Catalogue of the Pleistocene vertebrata, from the neighbourhood of Ilford, Essex, in the collection of Sir Antonio Brady ... / by William Davies ; with an introduction by Sir Antonio Brady ; and a description of the locality, etc., by Henry Woodward and William Davies.

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CATALOGUE

OF THE

PLEISTOCENE VERTEBRATA.


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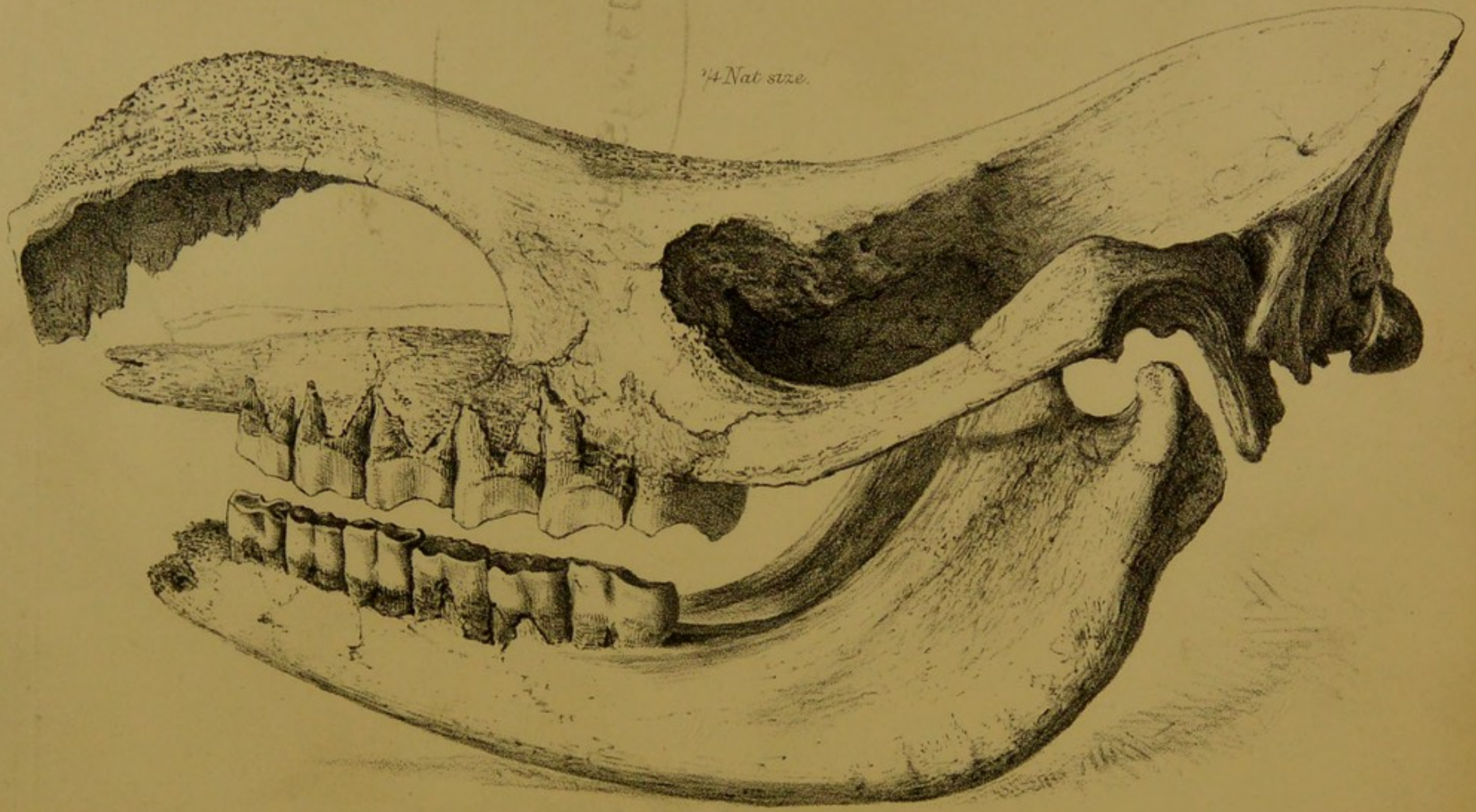


G. R. De Wilde del. et lith.

Rhinoceros leptorhinus, Owen, Pleistocene, Ilford, Essex.

W. West & Co. imp.

CATALOGUE

OF THE

PLEISTOCENE VERTEBRATA,

FROM THE NEIGHBOURHOOD OF ILFORD, ESSEX,

IN THE

COLLECTION

OF

SIR ANTONIO BRADY, Kt., J.P., F.G.S., etc.

OF MARYLAND POINT, STRATFORD, ESSEX.

BY

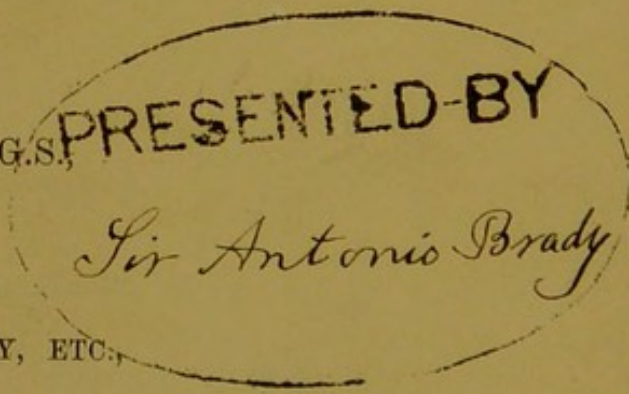
WILLIAM DAVIES,

OF THE BRITISH MUSEUM,

WITH AN INTRODUCTION

BY

SIR ANTONIO BRADY, F.G.S.,



AND

A DESCRIPTION OF THE LOCALITY, ETC.,

BY

HENRY WOODWARD, F.R.S., etc., and WILLIAM DAVIES,

OF THE BRITISH MUSEUM.

LONDON:

PRINTED FOR PRIVATE CIRCULATION ONLY.

1874.

HERTFORD :
PRINTED BY STEPHEN AUSTIN AND SONS.

TO

PROFESSOR RICHARD OWEN, C.B.,

M.D., D.C.L., LL.D., F.R.S., F.L.S., F.G.S., ETC., ETC., ETC.,
SUPERINTENDENT OF THE DEPARTMENTS OF NATURAL HISTORY IN THE BRITSH MUSEUM,

THIS

CATALOGUE

OF MY

COLLECTION OF PLEISTOCENE VERTEBRATA,

FROM THE VALLEY OF THE THAMES,—

MOST CAREFULLY AND LABORIOUSLY PREPARED FOR ME IN HIS LEISURE HOURS, BY

WILLIAM DAVIES,
OF THE GEOLOGICAL DEPARTMENT IN THE BRITISH MUSEUM,—

IS DEDICATED AS A TOKEN OF ESTEEM AND REGARD BY

ANTONIO BRADY.

Maryland Point, Stratford, Essex.

INTRODUCTION.

By Sir ANTONIO BRADY, Kt., J.P., F.G.S.

In submitting to the scientific world the following catalogue of a collection the acquisition of which, during a period of 30 years, has afforded much pleasure, and brought me into friendly relations with so many eminent geologists, a few words of explanation as to its origin and progress may perhaps not be out of place.

About 40 years ago, when the geology of this neighbourhood was not so well understood, and when even the science itself was in its infancy, the whole scientific, and I may say religious world was startled by the discovery of the huge bones of some unknown antediluvian animal of gigantic stature, in digging clay for the manufacture of bricks for the Great Eastern Railway, which was then in course of construction. By the care of the late Mr. Gibson, of Stratford, and the kindness of my late friend Mr. Thomas Curtis, the then owner of the field in which they were found, the late Dean Buckland and other distinguished members of the Geological Society were invited down to Ilford to view the bones *in sitû*, and much interest was excited by the discovery that they were the remains of a huge Mammoth (*Elephas primigenius*). They were exhumed with much care, and some few of them are now deposited in the Royal College of Surgeons.[1] It is not known what became of the rest.

From that time for about 10 or 15 years—I do not recollect the exact dates—the matter slept, and if any bones were discovered, they were in such a soft and friable state that they were not noticed, or, at any rate, were not preserved.

[1] See Appendix I.: Letter from Prof. Flower, F.R.S., p. 63.

About this time it so happened that a son of the late Dr. Buckland, who exhumed and described the bones first found, was dining at my house; and while we were at dinner a note was brought to me from my dear friend Mrs. Curtis, the widow of the former owner of the field, to the effect that the workmen in digging for Brick-earth had again come upon some more large bones, and knowing my geological proclivities, placed them at my disposal, and invited me and my friends to look after them. Thus I had an opportunity of disinterring the first bone which formed the nucleus of my now extensive collection.

It proved to be the femur of a large elephant, luckily in a very fair state of preservation, the smooth and polished surface of the bone being tolerably perfect, which is ascribable to the circumstance that it was imbedded in a matrix of clay which had resisted the percolation of water, and prevented the gelatine or animal matter in the bone from having been entirely dissolved and washed out, as is unfortunately the case with the majority of the bones which found their resting-place in the sands and gravels underlying the Brick-earths and resting on the London-clay. These sandy gravels are the beds which contain most of the animal remains of this district, and the water percolating through them washes out every trace of soluble animal matter, and although the bones retain their exact form, they are, so to speak, the mere honey-combed skeletons of the bones, of which the mineral parts alone remain. These remains, the principal part of which is phosphate of lime, when wet, are in most instances so soft as not to bear the slightest touch, and when dry are so friable as to be equally unmanageable. To exhume bones so situated manifestly requires great skill and care.

Fortunately the first bone brought to my notice had enough gelatine remaining in it to allow it when dry to harden sufficiently to bear handling, or in my then unskilful hands it could not have been preserved; indeed, many otherwise beautiful specimens crumbled to decay and were destroyed from this cause. However, practice makes perfect. But here I must pay a tribute of respect to the genius and ability of my first instructor in the

art—I mean Mr. William Davies, of the British Museum, to whose skill I am indebted for the preservation of many, nay most, of the larger specimens, and by whom they were named and classified; nor must I omit to mention the labours of my son, the Rev. Nicholas Brady, M.A., now the Rector of Wennington in this county, not far from Ilford. He was a pupil at Trinity College, Cambridge, of the illustrious, and ever to be lamented Professor Sedgwick, one of the fathers of English Geology, and one of the most eminent of its votaries, who, in conjunction with Owen, Smith, Buckland, Peacock, Conybeare, Phillips, and others, have done so much to raise Geology to the dignity of a science. England, I am proud to feel, is the original home—nay birth-place—of this noble science, noble alike to the physicist and the divine. For what more noble theme than to trace the history of the world which we inhabit, written by the finger of God in the rocks, teaching us—

To look through Nature up to Nature's God?

Notwithstanding the patient and laborious efforts of our ablest Naturalists, who, during the past century, and especially in the last fifty years, have devoted their whole lives to the study, we can, after all, form only a faint conception of the vast assemblage of living beings now peopling our earth; whilst of those which covered its surface "in the Old Time before them" we can never hope to know much more than the fiftieth part.

M. Alphonse de Candolle has estimated the whole existing terrestrial flora at from 400,000 to 500,000 species, not more than a quarter of which have however been catalogued by Botanists.

The number of animals is probably not less than that of plants. Provisionally they have been estimated at 260,000 or 280,000; but in reality it is unknown, excepting for the higher groups, and it is precisely these groups which are less rich in species.

Thus the Mammalia at present existing scarcely amount to 1400 species, of which Europe claims only 121, and of these the small-sized animals form by far the greater part.

In the same way, of the 8,000 varieties of Birds known to

Naturalists, more than 5,000 are of a size not exceeding a sparrow.

Of Insects alone, more than 150,000 species are known and described; whilst the Mollusca attain to 20,000.

Yet below the world of Insects, Crustaceans, Molluscs, Worms, and Echinoderms, moves an immense swarm of Animalculæ which are at once the admiration and the despair of those who seek to investigate them by the aid of the microscope.[1]

I do not find any very recent summary of Fossil organic remains, but from Professor Morris's celebrated "Catalogue," published in 1854, I have obtained the subjoined statement of "British Fossils;" whilst Dr. H. G. Bronn's *Index Palæontologicus*, published in 1849, furnishes the second column:

Prof. Morris's Catalogue of British Fossils, 1854.			Dr. H. G. Bronn's Index Palæontologicus, 1849. (Cosmopolitan)	
		VERTEBRATA.		
97	.....	Mammalia	708	
12	.....	Aves	148	
184	.....	Reptilia	384	
755	.....	Pisces	1,461	
	1,048	Total Vertebrata ...		2,701
		INVERTEBRATA.		
74	.....	Insecta, etc.	1,699	
367	....	Crustacea	894	
137	.....	Annelida	292	
5,057	.....	Mollusca	13,885	
264	.. ..	Polyzoa	810	
494	.....	Echinodermata	1,232	
474	.....	Zoophyta	825	
395	.....	Protozoa	2,028	
	7,262	Total Invertebrata..		21,665
	729	PLANTÆ.	.....	2,055
	9,039	Grand Total	.....	26,421
If to the above we add for the newly described species during the past 20 years, we shall have British Fossils	6,000[2]		Probably not less than fossils have been described in Europe and America, etc., since 1849, making as the Total for all the world	12,500
	15,039			38,921

The extent of the subject may well explain the reason why there are so few men capable of becoming able geologists; for

[1] Reclus' La Terre: English Edition, 1873. Edited by Henry Woodward, F.R.S. Section II. of the Second Series, "The Ocean, Atmosphere, and Life," pp. 96 and 139.

[2] The admirable summary given by the Rev. Thos. Wiltshire, M.A., Sec.G.S., the Hon. Sec. to the Palæontographical Society, in this year's volume, shows that during the 28 years of its operations upwards of 4,000 British species have been described and figured in this Society's monographs alone.

geology in its grander results must call to its aid the whole circle of the sciences.

Let none, therefore, presume to generalize too hastily upon the fragmentary data of Geology, a science, even now, but in its infancy; but, rather, I would exhort them to

Learn to labour and to wait,

—feeling assured that the works of God cannot contradict His Word.

But to return. When notice of a find is brought to me from Ilford, the first thing that has to be done is to reward the finder, and, having satisfied the workmen, which is sometimes difficult, for if it be a large tusk or scapula of an elephant, for instance, much time is required to prepare it for being taken up, and in this case the stoppage in the work of a whole gang of labourers has to be paid for.

If the bone or tusk is in a very moist and friable state (as is generally the case), it has to be under-drained and partially dried, to give it consistence. The next step is carefully to clear and preserve the natural surface intact, and, in some cases, to pour liquid glue or gelatine over it, so as partially to harden it. This done, the earth or clay is cleared away, exposing the fossil for about half, or rather more than half of its circumference, if it will bear it. Paper, dipped in water, is then carefully fitted all over the exposed surface, and over this liquid plaster of Paris is poured. The use of the paper is to prevent the plaster from sticking to, and injuring the surface of the bone. The plaster soon hardens, when a second and even a third coat is put on. If the specimen is a large tusk with much curvature, rods of nail-bar iron must be obtained and bent carefully, to the curve or shape of the fossil, to preserve the form. Usually, I had one fitted to the top, and one to each side of the tusk. More plaster is then poured on, so as to imbed the iron rods (which should be half an inch square) in a thick coat of this material. The next step is the most difficult, and requires the most care. It is to secure the part underneath, so as to take up the treasure in a solid mould, or in splints (like a

broken limb). This is done in the following ingenious manner: Commencing at one end, the earth is carefully taken out, leaving about three or four inches of soil under the tusk. To prevent the soil dropping down and tearing away the bone, only a small portion is excavated at a time; the under surface is then tied up carefully by list or haybands passed round and round the specimen, to prevent it falling in; it is then wedged up. The same operation is repeated at intervals of every three or four inches, till the whole length of the fossil is secured. At length the whole fossil is separated from the soil, and rests on the supports left under it, and being now quite detached from its matrix has next to be carefully turned over on to a framework of wood, prepared for the purpose. To make all secure, plaster is again poured on to keep the soil and bands from slipping, and the fossil is now in a solid and compact mould, ready for removal. A large tusk with its coating of plaster and attached soil will weigh several hundredweight; and to remove this from a deep pit, without proper machinery is often no easy task: but when accomplished, and the fossil in its coating is borne safely home, the real work of its preservation may be said to begin. After being allowed to dry, which under such a thick coating is a work of time, the covering of plaster and soil, which is now the top of the whole mass, and was formerly the bottom, has to be carefully removed by saw and chisel; an operation requiring great care not to disturb the bone within. The paper covering, first put on the top surface, prevents the plaster from adhering to the bone, but the matrix taken up with it adhering to the underside is readily removed, and the surface of the fossil is then allowed further time to dry. In doing so it cracks all over, like clay soils in hot weather, thus giving access to the interior of the bone, or tusk. It is obvious that bone will only take up fluid through the capillaries, and to enable them to do this they have to be freed from water by dessication. When this is accomplished, thin boiling glue, or size, is poured in. It is much filtered in doing so, but enough glue enters to harden it sufficiently to bear handling, when it is once more dried. It again separates into sections more

or less large, according to the extent to which the glue, or size, has penetrated. These are carefully marked and boiled separately in stronger glue, and are then connected together like a puzzle. This, if well done, leaves the joints scarcely visible. During all this time, the other side of the fossil lies undisturbed; when that has also been treated in a similar manner, and an iron rod cemented in the centre of a tusk, it is almost as hard and durable as it was when in the living state, and, of necessity, the form is accurately preserved. In short, the animal matter which gave strength to the bone in the lifetime of the beast to which it belonged has been restored to the mineral skeleton in the shape of strong gelatine. I generally use carpenter's glue for this purpose, as the strongest and cheapest form of gelatine procurable. For cementing large pieces of bone together I use glue with a small portion of fresh-burnt plaster of Paris mixed with it, but for smaller bones, shellac dissolved in naphtha answers best. Of course bones mended with glue require to be kept in a dry place. Small bones and delicate specimens, or teeth, may be admirably preserved by being infiltrated with paraffin, which melts at a tolerably high temperature, and, being very fluid, readily permeates every cell of a bone, or tooth, but it is apt in hot weather to leave a greasy surface; and on the whole I prefer glue.

From the preceding, it will be at once seen that Bone-collecting and preserving is an expensive undertaking, occupying much time, skill and labour, and is only to be defended from a scientific point of view. At one time I distributed the bones I acquired without stint; but Professor Owen, when he visited my then collection some years ago, and heard me say I had enough duplicates, and that I gave many away because I did not care to collect more specimens of the same variety, observed that there was no such thing as a duplicate, and that it was only from large collections that different varieties of species, age, and sex could be studied. Since that time I have preserved every specimen I could procure, and to the Professor's remark on that occasion may be traced the extent of my subsequent additions to the collection, which, having as-

sumed such importance, has been deemed worthy of a place in the National Collection, to which it has been recently removed. I was induced to part with my collection in order that it might be made more available for examination and study, and under the condition that the collection so acquired should for ever bear my name. As representing a most complete series of the remains of the old mammalian fauna of the Thames Valley, I venture to predict that this collection will long remain unrivalled.

I had always intended to present it to the East London Museum, in the establishment of which I took so much interest, my idea being that it was well to preserve local collections in local museums; but as I found the Government did not care to accept it, or even to exhibit it at Bethnal Green on loan, I was afterwards induced to offer it to the British Museum, hearing that the authorities there set great store by the collection, and would be glad to secure it. I feel it only right to give this explanation why I was induced to depart from my original intention of presenting the collection to the East London Museum, of which I feel so proud, and which is doing so much in elevating the tastes and habits of the working men, my neighbours, at the East End.

This introduction has already far exceeded the limits I proposed to myself when I commenced it; but before I conclude, I must say a few words on a most interesting point, and one on which I have often been asked for explanation when exhibiting specimens at Soirées, or lecturing to my friends the working men in Epping Forest, on its ancient inhabitants. The question often put to me was:—"How do you account for these bones being buried where they are found in such prodigious numbers and variety?" There are two explanations, I think, of this circumstance, either of which will account wholly or in part for the otherwise unexplained phenomenon.

Upon one hypothesis the animals to which the bones belonged could not all have lived and died in the spot where they are buried, yet the bones were found some of them with evidence that they were deposited in their grave at Ilford before the

cartilaginous membranes uniting them were destroyed. For instance, I have found as many as nine vertebræ in juxtaposition belonging to a Mammoth. None of the bones are in any way water-worn, yet they have been carried by water, and deposited in their resting place in Ilford marshes by the agency of water, as also have been the deposits of sand, gravel and silt in which they are found.

The explanation I apprehend to be this. The Thames at the period was not confined within its present narrow limits. The embankments which now confine it to its present channel did not then exist, although they were certainly formed in Prehistoric times. There is reason to believe that at the period in question Ilford was about the centre of a lake-like expansion of the river which at times may have extended to the Kentish hills on one side, and the Hertfordshire hills on the other, forming the present limits of the Thames Valley. I imagine that the current did not take a direct course through the centre of the lake. The main stream probably entered the lake-like extension at one corner, and left it at another, so that the waters of the lake would have imparted to it a somewhat rotary motion, and floating bodies would be drifted towards the centre. It is generally believed that England at this period of the world's existence formed part of Europe, and extended far into what is now the Atlantic Ocean, and that the German Ocean was only a vast estuary-valley. The Thames of that day may, therefore, have been a mighty river, and doubtless drained a much larger area than its present representative; or, as many think, it may have even been a tributary of a still larger river, like the German Rhine.

Be that as it may, my theory is this:—The animals whose remains are found at Ilford inhabited the whole of the valley drained by that river. In a state of nature probably the last thing an animal does before it dies, unless by a violent death, is to go to the river to drink, we will suppose in a weak state, and gets mired. The stream rises, and the animal is drowned. Decomposition sets in, gases are disengaged, and the carcass swells, floats, and is carried down stream so long as there is current

enough to carry it forward. We will suppose it enters the lake-like extension of the river where it floats till decomposition has proceeded so far that the heaviest bones rot off first and sink, while the lighter are carried further, or, being less durable, are decomposed and all trace of them lost. It is well known that in the case of sands and gravels, they are so assorted and arranged according to their specific gravity. Any one who has been on the mountains in Switzerland or elsewhere in stormy weather may have witnessed how large boulders are dashed down mountain ravines by torrents when swollen by heavy rain. While the declivity is steep and the current strong, large boulders are carried down like chaff before the wind, the heaviest are deposited first, and the rest in proportion to their weight and the lessening force of the stream as it nears a lake. The mud and earth in suspension in the water only get deposited when the force of the stream is lost in the greater body of the lake, and only sinks when the water holding it in suspension is at rest or nearly so.

This is the case with the brick-earths or sands beneath the Ilford marshes, thus indicating the centre of my assumed lake as comparatively still water. As with the sands and gravels, so with the bones ; they are more or less an index of the circumstances under which they are deposited.

Another and a very favourite theory is that when the bones we are considering were deposited, Ilford was emerging from beneath a lake, and was a marshy swamp, at times more or less inundated. Then, as now, wild herbivorous animals herded together for mutual support from their predatory enemies, for then, as now, one animal served as the food of others. The horned cattle, whether Bison, or Ox (*Bos primigenius*, or *giganteus*), with the Hairy Elephant (*E. primigenius*) and various Cervidæ were the prey of the carnivora of that period, which also inhabited the valley of this great river. It was then, in Middlesex and Essex, as it is now in North America and Africa, vast herds of wild cattle were waited upon by lions, wolves, and other carnivora, and if any lagged behind or fell, they were instantly seized and devoured ; or, perhaps, the herd

took to the swampy places to avoid their enemies, or got into deeper water when pursued and so perished. Thus in avoiding Scylla, they fell into Charybdis, and were suffocated in the very swamp in which they vainly sought for shelter. At Ilford, in the space of a few square yards, I have found the fragmentary remains of perhaps as many as five or six oxen skulls and bones, mixed pell-mell with the remains of other animals, which evidently perished in the same misadventure, doubtless in their endeavour to preserve life, an instinct of all animals, and which, when it arises from a common disaster, such as a general inundation, causes the timid herbivore and the savage carnivore alike to cast aside their reserve, and seek a common shelter, often alas! to find a common grave.

Both these theories will in part explain how such an enormous quantity of bones came into one and the same burial-ground. Ilford seems destined for a Cemetery; for as from natural causes so many animals found their graves there, thousands—nay, tens of thousands of years perhaps ago, Londoners are now making it the common Cemetery of this vast metropolis, to the great annoyance of the present inhabitants.

In order that my friends may have as complete a list as practicable of all the fossils found at Ilford, I have printed as an Appendix a summary of the fine collection made by Dr. Cotton, of Cavendish Square, who has kindly placed it at my disposal for this purpose; also a letter from Professor Flower, Curator of the Royal College of Surgeons, giving a brief description of the Ilford Mammalian remains which are to be found in that magnificent establishment; together with a list of the Fossils from the same locality possessed by the British Museum before the acquisition of my own collection; and lastly, some notes contributed by my friends Mr. Woodward and Mr. W. Davies. I am well aware that there are many other specimens in private collections scattered about the country, but of these I have been unable to obtain details for publication.

Maryland Point, Stratford, Essex.

DESCRIPTION OF THE LOCALITY AT ILFORD, ESSEX.

WITH

NOTES ON THE FOSSIL MAMMALIAN REMAINS.

By Henry Woodward, F.R.S. and William Davies,
Of the British Museum.

The Valley of the Thames, with its numerous tributaries, like nearly all our English river-courses, contains more or less extensive deposits of Brick-earth and gravel, which were accumulated at a period long antecedent to that when the streams had cut their higher channels down to the depth at which they at present flow.

In some places, as pointed out by Mr. Prestwich,[1] fragments of these ancient fluviatile deposits have been preserved as older river-valley terraces; in other spots, as in the neighbourhood of Ilford, they still form wide sheets, covering a considerable low-lying tract, which probably has been elevated and depressed more than once since its original deposition.

The bottoms of the valleys are for the most part occupied by more modern prehistoric deposits seldom raised much above the level of the stream. (See Geol. Mag. 1869, Vol. VI. p. 385.)

But even where their actual relative elevation is an uncertain guide, there is always a marked difference between the older and newer deposits as regards the materials of which they are composed.

The prehistoric as well as the present alluvia are mostly composed of clays, more or less stiff, and the gravels of pebbles more or less evenly sorted, both having been formed under conditions of climate not very different from those at present existing.

The Pleistocene Brick-earths, on the other hand, very seldom consist of stiff clays, and the gravels contain large and small pebbles and angular blocks confusedly mixed together, clearly indicating that the transporting power of the rivers at that period was greater

[1] Phil. Trans., vol. cliv.

in certain seasons than at the present day, and that freshets were probably of more frequent occurrence.

But perhaps the most striking difference which they present is offered by the remains of the fauna associated with each: for whereas the prehistoric and modern deposits of our river-valleys are characterized by stone-implements and other relics of human industry, associated with remains of animals at present indigenous to our island, or which are known to owe their extermination to man's agency, the Pleistocene Brick-earths and gravels of the Thames reveal no trace of man's presence,[1] but present us with a fauna almost wholly dissimilar from that now living in Europe, and most if not all of the species of which are extinct.

The brick-pits of the neighbourhood of Ilford have long been celebrated for the wonderful variety of extinct Mammalian remains which they yield. So long ago as May, 1824, Mr. Gibson, of Stratford, obtained from the brick-field on the London turnpike-road a large portion of the skeleton of an elephant, Mr. Clift and Prof. Buckland being present at the exhumation of the bones. Prof. Morris refers to Mr. Gibson's Collection in an article on "Deposits in the Valley of the Thames containing Mammalian Remains" (see Magazine of Nat. Hist., 1838, vol. ii. new series, p. 540). He mentions the "remains of the horse, elephant (a tusk 12ft. 6in. long), rhinoceros, deer, and two species of oxen; the bones are found in every stage of growth, rarely broken or rolled, and (land and freshwater) shells occur in abundance." Prof. Morris cites as from Ilford, *Cyrena fluminalis, Pisidium amnicum, Unio pictorum, Succinea oblonga, Helix hortensis, H. hispida, Limnæa auricularia, L. peregra, Planorbis corneus, Paludina impura* (*op. cit.* p. 544). We have only just discovered that some of the specimens once forming Mr. Gibson's collection are now preserved in the Royal College of Surgeons.[2]

The pit to which Sir Antonio Brady's attention has been mainly directed, and from which nearly all his magnificent series of Mammalian remains have been obtained (and which now form part of the National Collection in the British Museum), is known as the Uphall Brick-field, and is situated on the right-hand side of the lane

[1] Save that the Rev. O. Fisher found an undoubted implement in the gravel at the base of the Crayford Brick-earth; see Geol. Mag. 1872, Vol. IX. p. 268; see also Mr. Boyd Dawkins, in Quart. Journ. Geol. Soc. Lond., vol. xxviii. p. 414. This is the only instance of an implement being found in these older Fluviatile deposits, associated with *Elephas antiquus*, in this country.

[2] See Prof. Flower's letter in Appendix, p. 63.

leading to Barking. The ground forms a low terrace, bordering the small River Roding on the one side, and on the other it slopes gradually down to the Thames. The height of the surface of the ground at the pit is about 28 feet above the Thames H. W. M. (Prestwich, Geol. Mag. 1864, Vol. I. p. 245).

Probably no independent geological investigator, since the early days of Buckland, Trimmer, Prestwich, and Morris, has paid such careful attention to the structure of the Thames Valley, and of its contained deposits, as Mr. Searles V. Wood, jun., F.G.S. Numerous papers on this subject have been communicated by him to the Quarterly Journal of the Geological Society, and to the Geological Magazine.

Writing thereon in 1866 (Geol. Mag. Vol. III. p. 59), Mr. Wood observes: "The Brick-earth of Ilford, both that of Uphall and that of the London-road Field, is a deposit *underlying* the Thames gravel and unconformable to it." He also speaks of it as *anterior* in date to the similar deposit of Grays, which likewise contained *Cyrena fluminalis*, and other purely freshwater shells.

In a letter to one of the authors (dated March 1st, 1874), Mr. Wood writes:—"When I wrote the paper in Vol. III. of the Geol. Mag. (1866), I was under the impression that though the Grays Brick-earth was clearly newer than the main sheet of the Thames gravel (it forming distinctly a terrace beneath it), the *Cyrena* Brick-earth of Ilford, and of Crayford and Erith was anterior to, and passed underneath it. Some year or two afterwards, however, I satisfied myself that this was an error as concerned Crayford and Erith, and I wrote a letter to the Geological Magazine (Oct. 10, 1868, Vol. V. p. 534), directly to acknowledge this.

"The Ilford bed lying flush with the gravel sheet of that part of Essex does not present the means of determination by section, but I cannot doubt, however, that it is identical in age with the *Cyrena* beds of Grays, Erith, and Crayford.

"Such being the case, so much of the section No. 3, given at p. 61 of the Geological Magazine, 1866, Vol. III., as shows this Brick-earth (*x* 4′) as underlying the gravel (*x* 4″), is incorrect. . . . .

"The subject, however, is obscure, and while the Brick-earth at Ilford, Grays, and Erith lies low, and forms a lower terrace to the main sheet of the Thames gravel, it rises at Crayford to a greater elevation, nearly 80 or 90 feet in parts, and forms a high terrace

above the gravel of the Cray and Darent Valleys, but below the main gravel sheet which forms Dartford Heath (see bed *b* of Section 3, p. xxiv).

"This anomaly and seeming contradiction is due in my view to the reversal of the drainage during the progress of the formation of the Thames Valley, and the denudation of the Weald as discussed by me in my paper in the Quart. Journ. Geol. Soc. 1871, vol. xxvii. p. 3."

In order to make the foregoing view more intelligible Mr. Wood has most obligingly prepared a fresh Section (Sect. No. 3), and adds:

"Crayford is nearer to the region of Wealden elevation than the other localities of the *Cyrena* Brick-earth; and this Brick-earth has there been so elevated that the gravel of the Cray and Darent Valleys (*c* of Sect. 3) forms in places a very distinct deposit occupying the valley bottoms, and lying at a level considerably below that of the *Cyrena* Brick-earth. This gravel *c* is, in my view, a deposit formed since the drainage was reversed into its present direction; the *Cyrena* Brick-earth, on the other hand, having been deposited while the drainage from the Thames Valley flowed into the sea which covered the Weald. (See Section 3, p. xxiv.)

"I should, however, point out, as one of the perplexing features of this obscure subject, that if we follow the gravel *c* from the Cray and Darent Valleys to the edge of the Stone marshes, and crossing the Thames pursue it from its re-appearance above the West Thurrock Marshes to the edge of the *Cyrena* Brick-earth at Grays, it seems to inosculate with the gravel which (as shown in the section at page 62 of the Third Volume of the Geological Magazine) partially underlies the Brick-earth at that place. I, however, believe that this inosculation is not real, but that the gravel, *c*, really lies up against the beds of gravel, sand, and Brick-earth which form the *Cyrena* deposit of that place, and which are shown in the present Section (No. 3) under the letter *b*. All the gravel and Brick-earth beds occurring in the valleys of the Thames, and of its tributaries, are now pretty generally admitted by geologists to be posterior to the true Glacial period; and their relation to the extensive deposit of Glacial Clay which covers so much of the Midland and Eastern Counties (bed No. 6) is shown by Section No. 1" (see p. xxii, reprinted from page 43 of the Fifth Volume of the Geological Magazine).

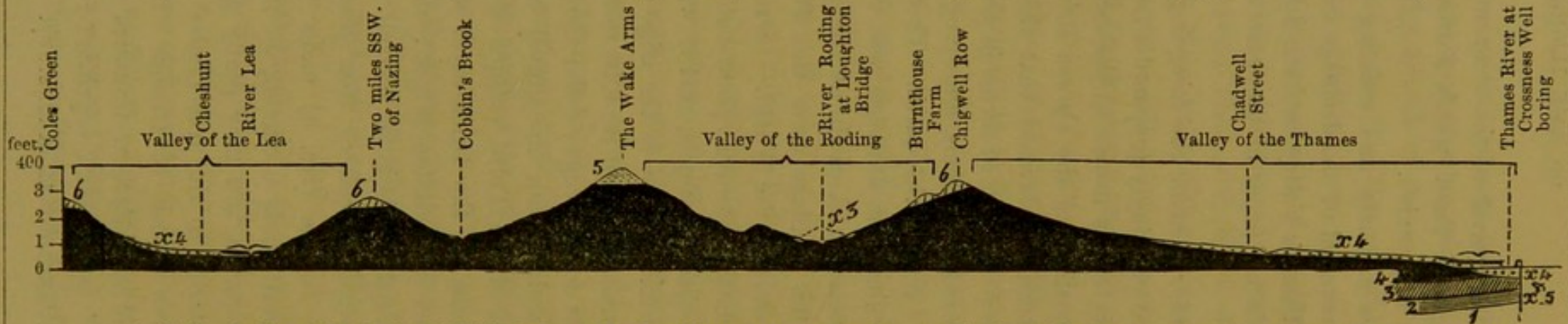
Section 2.—Section exhibited by the Uphall Brick-field, Ilford (Reprinted from Vol. III. of the Geological Magazine).

b. of Sect. 3.

a. Clayey Brick-earth, with *Cyrena fluminalis* and other freshwater mollusca,
b. Bright yellow sand, with *Cyrena fluminalis*, and in which, at the point marked by the asterisk on the left hand, occurred the elephant remains described at p. 242 of Vol. I. of the Geol. Mag. The black pot holes, marked by asterisks on the right of the section, are due to the denudation of *a.* and *b.* prior to their unconformable overspread by *c.*
c. Newer gravel, probably identical with that shown under the same letter in Sect. 3.
d. Humus, etc.

Section 1.—General Section to show the Position of the Thames Valley Beds relatively to the Glacial Beds of the Middlesex and Essex Heights. (Reprinted from Vol. V. of the Geological Magazine.)

(These Sections were drawn by Searles V. Wood, jun., Esq., F.G.S., by whom they have been most obligingly lent for this work.)



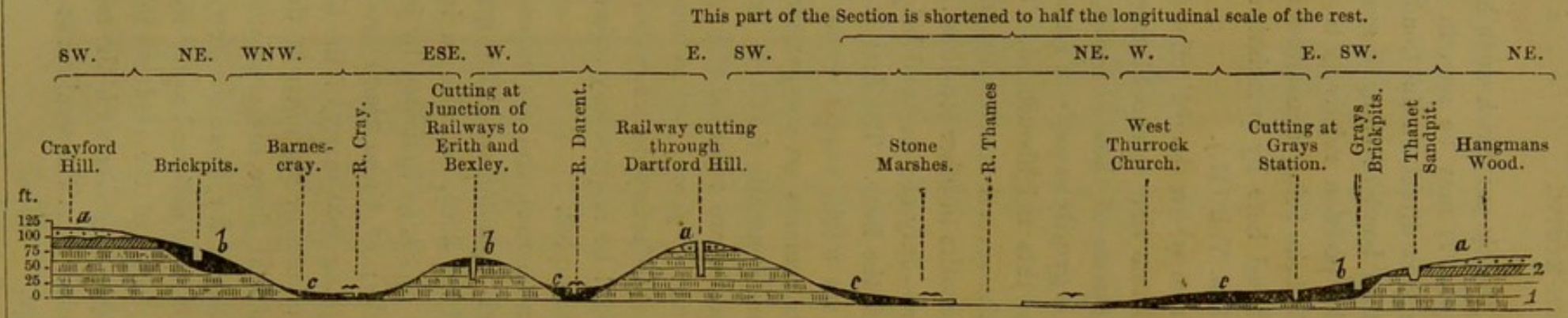
1. Chalk. 2. Thanet Sand. 3. Woolwich Beds. 4. London Clay. 5. Lower Bagshot. 6. The Great Chalky Clay (Glacial). *x*4 and *x*5. The Gravel and Brick-earth of the Thames and Lea Valleys, with which are associated the beds *a.* *b.* and *c.* of Section 2 and *a.* *b.* and *c.* of Section 3. *x*3. Gravels of the Roding Valley. ~~ Alluvium.

To return to the Ilford Brick-fields, the *Cyrena* Brick-earth here attains a thickness of nearly twenty feet. It may be seen in the field on the London-road resting in one part direct on the London-clay, while in another part it has a thin band of shingly gravel beneath it. In the Uphall Brick-field its position relatively to the newest gravel is best shown, the two deposits being unconformable (see Section 2 on opposite page, reproduced here by permission of Mr. S. V. Wood, jun., from the Geol. Mag. Vol. III.).

When we consider the limited area from which the collection has been made, it seems not a little remarkable that it should so well represent the vertebrate fauna characteristic of these deposits, in regard to the number of species; whilst it greatly exceeds in number of specimens any hitherto made from this neighbourhood. The relative proportions of the remains of the several families are, also, such as are generally found in similar deposits in other localities.

Of the Carnivores the remains are few—only eleven—and belong to the Lion, Fox? (one fragment), and the Bear. The first is represented by two examples; but, as we might expect, from the known active habits of the Felidæ, their remains are comparatively rare in all aqueous deposits, being more generally found in caves and rock fissures. Of the Bear two species are recorded as having been found at Ilford, viz. *Ursus arctos* and *U. ferox;* but as neither jaws nor teeth are in the collection, no satisfactory determination as to which of these species each bone should be respectively referred, could well be made, and has not been attempted.

The remains of the Proboscidæ are numerous, and are referable to two species, *Elephas primigenius* and *E. antiquus.* This group is not only numerous in specimens (about 300), but also in individuals, of which there are the remains of 84, as indicated by jaws and teeth alone, exclusive of the tusks; of these there are 14 examples, large and small. Even assuming that many of the limb and other bones might have belonged to one or the other of these individuals, we may still fairly estimate that there are portions of more than 100 Elephants in the collection; for there are few instances in which more than one bone could be assigned to the same animal. Of the greater portion of the bones of the skeleton there are many fine examples, and they illustrate, together with the teeth and jaws, individuals of every age and size, from the smallest sucking calf to the animal of most mature age.



Key to Map on Opposite Page.

- Alluvium.
- Brick-earth.
- Gravel.
- London-clay.
- Woolwich and Thanet Beds.
- Chalk.
- Roads.
- Railways.

Section 3.—Length: Nine Miles along an Irregular Line.

(This section was most obligingly drawn expressly for this paper by Searles V. Wood, jun., Esq., F.G.S.)

1. The Chalk. 2. The Thanet Sand.

a. Thames Gravel of the Highest Elevation and which covers Dartford Heath } Formed when the Sea occupied the Weald, and the Drainage from the Thames area passed into it.

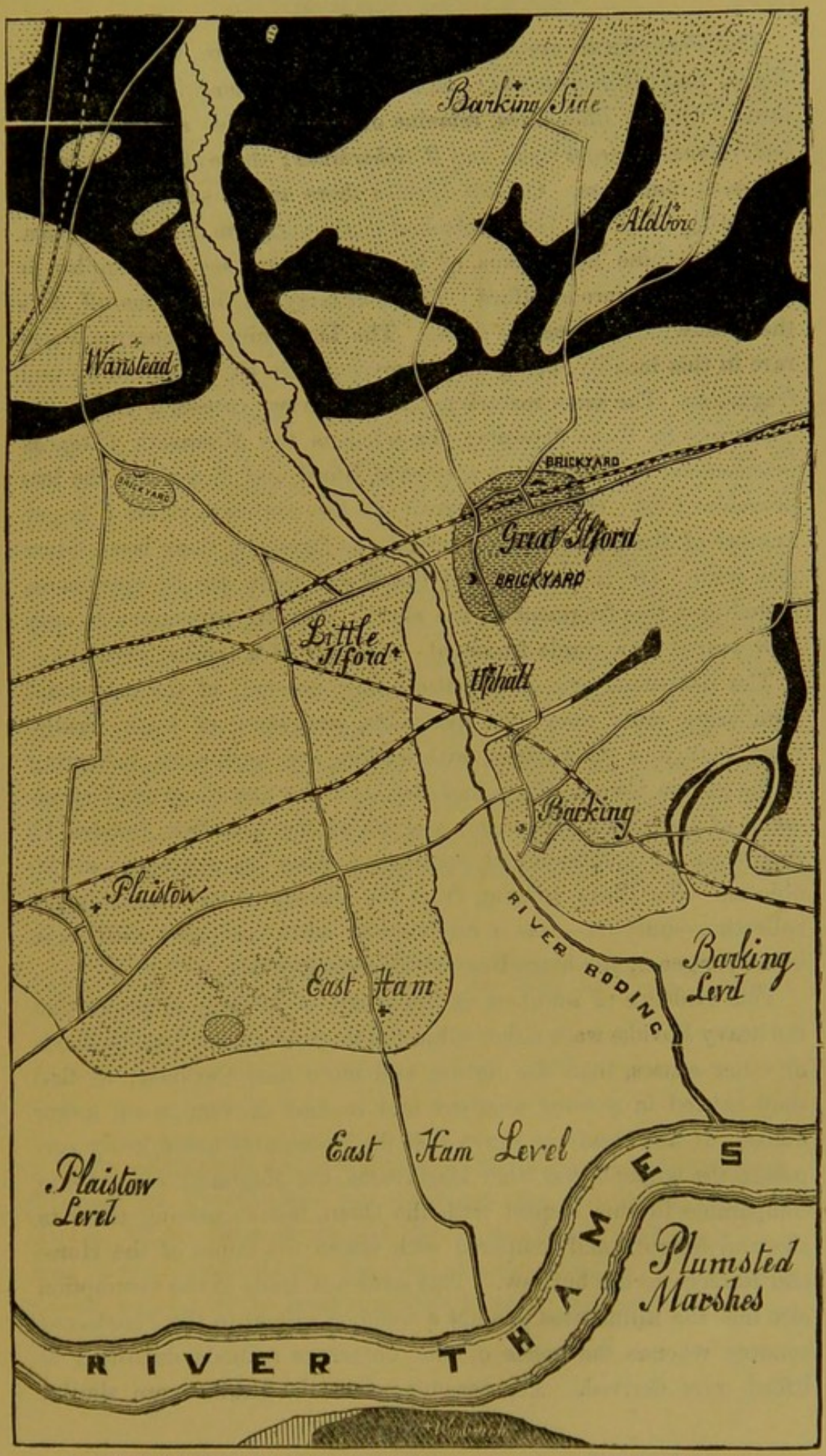
b. Cyrena Brick-earth }

c. Gravel (with some Brick-earth) formed since the Drainage acquired its present direction.

~ Recent Alluvium.

N.B.—The Cyrena Brick-earth at both Grays and Crayford is partially underlain by Gravel.

GEOLOGICAL MAP OF ILFORD.



Geological Map of the district around Ilford whence the great Collection of Pleistocene Mammalian remains was obtained by Sir Antonio Brady, F.G.S.

(Copied by permission from the Geological Survey Map.)

The Pachyderms are represented by three genera, viz. *Rhinoceros*, *Equus*, and *Hippopotamus;* and collectively comprise 121 specimens. Of the *Rhinoceros*, remains of three species are present, *R. leptorhinus*, *R. megarhinus*, and *R. tichorhinus;* those of the first being the most numerous. Of this species there are 77 separate remains, consisting of skulls, jaws, detached teeth, vertebræ, and limb-bones. The Megarhine Rhinoceros, of which there are seven examples, is comparatively rare at Ilford; whilst at Grays, a few miles off, it is the species most frequently found. The Tichorhine Rhinoceros is also rare in this locality, being only represented in the collection by two fragments. The same remark applies to the two species of Elephants occurring in these deposits; for whereas the Mammoth (*Elephas primigenius*) is the common species at Ilford, and *E. antiquus* the less prevalent form; the Grays deposit, on the contrary, yields a larger number of the latter species, whilst the former is there less seldom met with. Of the remains of the Horse there are 34 specimens, including a fine fragment of the skull. The Hippopotamus is only represented by a single fragment—the body of a lumbar vertebra.

The Ruminant remains constitute fully one-half of the collection, numbering more than 500 specimens, consisting of teeth, skulls, jaws, limb, and other bones, with antlers and horn-cores, belonging to the genera *Cervus*, *Bison*, and *Bos*. Of the first there are 7 specimens of the great Irish-deer, and 50 of the Red-deer, besides 13 fragments of undetermined species; making an aggregate of 70 objects. The Bison, judging from the paucity of its remains in the collection—only 34—was a rare animal, when compared with those of its congener, the large Bos, which exceed 300.

This evidence of numbers is important as tending to prove that the heavy Bovidæ were either subjected to greater casualties, by floods or other causes, than the lighter and more fleet Cervidæ; or that they existed in greater numbers and roamed in very much larger herds. It also tends to prove that the Ruminants numerically surpassed the whole of the other Herbivores, the Mammoth alone being comparable in this respect with the Oxen, but surpassing them in size and weight; and compared with which the bones of the Horse and Rhinoceros are but few. This evidence leads to the assumption also that the Rhinoceros was not a common animal in the Pleistocene country whence the bones of the numerous animals deposited at Ilford were derived. For assuming that the habits were similar

to those of the existing Rhinoceros, we should expect to meet with its remains generally in places and under conditions better adapted for their preservation, and hence more frequently found than that of other co-existing types of Mammalia.

It is a fact worth noting, that of this assemblage of vertebrate remains, it is seldom that two or more bones of the same animal are found in juxtaposition, showing that they did not find their resting-place where the animals died, but have been floated, probably for long distances, from the upper tributaries of the ancient Thames, and subsequently deposited in these fluviatile beds. But from whatever distance they may have been conveyed to this particular spot, they have been subjected to no rolling nor water-wearing action; for all the angles and ridges of the bones still retain their original natural sharpness.

If we could once more restore the physical features of the Valley of the Thames, as it existed in Pleistocene times, we should doubtless find[1] that all those places along its lower course, where considerable deposits of Brick-earth occur, and where the remains of the larger Mammalia are found in such abundance, as at Ilford, Erith, Grays, etc., mark the sites of ancient bays formed by the debouchment of side-valleys into the principal one, giving rise in flood-times to eddies into which the floating carcasses of land-animals would indubitably be drawn, and would, in course of time, sink, and become entombed in the soft and yielding argillaceous mud beneath.

[1] As suggested by Dr. Sandberger, in his interesting paper on the "Upper Rhine Valley," translated by Mrs. A. C. Ramsay. See GEOL. MAG. 1874, Decade II. Vol. I. p. 219.

NOTE.—The skull and lower jaw of *Rhinoceros leptorhinus*, Owen, forming the Frontispiece, are described, the former on page 29 (No. E, 1), the latter at page 32 (No. E, 8) of this Catalogue. They were found disassociated, but are clearly referable to the same species, and are in the same condition of wear, but do not belong to the same individual.

ERRATA.

Page 6, line 22 from top, *for* penultimate, *read* ultimate.
„ 8 „ 16 from top, *for* milk-molars on either side, *read* milk-molar of the left side.
„ 8 „ 18 from bottom, *for* Each, *read* The.
„ 8 „ 17 from bottom, *for* the molars are, *read* they are.
„ 8 „ 7 from bottom, *for* are, *read* is.
„ 10 „ 9 from bottom, *for* penultimate, *read* ultimate.
„ 18 „ 10 from top, *for* lower, *read* The greater.
„ 26 „ 9 from bottom, *for* vertebræ, *read* vertebra.
„ 36 „ 11 from bottom, *for* 42, *read* 43.
„ 46 „ 14 from top *for* left metatarsals *read* right metacarpals.
„ 54 „ 15 from top, *for* size, *read* length.
for *hemitæchus*, read *hemitœchus*.

CATALOGUE

OF

PLEISTOCENE VERTEBRATA

IN THE COLLECTION OF

SIR ANTONIO BRADY, F.G.S., &c.

CARNIVORA.

FELIS SPELÆA, Goldfuss.

A. 1.—The anterior half of the right ramus of the lower jaw. The fragment, which is broken posteriorly to the carnassial tooth, shows the symphysis entire, and three mentary foramina: the hinder one is divided by a thin partition of bone, and presents the appearance of a double foramen. With the exception of a portion of the crown of the third premolar, which is present, the crowns of all the other teeth are wanting, but the fangs are preserved in their respective alveoli, the first incisor is entirely wanting. The alveolar borders are more or less broken, the diastema is perfect.

Reference is made to this specimen in Messrs. Sanford and Boyd Dawkins' "Monograph on the Pleistocene Mammalia," Part I. p. 4, published by the Palæontographical Society, 1864.

2.—The second phalanx of the second digit of the left fore foot.

CANIS VULPES (?), Brissot.

A.° 1.—Part of the shaft of a right tibia of a small carnivore of the same size as the common Fox.

Length of fragment 3·2 in.

URSUS, Sp.

B. 1.—A nearly perfect posterior dorsal vertebra. The pre-zygapophyses and dorsal process are imperfect, the specimen otherwise is well preserved.

2.—A portion of a lumbar vertebra, only the centrum of which is perfect; the neural arch is preserved, but all the processes have been broken off.

3.—A fragment of the os innominatum; it comprises the entire right ischium and part of the acetabulum.

4.—The proximal end of the left scapula, showing the glenoid cavity entire.

5.—The distal extremity of the right radius.

6.—An entire right tibia; the articular surfaces at either extremity are quite perfect. Its dimensions are—

Length 13 in. Greatest width of proximal articular surfaces 3·3 in. Greatest width of distal end 2·3 in. Smallest antero-posterior diameter of do. 1·5 in. Smallest width of the shaft 1·2 in. Smallest antero-posterior diameter of shaft 1·2 in. Greatest antero-posterior diameter of shaft below the anterior tuberosity 1·7 in.

7.—The distal extremity of the left tibia; the articulating surfaces are perfect.

8.—An ungual phalanx.

ELEPHAS PRIMIGENIUS, Blumenbach.

C. 1.—The palatal portion of the cranium, showing palate, portions of the maxillaries, with the first true molars of either side in place, and parts of the incisive or tusk-sheaths. The left molar has eleven ridges and a heel, and the pressure of the successional teeth is well marked. The right molar is imperfect, eight ridges only being preserved; the anterior and posterior ridges are lost. Both molars are well worn.

Length of left molar 5·5 in. Width 3 in.

2.—The ultimate upper molars of the right and left sides of the same individual; each have nineteen plates, and have the first eleven ridges worn.

Length of molar 9 in. Width 3 in. Height at tenth ridge 6·3 in.

3.—A right ultimate upper molar; it comprises nineteen ridges and anterior and posterior talons; thirteen ridges are abraded.

Length 8 in. Width 3·2 in. Height at fourteenth ridge 5 in.

C. 4.—Another last upper molar of the right side; it has nineteen plates and posterior talon; thirteen plates are abraded.

Length 9 in. Width 3·5 in. Height at tenth ridge 5·5 in.

5.—The last upper molar of the left side, showing eighteen ridges and posterior talon. The first twelve plates are abraded, and the anterior plate and talon are wanting.

Length 9 in. Width 3·2 in. Height at twelfth plate 5·5 in.

6.—A last upper molar; it contains eighteen plates, twelve of which are much worn; the anterior plates being nearly ground down to the fang; the fang is broken, but is shown in section.

Length 10 in. Width 3·5 in. Height at thirteenth ridge 5·6 in.

7.—Another left ultimate upper molar, showing nineteen plates and a heel. Fourteen plates are more or less worn, the first four evenly, but the others are somewhat obliquely abraded. The upper portion of the vertical surface of the anterior plate is quite smooth from pressure against the penultimate molar.

Length 9 in. Width 3 in. Height at twelfth ridge 5·2 in.

[Note.—The enamelled plates in these six ultimate molars do not accord in number with the normal ridge formula (24 to 28) which Dr. Falconer assigns to *Elephas primigenius*.[1]

That they are ultimate molars is proved by the attenuation of the posterior plates, and the absence of any depression caused by the pressure of a successional tooth. And also that the ridges are in excess of the normal number (16) of the penultimate molar (see C. 50, p. 12).

That they are entire teeth is indicated by the fact that the anterior fang which supported the first plates is shown in section in each specimen, the fangs having been broken.

I think this fact of the numbers of the plates of sufficient importance to deserve special notice, and it may also be worth ascertaining by an examination of specimens in other collections, whether nineteen or twenty plates is a constant number in the ultimate molars of this species so abundant at Ilford. It also bears upon another point which I wish to call attention to here.

[1] See Falconer's Palæontological Memoirs, 1868, vol. ii. p. 175.

C. From an examination of many specimens I have come to the conclusion that there are *two varieties* of molars in the Mammoth; one thin-plated, the other thick-plated; and that all the molars from Ilford belong to the last-named variety, which is in this instance apparently a local one.

But whether the thick and thin-plated varieties are found associated together in other localities and may have been merely individual variations not confined to particular districts, will require further investigation.]

8.—A considerable portion of a left ultimate molar of a very aged animal; seventeen ridges remain, all of which are worn. That this specimen is an ultimate molar is inferred from the number of plates remaining, and by the absence of the impress left by a successional tooth.

Length 8 in. Width 3·5 in. Height at thirteenth ridge 4·7 in.

9.—Anterior portion of a right upper molar, probably the last. The fragment consists of twelve plates, six of which are obliquely abraded, the anterior subordinate ridge is wanting.

Length of fragment 5·4 in. Width 3·2 in. Height at seventh ridge 6·8 in.

10.—The anterior portion of an upper molar, of the left side, probably the ultimate, thirteen plates and the talon are present, the first three ridges are slightly abraded.

Length of fragment 6 in. Width 2·7 in. Height at fourth ridge 7 in.

11.—A considerable portion of a left upper penultimate molar, showing thirteen anterior ridges and a talon; the first six ridges are abraded.

Length of fragment 5·5 in. Width 3 in. Height at seventh ridge 6·5 in.

12.—Penultimate upper molar, right side, containing fourteen anterior plates and subordinate ridge; the first seven ridges are slightly abraded.

Length 7 in. Width at anterior plate 2·8 in. Height at seventh ridge 6 in.

13.—Right penultimate upper molar, containing thirteen plates, ten of which are more or less worn.

Length 7 in. Width 3·5 in. Height at tenth ridge 5 in.

14.—Upper antepenultimate molar, right side, showing twelve plates and a posterior talon; they are all inclosed in the cement, and the ridges are all worn. The posterior de-

C. pression caused by the vertical pressure of the penultimate molar is well marked in this specimen.

Length 7 in. Width 3 in. Height 4 in.

15.—Upper antepenultimate molar, showing twelve ridges and subordinate ridge. The first six ridges are slightly abraded.

Length 5·5 in. Width at the middle 2·8 in. Height at the sixth ridge 6 in.

16.—The greater part of an upper molar, consisting of ten plates, four of which are broken, six being entire and their points unworn. The cement has entirely disappeared.

17.—The anterior portion of an upper molar, showing six plates and talon; three ridges are obliquely abraded and the general form is somewhat abnormal.

18.—The middle portion of an upper molar, showing eight ridges, six of which are worn.

19.—A portion of the right maxillary and palate, with the ultimate milk-molar *in situ*; it shows twelve ridges, and anterior and posterior talons. The ridges are all abraded, and the great anterior fang is in its alveolus.

Length of molar 4·5 in. Width 2·2 in.

20.—The last upper milk-molars of either side of the same individual; each show ten ridges and anterior and posterior talons, and each have the eight anterior ridges abraded.

Length 5 in. Width 2·5 in. Height at eighth ridge 4·5 in.

21.—Right ultimate upper milk-molar, showing ten plates and a heel, all of which are abraded.

Length 4·5 in. Width 2·4 in. Height at eighth ridge 4 in.

22.—A similar tooth to the preceding, but of the left side, and probably of the same individual.

23.—The first true molar, of the left side; it contains twelve ridges and anterior talon, the points of three ridges are abraded.

Length 5·5 in. Width in middle 2·5 in. Height at third ridge 4·5 in.

24.—The third milk-molar of the upper jaw of the right side; it contains eleven ridges and anterior and posterior talons; the anterior seven ridges are worn.

Length 4·5 in. Height at seventh ridge 4 in.

25.—The palatal portion of the cranium of a young individual. The fragment comprises the palate and portions of the maxillæ, with the penultimate milk-molars of either side in

C. place; they are much worn, the anterior plates being nearly worn out. The alveoli of the last milk-molars are present, but the teeth are wanting.

26.—The last upper milk-molar, showing the remains of eight plates and posterior talon all very much worn. Two anterior fangs broken, the posterior fangs entire.

Length 4 in. Width 1·8 in.

27.—An imperfect last upper milk-molar, the six last ridges and talon only preserved.

Length 2·8 in.

28.—Another portion of an ultimate milk-molar; shows five posterior plates and talon, well worn.

Length of fragment 2·3 in.

29.—An ultimate milk-molar, showing eight posterior plates and talon.

Length of fragment 3 in.

30.—Part of an ultimate milk-molar, six posterior plates and talon preserved.

31.—Another portion of an ultimate milk-molar, showing seven ridges and a heel.

Length of fragment 2·8 in.

32.—A penultimate upper milk-molar, showing six ridges and a heel. The anterior plates are nearly worn out.

Length 2·8 in. Width 2 in.

33.—Part of a penultimate upper milk-molar, showing the remains of five ridges, worn nearly to their bases.

Length of fragment 2 in.

34.—Another fragment of a penultimate milk-molar, showing portions of four plates, very much worn. The anterior plates are quite worn away.

Length of fragment 1·8 in.

35.—An ultimate milk-molar (upper?) of the right side. It consists of ten ridges and an anterior subordinate ridge. The first four ridges being slightly abraded.

Length 4·3 in. Width 1·8 in. Height at sixth ridge 4 in.

36.—Fragment, consisting of four plates and heel, all very much worn, of a lower penultimate milk-molar.

37.—A most interesting specimen of the anterior portion of the

C. lower jaw of a very young animal. It comprises the larger portions of the horizontal rami with perfect diastema, and nearly entire symphysis, having a broad gutter. The penultimate milk-molars on either side are in place, the antepenultimates have been lost, but their alveoli, which are very small, are preserved. The alveolus of the third or ultimate milk-molar is also present in the right ramus. The penultimate molar of the left side is quite entire, and shows six ridges, with anterior and posterior talons; the first three ridges are abraded, and the centre points of the fifth and sixth ridges were just coming into wear. The anterior ridge and talon of the right molar are injured. The dimensions of the fragment are:

Length of right ramus 7 in. Greatest thickness 1·8 in. Height to alveolar margins anterior to tooth 2·2 in. Length of left molar 2 in. Width at third ridge 1·1 in.

38.—A portion of the left ramus of the lower jaw of another very young individual; the symphysis and vertical ramus are wanting, and the outer and inner dentary walls are imperfect. The second milk-molar is entire and in place; it shows six ridges and anterior and posterior talons; the points of the first three ridges are slightly abraded, the last plates had not come into wear. The entire, but very small alveolus of the antepenultimate milk-molar is present, the tooth having been lost probably subsequent to the death of the animal. A portion of the alveolus of the third milk-molar is also preserved, but the germs of the tooth are lost.

Length of fragment 5·7 in. Length of molar 2·1 in. Width at fifth ridge 1·2 in. Height at fifth ridge 1·5 in.

[Note.—In the two preceding specimens, the second milk-molars have but six plates each, besides the accessory ridges; and the teeth are absolutely entire. According to Dr. Falconer (See "Pal. Mem." vol. ii. p. 163), the ridges of the second milk-molars vary in number from seven to eight. These Ilford specimens have, therefore, one or two plates short of the normal number assigned by that very competent authority to this species. These teeth then are in the same category as the ultimate true molars already described (see Note to C. 7, p. 3).

I have no doubt that the teeth are those of a young *Elephas*

C. *primigenius*, and not of *E. antiquus*, with the ridge formula of the second milk-molar of which last-named species they agree. They differ from *E. antiquus* in the absence of the mesial expansion of the plates, by their being wider (laterally), and in closer proximity to each other.]

39.—The left horizontal ramus of the lower jaw. It contains the third milk-molar *in sitû*, which shows nine plates, all much worn. The discs of wear exhibit indications of crimping in the middle of the plates. Three outer mentary foramina and one inner are visible.

Length of fragment 8 in. Height 2·8 in.

40.—A much mutilated fragment of the left ramus of the lower jaw of a young individual. It contains in the alveolus the five posterior plates of the last milk-molar in germ.

41.—The anterior portion of both rami of the mandible containing the ultimate milk-molars on either side *in sitû*. The left ramus is broken posteriorly to the molar. The anterior portion of the alveolus of the first true molar is present. The right ramus is broken a little behind the coronoid process of the ascending ramus. The beak is broken, otherwise the symphysis and the diastemal ridges are entire. Mentary foramina, one inner and two outer, in each ramus. Each molar has eleven plates, all much worn; the molars are inclosed in the cement, which is well preserved.

Length of left ramus 11 in. Greatest thickness 2·5 in. Height 4·3 in. Length of molar 3·9 in. Greatest width 2·1 in.

42.—The right ramus of a lower jaw; the ascending ramus is imperfect, wanting the condyle and the coronoid apophysis. Part of the alveolus of the ultimate milk-molar is present, and the first true molar is in place. It contains thirteen plates and a subordinate anterior ridge and a heel. The ten anterior ridges are more or less worn. The beak is broken and the diastema are imperfect. Mentary foramina, two.

Length of fragment 14 in. Length of molar 6 in. Width at second ridge 2 in.

43.—A fine specimen of a lower jaw; it comprises the horizontal rami which are nearly entire, and considerable portions of the ascending rami, and has the first true molar on either side in place. The condyles and the left coronoid apophysis

C. are wanting. The diastemal ridges and the beak are entire, and there are two outer mentary foramina in each ramus. The molars have each twelve plates, and anterior and posterior subordinate ridges; they have all been subject to considerable abrasion.

Extreme length of jaw 19 in. Greatest height of horizontal ramus 5·2 in. Thickness 4·3 in. Greatest divergence of rami (outer sides) 16·5 in. Length of molar 5·2 in. Width 2·2 in.

44.—Another nearly entire lower jaw. The condyles are present, but the coronoid apophyses are wanting, otherwise the horizontal and ascending rami are perfect. Each ramus has one inner and two outer mentary foramina. The antepenultimate and penultimate molars on either side are *in situ*. The antepenultimates show twelve ridges and anterior and posterior subordinate ridges, all of which are well abraded, the anterior plates being ground nearly to the fangs. The penultimates are in germ, that of the right side has the points of eight ridges exposed, all being entire. The summits of all the ridges of the left penultimate molar are broken. The first molars have a considerable posterior divergence.

Extreme length of right ramus 21 in. Greatest thickness anterior to the ascending ramus 5 in. Height in front of molar 6 in. Greatest divergence of jaws (outer side) 20·5 in. Length of molar 5·9 in. Width at tenth ridge 2·2 in. Anterior convergence of molars at third plate 3·4 in. Posterior divergence of molars 6 in.

45.—A remarkably fine lower jaw, comprising the horizontal and ascending rami of either side. Both condyles and the left coronoid apophysis are present; the right coronoid is wanting. The beak is long and descending, the diastema are imperfect, and there are two outer mentary foramina in each jaw. The antepenultimate and penultimate molars of either side are in place. The right antepenultimate shows nine plates, that of the left side ten plates and a heel, they are all well ground, the anterior plates being worn away. Ten anterior ridges of each of the penultimate molars have emerged from their alveoli; the first two ridges had just come into wear, the points being slightly abraded; the posterior plates were still in germ, and remain hidden within the jaws.

Length of jaw 23 in. Greatest width 5·5 in. Height in front of molar 7·4 in. Greatest divergence of jaws (outer sides) 22 in. Height of ascending rami to condyles 16 in. Length of antepenultimate molar 5·5 in.

C. 46.—Another fine and nearly perfect lower jaw, containing the antepenultimate and penultimate molars of either side *in situ*. Both condyles are present; but the coronoid apophyses are wanting. The beak is long, and projects horizontally. Mentary foramina three, one inner and two outer; the diastemal ridges are quite entire. The penultimate molars have each only six plates remaining, and these are worn nearly to their bases; the anterior plates are quite worn away. Thirteen ridges of the penultimate molars have emerged, of which the first five ridges are abraded; the posterior ridges are imbedded in their alveoli. The dimensions of this fine example are:

Extreme length of jaw (including beak) 22 in. Greatest thickness 5 in. Height to alveolar border in front of molar 6·6 in. Height of jaw at condyle 14 in. Greatest divergence (outer side) 19 in.

47.—Another fine specimen, comprising the greater portion of the lower jaw of an adult animal. The anterior portion of the symphysis is broken, and both condyles are wanting; the coronoids are nearly entire. The first true molars of either ramus are *in situ*; each show eleven plates, all much abraded, the anterior plates and fangs being worn out. The alveoli of the penultimate molars are present; but only four plates of the left molar are preserved, the anterior plate of which is slightly worn. Mentary foramina, three outer and one inner in each ramus.

Extreme length of jaw 20 in. Greatest thickness 4·8 in. Height to alveolar border anterior to the molar 6·2 in. Length of first molar 5·8 in. Width at seventh ridge 2·8 in. Greatest divergence of jaws 21·5 in. The first molars are only three inches apart at the anterior fourth ridge, whence they diverge posteriorly, being 5·7 in. apart at the last ridge.

48.—Anterior portion of a lower jaw in fine preservation. Both rami are broken posteriorly to the penultimate molars, which are *in situ*. The beak is entire and points downwards, and has a shallow groove or gutter. Mentary foramina, three in the right ramus, two in the left, and one inner foramen on either side. The molar of left side shows fifteen plates and posterior talon; the anterior plates and talon are worn away; thirteen plates are abraded, the teeth being worn somewhat hollow in the middle. The enamel is thick and crimped, and the plates have a slight mesial expansion due to oblique

C. wearing. It approaches near to some forms of *E. antiquus*, but I consider it to be a coarse-ridged form of *E. primigenius*.

Length of right ramus from point of beak to broken posterior end 16 in. Height 5 in. Greatest thickness 4·7 in. Greatest divergence of rami (outer sides) 16 in. Length of crown of left molar 7·7 in. Width at seventh ridge 3·3 in.

49.—A superb lower jaw of a very old animal, the last molars only remaining, and these very much worn. The horizontal and ascending rami of either side are well preserved, both the condyles and the right coronoid being present; the beak is short and blunt. Three outer mentary foramina and one inner in each jaw. The right molar has fifteen plates, the anterior plates and the large fang are worn away, and its alveolus closed up. Of the left molar, sixteen plates remain; the anterior plates are broken, but the large fang is still in its socket. Twelve ridges in each tooth are abraded. The dimensions of this fine specimen are :

Extreme length 22 in. Height to summit of condyle 15·5 in. Height of ramus to alveolar border 5·8 in. Thickness 5·7 in. Greatest divergence 21 in. Length of crown of left molar 8·2 in. Width at the seventh ridge 3·2 in.

49.°—The greater portion of a lower jaw of a very large and also very aged individual. It shows the last fifteen plates of the ultimate molars in place in each ramus, and each have eleven plates more or less abraded, the anterior plates being quite worn away. The molars are wide, and their surfaces obliquely worn, the ridges being broad and the enamel thick. The symphysis is entire, and has a long and horizontally projecting beak. There are two mentary foramina in each ramus; they are situated rather high, near the alveolar border. The diastema are imperfect. The greater portion of the coronoid process of the right ramus is preserved, but the condylar process and the hinder border of the jaw are broken. The whole of the ascending ramus of the left side is wanting, the jaw being broken posteriorly to the molar. The dimensions are :

Extreme length of fragment of right ramus 21 in. Divergence of rami (outer measurement) 24 in. Height to alveolar border in front of molar 6·3 in. Length of remaining crown of molars 9 in.

[Note.—Although the molar ridges have a greater antero-posterior diameter than the typical *Elephas primigenius*, this may only be an individual character, attributable to great

C. size and age. The width of the molars, the absence of the mesial expansion in the ridges, and the greater number of these which the tooth possessed when entire—several of the anterior plates having been worn away—are differences which clearly distinguish it from *Elephas antiquus*, to which species I at first referred it.]

50.—A fine fragment, comprising both rami of the lower jaw, and having the ultimate molars on either side *in sitû*. The left ramus is broken posteriorly to the molar, that of the right side immediately below the condylar process. Mentary foramina two on the right side and three on the left; they are placed high up, and close to the alveolar border. The right molar shows eighteen ridges exposed, the posterior portion of the tooth being imbedded in the jaw. The left molar has nineteen[1] ridges and anterior and posterior talons. Ten plates of the left molar and fourteen of the right are more or less abraded; the abraded surface is slightly hollow and very oblique, the obliquity being from the outer to the inner side.

Length of right ramus 18 in. Length of crown of left molar 10 in. Width 3·2 in. Height of jaw anterior to molar 3·6 in.

51.—The greater portion of a lower jaw, showing the first true molars on either side *in sitû*. The beak is broken, the diastema are nearly entire. Mentary foramina three; two outer and one inner in each jaw. The molars have twelve ridges, with anterior and posterior talons; all the ridges—excepting the last of the right side—are worn. The plates are all inclosed in the cement, and the points only of the posterior ridges are abraded. A portion of the alveolus of the last right milk-molar is present, that of the left side is nearly closed with bone.

Length of molar 6 in. Greatest width at fourth ridge 2·5 in. The molars are anteriorly 2·4 in. apart, but diverge posteriorly to 6·7 in. apart.

52.—Anterior portions of the third upper milk-molars of the right and left sides, and of the same animal. They have respectively eight and seven ridges and anterior talons. Two anterior plates slightly abraded; the posterior plates are wanting.

[1] See Note to C. 7, at p. 3.

C. 53.—Part of a third milk-molar showing ten ridges, three of which are imperfect; the posterior plates are lost; the two anterior are slightly worn.

54.—Last lower milk-molar, left side; it shows twelve plates, all of which are well worn; the anterior plates being worn to the fangs, which are preserved.

Length 4·7 in. Width of posterior plates 2·1 in. Height of last plate 3·3 in.

55.—A milk-molar, probably the third, comprising eight posterior plates and heel; the first four are worn.

56.—Part of a lower milk-molar, probably the second, showing seven anterior plates and talon; the first ridge is slightly abraded; the sixth and seventh ridges imperfect, posterior ridges wanting.

57.—Anterior plates of the first (?) true molar, lower jaw; it consists of seven plates and a talon. The tooth was in germ, the talon only is slightly abraded.

58.—A similar tooth to the preceding; nine plates and a talon are conserved; the first two have their points a little worn.

59.—The first true molars of either side of the same individual; each show nine plates, all well worn; they are much curved and convex posteriorly; the anterior plates are missing.

60.—First true molars of the right and left sides of the same individual; they show nine and ten plates respectively, very much worn; the anterior plates have been worn away. The fangs, which are large, are preserved.

61.—First true molars of the right and left sides of the same animal; each show eleven ridges, and all are more or less abraded. Anterior plates wanting.

62.—First lower molar of the right side. It shows twelve ridges with a front and a hind talon; the cement of the tooth has entirely disappeared, the plates only being preserved. The anterior talon and plate had just come into wear.

Length of specimen 7·3 in. Width at second ridge 2·8 in. Height at third ridge 5·5 in.

63.—Second molars of either side of the same animal, that of the left side shows fourteen plates; the hinder plates are wanting; eleven plates of the right molar are preserved; its anterior and posterior plates are missing. The teeth were in

C. germ, none of the ridges having come into wear. The cement has been wholly decomposed.

64.—Anterior and posterior portions of a last lower molar, left side. The grinder has been broken, and one or more of the middle plates have been lost. The two portions are evidently parts of the same tooth. Unitedly there are eighteen plates, and those of the anterior portion are all abraded.

65.—Parts of the last right and left lower molars of the same animal. The left molar shows the talon and the first fifteen plates, the last plates are missing. The talon and the first four plates only of the right molar have been preserved. The teeth were just coming into wear, for the cement (which is rather thick), where it covers the surface of the anterior ridges, is worn, but not sufficiently to expose the enamel points of the ridges to the friction of the opposing grinders. The enamel of the talons shows marks of pressure upon the preceding molars.

66.—Posterior portions of two molars of the opposite sides of the same individual; they are probably the remains of the *last* molars of a very aged animal, for the posterior plates of neither have the least appearance of having been subject to pressure from a hinder tooth. Exclusive of the talons, each molar shows the remains of nine ridges, all very much worn; the anterior plates of each tooth have been worn away.

67.
68. } Portions of molars much worn.
69.

70.—Posterior portion of molar, five ridges and heel unworn.

71.—Anterior portion of molar, showing seven ridges and a talon; two ridges slightly worn.

72.—Part of a milk-molar much worn.

73.—Another fragment of a milk-molar, with the plates worn nearly to the base of the enamel.

74.—Portion of a milk-molar.

75.
76. } Portions of the second milk-molars.

77.—Portion of the base of a skull, showing occipital condyles, basioccipital, the foramen magnum and basal portion of the brain cavity.

C. 78.—Part of the sphenoid bone.

79.—Portion of the premaxillary, showing part of tusk-sheath.

80.—A large tusk nearly entire, and spirally curved.

Length of great curvature 108 in. Circumference at proximal end 19 in. Circumference near the tip 12 in. From the base to the point it measures in a straight line 41 in.

81.—Another fine and spirally curved tusk.

Length of outward curvature 105 in. Circumference near base 19 in. Circumference at twelve inches from the tip 10 in. From base to point in a straight line 42 in. This tusk and the preceding are nearly cylindrical.

82.—A long and very slender tusk, but slightly curved, and probably that of a female.

Length along outward curvature 91 in. Circumference at base 13·5 in. Circumference near the point 8·5 in. From base to point in a straight line 68 in.

83.—The greater part of the proximal portion of a large tusk; it has been crushed laterally in the matrix.

Length of fragment along great curvature 82 in. Greatest circumference 21·5 in. Circumference at anterior fracture 16 in. Straight line from the broken end to base 46 in.

84.—Two portions of a fine tusk, originally ten feet in length. It was irreparably broken in its extraction from the matrix.

The length of the proximal fragment is 55 in. (outer curve). Greatest circumference 20 in. Length of the anterior fragment 39 in.

85.—Anterior portion of a small tusk.

Length 50 in. Greatest circumference 11 in.

86.—A small and nearly entire, slender, and greatly curved tusk. The alveolus is present, the tip has been lost.

Its length (following outer curve) is 55 in. Greatest circumference 7 in.

87.—A small tusk.

Length 35 in. Greatest circumference 7 in.

88.—Anterior portion of a similar tusk.

Length 20 in. Greatest circumference 7 in.

89.—Anterior portion of a small and straight tusk.

Length 17 in.

90.—Fragment of the middle portion of a small tusk.

Length 14 in. Circumference 10 in.

91.—Anterior portion of a tusk of a very young animal.

Length 10 in.

92.—Tip of a small tusk, also of a very young individual.

Length 5 in.

93.—Atlas in good preservation, and showing all the articulations;

C. a part of the left lateral process is missing; its dimensions are:

Inferior length of body 2·5 in. Breadth (including lateral processes) 13 in. Anterior width of neural arch 2·6 in. Height of neural arch 2 in. Breadth of odontoid fossa 1·9 in. Height 1·7 in. Height of vertebra 7·4 in.

94.—A similar atlas vertebra, nearly perfect.

Length of body inferiorly 2·1 in. Breadth from point to point of lateral processes 11·8 in. Height 6·9 in. Breadth of neural arch 2·5 in. Height (excluding odontoid fossa) 1·9 in. Breadth of odontoid fossa 1·7 in. Height 1·6 in.

95.—Another atlas, with the posterior portion imperfect, and part of the left transverse process wanting.

Length inferiorly 1·8 in. Extreme height of vertebra 6·2 in. Breadth of neural arch 2·3 in. Height (exclusive of odontoid fossa) 1·7 in. Breadth of odontoid fossa 1·5 in. Height 1·4 in.

96.—Atlas, of probably a young individual. It differs in some particulars from the preceding, and notably so in the relative proportions of the spinal and odontoid cavities; the odontoid fossa being unusually large. The posterior edge of the inferior portion of the centrum is broken, and the ends of the transverse processes are also wanting.

Extreme height 5·7 in. Breadth of neural arch 2·5 in. Height of neural arch 1·6 in. Breadth of odontoid fossa 2·2 in. Height 1·9 in.

97.—Atlas, very imperfect, but similar in character and proportions to the preceding.

Breadth of odontoid fossa 2·1 in. Height 1·8 in.

98.—Axis, somewhat mutilated, the posterior epyphysis is lost.

Length of body inferiorly, including the odontoid process 3·7 in. Posterior breadth of body 5·4 in. Height of body posteriorly 3·5 in.

99.—Cervical vertebra (? 4th) imperfect, the posterior epyphysis is wanting.

Length of body 1·1 in. Breadth 4·6 in. Height 4·2 in.

100.—Cervical vertebra, larger than the preceding, and very much mutilated.

101.—Anterior dorsal vertebra (1st or 2nd); the inferior portion of the centrum is imperfect, and the extreme end of the spinal process is broken.

Anterior height of spinal arch 2·6 in. Inferior breadth of spinal arch 4 in. Length of neural spine 8 in.

102.—Anterior dorsal vertebra (2nd or 3rd), in good preservation; the pleurapophyses only mutilated.

Length of body inferiorly 2·3 in. Height of body 3·8 in. Breadth of body 4·7 in. Anterior height of spinal arch 2·8 in. Inferior breadth of spinal arch 2·5 in. Length of spinal process 13 in.

C. 103.—Posterior dorsal vertebra, the spinal canal is entire, otherwise the specimen is very imperfect; the anterior and posterior epyphyses are missing, and the processes are all broken.

104.—Dorsal vertebra in the same condition as the preceding.

105.
106.
107.
108. } Dorsal vertebræ, all more or less imperfect.

109.—A series of nine consecutive vertebræ, six dorsal and three lumbar. The bodies and the spinal canal of each (with the exception of the last) are preserved, but the processes are all more or less injured.

United length of the series 23 in.

110.
111. } Lumbar vertebræ imperfect.

112.—Spinal process of dorsal vertebra.

113.—Anterior rib, the epyphysis is wanting.

Length 18·5 in.

114.—A rib, both ends imperfect.

Length 29·5 in.

115.—A similar rib.

Length 36 in.

116.—Rib imperfect.

Length 29 in.

117.—Another imperfect rib.

Length 21·5 in.

118.—Rib, the epyphysis wanting.

Length 41 in.

119.—A superb scapula of the left side almost entire. The specimen was absolutely perfect when discovered; but owing to its fragile condition, a portion of the anterior border was lost in removing it from the matrix. It has the following dimensions:

Greatest length 32 in. Greatest breadth 37 in. Height of spine above infra-spinous fossa 8 in. Greatest diameter of glenoid cavity 6·8 in. Lesser diameter of glenoid cavity 4 in.

120.—A fine fragment of another left scapula. The glenoid cavity is well preserved, and also a large portion of the

C. spine, but the greater portion of the supra and infra spinal plates are wanting.

Greatest length of fragment 27 in. Height of spine above infra spinal fossa 6·5 in. Greatest diameter of glenoid cavity 6·5 in. Smallest diameter 3·9 in.

121.—Fragment of a right scapula. It consists chiefly of the spine, which is broken, and of the glenoid cavity, also imperfect.

Length of fragment 23 in.

122.—Lower portion of a left scapula, showing glenoid cavity. The fragment is imperfect.

Length of fragment from glenoid margin 26 in. Longest diameter of glenoid cavity 6·8 in. Shortest diameter 3·3 in.

123.—Fragment of scapula, comprising the neck and glenoid cavity.

Longest diameter of glenoid cavity 6·8 in. Shortest diameter 3·8 in.

124.—Part of a left scapula of a very young individual. The fragment consists of the spine, which is imperfect, and the glenoid cavity, nearly the whole of the supra and infra fossæ are wanting.

Length from margin of glenoid cavity to end of spine 14·5 in. Longest diameter of glenoid cavity 4·2 in. Shortest diameter of ditto 2·1 in.

125.—The upper end of a spine of a left scapula of an animal of similar age and proportions as the preceding.

126.—An imperfect humerus, of right side. It comprises the scapular articulation, the upper inner side of the shaft, and the whole of the distal half of the bone. The great tuberosity and the outer upper half of the shaft are wanting. Its dimensions are:

Extreme length 32·5 in. Antero-posterior diameter of upper articulation 7·5 in. Breadth of inferior extremity, including external condyloid ridge, 9·5 in. Breadth of trochlear surface 7·6 in. Smallest antero-posterior diameter of trochlear surface 4 in. Smallest antero-posterior diameter of shaft in centre 4 in. Smallest transverse diameter of shaft in centre 6 in.

127.—A left humerus; the upper portion is mutilated, only a part of the articular head and of the shaft being present; the lower half, including the condyles and external condyloid ridge, is in better preservation.

Greatest length 33·3 in. Breadth of inferior extremity, including condyloid ridge, 9·5 in. Breadth of trochlear surface 7·8 in. Smallest antero-posterior diameter of trochlear surface 3·7 in.

128.—A nearly perfect humerus of the left side of a young individual. The head, great tuberosity, and shaft are entire;

C. but the posterior surface of the bone at the distal extremity and also of the distal articulations have been injured.

Greatest length 28·7 in. Transverse diameter of upper extremity 8 in. Antero-posterior diameter of great tuberosity 8·3 in. Antero-posterior diameter of head (articulating surface) 6·7 in. Transverse diameter of head 5 in. Smallest transverse diameter of shaft in centre 3·3 in. Smallest antero-posterior diameter of shaft in centre 3·6 in. Breadth of inferior extremity (including condyloid ridge) 8·4 in.

129.—Another left humerus, partly restored, the proximal and distal extremities are present, but mutilated.

Greatest length 31·8 in. Smallest transverse diameter of shaft in centre 3·6 in. Smallest antero-posterior diameter of shaft in centre 4·2 in. Breadth of distal extremity (including condyloid ridge) 9·3 in. Smallest diameter of trochlear surface 3·9 in.

130.—Part of a left humerus. The head, the inner side of the shaft, and part of the right condyle is all that has been preserved.

Its length is 27 in.

131.—An imperfect right humerus, showing shaft and trochlear surfaces in good preservation.

Length of fragment 21 in. Smallest diameter of trochlear surface 3·4 in.

132.—Distal half of a left humerus; the condyloid ridge is imperfect.

133.—Distal half of right humerus, the articulations well preserved.

134.—Inner side of the distal extremity of a right humerus.

135.—Shaft of right humerus.

136.—Shaft of left humerus.

137.—The lower portion of a left humerus of a small but adult animal, possibly female.

Length of fragment 18 in. Breadth of distal extremity (including condyloid ridge 7·3 in. Greatest diameter of trochlear surface 6·1 in. Smallest antero-posterior diameter of trochlear surface 3·1 in.

138.—Shaft of the right humerus of a young individual.

The entire length of the fragment is 10 in. Smallest transverse diameter at centre 2·2 in. Smallest antero-posterior diameter at centre of shaft 1·9 in.

139.—The lower portion of the shaft of the left humerus of another young animal.

Entire length of fragment 8·5 in.

140.—The shaft of the right humerus of a very young animal.

The entire length of the fragment is 6 in. Smallest transverse diameter of the shaft at centre 1·3 in. Smallest antero-posterior diameter at centre 1·5 in.

141.—A head (articulating surface) of a humerus.

142.—Another proximal articular end of a humerus.

143.—The distal articular extremity of a humerus.

C. 144.—The proximal articular extremity of a humerus.

145.—A fine and nearly entire left ulna. The specimen wants the epyphysis of the distal extremity, and also a portion of that of the olecranon. Although the epyphyses had not become consolidated with the body of the bone, yet the bone belonged to a full-grown and mature animal.

Its entire length is 25 in. Greatest breadth at articular surface 7·5 in.

146.—An entire right ulna of an adult animal, having all the articular surfaces in perfect preservation. The distal epyphysis not having become anchylosed to the body of the bone, is detached from it, but is preserved.

Entire length of the bone 26 in. Width of upper end 7 in. Width of distal articular surface 4 in.

147.—An imperfect left ulna; the shaft is entire, but the olecranon, a part of the upper articular surface, and the distal epyphysis are wanting.

Entire length of fragment 22 in.

148.—A left ulna nearly entire, the distal epyphysis only wanting, all the upper articular surfaces are perfectly conserved; the epyphysis of the olecranon not having become anchylosed, although present, is displaced.

Entire length of bone 20 in. Width at articulations 6·5 in.

149.—Another left ulna, wanting the distal epyphysis.

Length 21·5 in.

[Note.—In the existing Elephants the epyphyses do not become consolidated by perfect anchylosis to the bodies of the limb bones, until the animal is far advanced in age. And this character appears to have pertained to their predecessor, the Mammoth, judging from the number of limb bones found, of apparently full-grown and mature individuals, from which the epyphyses have become detached at their sutures, and in which the sutural surfaces are perfectly conserved.]

150.—Part of a right ulna of a young individual; the olecranon and humeral articulations are incomplete, and the distal extremity is wanting.

Length 16 in.

151.—The proximal half of a right ulna of a young animal; humeral articulations imperfect; the olecranon wanting.

Length 12 in.

152.—Another proximal half of a right ulna of the same pro-

C. portions as the preceding; the articular surfaces are imperfect, and the olecranon is wanting.

Length 12 in.

153.—The proximal half of a right ulna of a much younger animal than the preceding; the articular surfaces are imperfect, and the olecranon is wanting.

Length of fragment 10·7 in.

154.—The proximal half of a left ulna of a very young individual; the greater portion of the articular surface and the olecranon are wanting.

Length of fragment 7·5 in.

155.—A perfect distal epyphysis of a right ulna; the fragment had not been anchylosed to the body of the ulna.

Greatest length from articular surface to the epyphysial suture 5·3 in. Greatest width 5·8 in. Greatest width of articular surface 4·4 in. Antero-posterior diameter of articular surface 3·8 in.

156.—The distal epyphysis of a left ulna of a young animal.

Greatest length 3·4 in. Greatest width 4·2 in. Greatest width of articular surface 3 in. Antero-posterior diameter of articular surface 3·1 in.

157.—Proximal or olecranon epyphysis of ulna.

158.—The proximal epyphysis of the ulna.

159.—A fine and nearly perfect right radius; the distal epyphysis only is wanting.

Extreme length 26 in. Greatest width of distal extremity 5·2 in. Antero-posterior diameter of distal extremity 3·5 in. Smallest width of shaft 2 in.

160.—A right radius, showing entire proximal articular surfaces; the distal epyphysis is wanting. As compared with the length, its proportions are slenderer than the preceding.

Greatest length 22·5 in. Smallest width of shaft 1·3 in. Greatest width of distal extremity 4·4 in. Greatest antero-posterior diameter of distal end 2·5 in.

161.—Another right radius, the proportions nearly the same as the preceding, but the shaft is not so well preserved.

Length 22 in.

162.—A left radius; the proximal end and the shaft are in excellent preservation, but the distal epyphysis is wanting; its proportions indicate a more robust animal than the preceding.

Length 19·5 in. Smallest width of shaft 1·9 in. Greatest width of distal end 3·7 in. Antero-posterior diameter (distal end) 2·7 in.

163.—The proximal half of a right radius.

164.—Another proximal half of a right radius.

165.—The right scaphoid, having all the articular surfaces entire.

C. 166.—A right scaphoid, shorter than the preceding,

167.—Right scaphoid in excellent preservation; it is more robust than the two preceding.

168.—An entire right cuneiforme; all the articular surfaces are most perfect.

169.—A part of the right cuneiforme.

170.—The right lunare.

171.—Left lunare, much smaller than the preceding.

172.—The left magnum; it is of small size, but quite perfect.

173.—The second left metacarpal, quite entire.

174.—The third right metacarpal, phalangeal end imperfect.

175.—The third metacarpal of a young individual, it is imperfect.

176.—The third and fourth metacarpals, of the same left foot.

177.—A large and very robust fourth metacarpal of the left foot.

178.—Another left fourth metacarpal, as long as the preceding, but not so robust.

179—Right metacarpal, the proximal end is imperfect, and the distal extremity is wanting.

180.—A fine and nearly entire right os innominatum; it comprises the greater portion of the ilium, ischium, and pubis. The superior border of the ilium and the posterior border of the ischium are imperfect. The pubis and acetabulum are entire.

Greatest length of fragment, inferior border, and including the ilium and ischium, 30 in. Height from the margin of the acetabulum to the superior border of the ilium 22 in. Smallest circumference of the pubis 10·3 in. Greatest diameter of acetabulum 6 in. Smallest diameter of acetabulum 5·6 in.

181.—A fine portion of the right os innominatum; the specimen shows the greater portion of the ilium, ischium, and pubis, and the entire acetabulum.

Length of fragment, inferior border, 25 in. Height from the margin of the acetabulum to the superior border of the ilium 23 in. Greatest diameter of acetabulum 6 in. Smallest diameter of acetabulum 5·6 in.

182.—The superior portion of the left ilium; it is evidently a part of the left innominatum of the same animal as the preceding.

Length of fragment 18 in.

183.—A fine fragment of the right os innominatum, showing acetabulum and portions of the ilium, ischium, and pubis.

Length of fragment, inferior border, 25 in. Greatest diameter of acetabulum 6 in. Smallest diameter of acetabulum 5·5 in.

184.—A fragment of the left os innominatum; the acetabulum is

C. imperfect, and only the inferior portions of the ilium and ischium are preserved.

Length of fragment 25 in. Greatest diameter of acetabulum 6·5 in.

185.—A much mutilated and otherwise badly preserved fragment of the right os innominatum; it shows the acetabulum, and parts of the ilium and the pubis.

Length of fragment 18 in.

186.—Fragment of the right os innominatum; acetabulum imperfect.

Length of fragment 17·5 in. Greatest diameter of acetabulum 5·7 in.

187.—Portion of a right os innominatum, parts only of the ilium, ischium, and acetabulum preserved.

188.—Fragment of os innominatum, containing portions of the acetabulum and pubis.

Length 11 in. Smallest circumference of pubis 8·7 in.

189.—A portion of the pubis.

Length 7 in. Smallest circumference 9·4 in.

190.—A superb specimen of an entire femur of the right side.

Length 45·5 in. Width of head and great trochanter 13·5 in. Greatest diameter of head 5·8 in. Antero-posterior diameter of the upper end of the shaft below head 2·6 in. Smallest width of the shaft near the middle 5·7 in. Width of shaft above the condyles 8·2 in. Antero-posterior diameter of lower end of the shaft 4·4 in. Antero-posterior diameter of great condyle 8·3 in.

191.—A nearly perfect right femur. The shaft and distal extremity are quite entire; the great trochanter is wanting, and the head is somewhat mutilated.

Length 41·5 in. Smallest width of shaft near middle 4·7 in. Width above the condyles 7·8 in.

192.—The left femur, wanting the upper extremity; the body and condyles are entire.

Length 35 in.

193.—The body of a left femur; the proximal and distal extremities wanting.

Length 36 in.

194.—The body of a left femur; both extremities wanting.

Length of fragment 26 in.

195.—The body of a right femur of a young individual; it is broken at each end.

Length of fragment 25 in.

196.—The body of a left femur; the proximal end is broken; the distal extremity shows the epyphysial suture.

Length of fragment 19·5 in.
This and the preceding specimen have belonged to half-grown animals.

C. 197.—Another shaft of a left femur of a young individual; it is broken at each end.

Length of fragment 18·5 in.

198.—Another shaft of a left femur of a very young individual. The proximal and distal extremities of the specimen are imperfect.

Length of fragment 11 in.

199.—The entire shaft of a left femur of a young animal. The epyphyses of the upper and lower ends are missing, but the rugose surfaces of the epyphysial sutures are present and well preserved.

Length of fragment 14 in.

200.—The shaft of the right femur of another young animal, or calf. The extremities are imperfect.

Length of fragment 9 in.

201.—The middle portion of the shaft of a femur of a calf.

202.—The shaft of a right femur of a very young calf.

Length of fragment 8 in.

203.—Another shaft of a right femur of a very young calf.

Length of fragment 7 in.

204.—Another shaft of a right femur of an extremely young calf (? fœtal).

Length of fragment 6 in.

205.—The proximal end of the shaft of a femur.

206.—The proximal end of a femur; the head is preserved, but is detached at the epyphysial suture.

207.—The head of a large femur.

208.—The head of a femur.

209.—Another head of a femur.

210.—The condyle of a femur.

211.—The left patella; the articular surfaces are all perfect.

212.—The right patella; the articular surfaces are not so well preserved as are those of the preceding.

213.—An entire right tibia, showing the proximal and distal articulations in good preservation.

Length of specimen 20 in. Width at proximal end 7 in. Width at distal end 5·8 in. Smallest antero-posterior diameter of shaft 2·5 in.

214.—The left tibia, wanting the proximal end. The shaft and the distal extremity are entire.

Length of specimen 18 in. Width at distal end 5·8 in. Smallest antero-posterior diameter of shaft 2·5 in.

C. 215.—The entire shaft of a right tibia; the proximal and distal epyphyses are missing; but the rugose surfaces of the epyphysial articulations of the shaft are shown at each end.

Length of fragment 15 in. Width at proximal end 5·8 in. Width at distal end 5·3 in. Smallest antero-posterior diameter of shaft 2·2 in.

216.—An imperfect portion of a shaft of a left tibia; the distal end is broken near the epyphysis.

Length of fragment 11 in.

217.—The shaft of a right tibia of a young individual. The proximal and distal epyphyses wanting.

Length of fragment 7·6 in.

218.—The shaft of a left tibia of a much younger animal than the preceding; the epyphyses of either end are wanting.

Length of fragment 5·5 in.

219.—The shaft of a left tibia of an animal of about the same age as the preceding, and the bone is in the same state of preservation. But relatively to the length—which is the same in both specimens—this is much more slender.

Length of fragment 5·5 in.

220.—The distal half of a right fibula. It is in good preservation, and shows the articular surfaces entire.

Length of fragment 16 in.

221.—Right astragalus, quite entire; all the articular surfaces are well preserved.

222.—Right astragalus, quite perfect.

223.—Right astragalus; it is smaller than the preceding, and not so well preserved.

224.—A small but perfect left astragalus.

225.—An imperfect left astragalus.

226.—A right astragalus in bad preservation.

227.—A considerable portion of the left calcaneum; it shows the large astragular facet, and also the cuneiform and fibular facets; the epyphysis is wanting.

228.—Right naviculare; the specimen is imperfect.

229.—The right mesocuneiforme.

230.—The left ectocuneiforme.

231.—The second metatarsal; right side.

232.—The left second metatarsal.

233.—The left third metatarsal.

234 and 235.—Third left metatarsals, imperfect.

C. 236.—The first phalanx of the third digit.

237.—An outer phalanx.

238 and 239.—Proximal ends of phalanges.

240.—The shaft of a right ulna of a very young individual, wanting the proximal and distal extremities.

Length 10 in.

241—Another shaft of an ulna of an extremely young animal (? fœtal); both extremities are imperfect.

Length 5 in.

242.—Shaft of radius of a very young animal; the proximal end is very imperfect, and the anterior surface of the bone at the lower extremity is also wanting. A portion of the distal epyphysial suture is preserved.

Length of fragment, which comprises the entire length of the shaft, 7·8 in. Width of proximal end 1·2 in. Width of distal end 1·9 in. Smallest width of shaft 0·7 in. Smallest antero-posterior diameter of shaft 0·6 in.

243.—The distal half of the radius of a young but half-grown animal, and of larger relative proportions than the preceding.

244.—Fragment of the os innominatum of a young animal; it comprises portions of the acetabulum and ischium.

245.—A fragment of the os innominatum, comprising portions of the pubes and acetabulum of a young animal. The fragment is interesting as showing that it had not become consolidated to the ischium, from which element of the pelvis it has been detached at the ischial suture, which is preserved.

246.—Proximal end of radius, wanting epyphyses.

247.—Fragment of the shaft of a femur of a young animal.

248.—Left metacarpal, the fourth of an immature animal.

249.—First phalanx of the fourth (?) digit.

250–260.—Portions of neural arches and spines.

261.—Two fragments of a cervical vertebræ. They comprise the entire pre- and post-zygapophyses, and portions of the centrum.

262.—Fragment of a cervical vertebra.

263.—Upper portion of the shaft of an ulna of a very young animal.

264.—A portion of the os innominatum of a very immature animal, comprising portions of the pubis and acetabulum.

265.—Fragment of last milk or first true molar of upper jaw.

C. The fragment is nearly worn away; it shows remains of five plates.

266.—Another fragment, nearly worn away, of a last milk or first true molar, and showing remains of six plates.

267.—Entire rib.

268.—Ditto.

269.—Head of rib.

270.—Ditto.

271.—Fragment of the atlas vertebra.

ELEPHAS ANTIQUUS, Falc.

D. 1.—A remarkably fine and characteristic upper molar of the right side. It comprises fifteen ridges; the grinding surfaces of the first seven being worn obliquely from the inner to the outer side of the tooth. The hinder ridges are intact, their apices being inclosed in the cement. The anterior ridges are slightly mutilated on their outer edges; but the characteristic mesial expansions on the discs of wear, although not large, are well defined. The last plates are missing. The anterior fang is broken, but is well shown in section. The ridges are broad, for only eight—the sixth to the thirteenth inclusive—are contained in a length of six inches, on the outer surface of the molar, which is slightly convex; thus averaging three-fourths of an inch to each plate. The dimensions of this fine fragment are—

Length of crown 11 in. Width 3·1 in. Height at ninth plate 8 in.

2.—A fragment of the right lower ultimate molar, and of the same individual as the preceding. Nine ridges only remain, those of the anterior and posterior ends of the tooth not having being secured by the workmen. Of those preserved, the first four are worn obliquely from the outer to the inner side of the molar. The angle of wear corresponds with that of the upper molar described above. The fifth ridge is slightly abraded; the others are all intact, and covered with cement. The anterior plates show great forward curvature, giving them a bow-like form, the centre of the arc of the second plate being one inch and two-tenths from the perpendicular.

Length of fragment 7 in. Width 3 in. Height 6·7 in.

D. 3.—A fine and characteristic ultimate molar of the left side. It consists of eighteen ridges, the last being lost. The first eleven are more or less abraded, the discs of wear showing the characteristic mesial expansion. The points of the posterior ridges are imbedded in the cement, which is thick and well preserved. The great fang which supports the anterior ridges is partly preserved, and the first three ridges are mutilated. This tooth must have belonged to an animal not only of great age, but also of large size. The dimensions of this fine fragment are—

Length of crown measured along the convex inner border 13 in. Width 3 in. Height at tenth ridge 6·8 in.

4.—Part of a lower molar of the left side, comprising ten plates, eight of which are worn; the anterior plate and the heel are imperfect.

Length 6 in. Width 2·8 in. Height 6 in.

5.—Fragment of a lower molar, consisting of three ridges and part of a fourth, all slightly abraded.

6.—Another fragment of a molar, showing remains of five plates worn nearly to the fangs.

7.—Fragment of anterior portion of an upper molar, showing remains of four plates nearly worn away; the cement is preserved.

8.—A long slender and straight tusk, which may be referred provisionally to *E. antiquus*, as differing from *E. primigenius*, by the total absence of curvature, which is so characteristic a feature of the tusks of the adults of the latter species. The specimen is broken anteriorly to the alveolus, of which there is no trace, the tusk being solid at the fractured end, where its greatest diameter is 3·5 inches, and whence it gradually tapers to the apex; it is laterally compressed, and is in a much better state of preservation than is usual with the large tusks found at Ilford.

The length of this fine fragment is 50 in.

9.—A nearly perfect atlas, showing all the articular surfaces in good preservation; the ends of the transverse processes are wanting.

Height of vertebra 8 in. Width of proximal articulations 4 in. Width of distal articulations 8 in. Length of neuropophyses 3·5 in. Width of neural canal 3·7 in. Width of odontoid articulations 2·4 in.

D. 10.—Axis of same individual as the preceding; all the articulations are present, but it wants the neural spine and the pleurapophyses.

Length, including odontoid process, 4·5 in. Width of the atlas articulations 8 in. Height of centrum 8 in.

11.—The upper half of a left ulna; a superb specimen, showing the olecranon and the humeral and radial articulations in fine preservation.

Extreme length of fragment 21 in. Greatest breadth of head 9 in.

12.—Upper half of a right ulna, and probably of the same animal as the preceding, but the bone is in a much inferior state of preservation. The olecranon is wanting, and what remains of the articular surfaces is in very bad condition. When entire, its proportions would have been the same as No. 11.

13.—A fine right radius, and probably belonged to the same animal as the preceding. The proximal end is imperfect, only a portion of the articulations being preserved. The distal epyphysis is lost; the shaft is entire.

Length 26·5 in. Width at distal end 5·5 in.

RHINOCEROS LEPTORHINUS, Owen.

Rhinoceros hemitæchus, Falc.

E. 1.—A remarkably fine skull, and probably the most perfect of this species which has hitherto been found in England. It is nearly entire, and evidently that of an aged animal; for the molars, of which there are six on each side, are all very much worn. The skull has not been crushed, and therefore shows well the normal form and proportions. The occiput is partly restored. The condyles and foramen magnum are entire, the basi-occipital is wanting. The parietal, frontals, and nasal bones are perfect. The last have a very rugose surface for the attachment of the nasal horn. The inter-orbital space is also slightly rugose, and probably supported a short frontal horn or boss. The zygomatic arches and styloid processes are perfect; the orbital rims are imperfect. The maxillaries are greatly mutilated, and the incisive bones are also imperfect, wanting the anterior ends by which they were united to the lower border of the nasal septum. The palate

E. is nearly entire. Appended to the nasals is the anterior portion of the bony septum of the nares, perfect in front, but broken behind.

Dimensions of skull—Length of molar series 10·7 in. Length of true molars 6·3 in. Length of pre-molars 4·4 in. Extreme length of skull from occipital crest to tip of nasals, measured along the curve, 33 in. Length from occipital crest to end of nasals in a straight line 31 in. Greatest constriction of skull between the zygomatic arches 5·1 in. Width of inter-orbital space 11 in. Width of nasals about the middle of the anterior rugosity 5·5 in. Extreme length of nasal opening, right side, 10·6 in. Width of zygomatic arches posterior to last molar 13 in. Width of zygomatic arches across glenoids 14 in. Width of occipital crest 4·6 in. Height of occipital crest from lower border of the foramen magnum 7·6 in. Width of condyles, including foramen magnum, 6·3 in.

[Note.—In clearing the skull from its matrix of sandy gravel, I found the anterior border of the septum joined and apparently consolidated to the end of the nasals; but the greater part of that portion of the septum which is preserved, I found detached from these bones, *but not broken;* and this detached portion showed upon its superior margin a hollow smooth surface, which perfectly fitted a rounded longitudinal smooth ridge upon the inferior surface of the nasals, to which it was originally joined by an unanchylosed sutural attachment. Moreover, I traced the septum beyond the middle of the inter-orbital platform to which it was also attached, and served as a support. At this point, the bony septum was thick, but of a very coarse cancellated structure, and so exceedingly friable as to render it impossible to detach and preserve any fragment of this part of the bone. The septum became gradually thinner toward the front of the nasals, the structure becoming less coarse, to about the middle of the nasal apertures, where the bone is thinnest, but its substance more compact. It again thickens a little forwards and downwards, where it forms a broad inferior border to join the intermaxillary bones.

During the process of restoring the skull, which was in a somewhat dilapidated condition, it was unfortunately necessary, in order to form a support for the palate and teeth, to cover the posterior portion of the septal sutural ridge with plaster, and thus destroy the evidence of its existence; but subsequently another skull (E. 2) of the same species was secured for the collection, in which this upper ridge is pre-

E. served and distinctly shown. There was also a central longitudinal ridge, but with a broken edge, upon the inner floor of the palate, to which bones I believe the septum was also attached; but owing to the broken condition of the palatal bones, and the displacement of the fragments, the fact of their being conjoined was not sufficiently noted by me at the time, so as to enable me to speak upon this point with absolute certainty.]

2.—Another cranium, but not so perfect as the preceding, inasmuch as the molars, the premaxillæ, and the whole of the palatal portion of the skull are wanting. This fine fragment comprises the entire upper portion of the cranium. The occiput and condyles, the right zygomatic arch with the articulating surface, and the right orbit, with its anterior tuberosity, are also quite perfect. The two auditory foramina are present and entire. The styloid processes are broken, and the basi-occipital and sphenoid are mutilated, as are also the maxillaries, left zygoma, and orbit. The fragment, moreover, shows the anterior and posterior portions of the bony septum of the nares. The anterior portion is broken posteriorly, and is attached to a medial ridge, which ridge does not terminate at a short distance from the anterior border of the nasals, as in the typical Clacton specimen, figured by Prof. Owen in his "British Fossil Mammals," and which is now preserved in the British Museum, but is continuous along the under surface of these bones and of the inter-orbital platform, and unites with the posterior fragment of the septum, which is preserved and conjoined with the sphenoid.

Extreme length of skull from the occipital crest to the ends of the nasals, following the curvature, 28 in. Length from the occipital crest to ends of nasals, in a straight line, 26·5 in. Greatest constriction of skull between the zygomatic arches 5 in. Width of inter-orbital space 9·5 in. Width of occipital crest 4·3 in. Least breadth between temporal ridges 2 in. Width of occiput above the condyles 9·5 in. Height of occiput from lower margin of the foramen magnum 7·3 in. Length of nasal apertures 9 in. Smallest diameter of the anterior portion of the septum 0·9 in. Smallest width of septum at the broken margin 0·2 in.

[Note.—The presence of these front and hind portions of the septal partition, with their broken inner margins, the coarsely cancellated bone found in the preceding specimen (see Note to E. 1), and the continuous ridge, lead to the

E. inference that the nares of this species were separated by an osseous division, the coarse structure of the greater part of which contributed to its speedy decomposition; the anterior portions, being of more compact texture, are found generally well preserved. Moreover, the inner edges of the portion of the septum which remain in this and the preceding specimen are jagged and broken, showing no trace of a true natural margin.

The surfaces of the inter-orbital platform and of the posterior portions of the nasals are so slightly rugose in this specimen, that they may be described as nearly smooth, and as affording but small support for the basal attachment of either a nasal or a frontal horn; and as the cranial sutures are all consolidated, this comparative smoothness is not due to immaturity. The skull is of somewhat smaller dimensions than the preceding, and may probably be that of a female.]

3.—Right upper molar (m. 3); the tooth is but slightly worn.

4.—Another ultimate upper molar (m. 3), left side, imperfect, and much worn.

5.—Second upper molar (m. 2), left side. The tooth with its cement is well preserved.

6.—A first upper molar (m. 1), right side. A tooth of a very aged animal, the crown having been well ground.

7.—Part of a right upper premolar.

8.—An exceedingly fine and nearly entire lower jaw, consisting of both rami, and containing the entire series of permanent teeth *in sitû*, with the exception of the second premolar of the left side, of which the alveolus only is preserved. The anterior end of the symphysis is mutilated; otherwise each ramus, with its condyle and coronoid, is perfect. They are firmly connected at the symphysial suture, which is thoroughly consolidated. That the jaw pertained to an aged adult, is shown by the condition of the teeth, for they have all, even the last molars, been well worn. There are two mentary foramina in each jaw.

Length of jaw 19 in. Height of ascending ramus to condyle 11 in. Height of ascending ramus to coronoid 12·5 in. Transverse length of condyles 4·5 in. Length of molar series 9·5 in.

E. 9.—Another fine portion of a lower jaw, comprising both horizontal rami; the symphysis being quite entire, and showing well the broad spatulate form. Both of the ascending rami are wanting, and the alveolar borders of the permanent molars of each ramus are mutilated. The three premolars (pm. 2, 3, and 4) of either side are *in sitû*, as is also the last permanent molar of the left side. The teeth are all much worn.

Combined length of premolars 3·9 in. Length of last molar 2·5 in. Length of left ramus 20 in. Length of symphysis 5·3 in. Greatest width of symphysis 3·2 in.

10.—Fragment of a lower jaw, right side, with the last molar *in sitû*.

11.—Part of a last lower molar (m. 3), left side.

12.—Second left lower molar (m. 2).

13.—First left lower molar (m. 1).

14.—Third right lower molar (m. 3).

15.—Fourth right premolar (pm. 4).

The preceding five teeth have every appearance of having belonged to the same individual.

16.—Crown of a last lower molar (m. 3), right side; the tooth has been well ground.

17.—Left lower premolar (pm. 2), much worn.

18.—Germ of a lower molar, right side.

19.—A similar germ of the left side.

20.—Fragment of lower molar.

21.
22.
23.
24. } Portions of upper molars.

25.—Cervical vertebra. The centrum has the anterior articulation injured; the posterior is well preserved. The anterior left, and both posterior zygapophyses, and also both the neural canals, are present; the neural arch and spine are imperfect.

26.—Cervical vertebra, having the centrum and neural arch in good preservation, the anterior zygapophyses are present, both of the posterior zygapophyses are missing; the neural canal of the left side is preserved, but the lateral processes of both sides are broken.

E. 27.—The seventh cervical; the fragment comprises the centrum and right lateral process.

28.—The first dorsal vertebra of the same individual as the preceding. Centrum, with lateral process and articular depression for rib on left side, in good preservation; the right side is imperfect, and the neural arch is wanting.

29.—The shaft of a left humerus of a full-grown but adolescent animal; the proximal and distal epyphyses had not become consolidated, and are lost.

Length of fragment 11 in. Greatest width at proximal end 6 in. Greatest width at distal end 6 in.

30.—The lower half of a right humerus in excellent preservation.

Length of fragment 11·5 in. Greatest width at distal end 6·4 in. Greatest width of distal articulation 3·7 in. Smallest antero-posterior diameter of distal articulation 2 in.

This bone and the two following are parts of the antebrachium of the same animal.

31.—The right ulna nearly entire; the epyphysis only of the olecranon wanting. All the articular surfaces are perfectly conserved.

Entire length 18 in.

32.—The right radius, having all its parts and articular surfaces in perfect preservation.

33.—A right ulna; the epyphysis of the olecranon and also that of the distal extremity are wanting; the specimen otherwise is in good condition.

Length 15 in.

34.—Another right ulna, also broken at its distal extremity.

Length 14·5 in.

35.—An entire left radius, having the proximal and distal articular surfaces most beautifully preserved.

Length 15 in. Width at proximal end 4 in. Greatest width at distal end 4·4 in. Smallest antero-posterior diameter of shaft 1·5 in.

36.—A nearly perfect right radius, but in bad preservation.

Length 15 in. Greatest width of proximal end 3·9 in. Greatest width of distal end 4·2 in. Smallest antero-posterior diameter of shaft 1·4 in.

37.—Another radius, left side; it is entire, and has the upper and lower articular surfaces most perfectly conserved; it is a little smaller than the preceding, probably that of a female.

Greatest length 14·5 in. Greatest width of proximal end 3·6 in. Greatest width of distal end 4·3 in. Smallest antero-posterior diameter of shaft 1·4 in.

38.—Left unciforme.

E. 39.—Right scaphoides.

40.—Proximal half of the second left metacarpal; the articular surfaces are well preserved.

41.—The third left metacarpal in good preservation.

Length 7·5 in. Greatest width at distal end 2·3 in. Greatest width at proximal end 2 3 in. Smallest antero-posterior diameter 0·8 in.

42.—A left femur, showing the head with the depression for the ligamentum teres; the shaft, with the third trochanter aud the condyles, in perfect preservation. The great trochanter is imperfect.

Length of specimen 19 in. Greatest diameter of head 3·6 in. Greatest transverse diameter of shaft below the head 6·2 in. Greatest transverse diameter of distal end of shaft 5·6 in. Smallest antero-posterior diameter of shaft near proximal end 1·7 in.

43.—Distal end of right femur, showing the condyles and the anterior articulation for the patella, in good preservation. The third trochanter is detached, the portion of the shaft from which it sprung having been lost. This fragment is in the same mineral condition, and its articulations so exactly fit those of the tibia next described that there can be no doubt but that they formed part of the same limb of the same animal.

44.—A nearly entire right tibia; the articular surfaces of the proximal extremity are in good preservation; the anterior tuberosity is wanting. The distal articulations are quite entire; a portion of the distal extremity of the fibula is present, and is anchylosed to the tibia. The lower portion of this bone is remarkable as showing a state of disease, producing considerable exostosis of its surface.

Length of specimen 15·5 in.

45.—A most entire left tibia, showing the upper and lower articulations, and all perfectly preserved.

Length 15·5 in. Width of upper end 5·1 in. Width of lower end 3·7 in.

46.—Distal end of left tibia, with the articulations entire.

47.—A mutilated left tibia. The shaft and all the articulations are more or less injured.

48.—A nearly perfect left calcaneum.

49.—The second metatarsal, left side, quite perfect.

50.—Another second left metatarsal.

51.—Third right metatarsal, perfect.

E. 52.—A left third metatarsal, entire.

53.—A right fourth metatarsal, wanting distal extremity.

54.—Another right fourth metatarsal, also wanting distal extremity, and otherwise in bad preservation.

55.—Second phalanx of the third digit.

56.—Ungual phalanx of the fourth (?) digit.

The following additional specimens were discovered and some obtained after the preceding portion of the Catalogue had been prepared.

57.—A fine specimen of the crown of an upper second molar (m. 2), of the right side. The tooth is entire, and had just come into wear.

58.—A part of a last upper milk-molar (d. m. 3), right side.

59.—A last lower molar (m. 3), left side. The fangs are lost, but the crown is in good condition.

60.—Left lower molar (? milk-molar); the crown well worn.

61. } Portions of two molars of the left and right sides, and
62. } apparently of the same individual.

63.—Part of a lower molar.

64. } Portions of lower milk-molars.
65. }

66.—Right lunare, showing all the articulations.

67.—A left lunare, with articulations entire.

68.—A left magnum.

69.—Another left magnum.

70.—Right cuneiforme, entire.

71.—Left cuneiforme, imperfect.

72.—Head of femur, right side. It probably belongs to the specimen numbered 42.

73.—A posterior dorsal (?) vertebra, showing the centrum, neural arch and spine, and the lateral processes; a portion of the spine is wanting.

74.—A first lumber vertebra, with the exception of the terminations of the dorsal and lateral processes, which are wanting; the specimen is entire. It probably belonged to the same animal as the preceding.

75.— A nearly perfect dorsal vertebra. The articular surfaces are all well preserved, and the neural spine is short and straight, with broad lateral surfaces.

E. 76.—Vertebra, the first lumbar (?) of a young individual; the epyphyses are wanting, and all the processes are broken. This fragment and the next specimen were found associated, and probably belonged to the same animal.

77.—Portion of the sacrum, showing the second vertebra and part of the third, the neural arches are preserved, but the summits of the spines are broken.

RHINOCEROS MEGARHINUS, Christol.

F. 1.—The first upper molar (m. 1), right side; the tooth is nearly perfect, and much worn.

2.—Premolar four (pm. 4), right side; the specimen is entire, but well worn.

3.—The left upper second molar (m. 2), nearly perfect.

4.—The crown of the fourth left premolar (pm. 4)

[Note.—These four specimens were found at the same time, and the wear and condition of the teeth show that they belonged to an aged animal, and were parts of the same dental series.]

5.—The right and left rami of the lower jaw, in good preservation. The right ramus has the two last premolars (pm. 3 and 4), and the three permanent molars in place; the left ramus contains the last premolar only, and the three permanent molars. The symphysial ends of each are wanting, and also the condyles and coronoids. The broad border of the posterior angle of the right ramus is nearly entire. It shows deep rugosities on its outer margin. This portion of the left ramus is not so perfect.

Length of molars 6·2 in. Length of two premolars 3·2 in. Length of right ramus 20 in.

6.—The second upper premolar, left side of an aged animal; the crown of the tooth is very much abraded.

7.—The crown of a last lower molar (m. 3), left side; the tooth is worn.

RHINOCEROS TICHORHINUS, Cuvier.

G. 1.—Part of the third upper premolar (pm. 3), left side.

2.—The greater part of the left ramus, and part of the right symphysis of a lower jaw. The teeth are all wanting, but

G. the empty alveoli are present; the dentary border being more or less broken. The jaw is broken at the angle, and the coronoid process is wanting. There are three mentary foramina on the left side, and two on the right.

Entire length of the fragment 20 in.

[NOTE.—The late Dr. Falconer, a short time previous to his death, determined the species of this specimen, and the label attached to it is in his own handwriting.]

EQUUS FOSSILIS, MEYER.

H. 1.—A fine fragment of the cranium; it comprises the nasals and nearly the whole of the skull above the post-orbital processes of the frontals. The frontals and parietals are present, but somewhat imperfect; the right post-orbital process with the super-orbital foramen are preserved. The occiput, foramen magnum, basi-occipital and right occipital condyle are entire; the left condyle is broken. The tympanic bones with the auditory canals, and the zygomatic arches on each side, are preserved; the paramastoids are imperfect. The jugals, maxillæ, and palate are entirely wanting.

Length from occipital ridge to anterior end of nasals 19 in. Height of occiput from lower border of occipital foramen to summit of occipital ridge 4·2 in. Height of occipital foramen 1·5 in. Greatest breadth of cranium between roots of zygomatic processes 5·2 in. Width between the extreme points of the squamosals 9 in.

2.—The first upper molar (m. 1), left side.

3.—The second upper molar (m. 2), left side.

4.—The second left upper premolar (pm. 2).

5.—A right upper premolar.

6.—Part of a right upper molar.

7.—Part of a left upper molar.

8.—The perfect series of molars of the right mandible, with a portion of the jaw attached. The teeth have been subject to much abrasion, and have belonged to a horse of small size.

Entire length of molar series 7·6 in. Length of the three molars 3·7 in. Length of the three premolars 3·9 in.

9.—A fragment of a left lower jaw, showing the second, third, and fourth premolars *in sitû;* the surfaces are well worn.

Length of molars 3·7 in.

10.—Last right lower molar (m. 3).

11.—First molar (m. 1), right side.

H. 12.—A lower milk-molar.

13.—Another lower milk-molar.

14.—The first sacral vertebra; the neural arch and posterior articulation are imperfect.

15.—Part of a left scapula; the glenoid cavity is quite perfect, and the acromion is well preserved.

Entire length of fragment 14·5 in. Greatest diameter of glenoid cavity 2·6 in. Smallest diameter of glenoid cavity 2·2 in. Greatest diameter of the distal end, including the anterior tubercle, 4·4 in.

16.—A left radius, showing the distal extremity entire, with anchylosed portions of ulna; the proximal articulate surfaces are imperfect; the shaft is partly restored.

Length 14 in.

17.—A quite entire right metacarpal.

Length 9·3 in.

18.—A left metacarpal, nearly perfect.

Length 9·5 in.

19.—Another nearly perfect left metacarpal.

Length 9·6 in.

20.—An imperfect left metacarpal.

Length 9·3 in.

21 and 22.—First phalanges, nearly perfect.

23.—Second phalanx.

24.—Fragment of the right os innominatum, comprising the entire acetabulum and portions of the pubis and ischium; the ilium is wanting.

25.—The distal end of a right femur; the inner condyle is present and perfect; the right is broken.

26.—An entire shaft of a right tibia, the proximal and distal epyphyses are wanting.

Length of fragment 10 in.

27.—Right astragalus.

28.—The right metatarsal, having the proximal and distal extremities nearly entire.

Length 10·8 in.

29.—Another right metatarsal of an adult animal, but of smaller proportions than the preceding. The distal articulations are missing.

Length 9 in.

30.—A left metatarsal; the distal articulations are perfect; the proximal, imperfect.

Length 11 in.

H. 31.—Another left metatarsal in similar preservation, but of larger proportions than the preceding.

Length 11·5 in.

32.—Phalanx; the distal end broken.

33.—A fine and nearly perfect pelvis. The first and part of the second sacral vertebræ and the neural spines are imperfect. The ossa innominata show the acetabula, ischia, and pubes in good preservation; the ilia are not so entire, having lost their superior borders and portions of the bodies.

34.—A right humerus; the specimen shows the proximal half of the shaft and the extremity incomplete. The scapular articulations or head, and the distal half with the ulnar and radial articulations, are quite perfect.

MEGACEROS HIBERNICUS, Owen.

I. 1.—A fine fragment of the right ramus of the lower jaw. It shows the second and third molars *in sitû*, and the empty alveoli of the first molar and of the third and fourth premolars. The condyle is imperfect, but the coronoid is entire; the symphysis is wanting.

2.—The dental portion of a right ramus, showing the fourth premolar, and the first, second, and third true molars in place. The teeth are all well preserved, and had been subject to but little abrasion.

3.—The right humerus, having the shaft and distal extremity quite perfect; the scapular articular surface is preserved; but the great tuberosity is wanting, and the proximal end is otherwise imperfect.

Length 12·5 in. Greatest diameter of distal articular surface 3·8 in. Smallest antero-posterior diameter 1·6 in. Smallest width of body 2·1 in. Smallest antero-posterior diameter of body 2·4 in.

4.—A distal half of a left humerus, not perfect.

5.—The left scaphoid.

6.—The distal half of a right humerus; it comprises the larger portion of the shaft, and the ulnar and radial articular surfaces are well conserved.

7.—The distal half of a left humerus, having all the articular surfaces quite perfect.

CERVUS ELAPHUS, Linnæus.

K. 1.—A portion of both frontal bones.

2.—Part of the basi-occipital.

3.—A portion of the maxillary, and last upper molar (m. 3) of the right side.

4.—A last lower right molar (m. 3).

5.—A last lower left molar (m. 3).

6.—A very fine and nearly perfect shed antler of an animal of full adult age; it is of the right side, and shows the entire beam and the proximal half of the brow antler or tyne, the tip being broken; the tynes of the second (bez-antler) and third (antler royal) are whole, and the crown, of which five tynes are present, one or more having been lost, is well preserved. Its dimensions are:

Greatest length in a straight line from the burr to the highest point of the crown 37·5 in. Length following curvature from the burr to the highest point of the crown 39·5 in. Greatest length of bez-antler 16·3 in. Greatest length of antler royal following curvatures 12 in. Greatest spread of crown in a straight line from tip to tip of tynes 19 in. Greatest width of crown below the tynes 9 in. Circumference above the burr 7·5 in.

7.—Another shed antler, showing the crown, with two tynes, and the brow and third tynes entire, the second tyne is broken. The size of the antler and the number of tynes indicate that it was shed by a young stag in its fifth or sixth year.

8.—The proximal portion of a shed antler; the fragment is remarkable as having the bez-antler very short, and it is situated midway between the brow and royal antlers; all three are in close proximity to each other; the entire length of beam preserved is only ten inches; all the upper portion of the antler is missing. The tynes are all perfect.

9.—A fine fragment of a fine unshed right antler; all above the antler royal is wanting; only the bases, which are close together, of the brow and bez-antler remain.

Length of fragment 21 inches.

10.—Part of the beam of the left antler of the same individual as the preceding; it is broken below the third tyne, and both of the lower tynes are wanting.

11.—The base of a shed antler in which the brow tyne is entire, but the second tyne is broken.

12 and 13.—The bases of the unshed antlers, attached to portions

K. of the frontals, of the same individual; the tynes are broken in each specimen.

14.—The base and shaft of a shed antler of a young animal; both tynes are broken.

15.—A shed antler, wanting the crown, of a young animal; the three tynes have been cut at their bases with a sharp instrument. I question if this specimen was found in the *brick-earth* at Ilford.

16.—Three burrs of shed antlers.

17.—Various fragments of shafts and tynes of antlers.

18.—The fifth cervical vertebra, showing the neural arch and vertebral canals entire; the neural spine and the lateral processes are imperfect.

19.—The sixth cervical vertebra; the lateral processes are imperfect, and the pleurapophyses are wanting.

20.—The anterior dorsal vertebra of the same individual as the preceding; it is imperfect, but all the articular surfaces are entire.

21.—A lumbar vertebra; the neural and lateral processes are imperfect, but all the anterior and posterior articulations are entire.

22.—A posterior lumbar vertebra, nearly entire. The left prezygapophysis and neural spine are wanting.

23.—The distal half of a right humerus; the articular surfaces are in bad preservation.

24.—The left ulna, showing olecranon and humeral articulations entire.

25.—A right radius, showing the humeral and ulnar articulations entire, but those of the lower extremity are wanting. The lower portion of the conjoined ulna is present.

26.—The lower extremity of a left radius, with perfect carpal articulations.

27.—Another lower portion of a left radius in same state of preservation as the preceding.

28.—An entire right metacarpus.

Length 10·3 in. Width of proximal end 1·8 in. Width of distal end 2 in.

29.—Part of a left os innominatum: it comprises the acetabulum and a part of the ilium. The specimen is interesting as

K. showing the sutures of the three bones which compose the pelvis, and although this is apparently that of a full-grown animal, yet the sutures have not been completely obliterated.

30.—The distal epyphysis of a right femur, having its articular surfaces entire.

31.—The right tibia, it wants the anterior tubercle, otherwise the specimen is quite entire.

32.—A right astragalus.

33.—Same.

34.—Same.

35.—Left astragalus.

36.—Same.

37.—A right calcaneum: it is entire, with the articular surfaces well preserved.

38.—Another right calcaneum, also entire.

39.—Same.

40.—A perfect right metatarsal.

Length 11·2 in. Width of proximal articulations 1·4 in. Width of distal articulations 1·9 in.

41.—A nearly entire right metatarsal; it wants the inner trochlea, and the upper articular surfaces are also imperfect.

Length 11·2 in.

42.—A left metatarsal, imperfect.

Length 10·7 in. Width of upper articular surfaces 1·4 in. Width of lower articular surfaces 1·7 in.

43.—Another left metatarsal; the distal extremity is entire, but the proximal end is imperfect.

Length 10·7 in. Width, proximal articulation, 1·8 in.

44.—A first phalanx.

45.—Same.

46.—A second phalanx.

47.—An ungual phalanx.

48.—A fragment of the os innominatum.

49.—Part of the os innominatum of a young animal, consisting of the acetabulum and part of the ilium. The fragment shows the iliac, pubic, and ischiac sutures which have not been completely anchylosed. It belonged to a much younger individual than No. 29, which also shows the same characters.

50.—A dorsal vertebra; with the exception of the distal portion of the neural spine, the specimen has all its parts entire.

CERVUS, SPECIES UNDETERMINED.

L. 1.—Part of a frontal bone with a long pedicle, having the basal portion of the antler attached; it is erect and tapering, and has no tynes; the upper portion is lost. The antler seems too robust and the pedicle too long for the pricket, or first antler of the Red Deer.

Shortest length of pedicle 2·1 in. Length of antler 4·5 in. Greatest diameter above the burr 1·3 in. Smallest diameter above the burr 1 in. Greatest diameter at the fractured end 1 in. Smallest diameter at the fractured end 0·8 in.

The missing portion was probably much longer than the part preserved.

2.—A mutilated centrum of a cervical vertebra.

3.—A dorsal vertebra.

4.—The centrum of a dorsal vertebra.

5.—A series of eight consecutive vertebræ of a species of Cervus much smaller than the Red Deer; the series comprise the last three dorsals and five lumbar, the centre of all, and most of the articular surfaces are entire; but the dorsal and lateral processes are all more or less broken.

6.—The centrum of a lumbar vertebra.

7.—A portion of a sacrum, but very imperfect.

8.—A right humerus, wanting the proximal end; the shaft is partly restored, but the distal extremity is perfect.

9.—An entire right metacarpal.

Length 9·6 in. Width of proximal end 1·5 in. Width of distal end 1·7 in.

10.—An entire left metacarpal.

Length 9·6 in. Width of proximal end 1·5 in. Width of distal extremity 1·7 in.

11.—Fragment of the os innominatum.

12.—Part of the os innominatum.

13.—The perfect astragalus of a small deer about the size of the Roebuck, and probably referable to that species, although we have no evidence that the antlers have ever been found at Ilford.

BISON PRISCUS.

M. 1.—A superb upper portion of the skull of a large bull; it consists of the frontals with both horn cores, the occiput, condyles and basi-occipital, the right zygoma, orbital bones,

M. and the glenoid cavities; all these are absolutely perfect. Only a part of the left orbit is present, and the zygoma is wanting; the foramen magnum is entire. The dimensions of this fine specimen are:

Width of frontals between the horn cores 13 in. Width of face at the upper edge of the orbits 16 in. Length of right horn core, outer curve, 24·5 in. Greatest diameter of horn core at base 5·5 in. Antero-posterior diameter of core 4·4 in. Height from lower edge of orbit to occipital ridge 16 in. Width of occipital ridge between temporal fossæ 9·2 in. Height from margin of foramen magnum to occipital ridge 5 in. Width of condyles including foramen magnum 5·7 in. Length in a straight line from tip to tip of horn cores 39·5 in.

2.—An entire left horn core and part of the frontal bone of a much smaller animal, probably a female.

Length of core, outer curve, 10 in.

BISON (?).

3.—A left humerus, wanting the proximal extremity; it comprises the greater portion of the shaft and the distal articulations; the latter quite entire.

I refer this specimen, but with some reservation, to the *Bison*, as it differs from the humerus of *Bos giganteus* in the longer and more slender proportions of the shaft, agreeing in this respect with the humerus of the Lithuanian Bison in the British Museum: although the fossil is much larger than the humerus of the recent skeleton, yet the relative proportions of the two bones are the same. I also refer all of the following bones to the Bison, as they agree in their general character and proportions with the corresponding bones in the skeleton of the Bison above referred to.

4.—A right radius, showing the proximal articulations complete; the distal epyphysis is wanting.

Greatest length 11·4 in. Width of proximal articular surface 3·5 in. Smallest width of shaft 1·9 in.

5.—Proximal extremity of another right radius, with perfect articular surfaces.

Width of proximal articular surface 3·5 in. Antero-posterior diameter 1·7 in.

6.—Left lunare.

7.—Left lunare.

8.—Left cuneiforme.

9.—The left unciforme.

M. 10.—The left magnum and trapezoides, imperfect.

11.—The left scaphoid.

12.—The left metacarpal, perfect.

Length 9·7 in. Width of proximal articular surface 3 in. Greatest antero-posterior diameter of proximal articular surface 1·7 in. Width of distal extremity 3 in. Greatest antero-posterior diameter of a single trochlea 1·6 in. Smallest width of shaft 1·7 in. Smallest antero-posterior diameter of shaft 1·3 in.

13.—A left metacarpal, nearly entire.

Length 9·3 in. Width of proximal articulations 3·1 in. Greatest antero-posterior diameter of proximal articulations 1·7 in. Width of distal end 3 in. Smallest width of shaft 1·7 in. Smallest antero-posterior diameter of shaft 1·2 in.

14.
15. } Left metatarsals.

16.—The right tibia, showing distal articulations quite perfect; the proximal articular surfaces and the anterior tubercle are imperfect.

Length 11·3 in. Width of proximal articular surface 3·8 in. Greatest width of distal end 2·9 in. Transverse diameter of distal articulations 2·1 in. Smallest antero-posterior diameter 1·1 in.

17.—Another right tibia, and in a similar state of preservation as the preceding.

18.—A right tibia, articular surfaces imperfect.

19.—Right astragalus.

20.
21. } Right astragali.
22.

23.—Left astragalus (? Bison).

24.—Right scapho-cuboid.

25.—Left scapho-cuboid.

26.—Right metatarsal.

27.—Left metatarsal; the distal end below the nutritive foramen is wanting.

28.—The left metatarsal, very perfect.

29.—A left metatarsal, also perfect.

30.—Another left metatarsal; the proximal articular surfaces are imperfect.

31.—A very perfect left metatarsal.

32.—A right unciforme of Bison (?).

BOS GIGANTEUS, Owen (ms.).

Bos primigenius, Bojanus.

N. 1.—A superb and nearly entire cranium, and probably the only specimen from the Ilford deposits in which the whole of the face has been preserved, with each bone in its natural position, and uncrushed or distorted. It thus affords a most valuable example of the skull of this Ilford race of large Oxen for comparison with the skulls of the true *Bos primigenius* found in bogs, turbaries, and other comparatively modern deposits. It comprises the entire frontals, with both horn cores, the nasals, lachrymals, and the premaxillaries. The alveolar portion of the maxillaries, the palate, and the whole of the teeth are wanting. The eye-orbits are entire, and the right zygoma nearly so; the left is wanting; the glenoid cavities are present. The occipital region and the temporal fossæ are nearly perfect; the condyles, foramen magnum, and basi-occipital are quite perfect. The horn cores have an outward and forward curvature, their points curving a little inwards and upwards. This character is common to all the horns from Ilford (of which there is a fine series in the collection), and also to the typical *Bos primigenius*. They are all of large and nearly uniform size, allowing for sexual differences. This fine fragment affords the following dimensions:

Length of face from the occipital ridge to the extreme ends of the premaxillaries 29 in. Length of face from occipital ridge to the end of nasals 23·5 in. From occipital ridge to orbits 12 in. Width of frontals between the horns 11·5 in. Width between the orbits 13·5 in. Length of horn core, outer curve, 36 in. Length of horn, inner curve, 25·5 in. Vertical diameter of horn at base 6·2 in. Antero-posterior diameter of horn at base 4·4 in. Circumference 17 in. Extreme length of horns including occipital ridge 78 in. Span of horns from tip to tip 28 in. Breadth of occipital condyles 5·8 in.

2.—Various portions of a fine skull, which when discovered was nearly entire, but it was irreparably broken in its removal from Ilford. The parts preserved comprise the upper portions of the frontals, with the combined horn cores, the extreme tips of which are lost, a large portion of the occiput, with the condyles and basi-occipital entire. The foregoing are all united, and form one fine fragment. The orbits are preserved, but detached. Portions of the maxillaries having the last molars (m. 2 and 3) of either side in place,

N. and also portions of the premaxillaries, palate, and palatine bones, are preserved and joined together.

Combined length of horns, including occipital ridge, outer curve, 69 in. Circumference of horns at base 16·5 in.

3.—A pair of horn cores, the frontals are wanting.

Length of left horn core, outer curve, 38 in. Greatest circumference of right horn 17·5 in. Span in a straight line from tip to base 30 in.

4.—Upper portion of cranium, comprising the frontals with both horn cores and the occipital condyles entire; the supra-occipital and ex-occipitals are somewhat imperfect.

Extreme length of combined horns and frontals 90 inches. Length of left horn core 38 in. Greatest circumference of left horn 19 in. Span in a straight line from tip to tip of horns 34 in.

5.—Horn cores, with imperfect frontals; the occiput and both condyles are entire.

Extreme length of combined frontals and horns, outer curve, 76 in. Length of left horn 33 in. Greatest circumference 17 in. Span from tip to tip of horns 32 in.

6.—Frontals, with horn cores, having the occiput and condyles entire.

Extreme length of horns and frontals, outer curve, 86 inches. Length of horn 38 in. Circumference at base 18·5 in. Span of horns between the tips 40 in. Width of occipital ridge 11 in.

7.—Frontals and horn cores; the occiput, condyles, and basi-occipital are present.

Extreme length of horns and frontals, outer curve, 84 in. Length of horn 36 in. Circumference of horn at base 18 in. Width of frontals between the horns 11 in. Span of horns between the tips 25 in.

8.—Horn cores and the upper portion of the frontals; the anterior end of the right horn is wanting.

Extreme length of horns and frontals, outer curve, 79 in. Length of horn 34 in. Circumference of horn at base 18 in. Width of frontals between the horns 11 in. Span of horns between the tips 32 in.

9.—Frontals and horn cores, with entire occiput, occipital, condyles, and basi-occipital.

Extreme length of combined horns and frontals, outer curve, 71 in. Length of left horn, outer curve, 31 in. Circumference of horn at base 18 in. Width of frontals between the horns 9 in. Span of horns between the tips 33 in.

10.—Frontals and horn cores; the anterior end of the right horn is lost; the occiput, occipital condyles, and basi-occipital are present.

Extreme length of combined frontals and horns, outer curve, 72 in. Length of horn, outer curve, 32 in. Circumference of horn at base 15 in. Width of frontals between the horns 9 in. Span of horns between the tips 34 in.

11.—A fine fragment of the cranium. It comprises the frontals

N. and the post-orbital processes and supra-orbital fissure, and also the squamosals. The foramen magnum, occipital condyles, and the basi-occipital are entire. The supra-occipital is imperfect, and both horn cores are wanting.

12.—Upper portion of the cranium, showing the frontals, and part of the left horn core; the anterior third is lost; the right horn is entirely wanting. The occipital ridge, occiput, occipital condyles, and the basi-occipital are perfect.

13.—An entire right horn core.

14.—Another entire right horn core.

15.—Anterior portions of a pair of horn cores.

16.—Portion of horn core.

17.—Ditto.

18.—Ditto.

19.—Ditto.

20.—Part of the right premaxillary.

21.—Anterior portion of right premaxillary.

22.—The left jugal and part of the orbit.

23.—The basi-occipital.

24.—Occipital condyles and basi-occipital, imperfect.

25.—The upper dental series of three molars and three premolars of the left side, and the three molars of the right side of the same individual.

26.—The last or third upper molar (m. 3), left side.

27.—Ditto.

28.—Ditto.

29 to 31.—Second upper molars (m. 2), left side.

32.—First left upper molar (m. 1).

33 and 34.—Upper molars, much worn.

35.—Left premolar (pm. 3).

36.—Left fourth premolar (pm. 4).

37 and 38.—Second upper molars (m. 2), right side.

39.—The third right upper molar (m. 3).

40.—A nearly entire right ramus of the lower jaw, wanting the coronoid process. Five teeth are *in situ*, the second premolar is wanting, but its empty alveolus is present. The teeth are all well abraded, indicating an aged animal.

Length of the jaw from anterior end of the symphysis to the posterior curve 19 in. Combined length of the five teeth 6 in., including the alveolus of the missing tooth 7 in.

N. 41.—The right ramus of a lower jaw; the anterior end of the symphysis and the coronoid process are wanting. The last premolar and the three true molars are in place; the empty alveoli of the second and third premolars are present.

Length of fragment 18 in. Length of the alveolar border 7 in. Combined length of the four teeth 5 in.

42.—A nearly perfect right lower jaw; the coronoid is present, but part of the condyle is wanting. The last two molars are in place.

Length 19·5 in.

43.—A right lower jaw. The symphysis and ascending ramus, with the condyle and coronoid process entire. The third and fourth premolars and the three true molars are *in sitû*; they are all much worn. The alveolus of the second premolar is completely filled up with bone. The alveoli of the incisors are shown, but imperfectly preserved.

Length of the jaw 19 inches. Combined length of the five molars 6 in.

44.—Part of the right ramus of a lower jaw, wanting symphysis and coronoid process. The last premolar and the three molars are *in sitû*; the fangs of the second and third premolars are in their respective alveoli.

Length of the four teeth 5·5 in.

45.—Part of the right ramus of the lower jaw; it contains the three molars and the third and fourth premolars *in sitû*. The symphysis, which is nearly perfect, shows the alveoli of the first and second incisors. The teeth are all very much worn. The jaw is broken behind the ultimate molar, and is interesting as showing that the bone had been injured in front of the first molar during the life of the animal, and had subsequently healed.

Length of the series of teeth 6·2 in.

46.—Anterior portion of a right lower jaw; it contains the series of three molars in place. The symphysis is imperfect, and the ramus is broken behind the ultimate molar.

Length of molars 4·4 in.

47.—The nearly perfect ramus of a lower jaw, left side. The coronoid process and the symphysial alveoli of the incisors are deficient. The molars are present, but the premolars are wanting.

Length of jaw 18·5 in. Length of the three molars 4·3 in.

N. 48.—Part of a left ramus of the lower jaw, wanting the symphysial end, but showing the entire condyle and coronoid process, and the three molars in place; the premolars are wanting.

Length of jaw 16·5 in. Length of molars 4·5 in.

49.—The left ramus of a lower jaw. The condyle is entire, but the coronoid process is wanting, and the jaw is also broken at the posterior angle. The second and third molars are present.

Length of jaw 18 in.

50.—Part of a left ramus of a lower jaw; it comprises the dentary portion of the horizontal ramus, and the ascending ramus with the condyle and coronoid process. The molars are *in situ*, and they indicate that the jaw is that of a very aged animal, for the crowns of the second and third molars are nearly worn away.

51.—The posterior portion of a lower jaw, left ramus. The condyle is present, and the ultimate molar in place.

52.—The anterior portion of a left lower jaw; all behind the last premolar is deficient. The diastema and symphysis, with the alveoli of the incisors, are perfect; and the third premolar is present. This fragment and the preceding are probably portions of the same jaw.

53.—A series of five molars,—the two last premolars and the three molars,—with a portion of the jaw, left ramus.

Combined length of molars 6·2 in.

54.—Fragment of a left lower jaw. The teeth are broken, but the fangs are in their alveoli.

55.—Condyle of right lower jaw.

56.—A fragment of a left mandible, with the second molar in place.

57 to 63.—Detached lower molars, right side.

64 and 65.—Detached lower fourth premolars, left side.

66 to 71.—Detached left lower molars.

72 to 77.—Detached third lower molars, left side.

78.—Germ of lower molar.

79.—Germ of left molar three.

80.—Portions of molars.

81.—Condyle of lower jaw.

N. 82.—Atlas, nearly entire. The articular surfaces and the foramina are perfect. A portion of the left lateral process is wanting.

83.—An atlas, wanting part of the right lateral process. The articular surfaces are not well preserved.

84.—Atlas, showing the occipital articulations entire; part of the right axial articulation and the lateral process wanting.

85.—Another atlas, but in a bad state of preservation.

86.—A fine and nearly entire axis; the left lateral process is wanting.

87.—The axis, showing the body and fore and hind articulations and the neural arch in very good preservation. The distal end of the spinal process and the lateral processes are broken. The vertebral foramina are present.

88.—Another axis, in nearly as good preservation, and wanting the same parts as the preceding.

89.—The third cervical vertebra, showing the body with the anterior and posterior articulations; the neural arch and the canals on either side for the neural arteries entire. The right diapophysis and the pleurapophyses are wanting.

90.—Another third cervical vertebra. The specimen wants the neural spine, and the diapophyses are also imperfect.

91.—A third cervical vertebra; the body wants the fore and hind epyphyses, both lateral processes, and also the neural spine.

92.—The fourth cervical vertebra, a fine example, and showing all the articulations and the processes entire.

93.—The fourth cervical vertebra; the lateral processes (diapophyses) are imperfect, and the neural spine is wanting.

94.—Another fourth cervical vertebra, with the neural and lateral processes imperfect.

95.—Part of a fourth cervical vertebra.

96.—Part of a fourth cervical vertebra.

97.—The fifth cervical vertebra; it is imperfect, the anterior epyphysis and the lateral processes are wanting.

98.—The fifth cervical vertebra, much mutilated.

99.—A portion of another fifth cervical vertebra; it shows the centrum and the vertebral canals.

100.—A nearly entire sixth cervical vertebra, the left pleurapophysis only wanting.

N. 101.—The sixth cervical vertebra. It shows the neural arch and spine, and the pre- and post-zygapophyses entire; the diapophyses are imperfect, and the pleurapophyses and the fore and hind epiphyses of the centrum are wanting.

102.—Part of a sixth cervical vertebra.

103.—The seventh cervical vertebra; the pre-zygapophyses and the lateral processes are imperfect, and the neural spine is wanting.

104.—An anterior dorsal vertebra, nearly perfect; the neural spine, although broken at its distal end, is fifteen inches long.

105.—An anterior dorsal vertebra, in good preservation. The neural spine is broken.

106 to 108.—Anterior dorsal vertebræ, more or less imperfect.

109 to 112.—Four dorsal vertebræ, and most probably of the same individual. They all show considerable disease or exostosis of the centra.

113 to 116.—Dorsal vertebræ, all more or less imperfect.

117 and 118.—Posterior dorsal vertebræ.

119 and 120.—Posterior dorsal vertebræ.

121.—A nearly entire lumbar vertebra, but wanting the lateral processes.

122.—A mutilated lumbar vertebra.

123.—A lumbar vertebra. The neural and lateral processes broken.

124.—The last lumbar vertebra, nearly entire, the left lateral process wanting.

125.—The last lumbar vertebra; the centrum, the neural arch, and all the articular surfaces are perfect; but the processes are all broken.

126.—Another last lumbar vertebra, and in exactly the same state of preservation as the preceding.

127.—A lumbar vertebra. The centrum, neural arch, and the pre- and post-zygapophyses are perfect; the lateral and spinal processes are imperfect.

128.—A nearly entire last lumbar vertebra and sacrum of the same individual. The sacrum shows five anchylosed vertebræ, of which the first and part of the second have lost the neural arch and spine. The other vertebræ are nearly entire.

Length of the sacral vertebræ 12 in. Anterior width of centrum and lateral processes 12 in. Greatest height of spinal processes 4·4 in.

N. 129.—The greater portion of a right scapula. The glenoid cavity is entire; the spine is imperfect, and the posterior upper angle of the body is broken.

Extreme length of specimen 21 in. Greatest diameter of glenoid cavity 3·3 in. Smallest diameter 2·5 in.

130.—The lower portion of a right scapula, showing perfect glenoid cavity.

131.—The lower portion of a left scapula, with imperfect glenoid.

132.—Another fragment of a left scapula, very much mutilated.

133.—A fine right humerus, a portion of the anterior tubercle is missing, otherwise the bone is quite perfect.

Extreme length 17·5 in. Greatest diameter of head 4·5 in. Smallest diameter 3·8 in. Width of distal articular surface 4·8 in. Smallest antero-posterior diameter 2·1 in.

134.—The left humerus; it is of the same size, but not so perfect as the foregoing. The great trochanter and the anterior tubercle wanting.

Width of distal articular surface 4·5 in. Smallest antero-posterior diameter 1·9 in.

135.—The left humerus. The head and distal extremity are perfect; the great trochanter, the anterior tubercle, and a part of the shaft are wanting.

Length of fragment 14·5 in. Width of distal articular surface 4·4 in.

136.—Another left humerus; it is in the same state of preservation, and also of the same size as the preceding.

137.—The distal half of a left humerus, with the articular surfaces perfect.

138.—An imperfect distal half of a left humerus.

139.—Distal end of a left humerus, articulations entire.

140.—A distal end of the left humerus, articulations perfect.

141.
142.
143.
144. } Distal ends of left humeri, more or less imperfect.

145.—The proximal half of the right ulna, showing the humeral articulation quite perfect; the olecranon is imperfect.

146.—The proximal end of the left ulna with entire olecranon, but humeral articulations imperfect.

147.—Another imperfect left ulna.

148.—An imperfect proximal end of the right ulna.

149.—A very imperfect right ulna.

N. 150.—A fine and entire left radius, with the conjoined shaft of the ulna; the olecranon and sigmoid cavity are wanting. This is the largest radius of *Bos* in the collection, and its dimensions are:

Length of radius 15·5 in. Width of proximal articulation 4·6 in. Width of distal articulation, including the ulna, 4·5 in. Width of upper end of the shaft 3·8 in. Smallest width of shaft (middle) 3·1 in. Smallest antero-posterior diameter of shaft 1·7 in. Width at distal end of shaft, above the articular surfaces, 4·7 in.

151.—A nearly perfect ulna and radius of the left side, and a little smaller than the preceding.

Extreme length of ulna 19 in. Length of radius 14·5 in. Width of proximal articulation 4·3 in. Width of distal articulations of the confluent radius and ulna 4·2 in. Smallest width of shaft 2·8 in. Smallest antero-posterior diameter of shaft 1·6 in.

152.—A right ulna and radius, of nearly the same size as the preceding; the surface of the bone is badly preserved.

153.—A nearly perfect left radius.

Length 15 in.

154.—Another left radius, with part of the shaft of the conjoined ulna. The upper articulations are quite entire, but the distal extremity is imperfect.

Length 15 in. Width of proximal articulation 4·2 in.

155.—A quite perfect right radius and shaft of ulna; the latter has lost the olecranon and the sigmoid cavity, but the distal articulation is perfect.

Length of radius 14·5 in. Width of proximal articulation 4·4 in. Smallest width of shaft 2·8 in. Width of distal articulation 4 in.

156.—A left radius with the attached shaft of the ulna.

157.—Right os scaphoides.

158.—Left os lunare.

159.—Left os cuneiforme.

160.—Ditto.

161.—Ditto.

162.—The right os magnum and trapezoide.

163.—A quite entire left metacarpal. It is the longest metacarpal in the collection, and is probably that of a bull.

Greatest length 10·4 in. Smallest width of shaft 2·2 in. Smallest antero-posterior diameter of shaft 1·5 in. Width of proximal articulation 3·6 in. Width of distal articulations 3·7 in.

164.—A perfect right metacarpal.

Greatest length 10 in. Smallest width of shaft 2·2 in. Smallest antero-posterior diameter of shaft 1·4 in. Width of proximal articulation 3·6 in. Width of distal articulation 3·7 in.

N. 165.—Another entire right metacarpal. This specimen and also the next three closely correspond in their dimensions with the preceding.

166.—An imperfect right metacarpal.

167.—A left metacarpal; the specimen is not well preserved.

168.—A nearly perfect right metacarpal.

169–182.—First phalanges.

183–192.—Second phalanges.

193–202.—Ungual phalanges.

203.—A fine fragment of the sacrum and pelvis. It comprises considerable portions of the ilium, ischium, and pubis of each side. The left ilium is nearly entire; the posterior borders of the ischia and pubes are wanting, and consequently the obdurator foramina are imperfect. The acetabula are present; that of the right side shows the cotyloid notch and the ligamental scar entire. The portion of sacrum conserved consists of the two first vertebræ and a part of the third.

204.—Another sacrum and pelvis. The former comprises the first two anchylosed vertebræ, and the latter the ilia, ischia, and pubes, with the acetabula; all more or less imperfect.

205.—The left os innominatum, showing the acetabulum and the cotyloid notch and scar entire. Portions of the ilium, ischium, and pubes are preserved; the ilium showing the sacral symphysis.

206.—Another left os innominatum, showing the acetabulum, perfect, and part of the ilium with the sacral symphysis.

207.—A right os innominatum, with entire acetabulum and part of ilium.

208.—Fragment of the right acetabulum.

209.—Another fragment of the right acetabulum.

210.—Superior portion of the left ilium.

211.—Fragment of the right ilium.

212.—A fine and quite entire left femur; its dimensions are:—

Extreme length from proximal end of great trochanter to articular surface of condyle 20·6 in. From head to lower end of condyle 19 in. Width of head 3·9 in. Antero-posterior diameter of head 2·7 in. Smallest diameter of shaft 2·5 in. Smallest antero-posterior diameter of shaft 2·4 in. Greatest antero-posterior diameter of distal end of shaft 7·1 in.

213.—Right femur, shaft and head quite entire, patellar ridges

N. imperfect, and the condyles slightly injured. Dimensions same as the preceding.

214.—Right femur, shaft and head entire, great trochanter wanting, smaller entire, the lower end imperfect.

215.—Left femur, shaft partly restored, head, smaller trochanter and condyles entire, great trochanter wanting.

216.—Left femur, shaft nearly perfect, upper and lower ends very imperfect.

217.—Left femur, wanting upper end, condyles entire.

218.—Proximal end of left femur, wanting great trochanter.

219.—Distal half of left femur, and probably part of the same bone as the preceding; articular end imperfect.

221.—Shaft of right femur, lower end imperfect.

222.—Shaft of left femur.

223.—Distal end of right femur; condyles and articular surfaces in fair preservation.

224–227.—Heads of femora.

228.—Patella.

229.—Ditto.

230.—Ditto.

231.—Right tibia nearly perfect; the articulations at both ends are entire, the anterior tubercle is imperfect.

Extreme length 18·7 in. Smallest width of shaft 2·6 in. Smallest antero-posterior diameter of shaft 1·8 in.

232.—Left tibia; distal end entire, part of the upper portion of the shaft with the condylar articulation lost, the anterior tubercle entire.

233.—Right tibia, wanting proximal articulation, anterior tubercle present, distal end perfect.

234.—Right tibia, nearly entire, the articulations at each end being slightly injured; the shaft and anterior tubercle perfect.

235.—Right tibia; proximal end entire, shaft slightly restored, distal articulation eroded.

236.—Lower half of right tibia; articulations nearly entire.

237.—Lower half of right tibia; articular surfaces perfect.

238.—A similar fragment to the preceding, but wanting the malleolus internus.

239.—Fragment of distal end of tibia.

240.—An entire right tibia.

N. [The dimensions of the tibiæ, Nos. 232–240, are nearly the same as those given with No. 231.]

241–245.—Right astragali.

246–250.—Left astragali.

251–255.—Right calcanei, perfect.

256–257.—Right calcanei, imperfect.

258–261.—Left calcanei, articular surfaces broken.

262, 263.—Left calcanei, perfect.

264.—Right scapho-cuboid.

265.—Right scapho-cuboid.

266.—Left scapho-cuboid.

267.—Left scapho-cuboid.

268.—Metatarsal, right side, entire.

269.—Metatarsal, right side, entire.

270.—Right metatarsal, inner phalanx, articulations broken.

271.—The same.

272.—Right metatarsal, upper end imperfect, lower end wanting.

273–280.—Left metatarsals, all perfect.

281.—Proximal half of left metatarsal.

282.—Distal half of left metatarsal.

283–287.—First phalanges of hind foot.

288.—Right scaphoid, imperfect.

289.—Right lunare.

290.—Right unciforme.

291.—Right metacarpus, proximal end imperfect.

292.—Left metacarpus, entire, but smaller than the preceding.

293.—Fibular element.

294–298.—First phalanges, fore foot.

299.—Shaft of right metacarpal.

300.—Left os magnum and trapezoide, articular surfaces all perfect.

301.—Lingual or hyoid bone.

302.—Right condyle of lower jaw.

303.—Entire shaft of the right femur of a young animal; the epyphyses at both extremities are wanting.

Length of fragment 12·5 in.

304.—Tibia of the same individual as the preceding, the shaft is quite entire, but the epyphyses of each end are wanting.

Length of fragment 11·6 in.

305.—Last lumbar vertebra, imperfect.

MISCELLANEOUS RUMINANT REMAINS,

Chiefly Bovine, *the species undetermined.*

O. 1.—Portion of a cervical vertebra.

2.—Ditto.

3.—Anterior dorsal vertebra, centrum and articular surfaces entire, upper end of spine broken.

4.—Anterior dorsal vertebra, showing centrum, neural arch, and articular surfaces entire, spine broken.

5.—Anterior dorsal vertebra, imperfect.

6.—Dorsal vertebra, perfect.

7–12.—Dorsal vertebræ, all more or less broken.

13.—Posterior dorsal or first lumbar vertebra; the right lateral process and part of the spine wanting.

14.—A similar vertebra to the preceding, but imperfect.

15–19.—Lumbar vertebræ, all imperfect.

20.—Rib; the head is perfect, part of the lower end wanting.

21–25.—Upper ends of double-headed ribs, with the articular surfaces in good preservation.

26.—Portion of scapula.

27.—Fragment of distal end of humerus.

28.—Upper portion of a right ulna.

29.—Proximal end of radius, wanting the epyphysis.

30.—Lower articular end of radius.

31–34.—Portions of metacarpals.

35.—Shaft of femur.

36.—Fragment of tibia.

37.—Cubo-scaphoid.

38.—Metatarsal, both ends wanting.

39–41.—First phalanges.

42–50.—Second phalanges.

51–55.—Ungual phalanges.

56–57.—Fragments of rami of lower jaws.

58.—Distal epyphysis of humerus.

59.—Shaft of humerus (*Bos*).

60.—Fragment of acetabulum (*Bos*).

HIPPOPOTAMUS MAJOR, Nesti.

P. 1.—Centrum of the last lumbar vertebra, the only fragment of Hippopotamus in the collection. The posterior articular surface is entire, the anterior surface is imperfect, and all the processes are wanting. There is a large foramen on the right side of the sharp median ridge of the inferior surface.

Length of body 3·2 in. Height of posterior articular surface 2 in. Width of posterior surface 3·8 in.

Undetermined Species.

R. 1.—Dorsal vertebra.

2.—Portion of the body of a vertebra.

3.—Fragment of a rib which had been broken during the life-time of the animal, and had subsequently united and healed.

4.—Fragments of ribs more or less imperfect.

5.—Head of femur.

MISCELLANEOUS VERTEBRATE REMAINS,

From Chatham and other localities.

S. 1.—Tusk of *Elephas primigenius*, Blum., dredged off the coast of Harwich. It shows entire alveolus, but the anterior end is broken.

Extreme length along outer curve 58·6 in.

The following are from excavations for new docks at Chatham.

2.—Occipital condyles of *Elephas primigenius*.

3.—Last upper molar of the left side of *Elephas antiquus* (?). It shows ten plates and a heel all worn, the anterior plates being worn away. I believe this to be an ultimate molar, as it shows no depression from the pressure of a posterior tooth.

4.—Upper ultimate molar, left side of *Elephas primigenius*, it shows twenty plates, posterior plates and heel lost. Twelve anterior plates abraded.

5.—Fragment of upper molar, three plates only, unworn.

6.—Lower molar, either the last milk or the first true molar. The ridges are all worn, the anterior plates are lost. The cement and part of the anterior fang is preserved.

7.—Fragment of lower molar of *Elephas*, showing six plates, ridges all worn.

S. 8.—Another fragment, showing seven plates, with their surfaces worn.

9-16.—Eight fragments of molars; each have but few plates preserved, and their surfaces are well worn. The fragments are too imperfect to determine their sequence, or whether they are of upper or of lower jaws.

17 and 18.—Two unworn fragments of molars.

19.—Two fragments of a scapula of *Elephas*; one fragment shows a portion of the glenoid cavity.

20.—Part of shaft of humerus of *Elephas*.

21.—Right innominatum of *Elephas*, showing acetabulum and portions of the ilium and ischium.

22.—Fragment of ilium of *Elephas*.

23.—Left radius of *Rhinoceros*; the proximal end is entire, the shaft slightly restored, and the distal end very imperfect.

24.—Base of shed antler of *Cervus elaphus*; the brow tyne is entire, the second tyne is lost.

25.—Portion of the os innominatum of a young *Elephas primigenius*.—Locality uncertain.

26.—Four anterior plates and talon of molar of *Elephas*; the ridges are unworn, but the anterior plate and talon show abrasion by pressure against the preceding tooth.—Locality unknown.

AVES.

1.—Right humerus of an aquatic bird of the Duck family.
Length 5·5 in.

2.—Upper half of a radius.
Length 2·7 in.
[These are both from Ilford.]

PISCES.

1.—*Esox lucius* (?), Linn.

Portions of the lower jaws, palatine bones and detached teeth of a species of *Esox*, indistinguishable from the existing Pike (*Esox lucius*, Linn.). This is the first recorded instance of the remains of this fish having been found at Ilford.

W. Davies.

NOTE.

Every Mammalian specimen in Sir Antonio Brady's Collection is fully labelled, and bears a distinctive letter and number; and in the foregoing Catalogue each species bears a number (from one upwards), and each is characterised by a *distinctive letter before* the number corresponding to that on the label attached to the specimen, thus:—

A.	*Felis spelæa*	Nos. 1—2
A°.	*Canis vulpes*	„ 1
B.	*Ursus*	„ 1—8
C.	*Elephas primigenius*	„ 1—271
D.	*Elephas antiquus*	„ 1—13
E.	*Rhinoceros leptorhinus*	„ 1—77
F.	*Rhinoceros megarhinus*	„ 1—7
G.	*Rhinoceros tichorhinus*	„ 1—2
H.	*Equus fossilis*	„ 1—34
I.	*Megaceros Hibernicus*	„ 1—7
K.	*Cervus elaphus*	„ 1—50
L.	*Cervus sp.*	„ 1—13
M.	*Bison priscus*	„ 1—32
N.	*Bos giganteus*	„ 1—305
O.	*Miscellaneous Ruminant remains* . . .	„ 1—60
P.	*Hippopotamus*	„ 1
R.	*Undetermined species*	„ 1—5
S.	*Miscellaneous Vertebrate remains not from Ilford*	„ 1—26

The Bird and Fish remains from Ilford have no characterising letter.

All the measurements are given in inches and tenths of inches.

W. D.

APPENDIX.

I.

COPY OF A LETTER FROM PROFESSOR WILLIAM HENRY FLOWER, M.D., M.R.C.S., F.R.S., F.L.S., HUNTERIAN PROFESSOR, ROYAL COLLEGE OF SURGEONS OF ENGLAND, LINCOLN'S INN FIELDS, LONDON, W.C.

To Sir Antonio Brady, Kt., J.P., F.G.S.,
Maryland Point, Stratford, Essex.

My dear Sir Antonio,—

I am afraid that the information I gave you about Mr. Gibson's Ilford specimens will be of but little use for your Catalogue.

On looking through our published Catalogue of Fossil Organic remains of Mammalia and Aves (1845), I only find—

"No. 583. A fragment of a left superior maxillary bone from a young Mammoth, including a small anterior molar (this Dr. Falconer determined to be *E. antiquus*) from the Drift in Pleistocene bed at Ilford, Essex."

"No. 642. A posterior dorsal vertebra of a Mammoth from the Pleistocene mixed earth at Ilford, Essex. The bone was discovered twenty-two feet below the surface."

"Nos. 1394–1398. Bones of a large Auroch (*Urus*) or Ox (*Bos*?) from a Pleistocene deposit in Essex."

From the same locality (Ilford) are:

"Nos. 1410 and 1411. Portions of the bony core or horn of *Bos primigenius*, dug out of the soil or maiden earth twenty-two feet below the surface at Ilford, in Essex, in the year 1786, by John Gilbert."

On Mr. Gibson's death, in 1846, his widow presented the remainder of his collection to the Museum; but, as was the case with many other things which came to the Museum about that time, they were never catalogued, and no record of their localities preserved.

I commenced last year to endeavour to get this department of the collection in better order, but as I told you, was interrupted by illness.

I hope soon to resume it, but it is difficult and unsatisfactory work.

Believe me, yours very truly,
(Signed) W. H. Flower.

Royal College of Surgeons of England.
Lincoln's Inn Fields, W.C.,
Sept. 1*st*, 1874.

II.

LIST OF MAMMALIAN REMAINS FROM ILFORD IN THE COLLECTION OF RICHARD PAYNE COTTON, ESQ., M.D., F.G.S., OF 33, CAVENDISH SQUARE, LONDON, W.

MAMMOTH (*E. primigenius* and *E. antiquus*).

	NO. OF SPECIMENS.
Tibiæ	3
Heads of Femora	4
Astragalus	1
Condyles of Femora	2
Vertebræ	3
Calcaneum	1
Tusks (Portions of)	3
Humerus (large and perfect)	1
Phalanges	2
Patella	1
Lower Jaw, with teeth	1
Teeth (of all ages)	37
	—59

RHINOCEROS (*R. megarhinis* and *R. tchorhinus*).

Radius with Ulna	2
Radius	1
Head	1
Lower Jaw, with part of Upper	2
Metacarpal bones	7
Femur	1
Lower Jaw and Teeth	3
Metacarpal bone (large)	1
Humeri	2
Calcaneum	1
Teeth	21
	—42

OXEN (*Bos primigenius* and *Bos giganteus*).

Lower Jaw (perfect)	1
Lower Jaw (Portion of)	1
Metacarpal bone	1
Tibiæ (perfect)	3
Tibia (Part of)	1
Horn core	1
Calcanea	5
Radius	1
Head with Horns	1
Rib	1
Occiput, with Atlas, Axis, and Cervical Vertebræ	9
Astragalus	1
Phalanges	16
Teeth	17
Hyoid bone	1
Ungual Phalanges	2
Scaphoids	2
Ulnæ	2
	—66

AUROCH (*Bison priscus*).

	NO. OF SPECIMENS.
Head	1
Metacarpals	4
Metatarsal bone	1
	— 6

Hippopotamus major.

Femur	1
	— 1

HORSE (*Equus fossilis*).

Metacarpals	4
Tibia	1
Teeth	9
Phalanges	4
	—18

DEER (*Cervus elaphus ?*).

Jaws	2
Antlers	2
Teeth	19
Astragalus	1
Calcanea	3
Atlas	1
	—28

IRISH DEER (*Megaceros Hibernicus*).

Antler	1
Jaw, with Teeth	3
Tooth	1
	— 5

LION (*Felis spelæa*).

Metacarpal bone (2nd)	1
	— 1

BEAR (*Ursus* sp.).

Teeth	2
	— 2

BEAVER (*Castor Europæus*).

Lower Jaw (perfect)	1
Teeth	12
	—13

WATER RAT.
(Probably from an upper deposit.)

Lower Jaw	1
	— 1

WOLF (*Canis lupus*).

Lower Jaw	1
	— 1

BIRD (Indetermined).

Ulnæ (of different Species)	3
	— 3
Total	246

Abundant remains of Fossil Wood, shells of *Helices*, *Anodon*, *Cyrena*, etc.

III.

LIST OF MAMMALIAN REMAINS FROM ILFORD IN THE BRITISH MUSEUM PRIOR TO THE ACQUISITION OF SIR ANTONIO BRADY'S COLLECTION.

Mammoth (*Elephas primigenius*).

	NO. OF SPECIMENS.
Nearly entire skull with both tusks[1]	1
Tusks	2
Jaws and molars	10
Limb bones...	7

Rhinoceros (*leptorhinus*).

Vertebræ	3
Limb bones	12

Bos primigenius.

Parts of skulls	3
Vertebræ	5
Limb bones	8

Bison priscus.

Part of cranium	1

Ursus.

Ulna and radius	2

Beaver (*Castor Europæus*).

Lower Jaw	1
Molars	4
Total	59

[1] This fine and unique specimen would have certainly been secured by Sir Antonio Brady for his own Collection; but being called abroad at the time as one of H. M. Commissioners for the International Exhibition, Dublin, 1864, he very generously relinquished his claims in favour of the British Museum authorities, who at once took means to secure it (see Appendix VII. p. 73).—H.W.

IV.

NOTE ON THE REMAINS OF *RHINOCEROS LEPTORHINUS*, OWEN; (*RH. HEMITŒCHUS*, FALCONER).[1]

By Henry Woodward, F.R.S.,
of the British Museum.

In the late Dr. Falconer's Palæontological Memoirs[2] so ably edited by Dr. Charles Murchison, F.R.S., a masterly and critical examination is given of the European Pliocene and Post-Pliocene species of the genus Rhinoceros, from which we venture to extract the subjoined introductory remarks.[3]

"After examining all the collections in England and Italy, and those of Lyons, Montpellier, etc., I have come to the conclusion that there were four distinct Pliocene and Post-Pliocene species of Rhinoceros, three of which have long been confounded by Cuvier and other palæontologists under the name of *Rhinoceros leptorhinus*.

"I have carefully examined at Stuttgart the materials on which Kaup's and Jäger's *Rhinoceros Merckii* is founded. It is not a distinct species, but is identical with the Grays Thurrocks species, or *Rhinoceros leptorhinus* (*mihi*). The *R. Lunellensis* of Gervais is founded on a young jaw with milk-dentition, which is not to be depended on for determining distinctions. So, also, the *R. elatus* of Croizet, and the *R. mesotropus* of Aymard, found in Auvergne, are not distinct species. I have examined the chief collections in Auvergne. The specimens in M. Pichot's collection and in the Museum of Le Puy are mainly *R. Etruscus*, while the *R. mesotropus* of Aymard comprises both *R. leptorhinus* and *R. antiquitatis*.

"The four species may be classified as follows:—

PLIOCENE. I. No bony nasal septum.
1. *RHINOCEROS LEPTORHINUS* (Cuvier, *pro parte*).
Syn. *R. megarhinus* of Christol.
II. Partial bony septum.
2. *RHINOCEROS ETRUSCUS*, Falconer.
Syn. *R. leptorhinus* (Cuvier, *pro parte*).
3. *RHINOCEROS HEMITŒCHUS*, Falconer.[4]
Syn. *R. leptorhinus* (Owen, *pro parte*).
POST-PLIOCENE. III. Complete bony septum.
4. *RHINOCEROS ANTIQUITATIS*, Blumenbach.
Syn. *R. tichorhinus*, Fischer and Cuvier.

"1. *Rhinoceros leptorhinus*.—This is the original and typical *Rhinoceros leptorhinus* of Cuvier, founded on Cortesi's Monte Zago

[1] Extracted in part from the Geological Magazine, 1874, Decade II. Vol. I. pp. 398-403.

[2] 8vo. London, 1868, vol. ii. p. 309.

[3] Compiled by Dr. Murchison from two letters addressed by Dr. Falconer in 1862 to Mons. Lartet, of Paris, and Col. Wood, of Stouthall, Swansea, and from his note books.

[4] This determination of Falconer's has now been reversed, as will be seen at the conclusion of this notice: see the last paragraph of p. 69, and top of p. 70.

cranium. It is the species described by Christol as *R. megarhinus*, and is the only Pliocene or Post-Pliocene European species that had not a nasal septum.

"To this belongs the celebrated Cortesi cranium in the Museum at Milan, which I have carefully examined. With this species also I have identified the Rhinoceros remains found in the Sub-Apennine beds of Piacenza, in the Val d'Arno upper beds, at Montpellier and Lyons, and at Grays Thurrocks, in Essex. The Rhinoceros, however, found in the Elephant-bed of the Norfolk coast is different.

"2. *Rhinoceros Etruscus*.—This species, like the following, had an incomplete bony nasal septum, but it had a comparatively slight and slender form. It is met with along with *Elephas* (*Loxodon*) *meridionalis* and *Mastodon Arvernensis*, in the lower beds of the Val d'Arno, and in the 'Submarine Forest Bed,' or superimposed blue clays of the Norfolk Coast, immediately underlying the Boulder-clay; but as yet it has been found in none of the ossiferous caves of Britain. With this species, also, I have identified the remains of a Rhinoceros submitted to me by Professor Ansted, which were found a few miles from Malaga, in white marl overlying Pliocene blue clay abounding with shells.

"3. *Rhinoceros hemitœchus*.—This species has been described by Professor Owen as *R. leptorhinus*. It has the nasal septum incomplete in the centre, and it differs from *R. antiquitatis* (*R. tichorhinus*) in other cranial characters, as well as in those of the teeth. I am satisfied on this point, after examining the entire dentition of both young and old animals. *Rhinoceros hemitœchus* accompanies *Elephas antiquus* in most of the oldest British bone-caves, such as Cefn, Durdham Down, Minchin Hole, and other Gower Caverns. It is also found at Clacton in Essex, and in certain beds in Northamptonshire. It is also met with in Italy.

"From some of these localities entire skulls and a great portion of the skeleton have been obtained.

"4. *Rhinoceros antiquitatis* (*R. tichorhinus*). This species had a complete bony nasal septum. It is found in the newer Pliocene deposits of Kent, Surrey, and Essex, and associated with *Elephas primigenius* in caverns of the same date.

"*Elephas antiquus* with *Rhinoceros hemitœchus*, and *Elephas primigenius* with *Rhinoceros antiquitatis*, though respectively characterizing the earlier and later portions of our period, were probably contemporary animals; and they certainly were companions of the cave-bears, cave-lions, and cave-hyænas, and of some at least of the existing mammalia.

"There can be no reasonable objection to the name *Rhinoceros antiquitatis*. South of the Rhine, that is, in Geneva, France, and Italy, all modern palæontologists call the species *R. tichorhinus*; but, north of the Rhine, in Germany, Holland, Scandinavia, and Russia, the most eminent authorities designate it *Rhinoceros antiquitatis*.

"A name in science ought not to be a disputed point of mere geographical predilection.

"Blumenbach named it first *Rhinoceros antiquitatis*. Fischer de

Waldheim, a palæontologist of no great authority, changed the name into *Rhinoceros tichorhinus*, and Cuvier adopted Fischer's name without acknowledgment. Desmarest called it *Rhinoceros Pallasii*. Blumenbach's names of *Elephas primigenius* and *Mastodon Ohioticus* are now accepted by every one; and there is no reason why his *Rhinoceros antiquitatis* should be rejected for a more modern name.

"Living neither north nor south of the Rhine, I have no geographical predilections, and as an impartial foreigner I accept the earliest name, viz. Blumenbach's; besides, the name *Rhinoceros tichorhinus* is faulty, inasmuch as three species had a nasal septum."

We make the foregoing extract from Dr. Falconer's Memoirs, for the purpose of calling attention to the remarkably fine skull and lower jaw (figured in the Frontispiece of this Catalogue) of *Rhinoceros leptorhinus*, Owen (*Rhinoceros hemitœchus*, Falconer), obtained from the Uphall Brickpit in the vicinity of Ilford, and probably the most perfect of this species which has hitherto been found in England (see Catalogue, p. 29, E. 1).

This species was heretofore only known in this country from exceedingly fragmentary remains, as, for example, the upper part of a skull and parts of lower jaws from Clacton and Walton, in Essex, (figured in Owen's British Fossil Mammals, pp. 356–381, figs. 131–141), and the basal portions of two crania and eleven rami of the lower jaw from the Gower Caves and Northampton (figured in Falconer's Palæontological Memoirs, vol. ii., plates 19-21 and 23-25.

Concerning the specimen from Ilford Mr. William Davies writes as follows (see *antè* Catalogue, p. 29) :—

"The skull is nearly entire, and evidently that of an aged animal; for the molars, of which there are six on each side, are all very much worn. The skull has not been crushed, and therefore shows well the normal form and proportions. . . . Appended to the nasals is the anterior portion of the bony septum of the nares, perfect in front, but broken behind." . . .

Concerning the *cloison*, or bony septum dividing the nostrils, upon which Dr. Falconer in his classification (already quoted) lays so much stress, Mr. Davies contributes the following most important information :—

"In clearing the skull from its matrix of sandy gravel, I found the anterior border of the septum joined and apparently consolidated *to the end of the nasals;* but the greater part of that portion of the septum which is preserved, I found detached from these bones, *but not broken*; and this detached portion showed upon its superior margin a hollow smooth surface, which perfectly fitted a rounded longitudinal smooth ridge upon the inferior surface of the nasals, to which it was originally joined by an unanchylosed sutural attachment. Moreover, I traced the septum beyond the middle of the inter-orbital platform to which it was also attached, and served as a support. At this point, the bony septum was thick, but of a very coarse cancellated structure, and so exceedingly friable as to render it impossible to detach and preserve any fragment of this part of the bone. The septum became gradually thinner toward the front

of the nasals, the structure becoming less coarse, to about the middle of the nasal apertures, where the bone is thinnest, but its substance more compact. It again thickens a little forwards and downwards, where it forms a broad inferior border to join the intermaxillary bones.

"During the process of restoring the skull, which was in a somewhat dilapidated condition, it was unfortunately necessary, in order to form a support for the palate and teeth, to cover the posterior portion of the septal sutural ridge with plaster, and thus destroy the evidence of its existence; but subsequently another skull of the same species was secured for the collection, in which this upper ridge is preserved and distinctly shown. There was also a central longitudinal ridge, but with a broken edge, upon the inner floor of the palate, to which bones I believe the septum was also attached; but owing to the broken condition of the palatal bones, and the displacement of the fragments, the fact of their being conjoined was not sufficiently noted by me at the time, so as to enable me to speak upon this point with absolute certainty."

The second cranium[1] is not so perfect as that figured in the Frontispiece, "inasmuch as the molars, the premaxillæ, and the whole of the palatal portion of the skull are wanting. This fine fragment comprises the entire upper portion of the cranium. . . . The fragment, moreover, shows the anterior and posterior portions of the bony septum of the nares. The anterior portion is broken posteriorly, and is attached to a medial ridge, which ridge does not terminate at a short distance from the anterior border of the nasals, as in the typical Clacton specimen, figured by Prof. Owen in his 'British Fossil Mammals,' and which is now preserved in the British Museum, but is continuous along the under surface of these bones and of the inter-orbital platform, and unites with the posterior fragment of the septum, which is preserved and conjoined with the sphenoid."

Mr. Davies further remarks :—"The presence of these front and hind portions of the septal partition, with their broken inner margins, the coarsely cancellated bone found in the preceding specimen, and the continuous ridge, lead to the inference that" (contrary to the opinion of Dr. Falconer as already quoted) "the nares of this species were separated by an osseous division, the coarse structure of the greater part of which contributed to its speedy decomposition; the anterior portions, being of more compact texture, are found generally well preserved. Moreover, the inner edges of the portion of the septum which remain in this and the preceding specimen are jagged and broken, showing no trace of a true natural margin." . . . .

We have to thank Mr. Davies most heartily for clearing up this obscure and difficult point, involving as it does the fundamental character upon which Falconer's species of *Rhinoceros hemitœchus* rests. For the future Falconer's name (*R. hemitœchus*) must give way before Prof. Owen's *R. leptorhinus*,[2] not only as the older name, but also

[1] See Catalogue, p. 31, E. 2.

[2] See Owen's History of British Fossil Mammals and Birds, London, 1846. 8vo., p. 356.

because Falconer's specific appellation "is faulty" (to quote Dr. Falconer's own words as to the abolition of *R. tichorhinus*, see *antè, op. cit.* p. 400), "inasmuch as this species had a completely ossified nasal septum." From the observations of Mr. Davies it seems probable that the greater or less development of the bony nasal septum (upon which Dr. Falconer laid so much stress) cannot be relied upon in the present state of our knowledge as a basis of specific distinction between *R. Etruscus; R. leptorhinus*, Owen (*R. hemitœchus*, Falc.); and *R. antiquitatis*, Blum. (*vel R. tichorhinus*, Cuv.), although it may assist us, when preserved in fossil crania, to decide whether it was a horned, or hornless, Rhinoceros.

V.

NOTE ON THE FREQUENT OCCURRENCE OF NUMBERS OF SHELLS OF *HELIX* WITHIN THE BRAIN-CAVITY OF THE SKULLS OF FOSSIL OXEN AT ILFORD.

By William Davies,
Of the Geological Department of the British Museum.

During the preparation of fossil remains from the Brick-earth, I have had frequent opportunities of noticing points which would otherwise have passed altogether unobserved by any one, as they could only have been seen at the time the specimen was being actually cleared and developed from its sandy or argillaceous matrix.

I observed, for example, in the skulls of several fossil oxen numerous shells of the common land-snails, *Helix nemoralis* and *H. hortensis*, in one instance more than thirty examples, all in good condition.

I cannot help imagining that these snails, whilst still living, may have found their way into the hollow cavity of the skull through the only aperture (the foramen magnum) for the purpose of hybernation—as is common with all Helices now living in this country—whilst the skull was still lying on the dry land, where it may have been left for a long time after a flood: or, the animal to which it belonged may perhaps have fallen a prey on that very spot to wild beasts, and afterwards the skull may have been cleared of animal matter by predaceous insects. It seems incredible that such a large number of adult snails could have been washed in by water through so small an aperture, and that one the sole opening into the brain-cavity.

VI.

ON THE PRESERVATION OF FOSSIL MAMMALIAN REMAINS FOUND IN TERTIARY DEPOSITS.

By W. Davies,
Of the Geological Department of the British Museum.

The following extract from the Geol. Mag. for 1865, Vol. II. p. 239, may not inappropriately find a place here :—

Owing to the loose mineral character of the Tertiary deposits, in which most of the Mammalian and other vertebrate remains are found, consisting as these deposits chiefly do of sands, gravels, clay, or peat, their fossils are necessarily in a more or less friable condition, difficult to preserve entire, or to handle for scientific examination with safety. Hence, probably, a few remarks as to the method usually adopted for hardening and preserving them may interest, and be of service to those who collect such fossil remains.

The substances generally used are glue or gelatine. For the bones of the larger Mammalia there is nothing better than the best glue; whilst for the more delicate bones of the smaller Mammals, Birds and Fishes, gelatine is the best, being purer, dissolving more easily, and imparting but little, if any, colour to the fossil. The consistency of these substances when used will have to be varied according to the structure of the bone; and as they also differ greatly in quality, it is impossible to lay down any definite rule as to the exact proportions to be used with a given quantity of water; this must be left to the judgment of the operator. As a general rule, however, all bones which have a coarse cellular structure, as the ends of large limb-bones, deer-antlers, etc., require the glue-solution to be of a consistency which will form a stiff jelly when cold; whilst for bones of a compact structure a much thinner solution, about the consistency of ordinary size, will suffice. If the solution is too thick, it clogs the absorbing power at the surface, and prevents its penetrating to all parts of the bone.

The fossils should be thoroughly dried and cleaned from as much of the matrix as can be removed with safety; and if it can be managed, *warmed* before being placed in the solution. When the glue is all dissolved, and the liquid nearly at boiling heat (ebullition should be avoided, if possible), it is ready for the immersion of the fossils, and they should remain in it as long as air-bubbles rise to the surface; when these cease, they will be sufficiently soaked. When taken out, they should not be drained, but laid in a position to retain as much as possible of the imbibed solution, until they are cold,

when the glue will have set. Their position must then be shifted, to prevent their adhering to the board on which they may be laid. Any glue that may have drained from them may be then removed with a wet sponge and warm water.

The vessels required are of the simplest kind. The common domestic utensils will answer for most purposes. The ordinary house-copper, saucepan, or, better still, a large-sized fish-kettle with its strainer. But whatever the vessel used, a strainer of some kind, on which to place the bones for immersion and withdrawal, is indispensable; for the copper nothing is better than a wire sieve. For bones too large for the vessel used, the treatment will have to be varied. For long limb-bones, strong enough to bear their own weight when saturated, it is only necessary to place one end in the vessel, and ladle the solution over the other end for a short time, and then reverse their position. But for bones which will not bear such treatment, the only plan is to securely fix them to a board, and place them in a slanting position in the solution, and well saturate them with it by ladling. For these, and for long portions of tusks of the Mammoth, and horn-cores of the large species of Bos, a special vessel, about three feet long, one foot wide at the top, nine or ten inches wide at the bottom, and nine inches deep, made of stout tin or galvanized iron, with a handle at each end, will be found most useful.

Occasionally fossils are found which are either too large or too friable (as skulls and tusks from their natural construction frequently are) to be placed in the solution: for these a different method must be adopted to preserve them entire. Cover the fossil with thin paper, over which—on the sides and underneath if possible—put a coating of plaster of Paris, just thick and strong enough to keep together; when the plaster is firmly set, gently pour the solution boiling-hot over the fossil as long as it continues to absorb, to assist which it may be necessary to remove in a few places some of the surface-bone, which can be carefully replaced; in two or three days the plaster may be partly removed by sawing and in small pieces, taking care not to injure the fossil by jarring it; the paper will prevent the plaster adhering to it. But this process is never so effective as submersion in the solution, and may require to be repeated. Some bones are better for being dipped a second time, but not allowed to remain long enough in the solution to melt the glue they had previously imbibed.

Delicate shells from the same kind of deposits may be treated, with care, in a similar manner with advantage.

VII.

HOW THE SKULL OF THE MAMMOTH WAS GOT OUT OF THE BRICK-EARTH AT ILFORD.

By Henry Woodward, F.R.S., F.G.S.,
Of the British Museum.

[*Extracted from the* Geol. Mag. 1865, Vol. II. p. 93.]

* * * * Having been present during the exhumation of the cranium of the Mammoth (*Elephas primigenius*) at Ilford (described and figured in the Geological Magazine, 1864, Vol. I. p. 241), I will state the method adopted by Mr. W. Davies, of the British Museum, assisted by Mr. Thorn and others.

A spring van was sent down, carrying a good supply of the best plaster of Paris (1 cwt.), six pieces of ½-inch "nail-bar iron," six to eight feet long, a bundle of splines, a box full of hay and tow, some strips of old canvas, whitey-brown paper, two large earthen pans in which to mix the plaster, spades, trowels, a saw, iron hammers, spatulæ, etc., good stout cord and rope, deal planks, and a hand barrow upon which to move the remains, and some large wooden trays in which all the loose portions were to be systematically placed, and marked with pencil on separate papers to show the parts to which they belonged.

You must imagine the skull resting half exposed in compact brick-earth, requiring a spade or trowel to remove it, but the fossil itself as friable as decayed wood or tinder, the ivory of the tusk being equally soft and shattered.

The first operation was to remove as much of the soil as could be done with safety; the whole tusk was then covered with sheets of whitey-brown paper; a coating of well-mixed plaster of Paris was placed over the paper covering the tusk, and allowed to settle down upon each side in the grooves which had been scraped in the brick-earth, forming a coat, of this shape ∩, over the entire length of the tusk. When the plaster had set, two bars of the iron (above mentioned), which had been bent to the proper curve, were placed upon the hard plaster, and fixed to it with another coating of fresh mixed plaster of Paris.

When these coats had properly set, the base of the tusk (which had been carefully cleared and coated all round with plaster) was sawn through a few inches below the socket, the tusk was burrowed under at intervals with the trowel, and hand-holes thus made beneath it, through which were thrust strips of canvas, hay and cord, like the cerements of a mummy. When thus secured, six men turned it gently over from its matrix, and placed it on a long plank prepared for it (the curved part being supported and fixed with packing), and so transferred it to the van. The second tusk (removed a week later) was raised in a similar manner.

The treatment of the skull was much after the same fashion, except that a coat of fine tenacious clay was used to fill up the nasal apertures and cracks. Over the first coat of plaster laths

and soft iron bars, bent to the curve, were fixed as in the case of the tusk, to give rigidity to the whole. As the matrix was removed, pieces of wood were packed under with soft hay to support the head, which being filled with brick-earth and sand, was very heavy. When quite cleared and secured, it was turned gently over upon a soft bed of hay placed on the hand-barrow ready to receive it.

The zygomatic arch invariably falls away from the cranium, dividing at its sutures; the pieces should always be sought for in the matrix beneath and taken especial care of.

The labour and care necessary are immense, but I feel sure that almost any similar fossil remain might thus be secured, provided always the same amount of skill and patience be brought to bear upon the brittle mass.

Note.—For Notes on the Mammoth, *Elephas primigenius*, see papers by H. Woodward, F.R.S., in Geol. Mag., 1864, Vol. I. p. 241; 1865, Vol. II. p. 93; 1868, Vol. V. p. 540; 1869, Vol. VI. p. 65.

VIII.

NOTE ON UPHALL PIT, ILFORD, ESSEX.[1]

By Prof. Phillips, M.A., F.R.S., F.G.S.

The section at Uphall Pit, Ilford, as it appeared lately in June, 1871, presented the following circumstances, on the Eastern side, where many bones have been found:—

	ft.	in.
Soil, dark, sandy with scattered pebbles	3	0
"Uncallow"—consisting of gravel, bands of sand, brick-earth, and loam, generally ferruginous, much confused in arrangement. Some pebbles have the long axis vertical.[2]	7	0
Sandy loam	2	3
Sand, yellow and ferruginous, curved and irregular, with scattered gravel	4	0
Gravel and sand, irregular bed	0	4
Sand and gravel scattered as above, yellow and ferruginous (Mammoth, Rhinoceros, and Bison here)	3	0
Shell-bed of Anodon, Unio, and Cyrena fluminalis (Undisturbed deposit of Shells living on the spot)	0	6
Clay laminated below the shells	1	0
Pebble-bed in sand of a greenish and ferruginous aspect (not penetrated)		

The series of these irregular layers varies from point to point, and suggests the intermitting action of violent land-floods, snow melting, and drifting of shore-ice, much as the gravel-beds farther up the valley. Loam and brick-earth, the terms used in the district, are not exactly expressive of the deposits; both are very sandy, the former most so, and all the sorts of sands, gravels, loams, and brick-earth are much confused together, except towards the bottom of the pit.[3]

[1] Geology of Oxford and the Valley of the Thames," by John Phillips, M.A., F.R.S. (Oxford, 1871), p. 470.

[2] Mr. W. Boyd Dawkins, F.R.S., observed in this bed a large mass of "Grey-weather" stone, Proc. Geol. Soc. 1867.

[3] The Uphall Brickfield at the present date (1874) is now *worked out* and is levelled for planting.—W.D.

STEPHEN AUSTIN AND SONS, PRINTERS, HERTFORD.

POSTSCRIPT.

In turning over the pages of this Catalogue, as it was passing through the press, the note at foot of p. xix caught my attention, and I was at once reminded of a remarkable polished Celt in my Collection, manufactured from a banded flint of singular beauty, obtained by me from Barking-side, imbedded in gravel five feet below the surface, on the 30th December, 1868. On referring to the Rev. O. Fisher's paper, in the Geological Magazine for 1872, Vol. IX. p. 268, I find the implement discovered by him at Slade Green Pit, Crayford, Kent, was eleven feet five inches below the surface, and certainly belonged to the Palæolithic River-drift period, not to the later Neolithic period, to which my beautiful *hache* must be assigned. Referring to the magnificent work on "The Ancient Stone Implements, Weapons, and Ornaments of Great Britain," by John Evans, Esq., F.R.S., President of the Geological Society of London, I find my Celt is very like *in form* to one from Santon, Downham, Suffolk, figured at page 90 of that work, but is more highly polished and finished, and perhaps more nearly to be compared with another example from Botesdale, Suffolk, figured in the same work (page 100). This type of Celt appears to have been common in the Eastern Counties. Although found so near to the Uphall Pit as Barking-side (see Geological Map, p. xxv), my friend Mr. Henry Woodward is of opinion that it belongs to a *later date* than the *Cyrena* Brick-earth and Gravels with Mammalian Remains. It seems, however, of sufficient interest to be recorded here.

Length of Celt, 155 millimetres; breadth at trenchant border, 58 mm.; greatest thickness, 35 mm. The lateral borders are nearly acute, being scarcely at all flattened in grinding and polishing. The surface is highly finished, and the cutting edge forms an elegant ellipse.

ANTONIO BRADY.

Maryland Point, Stratford, Essex,
Oct. 19, 1874.

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