REMAINS OF LAND MAMMALS FROM
THE MIocene OF THE CHESAPEAKE
BAY REGION

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The occasional discovery of the remains of various land mammals in the Miocene marine deposits, principally along the cliffs of the Chesapeake Bay in Maryland, has, in the course of a number of years, resulted in a rather significant representation of these forms. Heretofore no systematic attempt has been made to bring together the various previous reports of land mammals from these beds and to place on record the undescribed remains known to exist. Much of the material extant is preserved in the U. S. National Museum. It is comprised of an accumulation of gifts from private collectors, Johns Hopkins University, U. S. Geological Survey, and U. S. National Museum personnel and, in particular, represents the results of searches by the junior author. The drawings depicting the specimens were prepared by William D. Crockett, of the U. S. National Museum.

The materials described in this paper are for the most part from the Calvert formation, associated with a wealth of invertebrate fossils, and with unquestionably the most abundant representation known, both in numbers and diversity, of Miocene marine mammals. In some instances the fossils have weathered out and were found loose on the strand at the foot of the cliffs, and in cases where only Calvert is reported exposed in the immediate section their derivation from this formation is logically inferred. However, where Choptank formation, also Miocene in age, is exposed in the upper portion of the cliff section some doubt attaches to the origin, unless the specimen was uncovered in place.
PREVIOUS REPORTS

The occurrence of remains of Mammalia in the Chesapeake Miocene is the basis of some of the very early reports on vertebrate fossils in this country. The cast of a mastodon tooth that Leidy \(^1\) included in his description of *Mastodon obscurus* was considered to have been made from the tooth mentioned by Harlan \(^2\) in 1842 as coming from the Miocene of Maryland, and by Lyell in the Proceedings of the Geological Society of London for 1843 to 1845 (p. 38). Further discussion is found in Warren's \(^3\) work on "*Mastodon giganteus*."

Manatee and porpoise were also described from the Maryland Miocene at about this time,\(^4\) with subsequent papers by Leidy and others on occasional finds. However, the first extensive reports on the marine mammals of these beds were Cope's studies of 1867-1869. Included in Cope's 1867 \(^5\) paper was the description of *Cynorca proterva*, the second type of land mammal to be described from these beds, first thought to be a squalodont but later recognized as a peccary.

In the general review of the fauna from the Maryland Miocene in the Maryland Geological Survey report of 1904, E. C. Case, in his treatment of the mammals, overlooked the records of land types.

GEOLOGIC RELATIONS

The Miocene series in Maryland, known as the Chesapeake group, includes three formations, the Calvert, Choptank, and St. Marys, in ascending order. These consist essentially of sands, clays, marls, and diatomaceous sediments, for the most part highly fossiliferous. The beds are exposed in southern and eastern Maryland, to the southeast of Baltimore and Washington, where they unconformably overlie the greensand marls of the Eocene. For the most part they dip gently to the southeast, preserving the higher formations of the group in the more southerly portions of the State. The Chesapeake group is, in turn, unconformably overlain by Pleistocene and possibly Pliocene detritus over much of its extent, exposure of the Miocene resulting

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largely from dissection of the older surfaces and terraces. Its development is most impressive in the cliffs along the Chesapeake Bay.

The Calvert formation, with the superadjacent portions of the Choptank, is the principal mammalian fossil-bearing formation of the group. It is exposed from near Washington to below the mouth of the Wicomico River along the Potomac, associated with Eocene northward and with the Choptank southeastward. It extends south into Virginia, and as a belt northeastward across eastern Maryland and Delaware, and probably has for its equivalent the Kirkwood in New Jersey.

AGE AND FAUNAL RELATIONSHIPS

The age of the Chesapeake series has been regarded by Dall 6 as most nearly equivalent to the Helvetian of the European sequence, which in turn is currently regarded as about middle Miocene. In the committee report 7 on the "Nomenclature and Correlation of the North American Continental Tertiary," the Calvert is regarded as more nearly equivalent to the Tortonian of Europe, a stage higher than Helvetian, and, hence, approximately upper middle Miocene or upper Hemingfordian in the North American continental sequence. It is compared to the "lower Sheep Creek" of the Nebraska Miocene, "or, possibly, a slightly earlier age."

From a critical examination of the fauna, the composition of which was not fully known to the committee, we are inclined to regard the stage of development as slightly later. This is based to a large extent on the development reached in the Equidae and to some extent on certain of the other forms. The horizon represented is probably a little later than the lower Sheep Creek, or than the Florida Hawthorn (as determined by the vertebrate localities in the northern part of the State), although the extent to which the fauna is advanced over the faunas of those horizons is not great. The most nearly comparable fauna is to be seen in the Merychippus zone of the Temblor formation in California. The stage represented, if not the latest Hemingfordian, is early Barstovian, earlier than the typical Barstow fauna, and might be regarded as early Sarmatian.

The land mammals thus far recognized from the Calvert formation are as follows:

Carnivora:

*Tomarctus marylandica* Berry

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Proboscidea:
Gomphotherium calvertensis, n. sp.

Perissodactyla:
Tapirus cf. validus (Marsh)
Aphelops?, sp.
Archaeohippus, sp.
Merychippus, sp.

Artiodactyla:
Cf. Cynorca proterva (Cope)
Hesperhyus (Desmathyus)?, sp.

In a consideration of the age assignment, the Carnivora and Artiodactyla listed above are not significant, although Hesperhyus would suggest a relatively earlier age than some of the other forms. Its listing, however, cannot be regarded as in any way indicative, inasmuch as Hesperhyus has not been identified with any degree of assurance. The presence of "Desmathyus" in the base of the Kirkwood is open to various interpretations, but for whatever it is worth attention should be called to the fact that Dall regarded the southern New Jersey Miocene as containing reworked fossils from older sediments.

Gomphotherium is significant in either of two ways. If the presence of mastodon is to be regarded as placing an early limit on the possible age assignment, then a lower Barstovian age would likely be indicated. On the other hand, there is always the possibility that the Calvert represents the first appearance of mastodons in North America, a conclusion not out of keeping with its geographic remoteness from the western occurrences. Early appearances of mastodons in other regions of North America include their presence in the Pawnee Creek, Deep River, Mascall, Skull Spring, Sucker Creek, and Temblor faunas. So far no mastodon has been recorded from the lower Sheep Creek beds of Nebraska, from the Hawthorn of Florida, or from the Phillips Ranch locality in California.

Among the Perissodactyla, the tapir gives little evidence regarding the age assignment which may be made, other than to indicate a relationship with the Shiloh marl of the Kirkwood formation in New Jersey (from which Marsh described the species, Tapirus validus), inasmuch as tapir remains are exceedingly scarce in this portion of the geologic column. Also, the rhinoceros present is of no great help because the remains are too fragmentary for certain generic reference, and Aphelops has been recorded from Hawthorn to Pliocene times.

8 So far recorded only in zones 17 and 19, which are allocated to the Choptank.
9 Dall, W. H., ibid., p. cxliv, 1904.
The horses, however, although only the lower teeth have been found, give rather good indication of the portion of the Miocene represented. The *Merychippus* teeth appear advanced over related types from the Hawthorn or from the Sheep Creek beds, but, as noted under the systematic treatment of this portion of the fauna, the stage of development reached is nearly comparable to that in *Merychippus californicus* of the Temblor. The Temblor mammalian fauna is represented, as is the Calvert, by materials derived from a marine sequence and includes a strikingly similar assemblage, suggesting an ecologic relationship in addition to one in time.

**SYSTEMATIC DESCRIPTION OF THE MAMMALIAN REMAINS**

**Order CARNIVORA**  
**Family CANIDAE**  
**TOMARCTUS MARYLANDICA** Berry

A second lower molar and the greater part of the lower carnassial of a dog (U.S.N.M. No. 15561) were found by Charles T. Berry in zone 10 of the Calvert formation, about 1 1/2 miles south of Plumpoint Wharf, Calvert County, Md. These were described and given the name *Tomarctus marylandica* by Berry in 1938. He noted a marked resemblance of his form to that described by Merriam10 as *Tephracyon kelloggi* from the Miocene Virgin Valley beds of northwestern Nevada. The Calvert material appears inadequate for good specific diagnosis. Nevertheless, the geographic remoteness of its occurrence suggests a probable distinctness from previously described forms, a matter for future collecting to demonstrate.

**Order PROBOSCIDEA**  
**Family GOMPHOTHERIIDEA**

Considerable confusion has existed, and still exists, in mastodont nomenclature, particularly as applied to the mastodon known to occur in the Maryland Miocene. Details of its complexity in this instance were not clarified by Osborn in his monograph of 1936.11 In order to illustrate the taxonomic procedure that the present authors have followed, it is necessary to review briefly the origin of the name "Mastodon" *obscurus* Leidy and the history of the use to which it has been put.

Leidy,\textsuperscript{12} in his work on the "Extinct Mammalian Fauna of Dakota and Nebraska," described several mastodon teeth and figured three, which were considered to be from various localities in the eastern States. One of these, the first of the series discussed, was a cast of a tooth (see fig. 3), the original of which was lost, but demonstrated with some degree of probability by Leidy to have come from near Greensboro, Caroline County, Md. As shown by the Maryland Geological Survey \textsuperscript{13} this area is underlain by Choptank Miocene. A second tooth of confused history included in the discussion was purchased in London and purported to be American. Two incomplete teeth from Tarboro, N. C., a fragment of a molar from an unknown locality referred to as \textit{M. chapmani}, and a tooth portion from Darien, Ga., were also described.

In a later part of the paper Leidy \textsuperscript{14} proposed the name \textit{Mastodon obscurus}, citing the description beginning on an earlier page and the three figured teeth. However, he did not designate a type. Beneath the synonymy the following statement is made:

Apparently a species distinct from the preceding (\textit{M. mirificus}), indicated by specimens from North Carolina and Georgia. Other specimens from unknown localities supposed, however, to be American probably belong to the same. One of the latter was referred to a separate species by Dr. Hays under the name of \textit{M. chapmani}, but Dr. Hays expresses the opinion to me that this is distinct from the former. Under the circumstances I propose to distinguish the species represented by the undoubted American specimens by the name heading the article. The species has been suspected to be of Miocene age. . . .

This discussion, constituting the designation of the typical and referred materials, does not include Maryland specimens as indicative of the species, but regards them as of dubious origin; hence the cast of the lost tooth, believed to have come from Caroline County, is eliminated from consideration as the type.

In keeping with the above limitations, Merrill \textsuperscript{15} in 1907 selected as type, by lectotype, one of the Tarboro, N. C., specimens, U.S.N.M. No. 426. At this point the record is clarified, but in 1936 Osborn \textsuperscript{16} stated that Merrill's designation of the type was an error and that the cast of the lost tooth is the proper type. He further indicated that the Tarboro tooth really represents the species, \textit{Ocalientinus (Ser.)}

\textsuperscript{13} Maryland Geological Survey, Miocene, map facing p. xxiii, 1904.
\textsuperscript{14} Leidy, Joseph, ibid., p. 396, 1869.
\textsuperscript{16} Osborn, H. F., ibid., p. 286, 1936.
obliquidens, of somewhat later age. The taxonomic arrangement made by Osborn is untenable, and we are forced to the following conclusions: The Tarboro specimen is the type of "Mastodon" obscurus, and Serridentinus obliquidens is a synonym of Serridentinus obscurus (Leidy). "M." chapmani Hays must be ignored, as there is a strong probability that this specimen is of foreign origin. The various mastodon teeth now known from the Miocene of Maryland are without a specific designation. For these we propose the following name:

GOMPHOTHERIUM CALVERTENSIS, new species

**Type.**—Left upper second molar, U.S.N.M. No. 13764.

**Horizon and locality.**—Zone 13 or 14, Calvert formation; in green sandy clay about 4 feet above beach, 1.1 miles north of Governor Run Road, Calvert County, Md.

**Specific characters.**—Size of teeth approximating those in the genotype, G. angustidens (Cuvier), from the Miocene of France. Teeth low-crowned. Bunodont lophs of upper molar arranged transversely, with well-developed trefoils. Anterior and posterior lobes of trefoils partially distinct or cuspate. Lophs of lower molars more arcuate and forward sloping, and with posterior lobe of trefoils better developed than anterior, and with more noticeable separation. Slight tendency to the formation of trefoil form on inner part of lower teeth and outer part of upper teeth. Teeth noticeably resemble those of G. (Serridentinus) obscurum from North Carolina, but decidedly smaller and lower-crowned.

**Description.**—In addition to the type upper molar (fig. 1), which was collected by M. H. White about 1931 and given to the National Museum in 1935, there is a complete unworn last lower molar, also from near Governor Run, collected by A. Hecklinger in 1931 and deposited in collections of the Maryland Academy of Sciences. A cast of this tooth (fig. 2) is in the collections of the National Museum, U.S.N.M. No. 12134. The controversial lost tooth that Leidy regarded as coming from Caroline County, Md., and which Osborn considered as the type of G. obscurum, is represented also in the national collections by a duplicate (fig. 3) of the cast in the Academy of Natural Sciences of Philadelphia.

The second upper molar of G. calvertensis lacks only the front half of the anterior loph and the root portions. It is relatively unworn and shows clearly the details of the cusp development. In occlusal view the sides of the tooth are nearly parallel and the lophs almost at right
angles to the long diameter. The crests of the lophs are characterized in the unworn condition by a series of rounded cusps. The trefoil plan is markedly developed with the anterior and posterior lobes, between the lophs, about equally developed and tending to be separated from

![Image of Gomphotherium calvertensis](image)

**Fig. 1.—Gomphotherium calvertensis**, new species: Left upper second molar (U.S.N.M. No. 13764) type specimen, lateral and occlusal views, \( \times \frac{5}{3} \). Calvert Miocene, Maryland.

the lophs at their summits. A slight, or subdued, trefoil arrangement is also seen on the outer half of the lophs on the opposite side of the clearly defined median crease or fold extending the length of the tooth. In end view the inner and outer portions of the lophs are of about equal height, except for the first loph where wear has
somewhat lowered the lingual half. The slopes of the inner and outer columns are nearly equal, although the inner wall appears to be less erect. No cingular crest is developed on the buccal wall and only between the lophs lingually. The character of the forward margin of the tooth cannot be determined, but the posterior margin exhibits

![Diagram of Gomphotherium calvertensis](image)

Fig. 2.—Gomphotherium calvertensis, new species: Drawing from cast (U.S.N.M. No. 12134) of right last lower molar belonging to Maryland Academy of Sciences, lateral and occlusal views, \(\times \frac{3}{4}\). Calvert (?) Miocene, Maryland.

a markedly cuspate crest across the midportion and about halfway up the posterior loph, rising toward the inner extremity.

The last lower molar, belonging to the Maryland Academy of Sciences, appears somewhat smaller than would likely have been associated with the type upper molar but may well be within the range of this species. It is also a little shorter and narrower than the cast of the Caroline County specimen. The tooth is unworn and complete except for roots. Resemblance to the corresponding tooth of *G. angustidens* is striking, although the Maryland Academy tooth
is noticeably smaller than U.S.N.M. No. 150 from the Miocene of France. These teeth, including the cast of the Caroline County specimens, are alike in structural pattern with arcuate lophs in which the outer trefoil portion is offset or directed backward, and the posterior buttress or lobe of the trefoil is very well developed. This lobe is even more prominent and shows better separation directly behind the first loph. It is essentially single in the Maryland Academy specimen but may be bilobed in \textit{G. angustidens}. The posterior lobe of the trefoil is less distinctly separate from the second loph but there is a suggestion of bilobing near the base in the Maryland form. Slight basal cuspsules or weak and irregularly developed trefoiling is seen inward of the median longitudinal cleft.

In critically examining the type and other materials of \textit{Serridentinus productus} and \textit{Serridentinus floridanus} the structural arrangement is scarcely different from that in typical \textit{Gomphotherium}. Except for

![Fig. 3. — Cf. Gomphotherium calvertensis, new species: Drawing from cast (duplicate of Acad. Nat. Sci. Philadelphia No. 13278), lateral and occlusal views, \( \times \frac{3}{5} \). Original purported to be from Choptank Miocene, Maryland.](image-url)
size and height of crown, the molar teeth of Pliocene *Serridentinus* in this country differ but little from Miocene *Gomphotherium* molars at hand. We suspect that but one phyletic group is represented.

Measurements (in millimeters) of cheek teeth of *Gomphotherium* calvertensis

Transverse diameter of M\(^3\), U.S.N.M. No. 13764 (type) .................. 70.5
Length of M\(^3\), U.S.N.M. No. 12134 (cast of Maryland Acad. Sci. specimen) .................................................. 140.
Transverse diameter of M\(^5\), U.S.N.M. No. 12134 ........................ 61.

Order PERISSODACTYLA
Family TAPIRIDAE

*TAPIRAVUS* cf. *VALIDUS* (Marsh)

A right maxilla, U.S.N.M. No. 18372 (fig. 4), with P\(^3\) and M\(^4\) preserved, but exhibiting the root portions or alveoli for the remaining cheek teeth, was found by J. E. Smedley, of the U. S. Geological Survey, about 2 miles south of the Chesapeake Beach resort. The specimen was discovered weathered-out on the beach, but at this point only the Calvert formation is reported in the adjacent cliff section so that there seems little doubt of its origin.

The teeth resemble to a marked degree those seen in the modern tapir, but are very much smaller and appear to be relatively lower-crowned. Their size is rather close to the dimensions given by Marsh\(^{17}\) for *Tapiravus validus* from the "Miocene marl of Cumberland Co., New Jersey." The Calvert specimen is tentatively referred to the New Jersey species.

Schlaikjer,\(^{18}\) in his work on the tapir from the lower Miocene of Wyoming, considered that Marsh’s form represented uppermost Miocene or lower Pliocene time. However, from a consideration of Tertiary stratigraphy in southern New Jersey it seems probable that the type is from the marl of the Kirkwood formation, which is considered to be very close in age to the Calvert formation in Maryland. Except for clay lenses in the Cohansey formation, there does not appear to be any beds of later date that could properly be referred to as marl. Since we have some assurance that the Maryland specimen is from the Calvert we may also reason that Marsh’s type may well have come from the Kirkwood.

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Comparison of the Calvert specimen with modern *Tapirus* shows that its maxilla, though smaller, is relatively a little deeper, when the lengths of the cheek tooth series are considered. The infraorbital foramen opens anteriorly above the posterior part of *P*², much as in recent specimens; also the notch between the zygomatic wing of the maxilla and the maxilla proper is about opposite *M*³, and the anterior margin of the orbit is located above about the middle of *P*⁴. However, the outward face of the lachrymal is less modified, though actually nearly as long, and the lachrymal processes are not nearly so prominent. The lachrymal foramen is divided posteriorly, and the two openings are close together and face posteriorly. In modern *Tapirus* skulls the lower of these foramina, when separate, is often observed to face outward beneath the posterior lachrymal process. The sulcus on the lateral face of the ascending portion of the maxilla is shallow and confined to the maxilla and probably the frontal, whereas in *Tapirus* this sulcus is much more deeply impressed, involves the lachrymal bone, and
may extend as far down as the infraorbital foramen. A small segment of the frontal bone in the Calvert specimen is seen wedged between the maxilla and lachrymal, much as in the modern tapir, so that we may infer frontal and nasal modification for a proboscis, although probably less strikingly developed. Modification of this portion of the skull was probably not greatly different from that shown by Schlaikjer for the Harrison tapir.

*Measurements in millimeters*

- **Anteroposterior diameter:**
  - U.S.N.M. No. 18372
  - \( P^3 \): 13.4
  - \( M^3 \): 15.0
  - T. validus type
  - \( P^4 \) or \( M^3 \): 14.8 *
  - \( P^4 \) or \( M^3 \): 17.5 *

* and \( 8\frac{1}{2} \) lines, respectively.

Family RHINOCEROTIDAE

APHELOPS?, sp.

Three isolated lower molars, representing two individuals of rhinoceros, were collected by Collins from a locality about 0.8 mile south of Randle Cliff Beach, Calvert County, Md. Two of these, unworn right and left (fig. 5a) molars, U.S.N.M. No. 18427, were found together on the beach, but with matrix attached which suggested their derivation from a weathered zone high on the cliff, probably zone 14 or 15 of the Calvert. The third tooth, partially worn molar in jaw fragment, U.S.N.M. No. 18428 (fig. 5b), was found in the same general locality at a later date, and presumably represents a different individual. The worn tooth is considered to be a first molar and the unworn teeth may well be second molars.

The teeth are of moderate size, broad, and appear fairly high-crowned, particularly when viewed from the outer side. The tooth which Marsh described as *Rhinoceros matutinus* from Squankum, in Monmouth County, N. J., revised by Wood as *Diceratherium matutinum*, may not be significantly different in size from the Calvert teeth, as indicated by Marsh’s illustrations, but appears appreciably lower-crowned and exhibits a strong external cingulum not seen in the Maryland material.

The only other Miocene rhinoceros material

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19 Schlaikjer, E. M., ibid., figs. 1 and 2, 1937.
from eastern United States is that described by Colbert \(^{22}\) from the Hawthorn formation in Florida. The material which the Florida Geological Survey lent to Dr. Colbert for study included five lower teeth, apparently of one individual, which he referred to *Aphelops*. Again, these teeth do not appear to be significantly different in size from those of the Calvert form but are much more worn, and are described as having a strong internal cingulum, closing the inner valley of the premolars. No premolars are represented in the Calvert material

but the molars do not have the cingulum developed either internally or externally.

Reference of the Maryland material to *Aphelops* is highly tentative. The specimens furnish little or no information which would serve to distinguish the form represented from *Aphelops*, and at the same time the material is too incomplete to warrant certain generic reference.

**Fig. 5.—** *Aphelops*, sp.; (*a*), Unworn left M\(_3\) (U.S.N.M. No. 18427); (*b*), left M\(_1\) (U.S.N.M. No. 18428). Lateral and occlusal views, \( \times \frac{3}{4} \). Calvert Miocene, Maryland.

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<th>Measurements in millimeters</th>
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<tr>
<td><strong>M(_3)</strong> (U.S.N.M. No. 18428)</td>
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<tr>
<td>Anteroposterior diameter</td>
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<td>40.0</td>
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Family EQUIDAE

ARCHAEOHIPPUS, sp.

A slightly worn lower cheek tooth in a jaw fragment, U.S.N.M. No. 18431 (fig. 6a), is the only specimen of the small brachydont horse Archaeohippus known from these beds. It was found by F. Stearns MacNeil, of the U. S. Geological Survey, a little less than a mile south of Plumpoint, Calvert County, Md. The Calvert formation is the only Tertiary reported in the cliff section in this vicinity.

Fig. 6.—a, Archaeohippus sp., portion of right ramus of mandible with M₂ (U.S.N.M. No. 18431); b, Merychippus sp., left lower premolar (U.S.N.M. No. 12032); c, Merychippus sp., left lower premolar (U.S.N.M. No. 18430). Lateral and occlusal view, × 1. Calvert Miocene, Maryland.

The tooth of No. 18431, apparently M₂, is rather simple in construction, decidedly brachydont, without cement, and with very little evidence at its present stage of wear for any separation of the metaconid and metastylid. A cingulum is developed only on the anterior and posterior walls, where it rises internally to the parastylid and hypoconulid, respectively. Its size is distinctly less than this tooth in the paratype of Archaeohippus mourningi (Merriam) from the Barstow beds, but only a little less, and it is somewhat more slender than in A. mourningi from the Temblor formation in California. Size difference is not significant in comparison with isolated

lower molars of *Archaeohippus ultimus* Cope \(^{25}\) from the Mascall formation of Oregon. The tooth is longer and narrower than lower cheek teeth in the type of *Archaeohippus penultimus* Matthew \(^{26}\) from the Sheep Creek horizon but appreciably smaller than in referred specimens. The Maryland tooth is also, presumably, lower-crowned.

The only *Archaeohippus* species known from the eastern region is *A. nanus* Simpson \(^{27}\) from the Thomas Farm fauna of the Hawthorn formation in Florida. The Maryland tooth is very close in size to *M₂* in *A. nanus*. However, there is no assurance that the form represented is this species, as the specimen is much too incomplete to warrant specific diagnosis.

**Measurements (in millimeters) of M₂, U.S.N.M. No. 18431**

- Anteroposterior diameter: 11.3
- Transverse diameter: 7.6

**Merychippus, sp.**

Two left lower premolars of the horse *Merychippus* were found on the beach between the Chesapeake Beach resort and Randle Cliff. One of these, an unworn tooth, U.S.N.M. No. 12032 (fig. 6b), was discovered by John J. O’Brien, of the Soldiers’ Home, and the other, U.S.N.M. No. 18430 (fig. 6c), worn for probably half of its original length, was collected by Charles Welter, of New York City. Between the two beach resorts only Calvert of the Miocene sequence is represented in the cliff section, as shown by the columnar sections in the Maryland Geological Survey’s report on the Miocene.

Two phalanges, collected by W. E. Salter, of the U. S. Geological Survey, from the vicinity of Scientists Cliffs, a short distance north of Governor Run, may also represent *Merychippus*. Scientists Cliffs includes the lower part of the Choptank formation as well as the upper part of the Calvert, so that although a Miocene age is assumed for the toe bones they are not certainly Calvert.

Unfortunately, no upper teeth have been found in the Calvert, and lower teeth are less satisfactory for comparative purposes. Nevertheless, the developmental stage reached in the lower teeth affords strong evidence toward conclusions as to the stage of the Miocene represented.

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\(^{25}\) See Bode, F. D., ibid., pp. 51-52, pl. 3, figs. 1-3.


The two lower teeth have very nearly the same cross section and must surely represent the same species. Together they demonstrate the unworn or total length of the tooth and the enamel pattern at about one-half the tooth length. Their construction does not represent a very early stage of *Merychippus*, but demonstrates pronounced hypsodonty and well-developed enamel folding. Both teeth show cement-filled folds on the lingual side and discontinuous or a scattering of cement deposition on the outer walls and in the median fold. The teeth are of small size, but distinctly more advanced than *Merychippus primus* from the Sheep Creek horizon. They more nearly approach in pattern and proportions those of *Merychippus californicus* Merriam from the *Merychippus* zone of the Temblor. They are distinctly less advanced than material of this genus from the Barstow.

It would seem that the stage of evolution reached in the Calvert teeth is approximately that of *Merychippus californicus*, but with a simpler pattern than those illustrated. They may not be far removed in time from the *Merychippus* horizons represented in the Mascall and Virgin Valley beds of Oregon and Nevada but appear advanced over the stage indicated by *Merychippus gunteri* and *Merychippus westoni* from the Hawthorn beds of Florida.

*Measurements* (in millimeters) of *Merychippus* sp. cheek teeth

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<tr>
<td>Antero-posterior</td>
<td>21.0</td>
<td>19.0</td>
</tr>
<tr>
<td>Transverse</td>
<td>11.0*</td>
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*About midsection of tooth length.*

Order **ARTIODACTYLA**

Family **TAYASSUIDAE**

Cf. **CYNORCA PROTERVA** (Cope)

The presence of a distinctly small peccary in the Maryland Miocene has been a matter of record since 1868, but since that time very few references have been made to the occurrence. In the preceding year Cope described what he regarded as a new type of squalodont on the basis of material found by James T. Thomas near his residence in the eastern part of Charles County, Md., not far from the Patuxent

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River—not the Ashley River, S. C., as Palmer indicated. Cope's description was based on characters of an upper canine of a peccary, but included in the material mentioned were two squalodont cheek teeth. In 1868 Cope announced that Leidy had called his attention to the fact that the canine belonged to a small peccary, whereupon he attempted to retain this name for the other teeth. The correction was not noticed by Case, but Kellogg later demonstrated that since the distinctive characteristics of Cynorca proterva were based on a peccary canine, obviously the type, the name was not available for use as a squalodont, and in this he was supported by Hay.

Leidy, on the other hand, followed Cope in retaining the name for a squalodont and referred the peccary canine to his species, Dicotyles lenis, the type of which is from the Ashley River deposits, and also included additional peccary material from Charles County, Md., which Cope regarded as Pleistocene and referred to the modern species under the name Dicotyles torquatus (Pecari angulatus). We have not examined these specimens so are unable to verify their age assignment. The Chesapeake Bay collections of the National Museum include peccary material from both the Miocene and Pleistocene, the latter apparently being referable to Tayassu lenis (Leidy).

The peccary material at hand from various localities in Calvert County, along the cliffs adjacent to Chesapeake Bay, indicates a noticeably small form which is distinct from species of Miocene pec- caries known from elsewhere. Since Cope described Cynorca proterva as coming from the Miocene of the same general area, and Leidy characterized it as distinctly smaller than modern forms, it seems probable, although no other canines are at hand, that our material belongs to this species.

Description.—Among the materials here referred to Cynorca proterva are some six isolated upper and lower cheek teeth and a lower jaw portion, U.S.N.M. No. 18429 (fig. 7), including M₂ and M₃. Moreover, some incomplete limb and foot bones may belong to the same species. The lower jaw was found on the beach 0.7 mile south of

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30 Palmer, T. S., Index generum mammalium, p. 213, 1904.
31 Cope, E. D., ibid., vol. 20, pp. 185-186, 1868.
32 Case, E. C., Maryland Geological Survey, Miocene, pp. 7-8, 1904.
Randle Cliff Beach, where the Maryland Geological Survey indicates only Calvert.

Two premolars, possibly \( P_2 \) and \( P_3 \), but not of the same individual, are simple and smooth with the elevated crest of the trigonid and the lower talonid divided but free of accessory cuspules. The paraconid is weak on the smaller of the two teeth, but prominent, though lower, on the other. These premolars, if properly referred to the same species as the molars, are relatively large.

Fig. 7.—Cf. Cynorca proterva (Cope): Right ramus of mandible with \( M_2 \) and \( M_3 \) (U.S.N.M. No. 18429), lateral and occlusal views, \( \times 1 \). Calvert Miocene, Maryland.

Two last upper molars are strikingly smaller and relatively narrower than in the living collared peccary, the cusps are more nearly conical, the cingulum is much less developed, and there are fewer accessory cuspules.

The lower jaw, No. 18429, is relatively shallow and exhibits rather smooth, narrow molars, particularly \( M_3 \), with cusps, as in \( M_3 \), more nearly conical than in modern peccaries. It should be noted, however, in comparison with modern forms that the large white-lipped peccary, *Tayassu pecari*, exhibits teeth having less tendency toward the formation of transverse crests, lower trigonid portions in the premolars, and more nearly conical cusps in the molars than the smaller *Pecari*.
angulatus. The absence of cingular cusps between the external cusps of the lower molars, noted by Leidy for T. lenis, is also characteristic of T. pecari, but not P. angulatus.

The dental characteristics noted for the form Cynorca are much more prophetic of the modern peccaries than are characters of the better-known Pliocene species of Prosthennops. Although it is possible that Prosthennops is a synonym of Cynorca it seems more likely that the two are distinct and that Cynorca is actually in the line of descent for Tayassu and Pecari. As noted by Colbert, Prosthennops does not fall in this line and Platygonus has become too specialized in its dental characters. On the other hand, "Desmathyus" and the closely related form, Floridachoeerus, are known only from large species, having teeth so modified that it seems unlikely they in turn could have given rise to Cynorca.

Measurements in millimeters of lower jaw
(Cf. Cynorca proterva, U.S.N.M. No. 18429)

<table>
<thead>
<tr>
<th>Measurement Description</th>
<th>Measurement Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of jaw beneath point between M₂ and M₃</td>
<td>24.0</td>
</tr>
<tr>
<td>Anteroposterior diameter: transverse diameter, M₂</td>
<td>1.21</td>
</tr>
<tr>
<td>Anteroposterior diameter: transverse diameter, M₃</td>
<td>1.47</td>
</tr>
</tbody>
</table>

HESPERHYS (DESMATHYUS) ? sp.

A peccary of considerable size is represented in the collections by a humerus, the distal portion of a radius, several carpals and phalanges, and some vertebrae and ribs, all belonging to one individual. These were found by Dr. W. F. Foshag, of the U. S. National Museum, in 1940 in fallen blocks from zone 17 of the Choptank Miocene immediately above the Calvert, at Calvert Beach, Md. Three isolated metapodials from along the Chesapeake are of a size comparable to the foregoing. Two of these are not documented as to horizon, but the third was collected by Collins from zone 19 of the Choptank.

There is no certainty as to the genus represented, but it is thought that the form might possibly be "Desmathyus," as a peccary from the base of the Miocene Kirkwood formation in New Jersey, which Marsh described as Perchoerus (Dicotyles) antiquus, has since been referred by Wood to "Desmathyus." Moreover, "Desmathyus"

has been described from the *Merychippus primus* zone of the Snake Creek beds as well as from the Upper Rosebud and Harrison.

The humerus and other elements of this peccary are as large and massive as in the Pleistocene form, *Platygonus cumberlandensis*. No limb material of true *Hesperhys* was available for direct comparison and these seem undescribed in the literature.