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Nov. 15, 1843.—G. T. Vigne, Esq. of Woodford, Essex, was elected a Fellow of this Society.

"On some Fossil Remains of Anoplotherium and Giraffe, from the Sewalik Hills, in the north of India." By H. Falconer, M.D., F.G.S., and Capt. P. T. Cautley, of the Bengal Artillery, F.G.S.

In continuation of their former researches on the fossil remains of the Sewalik Hills, the authors, in their present communication, establish, on the clear evidence of anatomical comparison, certain discoveries which, in previous publications, they had either merely announced, or had supported by proofs professedly left incomplete. They now demonstrate that there occur in the remarkable tertiary deposits of the Sewalik range, together with the osseous remains of various other vertebrate animals, bones belonging to the two genera, Anoplotherium and Giraffe: the former genus determined by Cuvier from parts of skeletons dug out from the gypsum beds of Paris; the latter genus known only as one of man's contemporaries, until, in the year 1838, the authors gave reason for believing its occurrence in the fossil state.

The specimens now figured and described form part of the collection which was made by the authors on the spot, and is now deposited in the British Museum. They were found, together with remains of Sivatherium, Camel, Antelope, Crocodile, and other animals, in the Sewalik range to the west of the river Jumna.

The bones are found imbedded either in clay or in sandstone. When clay is the matrix, they remain white; and, except in being deprived more or less completely of their animal matter, they have undergone little alteration. The bones in this state the authors have elsewhere designated as the "soft fossil." When sandstone is the matrix, the animal matter has completely disappeared, and the bone is thoroughly mineralized and rendered nearly crystalline by the infiltration of siliceous or ferruginous matter, and acquires a corresponding hardness, or tinge of iron, with increased specific gravity. The matrix in contact with the bone is rendered compact and crystalline in texture. The remains in this state have been designated by the authors as the "hard fossil."

The remains of Anoplotherium and of the larger species of Giraffe, described in the present communication, belong to the "soft fossil;" those of the smaller species of giraffe to the "hard fossil."

Anoplotherium.—The occurrence, in the Sewalik deposits, of bones belonging to this genus, was announced by the authors in their 'Synopsis of the fossil genera from the upper deposits of the Sewalik hills,' published in the 4th volume of the Journal of the Asiatic Society of Bengal, in the year 1835; and the same fact was afterwards referred to in the 6th volume, p. 358, of that journal. In these communications the species was not described, but was named provisionally, *A. posterogenium*. In a communication made to the Geological Society in the year 1836, descriptive of a quadrumanous fossil remain, and published in the 5th volume of the 2nd series of their Transactions, the same species was mentioned under the name of *A. Sivalense*, a term which the authors propose to retain, in accordance with the principle they adopted in the cases of the horse, camel, hippopotamus, &c., of connecting the most remarkable new species of each fossil Sewalik genus with the formation itself.

In their present communication the authors purposely abstain from entering on the anatomical characters of this new species further in detail than is barely sufficient for its determination; and they therefore confine their notice to two fine fragments of one head, one fragment (Pl. II. fig. 1.) belonging to the left upper jaw; the other fragment (Pl. II. fig. 2.) to the right upper jaw.

By a happy chance the teeth are beautifully preserved. The age of the individual, which was just adult, was the best that could be desired to show the marks characteristic of the genus; for the teeth had attained their full development, though the two rear molars had hardly come into use.

Pl. II. fig. 1. p is a horizontal view of the left upper jaw, comprising the six back molars. These teeth were subjected to a rigid comparison with a cast from the jaw of *Anoplotherium commune*, figured by Cuvier in the 3rd volume of the 'Ossemens Fossiles,' (pl. 46. fig. 2), and also with casts from the corresponding molars of *Chalicotherium Goldfussi*, figured by Kaup in the 2nd livraison of his 'Ossemens Fossiles,' (pl. 6. fig. 3–5 and 8–10), between the teeth of which two extinct quadrupeds those of the Sewalik fossil are intermediate in size. In general form and in the principal distinctive marks they agree closely with the teeth of the typical European species of Anoplotherium, as described by Cuvier; but they differ from those types in some particulars requiring special notice: they are closely allied to the teeth of the Chalicotherium of Kaup.

The three rear molars considerably exceed, in all their dimensions, the corresponding teeth of *A. commune*; and the two rear molars also differ from the corresponding teeth of *A. commune* in the following respect, that their width is greater than their length. This proportional compression lengthwise belongs to the last two premolars of the Sewalik fossil, and it holds also with the back molars of the Chalicotherium. The outer surface presents, both vertically and horizontally, the usual double chevron, or W-form of Anoplotherium, with the three salient vertical bulges swelling up from the base to the crown; but with this difference from Anoplotherium, that the surface of the re-entering angles is more inclined

inwards. The latter point is one of agreement with Chalicotherium, in which the outer ridge of the crown is so inflected as to be brought into the middle of the plane of the tooth. The interspaces forming these re-entering angles are more unequal than in *A. commune*, the anterior one being much the broader. The posterior one in the last molar is placed very obliquely, sloping backwards and inwards. In these respects also the fossil agrees closely with Chalicotherium. The vertical bulges, more especially the rear one of the last molar, are slightly notched near the apex into a lobule of the enamel, but much less so than in Chalicotherium. In consequence of the progress of wear being more advanced in the two other back molars, they show no indications of this notch.

From the great inflexion of the outer surface, the longitudinal ridge of the crown is strongly zigzaged. The apex of the anterior re-entering angle gives off a transverse ridge, which is much inclined downwards, and joins on with the base of the isolated conical cusp (*a*, *a'*, *a''*) in the anterior and inner corner of the tooth, a cusp characteristic of Anoplotherium. In the Sewalik species, as in Chalicotherium, this cusp is much larger, more pointed, surrounded by deeper hollows, and more in relief than it is in *A. commune*. It is even more developed than in Chalicotherium. The apex of the posterior re-entering angle gives off a like transverse ridge which sweeps round into the posterior side, and forms in the germ a sort of three-sided pyramid, connected by a low ridge with the cusp. The anterior border of the crown is formed of a similar low ridge, sweeping round to the inner side of the cusp, upon which it terminates near the middle of the cusp. This ridge is less developed than in *A. commune*.

The penultimate and antepenultimate are so like the last molar, that the authors deem it sufficient to refer to the figures. The penultimate is the largest of the three, and the antepenultimate considerably the smallest. There is in all the three molars a strong development of the cusp; though, from the different stages of wearing, it shows differently in the several teeth. In the back tooth it is intact and has a sharp edge; in the penultimate the point is just worn off into a slight oblique facet; in the antepenultimate it is ground low down into a circular depressed disc, surrounded by a ring of enamel.

The other teeth in the specimen (Pl. II. fig. 1.) are the last three false molars. What was the entire number of this series, whether it extended to four, as in *A. commune*, or was limited to three, the specimen affords no certain indication. If there was a fourth tooth (which is most probable), it must have been in a rudimentary or reduced state, as in the rhinoceros, and must have been disconnected from the rest of the series by being placed somewhat forwards in a diasteme; for no indication is obtained, from the appearance of the anterior tooth, or from remains of any alveolus, that there was another tooth close in front of the sixth. These three premolars, taken in succession from rear to front, diminish rapidly in size; and in the aggregate are much shorter than the same three teeth in *A. commune*,

the joint length in the Sewalik fossil being 1·8 inch, whereas in the smaller jaw of *A. commune* it is 2·3 inches. In the latter, as is the case in the ruminants, the anterior premolars are narrow and elongated; in the Sewalik fossil they are short and wide. This general condensation of the premolars adds to the probability of the existence of a vacant diasteme. All the premolars exhibit, in a well-developed form, the characteristic cusp. The posterior two have their outer surface flat or slightly convex; and they contract inwards towards the cusp in a subcuneiform shape, the cusp and inner side being bounded by a low basal ridge.

The antepenultimate premolar of the Sewalik fossil is somewhat different from the two others, being much smaller, and contracting upwards into a trenchant edge. The cusp is connected by a transverse ridge with the main ridge of the crown, and the basal ridge is reduced to a small mammilla in front of the cusp.

Pl. II. fig. 2. represents the outside of the right upper jaw, comprising the four back molars, and is an exact counterpart, so far as it goes, of the left upper jaw.

There is little else shown by this specimen than what regards the teeth. The muzzle appears to have fined off rather abruptly in front of the malar protuberances, and the orbit to have been advanced more forward on the face, and to have been more depressed below the brow than in *A. commune**. The upper orifice of the suborbitary canal is seen opening behind the anterior angle of the orbit, the floor of which appears to have extended behind the post-orbitary processes.

The dimensions, as compared with those of *A. commune*, and *Châlicotherium Goldfussi*, are as follow:—

	A. Sivalense.	*A. commune.*	*Ch. Goldfussi.*
	Inches.	Inches.	Inches.
Length of the series of 6 molars	5·5	5·5	
Ditto 3 true molars	3·7	3·2	
Ditto 3 premolars	1·8	2·3	
Length of the last true molar	1·3	1·2	1·8
Width of ditto	1·5	1·2	1·94
Length of the penultimate true molar	1·4	1·2	
Width of ditto	1·55	1·1	
Length of the antepenultimate true molar.	1·1	1·	
Width of ditto	1·1	1·1	
Length of the last premolar	0·75	0·65	
Width of ditto	0·88	0·75	
Length of the penultimate premolar	0·70	0·90	
Width of ditto	0·80	0·62	
Length of the antepenultimate premolar.	0·55	0·75	
Width of ditto	0·55	0·50	
Height of the last molar	1·1	0·65	0·87

These measurements show the Sewalik species to have been larger than *A. commune*, and smaller than *Ch. Goldfussi*. One of the most

* See Ossemens Fossiles, tom. 3. tab. 57. fig. 1.

striking points in which it differs from the two latter terms of comparison, is in the dimensions of its back molar, which, with the same amount of wear, is about half an inch higher than in *A. commune*, and in this respect considerably exceeds even the longer and wider tooth of the Chalicotherium.

	Length.	Width.	Height.
A. Sivalense	1·3	1·5	1·1
A. commune	1·2	1·2	0·65
Ch. Goldfussi	1·8	1·94	0·87

On the whole, the Sewalik species appears to be most closely allied to the *Chalicotherium Goldfussi*. The existence of a vacant diasteme in front of the anterior tooth would constitute a difference from the Anoplotherian type of some importance. The characters generally show a return from the ruminant tendencies of the Cuvierian species back to a more pachydermatous type, and a closer affinity with the rhinoceros, between which and *A. commune* it may ultimately prove to be an intermediate form. Until the evidence for separation is conclusive, the authors suggest leaving it with the genus Anoplotherium. The *A. commune* was determined by Cuvier to be of the size of a small ass; the *A. Sivalense* would rank in dimensions between a horse and the small Sumatran Rhinoceros.

Remarks on Chalicotherium.—Kaup appears to have founded this genus, as distinct from Anoplotherium, on real or supposed differences, 1st, in the rear molars; 2nd, in the incisors; 3rd, in the canine. The difference in the rear molars consists in the size of the lobule of the enamel into which the vertical bulges, near the apex, are notched; this character indicates, as he conceives, an affinity with the Tapir and Lophiodon. But this lobule, even if constant, does not appear to the authors of sufficient importance to constitute the basis of a generic distinction. The general form of the rear molars of both the upper and lower jaws is only an enlarged and less rectangular representation of those of Anoplotherium. Moreover, in the direction of the ridges of the crown, and in the insulation of the conical cusp, the accordance between Chalicotherium and Anoplotherium is complete. As to the second distinction, drawn from the supposed form of the incisors, the detached tooth which he figures and describes as a lower incisor (Oss. Foss. livraison ii. p. 30. pl. 7.), judging from the figures and from a cast which the authors have examined, very closely resembles, both in form and in the development of the crown, the penultimate premolar of the *A. Sivalense*. The channeled sides and the bifid extremity of the fang, indicating two confluent fang roots, and the complicated form of the crown with three mammillæ on the inside, appear to the authors strongly to militate against regarding the tooth as an incisor. They therefore consider this tooth as an upper premolar (and probably as the penultimate one) of the right side.

As to the third distinction, drawn from the canine teeth, judging from a cast of the detached fragment which Kaup describes and figures as the canine of *Ch. Goldfussi*, the authors consider that determination as problematical. It seems to them to bear a resem-

blance in form rather to the lower incisor of an animal allied to Rhinoceros. They advance these doubts with the utmost deference to the distinguished author.

Remarks on the Genus Anoplotherium.—The true Anoplotheria of Cuvier (of which *A. commune* may be regarded as the type), together with the *A. Sivalense* and the *Chalicotherium* (Anoplotherium?) *Goldfussi*, are allied, by their dentition, to Rhinoceros. The Dichobunes, *A. Leporinum*, *A. murinum* and *A. obliquum*, Cuvier arranges with considerable doubt, and provisionally only, among the Anoplotheria. He considers it not impossible that the two latter species were small *ruminants*. The *A. cervinum* of Professor Owen (Geol. Trans. 2nd ser. vol. vi. p. 45), obtained by Mr. Pratt from Binstead in the Isle of Wight (Idem. vol. iii. p. 451), is admitted on all hands to be exceedingly like a musk deer. Such heterogeneous materials are too much for the limits of any one genus. Cuvier imagined the separation of the two metacarpal bones to be a character limited to the Anoplotheria exclusively. He has also regarded the union of the metacarpal bones as holding without exception in all the ruminants; and this law with respect to ruminants, though empirical, he regards as equally certain with any conclusion in physics or morals, and as a surer mark than all those of Zadig (Disc. Prel. p. 49).

The authors, having had an opportunity of examining the skeleton of an African ruminant, the *Moschus aquaticus* of Ogilby, described in the Proceedings of the Zoological Society by that gentleman from a living specimen, found it wanting in the above supposed essential character of the ruminants, and possessing the above supposed distinctive character of Anoplotherian Pachyderms. Its metacarpals are distinct along their whole length; its fore leg, from the carpus downwards, is undistinguishable from that of the peccary; and its succentorial toes are as much developed as in the last-mentioned animal.

The deviation from the ordinary ruminant type, indicated by the foot of this Moschus, is borne out by a series of modifications in the construction of the head and in the bones of the extremities and trunk, all tending in the direction of the pachyderms.

The authors believe the present to be the first announcement of the existence of such an anomaly in any living ruminant: they had previously ascertained the occurrence of the same structure in a fossil ruminant from the Sewalik hills. As the Dorcatherium of Kaup breaks down the empirical distinction between the ruminants and pachyderms, as regards the number of the teeth, so does the *Moschus aquaticus* as regards the structure of the feet.

Giraffe.—In the 7th volume of the Journal of the Asiatic Society of Bengal (pp. 658–660) is a communication dated "Northern Doab, July 15, 1838," and intituled, "Note on a Fossil Ruminant Genus allied to Giraffidæ, in the Sewalik hills, by Capt. P. T. Cautley." The specimen referred to in that paper was the third cervical vertebra of a ruminant, which, for the reasons therein assigned, was supposed to have been a giraffe. At that time the authors of the present communication had not access either to drawings of the osteology

or to a skeleton of the existing giraffe: but the grounds for referring the vertebra to that genus were, that it belonged to a ruminant with a columnar neck, the type of the ruminants being preserved, though very attenuated in its proportions: that the animal was very distinct from any of the camel tribe: that it was in the giraffe that there existed such a form most aberrant from the mean in respect of its great elongation. That the bone belonged to a giraffe was put forth at the time as only a probable inference, and chiefly to serve as an index to future inquiries.

The authors, having since the former period obtained additional specimens, and had access to the fullest means of comparison, are now able to place on the record of determined Sewalik fossils, one very marked species of giraffe, and also indications of a second species, which, so far as the scanty materials go, appears to come near to that of Africa.

The first specimen to which they refer is the identical vertebra noticed by Capt. Cautley in 1838. (See Pl. III. fig. 1–5.) It is an almost perfect cervical vertebra. It were needless to enter on the characters which prove it to have belonged to a ruminant. Its elongated form shows that it belonged to one with a columnar neck; that is to say, either to one of the camel and Auchenia tribe, or to a giraffe, or to some distinct and unknown type. The fossil differs from the vertebra of a camel, 1st, in the position of the vertebrary foramina (*a*, *a'*); 2nd, in the obsolete form of the upper transverse processes. According to the masterly analysis of the Macrauchenia by Professor Owen, the Camelidæ and Macrauchenia differ from all other known mammalia in the following peculiarity; that the transverse processes of the six inferior cervical vertebræ are without perforations for the vertebrary arteries, which enter the vertebrary canal along with the spinal chord, then penetrate the superior vertebrary laminæ, and emerge on the canal again close under the anterior oblique processes. This structure appears on the cervical vertebræ of the Sewalik fossil camel. In the vertebra now under consideration, on the contrary, the foramina (*a*, *a'*) maintain their ordinary position, that is, they perforate the transverse processes, and appear on the surface of the body of the vertebra.

Since the bone therefore does not belong to a camel, is it the bone of a giraffe? There is preserved in the museum of the Zoological Society the skeleton of a young Nubian giraffe which died at the Society's gardens. When its third cervical vertebra is placed in apposition with the fossil, the two are found to agree in every general character, though they disagree in some of their proportions, and in certain minor peculiarities. In this young and immature giraffe the length of the third cervical vertebra is $7\frac{1}{2}$ inches; what, then, is the length of this bone in the adult Nubian giraffe? The authors, from their not having had under their examination this vertebra of an adult animal, have been unable to ascertain this point directly; but they are able to infer it, from the length of a detached bone preserved in the museum of the Royal College of Surgeons of London, which is the second cervical vertebra of a giraffe, nearly, but not quite full-

grown*. The length of this bone is 11½ inches. Now in the skeleton of the young giraffe belonging to the Zoological Society the 2nd and 3rd cervical vertebræ are exactly of the same length. The authors infer, therefore, that in an animal nearly full-grown, such as was that to which the detached bone at the College of Surgeons belonged, the length of the 3rd cervical vertebra is 11½ inches; and consequently, that the length of the same bone in an animal which has reached full maturity, is about 12 inches†.

That the fossil vertebra belonged to an adult which had long attained its full size, is shown by the complete synostosis of the upper and lower articulating surfaces, by the strong relief of the ridges and the depth of the muscular depressions. But the length of this bone is only a little more than eight inches. As the other dimensions of the fossil and recent vertebræ that the authors placed in apposition, are nearly in proportion to their respective lengths, it follows that this fossil species of giraffe was one-third shorter in the neck than an adult of the existing Nubian variety.

But it was not only in size that the two giraffes differed; they differed also in their proportions. In the young giraffe at the Zoological Society the vertebra, which is 7½ inches long, has a vertical diameter of 3·8 inches; whereas in the fossil species the vertebra, which is 8 inches long, instead of having a vertical diameter exceeding 4 inches (as it ought, if its breadth were proportional to its length), has a vertical diameter of only 3·6 inches. This goes to prove that in this fossil giraffe the neck was one-tenth more slender in proportion to its length than the neck is in the existing species.

The inferior surface of the body of the vertebra is more curved longitudinally in the fossil than it is in the recent bone; the height of the arc in the former case being to the height in the latter as 3 is to 2.

On the under surface of the fossil vertebra a very distinct longitudinal ridge (*b*) runs down the middle, and this ridge is wanting in the recent bone; but this difference, probably, is chiefly owing to difference of age.

In the fossil vertebra the upper articulating head (*c*) is very convex; for with a transverse diameter of 1·4 inch it has a vertical height of 1 inch: laterally it is a good deal compressed. (See Pl. III. fig. 4.)

The posterior articulating surface (*d*) forms a perfectly circular cup, two inches in diameter; and this diameter, in the immature Nubian giraffe, is one-tenth greater, although the vertebra is one-sixteenth shorter. This affords a further proof of the comparative slenderness of neck in this fossil species.

In regard to the apophyses, the inferior transverse processes (*i*, *i*) are sent off downwards and outwards from the lower part of the

* This appears from the detached state of the upper and lower articulating heads of the bone.

† The height of the skeleton of the young giraffe in the museum of the Zoological Society is 10½ feet; that of a full-grown Nubian giraffe is 16 feet.

anterior end, exactly as in the recent species, and they are developed to nearly the same amount of projection. There is, however, this considerable difference, that whereas in the recent species they do not run half-way down the body of the vertebra, in the fossil they are decurrent along the whole of its length in well-marked laminar ridges, which are confluent with the nearly obsolete ridges of the upper transverse processes, the united mass near the posterior end being dilated into two thick alæform expansions (*e*, *e*).

In the fossil, as in the recent bone, the superior transverse processes are seen only in a rudimentary state; in the former, however, they run forwards across the body with less obliquity, and consequently make the canals for the vertebrary arteries twice as long as they are in the recent bone. In the fossil the orifices (*a*, *a'*) of these canals divide the length of the vertebra into three nearly equal portions; whereas in the recent bone the orifices are both included within its anterior half.

The anterior oblique processes (*f*, *f*) have the same general form and direction both in the fossil and recent species; but in the former they are considerably stouter and larger, and their interspace is less. The articular surfaces are convex, and are defined exactly as in the recent species.

The posterior oblique processes (*g*, *g*) of the fossil differ in form very little from those of the recent bone; in the fossil, however, the articular surfaces are considerably larger; and the ridges in which they are continued along the side of the upper vertebrary arch, are much less convergent than in the recent bone; so that in the latter this part is somewhat heart-shaped; whereas in the fossil it is nearly oblong, and "looks squarer," so to speak.

The spinous process (*h*) in the fossil is the same thin triangular lamina that is seen in the recent species; and it differs only in having its most prominent point lower down on the arch.

The spinal canal is very much of the same form and dimensions in both the fossil and the recent vertebra. At this point some of the matrix remains attached to the fossil bone, and prevents any very precise measurement.

As a minor point of agreement between the fossil and recent bones, it may be noted that, in both, the foramen (*k*) for the small nutritious artery on the inferior side of the body of the vertebra is on the right. In the other cervical vertebræ of the recent skeleton, this solitary foramen is on the left.

From the above comparisons it appears that the fossil vertebra, while it is very distinct from that of a camel, fulfils all the conditions required for a strict identification with that of a giraffe; that its peculiarities are not of greater than specific importance; and consequently do not warrant its being referred to a distinct and unknown type among the ruminants.

The following are the dimensions, in detail, of the third vertebra in the adult Sewalik fossil and in the immature Nubian Giraffe, 10½ feet high, in the museum of the Zoological Society:—

	Sewalik Fossil. Inches.	Nubian Recent. Inches.
Length between the ends of the oblique processes	8·1	7·5
Length of the body of the vertebra between the articulating heads	7·8	
Greatest width at the posterior end of the body, between the transverse processes	3·1	2·8
Least width at the middle of the body, between the upper transverse processes	1·65	1·6
Width between the outer margins of the upper oblique processes	2·65	2·55
Width of sinus between the upper oblique processes	1·1	1·2
Width between outer edges of posterior oblique processes	2·5	2·3
Least width of spinal arch between the ridges connecting the upper and lower oblique processes	1·25	1·0
Vertical diameter, posterior end of vertebra	3·6	3·8
Vertical diameter, anterior end, between the inferior border articulating head and upper margin spinal canal	2·6	2·7
Antero-posterior diameter articulating head	1·9	1·55
Transverse diameter articulating head at the middle	1·4	1·5
Greatest diameter articulating head	1·4	1·8
Vertical height articulating head	1·0	
Length of articulating surface, lower oblique process	1·6	1·2
Width of ditto	1·0	0·8
Length of articulating surface, upper oblique process	1·2	0·85
Width of ditto	0·8	0·7
Vertical diameter, spinal marrow, posterior end	1·25	
Vertical diameter, articulating cup, posterior end	2·0	2·2
Transverse diameter..... ditto..... ditto	2·0	2·3
Diameter upper transverse processes	0·8	0·7

Hence the authors conclude that there belonged to the Sewalik fauna a true well-marked species of giraffe closely resembling the existing species in form, but one-third less in height, and with a neck proportionately more slender; and for this small species they propose the name *Camelopardalis Sivalensis*.

Second Fossil Species of Giraffe.—The fossil specimens next to be described have been in the possession of the authors ever since 1836. They are fragments from the upper and lower jaws of another fossil species of giraffe, in which the teeth are so exactly of the same size and form with those of the existing species, and so perfectly resemble them in every respect, that it requires the calipers to establish any difference between them.

The largest specimen (Pl. II. fig. 3 *a*. 3 *b*.) is a fragment of a left upper jaw containing the two rear molars. The back part of the maxillary, beyond the teeth, is attached, and clearly proves that they belonged to a full-grown animal. These teeth were compared with the teeth, in the same stage of wearing, contained in the head of an adult female giraffe belonging to the museum of the College of Surgeons, and the fossil and recent teeth were found to agree together in the most minute particulars. The following are the corresponding dimensions of the fossil and recent teeth:—

	Fossil. Inches.	Recent. Inches.
Joint length of the two back molars, upper jaw	2·5	2·55
Greatest width of last molar	1·4	1·3
Ditto ditto of penultimate molar	1·45	1·35

The second specimen (Pl. II. fig. 4.) is the rear molar of the right

upper jaw, corresponding exactly in size and form with that of the left side, but if anything, rather more worn, and belonging therefore, probably, to a different individual. The agreement extends down to the small cone of enamel at the base of the hollow between the barrels on the inside. Its dimensions are:—

Length	1·2 inch.
Width	1·4

The third specimen (Pl. II. fig. 5 *a*. 5 *b*.) is a fragment of the left lower jaw, containing the last molar. It has precisely the form and proportions of the corresponding tooth in the left lower jaw of the female head referred to, and the same development of its third barrel or heel, which is always found in this tooth in ruminants. Its dimensions are:—

Length	1·7 inch.
Greatest width	1·0

The fourth specimen (Pl. II. fig. 6.) is the last false molar of the left lower jaw, detached. It agrees closely with the corresponding tooth in the recent female head above referred to. This tooth is thicker in proportion to its length in the giraffe than in other ruminants, and this constitutes one of the most distinctive characters of the giraffe's premolars. The anterior semibarrel appears a trifle longer than the corresponding tooth of the recent animal; but this is owing to a difference of wear, and is not borne out by measurement. The dimensions are:—

	Fossil.	Recent.
Length	1·0 inch.	1·0 inch.
Breadth	0·9	0·86

The authors are possessed of the same tooth of the right lower jaw, detached; but have not thought it necessary to figure it.

The fifth specimen (Pl. II. fig. 7.) is the penultimate false molar of the right upper jaw. It is of the same size and form with the corresponding tooth in the recent female head, with this difference, that it has three tubercles at the inside of the base. On a sixth specimen of the first false molar of the right upper jaw, which is not represented among the figures, there are three similar tubercles similarly placed. It would require an extensive comparison of recent heads to determine what value attaches to this peculiarity; whether the tubercles are constantly absent from the teeth of the recent species, or appear occasionally as a variation on those of individuals. The dimensions of the penultimate false molar of the upper jaw are:—

	Fossil.	Recent.
Length	1·0 inch.	0·95 inch.
Breadth	1·12	1·12

There is a peculiar, finely reticular, striated and rugose surface to the enamel of the teeth of certain quadrupeds, the appearance of which the authors compare to that of a fine net, forcibly extended, so as to bring the sides of the meshes together. This texture they formerly described as existing on the surface of the molars of the Sivatherium. It is found also on the teeth of the recent giraffe,

and is more or less conspicuous on those of the hippopotamus. It is not observed in the camel, the moose deer, or the larger bovine ruminants; or if ever present, it is but faintly developed. This texture is well marked on the enamel of the teeth of this second species of giraffe. A magnified representation of it is given in Pl. II. fig. 3 *c*.

The series of teeth last described, excepting the fifth and sixth specimens, are all but undistinguishable from those of the Nubian giraffe; and the authors have sought in vain for any distinctive character by which to discriminate them. There is no good evidence to show that this fossil species and the living are even different; but in putting the case thus, the authors are far from advancing that the species are identical. The materials are far too scanty to warrant a conjecture to that extent.

Since the neck of the *C. Sivalensis* was one-third too short and slender to sustain the head that would have suited the teeth last described, the authors consider it a necessary consequence that these teeth belonged to a distinct species. Had the difference been less considerable, they might have hesitated regarding this conclusion; but the difference between 8 inches and 12 inches in the length of the same cervical vertebra of two adult animals of the same genus, admits, in their opinion, of no other construction than distinctness of species. For the present, until sufficient materials shall be obtained to determine the relationship between the African giraffe and the second Sewalik species, in reference to their supposed resemblance, the authors propose to mark the latter by the provisional name of *Camelopardalis affinis*.

General Remarks.—In a former communication to the Society, (Geol. Trans. 2nd ser. vol. v. p. 503) the authors noticed the remarkable mixture of extinct and recent forms which constituted the ancient fauna of Northern India. An extinct testudinate form, *Colossochelys Atlas*, as enormous in reference to other known Chelonians as the Saurians of the lias and the oolite are to their existing analogues, is there associated with one or more of the same species of crocodile that now inhabit the rivers of India. The evidence respecting one of these species of crocodile, resting as it does on numerous remains of individuals of all ages, is considered by the authors as nearly conclusive of the identity of the fossil with its recent analogue. These reptiles occur together with extinct species of such very modern types as the monkey, the camel, the antelope, and (as has now been shown) the giraffe: and these are met by species of the extinct genera Sivatherium and Anoplotherium. As regards the geographical distribution of the true Anoplotheria, those hitherto discovered have been confined, as the authors believe, to Europe; and as regards their geological distribution, to the older and middle tertiaries. In India this genus continued down to the period when existing Indian crocodiles and probably some other recent forms had become inhabitants of that region.

It might be expected that in a deposit containing Anoplotherium, Palæotherian remains also would sooner or later be discovered. However, among the very large collection of fossil bones from the

tertiary sub-Himalayan range, made by the authors during ten years in that part of India, they have never found a single fragment of a head or tooth which they were able to refer to Palæotherium. This is merely a negative result, and only proves the rarity of that form*.

Although there occur among the Sewalik fossils abundant remains of almost every large pachydermatous genus, such as the elephant, mastodon, rhinoceros, hippopotamus, sus, horse, &c., yet no remain has been found referrible to the Tapir, a fact the more remarkable, inasmuch as one of the only two existing species of that genus is now confined to the larger Indian islands and a part of the adjoining continent.

The finding of the giraffe as a fossil, furnishes another link to the rapidly increasing chain which (as the discoveries of year after year evince) will sooner or later connect extinct with existing forms in a continuous series. The bovine, antelope, and antlered ruminants have numerous representatives, both recent and fossil. The camel tribe comprises a considerable fossil group, represented in India by the *Camelus Sivalensis*, and is closely approached to in America by extinct Pachydermatous Macrauchenia. The giraffe has hitherto been confined, like the human race, to a single species, and has occupied an isolated position in the order to which it belongs. It is now as closely represented by its fossil analogues as the camel; and it may be expected that, when the ossiferous beds of Asia and Africa are better known, other intermediate forms will be found, filling up the wide interval which now separates the giraffe from the antlered ruminants, its nearest allies in the order according to Cuvier and Owen†.

The giraffe throws a new light on the original physical characters of Northern India; for whatever may be urged in regard to the possible range of its vegetable food, it is very clear that, like the existing species, it must have inhabited an open country, and had broad plains to roam over. In a densely forest-clad tract, like that

* Mr. M'Clelland in his paper on *Hexaprotodon* (Journ. Asiatic Society of Bengal, vol. vii. p. 1046) casually mentions a species of Palæotherium as occurring among the Sewalik fossils. But he does not describe or figure the specimen. Messrs. Baker and Durand in their remarks appended to their catalogue of the Dadoopor collection (Idem, vol. v. p. 836), mention four specimens containing teeth of the upper and lower jaws belonging to what they provisionally designate "Cuvierian genera:" in regard to one of which, having the upper and lower jaws in contact, they state that, "although it affords some analogies both to the Palæotherium and Anoplotherium, its essential peculiarities are sufficiently remarkable to cause it to be separated from either genus." Till these specimens are either figured or described, the point must remain undecided in regard to Palæotherium being represented in the Sewalik fauna.

† M. G. de St. Hilaire, in his zeal for the mutability of species, imagined that he had detected in the Sivatherium the primeval type which time and necessity had fined down into the giraffe. Anatomical proofs were all against this inference; but if a shadow of doubt remained, it must yield to the fact, that in the Sewalik fauna the Giraffe and the Sivatherium were contemporaries.

which now skirts the foot of the Himalayahs, it would soon have been exterminated by the large feline feræ, by the hyænas, and large predaceous bears which are known to have been members of the old Sewalik fauna.

Postscript.—Since the above remarks were submitted to the Society, M. Duvernoy's paper, embodying two communications read to the Academy of Sciences on the 19th May and 27th November last, has appeared in the January Number of the 'Annales des Sciences Naturelles.' These notices were published in the 'Comptes Rendus,' but were unknown to the authors at the time. M. Duvernoy describes the lower jaw of a fossil giraffe found in the bottom of a well, lying on the surface of a yellow clay, along with fragments of pottery and domestic utensils, in the court of an ancient donjon of the 14th century in the town of Isoodun, Département de l'Indre. Considerable doubt remains as to the bed and source whence the fossil was derived. M. Duvernoy attributes the jaw to a distinct species of giraffe, which he names *Camelopardalis Biturigum.* Professor Owen, from the examination of a cast, confirms the result, expressing his conviction "that in the more essential characters the Isoodun fossil closely approaches the genus Giraffe, but differs strikingly from the (*single*) existing species of the south and east of Africa, and that the deviations tend towards the subgenus Elk."

M. Duvernoy also mentions the discovery of a tooth in the molasse near Neufchatel, by M. Nicolet, determined by M. Agassiz to be the outer incisor of a fossil giraffe.—(*Duvernoy, Annales des Sciences Naturelles,* No. for January 1844.)

References to the Figures in the Plates.

Plate II. Fig. 1. *Anoplotherium Sivalense*; left upper jaw with the teeth seen from above; (*a a' a''*) the conical cusp.
2. Ditto; upper jaw, right side, with the four back molars and part of the orbit.
3 *a*. *Camelopardalis affinis*; the last two upper molars; left side seen vertically.
3 *b*. Ditto, ditto; horizontal view of the crown.
3 *c*. Rugous reticulated surface of the enamel, magnified to twice the natural size.
4. Last upper molar of ditto, right side.
5 *a*. and *b*. Last molar of ditto; lower jaw, left side.
6. Last false molar of ditto; lower jaw, left side.
7. Second false molar; upper jaw, right side.

Plate III. Figs. 1–5. *Camelopardalis Sivalensis*; third cervical vertebra.
a a'. Orifices of the arterial canals.
b. Longitudinal ridge, underside of the body.
c c. Upper articulating head.
d. Lower articulating surface.
e e. Alæform expansions of the transverse processes.

f f. Superior oblique processes.
g g. Inferior ditto ditto.
h h. Spinous processes.
i i. Inferior transverse process.
k. Foramen of the nutritious artery.

N. B. The figures in both plates are drawn to the natural size, excepting fig. 3 *c*. of Plate II.

Fig: 1.

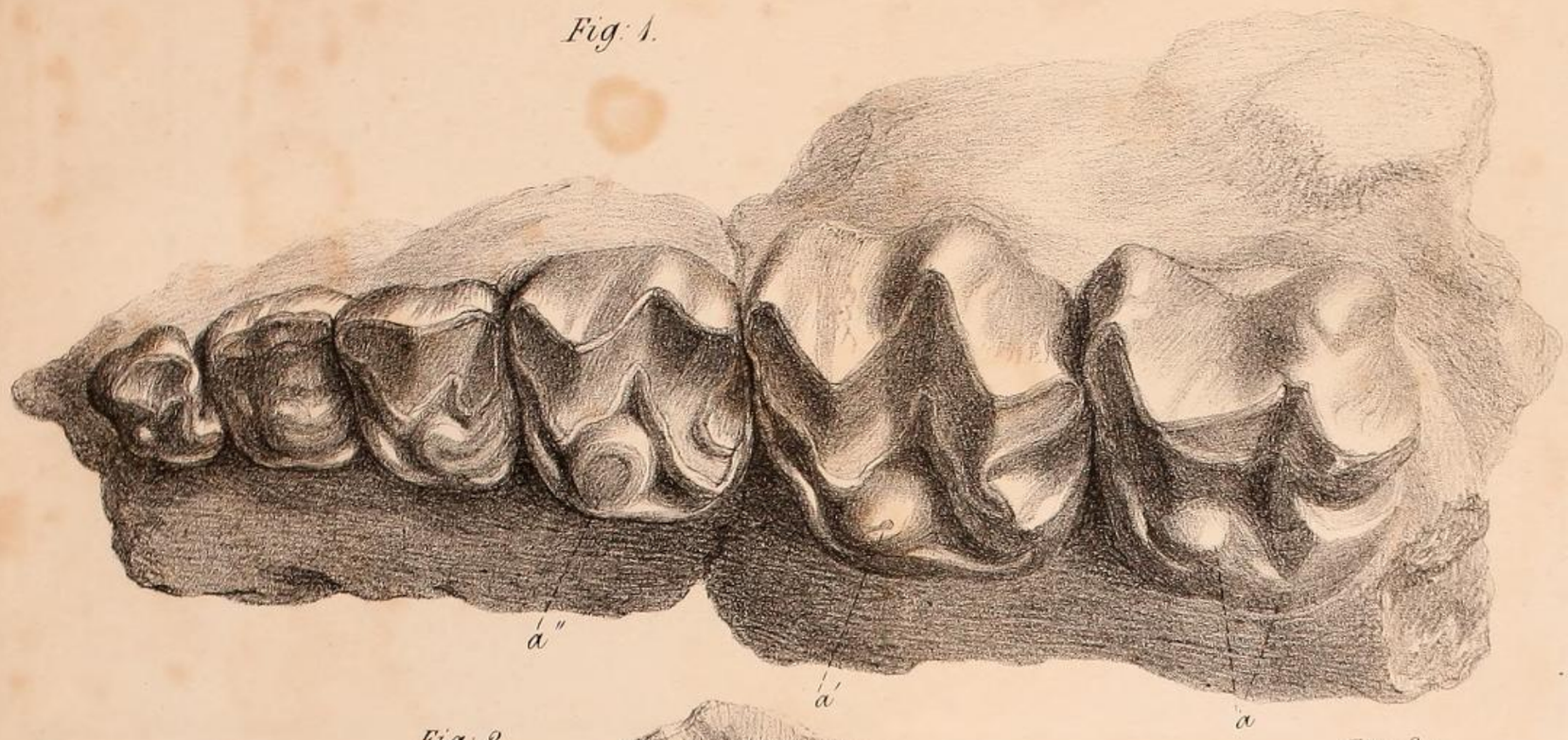

Fig: 2.

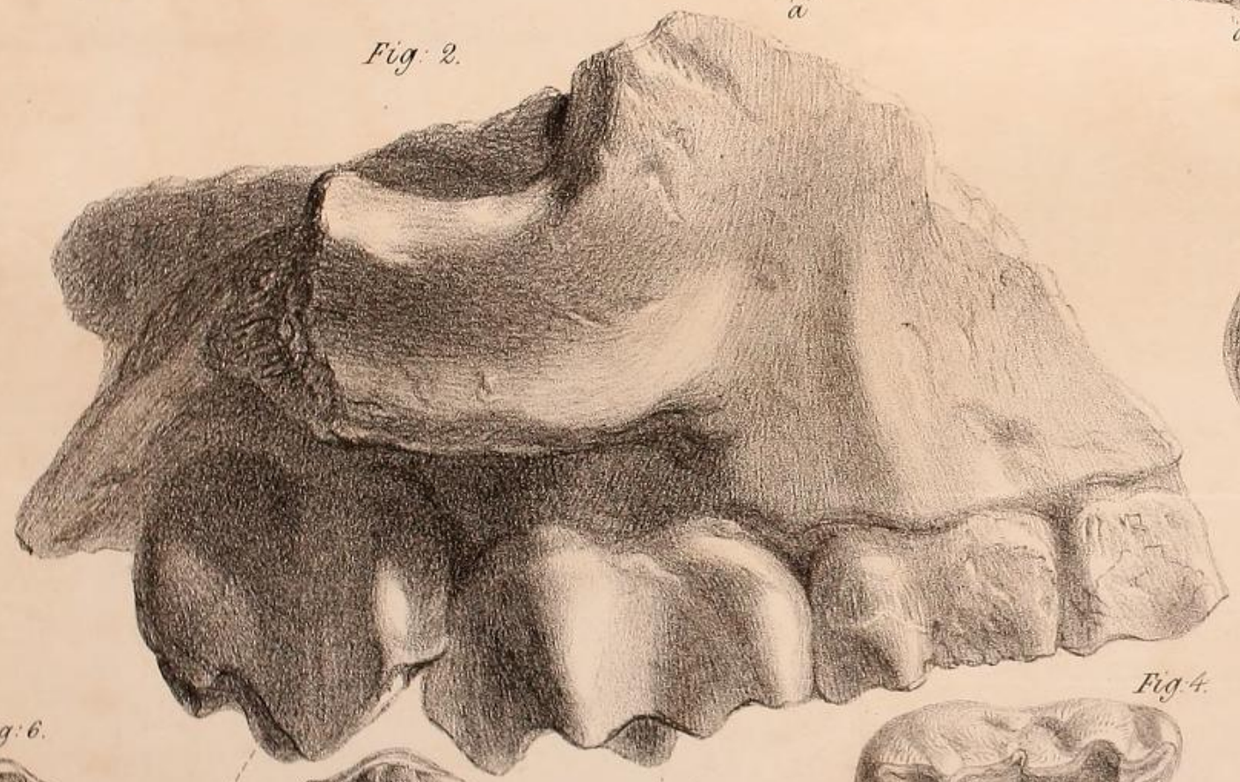

Fig: 3a.

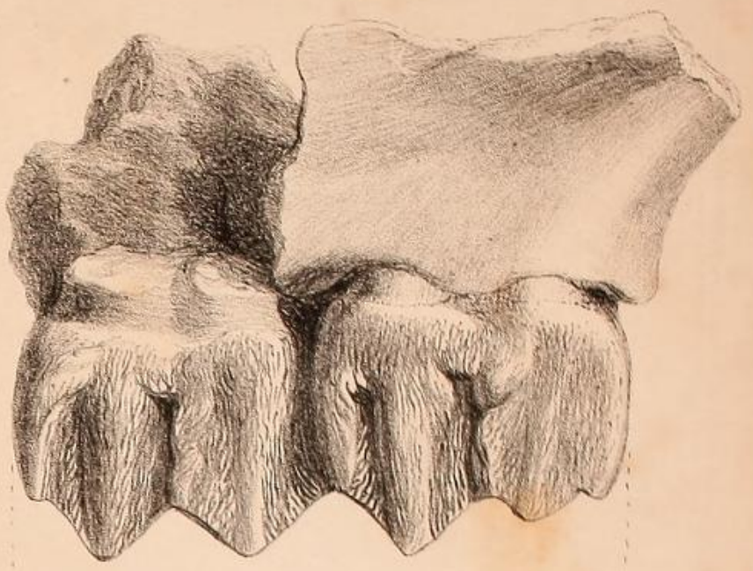

Fig: 3b.

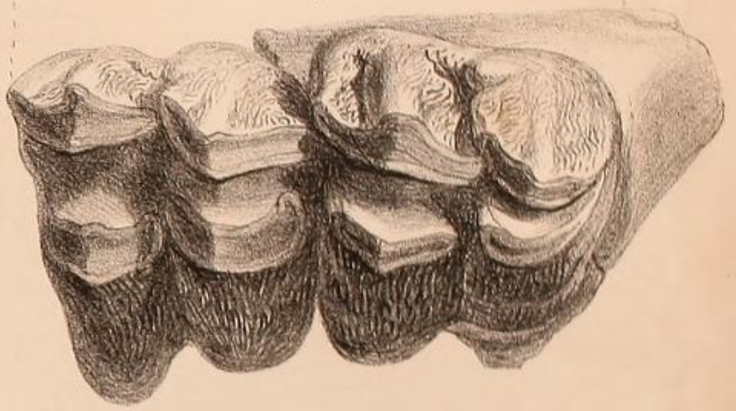

Fig: 3c.

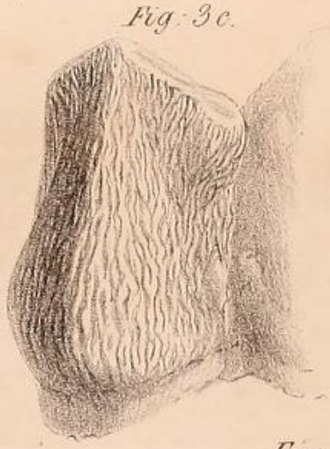

Fig: 5b.

Fig: 5a.

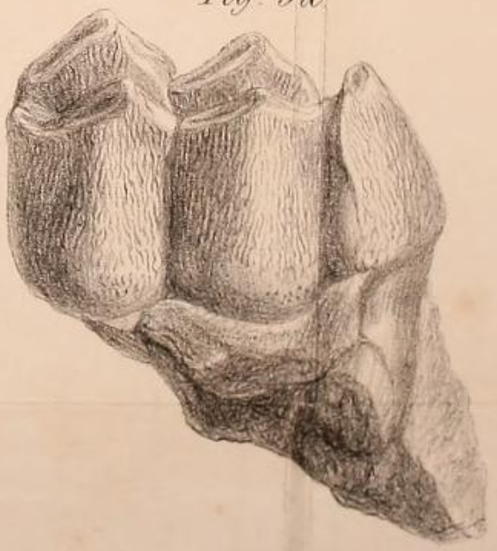

Fig: 4.

Fig: 6.

Fig: 7.

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Fig: 1-2. Anoplotherium Swetense.
Fig: 3-7. Camelopardalis affinis.

Camelopardalis Sevalensis
Third cervical Vertebra