Vertebrate Evidence of a Low Sea Level in the Middle Pliocene

Abstract. *Marine and untransported terrestrial vertebrates of Middle Pliocene (Hemphillian) age occur together in well-sorted, sandy, phosphatic gravels at an elevation of 1.8 to 3 meters in Manatee County, Florida. If no crustal warping of the Late Cenozoic age has occurred in this part of Florida (as investigators generally agree), the sea must have approached its present level 4 to 7 million years ago.*

Certain vertebrate fossils of Pliocene age provide evidence of a low sea level. They were collected in well-sorted, sandy, phosphatic gravels (0.6 to 1.2 m thick) exposed by excavation of the Manatee County Dam on the Manatee River 17.7 km east of Bradenton, Florida (*1*). The deposit constitutes a slight westward extension of the Bone Valley Formation. The elevation of the bed containing the vertebrates at this site ranges from 1.8 to 3 m above present sea level. The conglomerate produces both marine and terrestrial vertebrates (Table 1). Several species indicate a Middle Pliocene (Hemphillian) age (*2*) for these beds, and none contradict this.

A number of streams in south Florida contain land vertebrates of Pliocene age at low elevations, but it is generally thought that the vertebrates were carried downstream from the rich source in the Bone Valley phosphate mining district at elevations of 30.5 m or more. This interpretation is correct in the many instances in which waterworn Pliocene fossils occur alongside well-preserved Pleistocene specimens. That this explanation does not apply to the Manatee County damsite, however, is shown by the evidence that all determinable fossils are of the same (Middle Pliocene) age and that a number of land vertebrates, including a mastodont skull with tusks and teeth (*Rhynchotherium*) and certain fragile milk teeth of horses, could not have been transported more than a few meters.

This deposit accumulated just above sea level. The vertebrates evidently were derived from two principal habitats, a shallow estuary and a well-watered savanna. The most abundant aquatic vertebrate, the shark *Carcharhinus leucas*, occurs today in Florida near shore or ranging inland in brackish or even fresh waters and is also found as a landlocked subspecies in Lake Nicaragua (*3*). Most of the aquatic vertebrates are marine species found near the shore. The cormorant *Phalacrocorax* cf. *wetmorei* is an inshore bird, seldom ranging out of sight of land (*4*). The land vertebrates include numerous grazing types, particularly llamas, several genera of hypsodont horses, and tortoises. There is also a considerable group of amphibious and freshwater aquatic animals, including alligators, turtles of the genus *Pseudemys*, the amphibious rhinoceros *Teleoceras*, tapirs, and the mastodont *Rhynchotherium* (*5*). These terrestrial, amphibious, and aquatic animals evidently occupied adjacent habitats and were deposited in a common situation with little transport, that is, at the mouth of a stream very near the sea.

Table 1. Vertebrate fauna of the Manatee County damsite.

Elasmobranchii

Selachii
- Odontaspidae: *Odontaspis cuspidata* and *O. macrota*
- Isuridae: *Isurus hastalis* and *Carcharodon megalodon*
- Carcharinidae: *Carcharhinus leucas, Negaprion brevirostris, Hemipristis serra, Galeocerdo aduncus, G. contortis,* and *Rhizoprionodon* cf. *terrae-novae.*

Rajiformes
- Myliobatidae: *Aetobatus* sp. and *Myliobatus* sp.
- Pristidae: *Pristis* sp.

Osteichthyes

Tetradontiformes
- Diodontidae: *Diodon* sp.

Perciformes
- Sciaenidae

Reptilia

Chelonia
- Testudinidae: *Chrysemys inflata* and *Geochelone* cf. *turgida*
- Cheloniidae
- Trionychidae

Crocodilia
- Crocodylidae: cf. *Charactosuchus*
- Alligatoridae: *Alligator* sp.

Aves

Pelicaniformes
- Phalacrocoracidae: *Phalacrocorax* cf. *wetmorei*

Mammalia

Carnivora
- Canidae

Proboscidea
- Gomphotheriidae: *Rhynchotherium* cf. *euhypodon*

Perrisodactyla
- Rhinocerotidae: *Teleoceras* sp.
- Tapiridae: *Tapiravus* cf. *polkensis*
- Equidae: *Griphippus* sp., *Neohipparion* sp. (*eurystyle* group), *Nannippus minor,* and *Hipparion ingenuum*

Artiodactyla
- Camelidae: cf. *Tanupolama*

The crucial question regarding this evidence for low sea level in the Middle Pliocene age is whether there has been subsequent crustal warping in southern peninsular Florida. Detailed studies of Late Cenozoic shorelines in Florida strongly suggest that this area has remained quite stable since the late Miocene (*6–9*).

Unfortunately, there is still doubt concerning the ages of these shorelines; current opinions on the age of the oldest, clearly recognizable shoreline (Okefenokee) range from Late Miocene (*7*) to preglacial (*8*) to Yarmouthian (*9*). Although Cooke (*10*) suggests some post-Pliocene downwarping of the Gulf Coast from Tampa Bay north, there is strong evidence that such warping, if it occurred, did not extend farther south. Contours on the limestone member of the Miocene Hawthorne Formation (*11*) and on the Eocene Ocala Limestone (*12*) indicate that only minor deviations from a gentle southwestward dip have occurred in this area during most of the Cenozoic age. No examples of faulting or limestone collapse have been observed in the area. Thus, the Manatee County site lies very close to the same elevation now as in the Middle Pliocene.

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References and Notes

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