Finally, the *Solenastræa* I described in Quart. Journ. Geol. Soc. vol. xxvii. p. 369 is probably a *remanié* fossil*. It is remarkable that the present coral fauna of the British seas should be so poorly represented in the Crag deposits.

The resemblance of the new species to *Trochocyathus meridionalis*, Duncan, of the Australian marine Upper Tertiaries below the horizon of the so-called Pliocene is remarkable; but it probably depends upon the descent of both forms from some unknown Jurassic or Cretaceous ancestor.

EXPLANATION OF PLATE XXVIII.

- Fig. 1. Calice of *Trochocyathus anglicus*: nat. size.
2. The same, magnified.
3. Side view of the corallum.
4. The base, magnified.
5, 5a. The corallum of *Solenastræa Prestwichi*: nat. size.
6. The calice, greatly magnified.
7. The epitheca, magnified.
8. The endotheca, greatly magnified.

DISCUSSION.

Mr. PRESTWICH inquired whether the fossil bore any resemblance to any of the French Eocene forms, and whether there was any possibility of its being derivative.

Prof. DUNCAN replied that the specimen was but little worn, and was therefore probably not *remanié*, though this point was not absolutely certain.

2. On the DISCOVERY of PALÆOLITHIC IMPLEMENTS in ASSOCIATION with ELEPHAS PRIMIGENIUS in the GRAVELS of the THAMES VALLEY at ACTON. By Colonel A. LANE FOX, F.G.S.

THE gravels and brick-earths of this part of the Thames valley have been classed by Mr. Prestwich† and Mr. Whitaker into two principal groups:—1st, the high-level gravels of Mr. Prestwich, occupying the summits of the hills above the valley; and, 2ndly, the valley-gravels, occupying the sides and bottom of the valley itself.

With respect to the former, or high-level gravels, some slight difference of opinion appears at one time to have existed between the two authorities whom I have quoted—Mr. Prestwich including the gravels upon Wimbledon, Wandsworth, and Clapham Commons amongst the high-level gravels, whilst Mr. Whitaker considers the gravels of Wandsworth and Clapham Commons to belong to the valley-gravels. He, indeed, if I understand rightly his memoir on Sheet 7 of the Geological Survey Map‡, appears to think it possible that

* As I find that this species cannot be figured, as I expected, in the 'Memoirs of the Palæontographical Society,' I have inserted figures showing its form and characters on the plate illustrating the new species described in the present paper.

† The Ground beneath us, its Geological Phases and Changes. By Joseph Prestwich, F.R.S., F.G.S.

‡ Memoirs of the Geological Survey of Great Britain, Sheet 7 of the Map of the Geological Survey.

the whole of the high-level gravel of Mr. Prestwich may be nothing more than higher terraces of the valley-gravel.

To enable the reader to understand at a glance the positions of the gravels I am about to describe, I have drawn a map of this part of the Thames valley, with contour lines of 10-feet levels strongly marked. A portion only of this map is given in the accompanying illustration (fig. 1), showing the part of the valley between Acton and the Thames. The margin of the London Clay is here shown by a dark tint, that of the gravel by a light one, and, for the sake of clearness, no distinction is made between the gravel and brick-earth. The geology of this district is taken chiefly from Mr. Mylne's map*, the accuracy of which I had the means of verifying in several places. The heights in this and all other cases are taken from the Ordnance datum, viz. mean tide at Liverpool, which is $12\frac{1}{2}$ feet lower than the Trinity datum of Mr. Mylne's map.

The valley-gravels proper of this neighbourhood, which for our present purpose may be roughly, though not accurately, described as the gravels lying below the 100-feet level, have been divided by Mr. Whitaker into three terraces, which it may be advisable here to describe, viz. :—a high-terrace gravel, occupying the shoulders and sides of the valley at a height of from 50 to 90 and 100 feet above the datum; a mid terrace, from 20 to 30 feet high, in the bottom of the valley; and a low terrace, occupying the low ground in the salient bends of the river, at an average height of from 10 to 20 feet.

Commencing with the north side of the river, he traces the margin of the uppermost river-terrace, or *high terrace*, as it may be convenient to call it, in contradistinction to the *high-level* gravel of Mr. Prestwich—from Drum Lane, north of Brentford, passing a little below Gunnersbury to Acton and East Acton, where this terrace ends off; and the next, or mid terrace, runs up at Wormwood Scrubs as far as the London Clay.

The northern boundary of the high-terrace gravel extends to beyond Hanwell on the west, passing by Ealing to Acton, where it is cut by a strip of the London Clay in the ravine of the Acton brook, dividing it from the isolated patch of high-terrace gravel to the eastward, which forms the particular subject of this paper. The average height of the northern limit of the high terrace is about 100 feet.

From Kensington to the Serpentine the high terrace is again found, rising at Campden Hill to the height of 129 feet, and extending beyond the Bayswater Road to the northward. Eastward of the Serpentine it rises again, extending from Piccadilly to Regent's Park, and from Paddington on the west to Finsbury on the east.

All the country to the north of this terrace, with the exception of a patch of gravel in the valley of the Brent, north of Twyford, and so no other patches beyond the limits of the tract under consideration, consists of the London Clay; and strips of the London Clay also run round the patches of high-terrace gravel along the sides of the Thames valley, at an average height of 50 feet, dividing it from the

* Geological Map of the Contours of London and its Environs. By R. W. Mylne, C.E.

Fig. 1.—Sketch Map of part of the Thames Valley, from Acton to near Chiswick and to the Thames at Kew.

a b. Line of general section, p. 459. A-K. Sections opened. +. Flint implements. O. Animal remains. The dark tint shows the margin of the London Clay; the light tint that of the gravel.

mid-terrace gravel below. These strips of London Clay are seen at Hanwell, at Acton, and for upwards of three miles from Kensington to Temple Bar, always at an average level of 50 feet*. Along the sides of all the tributary streams, the Brent, the Acton stream, and the Serpentine, this strip of the London Clay is also found at about the same general level of 50 feet, dividing the high-terrace gravel into patches. The lower margin of the mid-terrace gravel runs from the river at Kew, by Chiswick House to Chiswick, where it again joins the river; all below this line, in the bend of the river, is the third, or low-terrace. In the next bend of the river to the eastward, the margin of the mid-terrace is not so well defined; but Mr. Whitaker has traced it along the river below Hammer-smith to Fulham Church, and thence to Sandy End and Walham Green, and to the river at Cremorne. South of the river we have low-terrace at Ham, Petersham, Richmond, Kew, East Sheen, Barnes, Putney, Wandsworth, and Battersea. The mid-terrace is wanting, except between Barnes and Putney, to the north of the Barnes stream. A line of high-terrace gravel runs from Richmond Hill to East Sheen, commencing at the height of 50 feet. At Roehampton and Putney Heath, the high-terrace, if it be high-terrace, runs no lower than the 100-foot line, and rises to the height of 170 feet on Putney Heath. On Wandsworth and Clapham Commons the gravel rises to the height of 100 feet; this Clapham and Wandsworth gravel Mr. Prestwich formerly regarded as *high-level*, and considered it to form the same plain with that of Putney Heath. But both Mr. Prestwich and Mr. Whitaker, I believe, now consider the Wandsworth and Clapham to be high-terrace gravel, whilst that of Putney Heath and Wimbledon Common may be high-level gravel or a higher terrace of the river-gravel; certainly, if the level is to be taken as the criterion of classification, the Clapham and Wandsworth gravels would appear to correspond with the *high-terrace* gravel on the north side of the river, and to be somewhat lower than that of Wimbledon Common. As on the north, so on the south side of the river, the high-terrace gravels are divided from the mid- or low-terrace gravels by strips of the London Clay throughout nearly the whole of this district. Above Ham and Petersham the strip rises to a considerable height in Richmond Park. From Richmond to East Sheen, the upper margin of the strip, and the commencement of the high-terrace gravel, judging by Mr. Mylne's map, appears to be on the 50-foot line, whilst the mid-terrace gravel ends in about the 30-foot line. On the Roehampton and Putney-Heath hills the mid-terrace rises to the 50-foot line, while the upper-terrace gravel commences at about 100 feet, leaving the space between the 50- and 100-foot lines occupied by the strip of the London Clay†.

It seems to be doubtful whether or not this strip of clay runs along

* It is very probable that this strip will eventually be found to run further south along the valley of the Brent, and along the 50-foot line by Little Ealing, to join the strip at Acton; but this cannot now be determined.—A. L. F.

† This description is taken from Mr. Mylne's Map, which I have not had an opportunity of verifying in this place.

the steep slope which marks the boundary of the valley near Wandsworth and Battersea Rise*. It is seen along the valleys of all the tributary streams, which correspond in this respect with those on the north side of the river. This general description of the valley-gravels will, I trust, enable the reader to appreciate the position of the implement-bearing gravels under consideration.

My examination of the gravels in this district commenced in the year 1869, and has continued almost uninterruptedly ever since. A notice of the discovery of drift implements was communicated to the Meeting of the British Association at Exeter in that year. Several brick-pits were examined in the mid-terrace between Wormwood Scrubs, Shepherd's Bush, and Hammersmith; and the workmen had the appearance of flint flakes and implements explained to them by showing them specimens from other localities; rewards were also offered, to induce them to preserve any similar implements they might find during the excavations; but nothing of the sort was found in any of these pits. The brick-earth here lies from 10 to 12 feet thick upon the gravel; and, with a few exceptions, the cuttings did not extend lower than the brick-earth.

Passing westward along the Uxbridge road, I found that some excavations were being made for the foundations of houses in the high-terrace gravel in Churchfield, east of the village of Acton. The lay of the ground in this place corresponded so closely with that of the implement-bearing gravels of the Somme and the Ouse, that I determined to watch the diggings closely, and repeated my visits to this spot almost every day for some months. Reference to the section across the Thames valley from Acton to Richmond Park (fig. 5, p. 459), will show the position of this patch of gravel, resting upon the London Clay, a strip of which, as already mentioned, comes to the surface on the slope of the hill, dividing the high- from the mid-terrace gravel†. Near this strip of clay the superincumbent gravel does not exceed 6 and 7 feet, and it is much contorted. Seams of sand may be seen to turn up nearly on end, a good example of which was seen in Section A, in Arthur Terrace, on the line of the 60-feet level. Higher up it increases to 10 and 13 feet thick, as was shown in Section G, in Lorne Terrace, between the 80- and 90-feet lines; and to the westward, in Horne Lane, it was found in cutting for a sewer to be 18 feet thick. As a rule, the sections at the higher levels show the lay of the various seams of gravel and sand to be more even than in those parts which adjoin the outcrop of the clay, the seams thinning out gradually and horizontally in various directions. Between the 80- and 90-feet lines it was also noticed that in some places the gravel was overlain by a deposit of brick-earth, which passed down gradually and imperceptibly into fine sand. This was the case in Section F, in Chaucer

* Since writing this, Mr. Whitaker has informed me that he has traced it along this line.—A. L. F.

† This strip of clay is not marked in the recently published Geological Map, Sheet 7, but it is correctly given in Mr. Mylne's Map. I ascertained its existence by cuttings for sewers made in the lane to the eastward of the railway, and also in Grove Road; it consists of clay, with occasional irregularly shaped holes on the surface, filled with gravel.

Road. The gravels consisted of the usual subangular flints mixed with rounded quartz and quartzite pebbles, with occasional fragments of pudding-stone. No traces of river or other shells were discovered in this place. In the surface-soil were found some fragments of Romano-British pottery, the relics of comparatively modern occupation. To the eastward of the railway-station, in the foundations of East Acton Villas, on the 60-feet line, the ground appeared to have been disturbed. Some flakes and small scrapers were found in this place, all of surface type, and of a dark colour. Two chipped implements found here in the gravel are worthy of notice as being of surface type, although stained with the ferruginous colour of the gravel; one of these, of the celt-form, with an edge at the broad end, was found at a depth of about 4 feet; but whether it belonged to the gravel-deposit, or had worked in from the surface, I was unable to determine; it is, however, completely gravel-stained. To the westward of the station the ground rises, as seen by the contour-lines marking the 70-, 80-, and 90-feet levels.

In Alfred Road, Section B, the surface being 63 feet above the datum, a small oval-shaped implement was found at a depth of 7 feet, resting on the actual surface of the London Clay, and beneath an undisturbed seam of sand 6 inches thick. The surface of this implement is very much rolled; I saw it a few moments after it was taken out, and I have preserved a piece of the London Clay taken from immediately below the spot.

In Section C (fig. 2), surface 75 feet, is seen the position of some flakes and a flint, shaped like a rough scraper, found at a depth of

Fig. 2.—Section C, in High-terrace Gravel at Hyde House, Shakespear Road. Surface 75 feet.

- a. Surface soil, 6 in. b. Disturbed soil, 2-3 ft. c. Gravel and sand, ferruginous and irregular, with lines of black oxide of iron, 1-2½ ft. d. Clay-sand, blue, grey, yellow, and red, 0-18 in. e. Gravel and sand, with chips throughout, 4 ft. f. London Clay. + Position of flint implements.

9 to 10 feet, beneath irregular seams of blue, grey, yellow, and red clay-sand.

In Section D, west of Spencer Road, surface 75 feet, a layer of yellow sand, 2 feet 6 inches deep, with thin seams of red- and green-coloured sand, were seen between subangular gravel above and below.

Section E (fig. 3), in Lorne Terrace, surface 83 feet, shows the stratification at a spot where an unusual number of implements were dis-

Fig. 3.—Section E, in High-terrace Gravel in Lorne Terrace, Myrtle Road. Surface 83 feet.

a. Surface-soil, 6 in. b. Sand, 4 ft. 2 in. c. Gravel, 1 ft. d. Sand, 3 ft.
e. London Clay.

covered. Two of these, 4 inches long and $2\frac{1}{2}$ inches in width, pointed, and thick at the butt-end, were found close to a beam of wood, possibly the trunk of a tree, portions of which being submitted to Mr. Carruthers, were pronounced by him to be pine, "and probably *Pinus sylvestris*, Linn., the only indigenous species." This section, as will be seen, is composed chiefly of sand, with a strip of gravel 1 foot thick, at about 5 feet from the surface. Close to this section was also found a portion of the tooth of *Elephas primigenius* in the gravel, at a depth of 7 feet from the surface.

In Section F, in Chaucer Road, surface 82 feet, occurred the rhizome of a fern, the depth and position of which are worthy of notice; the deposits consisted of 6 inches surface-soil, 5 feet of brown brick-earth, passing gradually into fine yellow sand without stones, 1 foot of gravel, 2 feet of white sand, and the London Clay. Resting on this London Clay was found the piece of wood exhibited, which Mr. Carruthers has been so kind as to identify for me as the rhizome of one of our indigenous ferns, either the *Lastrea filix mas*, Linn., or the *Osmunda regalis*, Linn. One of the fronds, or a portion of the

rhizome, rose in a serpentine direction to the seam of gravel 2 feet above, where it ended, and no trace of it was seen either in the gravel or the sand above. This section was seen by Mr. Flower and Mr. Searles Wood, the latter of whom suggested, in explanation of the position of the frond, that the rhizome of the fern must have been washed down by the stream, the heavier part resting on the bottom, and the frond rising towards the surface, in which position it must have become imbedded in volumes of sand. If this explanation is correct, it is evident that the flow of the river at that time must have been from west to east, viz. the direction of the present river. I leave it, however, for botanists to determine whether it may be possible that the rhizome of a fern of the surface-period may, by natural growth, have descended to so great a depth as 8 feet 6 inches from the surface.

Section G, at the top of Lorne Terrace, surface 83 feet, furnished the largest and best-formed implement discovered in this place. It is triangular, 8 inches long and 4 inches at the base; the natural surface of the flint is left at the butt-end. It was found beneath several deposits of sand, gravel, and brick-earth, at a depth of 13 feet 6 inches from the surface. The upper surface of the London Clay was here seen to slope gently upward towards the north.

Section H (fig. 4), shows the position of a number of flakes remark-

Fig. 4.—Section H, in *High-terrace Gravel north of Chaucer Road*.
Surface 82 feet.

a. Surface soil, 6 in. *b.* Brick-earth with seams of white sand, 4 ft. *c.* Gravel with seams of white sandy clay, 4 ft. 6 in. *d.* London Clay.

able for the sharpness of their edges, all the others being blunted by contact with the other stones of the gravel. These were found in seams of white sandy clay, 9 feet from the surface, beneath deposits of gravel and brick-earth: the position of these flakes is of interest, on account of the edges of the whole of them being as sharp as when they were flaked off from their cores, proving that, whilst the majority of the flakes and implements in this place were carried down by the water, and rolled in the gravel, especially that referred to in Section B, these, on the contrary, must have been flaked off on the spot, and dropped into the soft sandy bottom of the river in this place, after which the deposits of gravel and brick-earth must have accumulated over them. Although I did not myself discover these flakes *in situ*, I satisfied myself of the correctness of the accounts given me by finding some of these sharp flakes in the excavated material with the soft, sandy, clay-deposit adhering to them. [Some of these were exhibited.]

At Mill Hill, on the other side of the ravine of the Acton brook, about half a mile to the westward, a very large flake was found in a seam of sand, 7 feet 3 inches from the surface, beneath stratified gravel interspersed with seams of yellow sand, the surface being 80 feet above the datum.

At Ealing Dean, two miles to the westward of Acton, in some gravel excavated for the construction of a sewer, the surface being 92 feet above the datum, I found two implements, one of which is an exceedingly fine specimen; it has a slender point, and is 5 inches in length and $2\frac{3}{4}$ broad, rounded at the butt-end. It is worthy of notice that, although I watched this place for some months, examining the cuttings in the gravel for the foundations of houses along the very same piece of road in which the implements were found, and although the workmen were expressly instructed what to look for, I never afterwards found so much as a single flake in this gravel. Upon inquiry, I found that the cuttings for the sewer were carried much deeper than the foundations of the houses; and the implements must therefore have been brought up from the very bottom of the gravel-bed, thus confirming in a remarkable manner the experience derived not only from Acton, but from other similar deposits of drift-gravel, in which the implements are all found to lie almost invariably at the bottom of the gravel. I was particular in examining into this question, because I am aware that there is a natural tendency amongst workmen to say that what they find is "right down at the very bottom;" as, however, the cuttings at Acton were made in steps, and the several levels were in most cases excavated upon different days, it was easy to test the truth of their statements; and I found that in every instance the implements came out of the lowest stratum of the gravel. Here the largest flint stones lie, and with them the implements, mostly of the dimensions of the larger stones, so that it was common for the more experienced workmen to say that they should find no implements till they got down into the coarse gravel; the smaller flakes, however, were not so invariably at the bottom.

To the north of the Great Western Railway, between Hanwell and

Ealing, some extensive cuttings in the gravel produced no trace of flakes or implements.

In all, about 22 implements and 160 flakes were discovered in the gravels at Acton and Ealing, the implements being far less numerous than in the similar deposits of the Somme or the Ouse. The forms of the implements vary between the oval and the pear-shape; and there is no evidence of the greater antiquity of either. Of these forms, nearly all were rounded, and left with the natural surface of the flint at the butt-end, only one having been found at Acton roughly chipped to an edge at the end. This is exclusive of the surface-type implement already mentioned as having been found to the east of the Station. The forms of the implements appear to have been determined by those of the stones out of which they were fabricated, an oval stone producing an oval implement, and a long stone a long implement. Most of the implements are of small size; and those found in Section F, being the commonest, might perhaps be selected as the Acton type. One implement, found by me in this gravel, is remarkable for being entirely untouched on one side, and roughly chipped on the other, showing that the fabricator selected a suitable pointed stone for his purpose, and, having one side prepared for him by nature, devoted his whole attention to the trimming of the other. Another implement was found in a rudimentary stage of manufacture, having only one side formed, by blows delivered all in one direction, when the fabricator abandoned it. [Two well-formed cores were exhibited, one of which was from Mill Hill.] The flakes, as a rule, are more abundant, smaller, and finer than is customary in the drift; some of these might be taken for surface-flakes; they are no doubt peculiar to the drift of this locality.

The long, sharp, thin flake, $5\frac{1}{2}$ inches in length, $\frac{1}{4}$ thick, and $\frac{3}{4}$ broad, found in the seam of soft sandy clay, in the position represented in the diagram, Section H, is, I believe, almost a unique specimen of drift manufacture, and suggests the possibility of many of the other flakes having been originally of more perfect construction before they became rolled and fractured in the gravel. Two or three specimens are bevelled at the end, as in the form of scrapers. Some of the implements were found by myself in gravel laid on roads, and excavated from spots the particular position of which could be ascertained. In all cases where sections are given, I took particular care to test the accuracy of the statements of the workmen as to the exact positions of the implements, and I have no doubt of their correctness in each case. Shortly after I commenced my visits to Acton, some rather ingenious attempts at forgery were foisted upon me, by chipping, varnishing, and, when dry, burying the flints thus prepared in the ground; but upon my pointing out at once to the workmen the precise manner in which each chip had been made, the recent character of the whole, the varnishing, the burying, and the economy of time and labour which might be effected by looking for the real implements when at work in the gravel, instead of wasting so much time over very imperfect imitations, they at once saw that it was impossible to deceive me, and I never afterwards found any attempt made to impose upon

me. With respect to the animal-remains discovered in the high terrace, it was found that the surface-soil contained so many bones of recent animals which dropped down into the cuttings, that it was difficult to distinguish them from any that might be found in the gravel. The whole were therefore submitted to Mr. Busk, who has kindly undertaken to identify them, and whose report upon them will be read to the Meeting. (See p. 465.) The position of one tooth of *Elephas primigenius* may, however, I think, be regarded as fixed; it was found in the gravel, near Section H, in Lorne Terrace, at a depth of 7 feet. I did not see it taken out of the gravel; but it was handed to me shortly after it was discovered; and I have no reason to suppose, nor do I think there is any likelihood of its having been brought to this place from any other deposit of gravel. The nearest gravel-pit then being worked was a mile and a half distant; the bones of that gravel-pit were being collected for me by other workmen at the time; and there could be no object in transferring this bone from one pit to another when they knew that they would receive the same remuneration, from whichever pit it came. This, however, to the best of my belief, is the first tooth of *Elephas primigenius* which has been found in the high-terrace gravel. The mid terrace is prolific in animal-remains, as has been already shown by the researches of Professor Morris.

I now turn to the Mid-terrace gravel. About a mile and a half south of the Church field at Acton, in a place called Brown's Orchard, between Acton Green and the Brentford Road, some excavations were being made to obtain gravel. The position of this spot, with reference

Fig. 5.—Section across the Thames Valley from Acton to Richmond Park. (Vertical scale 10 times the horizontal.)

to the Acton gravels, is seen in the cross section of the valley which passes through both places (fig. 5). The outcrop of the London Clay is here seen intervening between the two localities, separating the high from the mid terrace. The surface in Brown's Orchard is 24 feet; the stratification of the deposits is shown in Section I (fig. 6),

Fig. 6.—Section I, in Mid-terrace Gravel, in Brown's Orchard, Acton Green. Surface 24 feet.

a. Surface soil, 1 ft. 6 in. to 2 ft. b. Mixed earth, 6 in. to 2 ft. c. Gravel, 6 in. to 1 ft. 3 in. d. Sand with seams of red and white sandy clay, 8 ft. e. Black seam. f. Gravel with bones. This cutting extended to within a foot or two of the London Clay.

consisting of:—Surface-soil, 1 foot 6 inches to 2 feet; mixed earth, 6 inches to 2 feet; gravel, 6 inches to 1 foot; 8 feet of sand, with irregular seams of red and white sandy clay; a black seam of oxide of iron or manganese; 2 feet of gravel; and at the bottom of all, in close proximity to the London Clay (which, however, was not attained in this section on account of the quantity of water lying upon it), a thick layer of animal-remains, consisting of a variety of extinct animals, mixed together, and lying invariably at a level 12 to 13 feet from the surface; the names of these, which through the kindness of Mr. Busk I am enabled to give, consist of:—

1. <i>Rhinoceros hemitechus.</i>	6. <i>Cervus clactoniensis, Falc.</i>
2. <i>Equus caballus.</i>	7. — <i>elaphus.</i>
3. <i>Hippopotamus major.</i>	8. — <i>tarandus.</i>
4. <i>Bos taurus.</i>	9. <i>Ursus ferox priscus.</i>
5. <i>Bison priscus?</i>	10. <i>Elephas primigenius.</i>

A detailed account of these will be given by Mr. Busk.

About 200 yards to the westward of this place, in Chiswick Road, on the other side of the Kensington and Richmond railway, and between it and the Brentford Road, another cutting for the foundation of a house showed the stratification represented in Section K (fig. 7),

Fig. 7.—Section K, in Mid-terrace Gravel, in Chiswick Row, Turnham Green Road. Surface 29 feet.

- a. Surface soil, 2 ft. b. Brick-earth, 2 ft. 9 in.—3 ft. c. Clay and gravel, 6 in.
d. Sand, 6 in. e. Gravel, 4 ft. 6 in. f. Sand with rounded and angular pebbles
and bones. g. London Clay.

consisting of:—Surface-soil, 2 feet; brick-earth, 2 ft. 9 in. to 3 feet; seams of clay and sand, 1 foot; gravel, $4\frac{1}{2}$ feet; and $4\frac{1}{2}$ feet of sand with rounded and angular pebbles; and the London Clay at 15 feet; close to which, in the sand, at about a foot from the bottom, animal-remains were also found, as in Brown's Orchard. This was, I believe, some little distance to the eastward of the spot examined by Professor Morris, and described by him in the 'Journal of the Geological Society,' vol vi. Reference to the contours in the map will show that this ground is on a slight rise in the mid terrace, forming the watershed between the Brent and the Acton brook, tributaries of the Thames. Throughout this district, over probably more than half a square mile in extent, wherever the London Clay is reached, animal-remains in great abundance are found above it, and always, I believe, in close proximity to the clay. Careful search was made here, as in

the high terrace, for flint implements; and as a proof that the total absence of human relics did not arise from any neglect in looking for them, I may mention that one of my most experienced men, who, on account of his numerous finds in the high terrace I called my flint-finder, was afterwards employed in Brown's Orchard; and although he laid down with his own hands upwards of three miles of gravel upon roads, and the same inducements were offered him as on the former occasion, he never found in this gravel so much as a single flake or chip which could be ascribed to the hand of man. This circumstance, tallying as it does with the result of my previous examination of the mid terrace, as before mentioned, near Hammersmith, is worthy of record. It would be unsafe to build an hypothesis upon negative evidence of this kind; but the gravel-excavations for the New Law Courts in the Strand, where the surface is about 40 feet above the Ordnance datum, and which is consequently on the level of the mid terrace, were found by Mr. Price, who examined them carefully from time to time, to be totally devoid of worked flints. The historical drift-implement of Gray's Inn Lane must have been found between the 60- and 70-feet line, and consequently on the level of the high terrace; and the flint found by Mr. Evans at Highbury was at a much higher level. It may, I think, be stated as a fact, that no flint of the drift-type in this region has hitherto been found below the 50-feet line, except in the bed of the Thames itself. From the Thames I have obtained one implement of drift-type; and Mr. Sparrow Simpson is in possession of a remarkably fine specimen, also from the bed of the Thames.

On the south side of the river my researches have been less complete than on the north side; I, however, examined the gravel-pits of the high terrace at East Sheen. The workmen had already been put on the look-out for implements by previous searchers, but, up to the time I visited the spot, had found nothing. In the high-terrace gravel at Wandsworth and Battersea Rise, after a fruitless search in several gravel-pits, and after carefully walking over some miles of gravel laid upon roads, I at last discovered one implement, together with a flake, lying on a heap of gravel at the junction of Gray-shot Road and the Wandsworth Road upon Battersea Rise. I made many inquiries to ascertain the exact position from which this gravel was obtained; I was informed by a workman that it came from an open gravel-pit within a few yards of the spot. The surface at this pit was between the 50- and 60-feet line, and it occupies exactly the same position above the strip of London Clay as the implement-bearing gravel at Acton. It is extremely probable that it came from this pit; but it is certain that it came from some part of Battersea Rise; for the quantity of gravel which is obtained from pits in this neighbourhood makes it extremely improbable that this particular heap should have been imported from elsewhere. Moreover the absence of implements in the gravel of this hill generally, makes it the more probable that it came from the particular pit near which it was found, as this pit had been but little worked; and it is possible, therefore, that the heap in question may have been the firstfruits of

an implement-bearing bed, which may turn out to be more productive hereafter.

It may perhaps be expected that, in concluding this paper, I should offer some conjectures of my own upon the unsettled question of the age and mode of deposition of the river-gravels. I confess, however, that the evidence which I have been able to collect does not appear to me to warrant any fresh hypothesis. There are, however, one or two fragments of archaeological evidence, proving the great antiquity of the present bed of the Thames, which appear to me to have some bearing on the question of the erosion of the Thames valley. Near the town of Dorchester, at the junction of the Isis with the Thame stream, are the ancient earthworks known as the Dorchester Dykes, attention to which has unfortunately been drawn by their recent destruction. These works consist of a nearly straight line of entrenchment in the bottom of the valley, running from the Isis on one side to the Thame stream on the other, and enclosing the flat salient promontory formed by the bend of the river. The flanks of the entrenchment rest upon the stream on both sides. The requirements of defence demanded that they should rest upon the stream at the time they were constructed; there is evidence, therefore, that the river must have run in its present course through the flat bottom of the valley at that time. Nor could the conditions of its flow have been materially different from what they are at present; for the river still floods a considerable portion of the enclosed space, and, if it had habitually risen only a few feet higher, it would have rendered the spot unsuitable as the site of an encampment. Now the associated relics prove that this entrenchment is the work of pre-Roman times. All the works of art discovered within the area of the entrenchment are of flint or bronze; and notwithstanding the existence of a Roman station at Dorchester close by, nothing Roman is found in this place. We have evidence, therefore that the Thames ran in its present course, and under nearly the same conditions as at present, ever since the bronze period of England; and how much longer, we cannot tell. But we have facts of the same kind within the district represented upon our map*. From Ham to Petersham the river runs northward, by Richmond to Kew, where it bends to the south, running to East Sheen, and then turns again northward, running by Barnes to Hammersmith; again turning to the south, it flows by Putney and Wandsworth, turning north again, in the direction of Battersea and Chelsea, thus making four bends between Ham and Chelsea in the comparatively flat bottom of the valley. Throughout the whole extent of this winding course, almost wherever the dredging machine is put into operation, relics of the bronze and stone age are turned up at various depths, extending to 10 feet below the existing bed of the river. Mr. T. Layton, F.S.A., of Kew, to whom I am indebted for information on this subject, has collected nearly one hundred specimens of the prehistoric age, many of which are bronze leaf-shaped swords, together with a number of stone and bronze celts from different parts of the river.

* Reference is here made to the larger map exhibited to the Meeting.

Near the mouth of the Brent, at Kew, piles may be seen beneath the water, marking, no doubt, the site of a river habitation, similar to those of the Swiss lakes; and at Barnes, in the opposite bend of the river, similar piles have been found, associated with a number of flint celts and dolichocephalic skulls of the form believed to have belonged to the earliest inhabitants of these islands. As these relics, to the best of my belief, are not found in the Thames valley elsewhere than in the existing bed of the Thames, it follows that the river must have flowed in the same meandering course for two thousand years, and in all probability for a much longer period, the bed of the river having actually *risen* during this period, as appears by the depth at which these ancient relics are found beneath the sedimentary deposits*. We are thus led to form an idea of the enormous time that would have been required to erode the whole valley by means of a river flowing under the same conditions as the present one, to effect which it would have been necessary for the river not only to have shifted its bed over every portion of the present surface of the valley, but to have done the same thing repeatedly at different levels, over an extent of country which, as shown by the section, must, on the 100-foot line, have exceeded four miles and a half. This theory of the gradual erosion of the valley by means of a river of the same size as the present one, however, appears to have been abandoned by some of the best authorities.

The presence of large tracts of brick-earth overlying the gravel, argues, as I venture to think, the existence of large volumes of water at the time they were deposited. Then to what cause are we to attribute the strips of the London Clay laid bare on the sides of the valley, and of the tributary streams, at the average level of 50 feet? Obviously to denudation of some kind. Why, then, is this denudation not continued along the sides of the same streams into the mid terrace and down to the present river? The mid terrace, instead of being broken into patches by denudation, like the high terrace, is continuous, following the sinuosities of the valley up to the limit of the 50-foot line, or thereabouts. I venture to suggest, though not without diffidence, that a body of water, occupying the whole valley up to the 50-foot line, would account for the phenomena presented. The denudation of the patches of the high terrace would be caused by the drainage *into* this body of water. The mid-terrace gravel would be the result, in a great measure, of accumulations *beneath* the surface of the water. If this hypothesis were admitted, the implements of the high terrace must belong to a period anterior to that at which the river or lake stood at this level; and there is no reason, therefore, why they should not be found in the gravels still higher above the river†.

The presence of these implements in the high terrace, their absence, so far as our researches go, in the mid terrace, and their reappear-

* The stone implements, I understand from Mr. Layton, are found lower than the bronze.

† I may here notice that no shells of any kind were found in the sands, although they were carefully looked for.

ance again in the present bed of the Thames—the abundance of animal-remains in the mid terrace, and their great rarity, if not absence, in the high terrace—and the invariable occurrence of both implements and animal-remains in the *lowest strata* of the gravel immediately adjoining the London Clay, are facts which demand an explanation of some kind. It is rather with the view of submitting these points to the judgment of geologists, than of attempting to explain them myself, that I have prepared the accompanying maps and sections with as much attention as possible to detail, and in the hope that the slight addition thus afforded to our knowledge of the distribution of the drift-implements in the Thames valley may not prove unacceptable to the Geological Society.

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3. *On the ANIMAL-REMAINS found by Colonel LANE FOX in the HIGH- and LOW-TERRACE GRAVELS at ACTON and TURNHAM GREEN.*
By GEO. BUSK, F.R.S., F.G.S., &c.

[PLATE XXIX.]

I. HIGH-TERRACE GRAVEL.

THE animal-remains from the High-terrace Gravel belong to *Bos*, *Ovis*, *Equus** and *Elephas*?

1. *Bos*.—The bovine remains comprise by far the greater part of the specimens collected at this level. They are all in a comparatively recent condition, though some appear to have been more exposed to atmospheric influence previous to interment than others. Most of the bones also exhibit marks of cutting or chopping with a sharp metallic implement; and none have been exposed to fire. Some few present faint indications of manganoous deposit, in the form of minute specks; but none, with one exception, can be called dendritic, nor do any of them adhere to the tongue, or but very slightly so. In fact, they may nearly all be regarded as of modern origin, and as belonging to the common ox of rather small size. A perfect metacarpal measures 8 inches in length. Amongst the bovine remains is what appears to be a portion of the metacarpal of a calf.

2. *Ovis*.—The ovine relics are very few in number, and all modern.

3. *Equus*.—Two specimens only belonging to the horse occur in the High-level collection, viz. a left lower molar and a portion of the right scapula, including the glenoid cavity. Both these specimens are dendritic; and the fragment of the scapula is highly ferruginous and much decomposed, apparently from subaerial exposure, so that the surface scales off in thin laminæ. From their condition, these bones would seem to belong to a different period than

* As a curious instance of the way in which animal-remains may become mixed together, it may be mentioned that the nearly entire pelvis of an *Emu* was found, as it is stated, in "brick-earth at Acton, close to the south of the High-level terrace Gravel, at a depth of about $2\frac{1}{2}$ feet from the surface," the truth being that it was found in garden-mould at that depth.