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On the Identity of the Tree Squirrel *Macroxus chinensis* Gray, 1867

BY JOSEPH CURTIS MOORE AND GEORGE H. H. TATE

John Edward Gray (1843, p. 144) listed "Reeve's Squirrel. *Sciurus Chinensis*, Gray. *a.* and *b.* China.—Presented by John Reeves, Esq." in a published list of mammal specimens in the British Museum, but it was some years before he (Gray, 1867, p. 282) validated this name as a species by giving it a description. There are two specimens, the type, which includes a skin and the anterior half of a skull, and a "co-type," which consists of a skin and a skull entire but for the supraoccipital and interparietal bones.

No one has since collected and published upon additional squirrels from China like these. Over the years, as collections have made other Oriental tree squirrels gradually better known, only doubt has been accumulating about the species *chinensis*. The locality is recorded on the specimen labels simply as China. In order to determine something of the extent of John Reeves's area of activities one of us (Tate) corresponded with Arthur de Carle Sowerby. The following data are summarized from Sowerby's letters of March, 1953, and a letter of the same month from Arthur W. Hummel, Chief of Orientalia of the Library of Congress: John Reeves (1774–1856), an Englishman, went to Canton, China, in 1812 with the East India Company as a tea inspector. He had Chinese artists make careful paintings of 340 species of fish which were the ground work for Sir John Richardson's 1846 report on Chinese and Japanese fish. Reeves contributed a long appendix on Chinese names of stars and constellations to the first English dictionary of Chinese, as well as providing the plant names in it, and

collected plant and animal specimens to send to England. He lived at Canton and Macao, Kwangtung Province, China, and as a tea taster would have had to be in Canton from March through August when the teas were coming in. The off season of September through February he spent in Macao. He returned to England in 1831, and lived and died at Clapham. A son, John Russell Reeves, replaced the father at Canton until 1834, when the company lost its charter, and stayed in the Orient for a time at other work but apparently did not collect zoological material.

That John Reeves, the elder, did send back mammal specimens from the Canton area is rather well substantiated. Glover Allen (1940) has, also, found no quarrel with Canton as the approximate type locality for the raccoon-dog, *Nyctereutes procyonoides*; the Chinese lesser civet, *Viverricula malaccensis pallida*; the bamboo rat, *Rhizomys sinensis sinensis*; the harsh-furred hare, *Caprolagus sinensis sinensis*; the Chinese tiger cat, *Felis bengalensis chinensis*; the eastern Chinese otter, *Lutra lutra chinensis*; and Reeves's muntjac, *Muntiacus reevesi*, the type specimens of which were all attributed to John Reeves. Furthermore, Gray (1842, p. 263) described a tree squirrel, *Sciurus castaneoventris*, for which he gave the "habitat" as China and the source as John Reeves. Glover Allen (1940, p. 629) records that earlier students had found material from the Chinese island of Hainan to agree perfectly with the type of *castaneoventris*, but that as yet no one had studied any pertinent material of the species [*Callosciurus erythraeus*] from the vicinity of Canton, where Reeves could most easily have collected it. Until some Cantonese material has been collected and reported to be unlike the type of *castaneoventris*, however, it seems premature to designate Hainan as the type locality, as does Ellerman (1940, p. 358). Glover Allen (*loc. cit.*) considered it extremely probable that the subspecies of *Callosciurus erythraeus* to be found about Canton would be identical with that found on the island of Hainan. Gray's *castaneoventris* is clearly a representative of the most widespread species of the Oriental tree squirrel genus *Callosciurus*.

Allen (1940, p. 628) notes that Bonhote had "found, on examining the skull [70a], that the specimens belonged to the genus *Tomeutes*." Allen (*loc. cit.*) contributed the suggestion that, as *Tomeutes* (the type species of which is [*pygerythrus*] *lokroides*) was not otherwise known to occur in China, Reeves may have purchased them in China as captives or obtained them in some other country on his travels. Allen adds, further, that he had examined the specimens himself and says that they are apparently identical with *Tomeutes philippinensis*,

which is now in the genus *Sundasciurus* Moore, 1958. At the same time Ellerman (1940, p. 376) placed *chinensis* in *Callosciurus*, but with uncertainty as to what other species within the genus it might be closely related.

One of us (Tate) examined the type specimen in the British Museum in 1951, made a series of measurements and photographs of the skulls, and recorded a detailed description of the pelage of the type. Tate's description of the pelage follows: "This is the type of *Sciurus chinensis*, collected by J. Reeves, ostensibly in China. It is B.M. No. 70a and is a male. It is a rather dark grayish brown, formed of the usual grizzle of brown-tipped hairs with blacker bases. On the head, forward of the ears, it becomes slightly more reddish. And forward of a line joining the eyes, it again becomes dark brownish gray on the dorsal portion of the body. This body coloration extends down the front and hind limbs and includes the feet which are also brownish gray. The tail, basally, is somewhat reddish and distally is more darkened owing to a mixture of a very dark brown shading with the tail. There is no black in this tail so far as I can see. The ears are moderately large and nearly naked. There is no eye ring. The whisker area is pale grayish white, and this extends backward along the under surface of the cheeks and under the throat and neck. The throat is white and the chin is white. This becomes slightly darker as the chest is reached and goes over to a light buffy color in which gray-based hairs are present. The buffy color extends down the forearms to the wrists on the inside, [but diminishes gradually] as the inguinal area is reached, because of the fact that the [gray] hair bases [are longer, and the] buffy tips of the hairs [shorter]. Then on the insides of the hind limbs the buffy tips become more prominent and [hide] the gray. It is [evident], however, [when] the hairs are ruffled. The under side of the tail shows no special characteristics. There are no lateral lines of any description. There is a very narrow pure-white line running from the white of the chest towards the tail, down the middle of the under parts, and separating the buffy areas on each side. The width of this line is [about] 8 to 10 mm.

"I come now to the second cotype of *Sciurus chinensis*. This specimen is B.M. No. 70b. It was collected by J. Reeves, allegedly in China. . . . The color of the skin is very much darker than the first, a kind of blackish brown with a grizzle of whitish tips; and this blackish brown extends down the limbs and down the tail, forward onto the head throughout. The under parts are dirty white, more or less self-colored, perhaps with traces of gray at bases [of hairs]. This white extends for-

ward on the throat to the chin and down the inner sides of the front and hind legs."

Compare with the above Gray's (1867, p. 282) type description: "Fur dark olive, minutely punctulated with yellow; chin, throat, belly, and inner side of limbs greyish white; tail elongate, black with long white tips to the hairs; tip blackish, hairs brown at the lower half, with a broad black band and a grey tip. *Hab.* China (John Reeves). B.M., type." He then adds:

"Var. Head and shoulders paler yellow; tail dull brown, with grey tips to the hairs. China. B.M."

It seems evident from a comparison of these descriptions that B.M. No. 70b is the specimen that Gray actually described as the type and that B.M. No. 70a is what Gray described as "Var." Glover Allen (1940, p. 628) gives a terse description: "The specimens, which I have examined at the British Museum, . . . are dark brown above, with a narrow whitish eye-ring, white throat and ochraceous mid-belly." This seems to have come altogether from B.M. No. 70a, and it disagrees with Tate's notes in the matter of the eye ring.

Allen (1940, p. 628) is quite correct in stating that the skin of B.M. No. 70a is rather like that of [*Sundasciurus*] *philippinensis*. Comparing our photographs of the two *chinensis* skulls with six skulls of *Sundasciurus philippensis* borrowed from the Chicago Natural History Museum, one of us (Moore) notes important points of disagreement. In both specimens of *chinensis*: 1. The permanent fourth upper premolar is markedly smaller in occlusal view than the first upper molar. 2. The third upper premolar does not occur. 3. The upper incisors are distinctly opisthodont. 4. In lateral view the lip of the infraorbital foramen forms a distinct arc, concave anteriorly, the lower end far forward of the upper.

Contrastingly, in the series of six *philippinensis*: 1. The fourth upper premolar rivals the first upper molar in size. 2. the third upper premolar is always present. 3. The upper incisors are distinctly to strongly proödont. 4. The lip of the infraorbital is rather straight and almost vertical to the occlusal plane. These characters firmly remove from consideration all prospect of specific identity or even intrageneric relationship between *chinensis* and *philippinensis*.

The fourth upper premolar is generally large and frequently quite large in squirrels of the Oriental squirrel tribe Callosciurini, but in the Holarctic and Neotropical squirrel tribe Sciurini this tooth is rather generally notably smaller than the first upper molar. Absence of the third upper premolar is a rare character in the Callosciurini but char-

acterizes many species of the Sciurini. Opisthodonty is of extremely rare occurrence in the tribe Callosciurini but characterizes some species of the Sciurini, particularly in the Neotropical region. The described difference in shape of the lateral lip of the infraorbital foramen distinguishes many members of the Sciurini from many of the Callosciurini. While no one of these four characters alone could be considered decisive, in the opinion of one of us, who has recently offered a classification of the Sciurinae based on skull characters (Moore, 1959), the four together are decisive. This species is a member not of the tribe Callosciurini but of the tribe Sciurini.

It has been shown elsewhere (Moore, 1959) that a skull character exists which is diagnostic for Holarctic and Oriental members of the tribe Sciurini. This is possession of a low squamosal. A low squamosal is one that does not ascend the side of the braincase above a point approximately midway between (1) the anterior base of the zygomatic process of the squamosal and (2) the posterior base of the postorbital process of the frontal. (See Moore, 1959, fig. 4.) The available photograph of the lateral side of B.M. No. 70b does not reveal the upper edge of the squamosal, but Mr. R. W. Hayman of the British Museum, provided with a definition and sketch of high and low squamosals, writes (letter of March 11, 1959) that he has examined B.M. No. 70b for this character and that it has a low squamosal. This character delimits the species *chinensis* further to the group of Sciurini that includes only the genera *Sciurus*, *Guerlinguetus*, and *Reithrosciurus*.

Because skull characters indicate that *chinensis* is a member of the tribe Sciurini, there remain three broad possibilities: 1. The *chinensis* material may have been sent by Reeves from the Orient and may represent a species of the Sciurini not otherwise known that surely must occupy an island or some quite restricted inland area. (The squirrels of Kwangtung Province are very poorly known.) 2. It may have been obtained by Reeves from some traveler and have come from a locality outside the Oriental region, but such information did not get attached to the specimens. 3. It may even be erroneous to attribute these specimens to Reeves, and they may have come from anywhere in the world where native squirrels are like these. Either of possibilities 2 or 3 will seem more likely than 1 to students of Oriental squirrels, even though the squirrel fauna of an area including Kwangtung, Kwangsi, and southern Hunan and Kweichow is still largely to be inferred from knowledge published on collections made outside the area. There is, admittedly, one species of the Sciurini, *Reithrosciurus macrotis*, occupying a restricted range much deeper still in the Oriental region

and much farther than Kwangtung from the edge of the general range of the Sciurini. Nevertheless, it seems unlikely that another such species survives in southern China apparently uncollected except for the type material of *chinensis*.

As we may, then, look farther afield for the source of the two *chinensis* specimens, it should perhaps be said that the Ethiopian region and Indian subregion are eliminated as possible source areas for the *chinensis* material, because the skull does not possess the characters known to distinguish the tribes of squirrels in those areas (Moore, 1959), as well as because it does possess these several characters of the Sciurini. The one specimen (B.M. No. 70b) that has auditory bullae seems in the photograph to have but one transbullar septum per bulla. This is a species characteristic of the Sciurini only in the Neotropical region, although it occurs as a variation from the norm in individuals elsewhere.

One of us (Moore) has searched the collections of the American Museum of Natural History for a species of the Sciurini which fits the detailed pelage descriptions given here of *chinensis* and the skull characters exhibited by our photographs. A species that possesses the skull characters evidenced by the photographs of the skulls of *chinensis*, and corresponds closely in skull measurements, is *Guerlinguetus ingrami* of eastern Brazil. Body measurements taken on the dry skins of *chinensis* by one of us (Tate) correspond nicely to the averages for 25 *ingrami* reported by J. A. Allen (1915, p. 263). The skins of the *Guerlinguetus ingrami* in the American Museum of Natural History possess the more striking characters of *chinensis* as detailed above for B.M. No. 70a. The ventral pelage characters fit the description almost perfectly. The dorsal pelage disagrees in that black bands are quite evident on the tail hairs and that no reddish color is seen on the head. Here there is definitely an eye ring. Joel A. Allen (1915, p. 263) has provided a detailed description of the pelage from 50 specimens of *ingrami* which, with the exceptions noted here, corresponds nicely to the description of B.M. No. 70a of *chinensis* above. The pelage of specimen B.M. No. 70b, which is properly the type, is still too poorly reported for us to suggest with any confidence the species of *Guerlinguetus* to which it belongs, but some American Museum material of that genus does possess a generally dark brown dorsum and a generally whitish venter.

SUMMARY

Specimen B.M. No. 70b, not specimen B.M. No. 70a, is evidently the type of the tree squirrel species *Macroxus chinensis* Gray, 1867.

Species *chinensis* is not synonymous with *Sundasciurus philippinensis*, as has been suggested, nor is it a member of the Oriental tribe Callosciurini. It is instead a member of the primarily Holarctic and Neotropical tribe Sciurini. Although the Sciurini have one member that occupies a relict range in the Oriental region (*Reithrosciurus macrotis* in Borneo), it seems unlikely that *chinensis* is another such Oriental species of which the range, except for being allegedly in China, remains entirely unknown. The *chinensis* material is believed to represent the South American genus *Guerlinguetus*. The specimen B.M. No. 70a seems to represent some geographic variation of *ingrami*. The pelage of the specimen B.M. No. 70b has not been adequately reported upon, but apparently it could represent some other species of *Guerlinguetus*.

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