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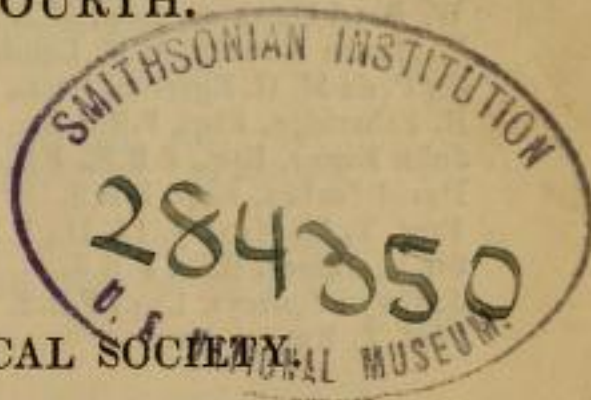
THE ASSISTANT-SECRETARY OF THE GEOLOGICAL SOCIETY.

Quod si cui mortalium cordi et curæ sit non tantum inventis hæerere, atque iis uti, sed ad ulteriora penetrare; atque non disputando adversarium, sed opere naturam vincere; demique non belle et probabiliter opinari, sed certo et ostensive scire; tales, tanquam veri scientiarum filii, nobis (si videbitur) se adjungant — *Novum Organum, Præfatio.*

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SOLD ALSO AT THE APARTMENTS OF THE SOCIETY.

MDCCCLXVIII.

3. *On the DENTITION of RHINOCEROS ETRUSCUS, Falc.* By W. BOYD
DAWKINS, Esq., M.A., F.R.S., F.G.S.

[PLATES VII. & VIII.]

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1. *Introduction.*—The dentition of three* of the fossil species of *Rhinoceros* has already been defined, and there remains only that of the fourth or Etruscan to complete the odontography of those members of the genus that inhabited Britain during the Pleistocene period. Some years ago Dr. Falconer, along with M. Lartét, had detected in the collections of Mammalia from the Forest-bed, and especially in that made by the Rev. John Gunn, teeth which clearly were neither Megarhine nor Leptorhine. Similar teeth he also found in Italy and Spain, and from their abundance in the former country he named the animal to which they belonged *Rhinoceros Etruscus*. Unfortunately its description was prevented by his sudden death; and the only authentic memorials consist of names attached to specimens in various museums, and of a few fragmentary notes which were dictated to the Rev. S. W. King, and which are printed at the feet of these pages†. At the time of Dr. Falconer's death there were not sufficient materials in Britain for an accurate specific determination; now, however, they are afforded by the entire molar series, except the first premolar of the lower jaw, forwarded to me by the kindness of the Rev. S. W. King, F.G.S. Specimens from France have also been sent me by M. Lartét; and others have been discovered in the British Museum. I am therefore in a position to complete the odontography of a species about which less is accurately known than any other ranging through southern Europe.

2. *Dental Formula.*—The number of teeth possessed by *Rhinoceros Etruscus* is the same as that of the three species already described; it consists of

$$\text{Dm. } \begin{array}{cccccc} 4 & \text{I. 0} & \text{C. 0} & \text{Pm. 2. 3. 4.} & \text{M. 1. 2. 3.} \\ \hline 4 & \text{I. 0} & \text{C. 0} & \text{Pm. 2. 3. 4.} & \text{M. 1. 2. 3.} \end{array}$$

The first premolar, if present at all, disappeared very early in life, without leaving any trace behind—a point by which the animal may be defined at once from all the Miocene species which have yet been found.

3. *Permanent Upper Molar Dentition.*—Only two specimens of the Etruscan milk-teeth have come before me:—the one a last lower molar, in the possession of Mr. Fitch, of Norwich; the other, consisting of the milk-molars 3 and 4, in a jaw belonging to the Rev.

* Nat. Hist. Rev. 1863, No. XII. p. 525; Nat. Hist. Rev. 1865, No. XIX. p. 339; Quart. Journ. Geol. Soc. vol. xxiii. (1867), p. 213.

† Since this paper was written (October 1867), Dr. Falconer's Memoirs have been published (January 1868), in which all the memoranda bearing on the species in his note-books are given. (Vol. ii. p. 354 *et seq.*)

S. W. King. The jaw in which the former of these is implanted is described by Dr. Falconer*. These two specimens afford insufficient data for describing the milk-molars; and therefore I will pass on at once to the true molar series.

The upper true molars of *Rhinoceros Etruscus* are defined at sight from those of any other British species by the lowness of their crowns, the abruptly tapering form of the colles †, *d* and *e*, and the stoutness of the guard, *o*, on the anterior aspect. The grinding-surface of the crown is deeply excavated, as in the Leptorhine and Megarhine teeth, instead of being worn flat, as in the Tichorhine; and the enamel is remarkable for its smoothness. For the British type of the species I have chosen the molar series found in the Forest-bed at Pakefield (Pls. VII. figs. 1, 2, and VIII. fig. 4), in which all the teeth are present except the first premolar of the lower jaw. It belonged to a *Rhinoceros* rather past the meridian of life. It is covered with a red ferruginous matrix, locally termed "pan," which is characteristic of fossils which have been imbedded in the Præglacial deposits of the east coast. The first of the premolars (Pl. VII. figs. 1, 2) is remarkable for the stoutness of the guard, *o*, that runs round the anterior and inner surfaces of the crown, forming a clearly defined step from its passage round the median collis, *e*, to its upward sweep at the point on the anterior aspect where the anterior collis, *d*, joins the lamina. Its horizontal position up to that point is characteristic, and defines the tooth from any of its Pleistocene or recent homologues. Its antero-external angle is slightly produced. Costæ 1 and 2 are slightly developed, while costa 4, bounding the tumid posterior area, is sharp and well defined. The second premolar, pm. 3, reproduces all the characters of the first, excepting the production of the antero-external angle. It is very much larger, and presents an outline more nearly approaching an oblong. The tumidity also at the base of the posterior area, *n*, is more pronounced. The third premolar, pm. 4, is differentiated from the second only by its greater size. The horizontality of the guard, *o*, and its height above the cingulum, characterize the whole of the premolar series, and prevent its being confounded with that of any other British species. The

* "*Rhinoceros* ——. Left ramus, lower jaw, five teeth out, last true molar not protruding, last milk-molar not dropped out, showing symphysis and diasteme; longitudinal striæ well marked; matrix of 'red pan' of forest-bed well marked. Length from anterior end of socket of first premolar (dropped out) to end of last true molar 10 inches." (Dictated to the Rev. S. W. King by Dr. Falconer.) Dr. Falconer, however, seems to have made up his mind afterwards as to its Etruscan character. See *Palæont. Memoirs*, vol. ii. p. 347, published after this essay was written.

† A list of the terms and letters used to identify homologous parts in the teeth of *Rhinoceros* has already been given, in the *Quart. Journ. Geol. Soc.* vol. xxiii. p. 218. Without the use of some such system it is impossible to assign a true value to the differences observable between closely allied species of the same genus. Throughout the essays on the dentition of *Rhinoceros*, the same terms and letters are used, so that the homologous parts in any one tooth may be compared with those of any other. Most of the terms are taken from the masterly work on the Tichorhine *Rhinoceros* by Professor Brandt (*Mém. Acad. St. Pétersb.* 6^e sér. tom. vii.).

height of the entrance of the anterior valley, *a*, above the cingulum, is also a point of difference. In this case it is worn away. There is but little difference observable between true molars 1 and 2. In both the guard is very strongly marked on the anterior aspect, and is represented, more or less, by a line of small obtusely pointed cusps passing across the anterior collis, *d*, and the posterior, *e*. In the first true molar it is not observable on the inner aspect of *d*, but it blocks up the entrance into the anterior valley, *a*; while in the second it is visible on the former and absent from the valley-entrance. In both it is present on the inner base of *e*. The entrance of the anterior valley, *a*, is wide, the posterior combing-plate, *h*, is very large. The third collis, *e*, is notched and cusplless, as in the Megarhine and Leptorhine teeth. The two anterior costæ, and especially the second, *k* 2, are strongly marked; and the posterior area, *n*, is excavated, and inclines very much inwards as it approaches the grinding-surface of the crown; at the point, however, where it joins the cingulum it is tumid. A ridge sweeps round the bottom of the laminae, and connects costa 1 with costa 4. These last two points are highly characteristic. The last true molar (Pl. VIII. fig. 4), which is about half worn, is remarkable for the great width of its valley-entrance, and for the great development of the posterior combing-plate, *h*, which passes across the valley and is fused to the anterior collis, *d*, and thus insulates the head, *c*, of the anterior valley, *a*. The guard, *o*, is very stout on the anterior aspect of *d*, and is represented by a line of cusps at the inner base of the latter. The posterior valley, *b*, is a faint depression behind the median collis, *e*, circumscribed by a cusplless ridge of enamel homologous with the third collis, *f*, in the upper molar series.

In the Rev. S. W. King's collection there are several isolated teeth belonging to the Etruscan species, and all obtained from the Forest-bed on the east coast. A right upper true molar 3* reproduces all the characters of that which has been just described. Two premolars also correspond exactly with the third premolar of the Pakefield jaw, while the third, or the first premolar (Pm. 2) of the right side, is remarkable for the development of an accessory combing-plate. Its posterior collis is notched and cusplless. The entrance of the anterior valley and the cingulum are situated respectively 0.82 and 0.48 inch from the base of the crown. Among the teeth of *Rhinoceros* forwarded to me by the Rev. John Gunn, is a small right

* *R. Etruscus*, Falc.; syn. *R. leptorhinus*, Cuv., pro parte, *R. tichorhinus* auctorum. Last true molar, upper jaw, right side, half-worn, and presenting the distinctive characters of the species. The imperfect pit (*puits*) at the base of the posterior inner angle is developed exactly as in the specimens from the Val d'Arno, and as in a specimen from Malaga with which it was confronted. The enamel still is thin, and the outer surface is marked by very fine, parallel, closely appressed grooves. The tooth differs from the ordinary character chiefly in having the plate which is thrown off from the posterior barrel continued across the valley so as to form a bridge between the anterior and posterior barrels, isolating a portion of the transverse fissure into a round hole. This character is rare among the Rhinoceroses. (Dictated to the Rev. S. W. King by Dr. Falconer, 13th December, 1861.)

upper molar labelled by Dr. Falconer "the penultimate." It belonged to an animal in its full prime, and agrees exactly with the first upper true molar figured. In Mr. Fitch's collection also, in Norwich, there is a first upper true molar, together with one too much worn to have its position in the jaw accurately determined. In the British Museum there is an Etruscan left upper true molar 2, which was formerly in the Layton collection. The black ferruginous matrix which adheres to it proves that it was obtained from the Forest-bed, while its waterworn condition shows that it has been exposed to the waves of the sea. It was therefore most probably obtained from the Norfolk or Suffolk shore, or perhaps may have been dredged up from the bottom of the German ocean off that coast. It agrees in every respect with the true molar which I have described above. This list comprises all the Etruscan upper molars from British localities which have passed through my hands.

I will now pass on to the consideration of the teeth of *Rhinoceros Etruscus* from foreign localities. In a collection of Mammalia in the British Museum, obtained by M. Bravard from Perolles, are two teeth described in his catalogue as those of the Tichorine species; they belong, however, beyond all doubt, to the species under consideration. The one, a left upper true molar 3 (Pl. VIII. fig. 5), agrees in every respect with that of the jaw from Pakefield. The entrance, however, to the anterior valley is rather wider and more open. The other is a left premolar 4 (Pl. VIII. fig. 2), very much worn, that probably belonged to the same animal as the last true molar. It presents all the characters ascribed above to the premolar series. To M. Lartét I am indebted for evidence of the occurrence of the species in a second locality in France, afforded by a first premolar (Pm. 2), half worn, from the Pleiocene beds of Etampes (Pl. VIII. fig. 1). The entrances of the two valleys, *a*, *b*, are situated high above the cingulum. The guard, *c*, is very stout, and especially on the anterior aspect, and is removed from the cingulum by at least 0.3 inch. It sweeps round from the antero-external angle of the tooth as far as the apex of the postero-internal, and forms a pedestal from which the two colles, *d* and *e*, gradually taper upwards. The external lamina, *l*, is tumid, and the second costa, *k* 2, is strongly marked. It presents one character not observable in any British specimen, in the insulation of an accessory valley by two combing-plates, *h*; as, however, they spring from the anterior wall of the second collis, *e*, they cannot be considered homologous with the anterior combing-plate, *g*, so characteristic of the Tichorhine species, in which the latter invariably springs from the external lamina. Both are therefore posterior combing-plates, *h*. A second specimen sent by M. Lartét is a premolar 3, from Velay; it agrees with the description of the corresponding tooth from Norfolk in all points, except the great size of its posterior combing-plate, which is bounded by a waved line of enamel.

The remains of the species are more abundant in Italy than anywhere else; and there are several jaws and teeth from that country in the Museums of Oxford and London. In the British Museum

there is a fine upper true molar 1 (Pl. VIII. figs. 3 *a*, 3 *b*) from the Val d'Arno, which is but little worn, and therefore belonged to an adolescent animal; as compared with the English specimens it is remarkable only for its smaller size. The guard, *o*, is represented on its inner aspect by a line of cusps passing across the second collis, *e*, and blocking up the entrance of the anterior valley, *a*. In the same museum, also, there is a plaster cast of a skull containing five out of the six teeth. The first premolar presents the same feature as that described in the specimen from Etampes. The two posterior combing-plates have insulated a portion of the anterior valley, as in Pl. VIII. fig. 1; and there consequently appear on the worn crown-surface three islands of enamel*. In the Oxford Museum there is a fragment of the maxillary bone containing premolars 3, 4, and true molars 1, 2, brought from the Val d'Arno by Mr. Joseph Pentland. The teeth are very much shattered, with the exception of the first true molar. They present all the characters of the Etruscan species. This specimen is highly impregnated with iron, and has been derived from a sandy matrix. From the same deposit are preserved the teeth of *Elephas meridionalis*, *E. antiquus*, and *Hippopotamus major*; and its fluviatile or lacustrine origin is proved by the presence of a large species of *Anodon*†. Evidence also is afforded by an upper jaw of the animal found at Malaga, and now preserved in the British Museum, that the animal lived in the south of Spain. The teeth, which consist of the whole molar series, except premolar 4, agree exactly with those which have already been described‡.

4. *Permanent Lower Molar Dentition*.—The lower molar series (Pl. VII. fig. 3) of *Rhinoceros Etruscus* is easily distinguished from that of the Megarhine species, with which it is associated on the Cromer shore, by the possession of the following characters:—The teeth are much smaller and the unworn crowns are much lower. In the true molars also, the guard, *o*, before and behind is much more strongly marked. In true molars 1 and 2 it frequently crosses the base of the posterior area, *n*, and disappears in the median groove, *i*, and is always represented more or less by a line of tubercles. This character is strongly exaggerated in the premolars, in which there is a similar prolongation of the anterior guard backwards to meet the posterior in the middle of the median groove, *i*. The enamel structure throughout is also rougher than in the Megarhine teeth. As compared with the Leptorhine and Tichorhine species, it is differentiated by the presence of the guard, *o*, on the external lamina, by the lowness of the crown, the thickness of the enamel, and by the absence of costæ from the rounded anterior area, *m*. The finest specimen that has passed through my hands consists of the two rami that belong to the same animal as the upper molar series from Pakefield. They contain five out of the six molars, premolar 2 only being absent.

* The remains of this species in the British Museum have now been largely increased by the accession of all the type specimens in the possession of the late Dr. Falconer.—January 1868.

† Described in Dr. Falconer's notes, *Palæont. Mem.* vol. ii. p. 354.

‡ Described by Dr. Falconer, vol. ii. p. 360.

The left ramus (Pl. VII. fig. 3) shows the typical molar dentition. Many other lower jaws of the Etruscan species have also been obtained from the Forest-bed; one left ramus in the possession of Mr. Fitch, of Norwich, was considered by Professor Owen* to belong to his Leptorhine species. Its correspondence, however, with other jaws which are indisputably Etruscan, place its determination beyond all doubt, although the only teeth it presents are the last milk-molar and the germ of the true molar†. In the Norwich Museum there is a right lower ramus, which belonged to an old adult, and a last true molar, both of which were obtained by Miss Gurney from the Forest-bed. In the Geological Museum at Cambridge there are also two rami that contain four out of the six molars, and belonged to an animal in the prime of life. They were found in the same locality as the preceding, by Miss Gurney. A left lower ramus containing the true molar series was forwarded to me by the Rev. John Gunn, which had been named by Dr. Falconer *Rhinoceros leptorhinus* of Cuvier. Its characters, however, read by the light of discoveries since his death, show that it really belongs to *Rhinoceros Etruscus*. There are also a few specimens in Britain of the lower molars of *Rhinoceros Etruscus* from foreign localities, consisting of a lower jaw from the Val d'Arno in Mr. Pentland's collection at Oxford, and some isolated teeth from Perolles in the British Museum. None, without exception, that have passed through my hands, present any deviation from the characters which have been ascribed above to the lower molars of *Rhinoceros Etruscus*.

5. *Comparative Measurements*.—The measurements taken at the base of the crown in inches and tenths are uniform with those of the preceding essays on the Tichorhine, Megarhine, and Leptorhine dentition. They are—

1. Antero-posterior, taken along the outside of the crown.
2. Antero-transverse, taken across the anterior lobe of the tooth.
3. Postero-transverse, taken across the posterior lobe of the tooth.

A comparison of the measurements of the Etruscan teeth with those of the Pliocene and Miocene species will show the difference of size existing between them.

TABLE OF MEASUREMENTS.

Upper Molar Series.

Species.	Locality.	Tooth.	1.	2.	3.
Rhinoceros Etruscus	Pakefield, Lowestoft.....	Pm. 2	1.24	1.4	1.62
		Pm. 3	1.48	2.0	2.02
		Pm. 4	1.5	2.16	2.15
		M. 1	1.75	2.36	2.2
		M. 2	1.78	2.42	2.16
		M. 3
		M. 2	1.8	2.45	2.2
		M. 1	1.8	2.38	2.12
		Pm. 3	1.45	2.05	2.05
		Pm. 2	1.22	1.49	1.66

* Brit. Foss. Mammals, p. 381.

† See Falconer's note, § 2.

Species.	Locality.	Tooth.	1.	2.	3.
Rhinoceros Etruscus	Cromer (Rev. S. W. King) ...	Pm. 2	1·0	1·84	1·79
		Pm. 3	...	2·05	2·01
		M. 3	...	2·15	2·09
	Cromer (Rev. John Gunn)	M. 1	1·79	2·3	2·1
		Forest-bed (Brit. Mus., Layton Coll.)	M. 2	1·8	2·3
	Perolles (Brit. Mus., M. Bravard)		M. 3	1·89	1·93
		Pm. 3	1·38	2·0	1·75
	Etampes (M. Lartét)	Pm. 2	1·21	1·45	1·59
		Pm. 3	1·4	1·98	1·86
	Velay (M. Lartét)	Pm. 2	1·35	1·55	1·68
		Pm. 3	1·55	2·03	2·03
	Val d'Arno (cast, Brit. Mus.)	Pm. 4	1·6	2·25	2·1
		M. 1	1·62	2·20	...
		M. 2	1·88	2·38	2·25
		Pm. 2	1·23	1·5	1·53
		Pm. 3	1·35	2·05	1·95
		Pm. 4	1·4	2·25	1·95
		M. 1	1·6	2·2	2·09
		M. 2	1·73	2·3	2·2
		Val d'Arno (Oxford Mus.)	M. 1	1·75	2·23
Pm. 2			1·26	1·5	1·6
Malaga (cast, Brit. Mus.)	Pm. 3	1·55	1·9	1·85	
	M. 1	1·6	2·1	2·0	
	M. 2	1·95	2·35	2·1	
Rhinoceros Schleiermacheri, Kaup ...	M. 3	2·2	2·2	...	
	Pm. 1	1·0	0·45	1·65	
	Pm. 2	1·25	1·44	1·7	
	Pm. 3	1·45	2·9	2·0	
	Miocene, Darmstadt	Pm. 4	1·49	2·19	2·06
		M. 1	1·9	1·7	2·4
		M. 2	1·98	2·6	2·39
	Acerotherium incisivum, Kaup	M. 3	2·2	2·28	...
		Pm. 1	0·95	0·8	...
		Pm. 2	1·28	1·6	1·74
Pm. 3		1·34	2·13	2·08	
Miocene, Darmstadt		Pm. 4	1·47	2·3	2·19
		M. 1	1·7	2·34	2·15
		M. 2	2·2	2·25	...
Rhinoceros d'Auvergne	M. 3	1·7	2·34	2·25	
	Pm. 1	0·92	0·48	0·88	
	Pm. 2	1·2	1·55	1·6	
	Pseudo-pliocène d'Issoire ...	Pm. 3	1·35	1·95	1·9
		Pm. 4	1·48	2·2	2·05
		M. 1	1·58	2·15	2·1
	Rhinoceros brachypus, Lartét	M. 2	1·88	2·25	2·1
M. 3		2·48	2·15	...	
Pm. 1		
Pm. 2		1·28	1·55	1·7	
Miocene, Ville-Franche d'As-tarac		Pm. 3	1·4	1·95	1·98
		Pm. 4	1·62	2·23	2·1
		M. 1	2·12	2·7	2·3
Rhinoceros Simorrensis, Lartét	M. 2	2·1	2·6	2·25	
	M. 3	2·75	2·6	...	
	Pm. 1	0·6	0·6	...	
	Pm. 2	0·9	1·12	1·34	
	Miocene, Ville-Franche d'As-tarac	Pm. 3	1·05	1·6	1·6
		Pm. 4	1·13	1·68	1·68
		M. 1	1·38	1·75	1·58
M. 2	1·48	1·7	1·6		
M. 3	1·6	1·55	...		

Lower Molar Series.

Species.	Locality.	Tooth.	1.	2.	3.
Rhinoceros Etruscus	Pakefield	Pm. 3	1.38	1.0	1.08
		Pm. 4	1.42	1.13	1.22
		M. 1	1.45	1.2	1.23
		M. 2	1.75	1.26	1.24
		M. 3	1.75	1.15	1.18
		M. 3	1.72	1.15	1.19
		M. 2	1.72	1.25	1.22
		M. 1	1.59	1.19	1.2
		Pm. 4	1.45	1.12	1.22
	Forest-bed (Cambridge Mus.)	Pm. 3	1.35	1.0	1.1
		Pm. 4	1.45	1.0	.95
		M. 1	1.5	1.12	1.12
		M. 2	1.75	1.2	1.15
		M. 3	2.2	1.2	1.15
		M. 1	1.85	1.2	1.14
Cromer (Rev. John Gunn) ...	M. 2	1.77	1.19	1.14	
	M. 3	1.85	...	1.05	
	Pm. 1	
Rhinoceros Schleiermacheri, Kaup ...	Miocene, Darmstadt.....	Pm. 2	1.19	0.72	0.89
		Pm. 3	1.55	1.02	1.08
		Pm. 4	1.08	1.18	1.25
		M. 1	1.85	1.25	1.45
		M. 2	1.99	1.45	1.52
		M. 3	1.85	1.38	1.25
		Pm. 1	0.6	1.55	...
Acerotherium incisivum, Kaup	Miocene, Darmstadt.....	Pm. 2	1.2	0.88	0.9
		Pm. 3	1.4	0.95	1.5
		Pm. 4	1.45	1.1	1.1
		M. 1	1.65	1.11	1.15
		M. 2	1.75	1.25	1.25
		M. 3	1.6	1.1	1.09
		Pm. 2	1.05	0.53	0.72
Rhinoceros Simorensis, Lartet	Miocene.....	Pm. 3	1.2	0.78	0.88
		Pm. 4	1.34	0.9	0.95
		M. 1	1.42	1.95	0.98
		M. 2	1.45	0.98	1.0
		M. 3	1.48	0.9	0.92

6. *Affinities*.—The Megarhine and Leptorhine Rhinoceros present, as we have seen in the preceding essays*, dental characteristics which are now shared among the living and widely divergent species; the Etruscan, on the other hand, points rather backwards than forwards in time, and its dental characters are represented only by the milk-teeth of some of the Rhinoceroses that lived after its extinction. The teeth of the genus *Rhinoceros* may be divided into two distinct classes, characterized severally by the height or lowness of their unworn crowns, and especially in the case of the upper molar series. To the high-crowned or hypsodont† division belong all the living and all the Pliocene and Pleistocene species, with the exception of *Rhinoceros Etruscus* and perhaps *R. pachygnathus* of Pikermi. To it also belong all the Rhinoceroses from the Sivalik Hills. The typical

* Nat. Hist. Rev. 1865, No. XIX. Quart. Journ. Geol. Soc. vol. xxiii. p. 227.

† ἕψος = height, ὀδὸν = tooth.

hypodont dentition reaches a maximum of development in the *R. tichorhinus*, *R. platyrhinus*, and *R. simus*. To the second or brachydont* division belong *Rhinoceros Etruscus* and all the Miocene species both of Europe and North America, the only exception being presented by those from the deposit in the Sivalik hills, which seems to me by no means of indisputable Miocene age. Into this group also falls the remarkable hornless Rhinoceros, the *Acerotherium incisivum*. This form of tooth, so universal in Miocene times, is preserved now only in the deciduous teeth of the recent and fossil species. We have therefore to compare *Rhinoceros Etruscus* with Miocene rather than Pliocene or Pleistocene members of the genus; and so closely does it approach some of these that an isolated tooth could hardly be determined with absolute certainty if the locality were unknown. All its characteristics occur in an intensified form, but are not altered in any essential point. It differs from the Rhinoceros of Auvergne only by the greater complexity of the anterior valley, by the larger development of the posterior combing-plate, and by the more slightly defined guard on the inner aspect of the premolar series. In the latter species, however, the first premolar, pm. 1, is persistent, so that it presented the normal molar formula of the placental mammals. The exact geological horizon of this species is very obscure. It was derived, according to M. Gervais†, from the "pseudo-pliocène d'Issoire," and is the same as the *R. elatus* of the Abbé Croizet, and has even been referred to the *R. megarhinus* of M. de Christol. The *Rhinoceros brachypus*, Lartêt, from the Miocene of Ville-Franche d'Astarac, in Auvergne, has also four persistent premolars. It diverges from the Etruscan species in the following points:—The guard on the inner surface of the true molars, which is merely sketched out in *R. Etruscus*, is fully and strongly developed; the strongly impressed guard in the premolars on the posterior area, and in the true molars on both areas; the posterior combing-plate is not so strongly marked. The crowns of the premolars are worn flat, while those of the true molars are excavated; but this may possibly be a mere peculiarity of the individual. In the lower molars of the same animal the guard is far more strongly impressed on both areas, and especially so in the premolars, and is very pronounced on the inner aspect of the anterior collis, which it traverses diagonally. The dentition of *R. Simorrensis*, Lartêt, from the same locality as the last, presents the following points of difference:—In the upper jaw the guard is more strongly impressed on the true molars, more slightly on the premolars. The lower jaws, however, of the two animals are identical in form. Premolar 1 is present in both, being very small relatively to the other teeth, and a mere representative of a departing structure. All the teeth are very much smaller. The *Rhinoceros Etruscus* is more or less allied to all these in the form of its teeth; but its closest ally is the hornless Rhinoceros of Darmstadt, the *Acerotherium incisivum* of Kaup (= *R. incisivus*, Cuvier). The latter, however, is defined by the large incisors and by the persistence of

* βραχὺς = short, οὐδὲν = tooth.

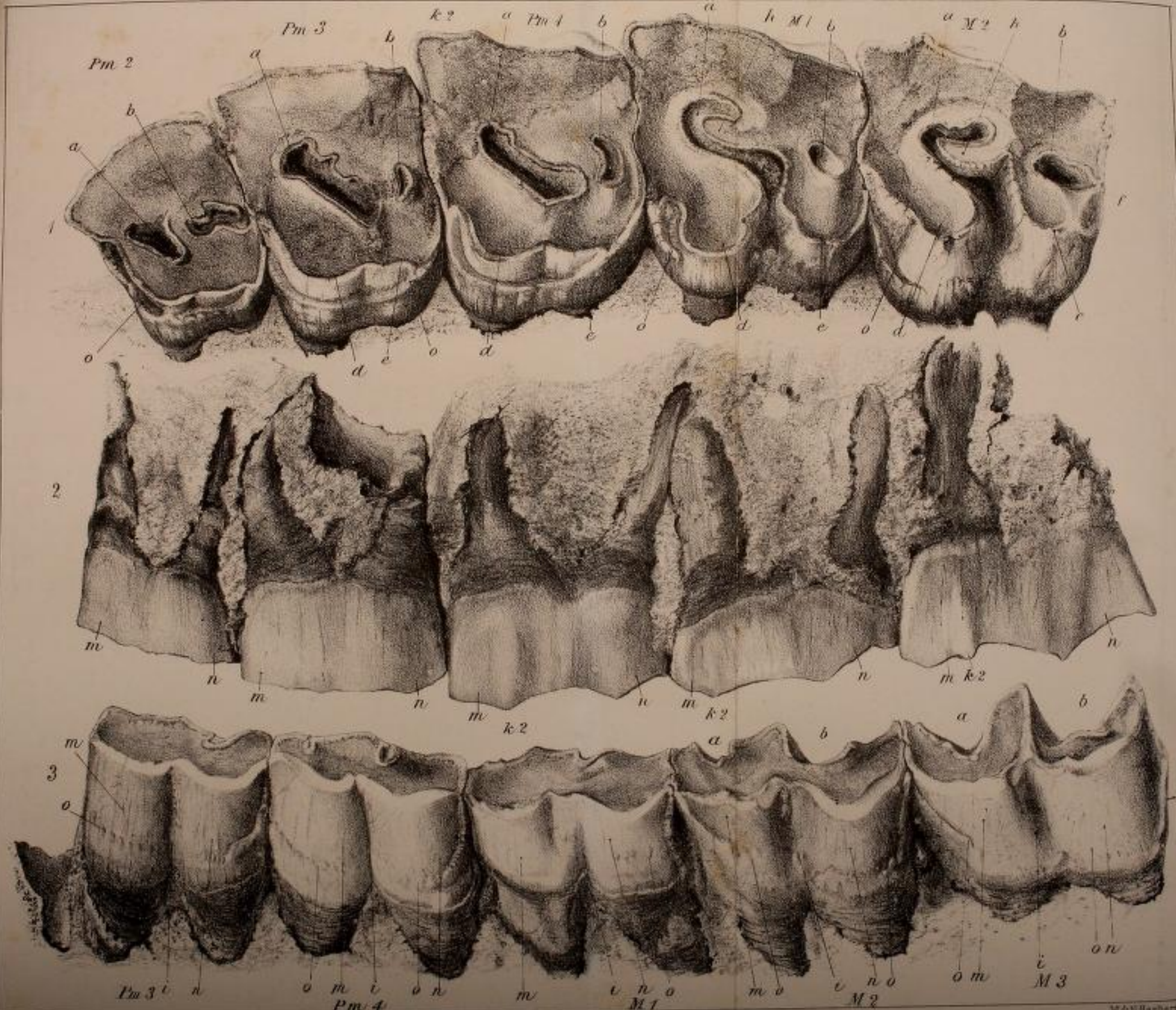
† Paléontologie, p. 59.

premolar 1. The guard round the inner bases of the premolars is somewhat stouter, but at the base of the posterior area is less developed. The posterior combing-plate in the last upper true molar does *not* insulate the head of the valley. In the lower molar series there is not the slightest trace of a guard. With these exceptions the teeth of the two species resemble one another so closely that it would be impossible to determine the separate molars of the one from those of the other. These points of difference are also found in *R. Schleiermachi*, from the same locality; but in addition the teeth of the latter animal are rather higher, and the *third costa* is more strongly marked on the posterior area of the premolar series.

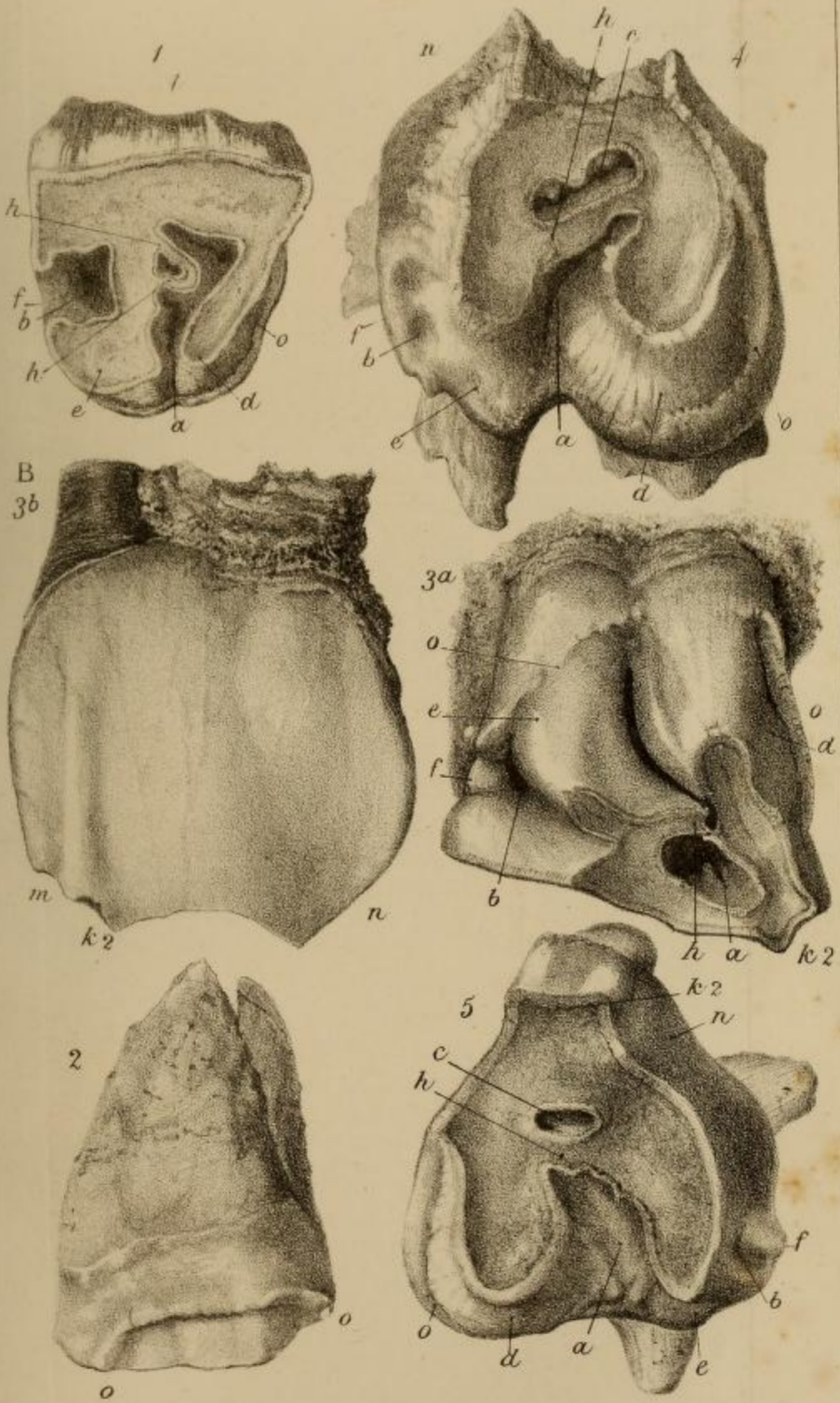
The second upper true molar of the Etruscan species bears a remarkable resemblance to the last upper milk-molar of the Megarhine; so close, indeed, is this that for a long time I classified an isolated tooth in the British Museum with those of the latter species, the only difference observable between them being the slightly thicker enamel, and the slightly more massive form of the Etruscan tooth. The same mistake, however, could not happen in the case of the milk-teeth of any other recent or fossil species; for the differences are so strongly marked that they need no mention in this place. Thus the permanent molar series of *R. Etruscus* is closely related to several of the Miocene species, and especially to that of *A. erotherium incisivum* and *R. Schleiermachi*, the only exception being that one of the teeth is represented in the milk-dentition of *Rhinoceros megarhinus*; we are therefore compelled to admit the Miocene character of *R. Etruscus*. Of the three other Pleistocene species, *Rhinoceros tichorhinus*, the most modern of them, stands in close relationship with the *R. simus* of India, while *R. megarhinus* and *R. leptorhinus* of Owen are closely related to the bicorn *Rhinoceros* of Sumatra. The Etruscan species, on the other hand, stands aloof from all these, and is to be viewed as the last representative of a Miocene type that lingered on into the first stage of the Pleistocene period, its peculiar adult dentition being found in none other of the Pleistocene species; and with it the hypsodont form of tooth universal in the Miocene of Europe became obsolete.

7. *Range in Space and Time.*—I have now, in conclusion, briefly to review the range of the species in space and time. It has not yet been proved to have existed in Germany*, nor has it been found elsewhere in any deposit of clearly Postglacial age. It wandered over the Italian portion of the Pliocene continent along with *Elephas meridionalis*, *E. antiquus*, *Hippopotamus major*, and *Rhinoceros megarhinus*. Thence it passed northwards, together with the great bulk of the Italian Pliocene fauna, into France, and westward into Spain, and advanced as far north as the low-lying country that now forms the bed of the German ocean, where it occurs in the Pre-glacial forest of the Norfolk and Suffolk shore. Its abundance

* The animal from Faxland, near Karlsruhe, described and figured by Hermann von Meyer under the name of *R. Merki*, is considered by M. Lartet to belong to the Etruscan species. If this determination be true, the range of the animal must be extended to the valley of the Rhine.



LEFT MOLAR SERIES OF RHINOCEROS ETRUSCUS.



De Wilde lith.

M & W Harbart impo

UPPER PREMOLARS AND MOLARS OF RHINOCEROS ETRUSCUS.

in Italy proves that its headquarters were in that country. Nowhere is it associated with any of the animals fitted for living in a severe climate. As the temperature of Preglacial France and Britain became lowered at the approach of the Glacial epoch, it retreated southwards, and most probably made its last stand in Spain and Italy. There is not the slightest trace of its ever having coexisted with *Rhinoceros tichorhinus*, which was its representative in the Postglacial European fauna that, favoured by the cold, passed southward over the Alps, at least as far as Rome. There has always been considerable doubt as to the exact correlation of the Italian Pliocenes with the Postglacial deposits of France and Britain, because of the great probability that while animals capable of living in a northern climate dwelt in those countries, a southern fauna inhabited Italy. This point has lately been settled by the discoveries of M. Caselli*, who has proved that the Cave-Hyæna and Cave-Bear, the Mammoth, and Glutton passed southwards and established themselves, to say the least, in the midst of the Italian Pliocene fauna. We have therefore the means of knowing that the great ossiferous deposits of the Val d'Arno are of Preglacial age, because they contain animals exclusively of a southern type. Even in Italy we have no proof that the Etruscan Rhinoceros was living at the time of the irruption of the Postglacial mammals.

In the following table I have represented the range in time of the four fossil Rhinoceroses found in British Pleistocene deposits, that their value in classification may be seen at a glance.

	<i>Rhinoceros tichorhinus.</i>	<i>Rhinoceros megarhinus.</i>	<i>Rhinoceros leptorhinus,</i> <i>Owen.</i>	<i>Rhinoceros Etruscus.</i>
Postglacial	*	...	*	...
Glacial
Brickearths of Thames Valley.....	*	*	*	...
Preglacial	*	...	*
Pliocene	*	*	*

EXPLANATION OF PLATES VII. & VIII.

(All the Figures are of the natural size).

PLATE VII.

- Fig. 1. Crowns of left upper Molar series, except m. 3. Pakefield. Nat. size.
 2. External laminæ of the same specimen, natural size.
 3. External laminæ of left lower Molar series, except pm. 2. Pakefield.

PLATE VIII.

- Fig. 1. Right upper Premolar 2. Etampes. M. Lartêt.
 2. Inner view of left upper Premolar 3. Pérolles. Brit. Mus.
 3 a. Inner view of left upper true Molar 1. Val d'Arno. Brit. Mus.
 3 b. External lamina of the same. *Ibidem.*
 4. Crown of right upper Molar 3. Pakefield.
 5. Crown of left upper Molar 3. Pérolles. Brit. Mus.

* Correspondance de Rome, May 5, 1867.

POSTSCRIPT.—The ‘Palæontological Memoirs’ of Dr. Falconer, published a few days after the reading of this Essay before the Society (Jan. 8, 1868), contain notes on *Rhinoceros Etruscus*, and many beautiful plates of jaws and teeth for the most part from Italy (vol. ii. p. 354–368, pls. 25–29). With the sole exception of the terminology being different, Dr. Falconer’s definition of the species is identical with my own. In the same work also there are Essays on the three other species of *Rhinoceros* found in Great Britain, which (if the name *R. antiquitatis*, Blum., be substituted for *R. tichorhinus*, Cuvier, *R. hemitechus*, Falc., for *R. leptorhinus*, Owen, and *R. leptorhinus*, Cuvier, for *R. megarhinus*, De Christol) differ but very slightly from those which form the series of which the memoir on *R. Etruscus* is the conclusion. The difference is merely one of names; and the conclusions arrived at independently of each other are identical.—W. B. D., Feb. 29, 1868.

JANUARY 22, 1868.

James Trubshaw Johnson, Esq., Mining and Civil Engineer, Lichfield, Staffordshire, and Stephen Brown Dixon, Jun., Esq., Pewsey, Wilts, were elected Fellows.

The following communications were read:—

1. *On the SPEETON CLAY.* By JOHN W. JUDD, Esq., F.G.S., of the Geological Survey of England and Wales.

CONTENTS.

- I. Introduction.
 - II. Bibliography of the subject.
 - III. General description of the Coast-section at Speeton.
 - IV. Is the Speeton Clay the equivalent of the Gault?
 - V. Classification of the beds constituting the Speeton Clay.
 - A. Upper Neocomian.
 - B. Middle Neocomian.
 - C. Lower Neocomian.
 - D. Portlandian.
 - E. Upper Kimmeridge.
 - F. Middle Kimmeridge.
 - G. Lower Kimmeridge.
 - VI. Conclusion.
- Appendix A. Table showing the vertical distribution of the fossils of the Speeton Clay.
- „ B. Notes on the distribution of some of the Speeton-Clay fossils.
- „ C. On the economic products of the Speeton Clay.

I. INTRODUCTION.

IN the attempt to study the Neocomian formation as developed in this country, my attention has been directed for some years past to the series of beds in Yorkshire which since 1829 has been known as “the Speeton Clay.” I have found that, although a very great variety of opinions had been expressed concerning the age of this formation, but little had been done towards working out in detail the true