

been kindly sent me by Edmund Getty, Esq. The wood itself is perfectly sound, but the tree is split and rived in the direction of the grain in some places almost into shreds by the boring powers of the *Teredo*.

XVII.—On the Pliocene Deposits of the Valley of the Thames at Ilford. By RICHARD PAYNE COTTON, M.D.

THE tertiary deposits bordering on the Thames appear to be composed of materials of the same general characters, variously arranged, but formed under the same physical circumstances. The formation may be well seen at Brentford, Ilford, Grays and Erith, where beds of gravel will be found resting upon sands of various colours, sandy loam and clays, abounding in remains of mammalia and freshwater shells*. The following description refers to two cuttings in brick-fields at Ilford, one on the north of the London road, belonging to Mr. Curtis, another on the south of the same road, and the west of the Barking lane, the property of Mr. Kilverton. In the former we observe—

	feet.
Vegetable soil with gravel	2
Coarse gravel	2
Coarse yellow sand, stratified	4
Brick earth of various shades of brown, regularly stratified with nodules of carbonate of lime (race) and a few bones	5
Light brown brick earth, interstratified with layers of sand, and full of bones	3
Thin veins of fine sand of shades of yellow and brown irregularly waved	2
Coarse gravel and sand.	—
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In the latter the arrangement is as follows:—

	feet.
Vegetable soil with gravel	2
Coarse gravel and sand stratified	3
Brick earth of shades of brown, stratified	6
Brick earth of a light brown with wavy veins of sand, calcareous nodules (race) and bones	2
Layers of brown and yellow sand, waved, containing in its upper part an abundance of bones	4
Fine yellow and white sand, with freshwater shells	2
Coarse gravel with water.	—
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The stratification of the clays is generally regular and horizontal, the layers however frequently thin out or expand, but the veins of sand are irregular and waved, so that the surface of the cutting, from the changing thickness of the strata, varies extremely

* A list of the shells occurring in these mammaliferous deposits has been given by Mr. J. Morris in the 'Magazine of Natural History,' vol. ii. p. 544.
—ED.

within the distance of a few feet, although the general character is the same; in some places the sands and clay pass into each other, but they are more usually distinct. In the latter section, the upper layer of brick earth in apposition with the gravel is regular and horizontal, but in the former the same part is hollowed into basins, from which fissures extend downwards, both filled by the sand from above; the usual width of the basins is from two to five feet, and their depth from one to four feet, whilst the fissures vary from one to five feet in length, and measure several inches at their widest part. I have not been able to ascertain the thickness of these deposits, as the cutting is seldom made lower than eighteen or twenty feet, below which the brick earth is either of an inferior quality or altogether absent; but in a well lately dug in the neighbourhood, sand and gravel with irregular layers of clay were met with to a depth of fifty feet. Throughout the valley of the Thames bones of mammalia and shells are generally found, but at no place so abundantly as at Ilford. The two genera of shells, of which hundreds may often be obtained at one visit, are *Helix* and *Cyrena*, but *Unio* and *Planorbis* are not uncommon, and *Ancylus*, *Succinea*, *Valvata*, *Limnæus*, *Cyclas* and *Paludina* have been discovered. The *Helix* cannot be distinguished from the existing *H. nemoralis*, and in many specimens the colouring matter is preserved: the *Cyrena* is stated to be identical with one now living in the Nile: of the other genera it is almost impossible to determine the species, owing to their imperfect condition; they are chiefly seen in the layers of sand upon which the brick earth reposes, and beneath the bones, but are sometimes intermixed with them, and have been found even within their cavities; they appear to be partial in their distribution, and are not met with in the former cutting. The bones occur both in the clays and sands, but their most common position is the point of union of the two, or the upper layers of sand: those from clay are in excellent preservation, but all from the sand fragile and difficult to remove entire; they appear to have undergone no other change than a slight impregnation with iron and the loss of their animal matter, and for their restoration I have found gelatine answer admirably. I have obtained very perfect remains of the following animals: *Ursus*, *Elephas primigenius*, *Rhinoceros leptorhinus*, *Equus*, *Bos primigenius*, *Bison priscus*, *Cervus Elaphus*, *Castor europæus*, *Megaceros hibernicus*, Sheep, Pig, and a bird of flight of the size of a crow. Of these, the remains of the Mammoth, Ox and Rhinoceros are most common, the Aurochs, Horse and Stag less so, and the rest comparatively rare. They bear no marks of attrition, and are always placed horizontally, and in most cases the skeletons appear nearly entire; a perfect Elephant was gradually discovered by the labourers a few months back, but from the greater

number of the bones being in sand, a humerus, tibia, portions of femur and tusks, some bones of the carpus, one metacarpal bone, a patella, and the teeth could only be preserved, and these are in my possession. I have obtained several bones of the *Bos primigenius*, including the head and horns, from what appeared to be the entire skeleton, and the lower and part of the upper jaw of a Rhinoceros; several teeth of the young Elephant, one of which had only just cut the gum, are in my collection, besides a canine tooth and metacarpal bone of a Bear, the lower jaw and several teeth of the Beaver, and portions of three lower jaws of the Irish Elk. The following table shows the size of three bones of the Mammoth, and a comparison with those of the Mastodon and recent Elephant:—

		Mammoth.		Elephant.		Mastodon.	
		ft.	in.	ft.	in.	ft.	in.
Humerus	Length	3	6	3	0	3	6½
	Width of condyles	1	1	0	11	1	1
	Diameter of head	0	10	0	7	0	10
Femur ...	Circumference of head	1	10	1	8	1	11
	Length of outer condyle ...	0	10	0	8	0	10½
Patella...	Length	0	6	0	5½	0	7
	Width	0	4	0	3	0	6

The large Elephant in the collection at the College of Surgeons, and the Mastodon in the British Museum, were selected for comparison. It is seen from the above how much larger was the Ilford Elephant than its modern representative, and how little inferior in size to the gigantic Mastodon, which it probably even sometimes exceeded, as I have seen fragments from bones apparently much larger than those in my collection. From a similar comparison of the bones of the *Bos primigenius* with the recent Ox, I have ascertained that those in my possession belonged to an animal more than one-half as large again as the largest living species I could measure. The *Rhinoceros leptorhinus* appears to have been a small animal, not larger than the living one from Sumatra, and much inferior in size to the Indian, with both of which I have compared several fossil specimens; the *R. tichorhinus* has not yet been found at Ilford, and seems almost limited to the caves. The absence of carnivora, as the Tiger, Lion and Hyæna, in these deposits is remarkable: amongst the hundreds of bones already examined, not one belonging to these animals has yet been discovered; it is possible that they may not then have existed in such numbers, or borne the same proportion to the herbivora, as at present, or were generally able to avoid being submerged with their less active contemporaries by escaping to the hills, where their remains might soon become decomposed, or destroyed by other carnivora, or within fissures and caves, which are known to have often served them both as dwellings and tombs.

The nodules termed by the brickmakers "race" are of various

sizes, from that of a marble to an orange, and occasionally very much larger, of a light brown colour, soft to the touch, smooth, and either compact or made up of concentric laminae, in outward appearance resembling Websterite, for which I had always taken them until very recently ; but a careful analysis has shown that they are composed almost entirely of carbonate of lime, with a slight addition of phosphate and sulphate of lime, a little phosphate of alumina, silica, and peroxide of iron ; they are chiefly in the upper layers of clay and not intermixed with the bones. Vegetable remains are scarce, but a large bed of lignite was discovered in the brick earth some time back. Dr. Lindley has kindly examined its structure, and reports that all he can assert is, it is not coniferous, that it contains some dotted tissue resembling that seen in elm, but presents no character by which its affinity can be determined.

The circumstances under which the bones are discovered lead to the conclusion that the animals lived and died near the spot which incloses their remains ; the skeletons are frequently entire, and have not suffered by attrition, and the presence of teeth of the young Elephant is opposed to the view that they may have migrated here upon some general geological change and have been subsequently destroyed. The strata were evidently quietly deposited, the shells are in general well preserved, and the stratification of the sands indicates the long continuance of causes alternating with one another and uninterrupted by violence. The freshwater origin is decided by the characters of the shells, all being of this class with the exception of the *Helix*, which, like the recent species with which it is probably identical, may have lived upon the banks of rivers and been buried with its aquatic neighbours. The arrangement of the strata does not differ from that seen in the bed of modern freshwater lakes and rivers, especially in those subject to occasional inundations ; giving great probability to the idea that they were formed during the elevation of older strata, when large quantities of solid materials were washed away from the rising mass, and deposited in hollows and valleys by the agency of water.

It is not impossible that the thick layers of gravel beneath the brick earth were the result of a breaking-up of a portion of the chalk originally covering the Wealden, and that the clays and sands were supplied by the partial destruction of the Wealden itself ; the similarity in the materials of the two formations is very conspicuous, and the frequent occurrence of calcareous masses adds great weight to such an hypothesis, especially as many of the nodules appear to be merely rolled pieces of chalk, with some earthy additions which may have been supplied by the clay in which they are found, and those more distinctly laminated

may have been formed by a gradual separation of calcareous matter in suspension, by homogeneous attraction. If the original surface of the Wealden were irregular, or the uplifting of the strata unequal, chalk, clays and sands might simultaneously or alternately be exposed to the action of the waters, which would produce the frequently repeated layers observed in the tertiary strata.

On the growing hills and rising valleys of the Pliocene period a gigantic race of mammalia flourished, which in its turn was swept away and entombed, just as we now find bones of the present creation in beds of rivers and lakes: I have seen several bones of Ox and Sheep inclosed in mud from the bed of the Thames, which when hardened might be easily mistaken for those from Ilford. For the support of so large a number of immense herbivora, a luxuriant vegetation must have existed; without it the Elephant and Irish Elk could not have thrived, or the Beaver made a dwelling; but indications of such are scarce, and I believe have not been found at Ilford, with the single exception to which I have alluded: this may be due to the larger trees having been drifted away by the waters, or a condition of soil unfavourable to their preservation. The presence of basins and fissures in the upper layers of clay shows the interference of time, and marks out an interesting series of events. After a long period of tranquil deposition the strata had reached the surface, from the waters having retired, or an elevation of the valley, and land succeeded water; streams and currents then hollowed out the surface into basins and disappeared; an exposure to the sun's rays followed, by which the clays became hardened and fissures formed; subsequently the whole was again submerged and rapidly covered by sand, which filled up the fissures and basins; and at last gravel was washed over the whole, and it became the resting-place of Man. The association of the remains of the Beaver, Megaceros and Red Deer with those of Mammoth and Rhinoceros is interesting, as it would show, that whatever the physical conditions were under which these animals were destroyed, they could not have been violent or universally destructive—that no grand convulsion occurred by which all were alike overwhelmed; but that during a regular and uninterrupted course of events, certain animals became extinct from some combination of circumstances unfavourable to their propagation, whilst others of different habits and necessities remained for ages later, to be destroyed only by the enterprise of Man;—the bones of the first-mentioned three are found in situations showing their existence down to a very late period, and that a race of animals once the associates of the Mammoth, Bear and Rhinoceros, have probably been the contemporaries of our race.

The strata of Ilford, although comparatively of a recent date, and the monument of but a small geological period, show that all things were not made in a moment, but were progressive, and associate the inorganic with the organic creation, in the common principle of growth and development, however differently each may be carried out; proving that the Mammoth and the Earth went on increasing gradually—both had an infancy, and both required time for their maturity.

But the operations of the Infinite are based upon benevolence, and seem to have had one great and creative act in view—to which all preceding were to be in some way subservient:—for ages did a large creation enjoy the undisturbed possession of the lands, but at length the Mammoth, Bear and Rhinoceros became extinct, whilst the Stag, Beaver, Sheep and Pig were preserved—valleys and irregularities were filled up and levelled by an accumulation of valuable materials—the action of natural laws was gradually reduced in degree—that at last Man might become the Earth's happy occupant.

4 Bolton Street, Piccadilly, June 1847.

XVIII.—*Additions to the Fauna of Ireland**. By WILLIAM THOMPSON, Esq., Pres. Nat. Hist. and Phil. Society of Belfast.

[Continued from vol. xviii. p. 397.]

BIRDS.

Baillon's Crane, *Crex Bailloni*, Vieill. (sp.).

By letter from Dr. Harvey of Cork, dated January 13, 1847, I was kindly informed that he had at that time in his possession—temporarily—a specimen of this bird, which was taken in a bog at Clay Castle, near Youghal, on October 30, 1845. It was also remarked that the Spotted Crane, *Crex porzana*, was obtained in the same locality in October 1843. Dr. Harvey subsequently, at my request, favoured me with a description of the specimen of *C. Bailloni* as to dimensions and colour. On applying the description to specimens in the British Museum and in Mr. Yarrell's collection, there was a perfect agreement, except in one particular, the white markings being in

* This title is used for brevity. Species are included under it that do not belong to the fauna proper of the country, but in the making out of a general catalogue of the species obtained in Ireland, a separation will be made of the indigenous from the others.

The present communication (excepting the note on *Tadorna rutila*) was read at the Meeting of the British Association for the Advancement of Science at Oxford in June last.



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