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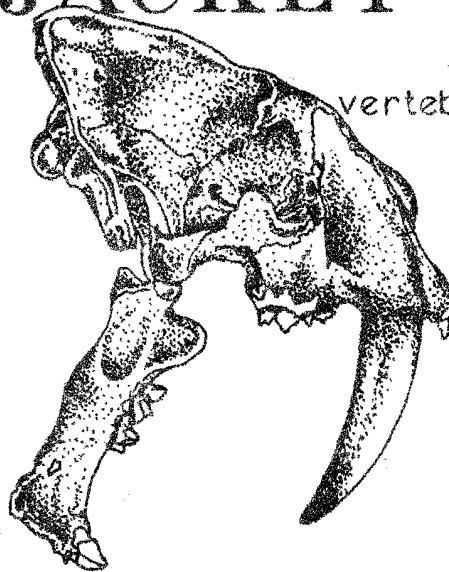
The PLASTER JACKET is a newsletter about fossil vertebrate animals of Florida. Its purpose is to circulate authoritative material on vertebrate paleontology and to foster communication among the growing number of enthusiasts of this subject.

Questions, announcements and other communications are solicited from all readers. Information of general interest will be included in future issues.

It is our intent to produce this series at the rate of about one issue per quarter year. We hope to add as many genuinely interested paleontologists as possible to our mailing list. If you are interested please send your name and address to the PLASTER JACKET. These issues are distributed free of charge to all interested people.

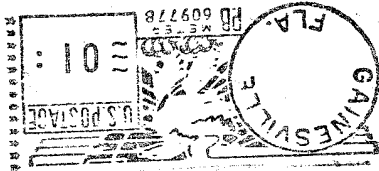
The
**PLASTER
JACKET**

-- about fossil
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FOSSIL HORSES OF FLORIDA

by

John Waldrop

INTRODUCTION

Horses first appear as fossils in North America and Eurasia during the Eocene, about 50 million years ago. Subsequent evolution of the family, the Equidae, has centered in North America and is better understood than most other groups of mammals because of the great abundance of fossils, representing virtually its entire history.

The climate of the Eocene was much warmer than today, and tropical forests inhabited by the earlier horses covered much of North America and Eurasia. During the Miocene, about 25 million years ago, the climate slowly began to get cooler and drier, and grasslands became progressively abundant. Those horses moving into the grassland habitat became faced with a new environment to which they were not fully adapted. Although more nutritious than leaves and twigs, grass is much tougher and has adhering particles of abrasive sand and silt. These particles, ingested along with the grass, cause serious attrition to low-crowned teeth, often wearing them down to the gum line before the horse reaches maturity. Through natural selection, horses have solved this problem in two ways. The first adaptation involved heightening of the crown of the tooth, which lengthened its functional life, secondly the tooth was strengthened by filling in spaces in the enamel with cementum, an adaptation which also provided the tooth with a larger grinding surface. This evolutionary change from a low-crowned cementless tooth to a high-crowned cemented tooth resulted in a more efficient grazing dentition (Fig. 8).

Another problem faced by the horse in this open grassland environment was that of escaping predators. The forest provided cover for hiding, but in this new,

more vulnerable situation, the horse had to depend more on alertness afoot for survival. The earliest horses were four-toed animals, about the size of a medium-sized dog, and like the dog, had a tough pad associated with each toe. For the small, early forest-dwelling horse, this was an efficient running mechanism. As the horse became larger and began a shift to the grassland environment, this pad foot became less efficient and natural selection favored the horses with longer, stronger, and fewer toes, and stronger, more complex ligament attachments. The result was a powerful springing foot which greatly increased running efficiency. Along with this change in the foot was a reduction, fusion, and modification of bones in the foot and limbs, especially in the wrist and ankle. This restricted the movement of the limbs to a fore-aft motion and greatly reduced the chances of a sprain. Thus, in response to changes in size and environment, the horse has perfected the running method to better escape predators.

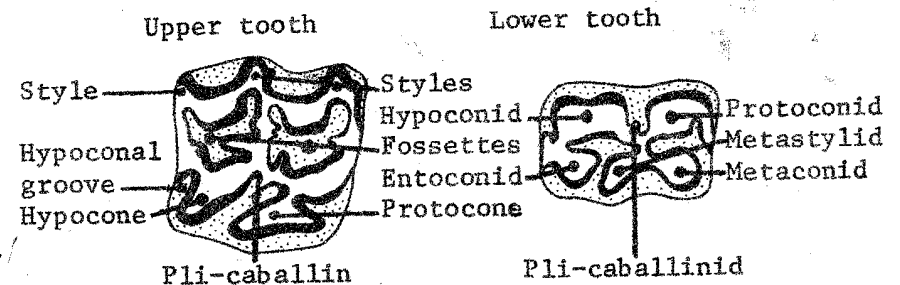
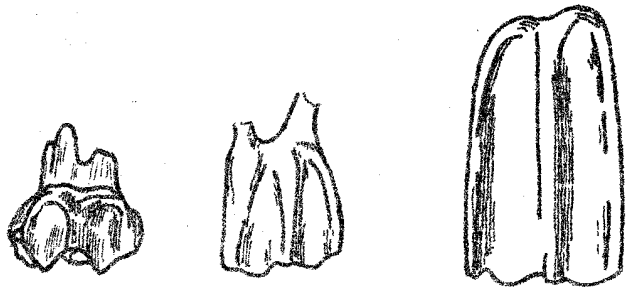


Figure 1. Grinding surface of the tooth. The heavier black line represents the enamel, the stipled area, cementum, and the white area, dentine. (After Simpson, 1951)

Most fossil mammal taxonomy is based on teeth as these are found most commonly and tend to reflect major evolutionary changes, since the food habits greatly influence evolutionary direction the the mammals. Figure 1 illustrates the principal features of horse teeth. Identification is based on the relationship of these features to one another, the presence or absence of a feature, the relative size and shape of the chewing surface, the presence or absence of cement, and whether the tooth is high crowned (hypsodont) or low crowned (brachyodont).



Parahippus brachyodont Merychippus subhypsodont Plihippus hypsodont

Figure 2. Relative height of crown of three horse genera showing the transition from low to high crowns.

Several complicating factors must be considered in attempting species identification. Tooth characters vary with position in the tooth row as well as with stage of wear. As in most mammals, the premolars tend to have simpler enamel patterns than the molars. In early and late wear stages, the pattern of enamel folding is more simple than in middle wear stages. Maximum complexity occurs at approximately one-third the total tooth length. In determining whether a tooth is high crowned or low crowned, the wear stage must be considered. Keeping these factors in mind, one should be able to identify the common horse teeth found in Florida.

Horses are first found in Florida in deposits of Oligocene age and they abounded here until the end of

the Pleistocene when they became extinct over all of North America. The equids now living here were reintroduced from the Old World by the Spanish conquistadores.

The following pages are a summary of the common horses of Florida with the characters for their identification. Unless otherwise stated, the discussion concerns only upper cheek teeth.

OLIGOCENE

The only Oligocene horse found in Florida and tentatively identified as Mesohippus, was recovered from a small deposit near Gainesville.

MIOCENE

Parahippus (Fig. 3A), the common Miocene genus in Florida, represents a stage about half-way up the phylogenetic tree of horses. It was about the size of a modern domestic goat. The cheek teeth have moderately complex enamel folding and are lightly covered with cement. The crowns are about an inch high. Each foot bears three toes; however the middle toe is the largest and supports most of the weight. Two species are present in Florida, Parahippus leonensis, a large form, and Parahippus blackbergi, a small one.

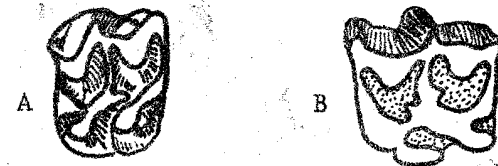


Figure 3. Occlusal views of A) Parahippus B) Merychippus. (Natural size)

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Another Miocene genus, Merychippus (Fig. 3B), is sometimes found in Florida deposits that are younger than those in which Parahippus is found. Merychippus differs from Parahippus in having slightly more hypsodont teeth and more cement on these teeth.

PLIOCENE

Several genera of horses are found in the Pliocene deposits of Florida. These have high-crowned, fully cemented teeth and fall into two categories; the hipparionines, characterized by separate protocones in the upper molars, and the equines with protocones connected to the rest of the enamel. The hipparionines have three toes, while the equines characteristically are single toed. The three-toed group is by far the more common and diversified in Florida. The four hipparionine species most frequently found are, in order of increasing size: Nannippus minor, Nannippus ingenuus, Hipparion plicatile and Neohipparion eurystyle. The equine line is represented by the genera Calippus and Pliohippus; however, due to the rarity of specimens, the exact specific names of the latter are uncertain.

Nannippus minor

Nannippus minor (Fig. 4A) is fairly easily recognized by its diminutive size. The protocone is separate and almost oval; the enamel of the fossettes is complexly folded. The only horses with which it may be confused are Nannippus ingenuus, which is slightly larger, and Calippus, which has a connected protocone and a much simpler enamel folding. Nannippus minor is endemic to Florida and has no small hipparionine counterpart in the Pliocene faunas of the western United States.

Nannippus ingenuus

Nannippus ingenuus (Fig. 4B) is easily confused with Nannippus minor. However, it is distinguished

from the latter by its slightly larger size and less complicated enamel folding. The separate protocone tends to be elongate rather than oval as in Nannippus minor. Nannippus ingenuus differs from Nannippus phlegon, which occurs later in time, by having a more nearly square crown and being less hypsodont.



Figure 4. Occlusal views of A) Nannippus minor, B) Nannippus ingenuus, C) Nannippus phlegon. (xl)

Hipparion plicatile

This species (Fig. 5A) is easily identified by its large size and the extreme complexity of its enamel folding. The protocone is separate and almost oval. In this genus, the trend toward enamel complexity in the three-toed horses reaches its climax. In the drawing notice especially the extreme complexity of the fossette folding.

Neohipparion eurystyle

Neohipparion eurystyle (Fig. 5B,C) is always larger than Hipparion plicatile. It is distinguished from that species by its simpler enamel pattern and its very elongated protocone. The lower teeth of this horse can be identified by the extra fold (pli caballinid) (Fig. 5C) on the inside of the tooth. The Florida specimens were originally named Neohipparion phosphorum by Simpson in 1930, but this species has since been found to be identical with Neohipparion eurystyle, described earlier from the Pliocene of Texas and therefore N. phosphorum must assume the earlier name.

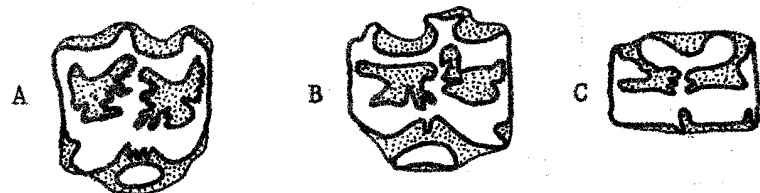


Figure 5. Occlusal views of A) Hipparion plicatile and Neohipparion eurystyle B) Upper molar, C) Lower molar. (Natural size)

Calippus

Calippus (Fig. 6A), like Pliohippus, exhibits a very simple enamel pattern and a connected protocone. Calippus is readily separated from Pliohippus, however, by its small size and nearly straight tooth as viewed from the side. Calippus is as small as Nannipus minor but has a simpler enamel folding and a connected protocone.

Pliohippus

Two kinds of Pliohippus (Fig. 6B) are found in Florida, a large and a medium sized species. The protocone is connected as in modern Equus, but unlike Equus, it is nearly circular and the enamel folding of the fossettes is less complex. Pliohippus teeth are strongly curved as viewed from the side, whereas in Equus the teeth are nearly straight. Some member of the Pliohippus group gave rise to Equus in the Pleistocene.

EARLY PLEISTOCENE

Nannippus phlegon (Fig. 4C) occurs in deposits of early Pleistocene age in Florida. This species is about the size of Nannippus ingenuus and both have only moderately folded fossettes and separate proto-

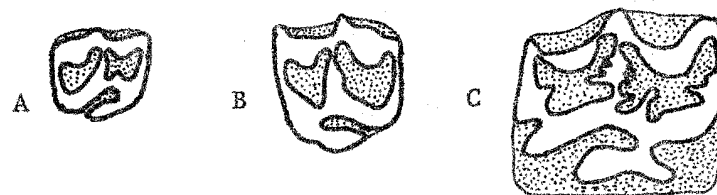


Figure 6. Occlusal views of A) Calippus, B) Pliohippus, C) Equus. (Natural size)

SKELETON

The post-cranial (skeletal) elements of horses are strongly modified for a swift-running (cursorial)

cones. The cheek teeth of Nannippus phlegon are more nypsodont and the chewing surface tends to be more elongate in the anterior-posterior direction than in N. ingenuus. Nannippus phlegon is usually found with primitive species of Equus. This last surviving hipparionine horse became extinct in the earliest Pleistocene.

PLEISTOCENE

The modern genus, Equus (Fig. 6C), is a characteristic member of Pleistocene faunas. Equus teeth are distinguished from teeth of most of the Pliocene three-toed horses by the connected protocone, and from teeth of Calippus by the long toe and heel developed on the protocone. Equus teeth are large, high-crowned, and have fairly complex enamel folding. Several fossil species of Equus have been described from Florida, but they are usually difficult to separate from each other without large samples, so it is not attempted in this paper. All are difficult to separate from the reintroduced Old World species, Equus caballus.

