Notes on the Geology of Lewisham.

By H. J. Johnston Lavis, Esq., F.G.S.

As the Chalk is one of the most important of our Cretaceous rocks, so is it the last of the Mesozoic series in Britain. I will not attempt a detailed description of it, but will notice a few of the leading facts connected with the upper division, called "Chalk with Flints," or "Upper Chalk."

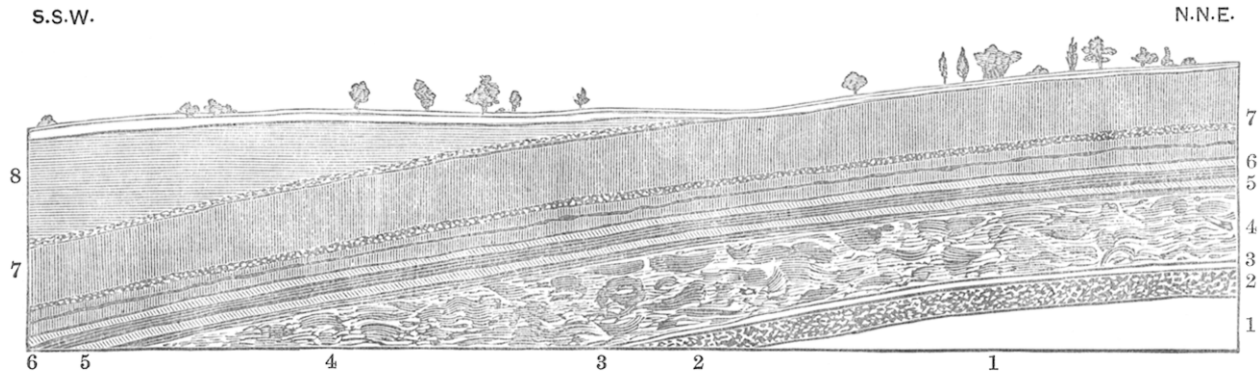
There are two important sections of the Upper Chalk in the neighbourhood of the metropolis to which I wish to draw attention, viz., at Lewisham and Charlton, besides other smaller and less important ones.

The first occurs in the most northern pit of Loam-pit Hill, about a quarter of a mile from St. John's Station. Here we see a face of Chalk of about 45 feet deep, with a base line of about 200 feet, capped by the Lower London Tertiaries. This shows in section two well-marked bands of flints, the first of which is situated about 6 feet from the top, and the second 4 feet below the former. Besides these there are many other less conspicuous bands of the same material. The Chalk here presents in two or three places a kind of cleavage which is parallel to important lines of dislocation or jointing situated close by, of which I shall say more hereafter. The Chalk in this locality is very fossiliferous. Appended is a list of fossils I have obtained from Loam-pit Hill.

Fish remains.
Belemnitella mucronata.
Pecten nitidus?
Spondylus spinosus.
Lima.
Ostrea.
Inoceramus.
Terebratula semiglobosa.
" carnea.
Rhynchonella octoplicata?
Crania.
Flustra.
Ananchytes ovatus.
Galerites albogalerus.
Cyphosoma.
Cidaris. (?)
Micraster coranguinum.
Goniaster Parkinsoni.
Apiocrinus ellipticus.
Serpulæ.
Escharina, and many other forms of Bryozoa.
Scyphia.
Ventriculites.

The next and largest exposure is situated near Charlton Station, where a very extensive section is seen. The chalk in this pit differs from the Lewisham chalk in being less ironshot. In this is also seen two well marked flint bands, besides subordinate

FIG. 1.—SECTION ACROSS LOAM PIT HILL, LEWISHAM.



1 Thanet Sand.
2 Greenish Loamy Sand with Pebbles.
3 White Sand.
4 Marl and
Sand with Pebbles.
5 Cyrena bed.
6 Ostrea bed.
7 Plant bed.
8 London Clay with
Basement Bed.

ones; the upper being about 9 feet from the top of the chalk, and the lower 9 feet from the upper. The surface of chalk here exposed is only 25 feet deep, as it cannot be worked below the drainage level; one place where this has been attempted is filled with water. Proportionately this is less fossiliferous than in the former locality, though it is a well-known resort of London collectors. The following are the principal fossils I have obtained from the Charlton pit:—

Saurian (?) bones.
Fish remains.
Lamna.
Ptychodus.
Belemnitella mucronata.
Pecten quinquicostatus.
„ nitidus.
Spondylus spinosus.
Inoceramus.
Lima Hoperi.
Ostrea dilatata.
„ sp.
Thecidium Wetherellii.
Terebratula semiglobosa.
„ carnea.
Crania Ignabergensis.
Rhynchonella octoplicata (?)
Flustra.
Apiocrinus ellipticus.
Cidaris.
Cyphosoma.
Ananchytes ovatus.
Ananchytes pilula.
Galerites albogalerus.
Micraster coranguinum.
Serpulæ.
Vermetus.
Bryozoa.
Ventriculites.
Scyphia.
Choanites.

Thanet Sands.—Resting almost directly upon the Chalk in this locality are the Thanet Sands, the lowermost division of the Lower Eocenes. They derive their name from the fact of their attaining their greatest development in the Isle of Thanet. They consist of a mass of light buff or greenish sands, more or less unfossiliferous in the north-west of Kent, generally ironshot, stratification faintly marked, and, when dry, appearing at a distance almost white. The sand is composed of fragments of nearly colourless subangular quartz, intermingled with glauconitic grains, and especially at its lowest part with a white argillaceous substance, which does not stain the sand. This material was probably uniformly distributed throughout the sands during their deposition, but has since been washed down to their lower part by the percolation of water.

Perhaps the most interesting point about these beds is the presence of the constant and well marked band of green-coloured flints which is found in immediate contact with the Chalk. These also occur at the bottom of the Woolwich and Reading Series,

where these beds rest upon the Chalk, where they occupy the same position, leading some to believe that they were the representatives of the Thanet Beds in that district. The flints are perfectly unrolled, and therefore could not have been deposited in their present position by marine action; Mr. Dowker considers them to have been left by the sub-aerial denudation of the Chalk; but the explanation of Professor McKenny Hughes and Mr. Whitaker is generally accepted. These gentlemen consider the bed to have been formed by the percolation of water containing carbonic acid through the superposed strata which, on arriving in contact with the chalk, dissolved the upper part away, leaving the flints behind to become simultaneously or subsequently covered by their characteristic green coating. In the neighbourhood of Lewisham there is a fact which would seem to confirm this. Just outside St. John's Station we see the Thanet Sands faulted down against the Chalk. We might expect to find the Thanet Sands in immediate contact with the Chalk, but we find that there is a thin layer of green flints interposed. Now the faulted surface is at about an angle of 40°; the water, therefore, draining through the Thanet Sands and containing carbonic acid, would dissolve away the chalk, though with less power on account of its sloping direction, leaving the flints behind. The bed of flints varies in the neighbourhood from 9 to 18 inches.*

The bed of green-coated flints, the "Bull Head Bed," is overlaid by the Thanet Sands proper. Mr. Whitaker says of this: — "(C) In a railway cutting close to Bekesbourne Station, east of Canterbury, there is a little sand below the sandy marl (D), in which the greater part of the cutting is made, and this I take to be the same as the Thanet Sand of London and the western part of Kent. The only other places in that neighbourhood where I saw anything of it was at Selling. This fine light buff sand thickens westward, and near Sittingbourne forms a considerable part of the Thanet Beds. Further west it gets still thicker at the expense of the beds above, until, on the other side of the Medway, it replaces them altogether, and takes up the whole of the space between the Woolwich Beds and theBase-beds

* I have obtained one flint from this place which was white where imbedded in the Chalk, but the part surrounded by the Thanet Sands was quite green graduating into the white.

some 60 or 70 feet. It thins slightly in the neighbourhood of Woolwich, and then rather more rapidly, until it dies out west of London."* In accordance with this the Thanet Sands are thicker at Charlton than at Lewisham.

He then goes on to say—"No fossils, except some casts of Pholodomya recorded by Professor Prestwich at Erith, have been found in this bed."

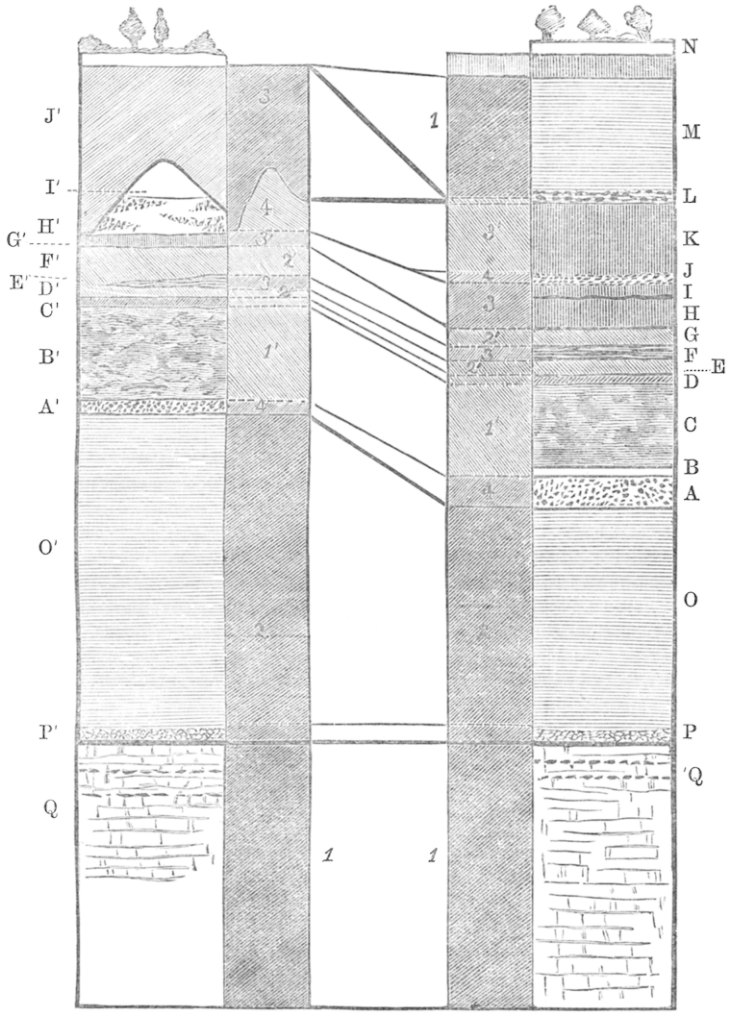
To these we can add some casts of the same shell at Charlton, recorded by Professor Morris, and confirmed by Mr. Taylor, besides which, before you is a cast of a *Cyprina*, obtained by Professor Morris and myself from the same locality, and I have lately found two similar casts close together at Lewisham, which I unfortunately broke while extracting them. There was also found by one of Professor Morris' students the cast of a fish vertebra, at Charlton. Small portions of lignite also occur occasionally. In the Woolwich pit, which faces the Thames, the upper part of the Thanet Sands may be seen to have been burrowed by annelids, which were subsequently filled up by the clayey sand of the bottom of the Woolwich and Reading Series, which overlies it. The Thanet Sands proper are considered to be the equivalents of the Landenian series in Belgium of M. Dumont. The Green Flint bed probably is represented by the Argile à Silex, of Professor Hèbert, in France.

The Woolwich and Reading Series is the middle member of the Lower Eocene. These beds consist of alternating gravels, sands, and clays, very fossiliferous in parts, almost barren in others. They are of marine, estuarine, and of fluviatile origin.

The bed marked (A and A′ in Fig. 2) consists of a green sand with a number of well-rounded black pebbles. At Lewisham this bed is 6 feet thick, containing very few pebbles, these being more or less equally disseminated through it. At Charlton it is only $1\frac{1}{2}$ feet thick, the pebbles predominating, each individual one being in contact with its fellow, the sand only filling the spaces between them. These pebbles are considered by Mr. Prestwich to have been formed on an island or shoal in the Thanet Sand sea, and were strewn over its bottom at the end of that and the commencement of the Woolwich and Reading period, by the movements of elevation which took place then. The sand was probably

* Quart. Journ. Geol. Soc., Vol. xxii., p. 408.

FIG. 2.—COMPARATIVE SECTIONS OF CHARLTON AND LEWISHAM.



a portion of the Thanet Sand which was washed up and intermingled with the pebbles by the rapid currents then naturally existing. As evidence of this the lowest bed of the series rests very irregularly on the Thanet Sands, as shown in Fig. 3, the bed above it being estuarine in character, showing a change from marine

to estuarine conditions. Though generally unfossiliferous, sharks' teeth are sometimes found in this bed.

At Lewisham the Bottom Bed is overlaid by a thin unfossiliferous bed of white or iron-stained sand (B), about a foot thick, which probably belongs to the bed (E). It is unrepresented at Charlton.

The next in the series at Lewisham is a stratum of well-rounded pebbles, imbedded in a small quantity of sand; at Loam-pit Hill it attains the thickness of about 13 feet. The pebbles very much resemble those of the Oldhavens, and when not examined *in situ* could not be distinguished from them. They exhibit much false bedding, and are unfossiliferous. At the upper part of this bed there is a stratum of white friable marl (D), varying from one to two feet in thickness.

At Charlton the bed (C) is represented by the bed (B') consisting of ferruginous sands, sometimes very argillaceous, containing a large number of branching concentric ironstone concretions, often containing fossils of estuarine character. The bed (C') at Charlton occupies the same position as the Marl Bed (D) at Lewisham, but is here chiefly composed of large fossiliferous ironstone nodules, which however are sometimes replaced by sandstone and by marlstone concretions. The stratum, C, at Lewisham may be considered to be estuarine in origin, the false bedding well illustrating the effect that would be produced at the mouth of a river by the rapid currents caused by the ebbing and flowing of the tides. The pebbles were probably derived from the Chalk land which the river drained, being partially rounded in their course down and subsequently finished off at its mouth. The Pebble-bed, C, as seen at Lewisham, is I believe of very local occurrence, being generally represented by finer material, as at Charlton. It probably formed a small shingle bank.

Superimposed on this we meet with the great fossiliferous clays of the Woolwich and Reading Series, which are capable of subdivision into three, viz., the Lower *Cyrena* Bed (E and D'), *Ostrea* Bed (F and E'), and the Upper *Cyrena* Bed (G and F'). The fossils from these beds attracted the notice of the earlier paleontologists, and even at the present time are of considerable interest to London Geologists. In both the localities of Charlton and Lewisham the beds are moderately well-developed, though they differ considerably in relative thickness.

At Loam-pit Hill, we see resting directly on the Marl Bed (D) the Lower *Cyrena* Bed (E). The matrix is a bluish clay but it exists in so small a quantity that the bed is practically made up of shells, the *Cyrena cuneiformis*, *C. deperdita*, and, *C. cordata* being the most abundant, with which are mingled in a much smaller proportion the other shells characteristic of this series. This bed occupies the same relative position at Woolwich, but in this locality contains a greater amount of clay in proportion to the shells, and is only 10 inches in thickness (D'). At the most North Eastern exposure where the overlying Oyster-bed dies out, it is in contact and passes into the Upper *Cyrena* Bed.

In both localities this bed is overlaid by the Oyster Bed (F and E'), a stratum almost entirely made up of the shells of *Ostrea bellovacina* and *O. pulchra*. At Lewisham it is 2 feet thick, at Charlton one foot and a half, and at the eastern end of Woolwich Ballast Pit it dies out altogether as already mentioned.

Above this we again see a *Cyrena*-bed (G and F'). This is the Upper one, though in its lithological and paleontological characters cannot easily be distinguished from the Lower. At Lewisham this bed is only from 2 to 3 feet in thickness, but at Woolwich attains the developement of 6 feet.

During the deposition of the *Ostrea*-bed (F and E') there was probably a subsidence which admitted the sea water necessary for the existence of oysters, but when a subsequent elevation took place, the oysters were replaced by cyrenas.

At Lewisham we have overlying the shelly series, the celebrated Plant Bed of the Woolwich and Reading Series (Fig. 2, H, I, J, K). It is well developed in this locality, attaining the total thickness of about 22 feet. It is here divisible into two parts, by a band of small well-rounded black pebbles varying from 1 inch to 2 feet in thickness (J).

The lower sub-division (H, I, J) which lies between the shell-beds and the band of pebbles, consists of greyish black sand alternating with clay of the same colour, and is about 9 feet in thickness. It contains a large quantity of iron pyrites in the form of irregular concretions which contain now and then the casts of shells and plant stems.

A foot or so beneath the Band of Pebbles there exists a Lignite Bed (I) which forms the floor of the clay pits of Loam-pit Hill towards their southern end. The wood composing it is coni-

ferous and is bored by *Teredo*, the burrows of which are filled with iron pyrites which is very abundant directly beneath this bed. The origin of this lower sub-division is somewhat difficult to explain, but it seems to be marine, though deposited near enough to an estuary for the shells of *Cyrena*, &c., to be washed down and get entombed contemporaneously with the waterlogged wood of the Lignite-bed.

The upper subdivision (J, K, L), or the Plant Bed proper is 13 feet thick; it consists of alternations of clay and sand, the former predominating at the bottom, and the latter at the top. Especially in the lower and more clayey part a large number of leaves may be found which seem to belong chiefly to the water flags. It contains no shells or other remains to denote marine conditions, therefore we may perhaps conclude that it was some estuarine mud-bank upon which grew a scanty and marshy vegetation which was periodically buried by fresh deposits of mud and sand brought down and spread over by rain floods and other agencies. The Pebble Band was formed much in the same way as the Bottom Bed (A), that is by the disturbance produced by change of depth from deep to shallower conditions.

This Lewisham-bed is represented at Woolwich by a well-marked bed (G′) overlying the shell-beds. In character it is not unlike that already described, though in colour it is yellowish, due to the iron being in an oxidized state, and also to the fact of the plant remains consisting of *Dicotyledonous* leaves and seed vessels denoting their growth on dry land. The presence of this bed at Woolwich was never before known; it may be well seen in the Woolwich Ballast Pit overlying the Upper *Cyrena* Bed, from which it is characterized by its yellowish brown colour.

At Lewisham, the Woolwich and Reading Series terminates with the Plant Bed, but at Woolwich we have overlying it 15 feet of gravels and sands (H′, I′) which were classed by Mr. Whitaker with the Oldhaven Beds.

(H′). The lower portion of this is composed of sands and pebbles interstratified with each other, and showing much false bedding. They rest conformably upon the underlying Plant Bed. The pebbles are well rounded and the sand is flinty. This bed is very fossiliferous and is characterized more especially by the presence of the well known *Cyrena tellinella*; this is generally found, in its natural position, buried in the sand. The shells are generally inter-

mingled with the pebbles and are in a moderately good state of preservation. This bed is 7 feet thick.

The upper bed (I′) is merely a continuation upwards of the stratum just mentioned, differing from it in being totally unfossiliferous, and containing no pebbles, being chiefly composed of white and yellow sand with a very small quantity of clay; its greatest thickness is from 6 to 7 feet. Like the Thanet Sands its surface, which is in contact with the overlying series, is bored by an Annelid or Mollusc to a depth of a foot, the boring being filled up with material partly argillaceous and therefore appearing more prominent than the surrounding sand.

Both of the last mentioned beds (H′I′) have suffered much denudation. One may observe in the section at Woolwich that the Oldhaven and Blackheath pebbles lie very unconformably to these beds; in some places they are entirely swept away, and the Oldhavens rest upon the Plant Bed, which being composed of clay was less susceptible to disturbing influences than the loose gravels and sands. The resemblance of these two sub-divisions of the Woolwich and Reading Series has led Mr. Whitaker to consider them a part of his Oldhavens, but, perhaps, the section was in a less favourable condition when that gentleman examined it than it is at present.

These beds were probably formed much in the same way as the bed C of Lewisham, but the action was not nearly so powerful, for otherwise the delicate shells that are found mingled with the pebbles would have been reduced to powder. The sea could not be far off, inasmuch as forms like *Lamna*, *Fusus*, *Murex*, *Natica*, *Pectunculus*, &c., could not have existed without much sea water.

We now arrive at beds which present some difficulty—namely, the so-called Oldhaven and Blackheath Series. They are composed of perfectly rounded pebbles, intermingled with sand, which varies in quantity, and show extensive false-bedding, the axes of the pebbles being sometimes as high as 45° to the dip. They play a very important part in the geology and physical geography of this neighbourhood, where they attain the thickness of 40 to 50 feet,* the Blackheath plateau being entirely due to their presence, inasmuch as being very permeable to water, which sinks as soon as it falls, instead of running off the surface and carrying materials away with it, and makes its appearance as

* Rev. De la Condamine, Quart. Journ. Geol. Soc., Vol. vi, p. 445.

small springs, which run out just above the out-crop of the Woolwich and Reading clays.

These Pebble-beds, and the uppermost sands of Upnor and Reculvers, Professor Prestwich classes with his Basement Bed of the London Clay, as representing the pebbly loam which occurs at the bottom of that formation in the West; * but Mr. Whitaker makes a line of demarcation between them at Oldhaven Gap and then proceeds to separate them in every other district.† In the locality under consideration, where the development of this series is very great, and, therefore, weighty in the consideration as to their classification, there are many points of interest to be carefully studied.

They appear to lie conformably to the Plant Bed at Lewisham, but, as already mentioned, not so at Woolwich. Now, as the London Clay generally rests very conformably upon the Oldhavens, we might consider that there was evidence that they belonged to the London Clay. Mr. Whitaker shows in his list of fossils a decidedly estuarine fauna, and then states his belief that they were formed on an old shingle bank which was well out at sea, where no unrolled flints could arrive without being first well rounded. How is this to be reconciled?

He divides them from the London Clay at Herne Bay entirely on palæontological grounds, apparently not taking into consideration that the fauna of a sandy bottom would change as clay took the place of sand, and as probably the water became deeper; in fact, in this locality there is a transition from the Woolwich and Reading Series right up into the London Clay.

The explanation of their origin as given by Professor Prestwich appears to me the more probable one. He seems to consider that the termination of the Woolwich and Reading period and the commencement of the London Clay epoch was marked by the elevation of a ridge of land to the south and a corresponding depression to the north. This would cause very active and powerful currents, and it is very probable that part of the land over which the rivers of the Woolwich and Reading period had flowed, and upon which they had deposited their valley gravels, was submerged, and the already partially-rolled pebbles were com-

* Quart. Journ. Geol. Soc., Vol. ii., pp. 254, 255, 261, 265; and Vol. x., pp. 105, 107, 110, 111, and 130.

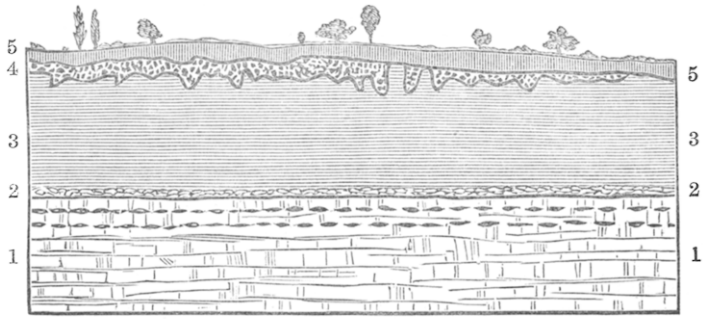
† Quart. Journ. Geol. Soc., Vol. xxii., p. 414.

pletely rounded and deposited in a very irregular manner by this powerful but transient action; so that at one place, such as Blackheath, they are 50 feet thick, and only three-quarters of a mile distant at Loam-pit Hill, they are not five inches. It is also probable that a large quantity of these pebbles and sand is nothing more than the resorted estuarine portions of the underlying series, such as the beds (H′ and I′), which are seen to have suffered much denudation at Woolwich, and yet may have extended over a very considerable area. Another point of interest is recorded by Professor Prestwich in a section at White Cliff Bay, where he found pebbles of red clay derived from the underlying mottled clays; and also at Herne Bay he found green flints, which must have been derived by the denudation of the Thanet Sands. *

We now arrive at the London Clay proper. There are numerous sections of it in this neighbourhood, but by far the most illustrative is at Loam-pit Hill, where it is exposed in section in the brick-pit. It is here about 20 feet thick. It presents the ordinary character of London Clay, but contains no septaria. It is also totally unfossiliferous, which Professor Prestwich explains by the fact that it required some considerable time for the emigration of a fauna suitable to a muddy sea.

Between this and the overlying Pleistocene deposits in this area there are no representatives of the deposits of the enormous period, during which the deposition of the Middle and Upper Eocene, the

FIG. 3.—SECTION IN CHALK PIT NEAR ST. JOHNS.



1 Chalk with Flints. 3 Thanet Sands.
2 Green-coated Flints. 4 Woolwich and Reading Beds.
5 High Level Gravel.

* Quart. Journ. Geol. Soc. Vol. vi., p. 277.

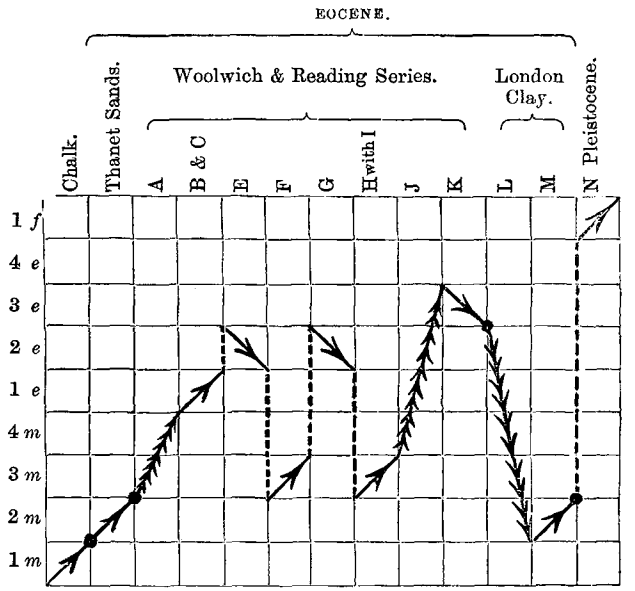
Miocene, and the Pliocene formations took place on other areas. The Pleistocene is represented at Lewisham by the mammaliferous brick-earths and gravels of the Thames, and especially of its tributary, the Ravensbourne, two sections of which are well worth notice—the first situated close to some new houses facing Loam-pit Hill, and the other, from which numerous bones and teeth have been obtained, is seen, in a brick-yard opposite the Angel Inn on the road from St. John's to Lewisham. There are also deposits of High-level Gravels covering the greater part of Loam-pit Hill, resting very unconformably on the Woolwich and Reading Beds, as shown in Fig. 3, and also on the London Clay in Mr. Hodson's brick-pit near Turwit Road.

The Upper Chalk forms the foundation upon which the different Lower Tertiary deposits took place. Professor Prestwich considers that the elevation of the Weald took place to a certain extent during the latter part of the Cretaceous period; that there was but a very thin deposit of Chalk over an area which he describes as follows:—"It is probable that there was some extent of dry land, possibly an island, somewhere intermediate between a line drawn on the north from Farnham towards Canterbury, and on the south between Winchester and Newhaven, and extending eastward into the north of France, and that the long-continued wear on its coast accumulated on the shores extensive banks of pebbles, whilst the finer sediment produced at the same time, in conjunction with the débris brought down by the operation of streams, formed at a distance from the land the strata of this oldest Eocene epoch." He considers the Thanet Sands to have been derived by the denudation of the Greensand; he does not account, however, for the absence of flint sand mixed with the Thanet Sands, which must have been formed by the rolling of the flints which had been derived from the thin layer of chalk; the pebbles he says were afterwards spread over the sea bottom by other agencies during the Lower and Middle Eocene period.

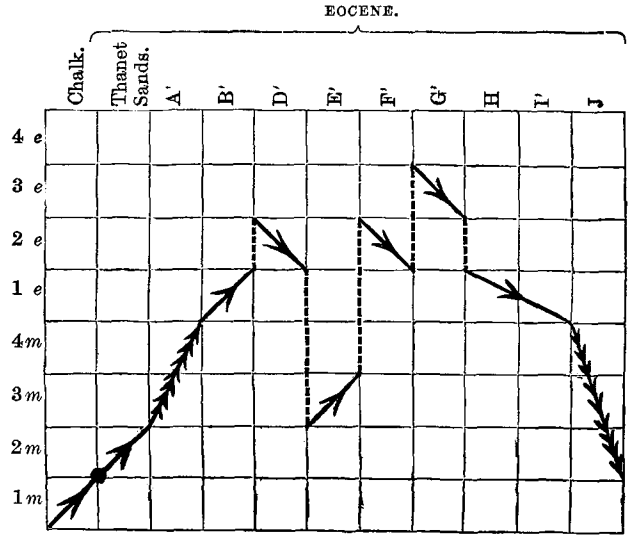
It is a curious and interesting fact, and is well illustrated in this locality, that the Thanet Beds seem to rest on an almost perfectly smooth and even surface of chalk, the lines of stratification being quite parellel, so that one might be led to imagine that there was a direct sequence instead of a great break in time, both paleontologically and stratigraphically, during which the Calcaire Pisolitique, Mæstricht Beds and the Faxoe Limestone were being accumulated.

FIG. 4—ILLUSTRATING THE CORRESPONDING CONDITIONS OF DEPOSITION AT LEWISHAM AND CHARLTON.

LEWISHAM.



CHARLTON.



m Marine.
e Estuarine.
Fluviatile.

∧ Water Deepening.
∨ „ becoming Shallower.
>>> Passage Bed.
● Break in Time.

Rapid movement from one condition to another.

As we in fact know that there is an "apparent" transition between Secondaries and Tertiaries in Denmark, represented in England by a great break in time; so it is found that in one locality there is a passage between one member of the Lower Tertiaries and in another place there is a decided break and sometimes an unconformity. This is the case with the Thanet Sand in the east of Kent, where they pass insensibly up into the Woolwich and Reading Series, it being almost an impossibility to draw a line of division between them, whereas westward, as at Loam-pit Hill, there is a decided boundary line besides a slight unconformity as shown in Fig. 3.

MINERAL CONTENTS.

Calcite is found crystallized inside empty echinoderm shells, and sometimes in terebratulæ from the Chalk. It also occasionally occurs crystallized in the oyster-shells from the *Ostrea* Bed of the Woolwich and Reading Series, and in the septaria of the London Clay near London.

Iron Pyrites.—This is sometimes, though rarely, found in the Chalk of this locality. It is most plentiful in the Plant Bed at Loam-pit Hill. It is also found lining some of the shells of the *Cyrena*-beds in both localities as well as in the London Clay.

Selenite.—Very fine crystals of this form of sulphate of lime, sometimes quite perfect, at others forming beautiful stars, are to be found most plentifully in the London Clay at Loam-pit Hill; in less numbers and much smaller in the upper part of the Plant Bed. It is also in the Upper Plant Bed that Professor Martin Duncan, Pres. G.S., described spaces in the clay from which the selenite which formed them had been removed.

Hæmatite occurs, though rarely, and in no case have I seen it more than half an inch thick, in the Ironstone Bed of the Woolwich and Reading Series at Woolwich.

Lignite occurs in the largest proportion in the Woolwich and Reading Beds, but it is sometimes found in the Thanet Sands and London Clay.

Quartz in a pure state, crystallized in its characteristic six-sided prisms, surmounted by a pyramid of as many sides, occurs in the Chalk flints, generally having some relation to a sponge cavity. It is most plentiful at Lewisham.

Silica (*Amorphous*) occurs as flint containing a small proportion of iron, carbon and manganese.

Silicate of Iron is the material which gives the characteristic and well-marked green coat to the flints at the base of the Thanet Sands. This was formed after the chalk covering had been dissolved away from them by the sesquioxide of iron contained in the flint, changing elements with the clay of the bottom of the Thanet Sand thus:—

Sesquioxide of Iron. Fe_2O_3 — $Al_2O_3,2SiO_2,2H_2O$ Silicate of Alumina of the Clay. X Fe_2O_3,SiO_2, A_2O_3,SiO_2,H_2O The green coating of flints. to form with water a Hydrous Silicate of Alumina or Allophane.

The green colour is very permanent, so that flints coloured with it can be detected in any gravels of later date.

Allophane is a hydrous silicate of alumina containing 40 per cent. of water. It was first discovered at Charlton by Professor Morris, who read a paper upon it before the Geological Society. It was, he says, "formed after the deposition of the Thanet Sand and the slight dislocations these have undergone since. It is found lining the fissures in the Chalk for some considerable depth." It is amorphous, and may generally be recognised by its resemblance to common gum. When broken it breaks with a resinous fracture. In one place where I saw it, in a small pot hole, it was more than six inches thick, though it seldom is a twelfth of that thickness.

I cannot conclude without expressing my deepest thanks to Professor J. Morris, F.G.S., for many valuable hints and much kind assistance.

EXCURSION TO SWINDON AND FARINGDON.

JUNE 5TH (WHIT-MONDAY), AND FOLLOWING DAY.

Directors—Professor JOHN MORRIS, F.G.S., CHARLES MOORE, Esq., F.G.S., and E. C. DAVEY, Esq., F.G.S.

(*Report by* W. H. HUDLESTON, ESQ., M.A., F.G.S.)

On the arrival at Swindon of the party from London, Mr. Moore, who had just come up from Bath, at once led the way to the brick-pits near the Station, which have yielded the magnificent remains of *Omosaurus armatus*, *Bothriospondylus suffossus*, and *Pliosaurus brachydeirus*, figured by Professor Owen in the last volume issued by the Palæontographical Society. At the period of