen consists of two fused bones indicating an adult animal. The St. Petersburg fossils are from small individuals and compare closely to a partial carapace (UF 95071) from Haile 15A. Robertson (1976) reported *Terrapene carolina* from Haile 15A.

*Pseudemys platymarginata* (Weaver and Robertson)

REFERRED MATERIAL.--UF 69700, left dentary; UF 69701, 2nd neural; UF 69702-69704, 6th or 7th neurals; UF 69705, right 1st peripheral; UF 69707, left 8th or 9th peripheral; UF 69708, five partial pleurals; UF 69709, entoplastron; UF 69710, left xiphiplastron.

The St. Petersburg Times fossils compare closely to the type series of the extinct pond turtle *Chrysemys (=Pseudemys) platymarginata* from Haile 15A (Weaver and Robertson, 1967). According to Weaver and Robertson, *P. platymarginata* can be distinguished by the presence of a well developed median keel on the carapace, a characteristic feature of the neurals from the St. Petersburg sample. The Times fossils are actually somewhat larger and thicker than comparable elements in the holotype and paratype shells of *P. platymarginata*, but nearly identical specimens are present in the extensive topotypic series from Haile 15A. A dentary of *P. platymarginata* from the Times Site is shown in Figures 2B and 2C. Weaver and Robertson (1967) also reported *P. platymarginata* from Santa Fe 1 and Port Charlotte, Charlotte County, Florida. A large sample of this species has recently been recovered from the Macasphalt Shell Pit.

ORDER SQUAMATA  
 SUBORDER SERPENTES  
 FAMILY COLUBRIDAE  
*Nerodia* cf. *N. taxispilota* (Holbrook)

REFERRED MATERIAL.--UF 69676, left dentary; UF 69677-69681, three right and two left compound bones; UF 69682, 104 vertebrae.

These vertebrae resemble those of large individuals of the green water snake, *Nerodia cyclopion*, and the brown water snake, *N. taxispilota*, based on the presence of elongated neural spines that are higher than long. In lateral view the neural spines are nearly symmetrical in *N. cyclopion*, but overhang more posteriorly than anteriorly in *N. taxispilota* (Auffenberg, 1963; Meylan, 1982). Many of the Times vertebrae possess complete neural spines that have a nearly straight anterior edge but overhang posteriorly as in *N. taxispilota*. The mandibular elements from the Times site are also similar to large individuals of *N. taxispilota*. Both Auffenberg (1963) and Meylan (1982) reported this species from the supposedly Blancan Haile 1A fauna. In Florida the brown water snake is most commonly found in rivers, lakes, and permanent ponds.

ORDER CROCODILIA  
 FAMILY ALLIGATORIDAE  
*Alligator* cf. *A. mississippiensis* (Daudin)

REFERRED MATERIAL.--UF 69672, three teeth; UF 69673, first caudal vertebra; UF 69674, osteoderm.

The crocodylian vertebra and teeth from this site are indistinguishable from those of large recent individuals of *Alligator mississippiensis*. Lack of more diagnostic cranial material prevents a positive identification. *Alligator* is common at Haile 15A and Macasphalt.

CLASS AVES

The fossil birds from the St. Petersburg Times Site are being studied by Steven Emslie who has kindly permitted us to include a brief discussion of the avifauna in this paper. Becker (1987) provided a preliminary list of the birds from the St. Petersburg Times Site. Nine species of birds occur in the fauna represented by 17 bones, including a grebe (*Podilymbus*), an ibis (*Eudocimus*), three species of ducks (*Anas*), two species of rails (*Rallus*), a gallinule (*Porphyryula*), and a coot (*Fulica*). The grebe is the most common bird with seven bones from at least two individuals, while the remaining species are represented by a single individual each. All of these species are aquatic birds commonly found in shallow quiet freshwater habitats in Florida. Campbell (1976) reported a small late Blancan avifauna from Haile 15A. Brodkorb (1963) described the gigantic flightless phorusrhacid bird, *Titanis walleri*, from the late Blancan Santa Fe River 1 fauna.

CLASS MAMMALIA  
 ORDER XENARTHRA  
 FAMILY PAMPATHERIIDAE  
*Holmesina floridanus* (Robertson)

REFERRED MATERIAL.--UF 69742, osteoderm from the hind limb.



The presence of a giant armadillo or pampathere in the St. Petersburg Times fauna is indicated by a single osteoderm. Its measurements are: anteroposterior length 25.9, transverse width 30.3, thickness 5.2. This specimen (see Figure 2E) is not a typical carapace scute, but is more similar to osteoderms labeled "upper hind leg" on a partial *Holmesina septentrionalis* shell (UF 9336) from the late Pleistocene (Rancholabrean) Branford 2A fauna, Suwannee County, Florida (see Edmund, 1985, Figure 13, second specimen from left). As noted by Edmund, these osteoderms may represent caudals. One end of UF 69742, presumably the proximal end (after Edmund), has a narrow slightly upraised lip posterior to which is a shallow transverse groove. The remainder of the specimen has the typical *Holmesina* ornamentation consisting of small shallow pits and a weak median keel. The Times pampathere osteoderm most closely resembles several hind limb or caudal scutes of *Holmesina floridanus* from the late Blancan Haile 15A fauna. It has a narrower anterior lip and is much thinner than the most similar Branford specimen. The Times specimen is referred to *H. floridanus* primarily on the basis of its small size and association with other Blancan forms.

The Blancan pampathere from Florida was originally placed in the South American genus *Kraglievichia* by Robertson (1976), but was transferred to the strictly North America genus *Holmesina* by Edmund (1987). *Holmesina floridanus* has been reported from four late Blancan faunas in Florida: Haile 15A (the type locality) and Santa Fe River 1 in the northern part of the state (Robertson, 1976), and Bass Point Waterway 1 in Sarasota County and El Jobean in Charlotte County, both in southwestern Florida (Churcher, 1984). This species also occurs in the Macasphalt Shell Pit fauna.

FAMILY GLYPTODONTIDAE  
*Glyptotherium* cf. *G. arizonae* Gidley

REFERRED MATERIAL.--UF 69743, osteoderm from the posterior border of the carapace.

This glyptodont osteoderm is from the caudal notch along the posterior border of the carapace, within two or three scutes of the midline (very similar to the osteoderm illustrated by Gillette and Ray, 1981, figure 79C, page 170). The Times osteoderm is nearly square in outline (anteroposterior length 45.7, transverse width 42.7, maximum thickness 28.0), has a slightly concave posterior margin, and lacks a boss or conical projection (see Figure 2D). The external surface is gently convex with a uniform punctate sculpture. This specimen lacks the circular and radial grooves outlining the central and peripheral figures found on the interior carapacial scutes. UF 69743 resembles the posterior border scutes along the caudal notch in the small late Blancan species *G. texanum* and the larger late Blancan-Irvingtonian *G. arizonae*, and differs from those of the Rancholabrean species *G. floridanum* by the absence of a conical projection (Gillette and Ray, 1981). The St. Petersburg osteoderm is tentatively referred to *G. arizonae*, since the only other Blancan and early Irvingtonian glyptodonts from Florida were provisionally assigned to that species by Gillette and Ray (1981). The only Blancan glyptodonts previously reported from Florida are from Santa Fe 1 (Gillette and Ray, 1981). They also referred a single scute from the earliest Irvingtonian Inglis 1A site to *G. arizonae*.

FAMILY MEGALONYCHIDAE  
*Megalonyx leptostomus* Cope

REFERRED MATERIAL.--UF 69744, left upper second or third molariform tooth.

An adult upper second or third molariform tooth is referable to the Blancan ground sloth *Megalonyx leptostomus* on the basis of its shape and relatively small size (see Figures 2F and 2G). The tooth has a subtriangular occlusal outline with the base of the triangle being medial and the rounded apex lateral. The anterior surface is slightly convex, the posterior surface is slightly concave. Hirschfeld and Webb (1968) note that although the transverse width of the upper second or third molariform of *M. leptostomus* is

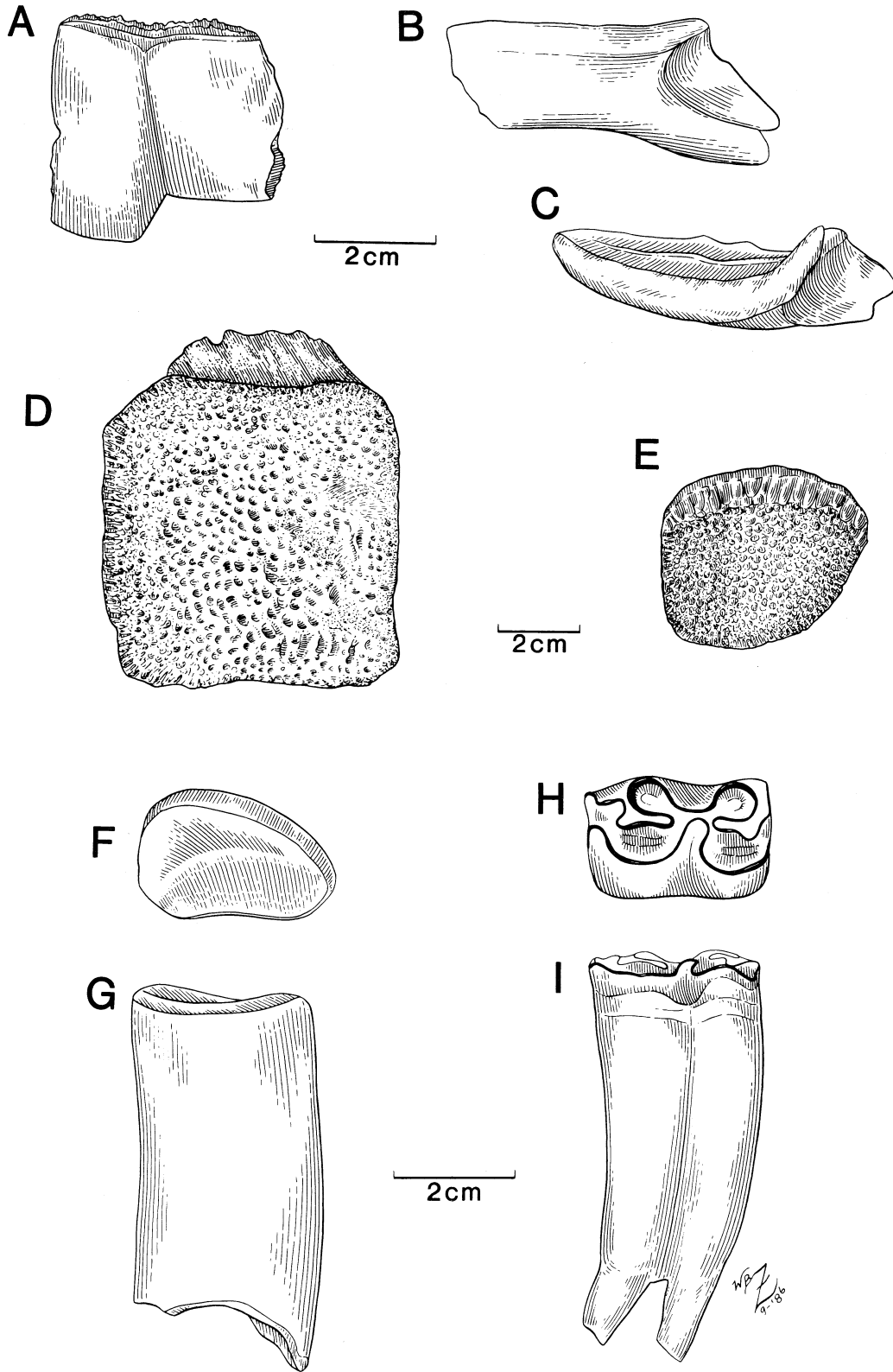


Figure 2. Specimens of fossil vertebrates from the late Blancan St. Petersburg Times Site, Pinellas County, Florida. A. UF 69690, *Macroclmys* cf. *M. temmincki*, left 10th peripheral; B. (lateral view) and C. (dorsal view), UF 69700, *Pseudemys platymarginata*, left dentary; D. UF 69743, *Glyptotherium* cf. *G. arizonae*, carapacial osteoderm from caudal notch; E. UF 69742, *Holmesina floridanus*, osteoderm from hind limb; F. (occlusal view) and G. (anterior view), UF 69744, *Megalonyx leptostomus*, left upper 2nd or 3rd molariform tooth; H. (occlusal view) and I. (lateral view), UF 69747, *Nannippus peninsulae* (= *N. phlegon*), right lower  $M_1$  or  $M_2$ .

comparable to that of the late Pleistocene species *M. jeffersoni*, the anteroposterior dimension is considerably less. Thus, these teeth are more compressed anteroposteriorly in *M. leptostomus*, as is the tooth from St. Petersburg. Measurements of the Times site *Megalonyx* tooth are considerably smaller than those of typical Blancan *M. leptostomus* from Mt. Blanco and Cita Canyon in west Texas (Table 1). Another adult upper second or third molariform (UF 94695) from the Macasphalt Shell Pit fauna is nearly identical to the Times site tooth. Even juvenile teeth of *M. leptostomus* from Cita Canyon are larger than the adult teeth from Florida (Table 1). The late Blancan and early Irvingtonian *Megalonyx* from Florida has been regarded as a small endemic form of *M. leptostomus* by McDonald (1977) and Kurten and Anderson (1980). The teeth from the Times and Macasphalt faunas further confirm the presence of a small *Megalonyx leptostomus*-like form in the Florida Blancan. More detailed comparisons of this material and the extensive sample from the earliest Irvingtonian Inglis 1A site with *M. leptostomus* from western North America may demonstrate that the dwarf *Megalonyx* from the late Pliocene and early Pleistocene of Florida is actually a distinct species.

Table 1. Measurements (in mm) of the 2nd or 3rd upper molariform teeth of *Megalonyx leptostomus* from Florida and Texas.

| FAUNA                               | anteroposterior length | transverse width      |
|-------------------------------------|------------------------|-----------------------|
| St. Petersburg Times<br>(UF 69744)  | 11.4                   | 16.4                  |
| Macasphalt Shell Pit<br>(UF 94695)  | 11.3                   | 15.9                  |
| Inglis 1A <sup>1</sup><br>(N=9)     | x=12.1<br>(11.4-12.9)  | x=16.4<br>(15.2-18.7) |
| Mt. Blanco <sup>2</sup>             | 14.0                   | 25.0                  |
| Cita Canyon (adult) <sup>2</sup>    | 15.0,15.5              | 25.3,24.6             |
| Cita Canyon (juvenile) <sup>2</sup> | 13.0,14.2              | 19.9,19.6             |

<sup>1</sup> Sample size (N), mean (x), and observed range (in parentheses) are included for the Inglis 1A sample.

<sup>2</sup> Measurements from Hirschfeld and Webb (1968).

ORDER LAGOMORPHA  
FAMILY LEPORIDAE  
genus and species indeterminate

REFERRED MATERIAL.--UF 69746, proximal end of left femur.

This specimen is from a small species of leporid and is similar to a juvenile femur from Haile 15A referred to *Sylvilagus* by Robertson (1976). The small sample of *Sylvilagus* from Haile 15A (Robertson, 1976) constitutes the only other published record of Blancan lagomorphs from Florida, although several teeth of *Sylvilagus* have been identified from the Macasphalt Shell Pit.

ORDER CARNIVORA  
 FAMILY PROCYONIDAE  
*cf. Procyon sp.*

REFERRED MATERIAL.--UF 69745, right fourth metacarpal.

This specimen compares well to the fourth metacarpal of the raccoon *Procyon lotor*, but is somewhat longer and more massive. A large extinct raccoon, *Procyon rexroadensis*, is known from the early Blancan Rexroad fauna of Kansas (Hibbard, 1941). A large undescribed species of *Procyon* (listed as *Procyon sp.* in Webb, 1974a) is present in a number of early and middle Irvingtonian faunas from Florida, including Inglis 1A, Haile 16A, and Leisey Shell Pit.

ORDER PROBOSCIDEA  
 FAMILY GOMPHOTHERIIDAE  
 genus and species indeterminate

REFERRED MATERIAL.--UF 69753, upper tusk fragment; UF 69754, occipital condyle; UF 69752, left lunar.

Although no lunars of Blancan gomphotheres have been reported from Florida, the Times specimen is similar to a large series of lunars of the gomphotheriid *Amebelodon* from the late Miocene Love Bone Bed. It is considerably smaller than the comparable element of the mastodon *Mammot*. The occipital condyle is also from a small proboscidean, but is not otherwise identifiable. The upper tusk fragment retains about half of the total circumference and there is no enamel band. It is possible, however, that the enamel band characteristic of the upper tusk of gomphotheres was present on the missing portion. Blancan gomphotheres have been reported from Santa Fe River 1 (Webb, 1974a), Haile 15A (Robertson, 1976), and El Jobean (Churcher, 1984). In addition, *Cuvieronius* has been collected from the Blancan Acline Shell Pit fauna in Charlotte County and *Rhynchotherium* is known from the Macasphalt Shell Pit.

ORDER PERISSODACTYLA  
 FAMILY EQUIDAE  
*Nannippus peninsulatus* (Cope)

REFERRED MATERIAL.--UF 69747, right lower  $M_1$  or  $M_2$ ; UF 69748, partial proximal phalanx.

A well preserved lower molar from the St. Petersburg Times Site is identical in size and morphology to the  $M_1$  or  $M_2$  of the small three-toed horse *Nannippus peninsulatus* (= *N. phlegon*). MacFadden (1984) resurrected *N. peninsulatus* as the oldest available name for the typical Blancan *Nannippus* more commonly known as *N. phlegon*. Similar teeth from a number of Blancan sites in Florida were described by MacFadden and Waldrop (1980, see their Figure 1, page 5 for dental terminology). In occlusal view (Figure 2H), the external borders of the protoconids and hypoconids are rounded, the ectoflexid is deep and partially divides the isthmus, the metaconid and metastylid are rounded and widely separated, the protostylid is absent, the enamel is very simple with few plications, and the cement is thick especially laterally. In lateral view (Figure 2I), the tooth is moderately curved anteroposteriorly. Measurements of the Times tooth are: anteroposterior length 15.9, transverse width at protoconid and metaconid 10.3 (including cement), 8.2 (not including cement), metaconid crown height 28.1. These measurements are well within the observed range of length and width of the  $M_1$  and  $M_2$  of *N. peninsulatus* from other Florida Blancan sites (MacFadden and Waldrop, 1980, Table 3, Page 13). A partial distal end of a first phalanx is very similar to a specimen of *N. peninsulatus* from Santa Fe 1 (MacFadden and Waldrop, 1980, Figures 13A and 13B), and is considerably smaller than the same element in *Equus*.

MacFadden and Waldrop (1980) reported *Nannippus phlegon* (= *N. peninsulatus*) from a number of Blancan faunas in Florida, including Haile 15A, four sites along the Santa Fe River, Port Charlotte, and three sites in the vicinity of Sarasota. Churcher (1984) listed this species from Bass Point Waterway 1 and El Jobean, and it has recently been identified from the Macasphalt Shell Pit.

*Equus* sp.

REFERRED MATERIAL.--UF 95068, fragment of left lower deciduous premolar; UF 69749, right fourth metacarpal; UF 69750, distal sesamoid.

The partial lower tooth compares favorably in size with *Equus*, but is too fragmentary for further identification. The two postcranial elements are useful for establishing the presence of *Equus* at the St. Petersburg Times Site. The fourth metacarpal is much larger than the comparable element of *N. peninsulatus* (MacFadden and Waldrop, 1980, Figure 10A,B,C). It tapers almost to a point distally reflecting the non-functional nature of this side toe, a feature shared by all monodactyl horses of the genus *Equus*. The Times specimen is quite similar to the fourth metacarpal of a Blancan *Equus* from Haile 15A. The distal sesamoid is also large in size, comparing favorably with a distal sesamoid of *Equus* from Haile 15A. *Equus (Dolichohippus) simplicidens* has been reported from three Florida late Blancan faunas, Santa Fe River 1 (Webb, 1974a), Haile 15A (Robertson, 1976), and Bass Point Waterway 1 (Churcher, 1984). Advanced *Equus* is known from Haile 15A (Robertson, 1976) and Macasphalt Shell Pit.

ORDER ARTIODACTYLA  
FAMILY CERVIDAE  
cf. *Odocoileus* sp.

REFERRED MATERIAL.--UF 69751, proximal phalanx.

This toe bone closely resembles proximal phalanges of the deer *Odocoileus virginianus*. *Odocoileus* has been reported from the Santa Fe River 1 (Webb, 1974a) and Haile 15A (Robertson, 1976) Blancan faunas.

PALEOECOLOGY

The most abundant vertebrates in the St. Petersburg Times fauna are freshwater inhabitants. Excluding mammals, there are only two non-aquatic species, the land tortoise *Geochelone* and the box turtle *Terrapene*. Although all nine species of mammals are terrestrial, they are rare in this deposit with most taxa being represented by only one or two bones. The most common vertebrates in the Times fauna are the water snake *Nerodia taxispilota*, the siren *Siren* cf. *S. lacertina*, the alligator snapping turtle *Macrolemys* cf. *M. temmincki*, the pond turtle *Pseudemys platymarginata*, and the grebe *Podilymbus*. All of these forms prefer quiet freshwater habitats such as lakes, ponds, marshes, swamps, and slow-moving rivers and streams. There are no marine or estuarine vertebrates in the fauna and many of the more common species are obligate freshwater forms that will not tolerate brackish water. A single shell of the freshwater gastropod *Viviparus georgianus* was recovered from the same unit as the vertebrate fauna. This species also occurs exclusively in quiet freshwater habitats.

A quiet water setting for the St. Petersburg Times Site is also supported by the depositional environment. The sediment in which the fossils were preserved is black and highly organic, with a small percentage of extremely fine quartz sand. The bones and teeth from the site are stained a shiny black color. The enamel in several of the teeth has been replaced with a metallic greenish mineral resembling iron pyrite. When washed the bones gave off a pungent "rotten egg" odor, presumably derived from a reaction

with iron sulfide. The highly organic sediments and the nature of the bone preservation both indicate a quiet water depositional setting, probably in a reducing or anoxic environment such as might be found in a pond, swamp, or marsh.

Although the St. Petersburg Times Site is located less than five km from Tampa Bay to the east and 10 km from the Gulf of Mexico to the west, and is situated near present sea level, the vertebrate fauna lacks marine forms. This suggests that the site was probably deposited during a period of somewhat lowered sea level. It cannot be determined from available evidence whether deposition occurred during a major glacial interval or when sea level was only slightly lower than present.

### AGE AND CORRELATION

Despite the rarity of mammals in the St. Petersburg Times fauna, several diagnostic species securely place it within the framework of the North American Land Mammal biochronology (e.g. Savage and Russell, 1983). Four of the mammals identified from this site, *Holmesina floridanus*, *Glyptotherium* cf. *G. arizonae*, *Megalonyx leptostomus*, and *Nannippus peninsulatus* (= *N. phlegon*) are diagnostic of the Blancan Land Mammal Age (early to late Pliocene, approximately 4.5 to 1.8 Ma) in Florida and elsewhere in North America. Furthermore, the association of several of these taxa, particularly *Nannippus* and *Glyptotherium*, allows a more exact placement within the Blancan. The large thick-shelled pond turtle, *Pseudemys platymarginata*, also appears to be restricted to the Blancan (Weaver and Robertson, 1967).

*Nannippus peninsulatus* (= *N. phlegon*) is the latest surviving hipparionine horse known in North America, and is one of the most characteristic mammals of Blancan faunas from the southern half of the United States. *Nannippus peninsulatus* is relatively common and widespread in Florida (MacFadden and Waldrop, 1980). The last occurrence of this species was in the latest Pliocene approximately 2 million years ago, based on radiometrically and paleomagnetically dated strata from the southwestern United States (Lindsay et al., 1984). *Glyptotherium* is perhaps the most significant biostratigraphic indicator in the Times fauna, as glyptodonts are unknown in North America prior to the late Blancan. Along with capybaras (*Neochoerus*) and mylodont ground sloths (*Glossotherium*), *Glyptotherium* was one of the earliest South American mammals to reach North America during the Great American Faunal Interchange (Webb, 1976, 1985; Marshall et al., 1979). According to Tedford (1981) and Galusha et al. (1984), the co-occurrence of *Nannippus* and the first South American immigrants, including *Glyptotherium*, represents a restricted interval of geologic time in the late Pliocene between about 2.5 and 2.0 Ma. The four best known Blancan faunas from Florida, including Santa Fe River 1, Haile 15A, St. Petersburg Times, and Macasphalt Shell Pit, all record the association of *Nannippus* with Neotropical immigrants, and are thus late Blancan in age (younger than 2.5 Ma) on the basis of biostratigraphic correlation with well-dated western faunas. Late Blancan faunas outside of Florida that compare closely in age to the St. Petersburg Times Site are 111 Ranch (Galusha et al., 1984) and San Pedro Valley (including the Wolf Ranch fauna, Harrison, 1978 and the Cal Tech Site, Johnson et al., 1975) in Arizona and Cita Canyon and Mt. Blanco in west Texas (Lindsay et al., 1975).

A semi-indurated marine shell bed/coral reef complex containing an invertebrate fauna typical of the Pinecrest Beds (e.g. Olsson and Petit, 1964; Stanley, 1986) directly underlies the vertebrate-bearing unit at the St. Petersburg Times Site. The presence of late Blancan vertebrates at this locality in a unit overlying the Pinecrest Beds indicates that at least a portion of, if not all, the Pinecrest is older than two million years.

### MACASPHALT SHELL PIT FAUNA

One of the most significant, but previously unpublished, Blancan vertebrate faunas in Florida has been collected from the Macasphalt Shell Pit, a commercial shell mine located 8 km east of Sarasota, Sarasota

County, E 1/2 sec.12, T36S, R18E, Bee Ridge 7.5 minute quadrangle (27°22'N, 82°27'W). This mine was originally called the Warren Brothers Pit (e.g. Weisbord, 1972). Blancan vertebrates were first collected from this locality in 1971 by H. K. Brooks and geology students from the University of Florida, and have been accumulated steadily since that time by field parties from the Florida State Museum, J. S. Waldrop, F. A. Garcia, and others. Petuch (1982) and Stanley (1986) have recently discussed the rich marine molluscan fauna from the Pinecrest Beds at the Macasphalt Shell Pit. Petuch referred to the locality as the Newburn Pit of the Macasphalt Company, while Stanley called it the Macasphalt, Inc. Pit. In January 1986 the name of the corporation was changed from Macasphalt, Inc. to APAC. The vertebrate fauna from this site is here designated the Macasphalt Shell Pit Local Fauna since the two most current papers on the molluscs use this locality name.

The Blancan vertebrates from the Macasphalt Shell Pit are derived from a dark brown to blackish sandy organic layer ranging from 10 to 60 cm in thickness (Unit 4 or "black layer" of Petuch, 1982, page 14). The vertebrate-bearing unit and the nearshore marine shell beds which occur below and above it (Petuch's Units 1-9) are all referred to the Pinecrest Beds (Petuch, 1982; Stanley, 1986) or the Pinecrest Sand Member of the Tamiami Formation of some authors (Hunter, 1968; DuBar, 1974). Petuch (1982, figure 2) presented a stratigraphic section for the Macasphalt pit that closely matches the stratigraphy where the majority of the Blancan vertebrates have been collected in place, particularly the upper 10 m of the section comprising Petuch's Units 1-6. The molluscan fauna from the vertebrate-bearing Unit 4 contains a mixture of marine, estuarine, freshwater and terrestrial species. Petuch (1982) regarded this fauna as a quiet, shallow-water, estuarine assemblage, with the abundant freshwater gastropods reflecting the presence of a river in the near vicinity. Most of the bones, shells, and matrix from this organic unit are stained dark brown or black, probably the result of an organic reducing environment such as that which characterizes brackish water habitats at the mouths of freshwater rivers.

The Macasphalt Shell Pit vertebrate fauna will undoubtedly exceed 100 species upon thorough analysis. Aquatic forms predominate in the fauna, including a rich sample of freshwater and estuarine fish, salamanders (*Siren*), ranid frogs, *Alligator*, water snakes (*Nerodia*), and turtles (particularly *Pseudemys platymarginata*). A diverse assemblage of aquatic birds is also present (currently under study by S. D. Emslie). Twenty-three taxa of land mammals have been identified from Macasphalt, at least 12 of which are characteristic of the Blancan (Table 2). All but three of these taxa are shared with either the Haile 15A or Santa Fe River 1 Blancan faunas, and five occur at all three localities. Four of the five Blancan mammals from the St. Petersburg Times Site have also been recorded from Macasphalt. The most biochronologically significant mammals in the Macasphalt fauna are *Nannippus peninsulatus* and the South American immigrants *Holmesina floridanus*, *Dasyus bellus*, *Glossotherium chapadmalense*, and *Neochoerus dichroplax*. Other typically Blancan forms include *Megalonyx leptostomus*, *Sigmodon medius*, *Trigonictis macrodon*, *Hemiauchenia blancoensis*, and *Rhynchotherium* sp. This fauna has also produced a new species of the hipparionine horse *Cormohipparion* (Hulbert, in press), a genus previously unknown after the Hemphillian, and the earliest record of the free-tailed bat *Tadarida*, a genus formerly thought to have emigrated from South America in the Rancholabrean (Kurten and Anderson, 1980). The Macasphalt Shell Pit vertebrates are late Blancan in age representing the interval between about 2.5 and 2.0 Ma, after the formation of the Panamanian landbridge and the beginning of the Great American Interchange, but before the extinction of *Nannippus*.

Invertebrate paleontologists disagree on the age of the Pinecrest Beds, with published ages for this unit ranging from late Miocene (Olsson and Petit, 1964; Hunter, 1968) to early Pliocene (Stanley, 1986) to middle or late Pliocene (DuBar, 1974). Stanley (1986) considered the entire section of Pinecrest Beds at the Macasphalt pit to be early Pliocene in age, whereas Petuch (1982) suggested that these beds may span most of the Pliocene. Bender (1973) obtained a helium-uranium date of 3.7 Ma on a sample of coral from the Macasphalt pit. The calcareous nannoplankton from this locality are indicative of planktonic zone N20, suggesting a middle Pliocene (Blancan) age (Akers, 1974). Unfortunately, neither Bender nor Akers discussed the stratigraphic provenience of their samples, and thus the samples could have come from anywhere in the 20 m thick section of shell beds exposed in the Macasphalt pit. Unless the vertebrate fauna represents a striking example of faunal heterochrony (i.e. vertebrate faunas referable to the same Land Mammal Age that are not precisely time equivalent, Flynn et al., 1984), the occurrence of late Blancan

vertebrates establishes a late Pliocene age (younger than 2.5 Ma) for at least the four uppermost units at Macasphalt.

## REVIEW OF OTHER FLORIDA BLANCAN FAUNAS

Table 2 lists the diagnostic mammals from the four best known Florida Blancan faunas. The location of these sites is plotted on Figure 1. Two of these faunas have been described previously, Haile 15A and Santa Fe River 1 (Webb, 1974a; Robertson, 1976; Kurten and Anderson, 1980) and two are first recorded in this paper, St. Petersburg Times and Macasphalt Shell Pit. The first two of these faunas and several other smaller samples are briefly reviewed in this section.

The Haile 15A vertebrate fauna was collected from a fissure filling in the marine Eocene Crystal River Formation. Haile 15A contains a mixture of estuarine, freshwater, and terrestrial vertebrates which led Robertson (1976) to propose that it was deposited during a period of high sea level, as the site is about 30 m above sea level and 80 km inland from the Gulf of Mexico. Opdyke et al. (1984) provide data suggesting that the limestone karst region of northern Florida may have been subject to isostatic uplift during the Plio-Pleistocene. Thus, although this site was deposited in close proximity to the Gulf of Mexico in the late Pliocene, the relative position of sea level at that time remains conjectural. The Haile 15A mammalian fauna consists of 20 taxa, 12 of which are characteristic of the Blancan (Robertson, 1976). The association of *Nannippus peninsulatus* with the South American immigrants *Glossotherium chapadmalense*, *Holmesina floridanus*, and *Dasyurus bellus* is indicative of a late Blancan fauna (younger than 2.5 Ma). Additional papers on vertebrates from Haile 15A include Weaver and Robertson (1967) on *Pseudemys platymarginata*, Kinsey (1974) on *Mylohyus floridanus*, Webb (1974b) on *Hemiauchenia macrocephala*, Martin (1979) on *Sigmodon medius*, and Edmund (1987) on *Holmesina floridanus*.

The Santa Fe sites are river bottom deposits collected along a 10 km stretch of the Santa Fe River, which forms the border between Columbia County to the north and Gilchrist County to the south. The best known and richest Blancan sample is from the Santa Fe River 1 locality, including sites 1A and 1B. Santa Fe River 1 was discovered by Ben Waller and consists of a bend in the river about 0.2 km in length. The Santa Fe 1 and 1A river bottom deposits produce a mixture of Eocene, Pliocene, and Pleistocene vertebrates, which are presumably derived from distinct stratigraphic units exposed in the bottom and banks of the river. Santa Fe 1B is an in-place deposit of strictly Blancan vertebrates located on the river bank adjacent to the Santa Fe 1A river bottom site (Webb, 1974a). The mammalian fauna from Santa Fe River 1B listed by Webb (1974a, Table 2.1) is actually a composite faunal list of all Blancan mammals recorded from Santa Fe River 1. The Santa Fe River 1 Pliocene vertebrates, including those from 1A and 1B, are almost certainly derived from the same deposit and constitute a single uniform fauna of late Blancan age. All taxa that are not clearly of Blancan age have been deleted from the Santa Fe River 1 faunal list (Table 2). Nevertheless, the Santa Fe 1 fauna has the most diverse sample of Blancan mammals from Florida. The association of *Nannippus* with the edentates *Glossotherium*, *Glyptotherium*, *Holmesina*, and *Dasyurus* is indicative of a post-interchange late Blancan fauna. Additional papers on Blancan vertebrates from Santa Fe River 1 include, Weaver and Robertson (1967) on *Pseudemys platymarginata*, Brodkorb (1963) on *Titanis walleri*, Kurten (1965), Churcher (1984), and Berta (1987) on *Smilodon gracilis*, Martin (1969) on *Castoroides*, and Gillette and Ray (1981) on *Glyptotherium*.

Blancan mammals have been reported from three additional Santa Fe River sites. MacFadden and Waldrop (1980) recorded *Nannippus phlegon* (= *N. peninsulatus*) from Santa Fe River 4A, a fauna that also includes *Equus (Dolichohippus) simplicidens*, *Capromeryx arizonensis*, and *Platygonus bicalcaratus*. In their review of eastern North American records of the Blancan mustelid *Trigonictis*, Ray et al. (1981) described and figured specimens of *T. macrodon* from Santa Fe River 8A. Berta (1981) reported and figured a maxilla of the rare hyaenid *Chasmaporthetes ossifragus* from Santa Fe River 15A.

Several other Florida Blancan sites (see Figure 1) have been mentioned in taxonomic studies of selected mammalian taxa. MacFadden and Waldrop (1980) discussed specimens of *Nannippus phlegon* (= *N.*



Table 2. Land mammals from the four best known Florida late Blancan vertebrate faunas. <sup>1</sup>

| Species  | Haile<br>15A | Santa Fe<br>River 1 | Macasphalt<br>Shell Pit | St. Petersburg<br>Times |
|--|--------------|---------------------|-------------------------|-------------------------|
| <b>CHIROPTERA</b>  |              |                     |                         |                         |
| <i>Tadarida</i> sp.  |              |                     | X                       |                         |
| <b>XENARTHRA</b>   |              |                     |                         |                         |
| <i>Glyptotherium</i> cf. <i>G. arizonae</i>                  |              | X                   |                         | X                       |
| <i>Holmesina floridanus</i>                                  | X            | X                   | X                       | X                       |
| <i>Dasypus bellus</i>  | X            | X                   | X                       |                         |
| <i>Glossotherium chapadmalense</i>                           | X            | X                   | X                       |                         |
| <i>Megalonyx leptostomus</i>                                 |              | X                   | X                       | X                       |
| <b>LAGOMORPHA</b>  |              |                     |                         |                         |
| <i>Sylvilagus</i> sp.  | X            |                     | X                       | ?                       |
| <b>RODENTIA</b>  |              |                     |                         |                         |
| <i>Cryptopterus webbi</i>                                    | X            |                     |                         |                         |
| <i>Castoroides</i> sp.                                       |              | X                   |                         |                         |
| <i>Geomys</i> cf. <i>G. propinectis</i>                      | X            |                     | X                       |                         |
| <i>Neochoeus dichroplax</i>                                  |              |                     | X                       |                         |
| <i>Sigmodon medius</i>                                       | X            |                     | X                       |                         |
| <b>CARNIVORA</b>   |              |                     |                         |                         |
| <i>Canis</i> cf. <i>C. lepophagus</i>                        |              | X                   | ?                       |                         |
| <i>Borophagus diversidens</i>                                |              | X                   |                         |                         |
| <i>Trigonictis macrodon</i>                                  |              |                     | X                       |                         |
| <i>Satherium</i> sp.   | X            |                     |                         |                         |
| <i>Procyon</i> sp.   |              | X                   | X                       | X                       |
| <i>Arctodus</i> cf. <i>A. pristinus</i>                      |              | X                   |                         |                         |
| <i>Smilodon gracilis</i>                                     | X            | X                   |                         |                         |
| <i>Homotherium</i> sp.                                       |              | X                   |                         |                         |
| <i>Chasmaporthetes ossifragus</i>                            |              | X                   |                         |                         |
| <b>PROBOSCIDEA</b>   |              |                     |                         |                         |
| <i>Rhynchotherium</i> sp.                                    |              | X                   | X                       |                         |
| <b>PERISSODACTYLA</b>  |              |                     |                         |                         |
| <i>Nannippus peninsulatus</i><br>(= <i>N. phlegon</i> )      | X            | X                   | X                       | X                       |
| <i>Cormohipparion</i> new sp. <sup>2</sup>                   | X            |                     | X                       |                         |
| <i>Equus</i> ( <i>Dolichohippus</i> )<br><i>simplicidens</i> | X            | X                   |                         |                         |
| advanced <i>Equus</i> sp. <sup>3</sup>                       | X            | ?                   | X                       |                         |
| <b>ARTIODACTYLA</b>  |              |                     |                         |                         |
| <i>Platygonus bicalcaratus</i>                               |              | X                   | X                       |                         |
| <i>Mylohyus floridanus</i>                                   | X            | X                   | X                       |                         |
| <i>Hemiauchenia blancoensis</i>                              |              | X                   | X                       |                         |
| <i>Hemiauchenia</i> cf.<br><i>H. macrocephala</i>            | X            |                     |                         |                         |
| <i>Capromeryx arizonensis</i>                                |              | X                   |                         |                         |

<sup>1</sup> This list does not include all taxa of mammals known from these four localities, only those that are either diagnostic of the Blancan or have their first or last appearance in the Blancan of Florida.

<sup>2</sup> This new species of *Cormohipparion* is currently being described by Hulbert (in press).

<sup>3</sup> These occurrences may not represent the same species of *Equus*, but all are referable to an advanced subgenus of *Equus*: either *E. (Asinus)* or *E. (Hemionus)*.

*peninsulatus*) from Port Charlotte in Charlotte County and from several localities in the vicinity of Sarasota in Sarasota County. Ahearn and Lance (1980) described the earliest North American species of capybara, *Neochoerus dichroplax*, from the Blancan of Arizona and Florida, including Florida specimens from Sommers Pit in Sarasota County and Mule Pen Quarry in Collier County. In his discussion of the small sabrecat *Ischyrosmilus* (= *Smilodon*, see Berta, 1985; 1987) *gracilis*, Churcher (1984) figured and described specimens in the Brayfield Collection from two late Blancan localities in southwestern Florida, Bass Point Waterway 1 in Sarasota County and El Jobean Pit in Charlotte County. Churcher (1984, after Edmund, pers. comm.) listed several other Blancan mammals from Bass Point Waterway 1, including *Holmesina floridanus*, *Nannippus phlegon*, and *Equus (Dolichohippus)*. The first two of these species are also present at the El Jobean Pit.

A few additional specimens of Blancan mammals from previously unpublished localities in Florida are deserving of note. The most complete specimen of the borophagine canid *Borophagus diversidens* known from Florida, a partial left maxilla with P<sup>4</sup> and the roots of M<sup>1</sup> (UF 50759), was collected in Northport, Sarasota County. This specimen compares closely to an isolated P<sup>4</sup> (UF 10701) of *Borophagus* from Santa Fe River 1. The Acline Shell Pit, located near Acline in Charlotte County, has produced several Blancan mammals from marine shell beds referred to the Pinecrest Beds by Olsson and Petit (1964). These fossils include an isolated upper tusk (UF/FGS 6074), a pair of associated upper tusks (UF/FGS 9911), and an M<sub>3</sub> (UF/FGS 9912) of the gomphotheriid proboscidean *Cuvieronius* and a claw of the mylodontid sloth *Glossotherium* cf. *G. chapadmalense* (UF/FGS 6075).

#### AGE AND CORRELATION OF FLORIDA BLANCAN FAUNAS

For several reasons the precise dating of Florida Cenozoic vertebrate faunas has not yet been possible. Florida has little topographic relief and is heavily vegetated and thus lacks the extensive well exposed stratigraphic sections found in the more arid regions of the western United States. The absence of igneous and metamorphic rocks at the surface precludes the use of most radiometric dating techniques. Bender (1973) obtained helium-uranium dates from corals in an attempt to develop an absolute chronology for Florida marine deposits, but the technique has not been widely applied recently. Uranium-thorium dating of corals (e.g. Szabo, 1985) and amino acid racemization of molluscs (e.g. Mitterer, 1975) have also been used to determine absolute ages for Florida marine strata, however, neither method is reliable for sediments older than about one million years. Strontium isotope stratigraphy may prove to be a valuable tool for correlating Florida Cenozoic marine faunas. At the present time, biostratigraphic correlation with well-dated faunas from western North America still offers the most satisfactory approach to constructing a biochronology of Florida vertebrate faunas.

According to Johnson et al. (1975:5), "The correlation of continental and marine strata is difficult because these mutually exclusive environments of deposition preclude the frequent interdigitation of diagnostic faunas and floras." In recent years, however, a significant number of Late Cenozoic vertebrate faunas have been discovered in Florida which permit correlation of terrestrial mammalian faunas with the marine record (e.g. Tedford and Hunter, 1984). Hulbert and Morgan (in press) reviewed the extensive Irvingtonian vertebrate fauna from the Leisey Shell Pit that was collected from marine shell beds of the Bermont Formation. In this paper we briefly discuss the late Blancan Macaspalt Shell Pit vertebrate fauna that occurs within the marine Pinecrest Beds. Ongoing studies at the Macaspalt Shell Pit should eventually allow correlation between biochronologies based on terrestrial mammals, marine molluscs, and several groups of marine microfossils, including planktonic foraminifera, calcareous nannoplankton, and ostracodes.

Several genera of mammals appear to have their youngest or oldest occurrence in the Blancan of Florida. According to Hulbert (in press), *Cornomhipparion* disappears in the late Miocene elsewhere in North America, but is present in two late Blancan faunas from Florida. Lindsay et al. (1984) place the extinction of *Nannippus* at 2.2 Ma and the first occurrence of *Smilodon* at 2.0 Ma, based on radiometrically and paleomagnetically dated strata from the western United States. However, these two genera occur

together in four Florida late Blancan faunas, suggesting that either *Nannippus* survived slightly later than 2.2 Ma or *Smilodon* appeared somewhat earlier than 2.0 Ma. The only Blancan records of *Tadarida*, *Holmesina*, and *Dasybus*, are from Florida. These three genera are otherwise known only from Irvingtonian and younger faunas in North America.

The first South American vertebrates to enter North America in the late Pliocene as participants in the Great American Faunal Interchange (Webb, 1976, 1985; Marshall et al., 1979) include six genera of mammals: the edentates *Glyptotherium*, *Holmesina*, *Dasybus*, and *Glossotherium* and the hystricognath rodents *Erethizon* and *Nechoerus*, along with the large flightless bird *Titanis*. Among these genera, only the porcupine *Erethizon* is unknown from the Blancan of Florida. The earliest Florida record of *Erethizon* is *E. kleini* from the early Irvingtonian Inglis 1A fauna (Frazier, 1981). South American immigrants appear almost simultaneously in faunas of late Blancan age in Arizona, New Mexico, Texas, and Florida. The late Blancan faunas from the 111 Ranch and San Pedro Valley sequences in Arizona contain the earliest well-dated occurrences of Neotropical mammals (*Glyptotherium*, *Glossotherium*, *Nechoerus*, and *Erethizon*) at about the time of the Gauss-Matuyama polarity transition approximately 2.5 Ma (Johnson et al., 1975; Galusha et al., 1984). According to Tedford (1981) and Galusha et al. (1984), the co-occurrence of *Nannippus* and South American interchange taxa in Blancan faunas from the southwestern United States defines a restricted interval of time in the late Pliocene between approximately 2.5 and 2.0 Ma.

The four best known Blancan faunas from Florida (Table 2) record the association of *Nannippus* and at least one of the South American immigrants present in late Blancan faunas from the southwest, including *Glyptotherium*, *Glossotherium*, and *Nechoerus*. Based on their occurrence in Florida with other well known Blancan taxa, *Holmesina*, *Dasybus*, *Tadarida*, and *Titanis* were almost certainly early members of the interchange fauna as well. The absence of these four genera from Blancan faunas outside of Florida limits their usefulness in correlation. It is possible that South American immigrants reached Florida earlier than their first well documented appearance in southern Arizona around 2.5 Ma. However, considering the rare occurrence of faunal heterochrony in North American Late Cenozoic terrestrial sequences (Flynn et al., 1984), it is more likely that the Florida faunas are equivalent in age to late Blancan faunas in Arizona and Texas and are between 2.5 and 2.0 Ma in age (=Blancan V of Repenning, 1980).

Repenning (1980) documented an influx of microtine rodents into North America from the Old World in the late Pliocene at about the same time as South American immigrants first appear. Both of these immigration events have been correlated with the low sea level stand accompanying the first major continental glaciation in the Northern Hemisphere, which began around 3.2 Ma and reached a maximum about 2.5 Ma (Shackleton and Opdyke, 1977; Shackleton et al., 1984). The combined effect of the tectonic uplift of southern Central America and a eustatic sea level drop probably led to the final formation of the Panamanian landbridge about 3.0 Ma (for a recent review on the timing of closure of the Panamanian isthmus see Jones and Hasson, 1985). The Great American Faunal Interchange began shortly thereafter.

After the late Blancan the number of South American immigrants entering North America declined rapidly with the last new arrivals appearing in the late Irvingtonian (Webb, 1976). Two previously unrecognized members of the South American interchange fauna have recently been discovered in the early Pleistocene of Florida, the vampire bat *Desmodus* and an as yet unnamed genus of dwarf glyptodont. *Desmodus* occurs in the early Irvingtonian Inglis 1A fauna and the middle Irvingtonian Haile 16A and Haile 21A faunas (Morgan, et al., in press), whereas the dwarf glyptodont is present in at least seven middle Irvingtonian sites (currently under study by K. Downing). Perhaps the Gulf Coast savanna corridor (Webb, 1974a, 1977), coupled with a subtropical climate, made it possible for such a diverse suite of South American vertebrates to reach Florida and flourish there during the late Pliocene and early Pleistocene. RanchoLabrean faunas document a continuation of this strong Neotropical influence in Florida throughout the remainder of the Pleistocene (Webb and Wilkins, 1984).

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