

6. A Revision of the fossil Lagomorpha in the Palaeontological Museum, Upsala.

By

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In the LAGRELIUS Collection of fossil vertebrates in the Palaeontological Museum, Upsala, remains of lagomorphs are fairly well represented. Part of the material was described by SCHLOSSER (1924), the rest by YOUNG (1927). Only one single upper jaw from Loc. 73 (Wu-Hsiang-Hsien, Shansi) was not available to these authors (found among some still unprepared material).¹ The descriptions of these fossils have not passed unnoticed. SCHLOSSER's *Lepus annectens* was by DICE made the type of a new genus *Alilepus* (originally *Allolagus*).

Some details in SCHLOSSER's description of this species made me suspect that there must be something wrong, and a preliminary examination of the type specimens made me aware that a new description of the whole material is highly desirable. It is chiefly the Tertiary and Early Quaternary forms that are of interest, the younger material I am going to deal with more summarily.

After the material was described by the two authors much of it was sent back to China and therefore I have access to a much smaller material than the one used by SCHLOSSER and YOUNG. This, I mean, is a regrettable fact, even if it might seem desirable that as many museums as possible could get correctly determined specimens of the original series. There might namely be reasons, as in the present case, why this original series should be preserved intact, even if the museums in that way would deprive themselves of material for exchange.

Leporidae.

Genus *Alilepus* DICE 1931.

Lepus KORMOS 1911, KHOMENKO 1914, SCHLOSSER 1924.

Allolagus DICE 1929.

Lepus SIMIONESCU 1930.

¹ Of the material from Mongolia numbers 83—87, 105—117, and 134 are from Ertemte; 102—104, and 132—139 from Olan-chorea.

The type species is *Alilepus annectens*; later three (possibly four) other species have been referred to the genus (see DICE 1931 p. 159, KORMOS 1934 p. 73, GAZIN 1934 p. 119, and SCHREUDER 1936 p. 236).

Alilepus annectens.

(Figs. 1; 2 A—D; 3; 4 C, F; 5; 6 A—F; 7 a—g, A—D; 8 A—C; 9; 10; 17.)

Material: An upper jaw fragment with the base of the jugal arch from Ertemte (U. M. Nr. 107 a).

Palate, right side, with internal walls of alveoli (SCHLOSSER 1924, Pl. III: 28) Ertemte (U. M. Nr. 83).

Skull fragment, left side. Jugal arch complete; P³—M³. Loc. 73.

Left premaxillary with I², I³; ramus frontalis missing (Loc. 73; U. M. Nr. 246). There is also a right bulla possibly of the same specimen.

3 lower jaw fragments (SCHLOSSER 1924, Pl. III: 37), Ertemte (U. M. Nr. 84): one of the right side with I₂ (alveolus) and P₃—M₁. Lower border preserved back to the angular process; — one, right side, with P₄—M₂; — one, left side, with M₁, M₂.

Condyle of right lower jaw. Olan-chorea (U. M. Nr. 102).

Two partial right lower jaws (angle and ascending ramus missing): one from Loc. 73 (U. M. Nr. 246); one from Yü-Shê-Hsien in Shansi.

I²: 3 specimens from Olan-chorea, 3 from Ertemte.

P²: 2 specimens from Olan-chorea.

Upper molariform teeth: 4 from Olan-chorea, 14 from Ertemte.

I₂: 3 from Olan-chorea, 4 from Ertemte.

P₃: 3 from Olan-chorea, 4 from Ertemte.

Lower molariform teeth: 6 from Olan-chorea, 9 from Ertemte.

M₃: 2 from Ertemte.

Skull.

For the description of the skull fragments I will make comparisons with the recent forms available to me and first of all with *Lepus timidus*. It might seem superfluous to go into such detail, but as *Alilepus* is supposed to belong to a line of evolution separate from most of the recent forms nothing in its structure can be considered as a matter of course.

The nasals are not preserved, but there is little doubt that the straight and strongly oblique anterior border of the frontal marks the course of the naso-frontal suture (Fig. 1 B). The shape of this suture appears to be very variable in the living genera.

The frontals show the same low relief as in the living leporids. There was a shallow groove on each side extending from near the mid-line in an antero-external direction delimiting the supraorbital flanges antero-medially. This pair of grooves encloses together with the nasofrontal suture a rhombic

area of the frontals as in *Lepus timidus*, but in contradistinction to *Pronolagus*, *Sylvilagus floridanus*, and the common rabbit, in which the grooves run parallelly to each other from the posterior supraorbital notch forwards to the postero-lateral corner of the nasals. Posteriorly in this groove there is a small group of nutritional foramina, which appears to be absent in *L. timidus*, but are very well developed in the other species mentioned above. In practically all skulls of recent leporids at my disposal there are approximately in the centre of the rhombic area mentioned above, very closely to the sutura frontalis (or even on the same) one or two small foramina which

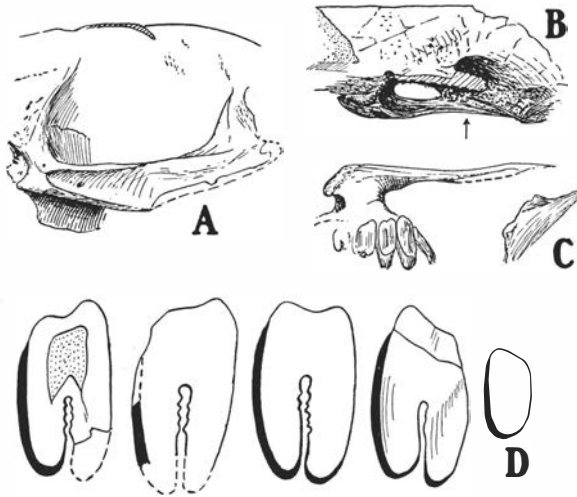


Fig. 1. *Alilepus* cf. *annectens*. Skull fragment, left side; Loc. 73. A From the side. B From above. C From below. D P_3 — M_3 , trituration surface. A—C Nat. size. D $\times 6$.

are evidently the analogues of the larger and more widely separated foramina seen in *Palaeolagus haydeni* (WOOD 1940, Pl. XXXIV, fig. 2 a). I cannot find even a trace of such a foramen in the preserved left frontal of *A. annectens*. The foramen was probably unilaterally developed. A group of small pits in the region of the skull has its analogue in several recent skulls, where a similar pitting of the bones might occupy the whole roof of the brain-case.

The supraorbital flange is broken away (the hatched area in Fig. 1 B = a possible reconstruction of missing parts). A small part of the anterior notch is preserved, but it is impossible to tell if there was an anterior lobe as in *Lepus*. The character is of doubtful importance (see for instance LYON Pl. LXXXIV; in my skull of *Pronolagus* the flanges are developed approximately as in fig. 9 of the same Plate). At the posterior notches the brain-case must have been remarkably narrow (Cf. *Lepus* (*Caprolagus*) *sinensis*). The most posterior part of the frontal is missing.

The antero-posterior extension of the palatal portion of the premaxillaries is about the same as in *L. timidus*, the alveolus of I² reaches just as far back in both species and ends backwards with a small swelling at the premaxillo-maxillary suture, its most posterior part evidently lying in the maxillary. In *Pronolagus crassicaudatus* the alveolus occupies only a little more than the half of the length of the corpus; in *Lepus glacialis* a swelling on the lower side of the maxillaries a couple of millimeters behind the suture marks the posterior end of the alveolus.

The reticulate structure of the maxillaries in front of the orbit was evidently well developed, and in the part of the bone preserved it reaches below the foramen infraorbitale. This latter lies somewhat lower on the side of the maxillary than in the living forms (see the table below).

The jugal arch is remarkably slender. When the trituration surface of the tooth row is placed horizontally the anterior attachment of the jugal arch is opposite the interval between P² and P³ in front and between P⁴ and M¹ posteriorly. The anterior face is excavated by a deep pit bordered below by a fairly thin edge of bone. In most of the leporid skulls at my disposal the lower border is formed by a heavy rounded ridge, and in some of them the pit is very shallow (e. g. in skulls of *L. cf. sinaiticus* belonging to the Zoological Museum, Upsala). Only in *Pronolagus crassicaudatus* (the Swedish Riksmuseum, Stockholm, Nr. 1119) the same rather thin floor of the pit as in *Alilepus* was observed. Seen from below the malar seems to show the greatest resemblance to *Pronolagus*, only the spina masseterica is less projecting forwards; the masseteric groove, on the other hand, extends farther in this direction, and it is bordered below by a distinct ridge as far back as $\frac{1}{3}$ of the length of the malar. In all these respects the similarity with *Lepus timidus* and other forms of the genus *Lepus* is much greater. The processus zygomaticus of the squamosal extends far forwards on the malar and continued on the medial side of this bone to nearly the half of its length (through the pressure which has somewhat deformed the malar this process has been detached from that bone; anterior end in the direction of the arrow in Fig. 1 B). It was evidently only little or not at all extended backwards. In the rabbit its extension is approximately the same (WOOD's statement that »in the living leporids, the zygomatic process does not extend far forward on the zygoma, its anterior and posterior extensions being approximately equal» (1940, p. 286) is apt to convey an erroneous idea of the relation between the two bones — but certainly the anterior portion is much reduced as compared with *Palaeolagus*).

The most interesting part of the skull (as far as my fragmentary material is concerned) is the palate. The specimen at my disposal is the one used by SCHLOSSER for his reconstruction (Pl. III, Fig. 38). In the explanation of the Plate it is designated as »right maxillary» which is cor-

rect, but is is figured together with a combined left tooth row. These remarks are necessary to prevent future misunderstandings. SCHLOSSER states that the palate »is longer than in *Lepus* and more similar to that in *Caprolagus*, the posterior foramen is also wider, which is also a character of the latter genus, but it seems as if the length of the gum is a primitive feature». Even if this statement were correct, which somewhat depends on how the measurements are taken, it misses the most essential

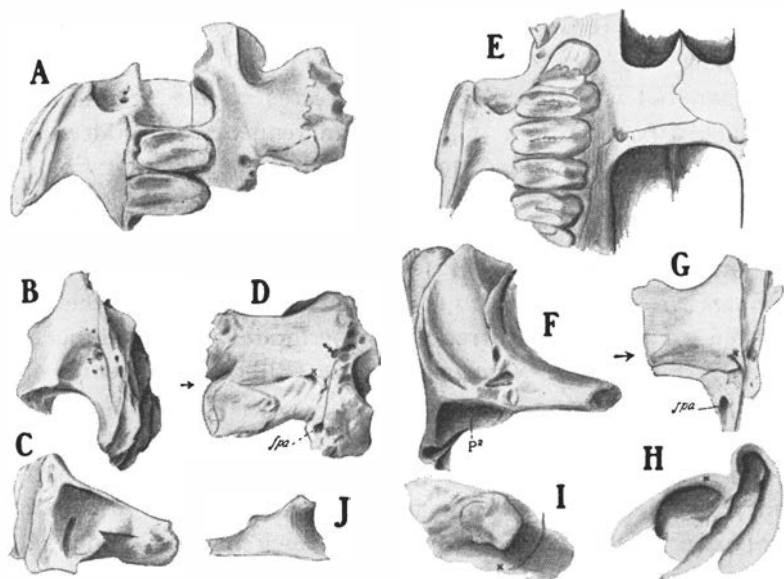


Fig. 2. A—D *Alilepus annectens*. Upper jaw fragments and teeth U. M. 83 (the palatal fragment in SCHLOSSER 1924, Pl. III: 38), U. M. 107 a, U. M. 104 (teeth). A From below. B Cheek, frontal view. C Palatal fragment, frontal view. D Same fragment from above. — E *Lepus americanus* ERXLEBEN. Zool. Mus. Uppsala. Right tooth row and adjoining parts of skull, palatal view. — F—J *Lepus timidus*. F Right maxillary, frontal view. G Right half of palatal bridge from above. H—J Mortice joint between the palatine (I, J) and the maxillary (H). — The arrow in Figs. D and G marks the extension of the palatine anterad. The double arrows in D and F the extension of a canal between the orbit and the nasal cavity (in G the orbital opening is seen to the right of the ×). × marks the fitting of the mortice. fpa Foramen palatinum majus. — A—G × 2; H—J × 8.

characters, which distinguish the palate of *Alilepus* from all living genera (at least as far as material and literature at my disposal are concerned). In front view (Fig. 2 C) a deep excavation is seen, which is undoubtedly a recess of the narial cavity, which extends farther medially than in the modern forms and inflates the anterior portion of the palate. Its homologue in *Lepus* is easily found by the aid of a canal, which opens into it anteromedially of the alveolus of P². This canal enters the medial wall of the alveolar process (corresponding to a bony lamella forming the medial wall of the orbit + the wall of the alveolar process in *Ochotona*) at mid-height

of the alveolar process, medially of P⁴. The canal is undoubtedly the homologue of the orbito-nasal canal in *Ochotona* (BOHLIN 1942, p. 80). In *Lepus* the nasal cavity does not enter the palatal process of the maxillary at all. What is seen below and medially of the anterior opening of the canal in Fig. 2 F is a cavity inside the palatal process of the maxillary, which has been opened by a fracture.

In the specimen of *Alilepus* the bony lamellae bordering the excavation are fractured, so that it is impossible to get an idea of the original extension of the bony palate forwards. It is, however, remarkable that the lamella forming the floor of the excavation is not on the same level with the palate proper, but is elevated by a deep recess on the palatal side of the lamella (Figs. 2 A, C). This might mark a tendency to reduce the palate, but the final product would certainly have become different from what is found in the recent genera. The posterior border of the recess lies namely opposite P³ (somewhat anterior to the middle of the tooth) whereas in most modern forms it lies opposite P²; in some primitive leporids, as *Romerolagus*, *Nesolagus*, and *Pentalagus*, the palate reaches still farther forwards. The bottom of this palatal recess is perforated by a number of small foramina (cf. Fig. 3). A similar structure, although evidently shallower and of smaller extension, is described by VAN BEMMELEN in *Nesolagus* (p. 173): »An den zwei von mir untersuchten Exemplaren ist beiderseits hinter den Foramina incisiva eine etwas vertiefte Stelle mit scharfem Medianrand vorhanden, und finden sich in der Substanz der Maxillaria kleine Knochenporien, aber ohne dass hierdurch auch nur die Andeutung einer werdenden Fontanelle¹ zuwegegebracht wird.« In my specimen of *Pronolagus* (R. M. 1119; LYON's specimen, 1904 Pl. LXXVIII, fig. 2?) the anterior rim of the palate is slightly excavated on both sides of the median protrusion, and there are two fairly large foramina on each side. In three skulls of *Sylvilagus* (two of them evidently referable to the subgenus *Microlagus* TROUSSERT) the anterior rim of the palate is rather deep and in its lateral parts perforated by several foramina of varying size. The same is found in skulls determined *Lepus swinhoei*, *Lepus capensis*, further in *Lepus timidus* and others. In *L. arcticus* the foramina are present but lie on the dorsal side of the palatal bridge, the anterior edge of which is thin. It might be that, after all, the structures met with in *Alilepus* — *Nesolagus* — *Pronolagus* — *Sylvilagus* (and others) — *Lepus arcticus* are homologous and represent different stages in the reduction of the palate (Fig. 3): First a thinning of the palate, chiefly anterior to the tooth rows, occurred, with a different extension backwards in different forms (farther backwards in *Alilepus* than in other genera) but always (?) well defined from the rest of the palate posteriorly. In this thin portion a fenestration took place,

¹ If conditions are the same as in *Alilepus*, *Pronolagus*, *Lepus*, and others this »Knochenporien« cannot represent an incipient fenestration.

which finally spread to its posterior limit but did not enter the thicker part of the palate which remained as the palatal bridge between the tooth rows.¹ A. SCHREUDER suggests after a study of three individuals of *Nesolagus* of different age that MAJOR is correct in assuming that the posterior part of the foramen incisivum were a fontanelle. In Fig. 3 I have given a hypothetical section of the anterior edge of the palate as it is suggested by various figures of *Nesolagus*. This might be erroneous, and I hope that it will be checked by authors, who have access to material. I have namely a feeling that a renewed still more detailed study may disclose facts which may even solve the problem definitely.

The most posterior part of the palatal bridge was formed by the palatines, but is missing in the specimen. The foramen palatinum majus is small and its position is close to the tooth-row opposite the alveolus of

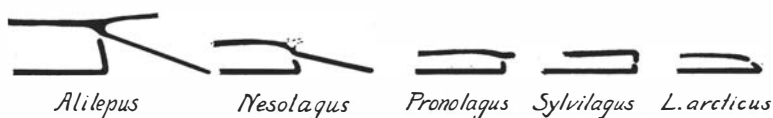


Fig. 3. Longitudinal sections through anterior part of palatal bridge. Schematical. See the text.

P⁴. There was evidently a smaller foramen postero-internally to the larger one. On the whole the arrangement of the foramina is much the same as in *Lepus timidus*, and differs from primitive forms as *Romerolagus*, *Nesolagus* and *Caprolagus*, in which the foramina appear to be larger and more approached to the middle of the palate (about half-way between the tooth row and the median suture). *Pentalagus* differs less from *Alilepus*. The forms, which agree with *Alilepus* in the position of the palatal foramen, have strongly reduced palatines, and I am therefore inclined to ascribe similar palatines to *Alilepus* (Fig. 2 A). A small part of the palatine must be preserved between the foramen and the alveolus of M¹ but the suture is obliterated. On the dorsal side the palatines have extended farther forwards than in *Lepus timidus*, but there has been a similar mortice-joint between the palatine and the maxillary as in the living species (× in Figs. 2 D, G; also H—J).

Of the petrosal I have prepared a drawing and for comparison drawings of *Lepus timidus* and *Pronolagus crassicaudatus* (the latter after a very poorly preserved specimen; Figs. 4 A—C). The fossa mastoidea is smaller than in *Lepus*, and its opening circular instead of oval. The apertura interna canalis facialis is of the same size as the porus

¹ In *Ochotona*, where the palatines form the greatest part of the palatal bridge the vacuities might resorb the palatal processes of the maxillaries entirely (for instance *O. lagrelii*; see below), the posterior limit for the fenestration of the palate being set by the palato-maxillary suture.

acusticus internus and its position is laterally to this latter. In *Lepus timidus* the apertura is strongly elongated forwards. *Pronolagus* appears to be intermediate between the two but more approached to the modern form.

The bulla tympani is small but not as small as in *Pronolagus*. If we compare the three figures 4 D—F we observe another interesting difference. In *Lepus* the lower face of the meatus auditorius externus is proximally produced into a process, that is attached to the bulla and in some species has a free tip reaching below the bulla. The figured

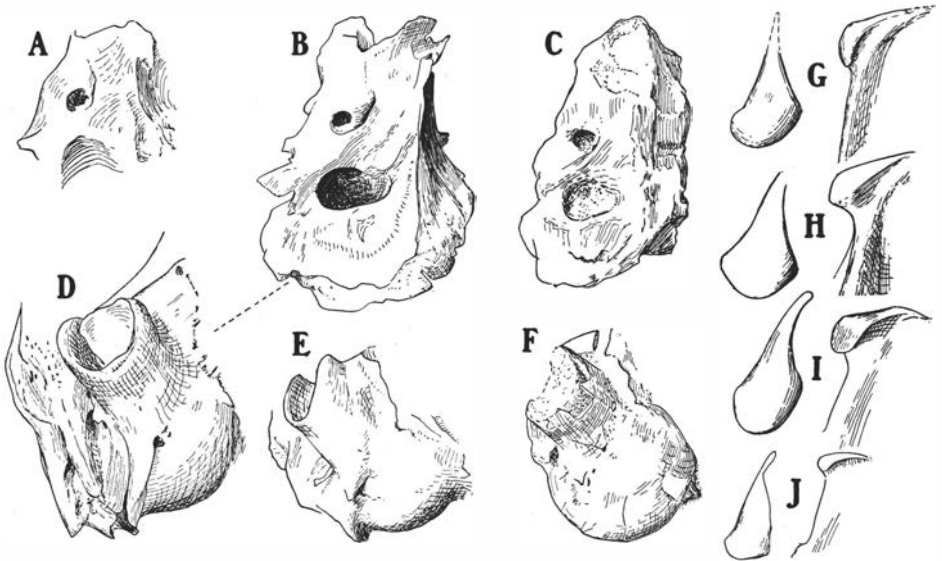


Fig. 4. A—C Right petrosal, medial face of: A *Pronolagus crassicaudatus*. B *Lepus timidus*. C *Alilepus annectens*. — D—F Right bulla ossea, lateral view of: D *Lepus timidus*. E *Pronolagus crassicaudatus*. F *Alilepus annectens*. — G—J Condylus of right lower jaw from the medial side, of: G *Alilepus annectens*. H *Lepus timidus*. I *Pronolagus crassicaudatus*. J *Ochotona melanostoma*. — All $\times 2$.

specimen was chosen because in it the process is most conspicuous. In *Pronolagus* it is very short, and in *Alilepus* it is practically missing, represented by only a small point of bone fused with the bulla. Of the sometimes very large and deep pit, that is seen in recent species in front of the process, there is hardly a trace in *Alilepus*. It is true that this character is rather variable in recent forms. Of two skulls from the Sinai peninsula one has very long processes reaching below the bulla; in the other one they reach only half-way between the meatus and the lower face of the bulla, but it is still far to the complete loss of them. *Palaeolagus* is similar to *Pronolagus* (WOOD 1940, Pl. XXXIV: 2) but the bullae are apparently larger. The function of the process is probably as a muscular attachment, as it often meets the mastoid process and forms part of a com-

Table of measurements (in mm.):

	<i>Alilepus</i> Loc. 73		<i>Lepus</i>				<i>Prono-</i> <i>lagus</i>	Rab- bit
			<i>youngi</i>	<i>wongi</i>	<i>oiosto-</i> <i>lus</i>	<i>timi-</i> <i>dus</i>		
Posterior end of jugo-squamosal suture — notch anteriorly on the anterior root of the jugal arch	30		—	30.5	33	36	34	31
Smallest breadth of frontals	2 × 7		15?	13	13.5	16	13	12
Upper border of foramen infra-orbitale — tip of the masseteric spine of jugal arch	6		9?	8.5	—	10	9	9
Height of skull from M ³ to most posterior point on nasofrontal suture	27		—	—	—	32	28	26.5
P ⁴ —M ³	8.2		{ (P ⁴ —M ² 7.9; + M ³ ?9.0)	9.3	9.1	10.6	9.1	8.4
	Loc. 73	Y.-sh.-hs.						
P ₃ —M ₃	12.7	14.2	—	—	15.4	16.4	16.1	12.7
Height of lower jaw behind M ₃	13.5	15.3	—	—	15.4	16.4	16.1	14.9

plex rugosity, which might also include the lower face of the bulla itself. I have thought these details worth mentioning although I am not able to appreciate at present their real value as systematic characters.

The lower jaw is decidedly modern in type, and most like *Lepus tolai* (R. M. 1126) of all forms with which I have compared it. In fact it differs very much more from *Pronolagus* than from any of the representatives of the genus *Lepus* in my material of recent skulls: Anterior border of masseteric fossa marked off from the lateral face of the horizontal ramus by a marked ridge (more diffuse in *Pronolagus*); diastema not excessively long and not bent down (the development of the diastema in *Pronolagus* is of course due to specialization). There is nothing in the structure of the lower jaw, that would approach *Alilepus* to *Palaeolagus*. A fairly good and correct figure is the one given by SCHLOSSER (1924, Pl. III, fig. 37).

I have figured the condyle of *A. annectens* and the one of three living forms for comparison (Figs. 4 G—J). It appears to be less symmetrical, and its anterior border less convex than is usually the case in recent forms.

Dentition.

The upper incisors are of the leporid type. The anterior groove in I² is shallow and uncomplicated. The two figured specimens (Figs. 5 A—G) differ in size and also in cross-section. The material is too small for an appreciation of the possible importance of these differences; however, in

the shallowness of its groove the specimen in Figs. E—G appears to be unique.

On closer examination the tooth supposed by SCHLOSSER to be the P^2 and used for his reconstruction of the tooth row (*op. cit.* Pl. III, figs.

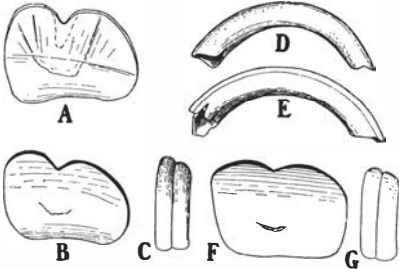


Fig. 5. Upper incisors of *Alilepus annectens*. — A—D smaller specimen (U. M. Nr. 85). A wear surface. B same seen as cross-section of the tooth. C Front view. D medial view. — E—G Larger specimen (U. M. Nr. 85; SCHLOSSER 1924, Pl. III: 40), same aspects as B—D. — A, B, F $\times 6$; C—E, G $\times 1.5$.

38, 38 a) proved to be the trigonid of a left lower molar. There were, however, among the material two specimens of the tooth. These differ from most living forms in having only two reentrant folds on the anterior face, the external one being very shallow (Fig. 6 A). — It is not quite certain that this outer groove is homologous to the external reentrant in *Lepus*. The course of development seems to have been: 1) The main anterior reentrant was first formed. 2) The internal one of the lobes thus formed was divided by the internal reentrant (*cf.* *Lepus youngi*, Fig. 12 A). 3) The

external lobe was divided in the same way. The external groove in *Alilepus annectens* might correspond to a depression lying externally to all the reentrants in *Lepus* (*cf.* Figs. 12 A—C). If the groove should correspond to the outer groove in *Lepus*, then we meet with the interesting fact that *Alilepus annectens* and *Lepus youngi* have complicated their P^2 in quite

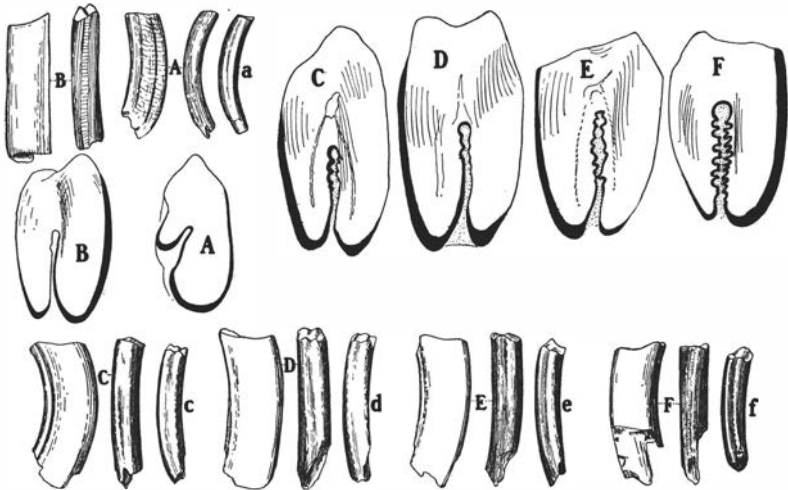


Fig. 6. Upper cheek-teeth (all except BB and FF from the left side) of: AA—FF *Alilepus annectens* (CC—FF, U. M. Nr. 83, used by SCHLOSSER for the combined tooth row Pl. III: 38, 38 a) a, c—f ?*Lepus* sp. Recent, Mongolia. AA (U. M. Nr. 139 a) a P^2 . — BB (U. M. Nr. 86) M^2 . — CC P^3 . — DD (P^4 or M^1), d P^4 . — EE P^4 (or M^1), e M^1 . — FF P^4 (or M^1), f M^2 . A—F crown view $\times 6$. A—F Front view and lingual view $\times 1.5$. a, c—f lingual view $\times 1.5$.

different ways: in the former the second reentrant is formed buccally, in the latter lingually of the main reentrant. — In all evidence the P^2 of *Alilepus* is of exactly the same type as in *Hypolagus* (various species described by GAZIN, 1934). This type of P^2 is retained in the living *Nesolagus* and a still simpler P^2 is met with in *Brachylagus* (SCHREUDER 1936, pp. 230—231). The antero-posterior curvature of the tooth is about the same as in *Lepus* (Figs. 6 A, a).

P^3 — M^2 were not described by SCHLOSSER, but DICE (1929, p. 342) gives a short characteristic based on SCHLOSSER's figures. The drawings are, however, so much simplified that all details of the structure are obscured. In the combined tooth-row P^3 is undoubtedly correctly determined. P^4 and M^1 are so similar that they might have been confounded (*cf.* text of Fig. 6). Regarding M^2 it is very doubtful if it is really this tooth (see below); further SCHLOSSER has put in as M^2 a right upper cheek-tooth, whereas all the other teeth are from the left side. The teeth must have belonged to individuals of different age, especially the » M^2 » does not fit well in with the other ones (compare Fig. 1 D). I am unable to tell for certain which were the older individuals, those with strong crenulation of the internal fold, or those in which the sides of the fold are almost smooth. In a tooth of more than 12 mm. height there is, namely, no noticeable difference between the two ends. A comparison with *Palaeolagus* might, however, furnish a clue to the problem. WOOD writes (1940, p. 296): »After wear has proceeded to the point where the fold no longer gapes widely lingually, but when the two sides have become essentially parallel, there intervenes a short period of time when there are distinct crenulations along the sides of the fold. Only a small amount of additional wear is needed to get below the zone of crenulations into a region where the sides of the valley are smooth and straight.» If the same sequence of stages occurred in *Alilepus*, then a tooth like the » M^2 » in Fig. 6 F would have belonged to a quite young individual, whereas the M^2 in Fig. 6 B would be old, which would hold true also for the skull fragment, Fig. 1. — My experience of leporid teeth, although not extraordinarily rich, seems to indicate that the crenulation of the walls of the »hypostria» is stronger in the upper premolars than in the molars, especially M^2 . In some modern forms, for instance *Lepus capensis* (Riksmuseum, Stockholm, Nr. 201) all the molariform teeth seem to have reached the same high complication, in others the M^2 does not seem to differ much from *Alilepus*. The crenulation is of course an advanced feature, and its development set in anteriorly in the tooth row and proceeded backwards. Forms with strong crenulation in M^2 would then have reached the highest specialisation in their dentition (*cf.* *Pentalagus*).

According to this I have arranged all P^3 from the Mongolian localities into a series (Figs. 7 a—g; the P^3 in Fig. 1 D, would come in between d

and f; it appears to be closest to e). The supposedly earliest stage of wear (a) shows a fairly strong crenulation; especially noticeable is the deep isolated fold in the posterior lobe near the opening of the lingual fold. This is present also in two other teeth but evidently on the verge to disappear (b, c). In d—f the crenulation of the internal fold is comparatively slight, and in g it has disappeared. The internal fold is deeper in a than in g, but it does not seem from the other specimens, as if there were a regular decrease as the tooth was worn down. The tooth prism is strongly curved in a transverse plane, in a longitudinal plane it is slightly less curved than the same tooth in *Lepus* (Figs. 6 C, c).

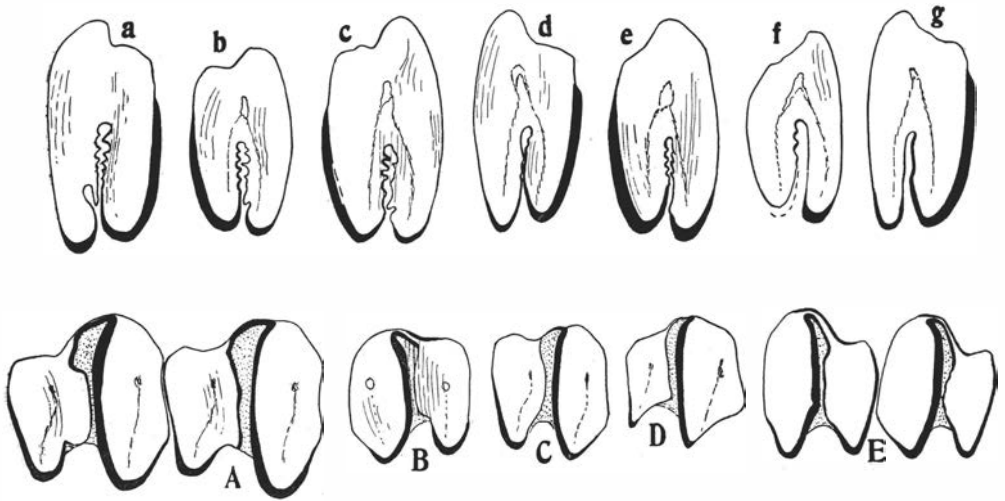


Fig. 7. a—g *Alilepus annectens*. P₃ presumably arranged according to age of individuals (a the youngest?). — U. M. Nrs. a 103, b 86, c 102, d 86, e 83, f 86, g 86. — A—D *Alilepus annectens*. A P₄ and M₁ (U. M. 84; specimens used by SCHLOSSER for the combined tooth row Pl. III: 37 a). B (U. M. Nr. 116) isolated lower cheek-tooth. C (Loc. 73) M₂. D (U. M. Nr. 116) isolated lower cheek tooth (see p. 131). — E (U. M. Nr. 249) »*Caprolagus*» *brachypus*. — All × 6.

P⁴ and M¹ are much less curved transversely than P³. Antero-posteriorly they are slightly curved, but the convexity is directed backwards, not forwards as in P³ and all molariform¹ teeth of *Lepus* (Figs. 6 D—F; d—f; Note! F is from the right, f from the left side). M² is straight in the transverse sense (Fig. 6 B) and it is therefore quite evident that the tooth supposed by SCHLOSSER to be a M² (Fig. 6 F) must be either a P⁴

¹ In the present paper and also in an earlier paper (1942) I use the term »molariform tooth» for P³—M² and P₄—M₂, *i. e.* the teeth in the upper or lower jaw respectively, which are of the same structure (»molar like») as distinguished from P², M³ and P₃, M₃, which are of different structure. This might be contrary to the common use of the term, which seems to be synonymous to »cheek-tooth», but in the case of the lagomorphs very convenient. In *Ochotona* P⁴—M² are the molariform teeth of the upper jaw.

or a M^1 . In *Palaeolagus* the teeth appear to be curved in the same way as in *Lepus*. — It is evident that in the earliest true leporids (at least in *Palaeolagus* and *Archaeolagus*, see BOHLIN 1942, Figs. 12 B, B', C, C') the upper cheek-teeth gradually become straighter when we pass from in front backwards, the posterior ones (M^2 and M^3) being straight or almost straight in the transverse sense. In *Lepus* the tooth is curved (*Op. cit.* Figs. 12 A, A'). The shape of the tooth in *Alilepus* reminds of the primitive genera.

Lower I. This tooth is of the same structure as in *Lepus*. It is slightly less curved than in *L. timidus* and the groove on the concave side is less well marked. There are species of *Lepus* which are more similar, for instance *L. tolai*.

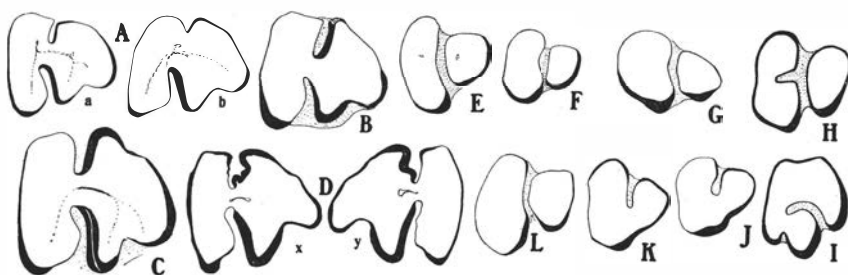


Fig. 8. A—C *Alilepus annectens*. A a, b U. M. Nr. 116; B Loc. 73; C U. M. Nr. 84 —D x y »*Caprolagus*» *brachypus* U. M. Nr. 249: x trituration surface, y 5 mm. below x. — E—L M_3 of: E *Alilepus annectens*. Isolated tooth, Ertemte; F »*Caprolagus*» *brachypus* U. M. Nr. 249, reverted; G *Pronolagus crassicaudatus*, Riksmuseum, Stockholm, Nr. 1119; H *Lepus tolai*, Riksmuseum, Stockholm, Nr. 1126, right side; I same specimen as H, left side; J *Sylvilagus floridanus mearnsii* ALLEN, Riksmuseum, Stockholm, Nr. 2107; K *Oryctolagus cuniculus* Zool. Mus. Uppsala; L *Lepus timidus* Zool. Mus. Uppsala. — All $\times 6$.

P_3 was correctly apprehended by SCHLOSSER in so far as he describes and figures two reentrants (»two columns connected in the centre of the tooth by a bridge of dentine», *op. cit.* p. 46). But in the drawing (Pl. III: 37 a) the anterior »column» is too short, and the posterior face is a little too much rounded. In the figure given by KORMOS (1934, Fig. 1 l), which is evidently a copy of SCHLOSSER's figure, these errors are further emphasized: the tooth appears to consist of two subequal lobes, the anterior one with a slight anterior swelling, which is marked off externally by a faint groove. — In reality the anterior column is almost twice as long as the posterior one and it shows a fairly deep reentrant externally. In the type specimen (U. M. Nr. 84; SCHLOSSER 1923 Pl. III: 37) the lingual reentrant is almost as deep as the posterior one on the labial side (Fig. 8 C). In a specimen from Wu-Hsiang-Hsien in Shansi (Loc. 73) the reentrants are more equal (Fig. 8 B; *cf.* YOUNG 1927 Pl. III: 16, in which the lingual reentrant appears to be deeper than the labial one). In a P_3 from Ertemte (U. M. Nr. 116; Fig. 8 A b) the lingual reentrant is very shallow;

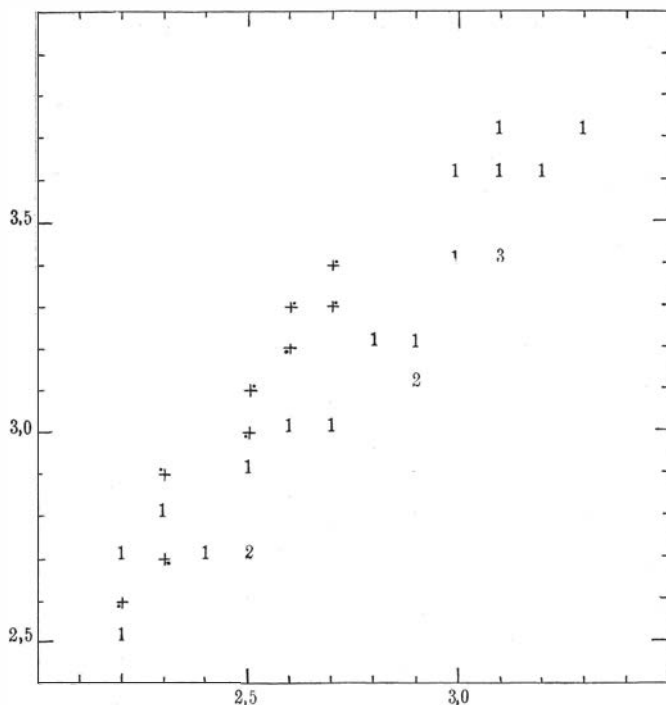


Fig. 9. *Alilepus annectens*. Relation between length (horizontal axis) and breadth (vertical axis) of lower I (+) and M (the figures, which indicate number of specimens). Measurements in millimetres. Dot in upper right quadrant of the + Ertemte, upper left Yü-Shê-Hsien, lower right Loc. 73, lower left Olan-chorea.

in two other specimens from the same locality (also Nr. 116) it is deeper but does not by far reach the development seen in the type specimen (Fig. 8 A a).

The lower molariform teeth are rather variable in size and structure (Fig. 7 A—D). In one of the specimens which SCHLOSSER used for the combined drawing in Pl. III: 37 (jawfragment with P_4 — M_2) the talonid has a deep groove antero-externally, which makes its anterior part stand out almost as a separate lobe. In most specimens this groove is less well pronounced (Fig. 7 B) and in some specimens it is almost missing (Fig. 7 C). One tooth from Ertemte (Fig. 7 D) is very different from the rest (angular lobes with sharp labial edges) but was undoubtedly scoured by the wind. — SCHLOSSER writes on p. 46: »The posterior P» (*i. e.* P_4) » does not differ from that of the following grinding teeth except by its breadth . . . » As far as I can see the breadth of the trigonids of P_4 , M_1 , and M_2 in SCHLOSSER'S specimen is exactly the same (at most there is a difference amounting to a few hundredth of a millimetre, M_1 slightly broader than P_4).

The teeth are of the same type as in *Lepus* (*L. timidus*, *arcticus* and others), and very different from those of *Pronolagus*. In this latter genus

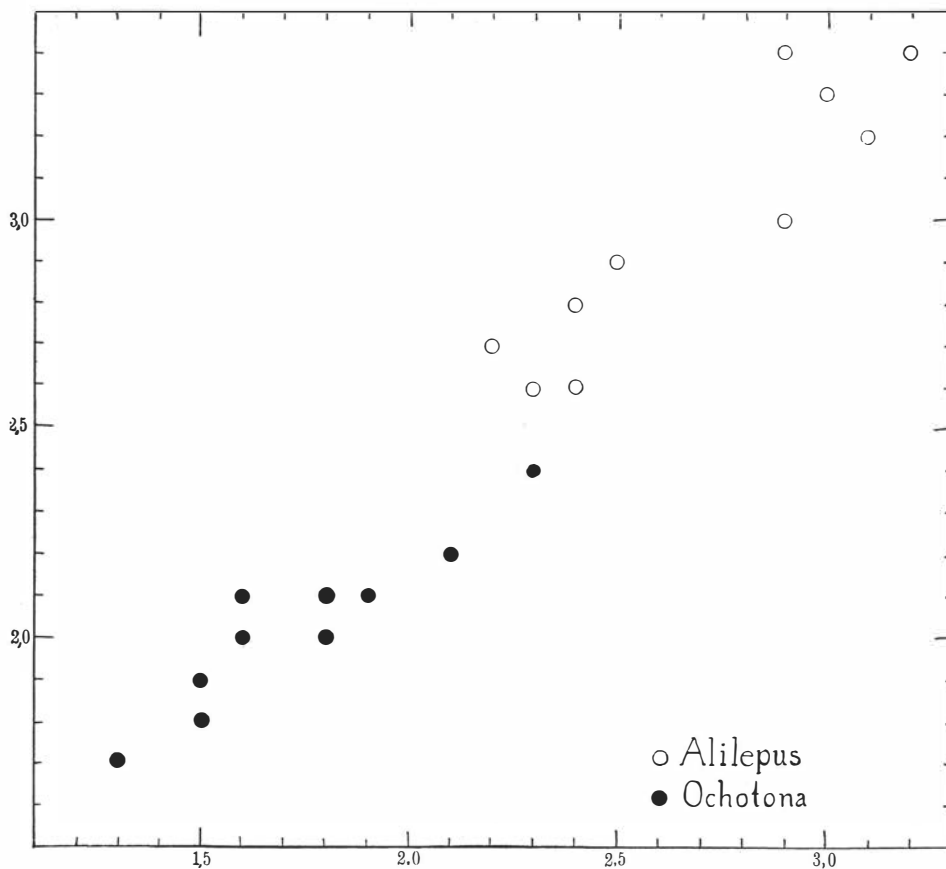


Fig. 10. *Alilepus annectens* and *Ochotona lagrelii*. Relation between length (horizontal axis) and breadth (vertical axis) of P_3 . Measurements in millimetres.

there is a heavy covering of enamel also on the back of the talonid, and on the back of the trigonid there is a pronounced ridge (such a ridge is indicated in some teeth of *Alilepus*, for instance in the jaw from Yü-Shê-Hsien, Shansi, but it is mostly indistinct or absent, as seems to be the case in most living forms).

M_3 , finally, is very similar to the one in *Lepus* (broad anterior lobe, posterior lobe narrower, sub-cylindrical see Fig. 8 E; cf. Fig. 8 L). In *Pronolagus* the whole tooth is narrower and more elongate, the posterior lobe is subtriangular in cross-section.

It is evident from the description above that in the diagnosis given by DICE (1929, p. 342) only the structure of P_3 holds good, and even this character seems to be subject to such strong variation that a much larger material is needed for a full appreciation of its significance.

Revised diagnosis: Skull and lower jaw definitely modernized: supraorbital processes large (anterior notch?), palate short, deeply excavated anteriorly, processus palatini of palatal bones evidently strongly reduced, P² simple with one single reentrant (and a shallow groove farther externally). Internal fold of P⁴—M² penetrating half-way across the tooth, its walls strongly crenulated in (?) young individuals, almost smooth in (?) old ones. Lingual reentrant in P₃ either as deep as the main buccal reentrant or shallower (very shallow in some specimens).

In all evidence *Alilepus* must be retained as a separate genus. Regarding the relation of the species *annectens* to other species referred to the genus I have to leave the question as it stands after the revision by KORMOS and others, as I think further discussion without access to the whole material of types will be useless. It is, however, evident that *A. annectens* as far as P₃ is concerned, comes much nearer to *A. laskarevi* than is indicated by KORMOS' figures (I have not access to KHOMENKO's paper).

Another question is if the Chinese and Mongolian material belongs to one single species. As seen from the graphs (Figs. 9 and 10) there is a strong variation in the size of the specimens; for the lower molars (Fig. 9) computed in the same way as in SCHAUB 1925, p. 16:

Length: varies between 2.2 mm.—3.3 mm.; per cent of average 40.0.

Breadth: » » 2.5 » —3.7 » ; » » » » 38.7.

According to SCHAUB 27 % to 29 % would mean too great a variation for one species. The distribution of the individuals on the various sizes is the following:

	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
L. . .	2	1	1	3	1	1	1	3	2	5	1	1				
B. . .	—	—	—	1	0	4	1	1	2	2	2	0	4	0	3	2

P₃ varies less but the specimens are more distinctly split into two groups. The material of lower and upper incisors (Figs. 9 and 17) is apparently more homogenous.

The material is too small to give a clear picture of the variation, but it seems to indicate that one larger and one smaller form are present. My graphs are not published as definite evidence, but if the material kept in Chinese museums and possible future finds will be plotted in them by and by, we might finally arrive at a reliable answer to the question.

»*Caprolagus*» *brachypus*.

Caprolagus brachypus YOUNG 1927.

Caprolagus brachypus TEILHARD & YOUNG 1931.

Caprolagus brachypus YOUNG 1935.

Hypolagus brachypus SCHREUDER 1936.

»*Caprolagus*» *brachypus* BOHLIN 1942.

(Figs. 7 E; 8 D, F.)

It must first of all be stated that this form does not belong to the genus *Caprolagus*; in this Dr. SCHREUDER is right. But, on the other hand, I think the reference of the species to *Hypolagus* is equally doubtful. It was based on YOUNG's figures of P_3 , of which the one of 1927 is erroneous; the one of 1931 at least very doubtful; only the one of 1935 appears to be reliable.

In the type specimen P_3 is of very nearly the same structure as in *Alilepus*, only the enamel is more irregular, especially in the lingual reentrant (Fig. 8 D x). I have been able to state that the pattern is practically the same 5 mm. below the trituration surface (Fig. 8 D y). The opening of the lingual reentrant is narrow, which might be a tendency towards the formation of an isolated enamel island as in the jaw figured by YOUNG in 1935. This »island» is, in fact, puzzling. SCHREUDER assumes that »the jaw has belonged to a rather young animal, because in both the lower jaws figured in the preceding publications the islet has been worn out». In a very little worn tooth such islands naturally would occur as remains of a primitive pattern; but that folds in the prism of a permanently growing tooth would form islands and disappear after a long period of wear appears to me less probable. Therefore I want to suggest that we have to do with an abnormality — it may, however, be advisable to reexamine the specimen, as sometimes structures of this kind can be misinterpreted by an ever so careful observer, especially if he is not aware, what conclusion apparently unimportant details can lead to. — Finally, we must not overlook the fact that a similarly developed P_3 of *Romerolagus nelsoni* has been figured by MAJOR (1899, Pl. 37: 19).

There is a slight crenulation on the anterior face of the talonid of P_4 — M_2 , but not in the trigonid.

»*Lepus*» *youngi* n. sp.

Lepus sp. YOUNG 1927.

(Figs. 11 B; 12 A.)

The most important specimen referred to this form is the skull figured by YOUNG (*op. cit.* Pl. III: 11). The material comes from the same locality as the lower jaws *etc.* on which »*Caprolagus*» *brachypus* was based, but YOUNG has, oddly enough, not discussed the possibility that the skull might

belong to this species, or mentioned why he considered it as a *Lepus*. In a later paper (1932, p. 9; also 1934, p. 114) YOUNG writes about the possible relationship of his *Lepus* sp.: »The question whether *L. wongi*, *L. oiostolus* Hodgson (Young, 1927 and 1930) from Locality 6 and *Lepus* sp. (Young 1927) from Hui-Yu near Sanchiatien in Hsishan really belong to a single species, or may be separated into several forms as I have provisionally done, is not easy to settle. It requires a large osteological series of different species which has not yet been possible for us to obtain.»

Like YOUNG I am not very well off when it comes to series of recent forms, but it seems possible to demonstrate that *Lepus* sp. is separate from the two named species, without such material for comparison — with re-

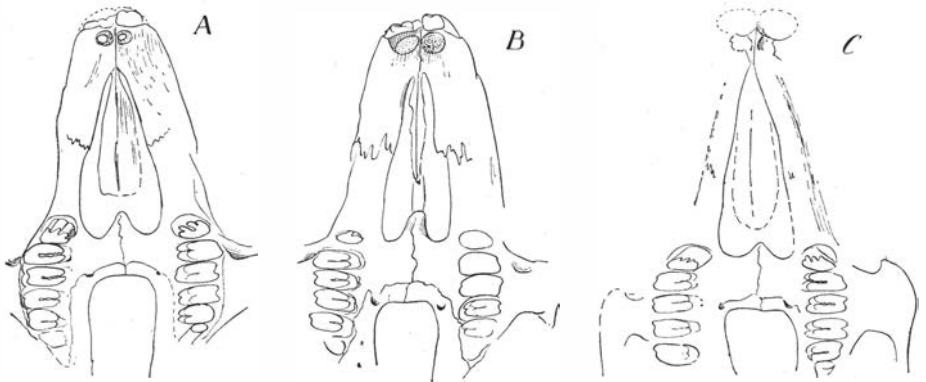


Fig. 11. Snout, palatal view of: A *Lepus wongi* (U. M. Nr. 243). — B *Lepus youngi* n. sp. (U. M. Nr. 248). — C *Lepus cf. oiostolus* (U. M. Nr. 219). — All nat. size.

servation for what might be found on a larger material of the fossil forms in question.

All three forms are of approximately the same size. The differences in the proportions of the skulls are not very conspicuous. The difference in the length of the snout will, for instance, be greatly reduced if allowance is made for the fact that in *Lepus* sp. the maxillaries and the praemaxillaries are torn apart by the pressure, which has deformed the skull. The snout in *Lepus* sp. seems, however, to be somewhat heavier and somewhat less pointed than in *L. wongi* (Fig. 11). The difference in the position of the pterygoidea might be due to deformation, as in *Lepus* sp. this part of the skull is crushed and partly restored with plaster of Paris.

The alveoli of I^3 (and probably also the teeth themselves) are much smaller in *L. wongi* than in *Lepus* sp. and this might be correlated with the somewhat different shape of the snout. The skull of *Lepus cf. oiostolus* (YOUNG 1927) is badly crushed, and the size and shape of the alveoli of I^3 cannot be determined with certainty, but the teeth appear to have been of exactly the same size as in *Lepus wongi* (stumps preserved in the alveoli).

The palate is longer in *Lepus* sp. than in *L. wongi*, but the difference from *L. oiostolus* is less marked. As the character is subject to great variation in living forms, its value for the classification appears to be very doubtful.

A comparison of the skulls indicates that *Lepus* sp. is distinct from *L. wongi*, but the nature of the available characters and state of preserva-

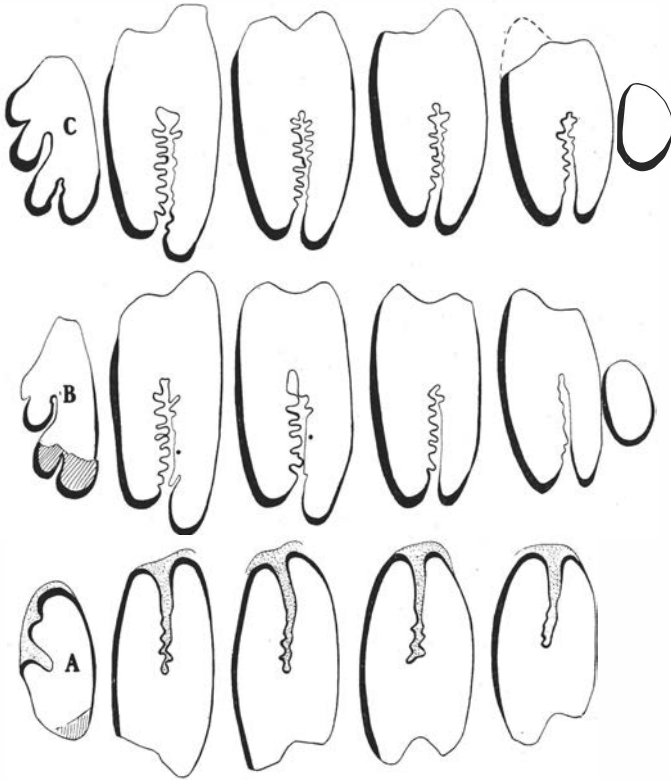


Fig. 12. Upper cheek teeth of: A *Lepus youngi* n. sp. (U. M. Nr. 248). — B *Lepus* cf. *oiostolus* (U. M. Nr. 219). — C *Lepus wongi* (U. M. Nr. 243). — All $\times 6$.

tion of the specimens leaves us somewhat in doubt. But if we go to the teeth, all doubts are removed. YOUNG rests satisfied with the statement that the teeth in *Lepus* sp. are »auffallend klein im Verhältnis zum Schädel» (1927, p. 61) and in *Lepus wongi* »im grossen und ganzen viel massiver ... im Vergleiche mit denen von anderen Arten» (1927, p. 60). It is quite true that the teeth of the latter form are larger than the ones of the former, but there are also structural differences, which may even be of very great importance.

P² of *Lepus* sp. is of a rather simple structure, only little more complicated than the same tooth of *Alilepus annectens*. There is a deep re-

entrant at the middle of the anterior face. Buccally there is only a very shallow depression (cf. p. 126) and lingually a marked groove, much shallower than the reentrant in the same position in *Lepus wongi* and cf. *oiostolus*. LYON mentions among the dental characters (1904, p. 391): »First upper maxillary tooth has typical folding of enamel on the anterior surface, a deep median reentrant angle, on either side of which is a smaller reentrant angle.» This character does not hold true for *Lepus* sp. and it is therefore doubtful if the generical reference is correct (*Lepus* sp. seems to be intermediate between *Hypolagus* and *Lepus*). *L. wongi*, on the other hand, is a typical *Lepus* (according to YOUNG its P² has only two grooves, the same number as in *Lepus* sp.; *op. cit.* p. 61). The molariform teeth are also simpler in structure than in *Lepus wongi*; the internal fold is possibly somewhat shallower, but, above all, its walls are much less crenulated. We have seen in *Alilepus* that this character might vary with the age of the individual, but the simple P² remains to be considered.

The conclusion must be that *Lepus* sp. is distinct from *Lepus wongi*, and it might even belong to another genus. Remains the question, if *Lepus* sp. can have anything to do with »*Caprolagus*» *brachypus*.

If the jaws, on which this latter species are based, are fitted on the skull, it is at once evident that they are much too short. The size of the teeth agrees fairly well, those of the lower jaw are, however, a little too small as is evident from a comparison with *L. timidus*:

	Length of P ² —M ²	P ₃ —M ₂	
» <i>Caprolagus</i> »	(computed 9.2)	11.0	(83.3)
<i>Lepus</i> sp.	10.1	(computed 12.1)	(83.3)
<i>Lepus timidus</i>	11.2	13.5	average 83.3 { 83.0 82.4 83.5 82.2 80.2 84.8 86.8
» » »	12.2	14.8	
» <i>arcticus</i>	12.6	15.1	
» » »	12.0	14.6	
» <i>cf. oiostolus</i> (not of same individual)	10.5	13.7	
» <i>tolai</i>	10.1	11.8	
<i>Pronolagus crassicaudatus</i>	10.5	12.2	

This difference in the size of the teeth does evidently not suffice to compensate the difference in the length of the snout in the two species »*Caprolagus*» *brachypus* is decidedly short snouted (see BOHLIN 1942 p. 69), whereas in *Lepus* sp. the snout is of normal length.

So far YOUNG was right, when he desisted from a comparison of the two species: they cannot be identical. But we have seen that P₃ of »*Caprolagus*» *brachypus* is very similar to P₃ of *Alilepus annectens*, only slightly

more complicated. And P² of *Lepus* sp. is not unlike the same tooth in *Alilepus* except for the addition of a lingual groove in the former (compare, however, p. 126). Also the comparatively slight wrinkling of the walls of the internal fold is an agreement between the two forms. The palate is, however, different (Fig. 2 A and 11 B).

The fact that *Lepus* sp. and »*Caprolagus*» *brachypus* each in its way approaches *Alilepus* does not necessarily imply that they are especially closely related. It is tempting to give a specific name to the former and I propose to call it *youngi*. I keep *Lepus* as the generic name although I believe that a detailed study of a larger material will show that it cannot be referred to this genus *sensu stricto*.

It may here be noticed that in 1927 Locality 60 (Hui-Yü 10 li north of San-Chia-Tien in Wan-Ping-Hsien, near Peking) is mentioned by YOUNG as the origin of both »*Lepus*» *youngi* n. sp. and »*Caprolagus*» *brachypus* YOUNG. No mention is made of the possible existence of two distinct levels at the locality and there is certainly nothing in the lists of localities, which accompanied the consignments of fossils that indicates that the whole material is not of the same age; and the state of preservation is very much the same: the bones are hard, of light colour, the lower jaw and the femur of »*Caprolagus*» *brachypus* slightly greyer than the skull of »*Lepus*» *youngi* which is partially cream-coloured. The same fine red clay is attached to all the bones. The femur and the pelvis (but not the lower jaw) referred to »*Caprolagus*» *brachypus* has »schwarze dendritenähnliche Flecken» like the skull of *L. youngi*. It is therefore a little surprising to find in YOUNG 1934 (p. 117) a list of the »Fossil Leporidae known in China» in which the *Lepus* sp. from Hui-Yü is considered as lower Pleistocene (»Choukou-tien») and ?*Caprolagus brachypus* from Hui-Yü and Ching-Lo as Final Pliocen (»Sanmenian»).

In all evidence *Lepus youngi* is contemporaneous with »*Caprolagus*» *brachypus*. It is primitiver than *Lepus wongi* (which appears to belong to the Chou-Kou-Tien stage) but it might be the forerunner of this or others of the somewhat later forms.

Lepus wongi and *Lepus* cf. *oiostolus*.

(Figs. 11 A, C; 12 B, C.)

In the discussion of *Lepus youngi* the somewhat later *L. wongi* and *oiostolus* have been mentioned several times for comparison. The latter of these forms seems to have a longer snout than the former (Fig. 11 A and C) and its upper cheek teeth appear to be slenderer and their internal fold slightly less complicated (the wrinkling of the posterior wall of the fold slight or absent, Fig. 12 B; in another specimen the wrinkling extends farther linguad in P³ and P⁴, approximately to the dots in the figures, but

is absent in M^1). At least of *L. cf. oiostolus* a large material has been discovered later and described by YOUNG (1930) and it is up to those who have access to that material rather than to me to find out, if the Early Pleistocene hares of China belong to more than one species. But it is about time that these hares are really studied and not only »described» in general terms with single facts mentioned at random to give the »description» an appearance of being accurate. The differences in the upper teeth discussed above may turn out to be of absolutely no importance, but an analysis based on such detailed study has never been tried. And if the teeth shall be figured at all, the figures must give all minute details or else they can be left out entirely. All that can be seen in most figures is that the teeth have belonged to a hare; — and as is the case with the figures of for instance *Alilepus annectens* the inaccuracies might be mistaken for facts and seduce into dangerous speculations.

Lepus tolai.

This species is represented by several lower jaws which are undoubtedly very close to *L. tolai*, but as is the case with *Lepus cf. oiostolus* we would do well to add a *cf.* to the specific name. It is, however, more likely that the subfossil remains referred to *Lepus tolai* really belonged to a still living species than those of the Early Pleistocene form. For a detailed study of *L. tolai* the fragmentary fossils are of very little importance.

The classification of the Chinese Leporidae.

If DICE is right, the Chinese Leporidae should belong to two widely separate phyla: *Alilepus annectens* and »*Caprolagus*» *brachypus* to the *Palaeologinae*, the rest to the *Leporinae* (*Lepus youngi*?). I have, however, always had a feeling that this classification pays far too much attention to one single detail, and except for its P_3 *Alilepus* is undoubtedly much closer in its structure to forms regarded as leporines than to *Palaeolagus*. GAZIN (1934, p. 120) writes: »However, whatever phylogenetic speculations are warranted by the implications of the pattern of P_3 remains to be demonstrated», and this appears to be one of the most true things that has been uttered in the discussion (P_3 undoubtedly can be used for classification, but to what extent?).

There were originally three subfamilies but »der sonderbare kleine Hase» *Pliolagus beremendensis* KORMOS showed that there were transitions in the structure of P_3 between *Palaeologinae* and *Archaeologinae* the latter characterized by a single, buccal reentrant penetrating only half-way across the tooth. But once this transition is recognized as possible a subsequent deepening of the remaining buccal fold till the condition found in the modern hares were reached would seem to be even less difficult to understand.

I do not deny that a lingual reentrant is characteristic of P_3 of *Pronolagus*, *Pentalagus* and *Romerolagus* but the type may even have arisen independently in the three lines.

All three genera appear to be highly specialized, *Romerolagus*, to judge from LYON'S figures (1904 Pl. 91: 3), at least in its teeth. And in *Pronolagus* and *Pentalagus* all teeth (not only P_3) are highly characteristic and evidently developed under special mechanical influences. The existence of these aberrant types have made me believe that the leporid teeth are rather

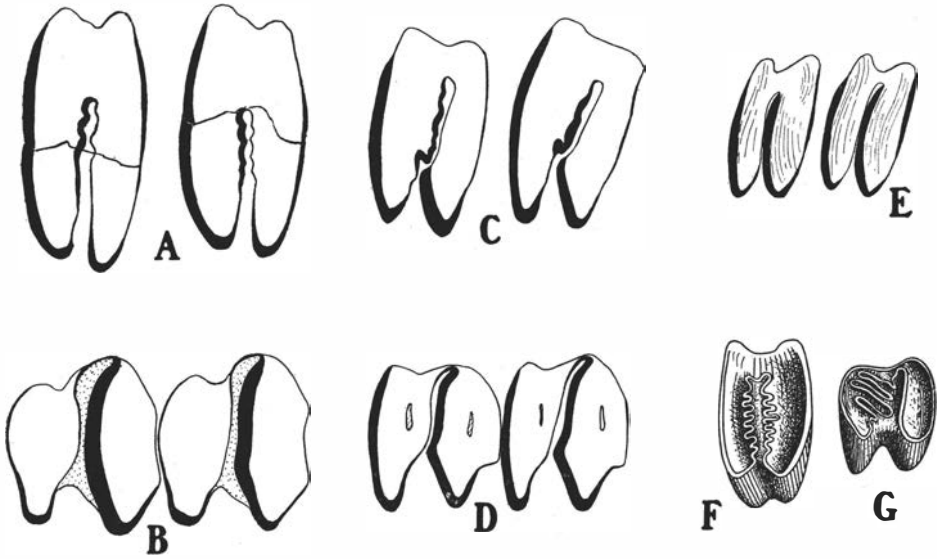


Fig. 13. A, B *Lepus timidus*: A P_4 , M_1 ; B P_4 , M_1 . — C, D *Pronolagus crassicaudatus*: C P_4 , M_1 ; D P_4 , M_1 . — E *Ochotona melanostoma* P_4 , M_1 . — F, G *Pentalagus furnessi* (after LYON): F M_1 ; G M_1 . — All $\times 6$.

plastic: The usual monotone development of the upper molariform teeth would then correspond to rather monotone feeding habits, or at least identical movements of the jaws. To judge from the structure of its teeth *Pronolagus* would, on the other hand, show a certain resemblance to *Ochotona*. In *Ochotona* the internal fold is widely open in its most internal part («strongly forked» according to TEILHARD); the same is the case in *Pronolagus* (cf. Figs. 13 A, C and E). In *Ochotona* the enamel forms a heavy lamella anteriorly on each lobe. *Pronolagus*, on the contrary, is a true leporid and the distribution of the enamel is accordingly different from *Ochotona*: there is a heavy covering on the anterior face of the tooth, buccally on the anterior wall of the internal fold and around the lingual end of the posterior lobe, but as is seen in Fig. 13 C the latter two form together a lamella, which is a perfect imitation of the posterior one of the lamellae in the *Ochotona* tooth (Fig. 13 E). In *Romerolagus* a similar specialisation occurs; at least do the teeth of *Romerolagus* and *Pronolagus*

show a certain similarity in the figures given by LYON (*cf. op. cit.* p. 421: »The teeth of *Romerolagus* in a general way resemble those of *Pronolagus*» . . . »The second, third, fourth and fifth upper molariform teeth show reentrant angles that extend nearly across the teeth, but not quite so far as they do in *Pronolagus*. The internal third of the reentrant angles is rather wide; for the external two thirds, the adjacent sides are almost in contact.»)

In a paper of 1942 (p. 57) I have spoken of an ochotonoid adaption of the teeth in *Pronolagus*, and this is further emphasized by the structure of the lower molariform teeth. In *Lepus* there is a heavy covering of enamel posteriorly in the trigonid and a marked thickening of the enamel on the buccal edge of the talonid (Fig. 13 B). In *Pronolagus* the enamel is as well developed on the posterior face of the talonid as on the trigonid exactly as in *Ochotona* (Fig. 13 D, and 14 P, Q). *Romerolagus* appears to agree with *Pronolagus* (LYON *op. cit.* Pl. XCI figs. 3 and 8; *cf.* pp. 421—422: »The posterior portions of the second, third, and fourth lower molariform teeth have their lateral diameters equal to those of the anterior portions, like these teeth in *Pronolagus*.» I have suggested (1942, p. 46) that the propalinal component in the movements of the jaws of *Ochotona* is more pronounced than in the leporids.¹ I have never seen a pika chew (nor any other of the lagomorphs except the common rabbit) and therefore my suggestion is merely a guess, but there must have been some mechanical cause for the development of these structures. And the same or a similar cause as in *Ochotona* must be responsible for the convergent development in *Pronolagus* (and *Romerolagus*?).

In *Pentalagus* one would rather suspect transverse movements of the lower jaw to be predominant and the deepening of the folds of the second order (in both upper and lower teeth, but especially in the latter) to be an attempt to produce enamel ridges standing perpendicularly to the direction of the movements.

The presence of a P₃ with a lingual reentrant in *Romerolagus* — *Pronolagus*, in *Pentalagus*, and in hares with »normal» cheek-teeth, as for instance »*Caprolagus*» *brachypus*, can of course be taken as a proof that the palaeolagine P₃ is such an old and well established character that it has

¹ According to WOOD (1940, p. 286) the articulation of the lower jaw behind the jugal process of the squamosal would make propalinal movements impossible (»complete absence of any potentiality for antero-posterior motion»). As far as I can see, however, this arrangement might put limits to the forward movements (which also the upper incisors do), but there is nothing to prevent that at least a certain amount of backward movement takes place. And without antero-posterior motion the wear of the upper incisors could not be brought about, especially not in *Ochotona*. Furthermore, in this genus the upper incisors form together a grove, in which the tips of the lower incisors slide, and a certain backward movement seems to be necessary to free the jaws from the lock formed by this incisor apparatus before lateral movements can take place.

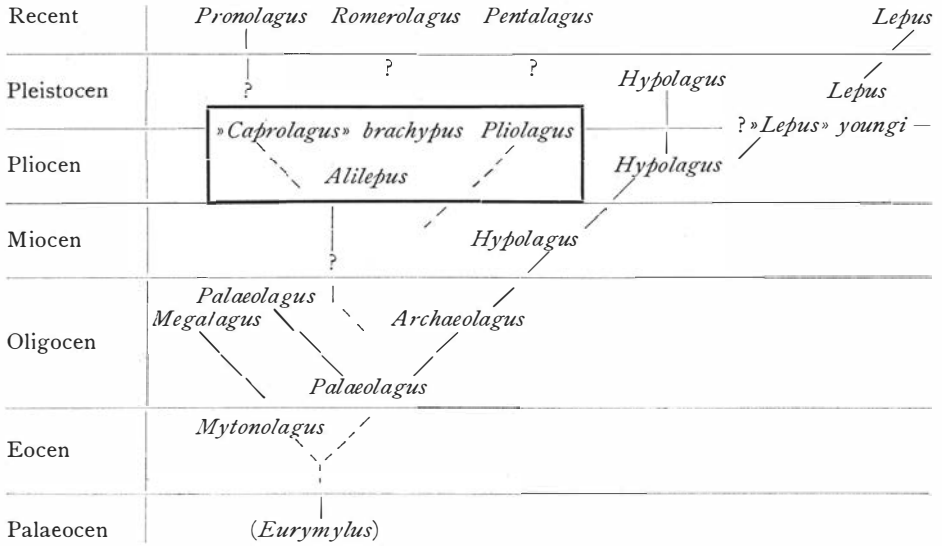
not been influenced by the factors, which have changed the rest of the dentition in very different ways. This is perfectly true, and I do not mean to say that the evidence now available gives us the right to assume that a transition from the P_3 met with in modern *Lepus* with its very deep buccal fold, to the P_3 in *Pronolagus etc.* has taken place. But it is possible that we do not have to go back further than to the Pliocene to meet forms which could have been the common origin of all living forms.

Leporinae, as the subfamily is defined by DICE, are not known earlier than the Pleistocene, the *Caprolagus* of DICE's list being at most Late Pliocene — *Lepus valdarnensis* is found together with *Equus* and therefore in my opinion Pleistocene, and *Caprolagus sivalensis* is also Pleistocene (Upper Siwalik, MATTHEW 1929, p. 560). As I said above, I cannot see any reason why *Lepus* should not be derivable from *Hypolagus*, especially as a penetration of a fold deeper and deeper into a tooth would not be without parallel inside the order: as a matter of fact the deepening of the »hypostria» is a very important event in the history of the group (for instance *Desmatolagus* — *Sinolagomys* — *Ochotona*); why not then also of the »hypostriid» in P_3 . The lower molars have their own history, the lobes being more independent of each other from the beginning and remaining so in the *Ochotonidae*.

The *Pliolagus* type of P_3 might mark the labile condition, which could turn either way and thus give rise both to the *Lepus* type and the *Pronolagus* type. At least it marks a line intermediate between a persisting palaeolaginoid type and the *Hypolagus* type, which latter in its turn partly persisted, and partly developed further and gave the so called leporine genera. A diagram should therefore not show two parallel columns: one containing the *Leporinae*, which would be of unknown origin, and the other *Mytonolagus*, *Megalagus*, *Palaeolagus*, and descendants of these earliest leporids.

Much seems to depend on what one will admit to be possible, *i. e.* purely subjective points of view will influence the standpoint of the various authors. If we pay due attention to all common characters and weigh them against the only difference which has earlier been used as subfamily character, the following diagram (which is more conservative as to the age of the common origin of the living forms than has been suggested above) would be as possible as the one proposed by DICE and modified by SCHREUDER, and others. (KORMOS 1934, p. 77 speaks of »*Alilepus* — *Pliolagus* — *Hypolagus* — *Lepus*» . . . »als eine geschlossene Ahnenreihe«.)

In the diagram I have placed the primitive Chinese *Leporidae* together with *Pliolagus* in a frame indicating a complex of possibly closer related forms derived from common Oligocene ancestors and possibly forming the ancestral stock from which the living palaeolaginoid genera in their turn were derived. I cannot agree with SCHREUDER that »*Caprolagus*» *brachypus*



is referable to the genus *Hypolagus*. It is undoubtedly closer to *Alilepus* in the structure of its P_3 , but should probably be referred to a new genus. However, the uncertainty regarding the specimens described by YOUNG after 1927 makes it impossible to give a reliable diagnosis. There is a marked difference in the structure of the lower jaw; the cross-section of the lower incisor is different (more square in »*Caprolagus*»), but I do not feel certain that a generic separation based on these characters is justified.

Further *Alilepus* appears to be less constant in the development of its P_3 than has been supposed by earlier authors, and one might have the right to wonder if the step from the P_3 in Fig. 8 A b to *Hypolagus* is so remarkably great. But in all specimens it seems to be within a hairbreadth the same (»haargenau gleich») at both ends.

I want to point out explicitly that I have no definite opinion as to the phylogeny and relationships of the *Leporidae*. I am only convinced that a careful and all round study of the fossil forms will raise objections against conclusions, which at present seem to be obvious, and in their stead afford a greath many new possibilities. I do not want to say that my diagram is right and the one given by DICE is wrong. They are both guesswork based on too scanty evidence; and the fact that the evidence can be used for so different constructions demonstrates its deficiencies. I am fully aware that my diagram is strongly under the influence of P_3 , as any diagram must be, at least until we know as much about the other parts of the living and fossil forms as we do about this tooth; — this in spite of the remarkable papers by MAJOR, LYON, VAN BEMMELEN, and others.

As is well known scientific method comprises two phases: I. analysis,

2. synthesis. One sometimes gets the impression that the former is considered as something inferior, something that should be left to novices, or to less talented workers. Real scientific work is supposed to be mainly synthetic, and as the scientist cannot have first hand knowledge of all material, he will have to go to the literature for most of his facts. But much of this literature is written by men, who have been in such a hurry to reach the synthetic phase of their work that their analytic work is one-sided, incomplete or, when at its worst, erroneous. Therefore the synthesist very often does not know what he is synthesizing. As an example I may take OSBORN's »Upper Miocene and Pliocene distribution of the Strepsicerine and Hippotragine Antelopes» (1910 pp. 336—338).

The terms synthesis and analysis are very commonly used in chemistry but with a real sense of responsibility. Without a thorough knowledge (gained by analysis) of the simpler compounds used for the building up of the more complicated ones, no Buna rubber and no tar-colours would have come into existence.

In some book of travel I have read a description of how houses were built in some southern country. The main thing for the bricklayers was to construct walls of a certain height; and to reach this aim as quickly and with as little toil as possible, they did not care much, if other things than bricks within reach, for instance empty wine bottles, were incorporated with the walls. Then the earthquakes came and the whole structure was turned into a mere heap of rubbish. Too many lines of descent and other structures in palaeontology have shared the same fate and for analogue reasons, and it seems to be about time to let the analyst take the lead, and to leave the synthetic somersaults till they can be made with less risk to the performers neck.

Ochotonidae.

(Figs. 14—19.)

SCHLOSSER (1924) has described a form from the Early Pliocene of Mongolia as *Ochotona lagrelii*. In 1942 I have given some additional facts about this species and also a few new figures. But in that paper *O. lagrelii* represented to me only a stage in the development from a type approaching *Sinolagomys* to the living forms, and I did not bring into question, if SCHLOSSER's material really belonged to one single species. A great variation in size was noticed by SCHLOSSER (see Pl. IV: 18, 19), who considered the very small specimens to have belonged to young individuals (»juvenile»). But these small specimens have had the full number of teeth — in the smaller jaw all alveoli are present, but of the teeth only M_1 , which is well worn. In a juvenile jaw of such a very small size one would expect traces of the milkteeth, but there are none; both P_3 and P_4 appear

to have been fully developed. The preserved tooth is very small as compared with the normal size (Fig. 14 P and Q). In my opinion the jaw Pl. IV: 19 and two others of about the same size have belonged to fully developed individuals and the difference in size would be of specific or at least subspecific value. I therefore make the small jaw figured by SCHLOSSER the type of a new form *Ochotona lagrelii* subsp. *minor* n. ssp., which except for its inferior size appears to be distinguished by its comparatively great breadth at the alveolar knobs of I_2 and P_4 (Fig. 15; Note! the difference in the position of the groove, which is due to the large alveolar knob of P_4 in *O. minor*). In almost all the graphs (Figs. 10, 17—20) single specimens separate from the bulk of the material. It is less evident re-

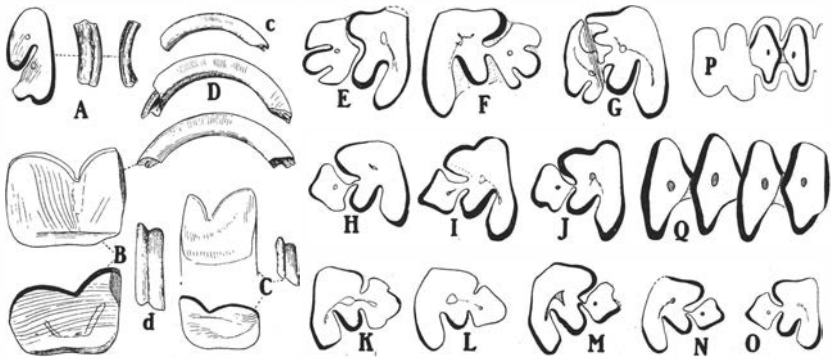


Fig. 14. A *Ochotona cf. lagrelii* P_2^2 (U. M. Nr. 136). Crown view, front view, and lingual view. — B, C c, D d. Ochotonids. Upper incisors. B (U. M. Nr. 85 a). Medial view and trituration surface (compare Fig. 5 A, B). C c (U. M. Nr. 104). Medial view and front view and trituration surface. D d (U. M. Nr. 104). Medial view and front view. — E—G *Ochotonidae* sp. P_3 (see pp. 145). E Olan-chorea (U. M. Nr. 138); F Olan-chorea (U. M. Nr. 104); G Olan-chorea (U. M. Nr. 139). — H—M *Ochotona lagrelii*. P_3 . H (U. M. Nr. 117); I (U. M. Nr. 108; type. SCHLOSSER 1924, Pl. IV: 14, 14 a); J »Ertemte»; K (U. M. Nr. 135); L (U. M. Nr. 104); M »Ertemte». — N, O *Ochotona lagrelii*? smaller form, no numbers, both from Ertemte. — P *Ochotona lagrelii* subsp. *minor* n. ssp. (U. M. Nr. 111). — Q *Ochotona lagrelii* (U. M. Nr. 109); SCHLOSSER 1924, Pl. IV: 18. — Crown views $\times 6$, front views and medial views $\times 1.5$.

garding P_3 (Fig. 10) and P_4 , M^1 (Fig. 18). The two smallest I^2 (1.0×1.4) in Fig. 17 might also represent the minimum of one single variation. But P_3 , M^2 (Fig. 18), possibly I_2 (Fig. 19), and the lower molariform teeth (Fig. 20) give a strong impression of the existence of a separate smaller form.

The remainder of the material is again inhomogenous and that in a way which might surpass the limits of what is allowed inside one single genus. There are namely three P_3 (all from Olan-chorea), which show almost identically the same complications as *Ochotonoides complicidens* BOULE & TEILHARD. In this form »la deuxième colonette externe (colonette 2), a lieu d'être, comme d'habitude chez les *Lagomys*, la plus petite des quatre, débordé nettement sur les colonettes 1 et 3 et est presque aussi forte que la colonette 4 (colonette postérieure du talon)» (BOULE, BREUIL, TEILHARD,

LICENT 1928, p. 95). Especially one of my specimens (Fig. 14 G) is very similar to the type specimen: The anterior (accessory) lobe has one single antero-external reentrant and the lingual reentrant is deep and complicated. My other two specimens are more similar between themselves (two reentrants on the anterior lobe) and approach, except for their somewhat higher complication, some specimens described later by TEILHARD & PIVETEAU 1930, and by TEILHARD & YOUNG 1931. The size of the second »colonette» might be smaller than in *O. complicidens* (inferior in volume, but distinctly protruding outside the first and third ones). My specimens are, however, geologically so much older than those described by the French and Chinese

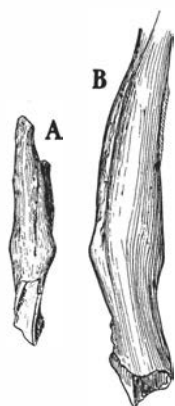


Fig. 15. Lower jaws from below. $\times 2$. — A *Ochotona lagrelii* subsp. *minor*, U. M. Nr. 111. — B *Ochotona lagrelii*, U. M. Nr. 109.

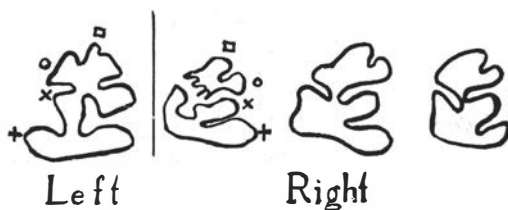


Fig. 16. Enamel pattern of P_3 of *Lagopsis verus*, left side, after MAJOR, and *Ochotonoides complicidens*, all of the right side (after BOULE, TEILHARD and YOUNG, various papers).

authors that they must represent an earlier stage in the development. As even the shape of P_3 is considered an important character for the classification, a reference to the genus *Ochotonoides* would seem possible. But there is a Pliocene form *Proochotona eximius* KHOMENKO 1914, the P_3 of which according to SCHLOSSER (1924, p. 52) »shows two vertical furrows on the innerside and four on the outside». This is true also about the Mongolian teeth only that one of the internal reentrants is very shallow and one of the external ones is rather anterior than external. I have not seen KHOMENKO's paper but a comparison between *Prolagus* and *Proochotona* made by SCHLOSSER makes it still more evident that the latter genus cannot be neglected: »It agrees therefore with *Prolagus*, yet the three prismas are similar to those of *Ochotona* by the want of folds which enter even into the hindmost prisma of *Prolagus*.» I therefore designate my three teeth as *Ochotonidae* sp. — *Ochotonoides complicidens* is said to be a large form, and this is true also about the three teeth from Olan-chorea. Some large incisors might belong to the same species. As is seen from Fig. 17 some ochotonid incisors are as large as the smallest specimens of *Alilepus*.

BOULE and TEILHARD have compared their *Ochotona* (*Ochotonoides*) *complicidens* with *Lagomys* (*Lagopsis*) *verus* from La Grive-Saint-Alban and

found that »taille et forme de la prémolaire inférieure (deuxième colonette externe presque aussi forte que la quatrième) se retrouvent exactement . . . Sur le *Lagomys verus*, toutefois, le talon de P_3 est notablement plus court que chez le *Lagomys* de Chine. Cette différence, jointe à celles de l'âge géologique et de l'origine géographique, ne permet pas de confondre les deux formes. Celles-ci présentent néanmoins entre elles une affinité indéniable.» To me it appears as if a careful analysis of the P_3 of the two genera would lead to the conclusion that *Lagopsis* and *Ochotonoides* cannot belong to the same line of evolution. In spite of its complication P_3 of *Ochotonoides* is not so very far from the one of *Ochotona*, the former might even be derived from the latter, in which the trilobation of the anterior lobe is clearly indicated. The deep lingual infold which separates the posterior two thirds of the tooth in *Lagopsis verus* (MAJOR 1899 Pl. 37: 26, DEPERET 1887 Pl. XIII: 16 a) is not present in either *Ochotona*, *Ochotonoides* or *Ochotonidae* sp. We evidently have to do with a case analogue to the palaeolagine and leporine P_3 in the *Leporidae* and it ought to be treated in the same way until very strong evidence to the contrary is gathered.

The P_3 of my *Ochotonidae* sp. is very similar to the one of certain *Leporidae*, for instance *Caprolagus hispidus*. This latter is of course a typical leporine with its main buccal fold extending to the lingual side of the tooth, but the anterior (accessory) lobe has two reentrants on its anterior face arranged in exactly the same way. There can of course not be the question of a closer relationship on account of this similarity. The same structure must have developed independently in the two widely separate lines, and it might be asked if the course followed in the two cases was the same in every detail. If we go to *Alilepus* we can see on specimens in a certain state of preservation how the pulp cavity marked by rows of small dots sends a branch into each of the buccal lobes — the anterior lobe was evidently formed by the development of an anterior buccal reentrant which penetrated deeper and deeper and caused a branching of the pulp cavity (Figs. 8 A a and B, C). In most specimens of *Ochotona* the pulp cavity of the anterior lobe seems to form a narrow tube isolated from the cavity in the rest of the tooth (in the type specimen, U. M. Nr. 108 = SCHLOSSER 1924 Pl. IV: 14, 14 a, there seems to be a kind of connection: From the well circumscribed cross-section of the tube a strand of differently coloured dentine extends in the direction of the isthmus. In another specimen, U. M. Nr. 135, a connection across the isthmus is very evident). From the majority of cases one is inclined to assume that the third lobe in *Ochotona* has arisen from a pillar growing up from the base of the tooth as in *Piezodus branssatensis* (VIRET 1929, p. 95); later this pillar would have been more or less intimately connected with the main part of the tooth. But of course the opposite might have taken place,

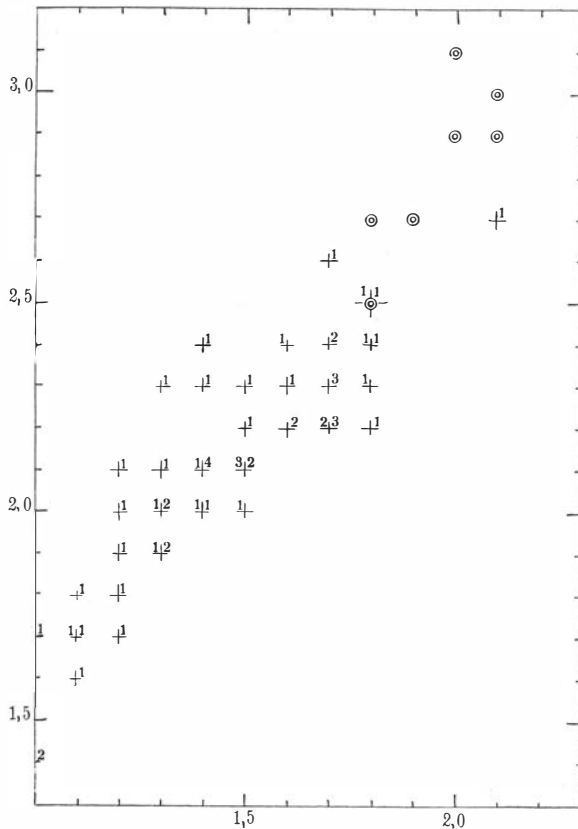


Fig. 17. Relation between breadth (vertical axis) and depth (horizontal axis) of upper incisors. \odot *Alilepus annectens*. + *Ochotona* various species (figures to the right = Olanchoarea, to the left = Ertemte). Measurements in millimetres.

namely, a process similar to the one assumed for *Alilepus*, which has led to an almost complete separation of the lobes (complete in the specimen in Fig. 14 E also at the base of the tooth). Whatever the reason, there is a fundamentally different disposition of the pulp cavity in the mass of the tooth in *Leporidae* and *Ochotonidae*. Of leporids with a well developed third lobe the best among my material is *Pronolagus crassicaudatus*. There we have a tubular portion of the pulp in the posterior lobe, and the middle and anterior lobes have one in common, from which at least 5 branches radiate into the branches of the lobes. *Pronolagus* has advanced far beyond *Alilepus*, in which a wider portion of the pulp cavity is common to the whole tooth. It is on the verge to divide into two and has reached quite far in the specimen in Fig. 14 A a. »*Caprolagus*» *brachypus* agrees with *Alilepus*. — In *Ochotona* there is a tubular part common to the middle and the posterior lobe and the anterior lobe has its own one.

Yet there seems to be no reason to assume that the three lobes of the tooth in *Caprolagus* and *Ochotona* are not homologous; thus the posterior

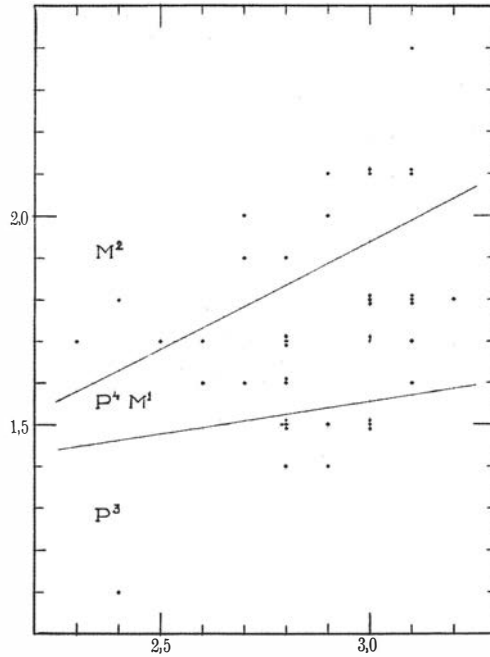


Fig. 18. Relation between length (vertical axis) and breadth (horizontal axis) of upper cheek-teeth of ochotonids from Mongolia. Each dot marks one specimen. Measurements in millimetres.

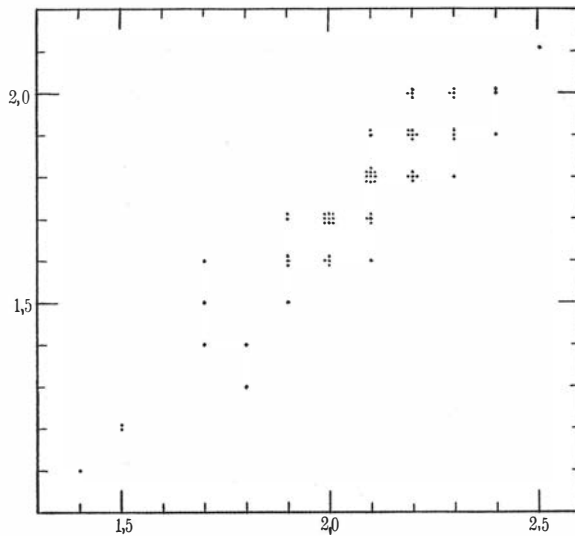


Fig. 19. Relation between »depth» (measured parallelly to medial surface; horizontal axis) and breadth (measured perpendicularly to medial surface; vertical axis) of lower incisors. Each dot marks one specimen. Measurements in millimetres.

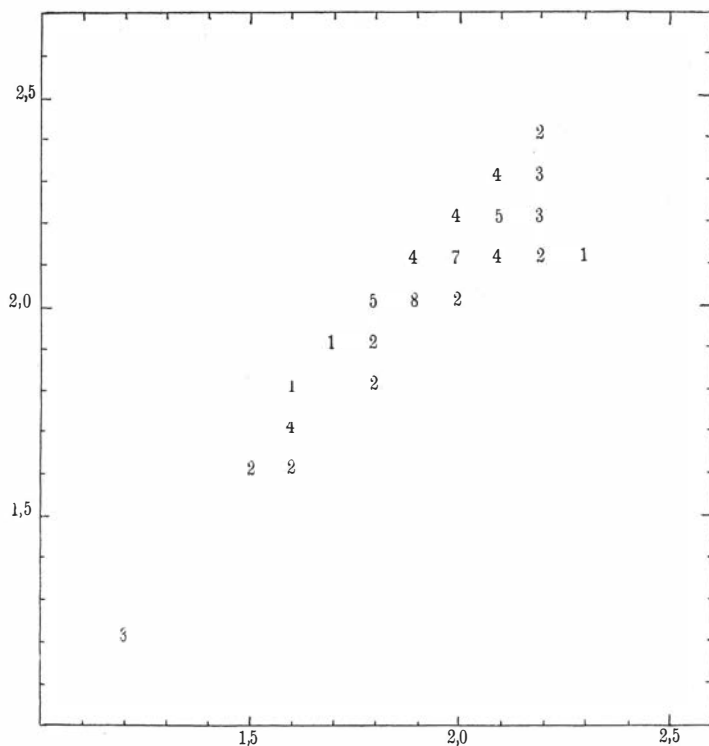


Fig. 20. Relation between length (horizontal axis) and breadth (vertical axis) of lower molariform teeth of ochotonids from Mongolia. The figures give the number of specimens. Measurements in millimetres.

lobe is the talonid, the middle one the trigonid, and the anterior one a later addition, which possibly comprises the paraconid. BOULE & TEILHARD 1928 speak about the fourth »colonette» as »colonette postérieure du talon», and thus evidently represent another opinion than the one expressed by me here.

In an earlier paper (1942) I have published some figures of skull fragments and lower jaws of *Ochotona lagrelii* (Figs. 9: 14, 11 b, 13 HH', 15 t, 16 C'—I', 18 gh, 19 a, 20 C, 25 DE, 29) and in connection with these figures several details in the structure of the specimens referred to *O. lagrelii* were discussed. I believe that I was able to demonstrate that the Pontian ochotonoids from Mongolia were in some respects (e. g. shape of jugal arch and processus coronoideus) intermediate between *Sinolagomys* and the living forms, although much closer to the latter. But in other respects the Pontian ochotonoids seem to have advanced beyond the living *Ochotona*.

The cheek-teeth come in closer contact with the jugal arch, the proximal end of the alveolus of M² being separated from the jugal arch by a narrow slit (Figs. 21 B and D). In the living forms there is a wide space

between the alveolus and the jugal arch, sometimes even the alveolus of M^1 is free to a certain extent.

In one fragment (Fig. 21 A) a very narrow palatal bridge is preserved, and it seems as if this were formed entirely by the palatine, the palatal processes of the maxillary being rudimentary and not by far meeting in the middle. In a second specimen the palate seems to have been developed in the same way. In living forms there is a strong variation with the age of the individual, but in all specimens in which the palato-maxillary suture is still traceable the processes seem to reach the middle of the palate. In the subfossil skull of *Ochotona »daurica»* (U. M. Nr. 253) the suture is almost obliterated; it seems, however, as if the palatal processes have been strongly reduced.

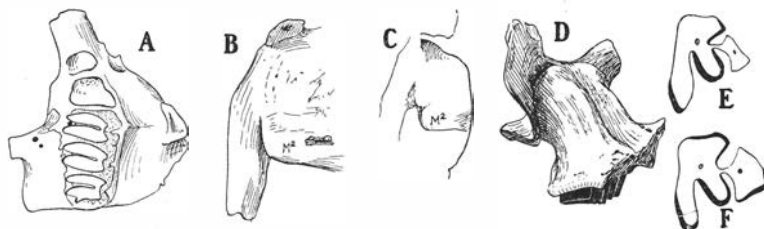


Fig. 21. A »*Ochotona lagrelii*». Upper jaw fragment, U. M. Nr. 106. Palatal view. — B »*O. lagrelii*». Upper jaw fragment, U. M. Nr. 105. Relation of molars to jugal arch, orbital view. — C Same as B of *Ochotona »daurica»*, U. M. Nr. 253. — D Same fragment as B from behind (= 1942, Fig. 12 H). — E *Ochotona* sp., Chow-K'ou-Tien. P_3 . — F *O. melanostoma* P_3 . — A—D $\times 2$; E, F $\times 8$.

I may here speak of »*Ochotona lagrelii*» (with quotation marks!) because the upper jaws are not with certainty referable to either the large or the middle-sized form distinguished above. They differ from living *Ochotona* in a way, which would perhaps justify their reference to a separate genus even as much as the aberrant characters noted in the skull of *Ochotonoides complicidens* (TEILHARD & YOUNG 1931). *Ochotonoides* is incompletely described as most fossil forms, and »*Ochotona lagrelii*» is too fragmentary; therefore I do not think that it is advisable draw any definite conclusions as to the phylogenetical significance of the Mongolian material before more material has been discovered.

We have to count with several possibilities:

The upper jaws might belong to *Ochotonidae* sp. and their peculiarities be correlated with the specialized P_3 in this form.

The upper jaws might belong to the middle-sized form (the most common one, comprising the type specimen of *O. lagrelii*). Then it appears doubtful if *O. lagrelii* belong to the genus *Ochotona*, under all circumstances the species cannot be ancestral to the living forms.

Ochotonidae sp. might have had the same type of upper jaw as *Ochotona lagrelii*, in which case the two forms might be close to each other

and both represent a line diverging from the one leading to the modern forms.

TEILHARD & YOUNG have stated that the *Ochotonidae* »are found with their modern characters fully developed from the Pontian Red Clays upward; so that they are generally of poor stratigraphical value» (1931, p. 30). *Ochotonoides* is one exception. A closer study of the Pontian ochotonids might, however, show that they are so well distinguished from the later forms that they can be used in stratigraphy, even if they are distinctly modernized in most regards. Even the teeth might be of interest (cf. BOILIN 1942, Figs. 15 *t* and *r, u*).

In 1931 YOUNG described a new *Ochotona* (*O. gobiensis*) from the Miocen Tung-Gur beds. This was compared with SCHLOSSER's figures of *O. lagrelii* and certain differences in the shape of the third lower premolar were stated. Now SCHLOSSER's figure is not correct (compare Fig. 14 I in the present paper), and the tooth is in fact more like TEILHARD's *O. cf. lagrelii* (1926, Fig. 22) than the teeth of *O. gobiensis* figured by YOUNG. YOUNG's figures agree better with BOULE & TEILHARD 1928, Fig. 23 A. This type of P₃ might be a mere abnormality. It is interesting, however, because it seems to support the interpretation of the anterior lobe of the tooth as an originally free pillar, which can be connected with the rest of the tooth in somewhat different ways.

O. gobiensis is said to be smaller than *O. lagrelii*. SCHLOSSER's measurements are, however, as far as I can find not correct, and I therefore, give new ones:

	<i>O. gobiensis</i>	<i>O. lagrelii</i>					<i>minor</i> Nr. 111
		Nr. 105	Nr. 106	Nr. 106	Nr. 108	Nr. 109	
P ³ —M ² L	5.4 ¹	7.8(8.4 ²)	8.6 ²	9.1 ²	—	—	
P ² M ² L	—	—	10.5 ²	—	—	—	
M ¹ B	3.0	3.1	3.1	3.4	—	—	
P ₃ —M ₃ L	10.5	—	—	—	9.5	10.6 ¹	6.3 ²
M ₁ —M ₃ L	6.0	—	—	—	5.2	—	—
P ₃ —P ₄ L	4.5	—	—	—	4.1	—	—

According to this table *O. gobiensis* and *O. lagrelii* are of about the same size, *O. lagrelii* even a little smaller.

¹ Cannot be correct; possibly P³—M¹ (compare YOUNG's Fig. 1 a). P³—M¹ of *O. lagrelii* (Nr. 105) = 5.9 mm. — ² Alveoli.

My material of later ochotonids is rather poor. From Chou-Kou-Tien I have only the fragmentary material described by ZDANSKY (1928, p. 21). The only P_3 makes the impression of being comparatively small: it is compressed antero-posteriorly and above all its anterior lobe is poorly developed (Fig. 21 E; cf. F). A detailed description of the tooth is given by ZDANSKY. YOUNG (1934, p. 118), who had a very large material from Chou-Kou-Tien, dismisses the subject with the remark that »the *dentition* of both upper and lower jaws is typically the same as in *Ochotona*, and uncharacteristic». It would be interesting to know if the peculiarity of P_3 described above is a constant feature.

In my earlier paper (1942) I have designated the subfossil material referred by YOUNG to *Ochotona daurica* as *Ochotona cf. daurica*, *Ochotona »daurica»*, or *Ochotona daurica* (det. YOUNG 1927). I have done this chiefly to make clear that my observations are made on YOUNG's material, and not in order to criticize YOUNG's determination. As far as I can see the subfossil material differs in certain respects from the living form, but this evidently varies a great deal. According to BÜCHNER (1894, p. 179) *O. melanostoma* is very similar to *O. daurica* in its skull structure (this I have been able to verify), but if we consider the recent distribution of the forms a reference of the fossil material to *O. melanostoma* seems less probable. Therefore I provisionally accept YOUNG's determination.

Postscript.

TEILHARD DE CHARDIN: The Fossils from Locality 18 near Peking (Pal. Sin. Whole ser. No. 124. Peking 1940). — The locality 18 (Huai-Yü) seems to be identical with locality 60 (»Hui-Yü») of the Swedish collection.

TEILHARD describes a new species of *Hypolagus*, *H. schreuderi*, which is shown to differ from *Lepus* in a few characters of the skull and in its P_3 , which is of the *Hypolagus* type. The upper cheek-teeth are stated to have the same structure as in *Lepus*. The P^2 seems, however, to be simpler: even if all three reentrants are present, the external and the internal ones are remarkably shallow. — I have a strong feeling that »*Lepus*» *youngi* described above might be referable to *H. schreuderi*, and I have therefore submitted the skull to a renewed examination. The relation between the posterior tips of premaxillaries and nasals cannot be seen on account of the crushing, but the ramus frontalis of the premaxillaries is remarkably heavy. The nasals are broad. The forward expansion of the frontals may have formed a similar broad triangle. The bullae were probably of the same size and appearance. My figure 12 A appears to be incomplete: in P^2 a small area antero-externally should have been stippled (cement), the groove in the tooth proper being about as marked as in TEILHARD's fig. 21 C (correctly observed by YOUNG; enamel externally of the groove!). Yet

there is a marked difference between the P^2 of this pre-Pleistocene leporid and the one of the Pleistocene forms, and apart from my error, I seem to have been right in my supposition (p. 136) that the skull might not belong to the genus *Lepus*. — Regarding the relationship between *Hypolagus* and *Lepus* TEILHARD seems to hold an opinion, which agrees with the one expressed in the present paper («*Hypolagus* . . . a typical Hare», *l. c.* p. 37).

With some hesitation TEILHARD refers a lower jaw to *Alilepus annectens* on account of its P_3 . The characters of the lower jaw: »very short and massive shape of the anterior part of the jaw»; »diastema . . . remarkably short . . ., incisor . . . proximally as far as P_4 , being . . . pushed out lingually by P_3 » agree with »*Caprolagus*» *brachypus*, which has the same type of P_3 as *Alilepus*. The absence of a crenulation of the folds in TEILHARD'S figure of P_3 might correspond to the actual condition, but a reexamination might disclose a greater similarity to »*C.*» *brachypus*.

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