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密勒著

中華民國十六年十二月

中國地質調查所印行

貴州省圖書館
中文圖書

QQ 959.8
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Series C. *Vol. V. Fascicle 2.*

PALÆONTOLOGIA SINICA.

Editors:

V. K. Ting and W. H. Wong

Revised determinations of some tertiary Mammals from Mongolia

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Published by the Geological Survey of China

Peking 1927

PUBLISHED APRIL 1927

STOCKHOLM
CEDERQUISTS GRAFISKA AKTIEBOLAG

REVISED DETERMINATIONS OF SOME TERTIARY MAMMALS FROM MONGOLIA.

By GERRIT S. MILLER, JR.

Curator, Division of Mammals, U. S. National Museum.

In his report on the Tertiary Mammals collected by Doctor ANDERSSON in Mongolia Professor MAX SCHLOSSER identified some of the species as representatives of the living genera *Scaptochirus*, *Crocidura*, *Neomys*, *Ursus*, *Meles*, *Martes*, *Hyæna*, *Aplodontia*, *Allactaga*, "*Siphneus*" [= *Myospalax*], *Sigmodon* and *Mus* (Palæontologia Sinica, ser. C., vol. 1, fasc. 1, pp. 3—43, pls. 1—3, 1924). It seems probable from the text that Professor SCHLOSSER made these determinations on the basis of inadequate recent material for comparison with the fossils. Living members of the genera alluded to are well represented by skulls and skeletons in the collections of the U. S. National Museum, and a comparison of specimens with Professor SCHLOSSER's descriptions and figures immediately aroused the suspicion that several if not all of these identifications were incorrect. Photographs of the more important types, kindly furnished me by Professor WIMAN, have fully confirmed this first impression. Under ordinary circumstances, where no far-reaching deductions have been made, the misdetermination of a few fossils is not a matter of sufficient moment to justify the publication of a special paper. In this instance, however, some unusually important conclusions are announced. (See especially the "General Rewiew" on page 119). For instance, (a) "*Neomys*" *inexspectatus* is said to be undoubtedly "the ancestor as well of the fossil *N. fissidens* [from the pliocene and pleistocene of Hungary] as of the living [European] *N. fodiens*," (b) "*Scaptochirus*" *primævus*, "*Crocidura*" *kormosi*, "*Neomys*" *inexspectatus*, "*Ursus*" n. sp., "*Meles*" cf. *taxipater*, "*Martes*" *anderssoni*, "*Hyæna*" sp., "*Allactaga*" *wimani*, "*Siphneus*" *eriksoni* and two species of "*Mus*" are made to appear as indubitable Miocene members of genera which are still in existence, while (c) "*Aplodontia*" *asiatica* and "*Sigmodon*" *atavus* are unhesitatingly brought forward as genuine examples of the occurrence in the tertiary of the Old World of two types of

mammal which have been hitherto regarded as exclusively and characteristically American. Reasons are deduced, moreover, (p. 119) for the supposition that *Sigmodon* originated in the Old World and subsequently passed over into America, while *Aplodontia* followed an exactly opposite course. Announcements of this kind are particularly attractive to the writers of popular articles and text books, and to the builders of land bridges. It is chiefly in the hope of at least partially counteracting their influence that I have prepared the following notes.

Scaptochirus primævus SCHLOSSER (p. 3, pl. 1, figs. 5—8).

A femur, 35 humeri and 6 lower jaws are referred to the genus *Scaptochirus* and made the basis of a new species, *S. primævus*. Two of the jaws, the femur and one humerus are figured. The chief reason assigned for regarding these remains as pertaining to a member of the genus *Scaptochirus* is the fact that there appear to be 10 teeth in the mandible. While this number of teeth, if correct, would coincide with that present in *Scaptochirus* there is so little else about the fossil which resembles the recent animal that it seems impossible to consider the Miocene species as congeneric with this living mole. The principal features in which the fossil differs from *Scaptochirus* are as follows: (a) the much greater size of m_3 and pm_4 relatively to m_1 and m_2; (b) the low, broad, evenly triangular form of pm_4 as viewed from the outer side, and the presence of a well developed cingulum extending along the entire outer margin of the base of this tooth, a character plainly shown in the drawings of both of the specimens figured, and not only strikingly unlike the smooth base of this tooth in *Scaptochirus*, but, to say the least, very unusual in moles of any kind; (c) the low, robust cusps of the molars; (d) the form of the mandible in one specimen (fig. 5), nearly twice as deep beneath the point of contact between m_2 and m_3 as immediately behind the toothrow; (e) the low angle formed between the alveolar line and the anterior margin of the coronoid process; (f) the low position of the under border of the masseter-temporalis fossa; (g) the much less broadened and specialized condition of the humerus.

While these features, particularly the structure of pm_4, the form of the mandible (in fig. 5), and the relatively slight modification of the humerus would be more than sufficient to distinguish the fossil generically from *Scaptochirus* they would not indicate any known genus to which a species thus characterized could be referred. There is, however, no certainty that the jaws and long bones ever formed parts of one animal, or even that the two figured jaws belong together. The humerus is evidently that of a mole. It differs widely from the humerus of *Scaptochirus* and closely resembles that of *Scapanulus*, the only essential difference, as compared with the latter, being that it is more robust, and the proximal widened portion is rather conspicuously wider and shorter, with corresponding adjustments of contours. It might or might not

represent a genus distinct from *Scapanulus*. The femur differs from that of *Scapanulus oweni* THOMAS in several minor details of form, but there appears to be nothing about it to indicate the probability that it came from some other animal than the humerus.

The characters of the jaws and the fourth premolar are distinctly un-mole like. The deepening of the jaw and the narrowing of the region behind the toothrow in the specimen shown in figure 5 suggests *Erinaceus*. The premolar in both jaws is essentially like that of *Neotetracus* except that the cingulum is better developed; and the general character of the dentition is obviously similar in its essential features to that which is present in this living Chinese Erinaceid. It is unlike that of any known mole. The position of the lower border of the masseter-temporalis fossa is exactly as in *Erinaceus* and *Neotetracus*.

Thus we are brought to the conclusion that "*Scaptochirus primævus*", as represented on plate 1, is a composite animal made up of (a) the humerus of a mole related to *Scapanulus oweni* and not generically distinguishable from the living animal on the basis of this bone alone, (b) a femur which may have come from the same mole, and (c) two jaws of Erinaceids, not improbably referable to as many undescribed genera related to *Neotetracus*, a genus in which the mandibular tooth formula is the same as that which appears to be present in the fossil.

As first reviser I restrict the name *primævus* SCHLOSSER to the mole represented by the humerus. Until more fully known this animal should stand as *Scapanulus primævus* (SCHLOSSER).

The characters of the jaws as shown on the plate are not definite enough to permit of any further determination than reference to *Erinaceidæ* gen. nov.? The differences in form between the two mandibles (compare figures 5 and 6) is so great as to suggest that they may represent members of two genera.

Professor SCHLOSSER's remarks on this species are: "*Scaptochirus primævus* has given rise to *S. moschatus* at least, now living in the same region, if not to the *Scaptochirus davidianus* too" (p. 110).

Crocidura kormosi SCHLOSSER (p. 5, pl. 1, figs. 1—2).

The type of *Crocidura kormosi* is a left mandible well preserved except that it is broken off at the level of pm_4 and the tip of the angular process is missing. The first and second molars are in place in the photographs sent me by Professor WIMAN; the third is shown in the drawing (SCHLOSSER's figure, pl. 1, fig. 1). The characters

of this specimen which do not coincide with those of the genus *Crocidura* are the following: (a) much lower angle between the anterior margin of ascending ramus and the alveolar line; (b) relatively much greater size of the articular process, and the heavier isthmus joining it to the main portion of the ascending ramus; (c) relatively small size of the internal temporalis fossa; (d) presence of a well developed oblique ridge extending downward and backward above the internal temporalis fossa from the middle of the tip of coronoid process; (e) the approximately equal transverse diameters of m_1 through the protoconid and through the hypoconid; (f) the lowness of the molar cusps in proportion to the length of their bases and in proportion to the depth of the mandible beneath them.

In all the more important of these peculiarities the fossil so nearly agrees with the characters of *Blarinella* as to leave no doubt that the Miocene animal should be referred to this genus and not to *Crocidura*. The only features that I am able to discover in which the mandible differs from that of the living *Blarinella wardi* THOMAS are the slightly greater length of the oblique posterior margin of the articular process, the slightly greater robustness of the isthmus which joins the articular area to the body of the ascending ramus, the broader base of the angular process, and the well developed oblique ridge on the inner side of the coronoid process above the internal temporalis fossa. The teeth of the fossil appear to differ in no important character from those of *Blarinella wardi* except that the entoconid is probably better developed and less unlike the hypoconid in size and form. In both animals the height of m_1 is less than the depth of the mandible beneath this tooth when viewed from the outer side, while in *Crocidura russula* the height of the tooth exceeds the depth of the mandible. As the fossil does not differ from *Blarinella wardi* in characters which can be with any degree of certainty regarded as generic it should stand as *Blarinella kormosi* (SCHLOSSER).

It is a very interesting fact that the characters in which the Miocene Mongolian *Blarinella kormosi* differs from the living Chinese *B. wardi* appear to approach, in every instance, those of *Blarina*, a genus now inhabiting the eastern part of North America. Too general conclusions, however, should not be based on these resemblances, which, it must be remembered, are confined to an incomplete mandible and two lower molars, all other parts of the skull and dentition being now unknown.

Concerning this animal Professor SCHLOSSER observes: "*Crocidura kormosi* is of signification perhaps as a parent of species now living in Asia, whilst the European ones may be connected with the contemporaneous *Crocidura* from Polgárdi, Hungary" (p. 110).

Neomys inexspectatus SCHLOSSER (p. 6, pl. 1, fig. 4).

The mandible of the type is nearly as well preserved as that of *Blarinella kormosi*. The extremity of the coronoid process is, however, broken off, and all of the teeth are lost. It agrees in form and size with the corresponding part of the mandible in *Anourosorex squamipes* MILNE-EDWARDS, a shrew now living in western China. Generic characters distinguishing *Anourosorex* from *Neomys* are easily recognizable in this part of the mandible, and they are perfectly shown by the drawing (pl. 1, fig. 4) and by the photograph. Probably the most important of these characters are the two following: in *Anourosorex*, the anterior border of the ascending ramus slopes more gradually upward, and the two articular surfaces are separated by a wider space, in which a broad and conspicuous depression is present. Both of these diagnostic features are apparent in the published figures, and both are fully confirmed by the photographs. In the fossil the angular process is more robust and the anterior articular surface projects farther inward beyond the alveolar line than in the specimens of *Anourosorex squamipes* which I have seen. These peculiarities indicate that the Miocene animal is a distinct species, *Anourosorex inexspectatus* (SCHLOSSER).

The observations on this species are as follows: "*Neomys (Crossopus) inexspectatus* is the oldest representative of the genus, known till now in fossil stage only in the pleistocene of Hungary. The strange shape of the ascending ramus of the mandible, provided with a large foramen between the last M and the condylus, and the presence of a prominent crest on the inner side in front of the condylus proves, that this genus occupies a very isolated situation" (p. 110).

Ursus n. sp. (p. 8, pl. 1, fig. 9).

The anterior first lower Ursid molar figured on plate 1 differs so widely from the corresponding tooth in all the known living genera of bears that it cannot be regarded as evidence that any one of these recent groups was represented in the Miocene fauna of Mongolia. The principal peculiarities of this tooth are the relatively short talonid as seen in lateral view, and the presence of a large central tubercle on the crushing face of the heel. These characters are sufficient to remove the animal from the genera *Ursus, Selenarctos, Helarctos* and *Melursus* now living in central and southern Asia, as well as from the strictly American *Tremarctos* and *Euarctos*. It is difficult to understand Professor SCHLOSSER's reasons for saying that this bear "from Mongolia is clearly related to the [American] *Euarctos* group." In *Euarctos* the entire crown of

the first lower molar is narrowed, and the marginal cusps, instead of standing at the edge of the tooth as represented in the fossil, are drawn inward toward the median line, a modification which is carried much further in the Old World *Selenarctos*. With little doubt the specimen pertained to a member of some genus long ago extinct.

Meles cfr. **taxipater** SCHLOSSER (p. 9, pl. 1, figs. 21—24).

The presence of a badger belonging to the genus *Meles* in the Miocene of Mongolia is supposed to be indicated by a right calcaneum, a broken molar tooth (m_1 left), and a piece of the right side of a lower jaw bearing three premolars and the anterior extremity of m_1. The question whether these fragments actually formed part of one animal is probably impossible to answer at the present time; but a conclusion which does not admit of reasonable doubt is that no one of them alone, and still less the three together, if they are assumed to pertain to a single species, can be referred to a member of the modern genus *Meles*. The molar tooth has a general badger-like structure, but the arrangement of its cusps precludes the possibility of supposing that it represents a species of *Meles*. The outer side of the talonid in *Meles* bears two cusps, the anterior and larger of which is widely separated from the protoconid by a deep notch. In the fossil this portion of the crown is shown as having no less than four distinct cusps completely and evenly filling the entire border behind the protoconid, with no one interspace obviously greater than the others. In addition to this peculiar arrangement of its cusps the tooth further differs from the first lower molar of *Meles* in the much greater height of the protoconid relatively to the length of the portion of the crown lying posteriorly to the base of this cusp, and in the presence of a broad flat area of wrinkled enamel covering the floor of the elongated valley which occupies the space between the bases of the cusps of the outer and inner sides of the talonid. Where such important discrepancies exist there can be no justification for referring this tooth to a member of the recent genus *Meles*. Similarly with the jaw and the teeth which it bears: they differ obviously from the corresponding parts of the mandible and dentition of *Meles*. As in the case of the fossil molar tooth this jaw and its teeth have a badger-like appearance; but the height of the teeth relatively to the depth of the ramus is so much less than in the living animal that this specimen cannot be taken as an indication of the presence of *Meles* as a member of the extinct fauna under discussion.

Finally the calcaneum differs so widely from that of *Meles meles* as to furnish no evidence that it ever formed part of the foot of a member of the same genus. In

the fossil the "neck" or distal portion of the bone is conspicuously shortened and the fibular facet is so placed as to face more forward than toward the side, a condition the exact opposite of that present in *Meles*, in which this facet is directed more toward the side than forward. These differences are well shown by figures 24 and 26 of plate 1, where figure 26 with slight modifications and an enlargement to a length of about 30 mm. would serve very well in a general way as a representation of the calcaneum of *Meles meles*. Exactly what animal or animals these teeth and bones may represent I cannot attempt to say, but it is certain that their presence in these collections does not show that the modern genus *Meles* occurred in the Pontian of Mongolia.

Martes anderssoni SCHLOSSER (p. 13, pl. 1, figs. 10—14, 25—27).

An exact generic determination of this species is rendered impossible by the incomplete nature of the remains by which the animal is known. The characters of the jaw and teeth as described and figured are, however, sufficient to show that Dr. ANDERSSON's material furnishes no warrant for extending the range of the modern genus *Martes* into the Pontian of Mongolia. Professor SCHLOSSER says: "In the lower jaw pm_1 has disappeared, pm_2 is tow-rooted but very small and inclined forward". These are exactly the dental peculiarities which characterize the more specialized genus *Mustela* as compared with the less advanced *Martes*. Their presence in the fossil, almost as fully developed as they are in some living species of *Mustela*, points to a long separation of the marten and weasel groups. The conformation of the jaw is also distinctly *Mustela*-like in the great depth at the level of the space between pm_2 and pm_3, a feature quite the opposite to the slenderness of the mandible in this region in *Martes*. So far as can be judged from the description and figure of the jaw the animal was probably a *Mustela* with pm_2 slightly less reduced than in living members of the genus. The calcaneum and astragalus appear to differ in rather important details from the corresponding bones of both *Martes* and *Mustela*, but on the basis of drawings alone it is idle to attempt to interpret such features.

Hyæna sp. (p. 18, pl. 1, figs. 45—51).

The remains as figured would indicate an animal differing at least as much from *Hyæna* as this genus differs from *Crocuta*. Hence an incorrect picture of the Pontian Mongolian fauna is given by referring to it a member of the living genus. The fossil is unlike *Hyæna* in the large size and quadricuspidate structure of the heel of pm_4,

a condition decidedly more primitive than the more reduced heel present in both of the living genera. The astragalus, if correctly shown in figure 51, differs notably from that of both *Hyæna* and *Crocuta* in the much more nearly equal surface area of the two sides of the trochlea, a feature which gives it some resemblance to the astragalus of a large cat.

Aplodontia asiatica SCHLOSSER (p. 30, pl. 2, figs. 7, 15—16, pl. 3, fig. 29).

Based on a right lower jaw with the four grinding teeth in place. To the same animal are referred a fragment of a left lower jaw containing pm_4, an isolated pm_4, three lower incisors, two tibiæ and a metacarpal.

Though the teeth resemble in a general manner those of *Aplodontia*, both they and the portion of the jaw that has been preserved show a complete absence of the essential characters of the American animal. The main diagnostic feature of the cheek-teeth in the genus *Aplodontia* and its extinct American relatives *Liodontia* and the *Allomyidæ* is the presence of a specialized mesostyle, an element of the tooth which has entered into the development of the strongly hypsodont molars of these rodents in much the same manner that is seen in the teeth of modern horses. Of this fundamentally important structure the fossil presents not the slightest trace. Furthermore there is a well developed though small enamel lake near the middle of the crown in pm_4, m_2 and m_3, obviously the last remnant of an infolding of enamel from the inner side of the crown now nearly lost by wear in these three teeth and completely obliterated in the first molar. Such a reentrant fold does not occur in the teeth of *Aplodontia* at any age, not even in the unworn enamel cap of sucklings. A further very important peculiarity of the fossil is the presence of a broad, well-developed reentrant angle on the anterior margin of the crown of the premolar, a region which in *Aplodontia* presents a smoothly rounded, forwardly directed convexity. Turning to the mandible the discrepancies between the fossil and its supposed American congener are no less conspicuous. In *Aplodontia* the anterior border of the ascending ramus curves up abruptly high above the toothrow from about the level of the second molar; in the fossil it begins in the same region but extends almost straight backward and remains below the level of the alveolar border to the point where it is broken off at a distance behind m_3 equal to slightly more than the antero-posterior diameter of this tooth. From the drawings reproduced in plate 2 it is impossible to determine whether this horizontal line represents the actual upper margin of the ascending process or whether the part which remains is the fractured base of an abruptly rising

coronoid. The photographs, however, clearly show that the specimen is uninjured in this region. The part of the jaw lying below the premolar of the fossil is not deepened in the manner which is characteristic of *Aplodontia.* Here again the plate leaves us in doubt whether or not the type is perfect, but the photographs supply the needed evidence that the jaw is uninjured. A photograph of the lingual aspect of the mandible shows a well defined basin-like depression in the region between the hinder termination of the incisor (which is at level of space between m_2 and m_3, as in *Aplodontia)* and the base of the angular process. No such depression exists in *Aplodontia.* Finally the form of the angular process in the fossil is obviously different from that in the American animal, but neither the drawing nor the photograph represents this part of the jaw with adequate clearness. The characters which I have enumerated are, however, sufficient to prove conclusively that "*Aplodontia*" *asiatica* is neither an *Aplodontia* nor even a member of the same family as the American animal.

While the exact systematic position of a rodent known from such fragmentary remains must be largely a matter of conjecture I believe that this animal is with little doubt a member of the dipodine group. The low coronoid region may be seen in *Allactaga* and in *Ctenodactylus*; in fact the entire jaw as viewed from the outer side and from above presents important features of resemblance to the corresponding region in *Ctenodactylus*, though it lacks the peculiar median longitudinal ridge which is a conspicuous character in the living animal. Finally on the lingual aspect, as shown by a photograph, the lower border of the angular process is seen to arise at a point situated beneath the posterior extremity of the incisor. This is a condition essentially similar to that which occurs in *Ctenodactylus;* it is quite unlike the structure present in *Aplodontia.* The general features of the cheek teeth are much the same as in *Ctenodactylus* if I am correct in interpreting the enamel lake as the last remnant of an outer reentrant angle. The position of the dental foramen and the backward prolongation of the incisor root to but not beyond the level of contact between m_2 and m_3 are further features of similarity between the fossil and this recent genus. The most important difference between "*Aplodontia*" *asiatica* and *Ctenodactylus* revealed by the known material is the presence in the extinct animal of four cheekteeth, the anterior of which is the largest and the posterior the smallest, the anterior tooth bearing on its front margin a reentrant fold apparently homologous with the fold which occurs in the same position in the first lower tooth of *Allactaga.* As I am unable to refer "*Aplodontia*" *asiatica* to any known genus of rodents I make it the type of:

Pseudaplodon gen. nov.

The characters have already been given in sufficient detail.

Of this fossil Professor SCHLOSSER says: "*Aplodontia* is one of the most important elements of the fossil Mongolian mammals, for it lives in the recent time only in North America, where it has been found in the pleistocene too. Its ancestor is *Meniscomys* from the oligocene and lower miocene of this continent. The invasion into Asia was not successful, for it died out there or returned to its original home" (p. 113). Of *Meniscomys* he remarks that "it is not quite improbable that this latter has descended from the strange genus *Sciurodon* from the oligocene phosphorites of France, which may have immigrated into the New World together with *Hyænodon* and *Ancodus*" (p. 30).

Allactaga wimani SCHLOSSER (p. 31, pl. 2, figs. 1—6, 8—10, 13—14).

The teeth on which this species was based present characters showing that they pertain either to members of two distinct genera, or, if they actually came from one animal, that the genus which they represent is distinct from any that has hitherto been made known. The lower molars, particularly the first, are similar in essential characters to those of the living species of *Allactaga*. Apparently the crowns are less hypsodont than they are in recent members of the genus, but the material is not sufficient to demonstrate that this peculiarity is of much importance. The enamel pattern of m_1 exactly agrees with the highly specialized pattern seen in *Allactaga mongolica*, but the dentine spaces appear to be wider in proportion to the enamel than in the living animal. The incisors are obviously different from those of *Allactaga* in their much stronger curvature, particularly of the upper tooth, and in the outline of the cross section. In both of these features the incisors rather closely resemble those of *Dipus* except that the upper tooth is not described or figured as grooved on its anterior surface. Even more noticeable is their likeness to the incisors of almost any small murine rodent, a resemblance which is not lessened by the absence of the groove in the face of the upper tooth.

Professor SCHLOSSER very justly remarks that "*Allactaga* is likewise deserving of high interest. It was known up till today in fossil stage only from the European pleistocene, but we must trace it back now even to the Pontian. The remarkable fusion and elongation of the three median metatarsals was at that time quite as complete as in the present time" (p. 113).

Siphneus [= Myospalax] eriksoni SCHLOSSER (p. 36, pl. 3, figs. 5—11, 15—26).

Of the mole-rat so abundantly represented in the deposits explored by Dr. ANDERSSON I have been able to examine two mandibles and seven isolated cheekteeth kindly lent to me by Professor WIMAN. These specimens show that the tertiary animal had not yet developed the open-based, continuously-growing cheekteeth characteristic of *Myospalax*. In the recent mole-rat the cheekteeth have reached the final stage of hypsodonty, that is, these teeth consist of infolded cylinders almost exactly alike in form at both ends. The open base continuously grows upward from a persistent pulp, a process which exactly compensates for the wear on the grinding surface of the crown. In the fossil, on the contrary, the infolding of the cylinder does not continue downward to the base; the lower part of the adult tooth, through about 5 mm. of its height, is closed, and the base has an obscurely bilobed form quite different from the crown in both aspect and structure. The growth of such a tooth is not continuous throughout the individual's life, and the grinding machine can eventually become worn out and ineffective. Although the living Chinese mole-rats, in the course of their dental evolution, undoubtedly passed through at condition similar to that which is present in the fossil mole-rat, the very important advance which they have made in the perfecting of their grinding apparatus is obscured by placing the extinct animal in he same genus with them. I therefore propose to separate the fossil as:

Myotalpavus gen. nov.

The tertiary *Myotalpavus eriksoni* is an exceptionally interesting discovery as it furnishes one of the very rare instances in which we may reasonably suppose that a fossil mammal represents the directly ancestral stock from which a recent genus has developed while living in much the same geographical region as its forbears, and, presumably, under environmental conditions which have not been subject to excessively great changes. It must be remembered, however, that the skull of *Myotalpavus*, if ever found, may present characters which could not have gone over into those of *Myospalax*.

Lophocricetus grabaui SCHLOSSER (p. 41, pl. 3, figs. 31—33).

Of the animal which he describes av *Lophocricetus grabaui* Professor SCHLOSSER remarks: "I cannot find any nearer relations with the strange new type either among the living or among the fossil *Myomorpha*. *Phlœomys* from the Philippines only can

be quoted as perhaps remotely similar, for it has also three pairs of cusps on its lower molars, but they are combined to three lophes and must have been originally opposite instead of alternating. Notwithstanding the new genus is of some importance, for a Murid with three pairs of alternating cusps must have been the ancestor of the numerous subfamilies of the Microtinæ, represented already in the fossil Mongolian fauna by the following genus *["Sigmodon"]*. Had he compared the fossils with specimens of *Cricetulus* and *Phodopus*, representatives of which might with little doubt have been trapped at the exact localities where Doctor ANDERSSON made his excavations, or with teeth of *Cricetodon* such as those shown in figures 1 and 7, plate 1, of SCHAUB's beautifully illustrated study of the tertiary hamsterlike rodents (Abhandl. Schweiz. Palæontol. Gesellsch., vol. 45, pp. 1—110, 1925) he would have found the relationships which he elsewhere sought in vain. The second mandibular tooth of *Lophocricetus*, as shown in figures 31, 32 and 33, differs in no essential feature from m_2 of *Cricetodon, Cricetulus* and *Phodopus*, though the antero-external lobe appears to be unusually well developed. The first mandibular tooth of the Mongolian fossil has the same elements as the corresponding tooth of *Cricetodon sansaniense* as figured by SCHAUB (pl. 1, fig. 1). It differs from the European fossil in its less antero-posterior elongation, in the narrowness of the reentrant angles, and in the consequently less conspicuous alternation of the three tubercles on the opposite sides of the crown, also in the greater height of the postero-internal tubercle. In *Cricetulus* and *Phodopus* the ground plan of the first tooth is like that of *Cricedoton gregarium* (compare SCHAUB, pl. 1, fig. 7 and pl. 5, fig. 9). Here the postero-internal tubercle is reduced to a low ridge, and an element not present in *C. sansaniense* and in *Lophocricetus* is added in the form of an antero-internal tubercle situated exactly opposite to the antero-external tubercle of the original 6-cusped plan. In *Cricetodon gregarium* the tubercles of the new anterior pair thus formed are well differentiated from each other, in *Cricetulus* and *Phodopus* they tend to become fused into a transverse plate. Undoubtedly the relationship between all of these genera is very intimate.

Sigmodon atavus SCHLOSSER (p. 42, pl. 3, figs. 35, 36).

Altnough the underlying scheme of the enamel pattern in this fossil, as best shown in fig. 36, is exactly the same as that of *Sigmodon*, the structure of the teeth in the two animals has developed in a manner which is not only unlike but actually opposed. In the American *Sigmodon* the teeth are crowded together, with loss of antero-posterior diameter and increase of transverse diameter; in the Mongolian fossil they are

elongated in the axis of the jaw. In *Sigmodon* the reentrant folds are, as a result of this crowding, very narrow, almost or quite parallel-sided, and the antero-external loop of m_2 and m_3 has been so nearly eliminated that it is present in the upper third or quarter of the crown only; in the fossil they are widely triangular, and, so far as can be judged from the photographs, all are of full depth. Such differences show that the two animals belong to stocks which have followed different lines of dental modification and that there is no possibility of regarding them as members of one genus. The characters of the dentition will be at once appreciated on comparing SCHLOSSER's figure 36 of plate 3 with figure 26 of plate 28 in TULLBERG's well known work, *Ueber das System der Nagethiere*. Therefore the fossil does not furnish the slightest evidence that the American genus *Sigmodon* ever occurred in Asia, or that it originated elsewhere than in North America.

The true relationships of *"Sigmodon" atavus* appear to be definitely with the Old World cricetines, in which group it probably stands not very far removed from *Lophocricetus*, the teeth of which are also figured on plate 3. The anterior lower tooth, however, has four salient angles on the outer side instead of the three present in *Lophocricetus*. It is therefore built on the plan seen in *Cricetodon gregarium* (SCHAUB, pl. 1, fig. 7) and in the modern *Cricetulus* and *Phodopus* rather than on the plan of m_1 in *Cricetodon sansaniense* (SCHAUB, pl. 1, fig. 1) which seems to have been followed by the first lower tooth of *Lophocricetus*. The teeth of *"Sigmodon" atavus,* however, unlike those of *Lophocricetus*, have undergone a definitely microtoid modification analogous to that which has also taken place in the Mascarene cricetid genus *Brachytarsomys* and in the American cricetid *Neotoma* and its allies. Photographs of the teeth make this microtoid character of the enamel pattern more evident than it appears in the drawings, where there has been a slight softening of the general angularity of the curves and projections. In one of the photographs the resemblance of m_1 to that of *Microtus nivalis* is very noticeable, allowance being made for the presence in the *Microtus* of one more reentrant angle on each side of the tooth. As I do not know of any described genus in which the fossil can be placed I propose to make it the type of:

Microtodon gen. nov.

The characters, so far as they can be determined from the original figures and from photographs of two jaws, both broken off slightly behind the level of the third molar, are as follows:

Mandibular teeth slightly more hypsodont than in *Cricetus* and *Cricetulus*, less hypsodont than in *Neotoma;* surface of crowns flat, and enamel pattern microtoid in aspect, the salient angles sharply pointed; outer side of each tooth with two well developed and widely open reentrant angles, of which the second extends farthest inward from the margin; inner side with reentrant angles three, two, and one respectively from first to third tooth; lower incisor apparently less curved than in *Cricetus* and *Cricetulus*.

Regarding this animal as the representative of a type now peculiar to America Professor SCHLOSSER says of it: "*Sigmodon* . . . still living now in North America, deserves a high amount of interest for it is the first genus among the tertiary *Muridæ* the grinding teeth of which have a flat surface showing the dentine even in unworn teeth instead of distinct cusps covered by enamel. The ancestor of this genus remains to be discovered" (p. 114). "In return it is probable that *Sigmodon,* known in present time and in the pleistocene from North America, only originates from an European *Cricetodon* rather than from an American *Eumys* or *Hesperomys*. It might have immigrated into the New World together perhaps with *Mephitis* and other *Mustelidæ*, but we are not sure whether this immigration has taken place already in the pliocene or not before the pleistocene" (p. 119).

Mus hipparionum SCHLOSSER (p. 43, p. 3, figs. 27, 28).

The teeth figured under the name *Mus hipparionum* are obviously those of a Murine rodent, but they cannot be referred to a member of the recent genus *Mus*. The transverse ridges of the mandibular teeth in *Mus* and also in *Rattus* are simpler than those of the fossil. The two ridges which in the living genus form practically the entire crown of m_2 and m_3 and the main part of the crown in m_1 are each composed of two tubercles (except the reduced posterior ridge of m_3), essentially alike in size and form, those on the outer side not bearing any reentrant angle or supplementary fold. This is a condition obviously distinct from that which occurs in "*Mus*" *hipparionum,* and to ignore it is to obscure the facts of history. Professor SCHLOSSER regards the fossil as a member of the "*Mus*" *sylvaticus* group, that is, an *Apodemus*, but the characters of the lower molars in this genus are even less like those present in the fossil than are those of *Mus* or *Rattus*. For teeth closely resembling those of "*Mus*" *hipparionum* we must go to the genus *Acomys*. Here it is not unusual to find lower molars which, at the right stage of wear, are not very different from those shown in figure 27. There is, in the recent animal, less contrast in size between the

tubercles of the inner and outer series, but otherwise the resemblance is obvious. I have not seen an *Acomys* in which the posterior ridge of m_1 exactly resembles that which is indicated in figure 28, but in some specimens this condition is distinctly approached. While it would be unsafe to assert, on no other basis than the figures of these two mandibles, that "*Mus*" *hipparionum* is certainly a member of the genus *Acomys*, there can be no doubt that such characters as are shown on the plate definitely remove the fossil animal from *Mus* and indicate a probable near relationship to *Acomys*.

Mus (p. 44, pl. 3, fig. 30).

The alternating tubercles in the two teeth referred by Professor SCHLOSSER to an undetermined species of *Mus* show that the animal was not a Murine rodent but a small Cricetine. It seems probable that these molars represent the unworn condition of the crowns in *Lophocricetus grabaui,* as the number and arrangement of the tubercles exactly agree with the conditions present in this animal. Professor SCHLOSSER regards the teeth as comparable with those of the *Mus abbotti* of NEWTON and the *Mus donnezani* of DEPÉRET. Both of these European species, however, are Murines, the former clearly an *Apodemus;* the latter may also be a member of the same genus, but the teeth of the type specimen are so much worn that no exact generic determination can be made.

THE GEOLOGICAL SURVEY OF CHINA

Palæontologia Sinica

中國古生物誌

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Mus ([illegible] fig. 30).

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W. H. WONG, DIRECTOR

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