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WEST INDIAN FOSSIL MONKEYS

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On three occasions (two previously published and one that is reported here for the first time) monkeys have been found interred in the soil of a West Indian island. Because no living indigenous monkey has been recorded by science in the Antilles, the poor remains of these animals have received more attention than their condition as specimens would ordinarily command. The three isolated finds, one on Cuba, one on Hispaniola, and one on Jamaica, are the sole scientific evidence of the existence of lower primates on these islands, except for three feral colonies of Old World monkeys in the Lesser Antilles, the introduction of which is a matter of historical record.

The present paper places on record the present status of our information regarding the three fossil finds. Their possible zoogeographic importance requires that even the poorest of them be given full and careful treatment. At the same time the incompleteness and inadequacy of all the material preclude major zoogeographic conclusions at this time. As with other papers that have recently appeared or are projected by the present authors (or by Max Hecht or others)[1] on West Indian materials, the primary intention is to add to the store of factual evidence regarding West Indian paleontology, Recent faunas, and zoogeography, and so to stimulate interest and activity in this field. When a broader base of fact has in the end been accumulated, firmer conclusions can be grounded upon it.

Because the interest of this paper, as of other papers in this informal series, is principally in the general West Indian picture, the wider taxonomic implications of one of the finds here discussed

[1] At present these are: Hecht (1951), Koopman (1950, and a paper in press), Koopman and Williams (1951), Williams (1950), and Williams and Koopman (1951).

are not followed through but are left to the specialists: the Jamaican monkey which is here for the first time described may, we feel, be the representative of a new subfamily of ceboid monkeys. But to define such a subfamily and to rearrange the classification of the other platyrrhine monkeys, as might be necessary, would be a task of a scope outside the limits of our materials and our knowledge.

THE CUBAN MONKEY

In 1911 Florentino Ameghino described the first of the fossil monkeys to be discovered in the West Indies. He erected the new genus and species *Montaneia anthropomorpha* for 16 teeth, all from the mandible of one animal found by Luis Montane in a pre-Columbian human burial cave near Sancti Spiritus, Cuba. Ameghino published the new name in a short "nota preliminar" without figures; he stressed resemblances in the teeth both to the spider monkey *Ateles* and to man.

In 1916 Montane brought the type of *Montaneia anthropomorpha* to the United States and submitted it to G. S. Miller for examination. Miller was struck at once by the similarity of the teeth to those of *Ateles*, a similarity which for him amounted to clear evidence of generic identity. He did not, however, find identification of the species so easy. The difficulties in this regard arose from the large size of the teeth and the unusually well-marked development of a hypoconulid, the latter feature being the one emphasized by Ameghino in suggesting hominoid affinities. No specimen at the United States National Museum, the American Museum of Natural History, or the Museum of Comparative Zoölogy could be considered conspecific. A photograph of the 16 teeth of *Montaneia anthropomorpha* was sent to Oldfield Thomas at the British Museum. Examining the collections of that museum, Thomas selected a specimen of *Ateles* from Ecuador as possibly conspecific but refused to commit himself in any positive fashion. Miller therefore published a note (Miller, 1916) relegating the genus *Montaneia* to the synonymy of *Ateles* but leaving the question of specific identity open.

We have not seen the type of *Montaneia anthropomorpha*, but we may safely rely on the very good photograph of the teeth of the fossil, side by side with a mandible of *Ateles*, published by Miller. The determination of the fossil as *Ateles* seems to be quite certain, and with the increase of collections since 1916 and with

recent advances in the taxonomy of *Ateles* (Kellogg and Goldman, 1944) it is now possible to be more positive about the specific identity. The Ecuadorean species of *Ateles* is now recognized as ranging up into Panama and thus well within trading range of Cuba. A geographic difficulty that doubtless impressed both Miller and Oldfield Thomas therefore disappears, and the hypothesis of importation becomes to that degree more probable. We have examined material of the Ecuadorean-Panamanian species *Ateles fuscipes* at the Museum of Comparative Zoölogy and at the American Museum of Natural History, and in size and in the frequent development of a hypoconulid the mandibular teeth of this form compare very well with those in the photograph of the Cuban type. In addition the hypothesis of importation is for us strengthened by the nature of the find. Sixteen loose teeth belonging to the mandible of one animal, without any other elements or fragments of the species, seem to us a most improbable accident of fossilization, especially since these teeth were found in a human burial cave. They may well have been used in connection with some type of human ornament. We think it likely that the teeth were imported, but we do not find it necessary to suppose that the animal was imported or to imagine with Thomas Barbour (1945, p. 302) that these monkey teeth in Cuba are "the remains of what once was an organ grinder's monkey which escaped to a Cuban cave and perhaps there died a miserable death." Tentatively we regard *Montaneia anthropomorpha* as a synonym of *Ateles fuscipes robustus* and its presence in Cuba as a consequence of the use of teeth in human ornamentation.

THE HISPANIOLAN MONKEY

The second fossil monkey was found in 1928 by G. S. Miller himself in a kitchen midden at Rio Naranjo Abajo on Samana Bay, the Playa Honda coast of Santo Domingo. It was represented by the distal end of a tibia found among miscellaneous limb bones, chiefly rodent, in this deposit. Its exact level was not determined but its state of preservation was essentially like that of the other bones of the deposit. The identified members of the associated fauna were *Solenodon paradoxus* (one mandible and the distal half of a humerus), *Brotomys voratus* (three mandibles and the right side of a palate), and *Isolobodon portoricensis* (three mandibles and a palate and a molar tooth).

The fragment was 42 mm. long, too large to be compared with the tibia of any South American monkeys smaller than *Cebus* or *Alouatta* and too stout to belong to any of these. In stoutness it resembled more closely that of *Cercopithecus* though agreement was not good with any available species of this genus. Miller therefore provisionally identified it as *Cercopithecus?* sp. in his 1929 report on his explorations of Hispaniolan kitchen middens.

The age of the midden in which Miller found the tibial fragment is not known, but the other recorded mammals of the midden deposit are all native and two are now extinct. The presence of only native mammals should point to an early rather than a late date for the midden.

We have compared the Rio Naranjo Abajo fragment with the distal ends of tibiae of both Old and New World monkeys. The detailed morphology of this area and the taxonomic value of its varied configurations are at present unknown. After the examination of considerable numbers of specimens but never of adequate series of any one species we are left with the impression that the distal ends of tibiae probably have characters that are useful in the recognition of species or genera, but we cannot at the moment say with any confidence what those characters are. Even allocation to family on the basis of this part alone seems to us not possible in the present state of our information. The Hispaniolan fragment more closely resembles the similar parts of some Old World monkeys than it does those of some New World monkeys. There is an evident but incomplete resemblance to some species of *Cercopithecus* and to some *Pithecia*, *Lagothrix*, and *Saimiri*. We have nowhere found a satisfying match for this element.

It is our opinion that the fragment is better stripped of even provisional generic identification and left unidentified except as Primates *incertae sedis*. Until greater numbers of complete skeletons of the order are available for comparison or until more material is unearthed in Hispaniola, no useful purpose is served by attaching any sort of name to this bone fragment.

In this state of affairs it is obviously useless to discuss whether the form represented was indigenous or imported. The hypothesis of importation has certain difficulties if the form is a *Cercopithecus*, since in that event the importation must have been very late in time, well within the historical period. None of the conditions of the midden would seem to offer positive support for

this suggestion, and its proponents are reduced to the plea that no facts are absolutely against it. The tibial fragment itself is in fact critical, and judgment on other points must be suspended until identification can be made.

THE JAMAICAN MONKEY

The third find of a West Indian fossil monkey has not been previously published, although it was made 30 years ago as another of the fruits of Dr. H. E. Anthony's 1919–1920 expedition to Jamacia. We are privileged to quote from Dr. Anthony's field journal the full account of the cave in which the find was made and of the circumstances of the discovery: "January 16, 1920. With Willie Hill to show me about I went down to look into a cave on the Long Mile Piece, referred to hereafter as the Long Mile Cave. It proved to be not more than a good overhang but it looked as if it had formerly been a fair sized cave the ceiling of which had fallen in. It was right alongside the footpath but so well hidden by trees that only one acquainted with the cave would find it. Not expecting to find much I selected the likeliest looking spot and began to dig back under the overhang. The ground everywhere was covered with blocks of limestone of all sizes and by rolling to one side large rocks I had a hole large enough to see what was in the earth. Almost at once I began to find bones and spent the whole morning digging. It proved to be a small kitchen midden on top and yellow limestone detritus below that. In the kitchen midden we found coney[1] bones in abundance as well as a fish bone and a few bird bones. One large bivalve—a conch—was seen. At one side of the midden we found a few human bones and some bits of pottery were scattered here and there throughout the surface. Charcoal was common, and the upper layer was dark and ashlike in appearance. The yellow soil held coney bones, quite common, and the extent of the deposit warranted further excavation in the hopes of getting material antedating the Indian occupation.

"January 17. Spent all day digging in the Long Mile Cave and secured some good bones. The most important find was the lower jaw and femur of a small monkey, found in the yellow limestone detritus. It was not associated with the human remains but not so far from them that the animal must not be

[1] *Geocapromys browni.*

strongly suspected as an introduced species. It was deeper however than any of the human bones by at least 10″ to 1′. Good *Capromys* material was secured, and the hole was put at least 5′ deep when a loose layer of fair sized rock was encountered and no bones were seen. . ."

The Jamaican mandible so discovered proves much more valuable and fertile of suggestion than the other finds (figs. 1–3). It is first of all a satisfactory sort of fossil, a part of the animal that can readily be compared with the abundant recent material. This is because, in the case of mammals, skulls and jaws are consistently saved by collectors. The data of discovery are also better recorded than in any other case, having been rather fully stated in a journal written at the time of discovery.

The Jamaican jaw has been compared with every living genus of New and Old World monkey and either directly or with figures of most fossil types. It seems clearly to be ceboid, but it is not identifiable with any known genus.

The dental formula is $i_2\ c_1\ pm_3\ m_2$, which is the dental formula of the marmosets. That the absence of a third molar is real and not due merely to the failure of that tooth to erupt has been demonstrated by an X-ray of the jaw (fig. 4). There is no trace of a tooth behind the apparent last molar, and in fact the latter tooth is set rather obliquely on the rise of the coronoid process, leaving little or no space for another tooth.

The two molar teeth are quite unlike those of marmosets, being bunodont, with the individual cusps greatly enlarged and the trigonid and talonid basins correspondingly reduced. Both teeth are widest anteriorly. But in *Cebus* in contrast to the Jamaican form there is a strong tendency to the formation of a cross loph connecting protoconid and metaconid. In addition the large hypoconulid, or fifth cusp, which is conspicuous on both molars of the Jamaican form, is not represented in *Cebus*.

In the reduction of the talonid basin and the greater anterior width of m_1 and m_2, the Jamaican animal is very different from *Alouatta*, less different from *Ateles*, *Brachyteles*, *Callicebus*, *Aotes*, *Lagothrix*, *Pithecia*, and *Cacajao*, and still less different from *Saimiri*. The difference is also very conspicuous in m_3, but in most cebids m_3 tends to be wider anteriorly (though sometimes not in *Alouatta*). An anterior loph between the two trigonid cusps is usual in *Callicebus*, *Aotes*, *Cacajao*, and *Lagothrix;* it is not present in the fossil. A fifth cusp is rarely present in living

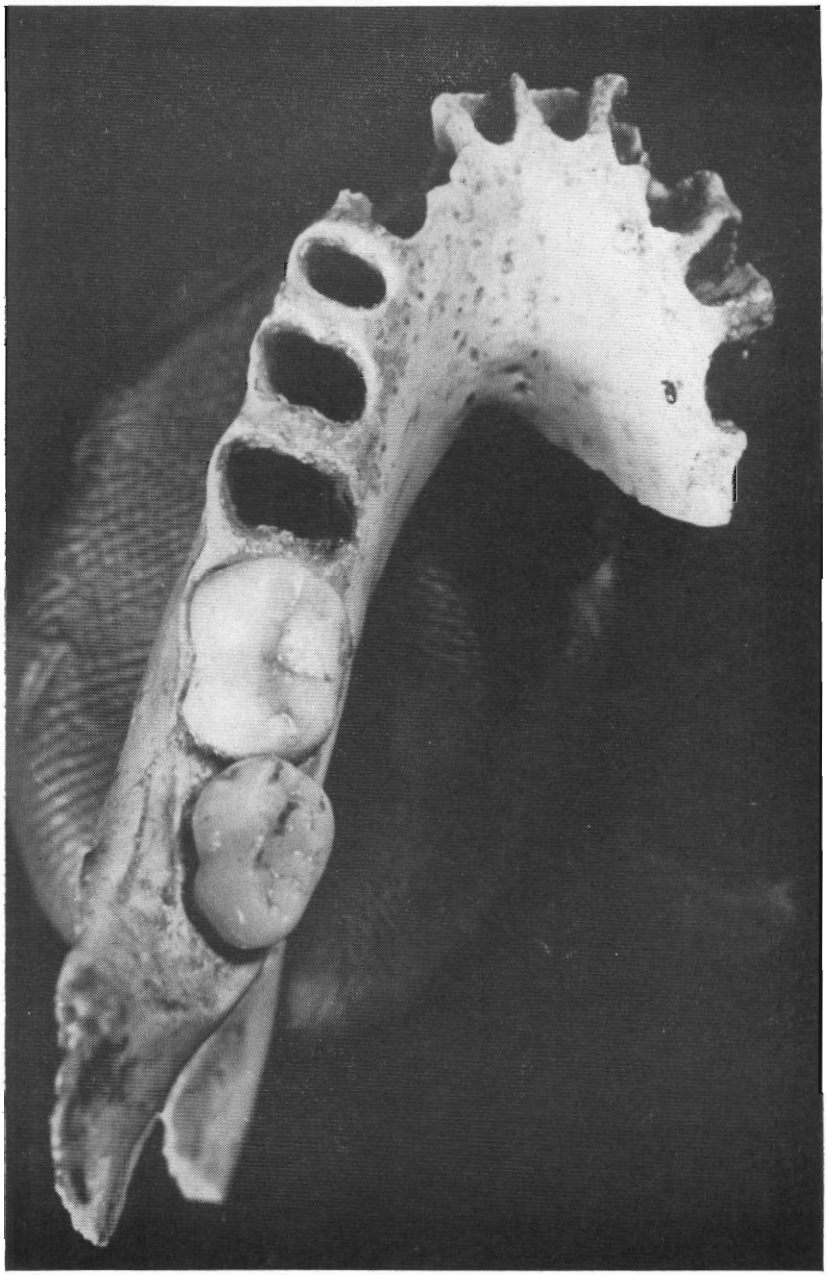

FIG. 1. *Xenothrix mcgregori*, type mandible, A.M.N.H. No. 148198, dorsal view. *Ca.* × 4.

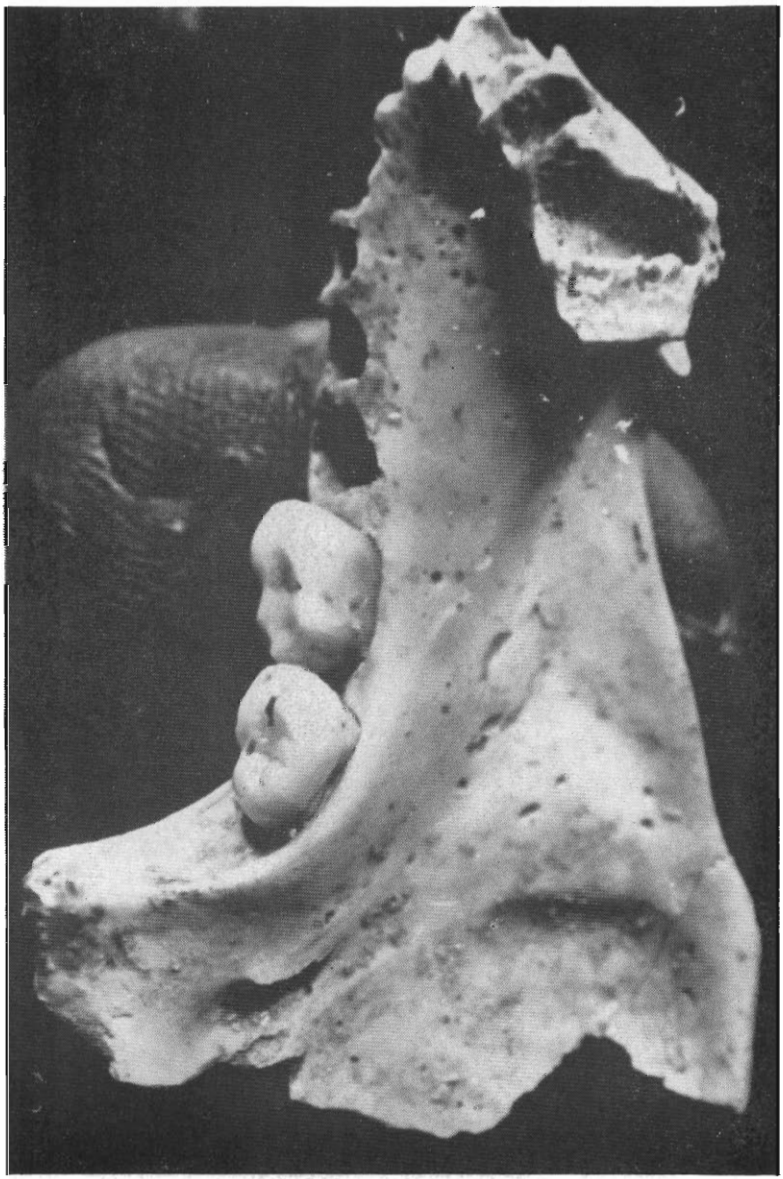

FIG. 2. *Xenothrix mcgregori*, type mandible, A.M.N.H. No. 148198, internal view. *Ca.* × 3½.

cebid genera, except that it is, as mentioned above, not infrequent in Panamanian *Ateles*.

In both molars of the Jamaican form the great size of the trigonid cusps is remarkable. In m_2, which is rather elongate, intermediate cusps are intercalated, one between the protoconid

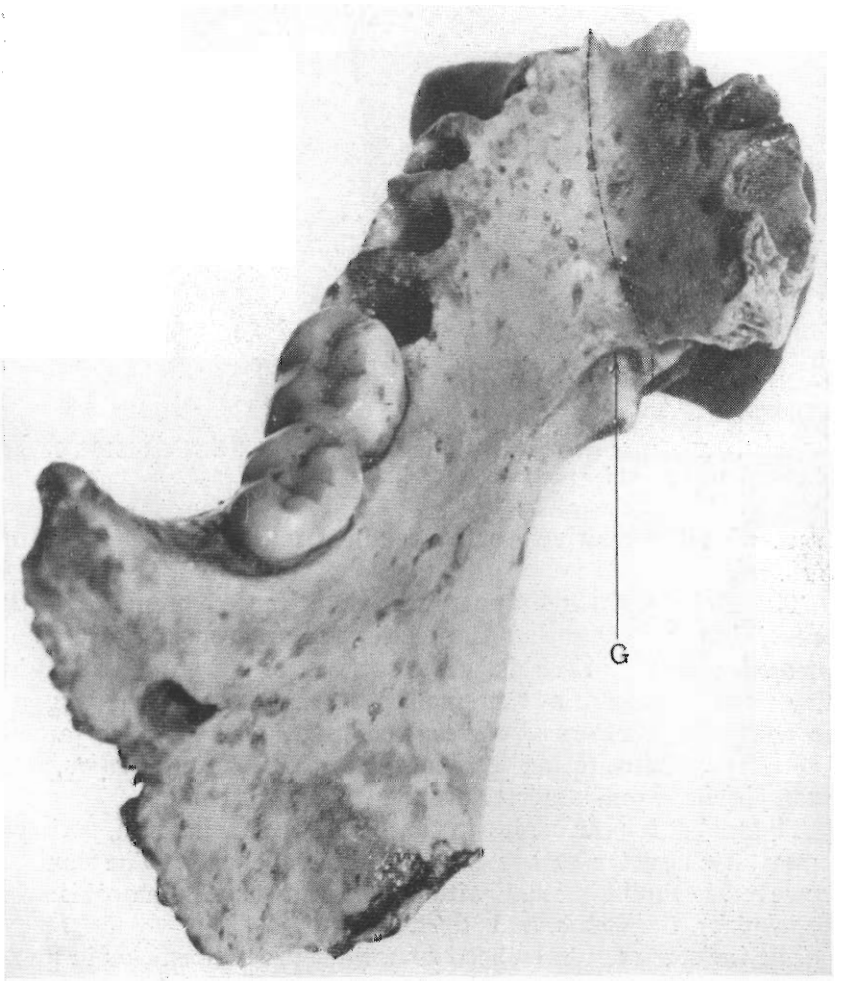

FIG. 3. *Xenothrix mcgregori*, type mandible, A.M.N.H. No. 148198, posterior view. Location of symphysis indicated by dotted line. G indicates fossa genioglossus. *Ca.* × 2¾.

and hypoconid and another between the metaconid and endoconid. These seem to be special features of the Jamaican form.

The molars are quite large relative to the jaw, though the jaw itself is robust. Such relatively large teeth are in living cebids characteristic of *Alouatta* or *Brachyteles* and are in strong con-

FIG. 4. *Xenothrix mcgregori*, type mandible, A.M.N.H. No. 148198, X-ray photograph of posterior portion. *Ca.* × 2.

trast with the relatively small teeth of marmosets or *Cebus* or *Saimiri*.

The sockets of three apparently single-rooted premolar teeth are visible and show that the teeth were anteroposteriorly compressed, as usual in cebids. The sockets form a graded series in size from that for pm_2 the smallest to that for pm_4 the largest. In this latter character *Callicebus* compares well with the Jamaican form. Some other cebids (*Cebus*, *Pithecus*, *Cacajao*, for example) have pm_2 larger, or even much larger, than pm_3.

The socket for the canine in the Jamaican jaw is small, perhaps a sexual character rather than a taxonomic one. The canine, however, is similarly small without marked sexual dimorphism in *Brachyteles*, *Callicebus*, and *Aotes*.

The incisors may have been somewhat procumbent, as in marmosets, i_1 being larger than i_2. These teeth lacked, however, the extreme specialization of those of *Pithecia* or *Cacajao*.

The symphysis slope in the Jamaican jaw is quite oblique, much as in marmosets, not more or less vertical as in cebids. The

fossa genioglossi (fig 3G) is low on the inner surface of the symphysis, almost at the ventral margin, as in cebids and marmosets and other lower primates.

The mental foramen is below pm_3, but the position of the mental foramina proves to be so variable in cebid genera that this character seems taxonomically quite unusable.

The posterior portions of angle and coronoid and all of the condyle are broken away, but enough of the angle remains to show that it was expanded about as in *Callicebus*, *Brachyteles*, or *Lagothrix*, less than is usual in *Alouatta* and more than in *Aotes*.

The top of the groove marking the opening of the mandibular foramen is about one molar distance posterior to the last tooth. This character depends on two factors: the large size of the molar teeth in the Jamaican form and the rather vertical position of the mandibular groove. Such a combination of factors occurs in no living cebid genus. *Brachyteles* sometimes approaches the condition of the Jamaican fossil more closely than does any other genus. The top of the mandibular groove is sometimes only one and one-half molar lengths behind the last molar. In *Alouatta* and *Saimiri*, in both of which the mandibular groove may be oblique and long, the same distance may be very much greater—four molar lengths.

In each of these features a general resemblance to one or another cebid (or ceboid) genus is evident, but the resemblance of the whole jaw to that of any living genus is not at all close. The Jamaican jaw combines the dental formula of a marmoset, the expanded angle of *Callicebus*, and a dental pattern approximating that of *Cebus*.

We have not so far mentioned the fossil cebid genera, *Homunculus* and the other genera erected by Ameghino, and those described very recently by Stirton and Savage (1951) and Stirton (1951) from the Miocene of Colombia (*Cebupithecia*, *Neosaimiri*). We have not in these cases been able to make direct comparisons with the specimens but have relied on the figures in the literature. Though such a procedure is not completely satisfactory, we are still confident that the Jamaican form is very distinct from these also.

Also neglected in the discussion thus far has been the rare and peculiar genus *Callimico*, interesting because intermediate in some characters between marmosets and cebids. We have here been able to make the comparison directly with specimens belonging

to the American Museum. It may first be stated that the Jamaican fossil has no closer resemblance to this genus than to any other genus of marmosets or cebids. Though both forms are in some ways intermediate between cebids and marmosets, the intermediacy is in different characters in the two cases. In dental pattern *Callimico* resembles the marmosets, in dental formula the cebids. In dental pattern the Jamaican form resembles the advanced genus, *Cebus*, in dental formula the marmosets. In the rather vertical position of mandibular symphysis and of the incisors Thomas (1913) found *Callimico* to manifest closer affinities with the Cebidae; in the obliquity of both symphysis and incisors the fossil is marmoset-like.

With such a problem confronting us, we find ourselves in full agreement with Stirton's (1951) suggestion that the separation of the marmosets as a family Callithricidae tends to obscure their true relationships. That conclusion is, we feel, almost demanded by the new evidence of the Jamaican form.

At all events we regard it as a conservative rather than a radical judgment to conclude that the Jamaican fossil requires the erection of a new genus to contain it.

FAMILY **CEBIDAE**

XENOTHRIX, NEW GENUS

GENOTYPE: *Xenothrix mcgregori*, new species.[1]

GENERIC DIAGNOSIS: Lower dental formula, i_2 c_1 p_3 m_2, as in marmosets, but size moderate rather than small and jaw stout, with angle expanded as in *Callicebus*. Lower molars large, quadrate, wider anteriorly, five-cusped and bunodont, with talonid basin greatly reduced. M_2 elongate, with accessory cusps between protoconid and hypoconid and between metaconid and endoconid. Premolars transversely compressed, graduated in size, the last largest. Canine small. Incisors slightly procumbent, the first larger than the second. Symphysis oblique.

Xenothrix mcgregori, new species

TYPE: A partial mandible with two teeth (A.M.N.H. No. 148198).

[1] This species is named in honor of Dr. J. H. McGregor, our respected teacher and world-famous student of living and fossil primates.

TYPE LOCALITY: Long Mile Cave, Trelawney Parish, Jamaica, British West Indies.

AGE: Pleistocene or Recent.

SPECIFIC DIAGNOSIS: With the characters of the genus.

The femur that Anthony described as associated with the Jamaican jaw has not been found. No such femur was placed with the jaw when the collection came into our hands. However, in sorting over the miscellaneous limb bones from the same cave (bones without definite data as to level or association or lack of association with the kitchen midden), we found a few limb bones that are not *Geocapromys*, the omnipresent rodent of the cave, and for reasons of erosion and fracture are difficult to identify. These include a femur, two tibiae, and a pelvis. After comparison of the femur with all primate material available to us, we have decided that it cannot belong to the Order Primates. Although the two tibiae are only proximal parts and are much eroded, they also seem not to be primate. The pelvis, however, compares closely with that of *Cebus* (but not more closely than with that of some other cebid genera), and, while we do not feel entitled to identify it generically, it would seem to be another fragment of a ceboid monkey from this cave. We have not referred it to *Xenothrix* because of the lack of any evidence of association beyond presence in the same cave. In size it would appear to be suitable, since *Xenothrix* was nearly the size of *Cebus*.

For the present, therefore, our conception of the new genus must be founded entirely on the mandible, and on that basis *Xenothrix* would seem to be a very well-differentiated form.

It is still a question whether it is an Antillean endemic. On this point it is well to review the meager evidence. The jaw was found 10 inches to 1 foot below a kitchen midden in yellow soil. In other caves in Jamaica such yellowish or reddish soil has often implied considerable age, and the contained fauna has included some extinct forms of bats and lizards. In this case, however, the only form mentioned by Anthony as occurring in the deposit apart from *Xenothrix* itself was *Geocapromys browni*, an animal that has unfortunately a considerable vertical range in Jamaica, being known still living and also from some of the oldest cave deposits.

Geocapromys, indeed, as Anthony remarked, was found abunbantly in the kitchen midden of Long Mile Cave, a midden apparently of post-Columbian age since it includes pig (*Sus*).

If the yellow layers were undisturbed and included no other hint of human agency, it would still seem probable that the monkey was ancient. However, since the collections came under study by us only after a 30-year interval and since any stratigraphic data or special association originally present is now lost, it is no longer possible to make any statement regarding association of objects in this cave except for those entries that were made in Anthony's journal at the time of excavation.

We thus arrive at an impasse. Neither the view that the jaw is ancient nor the one that it is very recent is quite excluded by the evidence. The jaw is very distinct, and it is ceboid. It can therefore be either a Jamaican endemic or an unknown form from South or Central America. Neither the paleontology and faunal history of Jamaica nor the paleontology and Recent fauna of South and Central America are so well known that we can conclusively reject either possibility.

Our own view is, however, that in the absence of clear evidence of disturbance of the deeper layers of Long Mile Cave, the Jamaican form should not be assumed to have been brought into the cave by human agency, that most probably monkeys did arrive in Jamaica under their own power, and that, whether or not native monkeys ever existed on the other islands of the Greater Antilles, a very distinct form was developed in Jamaica.

If the Jamaican animal is the only native monkey of the Greater Antilles, its occurrence on Jamaica only would not in any sense be a unique phenomenon; the rice rat *Oryzomys*, the bat *Tonatia*, and the octodont *Alterodon* would apparently be similar cases. But there are no theoretical grounds that make the occurrence of monkeys in the West Indies at all improbable. They are relatively small and arboreal; rafting for them is therefore more probable than for other, heavier, more terrestrial creatures. They are one of the three groups that are suspected of crossing to South America across a water gap in mid-Tertiary times (hystricomorph rodents, cebid monkeys, and procyonids). Such groups favorably adapted for cross-water transport in one direction may probably with equal ease be transported in another.

The evidence is not yet in that will tell the whole story, but it is no longer possible to assert, with Thomas Barbour, with regard to native monkeys living on any of the West Indian islands that "quite certainly they never did" (Barbour, 1945, p. 302).

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