Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. LXII. No. 4.

FOSSIL MAMMALS FROM CUBA.

By Glover M. Allen.

With One Plate.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM.
May, 1918.

No. 4.— *Fossil Mammals from Cuba.*

By Glover M. Allen.

Since the publication in January, 1917, of my paper on new fossil mammals from Cuba (Bull. M. C. Z., **61**, p. 1–12, pl.), the Museum has received a large quantity of subfossil bones from several localities in that island and the Isle of Pines, which so very materially supplement the few fragments on which the original descriptions were based, that it seems desirable to make an additional report on them. The material was collected by Dr. Thomas Barbour, assisted by Messrs. W. Sprague Brooks and Goodwin Warner, from caves in the Sierra de Hato Nuevo, and near Limones, Cuba, as well as from two caves in Sierra de Casas, Isle of Pines. Practically all of the specimens were found loose or only slightly compacted together in the soil-deposit of the caves, hence they are in much better preservation than the fragments originally studied, which had to be carefully chiselled out from a solidified mass. All are of recent origin, some so fresh in appearance that it is hard to believe they have been long in the ground. With the exception of a few skulls fairly well preserved, much of the material is more or less broken and scattered, as though the animals had been torn apart and eaten by owls or land-crabs. In addition to the three species first announced, a new dwarf Capromys was discovered, which has lately been described (Allen, 1917a) on the basis of several lower jaw-fragments, as *C. nana*. Most opportunely a living specimen of this supposedly extinct animal has now been received at the Museum through Dr. Barbour's efforts, so that a complete description of this interesting addition to the present-day fauna of Cuba is made possible.

In addition, I am under obligation to Mr. Gerrit S. Miller, Jr., for the privilege of making a cursory examination of the collection of subfossil bones brought from Cuba by Mr. William Palmer early in 1917, and now in the U. S. National Museum; also to Mr. H. E. Anthony of the American Museum of Natural History, for the opportunity of studying similar specimens collected by him in eastern Cuba. A brief report by Peterson (1917) has since appeared on cave-fossils from the Isle of Pines found in 1913 by the Messrs. Link. Curiously, no additional species have been recognized among the large number of fragments now obtained.

Nesophontes micrus G. M. Allen.

Plate 1, fig. 7–10.

Nesophontes micrus G. M. Allen, Bull. M. C. Z., 1917, **61**, p. 5, pl., fig. 14.

The only specimen previously available was the type, a fragment of the right lower jaw, containing a part of pm_4, m_1, m_2, and the roots of m_3. It was referred to Nesophontes with some doubt, but the large number of specimens now at hand proves that it was correctly assigned to that genus. In addition to several nearly complete crania and lower jaws, sundry limb-bones, chiefly femora, were also collected, so that a detailed comparison may now be made between this and the Porto Rican species, *N. edithae* Anthony. As in that species, the specimens fall into two series, a larger and a smaller, which as Anthony (1916) has suggested, probably represent males and females respectively. The differences are slight but constant, and can hardly mean anything else, though it is unusual among the Insectivora to find sexual dimorphism in size. The skulls assumed to be those of males have the rostrum broader and stouter, less tapering, with slightly broader palates and parallel instead of convergent tooth-rows; they are slightly larger also in general dimensions. Anthony's description of the skull of *N. edithae* applies in general to *N. micrus*. In one specimen of the latter, the pterygoids are intact and are seen to project ventrally below the level of the palate for about a millimeter, then curve posteriorly to end each in a delicate bony hook. The teeth seem essentially alike in both species, though in none of the skulls of the Cuban animal are the three incisors present. The double-rooted canine (Plate 1, fig. 9) is relatively large, with a deep groove on its anterior face, two similar grooves delimiting a median ridge on the inner face of the tooth, and a slight cingulum on the postero-external half. Anthony states that the paracone is absent in the molars of Nesophontes, but this is not the case except in much worn specimens. Those with unworn molars exhibit the typical W-pattern, except that the paracone is much reduced in size, hardly one fourth as large as the metacone. The hypocone is represented by a cingulum-like ledge. As previously pointed out, the third lower molar in *N. micrus* is relatively smaller than in *N. edithae;* the second lower premolar is also much smaller than the first, instead of being nearly the same size. In lower jaws presumed to be of females the ramus is much the more

slender, while in those assumed to represent the males, it is larger and more heavily proportioned with a greater downward curvature of the lower border of the ramus.

The following measurements illustrate the sexual difference in size of the skull: —

	♂9954	♂9907	♀9953	♀9890
Least interorbital width	7.2		6.2	
Width outside alveoli of canines	5.0		4.0	
Width outside last upper molars	9.2		7.8	
Length from canine to glenoid fossa	17.0		16.0	
Tooth-row, canine to back of m^3 (alveoli)	11.4		11.0	
" " upper molars	5.8		5.3	
Jaw, greatest depth of ramus		3.8		3.0
" " " through coronoid		8.1		8.0
Tooth-row, c-m_3 (alveoli)		12.2		11.8

While agreeing with Anthony (1916) that the characters distinguishing this genus from other insectivores with which suffieient comparison can be made, are enough to give it rank as the representative of a separate family, I am unable to share his view that they ally it "more closely to the Soricidae than to other families." The fundamental resemblances to the zalambdodonts seem more striking. It is natural to make comparison with Solenodon, the other insectivorous genus that has been contemporary in the Greater Antilles with Nesophontes. The general points of likeness are obvious: — the shape of the skull, the incomplete zygomatic arch, the long tubular rostrum, early fusion of the nasals (also in Soricidae), the slight inflation of the frontal region, large foramen magnum, prominent lambdoid, and low sagittal crests, the tooth-formula, the double-rooted upper canine, and the transversely expanded mandibular condyle. One specimen of Nesophontes has preserved the petrous bone of the ear, though the tympanic, which therefore is separate, has gone. The petrosum is very similar in general topography to that of Solenodon. On the other hand Nesophontes does not show the specialization of incisors nor the reduction of the canines, so marked in Solenodon. The latter, however, is rather an extreme type in this respect as compared with Microgale or Oryzoryctes, in which the canine is little reduced and the incisors have merely an additional posterobasal cusp. The milk incisors of Solenodon are small unspecialized teeth, the first pair in no way resembling their enormous permanent successors. A comparison of the upper molars is of great interest. In Solenodon as

in other zalambdodonts — Centetes, Potamogale, Microgale, etc.— the cusp-development seems to result in the formation of a single V instead of the more primitive W-pattern. The generally accepted view is that the main cusp represents a fused paracone and metacone in which the latter is the obliterated element. In Solenodon two small internal cusps are interpreted as protocone and hypocone, the large median cone as the fused paracone and metacone. Another view may be put forward, however; namely, that the main cusp in the Solenodon molar is the metacone, and that the paracone is represented by a small style-like eminence anteriorly at the outer rim. At all events it is frequent in the Chiroptera to find the paracone much smaller than the metacone, while protocone and hypocone are small, at the inner edge of the tooth. The point of interest is that the upper molars of Nesophontes offer a similar intermediate condition between the fully developed W-pattern of cones and the V-pattern of Solenodon and perhaps other zalambdodonts. For although Anthony states that the molars of Nesophontes have the "V-shaped metacone only, instead of both metacone and paracone," it seems clear that this appearance must have been due to wear in the specimens he studied. Most of our series of crania of *N. micrus* from Cuba are in a similar condition, but one nearly perfect specimen has the teeth unworn. These show that the first and second molars have a large protocone forming the main cusp of each tooth, with a low cingulum-like ridge representing the hypocone. A small paracone is clearly developed, about one fourth the area of the metacone. With wear, the former disappears; yet its outlines seem traceable even in Anthony's figure (Fig. 3) of the palatal view of *N. edithae*. A further reduction in the size of the paracone and protocone, with corresponding enlargement of the metacone, would easily give rise to the type of molar seen in Solenodon. It is not so obvious that this method of derivation would apply equally to the Old World zalambdodonts, but it seems fairly apparent in these two genera of the New World. If this view be accepted, Nesophontes may represent a stage in molar-development ancestral to that of Solenodon, in which the prominent features of the skull and limbs are similar, but the teeth are much more primitive, a stage perhaps in some degree intermediate between the zalambdodonts and the soricoids, though distinctly nearer the former.

The humerus is almost a miniature of that of Solenodon, but more slender, with globose head, strongly marked bicipital groove and deltoid ridge, the last so elevated as to accentuate considerably the compressed form of the shaft. At the distal end, the humerus is

expanded, and has an entepicondylar foramen, as well as a large supratrochlear perforation, which when present in Solenodon, is small. Two small radii that are presumably referable to Nesophontes, differ markedly from that of Solenodon in being much less flattened, and not unusually broadened at the distal end. The femur, except for its proportionally greater length and slenderness, is the counterpart of that of Solenodon.

Measurements.— A nearly perfect cranium, probably that of a female, 9,953 M. C. Z., measures as follows: — greatest length 28 mm.; basal length 25; palatal length 13.4; interorbital width 6.5; width of brain-case 11.2; upper tooth-row (alveoli) 12.8; lower jaw, ♂ (9,898 M. C. Z.), greatest length exclusive of incisors 18.5; tooth-row, from front of canine to back of last molar 12. Humerus, greatest length (9,914 M. C. Z.) 14.7 (of *N. edithae* 25); radius (9,947 M. C. Z.) 14.5; femur, ♂ (9,915 M. C. Z.) 21.5; ♀ (9,958 M. C. Z.) 16 (of *N. edithae* 26.5).

Mr. H. E. Anthony has kindly placed at my disposal a fine skull of this species, which he collected with others, in a cave at the eastern end of Cuba. It appears to differ in no way from the specimens in the Museum from the western end of the island. A single humerus from a cave in the Sierra de Casas, Isle of Pines, as well as Peterson's (1917, p. 360) recent announcement of the discovery of a poorly preserved skull and ramus establishes the former occurrence of the species on that island as well. The evidence at hand indicates that until a comparatively late date the species was common in Cuba and the Isle of Pines; that it was a primitive type, unmodified either for arboreal or fossorial life, hence probably of shrew-like terrestrial habits. While probably related to the Solenodon stock, its teeth appear to be of a more primitive style and represent what may have been a stage ancestral to the Solenodon molar, in which the paracone was becoming suppressed in favor of the metacone. So fresh is the appearance of some of the jaws obtained, that it would come as no surprise to discover that Nesophontes still exists alive in some isolated part of Cuba.

It is odd that no remains of the Solenodon have come to light in any of the cave-material collected, except at Maisi, where Señor V. J. Rodriguez obtained two lower rami, one of which has been presented to the Museum by Professor Carlos de la Torre. These seem in fresh condition, except for a slight reddish discoloration.

Boromys torrei G. M. Allen.

Plate 1, fig. 11–13.

Boromys torrei G. M. Allen, Bull. M. C. Z., 1917, **61**, p. 6, pl., fig. 10–13.

Boromys was founded by Miller (1916) on the anterior half of a skull excavated in the ancient Indian village-site at Maisi, Baracoa, Cuba, and named *Boromys offella*. The fragments from Sierra de Hato Nuevo which I described as *Boromys torrei*, a much smaller species, included but two upper teeth with palate, and all but the last molar of the lower jaw. The later collections of Messrs. Barbour, Brooks, and Warner include numerous jaws of both animals, and a very fine cranium (Plate 1, fig. 11–13), lacking the incisors, of *B. torrei*. This discovery enables a clearer determination of the characters of the species. The skull is evidently adult, though not aged, since the basioccipital suture is still unclosed. All the teeth are well worn down so that the posterior molar alone retains the enamel lakes left by the wearing away of the secondary re-entrant folds. That this smaller species is really a Boromys and not referable to the Santo Domingan Brotomys is proved by the presence of the supplementary groove at the inner lower corner of the large antorbital foramen, and the pronounced swelling on the inner wall of this part of the maxillary, caused by the root of the upper incisor. The general structure of the skull is much like that of Capromys, but the dorsal profile is more rounded. As in that genus, the parietals and interparietals have fused into a solid plate while the frontals still retain their boundaries distinct. The nasals are lost, but seem to have bowed outwardly at the sides, and to have ended proximally on a level with the ends of the ascending premaxillary branches. The rostrum is short. The incisive foramina open into a broadly excavated pit, the outlines of which are carried back as raised ridges to the inner corner of the first molariform teeth. The small cylindrical cheek-teeth are in two parallel rows, their grinding surfaces bevelled slightly outward. The anterior three have worn down below the level of the secondary re-entrant folds of enamel, so that their pattern is that of a figure 8, with the inner re-entrant very slightly in advance of the outer. The last molar is less worn, and contains in the anterior half of its crown, a transversely oval enamel-lake, and in the posterior half a much smaller circular one. The postpalatal portion of the skull comprises about one half its total length. The striking feature is the great proportionate size of the audital bullae, the length of which is a third the basal

length of the skull. As in Capromys, the mastoid and styloid processes are slender but well developed, though damaged in the specimen. Among the many fragments of crania and lower jaws are two rami containing all the teeth, and so supplying the characters of the last lower molar, which, in my previous paper, I was unable to give. As there shown, it is the premolar only that has a secondary re-entrant loop of enamel in the anterior half of the crown. In all three lower molars, the enamel-pattern is essentially similar, and consists of an outer and an inner median fold, the tip of the former ending slightly behind that of the latter; in the posterior half of the crown is a secondary shallower re-entrant from the inner side, that becomes cut off by wear to form a small round enamel-lake, and then by further wear disappears altogether. In *Boromys torrei*, the last lower molar differs from the two preceding in its reduced crown-area and in the proportionally greater length of the main inner re-entrant, which extends nearly to the opposite side of the tooth. The general character of the tooth-pattern shows much resemblance to that of the less specialized types of spiny-rats (Echimys) and even to that of Thryonomys. The form of the skull, however, is very different in its short rostrum, weak teeth, large bullae and full, rounded brain-case, suggestive of a tree-living animal.

The skull measures: — greatest length 42.5 mm.; basal length 33.4; palatal length 17; diastema 9.5; zygomatic width 23; mastoid width 18.5; least interorbital width 11; upper cheek-teeth (crowns) 7.2; lower cheek-teeth (crowns) 7; lower diastema 5.

Sundry associated limb-bones are taken to be those of this species, and indicate a relatively short-legged animal with separate tibia and fibula as in Echimys, Capromys, Thryonomys.

In addition to the series of specimens from Sierra de Hato Nuevo, Messrs. W. S. Brooks and Goodwin Warner obtained this species also in recent cave-deposits from Sierra de Casas, Isle of Pines, indicating that its distribution formerly included that island as well. Peterson (1917) has lately published the finding of five "skulls and portions of skulls" in a cave on this island by the Messrs. Link in 1913.

Boromys offella Miller.

Plate 1, fig. 6.

Boromys offella Miller, Smithsonian misc. coll., 1916, **66**, no. 12, p. 8.

This larger species of Boromys was based on the anterior half of a cranium from the Indian village-site at Maisi, Baracoa, Cuba. The

collections made by Messrs. Barbour, Brooks, and Warner, include maxillae and a fine series of lower jaws from the caves not only at Limones, Cuba, but from those of the Sierra de Casas, Isle of Pines, as well. Except for greater size, I am unable to find any real difference in the teeth and jaws of the two species. The young of *B. offella*, in which the last molar is unerupted, have a tooth-row as long as that of adult *B. torrei* with all four teeth. The crown-area in adults of the former is about thrice that of the latter. The cheek-teeth begin to wear at an early age. One specimen (9,935 M. C. Z.) has pm_4 and m_1 only in place, with an unworn m_2 just emerging, but already the premolar is so worn that the secondary enamel-folds are reduced to small, round lakes. The posterior of these is first to disappear, and in old animals the main re-entrants are also reduced to ellipses in the anterior teeth (Plate 1, fig. 6) before the secondary folds are quite gone from the posterior pair. The incisors are bright orange on their anterior face. The jaw is of the typical octodont form, but the coronoid process is small, the condylar process low and rounded, the angulare long and tapering, surpassing the condyle in backward extent.

The adult specimens give the following measurements: — upper cheek teeth (alveoli) 11.5 mm.; three anterior cheek teeth (crowns) 9; lower cheek teeth (alveoli) 11.5; (crowns) 10.8; lower diastema 9.4; greatest length from condyle of jaw to base of incisor above 37; greatest length from angular process to same point 42; depth of jaw at condyle 17.

The presence of two closely related species of Boromys in Cuba and Isle of Pines has an interesting parallel in the two (or more) species of Capromys, as well as of crows, among birds. No doubt there were some further differences in structure and habit that do not appear from the fragments at hand.

Capromys nana G. M. Allen.

Plate 1, fig. 1–5.

Capromys nana G. M. Allen, Proc. N. E. zool. club, 1917, **6**, p. 54.

This small species I described lately on the basis of jaw-fragments found in a subfossil condition in cave-deposits at two localities in Cuba, near Limones and in the Sierra de Hato Nuevo. These were collected by Dr. Thomas Barbour during his stay in that island early

in 1917, and were associated with remains of Nesophontes, Boromys, and Geocapromys. It was supposed that the species must have become extinct since the introduction of house-rats by Europeans, for, being of nearly the same size as a rat, it would soon come into competition with them. While in central Cuba, Dr. Barbour made many inquiries among the country people with a view to eliciting possible information as to the supposedly extinct mammals, and finally learned through Señor Lucas Ramos of a very small rat-like species, not a house-rat, that was seen rarely. Through the interest of this gentleman and of Señor Don José Garcia, one of these animals was finally captured and sent by Señor Garcia to the Museum, preserved in alcohol. It is of very great interest to find that it is *Capromys nana*, proving that this fourth species of the genus is yet extant in Cuba. According to Señores Ramos and Garcia, live individuals have been seen on a few occasions, as when saw-grass has been fired to improve grazing, thus forcing them to rush off to places of safety. No doubt its range was formerly much more extensive as shown by the presence of its remains in at least two separate localities in western Cuba.

The skin of this alcoholic specimen has been very handsomely prepared by Mr. George Nelson. The animal is an adult female, of about the size of a large Norway Rat, and a typical Capromys, nearest resembling in general appearance *C. prehensilis*, though with a tail distinctly bicolored, dark above and light below except at the tip which is black all around. The upper surface of the head, body, and forearms is a mixture of long black hairs with hairs having an ochraceous tip, except that on the muzzle and in front of the ear these particolored hairs have whitish tips instead. The fingers and sides of the feet are whitish, but the middle of the metacarpal and metatarsal regions is darkened. On the rump the ochraceous tips of the hairs become longer and deeper colored, and extend on to the base of the tail for nearly three quarters of an inch. Beyond this point, the character of the hair changes, becoming shorter, less coarse, and (particularly on the lower side) slightly recurved, so as to give a somewhat bushy appearance. The scaly surface of the tail is faintly visible through its covering. The dorsal side of the tail is black, as well as the terminal inch of the lower surface, but elsewhere is pale ochraceous buff, rather sharply marked off. The throat and sides of the belly are like the back, but paler and with less admixture of black hairs; the chin, middle of belly, and inner sides of the legs grayish or dull white. The vibrissae are deep black; the ears nearly naked but sparsely covered with short black hairs.

The mammae are two on each side, as in other members of the genus, one pair pectoral, one abdominal, situated well up on the sides. The naked soles of both fore and hind feet are granulated, but like those of *C. prehensilis*, have three larger pad-like areas on the palms, with on the fore feet, two additional ones nearer the carpus.

The measurements in the flesh are: — total length 395 mm.; tail 176; hind foot with claws, 45 long, by 14 in greatest width of palm; ear from meatus 19, its greatest transverse width 14.5.

The viscera were somewhat macerated, but in so far as could be ascertained, seemed to differ in no important way from the soft parts of *C. melanurus* as described by Dobson (1884). The coecum seemed relatively larger, about the length of the body-cavity, and distinctly sacculated (about 115 mm. long). The body-cavity posterior to the diaphragm is large to accommodate the intestinal mass. The large ovoid kidneys are conspicuous, and as in *C. pilorides* have an elongate oval adrenal body close to the anterior end of each. The liver is like that of *C. melanurus* except that it appears to lack the small secondary lobe at the base of the main anterior lobe of the left side. This lobe is present in both *C. melanurus* and *C. pilorides*. As first described by Say (1822), the liver in the latter species is remarkable on account of its being minutely divided into separate glandular masses closely appressed, so that exteriorly the main lobes have a reticulate appearance. This character, so evident in *C. pilorides*, is quite absent in the livers of *C. melanurus*, *C. prehensilis*, and *C. nana*, which present the usual solid structure. The small thoracic cavity is bounded posteriorly by the diaphragm which reaches ventrally the 10th rib, and dorsally extends back as far as the 12th. The lungs agree in their general form with those of *C. melanurus* and *C. pilorides* as described by Owen (1832).

In the characters of the skull, *C. nana* is in several ways the most primitive of the genus, with certain striking resemblances to the spiny-rats (Echimyinae). Thus the brain-case is much less prolonged and rounder in profile than in any of the other species. The orbit is very large for the genus, larger than the antorbital foramen, with a lighter zygomatic arch, in decided contrast to adults of the other species, in which the height of this foramen equals (*C. prehensilis* and *C. melanurus*) or exceeds (*C. pilorides* and Geocapromys (the vertical diameter of the orbit. A third point of resemblance to the spiny-rats is in the narrow ledge or beading overhanging the orbit and temporal fossa as far back as to include the upper edge of the squamosal process. That these characters are primitive is indicated by the fact

that in a young skull of *C. prehensilis* having but three molariform teeth, they are nearly as apparent, though the skull is already somewhat produced behind, the orbit is only slightly higher than the antorbital foramen, and the supraorbital ledge shows a distinct process. The incisors are white in the young *C. prehensilis* as in adult *C. nana*, but in adults of both *C. prehensilis* and *C. melanurus* are yellow. A distinctive feature of the palate in *C. nana* is the knife-like median bony ridge, terminating in a slight projection at the posterior border. The teeth are hardly to be distinguished except for their small size, from those of *C. prehensilis*.

Except for the brief account by Chapman (1901, p. 320) no comparisons seem to have been made between *C. prehensilis* and *C. melanurus*. The series of both species in the Museum, shows that the skulls of the two are very similar, and differ chiefly in that *C. melanurus* has slightly more inflated frontals, with less developed post-orbital processes. On the inferior side of the skull, the noteworthy difference lies in the narrower basioccipital and basisphenoid of the latter species. So greatly does *C. melanurus* resemble *C. prehensilis* in its general characters that it seems reasonable to consider it an offshoot from the latter, that under the slightly different conditions at the eastern end of Cuba, and with perhaps slightly more squirrel-like habits, has developed here since the isolation of Cuba from the mainland. The tail is apparently not used as a prehensile organ in the way characteristic of *C. prehensilis*, for the hairs are longer and unworn in the series studied, in contrast to the short-haired tails of *C. prehensilis* in which the hair is often much more worn away on one side than on the other. The color of the tail in *C. melanurus* varies from black to deep maroon or rusty.

Correlated with the difference in use of the tail, is its greater bushiness in *C. melanurus*, as well as its tendency to break off easily near the base, a peculiarity it shares with the Echimyinae. Dr. Barbour, who is familiar with both *C. prehensilis* and *C. melanurus* in life, says that the hunters are always careful not to seize a wounded *C. melanurus* by the tail, well knowing how easily that member parts and allows the animal to escape, whereas with *C. prehensilis* no such precaution is taken. As with the spiny-rats, the place where the tail breaks easiest is near the base, where the character of the hair changes sharply from the shaggy pelage of the body to the shorter covering of the tail. The loss of this appendage seems to cause no particular discomfort to the animal. It comes away easily, without bleeding, leaving a rosette of frayed muscle-fibers at the stump, just as with a lizard's tail when broken.

Following are measurements of the skull and other bones of *C. nana*. Skull: — greatest length 51 mm.; basal length 45.5; palatal length 26.4; diastema 13.7; nasals 15; zygomatic width 28; mastoid width, 20; least interorbital width 11.7; width outside last upper molar 9; audital bulla 12 × 8.6; vertical diameter of orbit 11.8; of antorbital foramen 9.5; length of upper tooth-row 11; of lower tooth-row 11.2. Length of humerus 32.7; radius 29.5; ulna 36.7; femur 39; tibia 40.5; fibula 36; pelvis 45.5.

The number of vertebrae in the four species of the genus, and in a specimen of Geocapromys, was found to be as follows:—

	Cervicals	*Dorsals*	*Lumbars*	*Sacrals*	*Caudals*
C. pilorides	7	16	7	4	21 = 55
C. prehensilis	7	18	6	4	28 = 63
C. melanurus	7	17	7	4	28 = 63
C. nana	7	16	6	4	28 = 61
G. thoracatus	7	15	6	4	17 = 49

The agreement in total number of vertebrae between *C. prehensilis* and *C. melanurus* is probably evidence of their close relationship. In the only two skeletons examined, that of the former had one more dorsal but one less lumbar than that of the latter. In *C. nana*, the number of ribs is slightly reduced — sixteen — and there are but six lumbars. Geocapromys has the fewest ribs — fifteen. The tail-vertebrae are 28 in *C. prehensilis*, *C. melanurus*, and *C. nana*, but are more reduced in *C. pilorides* (with 21) and Geocapromys with only seventeen.

The structure of the sternum is essentially similar in all four species. In *C. pilorides*, there are in addition to manubrium and xiphisternum, six other sternebra. In a ventral view, the adult sternum shows the fifth and sixth practically fused, though the line of fusion is distinctly marked. The seventh sternebrum is visible in a dorsal view only, as a very short nodule of bone, lying above the posterior end of the fifth. It offers attachment to the cartilaginous portions of the seventh pair of ribs. The xiphisternum adjoins this segment and consequently lies dorsal to the plane of the others. The cartilaginous parts of the eighth pair of ribs alone unite with its anterior end. The conditions in *C. prehensilis* seem to be nearly similar, except that in the single young specimen available, the fifth and sixth sternebra had not yet united, and the seventh sternebrum is extremely small, a minute nodule. The cartilaginous tips of the eighth and ninth ribs both adjoin

the anterior end of the xiphisternum. The sternum of *C. melanurus* is apparently similar, except that no trace of the small seventh sternebrum was found in the single skeleton examined. The sternum of *C. nana* differs only in that the small seventh segment has fused with the xiphisternum. The ends of the seventh and eighth pairs of ribs are attached at this point. The manubrium is transversely lozenge-shaped with a relatively long narrow stem, different from the short stem of *C. prehensilis* and *C. melanurus*. The xiphisternum also is slender as in *C. pilorides*.

In other details of the skeleton, *C. nana* resembles the three other species of the genus. The clavicles are well developed, the tibia and fibula are separate, and the femur has the straight outer border, rather characteristic of many octodonts, without the prominent external trochanteric ridge, seen for example in the house-rats (Epimys). The species is probably altogether, the most generalized of the genus.

Geocapromys columbianus (Chapman).

Capromys columbianus Chapman, Bull. Amer. mus. nat. hist., 1892, **4**, p. 314, fig. 3, 4.
Synodontomys columbianus G. M. Allen, Bull. M. C. Z., 1917, **61**, p. 5.
Geocapromys cubanus G. M. Allen, Bull. M. C. Z., 1917, **61**, p. 9, pl., fig. 7–9.

The wealth of excellent specimens received since my study of the fragments described as *Geocapromys cubanus*, shows not only that the latter represented young or smallish animals, but also that they are undoubtedly the same species as Chapman's *Capromys columbianus* described from Cuban cave-fossils. The approximation of the tooth-rows appears to increase slightly with age, but though considerable, does not amount to actual contact as had seemed to be indicated by the figures of the type and by the specimen itself, which is slightly broken at the front end of the palate. The Cuban Geocapromys proves to have been an animal quite as large as the Jamaican *G. browni* if not a trifle larger, hence considerably larger than *G. thoracatus* and *G. ingrahami*. The palate offers several differential characters. Its median bony ridge ends abruptly at the palatal margin in *G. browni;* in *G. thoracatus* it continues as a short median projection at that point; but in both *G. ingrahami* and *G. columbianus* it fades out before reaching the palatal margin. In the last species also, the opening of the posterior nares is much the most narrowed and the terminal wings of the palatals are correspondingly broadened

behind the palatal margin. The molar alveoli are more or less square in outline, and the re-entrant enamel-folds of the teeth are noticeably more nearly at right angles to the axis of the tooth-row than in the large *Capromys pilorides*, remains of which are found associated in the same caves. Another feature that comes out in comparison of the jaws of this and the last-named species, is that in Geocapromys the posterior face of the last lower molar is nearly straight across instead of at a decided angle to the long axis of the tooth-row. This character is useful to identify toothless jaws, since the shape of the alveoli is thus quite different; frequently too, the presence of the additional internal bony ridge in the alveolus of the premolar can be made out.

While the Cuban Geocapromys is intermediate in certain palatal characters between *G. ingrahami* and *G. browni*, I have been unable to find any points of difference between fragments from the Cuban caves and those from caves in Sierra de Casas, Isle of Pines, where Dr. Barbour's party obtained a series. This is the more interesting, since both species of Capromys from the latter island differ slightly from their Cuban representatives.

In a single skull in which the premaxillary is preserved, its ascending process is less broadened proximally than in *G. browni* and *G. ingrahami*, and is thus more like that of *G. thoracatus*.

The alveolar length of the maxillary tooth-row in a full grown specimen is 21 mm.; of the mandibular row 19 mm.

Remarks.

The preliminary exploration of the Cuban cavern-deposits, as carried out by Dr. Barbour and his associates, as well as by Mr. H. E. Anthony of New York, and Mr. William Palmer of Washington, has thus far revealed nothing really comparable with the fossil or subfossil mammals from the Porto Rican caves, with two exceptions. These are the insectivore Nesophontes, of which a small representative is found in Cuba, and a larger one in Porto Rico; and the small ground-sloth, Acratocnus of Porto Rico, which is represented in Cuba by a closely allied if not identical genus. For the rest, the three Cuban species of Capromys find no strict counterparts elsewhere, though Geocapromys is represented on Jamaica, Swan Island, and Plana Keys. The Porto Rican Isolobodon is nearly allied to Capromys and to the Santo Domingan Plagiodontia, but its origin is doubtful. In Porto Rico Mr. J. L. Peters and I found its remains either in Indian shell-heaps or

altogether superficially — actually exposed on the surface — in caves. This may indicate that it was kept for food by the natives and carried from one island to another, for neither Dr. Boaz, nor Mr. Peters and myself found its bones in deeper excavations that produced the ground sloth, Acratocnus, Heteropsomys, Heptaxodon, or Elasmodontomys. The complete identity of Isolobodon remains from Santo Domingo with those from Porto Rico, as shown by Miller, is further indication of some such equalizing factor. Nothing corresponding to Boromys has been discovered in Porto Rico, though Brotomys of Santo Domingo is probably related. Of other Porto Rican genera, Elasmodontomys, Heteropsomys, Homopsomys, and Heptaxodon, nothing has as yet appeared in the islands to the west.

Contrary, then, to what one might perhaps expect, the present evidence shows that Porto Rico, the Greater Antillean island most distant from the North American continent but nearest the South American end of the chain, contained the most varied fauna of terrestrial mammals as well as the largest forms (except for Megalochnus). For Elasmodontomys was bigger than the common porcupine, Heteropsomys was as large as an agouti; while Amblyrhiza, of Anguilla, was nearly the size of a paca. These facts suggest that the land-mammals of Cuba are farther distant than those of Porto Rico from some center of distribution and reached there, not by way of Central America, but from South America by way of the supposed former land-mass of which the Lesser Antilles now form the remnant. The fact that Procapromys, the nearest living continental relative of Geocapromys and Capromys, is to be found so far as yet known, only in the mountains of Venezuela, between La Guayra and Caracas, possibly points in the same direction. Further exploration alone, however, may hope to solve the matter.

The comparison with Santo Domingo merely accentuates the known peculiarity of its fauna, for with the exception of Solenodon, generically identical with the Cuban form, its few other genera hitherto known are not seen on the other islands, namely, Brotomys, Plagiodontia, and (if it be endemic there) Isolobodon.

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EXPLANATION OF THE PLATE.

EXPLANATION OF THE PLATE.

Fig. 1–5, *Capromys nana.*

Fig. 1. Cranium from below. 17,361 M. C. Z. × 1.
Fig. 2. Same in profile. × 1.
Fig. 3. Same from above. × 1.
Fig. 4. Exterior view of right ramus. × 1.
Fig. 5. Crown view of type ramus. 9,864 M. C. Z. × 2.

Fig. 6, *Boromys offella.*

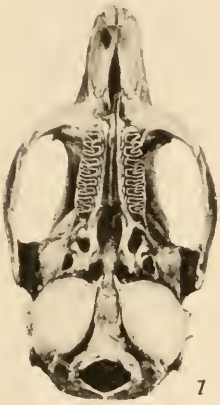
Fig. 6. Left lower ramus, showing much worn crowns of molars 1 and 2. 9,916 M. C. Z. × 2

Fig. 7–10, *Nesophontes micrus.*

Fig. 7. Left ramus in profile, showing canine, premolars and molars. × 2.
Fig. 8. Cranium from below, female. 9,953 M. C. Z. × 1.
Fig. 9. Rostrum in profile, showing double-rooted canine. 9,892 M. C. Z. × 2.
Fig. 10. Cranium from above, female. 9,953 M. C. Z. × 1.

Fig. 11–13, *Boromys torrei.*

Fig. 11. Cranium from below. 9,926 M. C. Z. × 1.
Fig. 12. Same in profile. × 1
Fig. 13. Same from above. × 1.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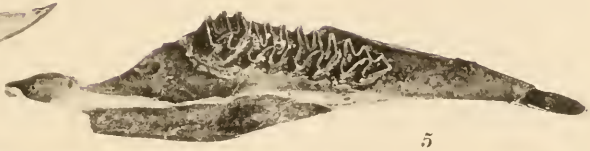
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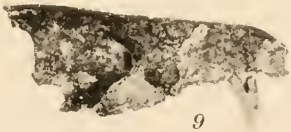
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