some sort. Whether the particles which remove the charge come from the air, or from the condensed gaseous layer, or from the material of the body itself, is still in dispute. It appears to me that the mass of the evidence is in favor of the latter hypothesis. But the possibility that the phenomena may be complicated by electrolytic conduction in the medium surrounding the charged body,* must not be forgotten.

ERNEST MERRITT.

CORNELL UNIVERSITY.

(To be concluded.)

THE NORTH AMERICAN ORIGIN OF THE EDENTATES.†

THE explorations of the American Museum Paleontological party in the basin of the San Juan, New Mexico, during the past summer secured, among other important materials, the larger part of the anterior limb of *Psittacotherium multifragum* Cope, associated with the lower jaws and a number of the upper teeth. The specimen in question was found by the writer, and, with the exception of a few unimportant weathered fragments, was bedded in its original matrix, a soft, friable, reddish colored clay. The jaws and limb were not more than a foot apart, so that there can be very little doubt that they belong to one and the same individual.

It has been the custom of paleontologists to place the genus *Psittacotherium*, after Cope, in the Tillodontia, but it can now be shown that it not only does not belong in this group, but that together with *Hemiganus, Ectoganus and Stylinodon* forms a closely connected consecutive series ancestral to and leading directly to the Gravigrada, or ground sloths. A second series, composed of *Onychodectes* and *Conorycetes*, is clearly an allied group, which probably gave origin to the Armadillos.

These two series I have arranged under a new suborder for which I have proposed the name Ganodonta, and considered them as constituting a primitive division of the Edentata.

This suborder has been defined as follows: "Primitive Edentates characterized in the earlier forms by rooted teeth with divided fangs, having a more or less complete enamel investment; in the later forms by the teeth becoming hypsodont, rootless, of persistent growth, and by limitation of the enamel covering to vertical bands in progressive decrease. By the presence of incisors in both jaws, by a typical molar and premolar dentition, by a trituberculate molar crown, which disappeared early in life through wear, leaving the dentine exposed."

The evidence of the Edentate affinities of these forms is displayed most strikingly in the *Hemiganus*, *Psittacotherium*, *Ectoganus* and *Stylinodon* series in the following characters: (1) The enlarged teeth in the front of both upper and lower jaws can now be determined as being canines, and not incisors, as has formerly been supposed. In the earliest genus, *Hemiganus*, from the lower Puerco, the lower canine had already lost the enamel from its posterior face, while the crown of the upper canine is completely encased in enamel; the teeth were rooted, having divided fangs, and the crowns of the molars and premolars in the single specimen known are enamel-covered. (2) In the succeeding genus, *Psittacotherium*, from the upper Puerco, the superior canines had also lost the enamel from the posterior face, the roots of the lower molars and premolars were connate, while the roots of the upper molars were more or less divided into fangs. The crowns of the molars early lost

* In an early paper Arrhenius [W. A. 32, 545; 33, 638. Phil. Mag. 28, p. 75] suggested that the air conducted electrolytically under the influence of ultra-violet rays.

† Bull. Amer. Mus. Nat. Hist., Art. XVI., 1896.

their tuberculate structure and all the molars and premolars are more or less elongated; the incisors were reduced to a single pair in the lower, and very probably a like number in the upper jaw, with the enamel confined to the anterior face. (3) In the Wasatch representative (*Ectoganus*) a still further advance is seen in that the canines grew from persistent pulps; the lower incisors had lost their enamel covering, and in the premolars the enamel is confined to external and internal vertical bands. (4) The Wind River and Bridger genus (*Stylinodon*) continues this specialization, and here we note that in the premolars, and molars as well, the enamel is confined to narrow external and internal vertical bands, with all the teeth hypsodont and growing from persistent pulps. (5) The feet of all these genera, so far as known, are remarkably short and provided with immense more or less compressed claws. (6) The carpus and ulna and radius of *Psittacotherium* are almost identical with that of *Mylodon*, and the humerus of *Ectoganus* displays a remarkable similarity to that of *Mylodon* and *Megalonyx*. (7) The muzzle is short, the lower jaw is heavy and robust, and the posterior end of the tooth line passes behind the enlarged coronoid, which, together with the large, powerful curved canines, growing from persistent pulps, at once recalls, in the most positive manner, the skull of *Megalonyx*. (8) The order Edentata, with the exception of one or two fossil forms, from the Santa Cruz and Monte Hermoso beds of South America, are characterized by enamelless teeth, growing from persistent pulps, notwithstanding the fact, as has been shown, that they possess a rudimentary enamel organ for each tooth in the earlier stages of its development. Ameghino has found that some of the older forms possessed bands of enamel on the molars and premolars similar to those seen in *Stylinodon*.

We know of no other group of extinct mammalia in which this progressive loss of enamel occurs, coupled with increasing length of the teeth, together with their growth from persistent pulps; and when we come to consider the remarkable similarities in other parts of the skeleton, the conclusion, in my judgment, is unmistakable that they are the direct forerunners of the Edentata. It is, indeed, a matter of great surprise that the foot structure of *Psittacotherium*, and for that matter *Hemiganus* as well, should show, even at the very beginning of the Puerco, such a high degree of specialization, almost equal to the large Ground Sloths. It clearly indicates that the modern Edentates are the surviving members of a very ancient and archaic group of mammalia, which had its origin far back in Mesozoic time.

It is also a matter of the greatest interest to note that this group apparently disappeared from North America before the close of the Eocene, no trace of them having as yet been found later than the Lower Bridger horizon, until they reappear in the Pliocene or Post-Pliocene beds of this country. It is also worthy of note that they make their first appearance in South America in the Santa Cruz and Monte Hermoso formations, which would seem to indicate that these beds cannot be older than late Eocene or older Miocene, corresponding with our Uinta and White River formations. Collateral evidence of this migration to the southward in Eocene time is furnished by the disappearance of *Meniscotherium* from our Wasatch and the subsequent appearance of its successors, the *Proterotheriidæ* in South America.

I think, from the evidence just adduced, that it can now be established that the South American Edentata, at least, originated on the North American continent in the group above described.

J. L. Wortman.