PUBLICATIONS OF THE ESSEX FIELD CLUB.

Containing a great store of information on the NATURAL HISTORY (in its widest sense) of the COUNTY OF ESSEX.

TRANSACTIONS AND PROCEEDINGS.

Edited by W. COLE. Five volumes, unbound, £2 16s.

(Only eight complete sets in hand).

THE ESSEX NATURALIST.

Edited by WILLIAM COLE, F.L.S., F.E.S. Published quarterly. The 11th volume is now in progress. Various prices, averaging 10s. per volume.

Subscription, 6s. per annum, post free.

SPECIAL MEMOIRS SERIES:—

REPORT ON THE EAST ANGLIAN EARTHQUAKE OF APRIL 22ND, 1884.

By Prof. RAPHAEL MELDOLA, F.R.S., F.C.S., F.R.A.S., M.A.I., &c.; and WILLIAM WHITE F.E.S., Member of Geologists' Association.

Price, neatly bound in cloth, 3s. 6d.

THE BIRDS OF ESSEX.

"A CONTRIBUTION TO THE NATURAL HISTORY OF THE COUNTY."

By MILLER CHRISTY, F.L.S.

Demy 8vo. Price 10s. nett. To Members of the E.F.C., 6s.

THE MAMMALS, REPTILES & FISHES OF ESSEX;

"A CONTRIBUTION TO THE NATURAL HISTORY OF THE COUNTY."

By HENRY LAVER, F.L.S., F.S.A., &c., *Vice-President.*

Price 10s. 6d. nett. To Members of the E.F.C. 6s.

THE TWO ESSEX NATURAL HISTORY MUSEUMS.

THE ESSEX MUSEUM OF NATURAL HISTORY.

(Established by the Corporation of West Ham and the Essex Field Club in the)

PASSMORE EDWARDS MUSEUM,

ROMFORD HIGH ROAD, STRATFORD, ESSEX.

THE EPPING FOREST MUSEUM.

(Established under the sanction of the Corporation of London in)

QUEEN ELIZABETH'S LODGE,

CHINGFORD, ESSEX.

The Essex Museum of Natural History will contain as complete a series as possible of all the forms of animal and vegetable life now or formerly living in the County of Essex and the adjacent sea, together with illustrations of the works of man, and of geological formations. It is also intended to exhibit, when funds and space will allow, an Educational Series, shewing the structure, relationship and development of the several groups.

The Epping Forest Museum, which is supplemental to the main institution, will serve to illustrate the Natural History and Archæology of the grand district which has now been so happily preserved for all taking an interest and delight in our few remaining ancient woodlands.

The two Museums are most happily housed: one in a very fine building furnished by the munificence and public spirit of Mr. Passmore Edwards and the Corporation of West Ham, and the other in an ancient Royal Forest Lodge, in itself an object of great antiquarian and historical interest, and now most carefully restored by the Corporation of London to serve as a home for these local collections.

The Curator appeals for aid in accumulating a really good collection. Hundreds of authentic Essex examples of Mammals, Birds, Fishes, Pre-historic Antiquities, &c., must be in private possession, and fresh specimens are daily occurring. Their proper resting-place is in our County Museums.

Information and assistance to Collectors will be freely given. The Curator will be very glad to see by appointment anyone willing to aid in this interesting and instructive work.

William Cole, *Curator.*

THE

ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club,

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.

Honorary Secretary.

VOLUME XII.

JANUARY, 1901—DECEMBER, 1902.

"*Men that undertake only one district are much more likely to advance natural knowledge than those that grasp at more than they can possibly be acquainted with. Every kingdom, every province, should have its own Monographer.*"—GILBERT WHITE, of Selborne.

"*Call things by their right names.*"—ROBERT HALL.

[*The authors alone are responsible for the statements and opinions contained in their respective papers.*]

PUBLISHED BY THE CLUB, AT THE ESSEX MUSEUM OF NATURAL HISTORY, STRATFORD, ESSEX.

1902.

"The course of Nature is the art of God."

YOUNG.

"Hear ye not the hum of mighty workings?"

KEATS.

"Lovely indeed the mimic works of art,
But Nature's works far lovelier."

COWPER.

"Nature hath made nothing so base, but can
Read some instruction to the wisest man."

ALEYN.

"If thy heart be right, then will every creature be to thee a mirror of life and a book of holy doctrine."

THOMAS A KEMPIS.

"O Nature! bare thy loving breast
And give thy child one hour of rest,
One little hour to lie unseen
Beneath thy scarf of leafy green."

OLIVER WENDELL HOLMES.

"He liked the well-wheel's creaking tongue—
He liked the thrush that stopped and sung—
He liked the drone of flies among
His netted peaches;
"He liked to watch the sunlight fall
Athwart his ivied orchard wall;
Or pause to catch the cuckoo's call
Beyond the beeches."

AUSTIN DOBSON.

ADVERTISEMENT.

The completion of our 12th Volume affords a convenient opportunity of giving a list of the dates of the publications of the Club, for the information of new Members and Librarians.

The Club was founded on January 10th, 1880, and its first publication was the *Inaugural Address* delivered by Mr. R. Meldola, on February 28th, 1880. This was published as a distinct pamphlet, and it also formed pp. 1-26 of Volume I. of *The Transaction of the Epping Forest and County of Essex Naturalists' Field Club*, of which Part I. appeared in September, 1880, and the following parts at irregular intervals. With Volume III. the shorter title of *The Transactions of the Essex Field Club* was adopted, in accordance with the change in the title of the Club. In the first three volumes, the *Transactions* and *Proceedings* had but one title-page, although with distinct pagination; but, in order to facilitate editing, it was resolved to separate them, and Volume IV. of the *Transactions* and Volume IV. of the *Proceedings* were so issued. In January, 1887, however, the publications were finally combined in *The Essex Naturalist*, of which the 12th Volume is now concluded. The volumes were annual up to 1894; now two years are included in each volume.

In future the *Essex Naturalist* will be issued at regular quarterly intervals, on or about the 20th of April, July, October, and January. The Council of the Club has decided to charge 5s. per part to non-members, but the journal will be sent free by post to Members. *Therefore those wishing to have the Essex Naturalist should become Members of the Club.*

The old series, therefore, consists of three volumes of *Transactions* and *Proceedings* combined, with single title-page for each volume, and one each of *Transactions* and *Proceedings* with separate title-pages, together with appendices. The parts were issued as follows, and the appendices indicated should be bound up with each volume :—

Vol. I. With *Proceedings* [*Title — Transactions of the Epping Forest and County of Essex Naturalists' Field Club.*]	President's Inaugural Address Part 1 (September, 1880) ,, 2 (December, 1880) ,, 3 (February, 1881) Title and Index—First List of Members and Rules.
Vol. II. With *Proceedings* [Same Title.]	Part 4 (June, 1881) ,, 5 (October, 1881) ,, 6 (July, 1882) Title and Index, Appendix and Revised Rules.
Vol. III. With *Proceedings.* [*Title — Trans. of the Essex Field Club.*] Price 16s.	Part 7 (June, 1883) With two Appendices. ,, 8 (April, 1884)
Vol. IV. *Transactions* only. Price 8s.	Part 1. Vol. IV. ('Trans.') (June, 1885) ,, 2. ,, ,, (Dec., 1886) Title and Contents.
Vol. IV. *Proceedings* only. [*Title—Proceedings of the Essex Field Club.*] Price 10s. 6d.	Part 1. Vol. IV. ('Proc.') (June, 1885) ,, 2. ,, ,, (Pub. Mar., 1892) With Appendices III. and IV. Title, Index, &c. Appendices I. and II.

Volume I. and II. can only be supplied with *Complete Sets, of which very few copies remain.*

The Club has also published three volumes of Special Memoirs, viz.: *Report on the East Anglian Earthquake of April, 22nd, 1884*, by Prof. Raphael Meldola, F.R.S., F.C.S., F.R.A.S., M.A.I., &c., and William White, F.E.S., Member of Geologists' Association; *The Birds of Essex*, by Miller Christy, F.L.S.; and *The Mammals, Reptiles & Fishes of Essex*, by Henry Laver, F.L.S., F.S.A., &c. *Vice-President*. And in connection with the Museums a series of *Handbooks* are in course of publication and will be continued from time to time as may be necessary.

All the publications are still obtainable, but some are rare, and those desiring complete sets must make early application for them.

W.C.

December, 1902.

INDEX TO VOLUME XII.

PLATES AND ILLUSTRATIONS.

ERRATUM.

Plate VI. is omitted from this Volume; it will be given with the paper to which it relates in Volume XIII.

Price (to Non-Members) 6s. per annum. Post free.

NOS. 1—6., VOL. XII.] *Price 3s.* **[JAN.—JUNE, 1901.**

The Essex Naturalist:

BEING THE

JOURNAL

OF THE

ESSEX FIELD CLUB.

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary and Curator.

Contents.

The authors alone are responsible for the statements and opinions contained in their respective papers.

PUBLISHED BY THE CLUB, AT THE ESSEX MUSEUM OF NATURAL HISTORY, STRATFORD, ESSEX.

Ent. Stationers' Hall.] [Published September, 1901.

Communications *and* Advertisements *should be addressed:—*
The Editor of "THE ESSEX NATURALIST,"
"Springfield," Buckhurst Hill, Essex

THE ESSEX FIELD CLUB.

List of Council and Officers for 1901.

Patron:

H.R.H. THE DUKE OF CONNAUGHT AND STRATHEARN, K.G.
(Ranger of Epping Forest).

President:

PROF. R. MELDOLA, F.R.S., F.R.A.S., F.C.S., F.R.M.S. *(ex-officio)*

Vice-Presidents:

E. NORTH BUXTON, J.P., ALD. C.C., D.L.
WALTER CROUCH, F.Z.S.
I. CHALKLEY GOULD.
J. C. SHENSTONE, F.L.S.

Permanent Vice-Presidents:
(Constituted under Rule IV.)

PROFESSOR R. MELDOLA, F.R.S.,
(President, 1880—82).
PROFESSOR G. S. BOULGER, F.L.S., F.G.S.
(President, 1883—84).
THOMAS VINCENT HOLMES, F.G.S., M.A.I.
(President, 1885—87).
EDWARD A. FITCH, C.C., F.L.S., F.E.S.
(President, 1888—91).
HENRY LAVER, J.P., M.R.C.S., F.L.S., F.S.A.
(President, 192).
FREDERIC CHANCELLOR, J.P., F.R.I.B.A.
(President, 1893—94).
DAVID HOWARD, J.P., F.C.S.
(President, 1895—1900).

Other Members of Council

JOHN AVERY, C.A.
REV. R. E. BARTLETT, M.A.
CHARLES E. BENHAM.
MILLER CHRISTY, F.L.S.
L. CRANMER-BYNG.
F. W. ELLIOTT.
JOHN A. FINZI, F.E.S.
A. J. FURBANK.
J. E. HARTING, F.L.S
REV. W. C. HOWELL, M.A.
A. JOHNSTON, CHAIRMAN C.C., J.P.
REV. W. S. LACH-SZYRMA, M.A
HUGH McLACHLAN, F.R.I.B.A.
ALFRED LOCKYER,
RIGHT HON. LORD RAYLEIGH, F.R.S.
F. W. READER.
JOHN SPILLER, F.I.C., F.C.S.
FREDK. H. VARLEY, F.R.A.S.
GEORGE E. VAUGHAN.

Hon. Treasurer:

DAVID HOWARD, F.C.S.

Hon. Secretary and Curator:

WILLIAM COLE, F.L.S., F.E.S., Buckhurst Hill, Essex.

Assistant Hon. Secretary:

BENJAMIN G. COLE, Buckhurst Hill, Essex.

Hon. Librarians:

Hon. Counsel:

W. C. DARE, B.A., *Barrister-at-Law.*

Hon. Solicitor:

HENRY I. COBURN.

Auditors:

WALTER CROUCH, F.Z.S., and JOHN D. COOPER.

Bankers:

LLOYD'S BANK, 72, Lombard Street, E.C.

Headquarters:

ESSEX MUSEUM OF NATURAL HISTORY (PASSMORE EDWARDS MUSEUM), ROMFORD ROAD, STRATFORD, E.

Museums and Library:

QUEEN ELIZABETH'S LODGE, CHINGFORD.
ESSEX NATURAL HISTORY MUSEUM, STRATFORD, E.

Dug-out Boat *in situ* at Excavations at Walthamstow.

Drawn by Mr. H. A. Cole,
from Photograph furnished by Mr. C. W.

THE

ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club,

(VOLUME XII.)

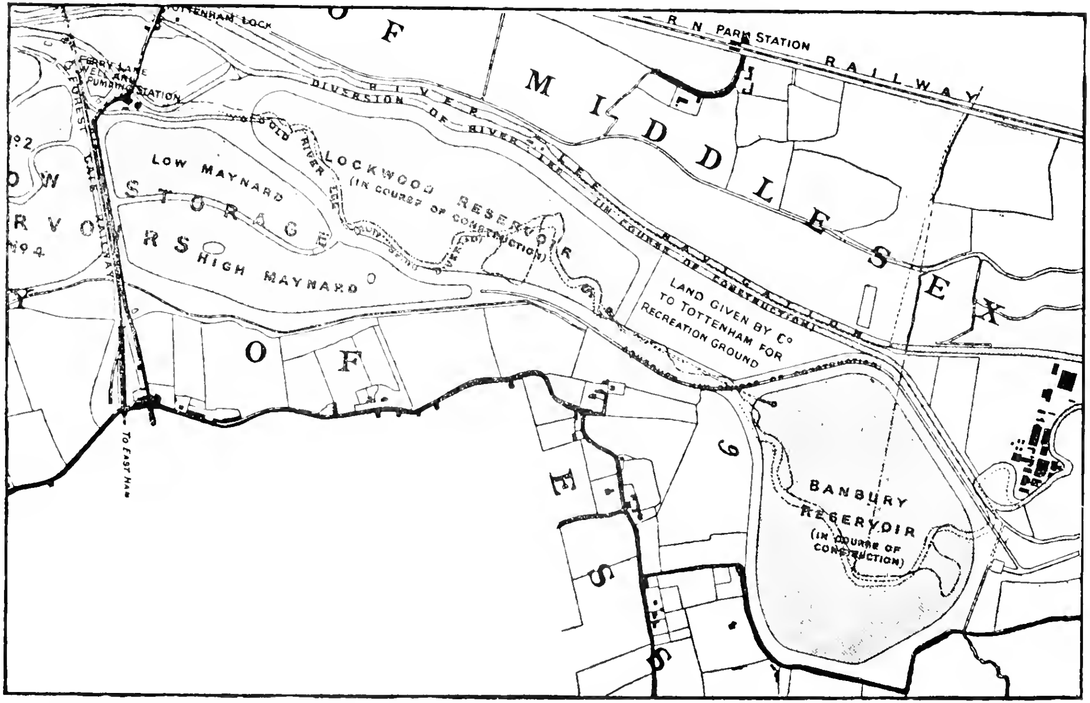
GEOLOGICAL NOTES ON THE NEW RESERVOIRS IN THE VALLEY OF THE LEA, NEAR WALTHAMSTOW, ESSEX.

By T. V. HOLMES, F.G.S., F. ANTHROP-INST.; *Vice-President E.F.C.*

[*Received April 25th, 1901.*]

These reservoirs, the excavations for which have been in progress for more than a year and are still proceeding, are in the Valley of the Lea west of Walthamstow and east of Tottenham, and are being executed for the East London Water Company by Messrs. S. Pearson and Sons. The more northerly, which will be known as the Banbury Reservoir, occupies the marsh between Higham Hill and the outfall of the Ching; the more southerly is south west of Higham Hill and east of Stonebridge Lock. The words "Mitchley Marsh" appear on the Ordnance Map (6in. to the mile) towards its southern end. Two older reservoirs, known as the Low and High Maynard, lie east or south-east of this new "Lockwood" Reservoir. All are north of the road connecting Tottenham Hale and Blackhorse Road railway stations. (See Plan).

Before touching upon the nature of the beds seen in the reservoir excavations, it may be useful to say a few words on the general geological structure of the locality. The oldest formation visible is the London Clay, which underlies the marshes in the Lea Valley and appears in the higher ground on each side. Patches of gravel and loam, fragments of old river deposits formed when the existing streams, not having eroded their



Plan of the two new Reservoirs, near Walthamstow, showing Course of the old River Lea. *g*. Gravel; *s*. Position of "Viking" Ship. The position of the Dug-out boat was near the western side of the Southern Reservoir, and south-west of the "Viking" Ship.

valleys to their present depth, were flowing at some higher level, often cap the London Clay at various heights. The lowest and most recent of these river-deposits are those forming the marshes bordering the Lea, in which the new reservoirs are being excavated. Other gravel patches, which may be seen here and there a few miles from the reservoirs, usually at greater heights than the highest of the deposits mentioned, being unconnected with any existing river system do not here concern us.

In the immediate neighbourhood of the new reservoirs, a good example of the fragment of an old river deposit may be seen on the northern slope of Higham Hill, about 150 yards south-east of Higham Hill Ferry, and the same distance from the southern edge of the more northerly of the two new reservoirs. West of the Lea, the high road between Tottenham and Edmonton is on old river gravel of less age and elevation than that of Higham Hill. And while no bare London Clay is anywhere visible between the marshes of the Lea and the slightly older and more elevated gravel of Tottenham and Edmonton, there is a distinct belt of London Clay between the marsh in which Banbury Reservoir is being excavated, and the gravel and loam capping the northern edge of Higham Hill.

Another point of distinction between the gravel and loam of Higham Hill, and of Walthamstow generally, and that of Edmonton and Tottenham lies in the fact that they appear to belong to two different rivers, the first-named to the Thames, the latter to the Lea. At the present day we naturally consider ourselves in the valley of the Lea four or five miles south of Higham Hill. But examination of the Geological Survey Map of the district showing the distribution of the river-deposits makes it evident that the Thames, at one time, both above and below London, took its course some miles north of its present channel. And that the gravel of Stamford Hill, Higham Hill, and Walthamstow was formed in all probability by the Thames, when flowing in ancient times in a more northerly and a more elevated channel than it now does.

Before descending from Higham Hill to the Marshes in which the reservoirs are being excavated it may be well to note the nature of the more ancient river-deposits capping the hill. They consist of gravel covered more or less irregularly by loam, as shown in a gravel pit, from 8 to 10 feet deep and from 30 to 40 yards broad, in the beds lying above the London Clay at the top of the hill. The gravel is largely subangular, and resembles in its general character that of the marshes below. And the loamy material by which it is more or less covered is evidently

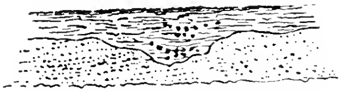


Fig. 1. Higham Hill Gravel, &c. Height of Section 6ft; length 20ft.

the equivalent of that which forms the surface bed in the reservoir excavations. (Fig. 1). But the Higham Hill deposits are shown only in an ordinary gravel pit. While the gravel, loam, &c., in the area occupied by the reservoirs, have been displayed in sections hundreds of yards in length and ranging in every direction. Consequently the latter gave not only exceptionally good opportunities for noting variations in details, but their length, and the changes in their direction, combined to throw much light on the local changes of conditions to which the variations in the nature and thicknesses of the beds were due. An additional advantage which they possessed, of an exceptional kind, lay in their cutting across a deserted channel of the Lea. Then, while the largest gravel pits or brickyards usually show

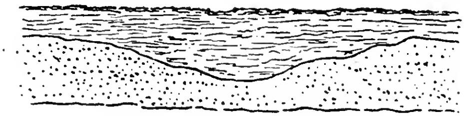


Fig. 1*a*. Higham Hill Gravel, &c. Height of Section, 8ft., length, 30ft

clear sections over but a fraction of their total expanse, the reservoir excavations were almost everywhere fresh and distinct, and they were free from the sloping which is so geologically pernicious in the case of new railway cuttings.

The depth from the surface of the sections in the reservoir excavations varied from about 9 to 11 feet. They always showed loam or clayey loam at the surface and gravel at the bottom, though the thicknesses of the two beds varied considerably. In one place, for perhaps 150 to 200 yards or more, gravel, capped by from 1ft. 6in. to 2ft. of loam and soil, constituted the whole section. Elsewhere the proportions of the two would vary extremely in the course of 20 yards or less, as in Fig. 2. Sometimes the loam towards its base became very dark and peat-like in appearance, and its line of junction with the underlying gravel very irregular, as in Fig. 3. Occasionally, between the gravel and the surface loam, a thin irregular bed of shellmarl appeared, or a definite bed of peat, formed of the remains of water or marsh plants, as in Fig. 4. Again, at about the level of a bed of peat of the kind just mentioned, formed of the remains of plants which had grown and decayed where the peat is now seen, tree and plant remains which had been deposited under totally different circumstances were occasionally visible in irregular bands towards the top of the gravel, as in Fig. 5.

The shell marl was usually in thin, irregular, lenticular bands, seldom exceeding 1ft. 6in. anywhere in thickness, and

Fig. 2. New Reservoirs, Walthamstow. Height of Section about 9 ft., length about 50 yds.

disappearing in the course of 20 or 30 yards, as in Fig. 4. But at one spot near the outfall of the Ching the section consisted of

	ft.	in.
Soil	1	6
Sand and loam with many shells	4	6
Gravel		

The shells were those usually making up the shell marl.

At another spot the beds were—

	ft.	in.
Clayey loam, a little shell marl towards the bottom	3	0
Gravel		

At a third place was seen—

	ft.	in.
Soil and clay	4	0
Shell marl	1	3
Peat	1	6
Gravel		

In this case the shell marl retained the above thickness for a horizontal space of about 3ft., the whole band disappearing in less than twenty yards.

At another spot appeared—

	ft.	in
Clay, darkening downwards, with a little shell marl at its base	3	0
Gravel		

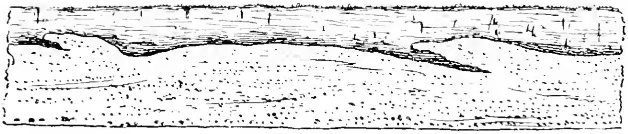


Fig 3 New Reservoirs. Section towards S. end of Mitchley Marsh, seen July, 6th, 1900 Showing Clay, darkening towards the bottom, above gravel Height of Section about 10ft., length about 50ft.

In some places there was nothing that could be called peat, and there were no traces of shell marl, though the thickness of the beds above the gravel was above the average, as in the two sections given below:—

	ft.	in.
Clay, darkening downwards	4	0
Dark soil	1	0
Gravel and sand		

And

Loamy clay	3	0
Dark clay	2	6
Gravel		

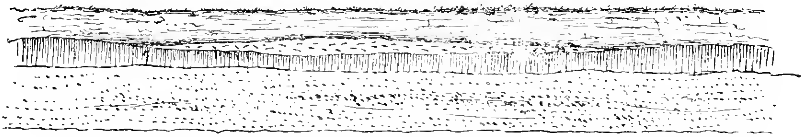
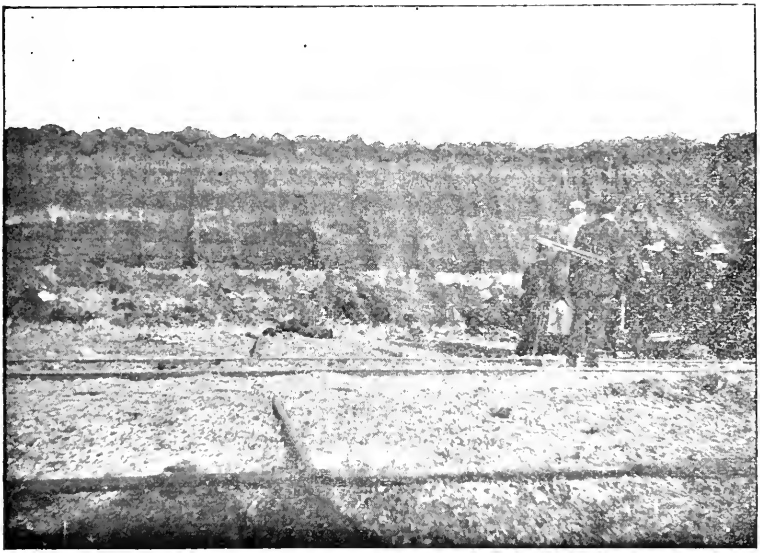


Fig. 4. New Reservoirs. Section about 100yds. N. of No. 1. Showing lenticular bed of Shell marl resting on Peat, and covered by the Clay forming the surface. Gravel at the base.

London Clay did not appear in the ordinary sections of 10 or 11 feet from the surface, which all ended in gravel, but it was usually visible at very slightly greater depths in trenches, &c.

An interesting feature in the marshes has been the presence of a disused channel of the Lea, which is partly included within the boundaries of the southern and partly within those of the northern reservoir. Towards the north-eastern corner of the southern reservoir at the spot marked (s) were found the remains of the old vessel described in the newspapers at the time of its discovery as a "Viking ship." It was seen on excavating from the old channel of the Lea a few feet southward, and had, doubt less, sunk in the then existing channel, which has since, possibly



Photograph of Section in New Reservoirs. Taken by Mr. F. Meeson during the visit of the Geologists' Association in April, 1901.

in consequence of the presence of the obstruction, been deflected a few feet towards the north. Another excavation made at this spot from the old channel northward showed that the channel had there, in more or less recent times, been deflected southward. This was demonstrated by the presence of fine gravel and sand containing irregular deposits of shells and vegetable remains, which were banked against 6 feet or more of ordinary alluvial clay, as shown in Fig. 6. Where this disused channel took a fairly straight course, the gravel in it was often diffused pretty evenly, so that the stream must have been of nearly the same depth everywhere. But where there were many bends the gravel tended to become piled on one side. Thus, a few yards westward of the Viking ship, the gravel was seen to be piled on the more southerly side of the channel to within 3ft. of the top, the opposite bank showing

Loam	3ft.
Peat, earth with mud, and here and there shell layers	5 to 6ft.
Gravel	

Again, fifty or sixty yards further westward the gravel was heaped up against the more northerly side of the channel.

South-west of the place where the Viking ship was found, and a few yards eastward of the spot at which the channel made a sharp bend to the south, the "steam navvy" cut away the ground so as to expose a long section ranging nearly north and south and crossing the old channel nearly at right angles to its course there. In Fig. 5 this section is shown for a distance of

Fig. 5. New Reservoirs. 1. Surface Loam; 2. Peat; 3. Gravel and Sand. The irregular dark patches are fragments of the Stems of trees and plants, with other vegetable matter.

about 50 yards; the spectator is looking eastward, and the disused channel appears towards the southern end of the section. Throughout there was gravel towards the base and loam at the surface each retaining the same character throughout the section. But the intermediate beds varied extremely. At the northern end of the section there was a comparatively thick bed of peat formed of the remains of water and marsh plants which had grown in situ. About 10 yards from the northern end it was found, as shown in Fig. 5, that the peat bed had been eroded away and that in its place were gravel and sand more irregular in stratification than that towards the base of the section. And in this gravel and sand were irregular deposits of blackened vegetable remains, from tree stems to a *débris* of twigs, leaves, &c., which had been heaped confusedly together, just as they appeared at the surface in the bottom of the old channel shown towards the southern end of Fig. 5. A few yards beyond the southern limits of Fig. 5 the section resembled that seen at its northern end.

I do not propose to say anything here about the fossil remains found in these reservoir excavations as a list of mammalian or molluscan genera and species, or to touch upon them in any way except so far as they may tend to throw light on various questions connected with the deposition of the beds and their relations to each other. Judging from the great variety of views which have been expressed by geologists of more or less eminence as regards river deposits of somewhat greater age, it seems desirable to point out the bearing on those questions of the evidence of these more recent beds. For light may fairly be expected from an appeal from the more obscure and fragmentary remains of the older river deposits to the fuller and more com-

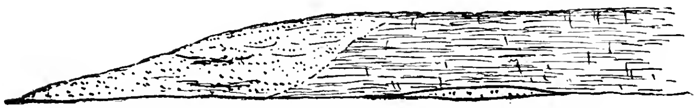


Fig. 6. New Reservoirs. Section from the Old Channel of the Lea northward, near the spot where the ship was found. October 1st, 1900.

plete evidence of the newer. It is true that in very recent times rivers like the Thames and Lea have been canalized more or less, and that, consequently, floods and specially high tides no longer deposit mud on the marshes adjacent to the streams as in more ancient days. But in the present case we have, on the other hand, the very unusual advantage of being able to inspect an old disused channel, which would be impossible but for the canalization of the stream for navigation. And, as I have already remarked, the length and varied direction of the sections shown in these reservoirs have given almost unique opportunities of noting the nature and variations of the strata and the way in which changes occur. As we have seen, the constant constituents of any section are the loam or clayey loam at the surface and the gravel towards the base. Their respective thicknesses may vary, but where they only are present the gravel always makes a larger proportion of the whole section than where peat, or more or less peaty clay or mud, with shell marl, intervene between them. And it seems clear to me that the gravel has always been brought down in the channel of the stream ; and that the surface loam is the mud which has been deposited on the surface during floods and very high tides. Where, between the gravel and the loam, there is a considerable thickness of peat, the plants, the remains of which compose it, having grown in situ, there shallow backwaters must have existed in which the plants grew. On the other hand, the irregular masses of vegetable matter mixed more or less with gravel and sand have evidently been brought down a channel, mainly in time of flood. And the little land and fresh-water mollusca, composing the shell marl, flourished either in backwaters or in shallow parts of a main stream where sand or mud were being deposited close to one bank, while that on the opposite side was suffering from erosion. The steady continuance of a state of things of this kind, at any one spot, for many years, would bring into existence a band of shell marl having a breadth corresponding to the lateral deflection of the channel of the stream.

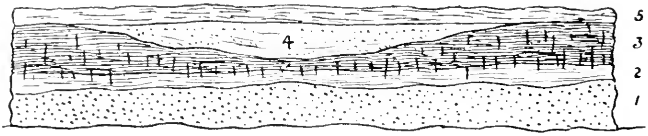


Fig. 7. New Reservoirs Section of Minor Channel in Southern Reservoir (1901). 1. Gravel; 2. Mud; 3. Peat, with many Plant-stems; 4. Sand with Shells in channel; 5. Surface Loam. Height of Section, 10 to 11 ft.; length, about 18 yards.

The section across the old channel, shown in Fig. 5, illustrates my remark that the constant constituents of a section are the gravel towards the base and the loam at the surface. Taking the height of the section as 10ft., then the changes are all in the 5ft., or thereabouts, of beds in the middle part; the gravel towards the base and the loam at the surface remain unaltered throughout. This is especially noteworthy in the case of the loam, and clearly indicates that it is a deposit resulting from a general cause which, like a flood, would affect a whole river valley. It would consequently not be affected by the local character of the beds on which it rested, and would tend to equalise the surface levels, as we know it does.

Then, the section shown in Fig. 5 illustrates the way in which sections in river deposits may show fossil remains of very different ages at the same depth below the surface and only a few feet apart from each other. They may be also in the same kind of material. For a human relic or mammalian bone found at the top of the gravel underlying the peat at the northern end of the section might have been deposited many centuries earlier than some similar object, at the same depth from the surface, and also in the gravel, but found midway between the end of the peat and the channel. The object under the peat might have been deposited there in pre-Roman times; that twenty yards or less southward might belong to the eighteenth century or later. For the changes in the position of the old channel, which have caused the destruction of the peat and its replacement by sand and gravel containing irregular seams of vegetable matter, might have occurred at any subsequent time.

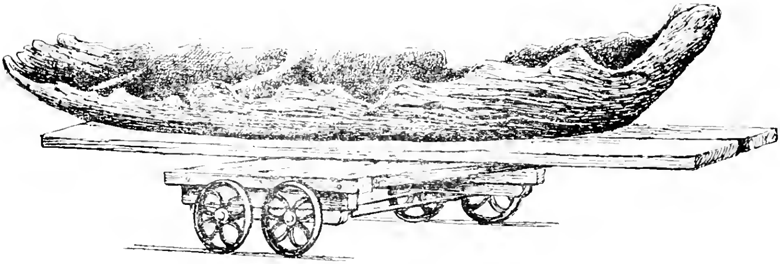


Fig. 8. Dug-out Boat found in the Walthamstow Reservoir Excavations, on trolly for removal. Drawn by Mr. H. A. Cole. For drawing of the boat *in situ*, see Frontispiece to the present volume.

I have already mentioned the discovery of the old vessel, generally supposed to be a Viking ship, near the old channel. But some distance to the south-west, in the excavations for the same reservoir, a boat of much more ancient character was found. This was an ancient British "Dug-out" canoe, of the kind so common in ancient lake dwellings. Mr. W. Traill, one of the engineers superintending the excavations, was fortunately able to get it out almost entire, and it is now carefully preserved. From an account which Mr. Traill has given of the canoe in *The Reliquary and Illustrated Archæologist* for January, 1901, I take the following details :—

"It was resting on a bed (5ins. thick) of fine sandy silt-mixed with fresh water shells. . . . The geological section is as follows:—Soil, 1ft.: clay, 2ft. 6in.; clay and gravel, mixed with vegetable matter, 1ft. 3in.: gravel, 1ft. 3in.; sandy silt, 5in.; gravel."

I had the good fortune to see the canoe and the place at which it was found, in the company of Messrs. W. and H. Cole, and under the guidance of Mr. Traill, a few days after its discovery. (See Frontispiece to present volume). Mr. Traill remarks that the canoe seems to have been drawn up on the bank of an old river. Probably it had been lying in the shallow part of the old channel when a sudden flood had carried it down and deposited it where it had become entangled in vegetable *débris*, had sunk and become silted up. It may be noticed that the section given by Mr. Traill much resembles that near the disused channel in Fig. 5. As these ancient dug-out canoes vary very much in size, it may be worth adding that this one was 14ft. 10in. long, 2ft. 4in. broad, and 1ft. 4in. deep, taking the extreme measurements in each case. (Fig. 8.)

Munro, in *The Lake Dwellings of Europe*, remarks that the intimate association of these dug-out canoes with lake-dwellings has been noted both in the British Isles and on the Continent. He adds that their discovery in lakes and bogs has been considered by Dr. Stuart as an indication of the existence of crannogs. Dr. Munro thinks that the period of greatest development of the Scottish and Irish Lake-dwellings was during the pre-Roman Iron Age, but points out that neither the use of lake-dwellings nor that of dug-out canoes is necessarily prehistoric. In the case of this Lea dug-out, Mr. Traill remarks that "several pieces of Roman pottery and a well-made iron spear-head have been found at points ranging from fifty to a hundred yards from where the dug-out was lying, and in practically the same stratum." But this, though an interesting fact, by no means—as we have seen—involves a similar antiquity for the dug-out.

Just as the Glacial Period doubtless came practically to an end in South-Eastern Britain many centuries before the climate had materially changed in Northern Scotland, so dug-out canoes must have been in use in the wilder parts of the British Isles long after they had become extinct on the Thames and Lea.

Besides the exceptional facilities for intercourse with the Continent possessed by the inhabitants of this district generally, waterways like the Thames and Lea gave special facilities, two thousand years ago, for local intercommunication, facilities of enormously greater relative importance than they now afford. And the sites of Tottenham, Edmonton, and of old London are such as must have recommended themselves to the earliest settlers in permanent towns or villages, from the water supply obtainable from the gravels on which their houses stand, as well as from their proximity to the rivers. In short this district must have been one in which dug-out canoes became extinct sooner than in any other part of the British Isles. Nor would they be likely to survive even as the coracle of the Severn has done. For, though primitive, the latter is extremely portable, while the dug-out must have been more ponderous than the least advanced of more modern craft, and have had no counter-balancing advantage of any kind. Now the explorer Pytheas, about the year 330 B.C., found that there was then considerable intercourse between South-Eastern Britain and the Continent, though the intercourse was confined to this part of the British Isles, which he found abounding in corn, and affording every evidence of a settled agricultural condition.

Among the human relics should be mentioned, in addition to the dug-out and the Viking ship, a considerable number of tobacco pipes. Those I have found myself were mostly towards the base of the surface loam, but some were in the sand of a disused channel They are not all alike as regards shape, but most of them appear to resemble the pipes of the seventeenth and eighteenth centuries, rather than those of a later date.

In short, the articles used by man found in these recent river deposits date from perhaps B.C. 500 to the present day. For its seems to me that the available evidence makes the dug-out's date here suggested more likely to be insufficient than excessive. Then the Roman pottery, &c., mentioned by Mr. Traill will be by some six or seven hundred years more recent. The Viking ship is not unlikely to have been one of the Danish fleet which went up the Lea in A.D. 895, were blockaded there by King Alfred and captured or destroyed in the following year, as narrated in the Anglo-Saxon Chronicle.[1] And the pipes, as already mentioned, vary in age from the 17th century to much more recent times.

1 Supposing that fuller examination confirms the view that it is a Viking Ship.

However, my object is not to give a list even of the human relics found in the excavations, but only to allude to them so far as may be necessary to illustrate the formation of these recent river-deposits, and consequently that of those which are older and more obscure. Where a river has cut its way through comparatively hard rocks, it may leave terraces clear enough to be traceable for a considerable distance marking its former position. But this is not the case where the river's course, as in South Essex, has been through a formation like London Clay. Then, as we know, it may be possible to note a broad flat composed of river-deposits which rises very gently northward, but it is impossible to trace a distinct terrace except for a few yards here and there. As in a river-deposit the Mollusca usually vary but little, it has naturally happened that geologists examining sections in the older and more obscure fluviatile beds have often dwelt mainly on the human relics or mammalian remains as the chief guide to their relative antiquity, and have disregarded the stratigraphical evidence. For illustrations of the extraordinary differences of opinion as to the older river-deposits of the Thames, and the relative antiquity of various members of the series which have thence resulted, see the chapter on the literature of the River Drift in Mr. Whitaker's memoir on *The Geology of London and of Part of the Thames Valley*, Vol. I., pp. 328-387.

Now in the case of these reservoir sections there can be no controversy about their stratigraphical position. No one can assert that the beds at one spot in either reservoir belong to an older series than those elsewhere simply because a pre-Roman dug-out canoe has been found here, and tobacco pipes only there, at the same level. The excellent sections, long but varying in direction, have illustrated, as no other sections could have done so well, how incessantly a river in its windings tends to change its course, and yet how often a spot a few yards from a recent or existing channel may have remained unmodified for centuries. And consequently it becomes evident that in older river-deposits there can be no legitimate excuse for assuming stratigraphical changes not only unsupported by, but contrary to, the available stratigraphical evidence, to account for apparent discrepancies in the nature of the fossil evidence analogous to those presented by the human relics found in the marshes of the Lea. In the absence of evidence like that furnished by these reservoir excavations, changes such as have been so amply demonstrated there come to be looked upon as mere abstract possibilities which may safely be disregarded in practice.

APPENDIX I.

Lake-Dwellings in the Lea Marshes.

I have mentioned that a close association between the existence of dug-out canoes and that of primitive lake-dwellings has been observed. Of course there is no necessary connection between them, and in all probability there was never anything that could be called a lake in the Lea Valley from Broxbourne southward. But there were probably on the Lea marshes, in primitive times, houses of the kind mentioned by Munro in *The Lake Dwellings of Europe*, p. 553. He says :—

"A reference to Lake Dwellings occurs in a passage by Hippocrates (*De Eribus*, &c. XXXVII) :—'Concerning the people of the Phasis, that region is marshy and hot, and full of water and woody; . . . . The inhabitants live in the marshes and have houses of timber and of reeds constructed in the midst of the waters ; and they seldom go out to the city or the market, but sail up and down in boats made out of a solid tree trunk, for there are numerous canals in that region' [This locality is east of the Black Sea.]"

The sections displayed in the reservoir excavations show frequent changes in the main channel of the Lea, and suggest the existence of many backwaters, or partly deserted channels, in which water-loving plants grew, leaving beds more or less peaty for our inspection to-day. The Lea Marshes would therefore afford many positions either wholly surrounded by water or easily made insular, as sites for pile dwellings. As when (for example) we traverse the hilly parts of the Chalk, and seldom, if ever, find a naturally strong site unoccupied by an ancient camp of refuge, so we may fairly conclude that eligible sites on marshes for pile-dwellings would not, in primitive times, remain unused. To come to a later period than that of dug-out canoes, we find the Lea shown, in Norden's Map of Essex (1594) as having two or more channels of apparently equal importance all the way from Broxbourne to Blackwall, the other rivers marked on the map having but one channel, except that the Thames, as at the present day, has many around Canvey Island.

It seems therefore highly probable that the pre-Roman users of dug-out canoes on the Lea lived in pile-dwellings on the marshes, which were unusually favourable to such habitations. In mediæval and later times the marshes were deserted, and the inhabitants of the river valley lived on older river deposits above the reach of floods, and obtained their water supply from the lower beds of the gravel on which their houses stood. And in the case of isolated dwellings, protection from robbers was obtained by the digging of a moat around the premises which was supplied with water from the same source. Moated houses of this kind are not uncommon in southern Essex and elsewhere, though at the present day the moats are often more or less filled up.

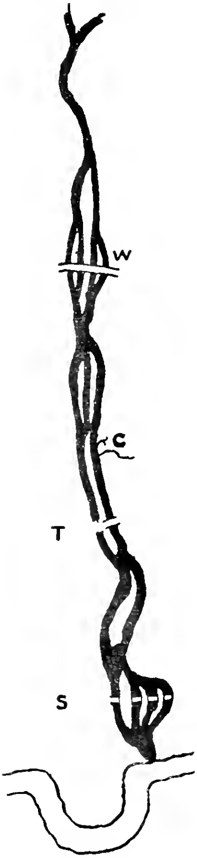


Fig. 9. The River Lea, from its junction with the Stort southward, as shown on Norden's Map of Essex (1594). W, Waltham; C, Outfall of the Ching; T, Tottenham; S, Stratford.

APPENDIX II.

Channels of the River Lea.

Though Norden's Map of Essex (1594), shows the Lee with two or three channels from Waltham Abbey to its outfall into the Thames, the map of Beacontree Hundred and the adjacent parts of South-west Essex in Morant's *History of Essex* (1768), reveals but one channel below Waltham Abbey. Of Waltham Morant remarks:—"Waltham is the most considerable place in this Half Hundred, to which it gives its name, and also to part of the Forest of Essex. . . 'Tis situated near the river Ley, where its parting into several streams, forms divers little islands."

Both the above-mentioned maps are doubtless trustworthy in their record of the number of channels locally existing in their respective periods, though without claims to minute accuracy as regards the shaoe of some island enclosed by the streams, or other points of that kind.

[Both Mr. Holmes and the Secretary desire to record their grateful thanks to Mr. Sharrock, Messrs. S. Pearson & Son's representative at the works, to Col. Byan, the Engineer to the East London Water Company, and to Mr. Traill and Mr. Marsh, Assistant Engineers, for much kind aid and sympathy during the numerous visits made to the works.—Ed.]

ON THE VARIATIONS IN NUMBERS AND HABITAT OF MARINE ANIMALS ON THE COAST OF ESSEX DURING THE LAST TEN OR TWELVE YEARS.

By H. C. SORBY, L.L.D., F.R.S. F.L.S. &c

During the last ten or twelve years I have spent a good deal of time in collecting marine animals along the coast, and in the estuaries, of Essex and the adjoining parts of Suffolk, as they were floating near the surface or by using a dredge or small trawl, or by examining the mud or shores exposed at low water; but paying little attention to such as are less than $\frac{1}{2}$-inch in length. In doing this, I have been much struck by the great variations that have occurred from year to year, and with the remarkable contrast between what I now find in some localities, and what I found 10 or 12 years ago, or even more recently. Some of the changes may be, and probably are, of a temporary character, and the original conditions may be restored in years to come; but some seem as if likely to be permanent. In the earlier years I did not expect to be in the district so long and so continuously, and never anticipated that I should witness any striking changes, and so unfortunately I omitted to take such detailed notes as would now have been very valuable. It was only by degrees that the great extent of the changes became apparent. In any case it now appears to me desirable to put some of the facts on record, since they may be of much interest in years to come.

I have not noticed any material change in the number of some animals. Of these I may mention the Common Shore Crab (*Carcinus mænas*), the Hermit Crab (*Pagurus bernhardus*), the common *Nereis* (*N. versicola*), *Nepthys hombergii*, *Arenicola marina*, *Sabella pavonia*, *Lanice conchilega*, *Cirratulus cirratus*, *Doris pilosa*, *Echinus miliaris*, *Solaster papposus*, *Asterias rubens*, *Ophiura texturata*, *Ophiothrix fragilis*, and several species of simple and compound Ascidians, such as *Ascidiella virginea* and *aspersa*, *Ciona intestinalis*, *Cione grossularia*, *Molgula arenosa*, *Botrylloides rubrum* and *leachii* and *Botryllus schlosseri* and *polyclyclus*.

There has, however, been a great change in the case of some other animals. I do not take into account such as are so rare that very few specimens have been seen, since in such cases too much depends on accident; nor would it be fair to take particular notice of what I have seen in places not visited repeatedly.

I think that some great changes were due to the very severe winters experienced a few years ago. For example, the number of living individuals of the common *Cardium edule* previously found near the mouth of the Crouch was very great; after the severe winter of 1894, which killed so many oysters, few could be found alive, but an enormous number of dead shells were seen. Also, previously, very fine specimens of the Gephyrian, *Priapulus caudatus*, could be obtained from the mud of the Deben near Waldringfield, but afterwards only comparatively small individuals, as though the larger had been killed. It, however, seems doubtful if this explanation will suffice in places where the water is always tolerably deep As an example, I may say that eight or ten years ago, in that part of the Deben, near Ramsholt, called the Rocks, I was able to collect by dredging fairly numerous fine specimens of the beautiful purple Nudibranch, *Eolis coronata*, but latterly I have not been able to obtain them, though most anxious to do so. They have also become more rare in other localities where I used to find them, as for example in the Orwell at Pin Mill, and off Mersea, in what may be looked upon an almost open sea.

It seems difficult to understand what can have occurred to influence such a large mass of sea water as in the Stour below and above Harwich, but yet I have remarked considerable changes during the last 10 or 12 years. I then found sundry Nudibranchs, which I have not obtained for years and the curious worm, *Aphrodita aculeata*, has become much more rare. Good small specimens of *Loligo media* were fairly common, but latterly they have become more and more scarce. Both there and in every locality in which I have trawled, the number of specimens of *Sepiola atlantica* has also become less and less, year after year, and, instead of catching dozens, I got only an odd one now and then. What may possibly have been a distinct small species of *Sabella* was at one time abundant in the Pye-fleet by Mersea, but I have not seen it for some years. On the contrary in 1899 I caught off Mersea some half score of what are probable the young specimens of *Sepia officinalis*, not one of which I had caught before anywhere along the coast. In some of the later years I have found one or two other animals I had never seen before in the district.

In considering this question it is, however, impossible to be sure that certain of the apparent changes are not due to the remarkably local distribution of some animals, and it is possible that the exact locality where they abound may shift somewhat from year to year, owing to a partial migration. As bearing on this subject, I may say that certain animals are very numerous in one particular place, though I have met with very few or none anywhere else over a wide district. In some cases this may fairly be attributed to the very peculiar conditions under which they are found. For example, I never saw a single individual of a *Phascolosoma* (not yet identified) until in 1899 I hit upon a particular locality near Brightlingsea where several specimens may be found in each spade-full of the sandy gravel. In 1900 and 1901 I examined this place more fully, and it seems to me that this unusual abundance in one part and absence elsewhere, close at hand, is due to the peculiar local conditions; since the *Phascolosomæ* seem to occur only where this sandy gravel is kept constantly soft by salt water draining out through it, when the tide is low, which occurs only in one part, at a particular level.

There is a locality in the Orwell, a short distance below Pin Mill, usually at about the level of half tide, but perhaps varying with the season, where a species *Synapta* occurs so abundantly that specimens may be collected out of the mud by dozens; and, yet, I do not remember seeing a single individual elsewhere along the coast. I cannot understand why this should be so, unless it be due to the percolation of a certain small amount of fresh water from the adjoining shore, which in this particular part is fringed with reeds. In 1901 I could not find a single specimen. In the Deben also, near Waldringfield, I have been able to collect in less than an hour more specimens of *Priapulus caudatus* than I could obtain in weeks in any other place along the coast; and yet I cannot even suggest a reason for this, since there do not appear to be any conditions not met with in many other localities.

So far most of the animals referred to are more or less fixed, or probably do not move far, but there seems to be an equally great variation in those which, like Medusæ, float with the tide over great distances. In such cases it is not a question of occasional inspection or of looking for them or dredging, since they are visible at any time in suitable weather from the deck of the yacht, when they are present. There seems to be great variation in the numbers of the very common Medusa, *Aurelia aurita*, in different years, unless it be that in some years they swim near the top and in others low down out of sight. This they certainly do according to the weather, coming towards the top when fine and smooth, but such a difference could scarcely occur throughout an entire season. In July, 1888, I saw in the course of a few days in the Alde below Orford, more deep blue specimens of *Cyanea lamarkii* than I have seen anywhere before or since, though year by year I have looked for them most attentively and not seen one. This handsome species had not been previously observed within some hundreds of miles of the English coast. Many years ago I saw at Queenborough a great many specimens of the beautiful Medusa, *Chrysaora isoceles*, but lately I have year after year seen comparatively very few. Last year (1900) I think they were somewhat more common ; but, strange to say, they were all a very pale variety, with none of the dark radiating stripes on the upper surface. In the last few years good fine specimens of *Pleurobranchia pileus* have been more and more scarce, whereas formerly they were common. Time alone will show whether such changes as these just described are permanent or only temporary. The great variation in the numbers of fish and shrimps is, of course, well known.

Of a totally different character is the remarkable occasional appearance of *Heteronereis*. I have never found specimens in mud, but in dredging I have obtained a few, very imperfectly developed. I have occasionally found them in my aquarium, into which they must have been introduced when young, living in tubes amongst algæ, before assuming the adult form. The remarkable fact is the manner in which they are now and then seen swimming at the surface of the sea water. I must have lived at anchor in the Orwell and Stour for a total period of between one and two years, and yet I never saw *Heteronereis* in that locality except off Harwich on July 16th, 1898, and perhaps once in the Orwell at Pin Mill. I do not know how early they appeared, but from the time I turned out at 5 a.m. until 7 a.m., they were swimming about on the surface in such numbers that they were only a few yards apart, and, as I judged over an area of probably one or two square miles, so that the number may have been something like a million. They were apparently all males probably of the species *Nereis dumerilii*. Not one was seen the day before or the day after. Some years earlier at Queenborough, I saw on one evening a similar large number of a somewhat different kind of Annelid, larger and coloured much more red by hæmoglobin, which were both males and females, and though I most carefully looked for them that year and subsequently I never saw another. Once before I witnessed a similar display off Sheerness. It thus seems probable that these worms usually live in tubes which they build amongst algæ, and just occasionally, for a few hours, swim about on the surface in the *Heteronereis* condition, probably when scattering the ova or spermatozoa; the remarkable thing being that apparently all do so at the same time. It is impossible to say what occurs lower down out of sight, and the swimming at the surface probably to some extent depends on the weather being calm.

I must now describe a series of changes which seem more easy to understand than those already noticed. Until a few years ago the bottom of the Orwell at Pin Mill was almost entirely free from mud, and was to a large extent covered with Sponges, *Alcyonidium*, and compound Ascidians. The number of *Caprella linearis*, a small *Terebella* (*Nicolea zostericola*), and the curious worm, *Siphonostoma diplochaitos*, was astonishingly great; and a larger number of different species of animals could easily be obtained by dredging than in any other place along the coast. In 1898 and 1899 I however found the bottom covered with a fine tenacious mud, built into short, stout, soft tubes by enormous numbers of the small Amphipod, *Jassa pulchella*, which had increased so much as to have smothered and almost exterminated most of the animals previously living at the bottom. There had been little, if any, change in the mudbanks left dry at low water, nor any marked change in the animals living there. To my surprise I found the bottom clean in 1900, near Pin Mill, though lower down the bottom was more muddy than it used to be. In 1901 the bottom was clean and there was a most extraordinary number of small specimens of simple Ascidians, to the almost complete exclusion of other animals. Probably some of these changes have been due to the extensive dredging operations carried on to improve the navigation to Ipswich, and perhaps in a few years the original conditions may be restored.

After living on a yacht for some months, it is, of course, desirable to clean off the various animals and plants that have grown on the bottom. Sometimes I can then obtain specimens not otherwise easy to find. The most remarkable circumstance I have noticed is that in different years the animals attached to the bottom may be most strikingly different, though the yacht may have been at the same places, or very nearly so. One year the entire surface under water was covered with small *Balani*, growing as close to one another as they could; I estimate that the total number was something like two millions. Another year there were few *Balani*, but the bottom was covered with Ascidians of the genus *Ascidiella*. On other occasions the most striking form was *Tubularia larynx*, good specimens of which I have not been able to obtain in the district except from the bottom of the yacht. In 1899, after lying a long time at Pin Mill, the bottom was covered by soft, tenacious mud, built up by the small Amphipod, *Jassa pulchella*. On other occasions we have found variable mixtures of the above-named animals. These facts show what great variations there may be from year to year, which is thus so marked, because the bottom of the yacht is always clean to begin with, and animals attached one year cannot be mixed with those attached another year, as must often happen on rocks, and stones, and other natural objects.

It will thus be seen that, even in the short period of 10 or 12 years, many noteworthy changes have occurred, and, in some cases at all events, it seems doubtful if the original conditions will be restored in years to come. This is certainly indicated by the fact that in so many cases vast numbers of well preserved dead shells are met with *in situ* in places where the same species are seldom if ever met with alive. Taking all into account, it certainly appears to me that a considerable number of interesting animals have become more and more rare, whilst but few have become more abundant. The first explanation that suggests itself is that the changes may in some way have been due to human agency, like so many changes in animals and plants inland. In some localities an increase in the amount of sewage discharge may have been the cause; but, though in this respect the worst place I ever stayed at is the water at the back of Walton-on-Naze, yet I never saw a better collecting ground for numerous interesting animals. The use of artificial manures and gas lime may also have had considerable influence in some localities. In some places the water is much more muddy than it used to be. Another probable cause of change in the estuaries is the improved draining of the land, which necessarily tends to increase the amount of fresh water at the time of floods. I have been told of a case in which such an event killed thousands of pounds worth of oysters, and this effect would explain why so many full grown shells of clams and other species are often seen farther up the rivers than living ones now occur. It is, however, very difficult to believe that this cause could operate in the case of comparatively open water. It is, of course, easy to understand that a permanent diminution of fish may have resulted from over fishing, and we may well believe that the great number of fish, shrimps, and star-fish caught, and the various operations of oyster culture, may materially affect the number of some other animals; since the inter-relations of those living together are probably sufficiently intimate to produce such an effect. We must also bear in mind possible cyclic changes in the weather, and the effect of a series of hot and cold, dry and wet years.

Though thus calling attention to various possible explanations of the facts I have described, I feel that they are little better than suggestions, and that possibly the final results may be due to the variable combined effect of many such temporary or permanent causes. It seems to me very desirable that those who have constantly studied other districts should record their experience, since that might throw far more light on the question, and eliminate various sources of error which beset this subject on all sides.

Note.—For the identification of the species named in this paper, I am to a great extent indebted to Mr. Walter Garstang, the Rev. T. R. R. Stebbing, F.R.S., and Professor Herdman, F R.S., so that I believe they may be relied upon as correct.

ADDRESS DELIVERED AT THE 21st ANNUAL MEETING OF THE ESSEX FIELD CLUB, MARCH 30th, 1901.

By DAVID HOWARD, J.P., F.C.S., *President.*

In completing my term of office as President I must yet again congratulate the Club on the achievement of the long delayed purpose of establishing a Museum, alike to render permanent, and to spread more widely, the work of the Society. I need not go again over the history of that arduous, and at times seemingly hopeless, task, but would venture to remind our members that the real work is but begun; in museums, as in everything else, growth is the text of life, and without living progress, a Museum sinks into the fossil stage of existence and is best buried out of sight along with other fossils. Unfortunately we already find that we need more money to develop the work, and any who are willing to assist, may rest well assured that their money will be fruitfully expended under the care of our indefatigable Curator. We are already beginning to feel that *space*, and not the wherewithal to fill it, will be our difficulty, and that even the noble generosity of Mr. Passmore Edwards so freely supplemented by that of the Technical Education Committee of the Borough of West Ham, has given us none too much room for our museum work. Perhaps some will say, "there is no satisfying such people." It is quite true, and it is better so; in scientific as in some more important matters, the sense of fulfilment and satisfaction is a very dangerous one. I do not know that there is great need that I should impress this on most of those here; for which of us, even in those matters in which we have done most, and learned most, is under any delusion that he has exhausted the possibilities. But I would urge all to keep this truth in mind, and not to fail to impress it on those especially who having made less progress are less conscious how little progress they have made. And there is special danger in a too keen satisfaction in the work of greater minds who have preceeded us. A great teacher may even dwarf the minds of his pupils, by giving them an unconscious despair of progress, by the admiration they rightly feel for his work. It was not the profoundly scientific, if imperfect, teaching of Aristotle, but the fatal "ipse magister dixit" of the schoolmen, that dwarfed scientific thought in the Middle Ages. They did not imitate their master in the study of nature; they contented themselves by studying *him*.

The danger is just as present with us as it was with them; there is so much to impress, delight, and satisfy us in the marvels of modern science, that perhaps all of us, most certainly the beginner, may easily allow the feeling to get the mastery, that there is nothing left to do, nothing even that needs doing.

And then in instructing others (and we all, if we know a little more of anything than those around us, cannot help doing that, even though we may never venture to count ourselves as teachers) it is tempting to human nature to dwell on how much we know, and but slightly on how little we know (which may be the more important of the two) and that is a lesson that finds too apt a pupil in a beginner.

It is one of the most hopeful elements in the best teaching of science, that such wise efforts are made to encourage the student to work out problems for himself. It is no easy matter; it is wonderful what pains the average boy will take to avoid thinking. He will perform the marvellous feat of learning a proposition of Euclid by heart, without understanding it, and he will go through life with two or three adjectives in his vocabulary which he uses with persistent inappropriateness to save himself the terrible trouble of thinking out what he means.

But even if we escape from these elementary forms of satisfaction, I am not sure that we have exhausted the dangers.

May I try to set before you two habits of mind which are not easy to define, for the words that seem naturally to explain them are themselves of such uncertain meaning (at any rate in common speech) that they need definition before we use them.

Idealism and realism, at any rate in their older senses, express the two modes in which one may regard scientific as well as other matters. One may dwell upon the general or on the particular, and I want to urge that the more idealism there is in our thought, the more one seeks for the general, the more progress one can make. It is easy to recognise a proposition of Euclid as true of the particular circles and triangles drawn on the black-board, but it is a distinct sign of progress to prove the proposition with the figures upside down; beyond that lies the larger conception that it is true of all possible triangles, and further still that the truth lies in the very nature of a triangle. Such is the irony of fate that we really never really understand the case of the particular triangle, until we have grasped the *idea* (in the Platonic sense) of all triangles.

Now if this is true in the simplest forms of study, it is yet more true in the recondite. The ordinary definition of the ideal is "that which is not real"—which is true—but what do we mean by the real; is not the ordinary sense of the word "real" a warning of how easy it is to confine our ideas to the particular example and lose the sense of the wider truth which underlies the particular example.

The word "real," that modern outcome of scholastic thought, if it means anything, means that which is "res," a definite concrete thing, and our use of it to connote the true, the "very" to use the good old word, is itself a warning how much our thought is bound down to the particular example that we know, and how apt we are to lose the sense of the wider truth, that we at best but half know and but half comprehend, but which is far truer than the real.

Are we not in danger of being caught in the meshes of our own thought. Even the wisest and best theory may be a trap, if we fail to recognise that it *must* be an imperfect explanation of the whole of the truth, unknown and unknowable in the fullest sense. We feel that the theory is "real," it is clear, definite and conclusive and exactly suits our power of comprehension; therefore let us beware of supposing that it is exhaustive. Nature is greater than our minds, and therefore if a theory is no greater than our minds, it must be smaller than the truth of nature. Just in proportion as a theory satisfies us, it bears upon it the evidence of incompleteness; and if we do not take care we may become hide-bound by it. Lavoisier's theory of the proportionate combination of elements: Dalton's theory of atoms: were magnificent and have borne fruit in much of the wonderful progress of modern science; and yet in their very perfection, they left out a something that the older phlogiston theory, erroneous and imperfect as it was, had got a glimpse of. Even their very success threw back the investigation of "thermochemistry" which is not less important to the grasp of the whole problem. Only a few years ago we were tempted to feel satisfaction in our grasp of the possibilities of the vibrations of the ether, and we had got a long way, no doubt, but Rentjen and his collaborators, who were not hide-bound, have compelled us to open our minds to the possibilities of vibrations of the extent of which we are by no means satisfied yet.

We must have theories; we cannot make progress without them; even a false theory may be better than none. Take for example, the theories of the alchemists; they were false, no doubt (though the possibility of transmutation seems now by no means so unthinkable as it did a while ago); yet false as they were, they served as an encouragement to the study of natural phenomena and indirectly laid the foundations for modern science.

Then again, popular ideas are mostly more or less wrong, but they embody an unconscious and unscientific summing up of experience that it is rarely wise altogether to ignore. Forty years ago the Italian peasant was nearer the mark in calling cholera "aquetta" and attributing it to poisoned wells, than the more educated people who learnedly discoursed of "blue haze" and so forth. Long ago experience had shown that there was some connection between malaria and mosquitos, improbable as it seemed to scientific thought.

Let us therefore hold fast to our theories—to our ideas—taking infinite pains to choose the best; those that are alike most far-reaching and most based on experience; yet never holding them as absolute truth, never saying that something is impossible because it will not come within their limits. Even though something be unknowable, let us be very careful not to say that it cannot be.

It may be said that this is all mysticisin and dreams. Possibly, and yet it may be that there is an ignorance worse than dreams. The Germans make a distinction, untranslateable into English, between *das mystic*—the feeling after a truth too great for comprehension—and *das mysticismus*—which is, to put it vulgarly, muddle-headed dreaminess. It is the first that I wish to plead for in science, especially to beginners filled with a sense of how much they know. I would urge such ever to hold fast to theories; without them progress is impossible. Try and grasp the ideal that underlies the real, and is more true than it; but never allow yourselves to be satisfied even in your ideal. Never lose sense of the imperfection of human knowledge and especially of your own. Never allow the sense of what has been known, great and wonderful as that is, to dim the higher sense of how little we know as yet, how much there is to know.

FISH-HOOKS OR GORGES OF WOOD FROM FRANCE (SIMILAR TO THOSE FROM ESSEX).

By EDWARD LOVETT.

[*Read January 26th, 1901.*]

In the Essex Naturalist for April, 1898 (vol. x., pages 300-305) I described and figured some primitive fish-hooks of wood still in use on a part of the coast of Essex. At that time I had heard that similar hooks were used in some parts of France and Russia (and probably elsewhere). For some time I made every possible enquiry as to these, but without success.

At length, however, I was fortunate in hearing that M. François Daleau, of Bourg-sur-Gironde, France, could assist me, and I at once wrote to this gentleman. His reply was indeed a surprise, for it was to the effect that on the Gironde fish-hooks of wood were used, not only like the Essex form, but actually made of the same wood, the White-thorn.

I sent him a line of our Essex thorn hooks, with a copy of the Essex Naturalist containing my paper, and he very kindly gave me a series of similar hooks from his locality, together with a copy of his most interesting pamphlet, extracts from which I have reprinted below.

It will be seen from his paper that the "survival" of the primæval fishermen is almost exactly alike on the Essex coast, and on the banks of the Gironde, but at the latter place we find the true gorge which again was evidently known in Essex, as will be seen from my correspondence with "Tom" recorded below

This true gorge is most interesting as regards its distribution, for I have stone examples of it from Hudson's Bay; bone specimens from Alaska (for catching sea-birds); and turtle-shell forms of the same thing from Santa Cruz, for taking Flying-fish.

The prehistoric type of fish-hook made of Mammoth ivory, described in M. Daleau's monograph, is represented in chert in North America, and in flint in this country.

These latter are, however, but little understood, for in some museums they are described as "awls," whilst in others they are more discreetly labelled "use unknown."

I now give some extracts from M. Daleau's report on :—

"HAMEÇONS MODERNES EN BOIS.

"Quelques vignerons habitant les bords de la Dordogne, dans les communes d'Ambès et de Prignac-et-Cazelles (Gironde), se livrent aux plaisirs de la pêche durant leurs moments de loisirs. Les hameçons en bois qu'ils fabriquent et dont ils se servent encore pour la pêche de l'anguille ont depuis longtemps attiré mon attention. Ceux que je possède figurent dans ma collection depuis 1876.

"Ces engins sont de deux types differents, appelés dans le pays, l'un *Hain* ou *In*, l'autre *Clabéou ou Claveau*.

"L'hain (Fig. 1) est un petit hameçon bifide en forme de fuseau, long de deux à trois centimètres, taillé dans un mince morceau de *brande-à-balais (Erica scoparia)*, acéré aux deux extrémités, fixé solidement au centre par un fil simple, long d'environ 35 centimètres.

"Le *clabéou* ou *claveau* (Fig. 2) est fait d'une petite épine de *briet blanc* (*Cratægus oxyacantha*), tenant à un morceau de sa tige, taillé en pointe à la base, évidé en gouttière au coude, pour faciliter le passage d'un fil double qui, maintenu près de la pointe par un nœud coulant, vient ensuite s'attacher à la naissance de l'épine.

"Ces hameçons en bois, que la plupart de nos pécheurs d'occasion préfèrent aux hameçons en acier, sont employés comme je viens de le dire pour le pêche de l'anguille.

"Le vigneron procède de la façon suivante : les engins, souvent au nombre de plusieurs douzaines, sont amorcés avec des vers de terre que l'on enfile jusqu'à ce que le bois soit complètement recouvert, l'extrémité opposée du fil est attachée à un bâtonnet de trente à quarante centimètres de long que la pêcheur enfonce entièrement dans le sol détrempé du rivage à marée basse ; l'eau monte, couvre l'engin et, un peu avant l'heure du flux, on va voir *si l'anguille a mordu* (terme local).

"Des chasseurs m'ont affirmé avoir vu sur les bancs de sable et sur les berges des îles du bas de la Gironde, des hameçons en bois plus longs que les hains, que l'on dissimule sous des morceaux de foie ou de poumons de bœufs, avec lesquels les indigènes capturent des canard sauvages et des *flahus* (Courlis)."

[Appended is a translation of the above passages from M. Daleau's paper, for which we are indebted to the kindness of Miss Mary H. Cole. ED. :—

MODERN FISH-HOOKS OF WOOD.

Some vinedressers who live on the banks of the Dordogne, in the parishes of Ambès and Prignac-et-Cazelles (Gironde) indulge in the pleasures of fishing during their leisure moments. The wooden fish-hooks which they make and which they still use for eel-fishing, have for a long time attracted my attention. Those which I have, have figured in my collection since 1876.

These instruments are of two different kinds, called by the natives *Hain* or *In*, and *Clabéou* or *Claveau* respectively.

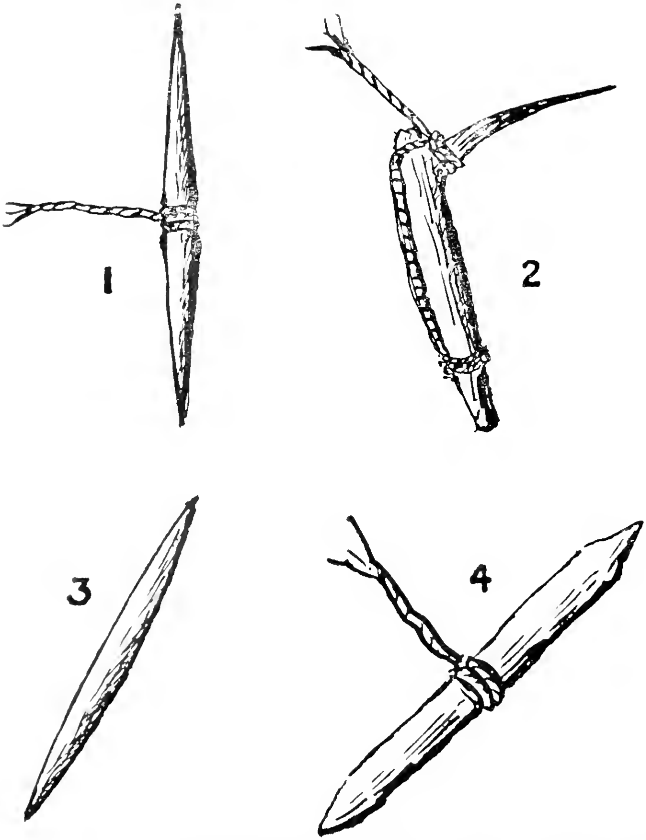


FIG. 1. L'hain (wooden fish-gorge). FIG. 2. Clabéou or Claveau (thorn fish-hook) Gironde. FIG. 3. Pre-historic fish-gorge of ivory, Cave-deposits, Gironde. FIG. 4. Fish gorge from the Essex coast, recent.

L'hain (Fig. 1) is a small fish-gorge pointed towards both ends, in the shape of a spindle, about two or three centimetres long, cut out of a slender twig of heath (*Erica scoparia*) sharpened at both ends, firmly secured at the centre by a mere thread, about 35 centimetres long.

The *Clabéou* or *Claveau* (Fig. 2) is made out of a small White-thorn (*Cratægus oxyacantha*) thorn on a portion of the stem, which is cut into a point at the bottom, and has a groove cut round it to admit of the passage of a double thread which is kept in position near the point by a slip-knot, and is then fastened at the base of the thorn.

These wooden fish-hooks, which the majority of our amateur fishermen prefer to steel fish-hooks, are used as I have just said, for eel-fishing The vinedresser sets to work in the following way; the hooks, to the number often of several dozen, are baited with earthworms, which are stuck on until the wood is completely covered up; the end opposite the thread is fastened to a small stick 30 or 40 centimetres long which the fisher plunges entirely in the damp soil at the river's edge at low tide. The water rises and covers the fishing rod, and a little before flood-tide they go to see whether " the eel has bitten " (local term).

Some sportsmen have assured me that they have seen on the sand banks and shores of the islands on the lower Gironde, wooden fish-hooks longer than the "hains," which are hidden by pieces of liver or ox "lights," and with these the natives catch wild ducks and curlews.

M. Daleau then goes on to describe some exceedingly interesting finds in Cave-deposits of Marcamps (Gironde) of small objects made of Elephant (Mammoth ?) ivory (Fig. 3) which he very logically considers to be the pre-historic ancestors of the "*Hain*" used by the peasants of the same district in the present day.

When I had read this most interesting paper I wrote at once to our old friend " Tom " in Essex asking him if he had ever used any other kind of wooden hooks than those he had already sent me.

His prompt reply very much astonished me, for he enclosed a few specimens of a gorge (Fig. 4) which he stated he formerly used; but after further enquiries on my part he could give no reason for doing so, nor did he know where he got the idea from. A more interesting case of unconscious heredity I have never met with.

As regards the other remarkable coincidences in M. Daleau's report, I can only add that he was as much interested to hear of a similar survival in our country as I was to hear of the use of the Essex wooden hooks in the valley of the Gironde.

Note.—I shall be glad to be informed of other records of similar hooks from any part of the world, or to receive any observations upon this interesting subject.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31st, 1900.

[*Read and Adopted at the 21st Annual Meeting, March 30th, 1901.*]

The year 1900 will be memorable in the annals of the Club. Not only did it complete twenty-one years of work, but it also witnessed the realization of the vision of a permanent County Museum of Natural History, which from the beginning has been an ideal of the Club, and which was first put into the practicable shape of a resolution at a meeting held at Mr. E. N. Buxton's house on December 8th, 1883, seventeen years ago. Within the year were also completed the extensive repairs and restorations of Queen Elizabeth's Lodge, thus affording a most suitable home for the Epping Forest Museum.

FINANCE.—The Statement of Account for the past year reveals the sound policy pursued by the Council of the Club, in steadily reducing the debit balance on the General Account, which, from over £100 in 1896, has sunk to a few shillings at the present time[1] The other accounts are also in a healthy condition, that relating to Special Memoirs and Publications alone showing a deficit; and against this may be set the value of the stock, for which a steady, though not a rapid sale may be predicted. The Forest Museum will demand the best energies of the members of the Club in the immediate future, the balance in hand being entirely out of proportion with the needs created by the necessary re-organisation.

MEMBERSHIP.—The list of members issued in the autumn, corrected up to Dec. 31st, shows a total of two hundred and eighty-eight, made up as follows:—Life Members, 29; Annual Members, 241; Exempt Members, 4; Honorary Members, 14. Of these twenty-two were elected during the year; the losses, from various causes, totalled twenty-six.

By death the Club lost four distinguished Honorary Members; two Life Members (Mr. Leaf and Mr. Ramsden); and six annual members. Thirteen members resigned, and one was amoved. Every effort should be made to fill up the vacancies at an early date.

MEETINGS.—Thirteen meetings were held within the year, including that in connection with the opening of the Central Museum, and a meeting in futherance of the objects of the Epping Forest Museum. As in former years, the Council have pleasure in acknowledging the services of those gentlemen who so kindly aided in the conduct of the meetings. At the meeting at the College of Surgeons on January 27th, Prof. Charles Stewart, F.R.S., gave one of his charming demonstrations of the contents of that magnificent Museum; at the meeting on February 14th, Mr. Lovett gave a demonstration lecture on Crustacea; on March 31st, Mr. S. Salmon conducted a meeting for the observation of the Mosses of Epping Forest; and on May 19th, Mr. G. Massee, F.L.S., acted in a similar capacity with regard to the minute Fungi. At the meeting on July 9th, Mr. Turner kindly acted as botanical guide in the Witham and Tiptree district; at this meeting the members were most

1 In the report of the Council for 1899 the printers inserted in error the Statement of Account for 1900 instead of that for 1899 (see last volume, pp. 306-7). The latter is now inserted to make the series complete.

hospitably received at the Tiptree Heath Fruit Farm by Mr. Wilkin and his family. At the Annual Fungus meeting on October 6th we had the great benefit of the assistance of Dr. Cooke, Mr. Massee, F.L.S., Mr. R. Paulson, Mr. F. O. Pickard-Cambridge, and Mr. Frank Smith The Council are fully sensible of the honour conferred upon the Club by the Countess of Warwick in consenting to open the Museum on October 18th and the ceremony was rendered the more valuable by the excellent address delivered by her Ladyship on that occasion. The thanks of the Council are also due to Prof. Meldola for the address delivered by him at the opening ceremony, and to Mr. E. N. Buxton for kindly taking the chair at the meeting on December 8th in support of the Forest Museum. An experiment was made on July 20th and 21st to interest the members in the collecting work of the Museum by means of two dredging excursions in the Colne Estuary. The Council regret that financially the experiment was unsuccessful, although otherwise the meetings were exceedingly interesting; there were, however, some drawbacks in weather and possibly other reasons for non-attendance, and the experiment might well be repeated with a somewhat varied programme. The whole of the above-named meetings have been, or will be, fully reported in our Journal.

ESSEX NATURALIST.—Members are referred to the paragraph on this subject in the last Annual Report. Two parts were published within the financial year, and much matter is in type ready for another part. The Council has again to thank Mr. H. A. Cole for some drawings for reproduction and Mr. F. W. Reader for assistance in getting matter ready for press. Mr. Reader has also kindly presented the blocks for use in the memoir of General Pitt-Rivers. But as this memoir will not be published until 1901 further reference to the matter will be made in next year's report.

ESSEX MUSEUM OF NATURAL HISTORY.—With respect to the Central Museum the Curator again finds it desirable to postpone a full report until the various collections are in a more forward state of arrangement. Many changes will be made during the ensuing summer, and the cases now being made, or refitted, will much improve the Museum. The members are again referred to the *Museum Handbook, No. 5*, and to the various reports in the ESSEX NATURALIST which contain most of the business details. The building was finished in the early part of the year and in April the temporary premises at Forest Gate were given up, and the whole of the collections, cabinets and cases with the books, were removed to the new Museum. Mr. Passmore Edwards' munificient donation of £1,000 enabled the Municipal Technical Instruction Committee to fit up the very handsome Museum wall-cases and floor-cases now in the Museum As soon as the furniture was in position, the Curator commenced the preliminary arrangement of the collections, so as to get the space available at least planned out before the date fixed for the opening of the Museum. In this high-pressure work he was greatly assisted by Mr. W. H. Dalton, Mr. J. E. Harting, Mr. H. A. Cole, and Mr. F. W. Reader. Mr. Dalton commenced the arrangement of the students' geological collections, and Mr. Harting put together and presented to the Club the very interesting collection of birds and trappings to illustrate the modern practice of Hawking which now adorns the Central Hall. A great many birds and mammalia were obtained and preserved by Mr. Pettitt and Mr. Burton, the Club's taxidermists, and a commencement was made with

ESSEX FIELD CLUB.

Treasurer's Statement of Receipts and Expenditure for the Year 1899.[1]

GENERAL RECEIPT AND EXPENDITURE ACCOUNT.

Receipts.

	£ s. d.	£ s. d.
To Subscriptions, 1897	3 15 0	
" " 1898	9 11 6	
" " 1899	144 1 6	
" " 1900 (in advance)	1 10 0	
		158 18 0
" Life Compounders for *Essex Naturalist* ...		9 0
" Balance forward (Deficiency)		26 9 1
		£185 16 1

Expenditure.

	£ s. d.
By Balance (Deficiency from 1898)	43 8 0
" Printing and Illustrating *Essex Naturalist* (2 parts) ...	42 9 3
" Printing (Circulars, &c.) and Stationery	8 8 9
" Postage of *Essex Naturalist*, Circulars, Correspondence, etc.	15 0 3
" General and Incidental Expenses	9 7 8
" Library Expenses	5 6 4
" Lecturers' Fees	3 13 6
" Amount transferred to Essex Museum (West Ham) Maintenance Fund	50 0 0
" Loss on Field Meetings, as *per* Hon. Secretary's Statement	6 18 11
" Loss on Tea Fund *do. do.*	1 3 5
	£185 16 1

SPECIAL MEMOIRS AND PUBLICATIONS ACCOUNT.

Receipts.

	£ s. d.
To Sale of Publications	8 1 6
Balance forward (Deficiency)	18 13 5
	£26 14 11

Expenditure.

	£ s. d.
By Balance (Deficiency from 1898)	25 16 5
" Cost of Prospectus of *Essex Mammals*	18 6
	£26 14 11

EPPING FOREST MUSEUM CAPITAL AND MAINTENANCE FUND.

Receipts.

	£ s. d.
To Subscriptions	6 10 0
" Balance forward (Deficiency)...	4 19 7
	£11 9 7

Expenditure.

	£ s. d.
By Balance (Deficiency from 1898)	4 1 10
" Oil for Lamps	3 8 8
" Gratuity to Caretaker	1 0 0
" Curatorial Expenses	10 7
" Fire Insurance	13 0
" Fawn stuffed and mounted	1 15 0
	£11 9 7

ESSEX MUSEUM (WEST HAM) EQUIPMENT FUND.

Receipts.

	£ s d.
To Balance	150 7 6
" Donations	54 2 0
	£204 9 6

Expenditure.

	£ s. d.
By Printing, Postage, and Stationery	7 2 0
" Carriage of Goods from Germany	1 0 11
" Apparatus and Fittings	39 14 11
" Specimens	17 19 3
" Sundries	6 18 7
" Balance at Lloyd's Bank, December 31st, 1899	131 13 10
	£204 9 6

ESSEX MUSEUM (WEST HAM) MAINTENANCE FUND.

Receipts.	£ s. d.	Expenditure.	£ s. d.
To Balance	16 2 6	By Rent at Woodgrange Road	28 3 4
,, West Ham Corporation (1898)	41 13 4	,, Curator's Stipend	73 6 8
,, ,, ,, (1899)	100 0 0	,, ,, Railway Fares	10 15 10
,, General Account for Amount transferred under Agreement of July 25th, 1898	50 0 0	,, ,, Disbursements	23 3 2
		,, Fire Insurance	1 2 6
		,, Sundries	2 13 1
		,, Balance at Lloyd's Bank and in the Curator's hands ...	68 11 3
	£207 15 10		£207 15 10

LIFE COMPOSITION ACCOUNT.

	£ s. d.		£ s. d.
To Balance from 1898, being the amount due in respect of the Life-Compositions of existing Members	104 10 6	By Balance forward	115 0 6
,, Life-Composition paid by Mr. Bryan	10 10 0		
	£115 0 6		£115 0 6

SUMMARY OF BALANCES, JANUARY 1st, 1900.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To Essex (West Ham) Museum:—			By Cash at Lloyd's Bank:—		
Equipment Fund	131 13 10		Equipment Fund, Essex Museum...	131 13 10	
Maintenance Fund	68 11 3		Maintenance Fund, Essex Museum	61 14 5	
		200 5 1	Life Composition Fund	57 4 8	
,, Life Composition Account		115 0 6	General Account ..	2 4 5	
					252 17 4
			By Cash in hand—		
			Curator (Maintenance Fund)	6 16 10	
			Hon. Sec. (General Account)	1 15 4	
					8 12 2
			Hon. Librarian (Mr. Lockyer)		3 14 0
			By Deficiencies:—		
			General Account	26 9 1	
			Special Memoirs and Publications Account ...	18 13 5	
			Forest Museum	4 19 7	
					50 2 1
		£315 5 7			£315 5 7

Having examined the above Accounts with the books, vouchers, and pass-book, we find them in accordance therewith and correct.

WALTER CROUCH,
JOHN D. COOPER, } *Hon. Auditors.*

N.B.—The Club possesses other Assets, consisting of Stock of Publications, Books, MSS., Copyrights, Specimens, Cabinets, etc.

1 The Statement for 1900 was inserted by mistake in previous volume, pp. 306-7.

collection of fishes and reptiles, crustacea, and insects, &c. A full report of the opening ceremony has been already printed in the ESSEX NATURALIST (vol. xi., pp. 319-331).

A series of *Handbooks* to the different collections in the Museum has already been commenced. One on the scope and business details of the Museum was prepared by the Curator, and contains a portrait of Mr. Passmore Edwards; Mr. Dalton has written one on the collection of Crag Fossils, and Mr. Reader on the Prehistoric Collections. To these gentlemen the Council tender their warmest thanks. It is intended to continue the series as funds will permit and the handbooks will be sold in the building at a small price.

THE EPPING FOREST MUSEUM.—The restoration of Queen Elizabeth's Lodge in order to afford more space for the Museum, and to put the building into a thorough state of repair, has now been completed. The matter is thus referred to in the Report of the Epping Forest Committee of the Corporation of London, received and passed by the Court of Common Council on February 14th:—

"The additions and alterations to Queen Elizabeth's Lodge have been completed at a cost of £1008. The restoration has given great satisfaction, and the Museum is now in course of re-arrangement, not only in the Banqueting Room, where it has existed for some years, but also in the renovated 'Oak Room' on the first floor."

Of this sum of £1008 the Council of the Club contributed £50 out of the Fund subscribed, towards the cost of fitting up a small room on the ground floor as a Curator's room. Several meetings of the Council and Committee have been held to consider and formulate the plans of work for the fitting up of the Museum in an adequate manner. It is the wish of the Corporation Committee that no high cases should be placed in the rooms. This necessitated some change of plan, and it has now been decided that no general collection of vertebrates should be exhibited, and that the upright cases and such specimens of vertebrata as were in the Museum (other than loan collections) should be removed to the County Museum at Stratford. It is intended to represent the birds, &c., in the Museum by a few cases of "groups" similar to those in the British Museum; but these will be very costly and must be specially provided. At the meeting held on December 8th last, the plans were settled and agreed upon, Mr. E. N. Buxton being in the chair. See full report in the ESSEX NATURALIST (vol. xi., pp. 300-303). A subscription list (which now amounts to over £100) has been started, and the alteration and construction of cases, &c., will be taken in hand at once. At the wish of the Corporation Committee the building is now open to the public, but the re-arrangement of the Museum must necessarily take a long time, and it is obviously better to reserve a full report until the work is completed. The Curator hopes to get the Museum into a fair state of completeness by the spring of 1902. Meanwhile the active sympathy and support of all our members is solicited for our Curator, whose task in organising and arranging two large Museums is one both difficult and onerous.

RETROSPECTIVE.—Inasmuch as the year 1900 completed the 21st year of the existence of the Club, it may be useful to record a few brief notes on the work accomplished during that period.

The Club was founded in the last months of 1879 by meetings called together by Mr. W. Cole, and the issue of a very large number of letters to the leading inhabitants of the County. The original advertisements, prospectuses, and the Rules were drawn up by Mr. Cole, and settled by the late Charles Browne, M.A., who acted as the first Hon. Counsel to the Club. The Inaugural Meeting took place on January 10th, 1880, at the rooms of the Epping Forest Art Classes, St. John's Villas, Buckhurst Hill. Mr. Meldola was unanimously chosen as the first President, and it is in the recollection of all the original members of the Club how much the Society owes to his guidance and scientific knowledge. His address delivered at the first Ordinary Meeting of the Club on February 28th, 1880, clearly laid down the lines upon which the policy of the Club was founded, and since that period Prof. Meldola has ever been ready with advice and assistance in the conduct of the affairs of the Society. Mr. Meldola retained office for three years; then Prof. G. S. Boulger took the post of President for two years, to be succeeded by Mr. T. V. Holmes, who filled the chair from 1885 to 1887. Mr. E. A. Fitch was President for four years (1888 to 1891). Then Dr. Henry Laver served for one year and Mr. Chancellor for two years. Mr. Howard was elected in 1895, and consequently has filled the office for six years. The Council most gratefully acknowledge the great value of the services of these gentlemen; under their guidance the Club has maintained a high position among similar societies. It is a matter of great satisfaction to say now that the Club is in a fair way of accomplishing all the objects laid down in the original Rules and in Prof. Meldola's Inaugural Address.

Second only in importance to the President is the office of Treasurer, and the Club has been fortunate in securing the services of gentlemen who have given much time and labour to its arduous duties. Mr. H. J. Barnes was the first Treasurer, acting during 1800 and 1881; then Mr. Andrew Johnston held the office during five years from 1882 to 1886; Mr. Thomas Royle acted during 1887 and 1888. Then Mr. A. Lockyer was Treasurer for seven years from 1889 to 1895, and in 1896 Mr. Waller took the office which he resigns to-night, after acting for six years.

Mr. W. Cole was the first Honorary Secretary. It may be noted that he has attended in this capacity every Meeting and Committee Meeting of the Club, with the exception of three Field Meetings, once through illness and the others from business connected with his duties under the County Council. Mr. Cole has also edited the Club's publications from the beginning and has reported every Meeting in full in the publications of the Club and in the Minute Books.

Mr. B. G. Cole has served as Assistant Hon. Secretary since his first election in 1882, and on him has mainly fallen the trying and sometimes unpleasant task of conducting the business details of our numerous Field Meetings.

The Club owes a debt of gratitude to Mr. A. Lockyer, who was the first Librarian, and who inaugurated the system of exchange of publications with other societies. He served in this capacity until 1886. In 1887 Mr. Wire took the office and 1893 was joined by Mr. E. Durrant. Mr. Lockyer acted in 1889 and 1890. Mr. W. C. Waller acted as one of the Librarians during several years, more particularly with regard to the sets of forest literature in the Epping Forest Museum. All these gentlemen gave most valuable services.

The Club has also largely benefitted by the services of Mr. Charles Browne and Mr. W. C. Dare as Hon Counsel and H. J. Coburn as Hon. Solicitor.

During the 21 years the Club has held 200 Ordinary Meetings, 158 Field Meetings and 32 other Meetings, making 390 Meetings in all. But it must be remembered that two meetings have sometimes been held on the same day.

The Publications of the Club comprise five volumes of Transactions and Proceedings, eleven volumes of the ESSEX NATURALIST (the last in progress) and three volumes of the Special Memoir series, making 19 volumes in all. Up to the end of 1900 the publications comprised about 5,310 pages of matter, and of this at least 7-8ths has direct connection with the natural history, geology, archæology, history and topography of the County of Essex. The average number of pages published has consequently been 252 per annum.

The Council very much regret the death of Mr. E. Durrant, which occurred on August 30th, 1900. Mr. Durrant joined the Club in 1881, and served on the Council. He also acted as Librarian and took part as Secretary of the old Chelmsford Museum in the attempt to establish the County Natural History Museum at Chelmsford. He was the founder of the Chelmsford Society of Odde Volumes and was one of the founders and the publisher of the *Essex Review*. During many years he was a constant attendant at such meetings of the Club as were held in the interior of the County.

TREASURERSHIP.—The Club will suffer a great loss in the retirement of Mr. W. C. Waller from the Treasurership, which he has filled to the manifest advantage to the Society since March, 1896. In addition to his services as Treasurer, Mr. Waller acted as Librarian to the Epping Forest Museum, and most skilfully arranged and catalogued the interesting set of Forest papers known as the Barclay collection, an account of which was published in the ESSEX NATURALIST, vol. ix., pp. 157-160. Mr. Waller also most kindly gave his services as Hon. Secretary to the Special Committee for the adjustment of the questions between the representatives of the old Chelmsford Museum and the Club, and in many other ways has acted for the benefit of the Society. The Council return their most hearty thanks for his past services, with an expression of sincere regret at the loss of them in the future.

Mr. Howard has most kindly consented to undertake the office of Treasurer, at least for a time, and has thus relieved the club of a serious difficulty.

LIBRARIANS.—The Club is again reminded that no members have yet offered to take the offices of the two Librarians. The absence of these officers is greatly to be regretted, and as the books must now be arranged and the list of corresponding Societies revised, and the exchanges sent out, a great deal of additional work will be thrown upon the Hon. Secretaries.

AUDITORS.—The Council cannot justly omit to thank Mr. Walter Crouch and Mr. J. D. Cooper for their persevering and skilful services as Auditors during many years past. Both these gentlemen have rendered most essential services to the Club which should be gratefully acknowledged by the members.

Presidency.—Mr. Howard resigns to-night the office of President, which he has held for the unprecedented term of six years. The Council most sincerely thank him for his services, which have been in the highest degree beneficial to the Club during a period of very considerable stress. The retiring President is to be heartily congratulated at having seen during his term of office the completion of the establishment of our two museums, and the settlement of the Club in the permanent head-quarters at Stratford. Both the members and the Council are glad that Mr. Howard's aid and sympathy will be retained by his election as one of the Permanent Vice-Presidents and as Treasurer of the Club.

The Council recommend the election of Prof. Meldola as President as an event likely to advance the scientific reputation and usefulness of the Club. And they also think that the members will have pleasure in welcoming back as the head of affairs a gentlemen who took part in the inception of the Club, and who now will, perhaps, have the satisfaction of giving the finishing touches to the edifice which was so well planned out twenty-one years ago.

Two very necessary things remain for accomplishment, the increase of our membership to 400, so as to give a sufficient income for the ordinary work of the Club, and the establishment of a reasonably adequate Museum Fund which will enable the Club to collect and preserve in the Museums a really good series of Essex animals, plants, and fossils. So much has been accomplished during the past three years by a small number of persons, that all members and friends of the Club are now asked to work heartily to bring about the establishment of the museums and the other work of the society on a firm financial and scientific footing.

THE ESSEX FIELD CLUB.

TWO HUNDREDTH ORDINARY MEETING.

Saturday, January 26th, 1901.

The 200th Ordinary Meeting was held in the Physical Lecture Theatre of the Municipal Technical Institute, Romford Road, Stratford, at 6.30 p m., Prof. R. Meldola, F.R.S., *Vice-President*, in the chair.

The Chairman said that the Council at their meeting that evening had considered the desirability of recording the grief which was universally felt at the lamented death of Her Majesty the Queen, and they had drawn up the following vote of condolence to the Duke of Connaught, who had been Patron of the Club since its foundation in 1880. If the Resolution met with the approval of the members, it was proposed that it should be suitably engrossed, and signed by the President and Hon. Secretary on behalf of the members, and forwarded to His Royal Highness. He begged to move the resolution in the following terms:—

"The President and Council of the Essex Field Club, on behalf of the members, by a resolution passed this day, beg to convey to

HIS ROYAL HIGHNESS THE DUKE OF CONNAUGHT,

who has been Patron of the Club since its foundation in 1880, their most respectful and heartfelt sympathy on the grievous loss which he has sustained through the decease of his revered Mother. The members of the Club desire to make known to His Royal Highness that they, in common with all Her Majesty's subjects, share in the universal grief which the demise of their beloved Sovereign has caused throughout the British Empire."—*January 26th*, 1901.

The vote of condolence was seconded by Mr. Walter Crouch, F.Z.S., *Vice-President*, and passed unanimously by the Meeting in respectful silence.

The following were elected members of the Club: Mr. H. W. Lee and Mr. Ernest Linder, B.Sc.

Mr. F. C. Clark exhibited a small clay lamp, apparently of Roman make, which had been found in a garden at Woodford.

In the discussion that ensued it was affirmed that no evidence of Roman occupation had yet been found at Woodford. Mr. Crouch referred to the Roman remains at Wanstead, which had been described in the *Archæologia*.

Mr. W. Cole exhibited a fine specimen of the true "Old English" Pheasant, shot in the Forest by Mr Maitland, Jun., and kindly presented in the flesh to the Museum by the Rev. J. Whitaker Maitland, Rector of Loughton. Mr. Cole alluded to the rarity of this form of a well-known bird The usually occurring pheasant of our coverts was generally considered to be a hybrid between the true pheasant (such as the Loughton specimen) and the Chinese Ring-necked Pheasant (*Phasianus torquatus*).

Mr. Cole also exhibited specimens of a dark variety of the Common Brown Rat (*Mus decumanus*) which had occurred very rarely in one set of out-houses at Buckhurst Hill. It appeared to approach very nearly the form described many years ago by Thompson as the Irish Rat (*Mus hibernicus*), but which the best authorities now held to be simply a local melanic form of the Brown Rat (*M. decumanus*). Mr. Cole showed specimens of the Brown Rat, and the true Black Rat (*Mus rattus*) for comparison, and said that he hoped to obtain more information and additional specimens of all the forms, so as to be enabled to place a good series in the Club's Museum.

Prof. Meldola, in presenting on behalf of the authors a copy of Prof. Miall and Mr. Hammond's book on the *Harlequin Fly*, said that in 1897 at the Toronto meeting of the British Association he had had a most interesting conversation with Prof. Miall on the subject of the study of the life-histories of British insects. As this seemed a subject eminently fitted for individual observers in local Societies, Prof. Miall had, at his request, brought the matter before the Conference of Delegates of Corresponding Societies, and his remarks had been published in the Report of the Conference for that year. The monograph now laid upon the table was an excellent example of the kind of work that was so much needed in this country, and he (Prof. Meldola) hoped that the appearance of the book would have the effect that its authors desired of stimulating research in a much neglected field.

Mr. J. P. Johnson read a paper entitled "Notes on Palæolithic Implements from the Uphall Brickyard, Ilford, Essex." Mr Johnson exhibited and presented to the Club's Museum the specimens referred to in the paper (printed in present part, pp. 52-57).

Prof. Meldola, after commenting upon the implements exhibited by the author, said that he quite accepted their authenticity as true palæoliths, and congratulated Mr. Johnson on having been able to supply the first evidence from that district of the existence of man as a contemporary of the extinct animals whose remains had in former years been so frequently discovered in the Uphall pits.

Mr. Edward Lovett gave a demonstration of the employment of fish-hooks of wood in France, similar to the hooks from the Essex coast, described in volume x. of the ESSEX NATURALIST. Mr. Lovett exhibited specimens in illustration of his remarks, and also presented specimens to the Museum (see Mr. Lovett's paper in the present part, *ante*, pp. 28-31).

Prof. Meldola, said that the spirit of conservatism which had led to the retention of such ancient customs was either a blessing or the reverse, according to the point of view from which it was considered. Although, from an industrial standpoint, the persistence of a custom because our fathers did so before us was a disaster so far as concerns national progress, yet from an anthropological point of view such survivals were often of great value, and the use of wooden fish-hooks at the present day, as made known by Mr. Lovett's observations, was a most interesting case linking a modern implement with a very remote antiquity. The author seemed to him to have been fortunate enough to have secured the evidence just at the vanishing stage in this country, and in view of the rapid disappearance of all such ancient methods and traditions it was a bounden duty of observers to record similar facts whenever they came across them in the interests of anthropological science.

Mr. E. J. Lewis gave a summary of an extensive paper on the "Oak-Galls and Gall Insects of Epping Forest" which he had prepared for the ESSEX NATURALIST. Mr. Lewis exhibited a long series of coloured drawings from his own pencil, in illustration of the subject.

[Mr. Lewis's paper will be published in a succeeding part of our journal.]

Prof. Meldola said that he was particularly interested in Mr. Lewis's paper, and was much struck by the modest way in which the author had brought forward a very valuable contribution to the county natural history. He thought that the list drawn up would form a natural and fitting sequel to Mr. E. A. Fitch's paper on the "Galls of Essex" published in the early years of the Club ("Transactions of E.F.C.," vol. ii., pp. 98-156). He remembered well the sensation caused in this country on the announcement by Dr. Adler that certain Gall Insects which had been placed by systematists in different genera were cyclical forms of the same species, and he fully concurred with Mr. Lewis that in such cases both forms in the alternating generations should be referred in nomenclature to one genus only. With regard to the origin of the two forms from the point of view of the evolutionist he thought that in the light of the analogy with the Daphnias it was more probable that the bisexual form was the parent form and that the asexual form had been evolved from this. The researches of Weismann on the Daphnias where a somewhat similar alternation was observed had led that author to the conclusion that the sexual form was the parent form.

Prof. Meldola said that he was also most particularly interested in the examples of protection among galls referred to by the author. He suggested that the term "protective resemblance" would be more appropriate than mimicry in such cases. The instance of a gall protecting itself by a secretion which was attractive to ants was one of the most interesting cases he had heard of of late years The protection was indirect; the ants protecting the gall because of the food which they found on it. This was quite parallel to the case published many years ago by the late Thomas Belt in his well-known *Naturalist in Nicaragua.* That distinguished observer had discovered that certain acacias were provided with hollow-thorns which secreted a juice palatable to ants, these insects finding both food and shelter within the thorns. By means of these standing armies of ants the shrubs were most effectively protected from other insect marauders which were immediately attacked if they alighted on the shrubs. It was a case of symbiotic association in which both insect and plant benefitted by the association and the same was doubtless true in the case of the gall mentioned by Mr. Lewis.

Mr. John Spiller, F.C.S., commented in a laudatory way on the beauty of the drawings shown by Mr. Lewis.

Votes of thanks were passed to the authors of the papers, and the meeting concluded.

THE TWO HUNDRED AND FIRST ORDINARY MEETING.

Saturday, February 23rd, 1901.

The 201st Ordinary Meeting of the Club was held in the Physical Lecture Theatre of the Technical Institute, West Ham, at 6.30 p.m., Mr. David Howard, J.P., F.C.S., *President*, in the chair.

The vote of condolence with the Duke of Connaught, Patron of the Club, on the death of the Queen, passed at the last meeting, had been engrossed on vellum and forwarded to His Royal Highness. The President read the following reply which had been received :—

"Buckingham Palace,

"*February* 11*th*.

"Sir,

"I am desired by H.R.H. the Duke of Connaught to convey His Royal Highness' warmest thanks to the members and Council of the Essex Field Club for the sympathy which they have shown with him in his great and deplorable loss, and to assure them of his grateful appreciation of their kind message.

"Believe me,

"Yours very faithfully,

"Alfred Egerton, Col.,

"Comptroller.

"W. Cole, Esq.,

"Secretary, Essex Field Club."

The first business of the meeting was the nomination of officers and new members of Council in anticipation of the Annual Meeting to be held on

Saturday, March 30th. These nominations were duly made and will be recorded in the report of the Annual Meeting.

Mr. Avery exhibited six water-colour drawings of Essex Churches with the object of ascertaining the name of the artist. They dated from 179; to 1797. For many years they were in the possession of the late Mr. Thomas Bird, J.P., of Romford, a member of the Club. Mr. Avery also exhibited an old plan of Wanstead House Gardens.

Mr. Walter Crouch said that the coloured sketches were very interesting. They resembled a number of drawings that formerly belonged to Sir Edward Hulse, Lord of the Manor of Barking.

The President remarked that the view of Little Ilford Church was an admirable memorial of a church which had sufficed for a parish containing only 250 inhabitants within his recollection. At that time Great Ilford was only a hamlet of Barking, and contained no parish church. The best estimate that could be made of the population of Little Ilford *now* was 25,000, and these parishioners certainly could not go to church all at one time!

Mr. H. W. Littler exhibited some old hand-printing blocks formerly used at Mr. Edmund Littler's Silk-printing Works at Waltham Abbey. Mr. Littler subsequently kindly presented these blocks to the Museum, and in doing so furnished the Secretary with the following notes on the subject.

NOTES ON THE HAND-PRINTING SILK WORKS AT WALTHAM ABBEY AND WEST HAM.

By H. W. LITTLER.

I have forwarded to you for the Essex Museum the hand-printing blocks I spoke about at the meeting of the Club on February 23rd. They were made and used at Mr. Edmund Littler's Silk and Cotton Printing Works at Waltham Abbey, Essex, and are exactly similar to those used in Mr. Reding Littler's factory at West Ham Abbey. These West Ham Works were afterwards sold to Mr. J. Tucker, of Messrs. Baker, Tucker and Co., and subsequently removed to Teddington. The Waltham Abbey factory was sold to Her late Majesty's Government, for the extension of the Powder Mills, about the middle of the 19th Century. Of the old silk printing factories near London I believe the only one left is that which is (or was a few years back) carried on by a Mr. Littler at Merton Abbey, Surrey. The reason that these factories (all of which were in the first instance used as silk printing works) were located on the sites of or adjacent to old Abbeys was that large quantities of pure water were required for the purpose of bleaching the silk. It was no uncommon thing for great stocks of silks to lay on the meadows adjoining the factories, while an armed guard paraded round his valuable charge. Looking now at the putrid water of the Channelsea at West Ham and Lea one can hardly realise that these two factories were established on the banks of these rivers on account of the purity of their waters. The receipt for making madder green dye for which Mr. Reding Littler, of West Ham, was famons, was kept a profound secret even from his immediate relations interested in the same work. His madder green dyed silk handkerchiefs were the beau-ideal at that time of what a sprightly coster's neck-cloth should be. This recipe I believe died with him, he only revealing an inferior method to Mr. Tucker when he sold the factory. The original recipe was, I believe, purchased by a Mr. Reding, of Manchester, from a Persian, and descended from him to Mr. Reding Littler, who brought the industry to West Ham. Much of the work turned out by these factories was sold in London as the latest French goods on account of their high merits of design and execution, although they were solely of Essex manufacture.

The blocks I have sent are as follows:—

(*a*) Set of three blocks; pattern a dancing girl; showing the necessary blocks for over-printing in different colours.

(*b*) Two square blocks, floral pattern.

(*c*) One circular block, pattern nearly all in copper.

(*d*) Border edging block, pattern all in copper; a very fine specimen.

(*e*) Pear-shaped block, very fine work in copper, with solid parts filled up with wood.

All the above date back to quite the beginning of the 19th Century, if not to the 18th.

There are seven zinc blocks, edgings and floral designs, one bent work and one bar work; these are of more recent date, but do not show such fine design or workmanship as in the earlier ones.

In the discussion that ensued, the President said that there was much talk of technical education afforded in these latter days, but in his firm's works at the City Mills, they had several men formerly employed in these old print works, and they certainly were remarkably good workmen, showing that these old factories afforded good manual training. He remembered the Lea water in its bright days, when people used to drink it unfiltered; indeed they could get no better water.

Mr. W. Cole said that the waters of the Thames and the Lea must have been pure enough in the first quarter of the last century, for records of the occurrence of salmon in the Lea, dating as late as 1833, were known.

Mr. John Spiller, F.C.S., said the silk printing blocks on the table revived ancient memories, for when a young student at the Royal College of Chemistry, he made the acquaintance of the late James Kayess, and from 1850 to 1860 often had the privilege of visiting the West Ham Abbey Print Works, of which his friend was then manager. At that time Messrs. Baker, Tucker and Co. were proprietors with a branch establishment at Manchester; but from this immediate locality their operations were eventually banished by the gradually increasing impurity of the River Lea, and they removed to the Upper Garrett Works at Tooting. Mr. James Kayess, J.P., died on Good Friday, 1884, and was buried at Norwood Cemetery. Another well-known personage in this district was Mr. John Tucker, member of the firm. Probably the President remembered him as a perfect giant in stature and weight, whose arm-chair was a remarkable piece of furniture and passed into the possession of our former member, Mr. W. C. Barnes, of Oak Hall. This Mr. Tucker was a successful breeder of prize cattle at West Ham Abbey. Amongst other things the speaker very well remembered the early trials of mauve and magenta for printing silk handkerchiefs in or about the year 1860, and possessed specimens given to him before the process became an extinct Essex industry.

Mr. Littler was thanked for his interesting communication.

Prof. Meldola said that having been informed of the proposed exhibit by Mr. Littler he had taken advantage of an opportunity which had recently presented itself for calling attention to a somewhat kindred subject. The importance of recording the survival or the decline and extinction of ancient industries while the chance still remained had been dwelt upon by him at the last meeting in connection with the use of wooden fish-hooks. He was particularly interested to learn, therefore, from the Duchess of Sutherland that in the highlands of Scotland, in spite of the now general use of coal-tar colouring matters, there was still a large amount of dyeing of home-made materials carried on by means of native plants. The Duchess, who had taken the greatest interest in promoting the home industries of Scotland, had been so good as to forward him a list of the plants so used and the colours furnished by them, and he thought that this list was of sufficient interest to place upon record in connection with the observations made by Mr. Littler :—

VEGETABLE COLOURING-MATTERS USED AS DYEING MATERIALS IN THE SCOTCH HIGHLANDS.

Black	Alder tree bark ..	*Alnus glutinosa*
,, ...	Dock root ..	*Rumex obtusifolius*
Blue	Bilberry (with alum)	*Vaccinium myrtillus*
,, ...	Elder (with alum) ..	*Sambucus niger*
Brown	Stone lichen ..	*Parmelia saxatilis*
,, ...	Dulse	*Halymenia edulis*
,, ...	Currant (with alum)	*Ribes*
,, (yellowish)..	Wall lichen ..	*Parmelia parietina*
Crimson (bright) ..	Corcar lichen ..	*Lecanora tartarea*
,, ,, ..	White lichen ..	*Lecanora palescens*
,, (dark) ..	Dark lichen ..	*Parmelia ceratophylla*
Flesh-colour ..	Willow bark ..	*Salix viminalis*
Grey	Iris root.. ..	*Iris pseudacorus*
Green	Broom	*Genista tinctoria*
,, ...	Furze bark ..	*Ulex europæus*
,, ...	Heather (with alum)	*Erica cinerea*
Magenta ..	Dandelion ..	*Leontodon taraxacum*
Orange (dark) ..	Bramble ..	*Rubus fructicosus*
Purple	Sundew.. ..	*Drosera*
Red (dark) ..	Rock lichen ..	*Ramalina scopulorum*
,, (bright) ..	Rue root (bedstraw)	*Galium verum*
Scarlet	Limestone lichen ..	*Urceolaria calcarea*
,, ...	Tormentil ..	*Tormentilla officinalis*
Violet	Water-cress ..	*Nasturtium officinalis*
,, ...	Bitter vetch ..	*Orobus tuberosus*
Yellow	Ash tree root ..	*Fraxinus excelsior*
,, ...	Bracken.. ..	*Pteris aquilina*
,, (bright) ..	St. John's Wort ..	*Hypericum perforatum*
,, ..	Sundew (with ammonia)	*Drosera*
,, ..	Bog myrtle ..	*Myrica gale*

[Compiled from various local sources of information for her book on *Woman's Work; Highland Home Industries*, by Millicent, Duchess of Sutherland.]

Mr. Crouch called attention to the specimen of the Bittern, recently found in the Zoological Gardens, at Regent's Park.

Mr. Cole observed that the Bittern still occasionally occurred in Essex. It was formerly found in the valley of the Roding.

The Secretary exhibited on behalf of Mr. Whitehead, the Assistant in the Museum, a specimen of *Lathyrus macrorrhizus* var. *tenuifolius*, from Epping Forest, near Goldings Hill. There was some doubt as to the specific distinctness of the form, and it was not at present known whether it was common in Essex or not.

Mr. F. W. Elliott exhibited bones found in the Forest at Monks Wood, which had been gnawed by some rodent—he suggested by rabbits.

Mr. Cole mentioned the curious fact that although there were so many deer in the forest, antlers were but seldom found. Foresters affirmed that they were eaten by some animals.

An address was then delivered by Prof. G. B. Howes, LL.D., F.R.S., Professor of Zoology at the Royal College of Science, illustrated by slides shown by the electric lantern. The following is an abstract of the address:—

RECENT WORK ON MOLLUSCAN MORPHOLOGY.

By PROF. G. B. HOWES, LL.D., F.R.S.

(*Abstract*).

Prof. Howes introduced his subject by briefly recapitulating the distinctive characters of the Acephala, with especial reference to the fact that under the burrowing habit and loss of the head respiratory organs had become the accessories to alimentation. He then called attention to the recent work of Drew, of Baltimore, U. S. A., on *Yoldia limatula*, particularly as concerning the labial palps, siphonal filaments, and piston-like action of the branchiæ, which together with the formation of the anchor-like foot, were shown to collectively furnish the acme of the physiological requirements of the acephalous molluscan type.

He then passed on to the consideration of the Trochosphere and Veliger larvæ; the former as exemplified by that of a marine worm; the latter by that of the oyster with special reference to the absence of the "head"; and by the late larva of *Vermetus*, as bearing upon the origin of the cephalic eyes.

Attention was then turned to the recent discovery, by Pelseneer, of eyes in the adult Mytilidæ, those of *Mytilus* being shown to be structurally of the *Patella* type, but post-oral, and, though innervated by the cerebral ganglia, distinct from the cephalic eyes of other molluscs. They were shown to agree in position with the post-velar eyes of the *Chiton* larva, and thereby to suggest a close connection between the Lamellibranchiata and Polyplacophora (Chitons). The limits of modification and salient features in the anatomy of the Chiton group were next indicated, leading up to the aplacophorous genus *Myzomenia* (*Dondersia*) and special emphasis was laid upon Pruvot's recent discovery that *M. banyulensis* during development is the bearer of the eight shelly plates of the true Chitons, and that the development itself is passed through within a cellular "test," from which the young mollusc escapes by a process of rupture. Referring to this "test" and its associated parts, as something at the time of its discovery wholly new, Prof. Howes proceeded to show it to be identical with that shortly afterwards discovered in the developing *Yoldia* by Drew; and he then showed the detailed differences between the two to be comparatively insignificant, and probably due to adaptation.

Commenting upon the facts, he regarded them as of supreme importance, when considered together with those of adult anatomy; and he expressed the belief that they involve the Acephala and the Polyplacophora in a direct genetic relationship—a community of origin from some bilaterally symmetrical ancestor. He argued that the facts altogether outweigh the supposed Rhipidoglossan affinity of the Acephala with the Gastropoda, which as a group are asymmetrical.

He next passed to the work of Lacaze-Duthiers, Kowaleyski, and others, on the structure and development of the Scaphopoda (*Dentalium*), a group of Molluscs of world-wide distribution, whose affinities have always been much in dispute. Concerning their development, he agreed with Drew that their 4—5 rowed ciliary girdle, which, at first equatorial, by forward translocation and reduction of parts becomes a complex velum, is probably the homologue of the test of *Dondersia* and *Yoldia*; and he said that if this be so, *Dentalium* might hark back with these to a common ancestrial series.

Prof. Howes next sought to show it to be a conclusion from these data that the velum is either a concentrated and translocated test, or the test an overgrown velum; and he also sought to prove that the existence of the test explains such hitherto anomalous features as the duplication of the trochal-ridge in the trochosphere of *Patella* and the presence of a pre- and post-oral ciliated annulus in the larva of the Ship-worm (*Teredo*), if not the polytrochal stage generally and its variants.

In conclusion Prof. Howes dealt with the habits of *Dentalium*, and indicated the structural features which that animal presents in common with the Acephalous and Cephalous Mollusca respectively, and considered more especially its shell, which when fully formed is a tapering tube. He showed that, like this, the "shell" of the Acephalous Mollusca (dealing with the "Gaper" and certain boring species) really forms, with its associated parts, a complete tubular investment, and that its specially characteristic feature—the calcification of its opposite halves—is said by the late eminent conchologist, Paul Fischer, to be passed through during development by *Dentalium* itself. He emphasised the need of confirmation of this remarkable statement, and deduced the final conclusion that the points of morphological community between the three Molluscan groups which had been considered, simplified our conception of their inter-relationships to a degree as unexpected as it was satisfactory. By these discoveries a really great advance had been made. It strengthened our confidence in the larval form as a guide to affinity, and had come as a welcome sequel to recent work in America upon the Trilobites, which had similarly justified our trust in the Nauplius.

Prof. Howes wound up by an earnest appeal to the members of the Essex Field Club, to seek, with all possible speed, a further knowledge of the developmental history of their indigenous marine Acephala.

Remarks were made by the President, by Prof. Meldola, and Mr. Walter Crouch, and Prof. Howes was most cordially thanked for his interesting and suggestive lecture.

Prof Howes briefly acknowledged the vote of thanks, and the meeting ended.

THE TWENTY-FIRST ANNUAL GENERAL MEETING AND THE 202ND ORDINARY MEETING.

Saturday, March 30th, 1901.

The 21st Annual Meeting was held at 5 o'clock p.m. in the Physical Lecture Theatre of the Technical Institute, West Ham, Mr. David Howard, President, in the chair.

The minutes of the 20th Annual Meeting, held on November 24th, 1900, and printed in the Essex Naturalist, vol. xi., pp. 296-298, were read and confirmed.

Mr. Crouch, in the absence of Mr. Waller, read the summary of the Treasurer's Statement of Account which had been duly signed by the Auditors, Messrs. Walter Crouch and J. D. Cooper. This statement was received and adopted by the meeting.[1]

The President said that they could not part with their Treasurer without expressing their great regret at his resignation of office and acknowledging the debt of gratitude they owed Mr. Waller for his care and skill in the management of the finances of the Club for the long period of five years. Mr. Waller had entered upon his duties at a period of considerable difficulty, and it must be a source of pleasure to him as it was of satisfaction to the Council and members, that many of the difficulties of the Society, financial and otherwise, had passed away. The Treasurer deserved the heartiest thanks of the Club for his work. [Applause.]

The Secretary read the Annual Report of the Council for the year 1900. This was received and adopted.

At the Meeting on February 23rd last, the following members retired from the Council under the Rules:—Messrs. H. T. Brown, B. Corcoran, Miller Christy, and Rev. W. C. Howell; the two last submitting themselves for re-election.

The following were duly proposed:—Mr. Miller Christy, F.L.S., Mr. John A. Finzi, F.E.S., and Rev. W. C. Howell, M.A.; one seat remaining vacant.

As Officers the following were nominated:—

President—Professor R. Meldola, F.R.S., F.C.S., F.E.S.; *Treasurer*—Mr. David Howard, J.P., F.C.S.; *Hon. Secretaries*—Mr. W. Cole, F.L.S., F.E.S., and Mr. B. G. Cole; *Librarians*—vacant; *Auditors*—Mr. Walter Crouch, F.Z.S. and Mr. J. D. Cooper.

1 By an unfortunate oversight this Statement for 1900 was inserted in the last part of the E.N. (vol xi, pp. 306-7), in place of Statement for 1899, which is inserted in the present part (pp. 34-35).

On retiring from the Presidency (after six years of office), Mr. Howard under Rule IV. becomes one of the Permanent Vice-Presidents of the Club.

No other Members having been proposed for any office, the above gentlemen stood elected as Members of the Council and Officers for the year 1901, and were so declared by the Chairman.

Prof. R. Meldola having taken the chair as President, Mr. Howard in concluding his long term as President congratulated the Club on the position it had attained as the result of its 21 years work and thanked the members heartily for the confidence they had reposed in him during his six years of office. Mr. Howard then continued his remarks in the form of an address which is printed in the present part of the ESSEX NATURALIST.

Prof. Meldola first returned thanks on his own behalf for the honour conferred upon him by his re-election as President after an interval of seventeen years. And he begged to move a very cordial vote of thanks to Mr. Howard for his long services as President. All connected with the Club knew the care and attention Mr. Howard had given to its affairs during years of considerable difficulty. It was very satisfactory to know that they would still have Mr. Howard's services as one of the Permanent Vice-Presidents, and also in the onerous post of Treasurer, the duties of which had been carried on with such good results by Mr. Waller. He was sure they had all listened with pleasure to Mr. Howard's remarks that evening, and hoped to read them in the pages of the ESSEX NATURALIST.

Mr. Walter Crouch cordially seconded the vote of thanks, which was carried unanimously amid applause.

Mr. Howard briefly returned thanks. He said that he handed the affairs of the Club to their new President with every confidence, and he viewed the future of the Club as one full of hope.

Mr. Hugh McLachlan proposed a very hearty vote of thanks to the officers, including the Hon. Counsel and Solicitor and the Auditors, for their services during the past year. And he particularly wished to record the sense of gratitude of the members to Mr. Waller for his long and successful work as their Honorary Treasurer. The work of the Auditors had also been most valuable, and deserved their warmest thanks.

Mr. G. E. Vaughan seconded the vote of thanks to the officers, which was carried unanimously.

Mr. H. J. Coburn, as Hon. Solicitor, thanked the meeting on behalf of the officers, collectively.

This concluded the ordinary business of the Annual Meeting. Mr. Vaughan brought forward the subject of erecting memorial tablets to eminent Essex Naturalists, &c., in churches in the county. After a long discussion Mr. Vaughan withdrew his proposal for the present.

THE TWO HUNDRED AND SECOND ORDINARY MEETING.

After an hour's interval for tea, the 202ND ORDINARY MEETING was held, Prof. R Meldola, F.R.S., President, in the chair.

The President briefly returned thanks for his re-election to the chair.

Mr. Thos. R. Brooke and Mr. Thos. Hacking, A.Sc., were elected members of the Club.

Mr. Miller Christy, F.L.S., exhibited a specimen of one of the Falconidæ, a form of the Gerfalcon, shot in Hatfield Forest ten years ago by one of the Forest keepers, and which was now the property of his widow. This specimen had been seen by the members of the Club when visiting Hatfield Forest on July 21st, 1897 (ESSEX NATURALIST, vol. x., p. 178).

Mr Christy also exhibited a series of rubbings of the "mines" of the larvæ of the Ash-bark Beetle (*Hylesinus*) which were shown as lantern slides. Mr. Christy also read some notes on the nature and characteristics of these borings, which will be published, with figures, in a future part of the journal.

Remarks on the exhibit were made by the President, Mr. Enock, Mr. Elliott, Mr. Hugh McLachlan and the author in reply.

Prof. Meldola exhibited by means of the reflecting electric lantern, one of Lippmann's colour photographs, and gave an explanation and demonstration of the scientific principles involved. In the experiments he was assisted by Mr. Briscoe, the Principal of the Institute, whom he thanked warmly for assistance and loan of instruments.

Mr. E. Sanger-Shepherd then gave a most interesting lantern demonstration of his process for producing colour photographic transparencies, and fully explained and illustrated the scientific basis of the problem. The pictures of flowers, shells, butterflies, birds, and landscapes, &c , were much admired, and Mr. Shepherd's lecture was received with hearty applause.

A discussion ensued, in which the President, Mr. Briscoe and Mr. Shepherd took part, and a cordial vote of thanks was accorded to Mr. Shepherd.

Mr. Briscoe was also thanked for his kind aid in allowing the use of apparatus for the use in the demonstrations.

Mr Cole exhibited some proofs of prints made by the three-colour photographic process, which had been kindly sent to him by Messrs. Andre and Sleigh, of Bushey, Herts.

A paper on Neolithic Implements from the North Downs, by Mr Johnson, was, from want of time, taken as read.

QUEEN ELIZABETH'S LODGE AND THE EPPING FOREST MUSEUM.

The summary of the Reports of the Architect and the resolutions of the Epping Forest Committee of the Corporation of London anent this matter published under the above title in the ESSEX NATURALIST, vol. xi., pp. 31-34, recorded the details of the repairs of the Lodge up to April, 1899. Since that date the restoration has been accomplished, and the Epping Forest Committee have issued some statements respecting it, which may appropriately be reprinted, in order to make the story of this excellent piece of work complete.

In the Report presented to the Common Council on the 25th January, 1900, the following statement occurs:—

"On the 17th April last (1899) we reported to your Honorable Court as to the proposed additions and alterations of Queen Elizabeth's Lodge with the object of strengthening the structural condition and improving the external appearance of this historical and interesting building, and enlarging the Museum established there by the Essex Field Club (which has received much public favour) in accordance with the reports furnished to us by Mr. J. Oldrid Scott, the eminent architect, and we recommended that your Honorable Court should make a special grant of £500 towards the cost, which recommendation was agreed to by your Honorable Court.

"Mr. Scott's approximate estimate for the work, made in May, 1897, was £750; but after your Honorable Court had agreed to the Report, we communicated further with that gentleman, and he submitted drawings and specifications of works, and stated that, in consequence of the increase in the cost of labour and materials, his estimate must be increased from £850 to £950. We accordingly invited Tenders for the work, and accepted the lowest, being that of Mr. Arthur Porter, at the sum of £797, and a contract was entered into with him for the work.

"When the external plastering was removed, it was found that in several places the timbers had seriously decayed and weakened the building, and Mr. Scott reported that it was desirable, if not essential, that some renewal of the timbers should be undertaken; which work was not included in the contract. We, therefore, authorised Mr. Scott to do what was necessary with regard to replacing the timbers, and to provide additional sanitary accommodation.

"The works included in the contract are nearly completed, but it will be necessary to provide better means of warming the Lodge for the protection of the building itself and of the exhibits in the Museum, possibly by means of hot-water pipes. The annual expense of heating will, we have every reason to believe, be increased but slightly, if at all."

In addition to the suggestion that the building should be warmed by hot-water, the Council of the Essex Field Club asked the Committee to favourably consider a request that a small room should be set apart, in which curatorial work could be carried on. It was found that the scullery at the base of the great staircase could be so adapted at a cost of about £50, and the Club offered to contribute this amount out of the Museum Fund. The whole of the work of restoration was accomplished by the summer of 1900, and in the report of the Epping Forest

Committee, dated 31st January, 1901, the conclusion of the matter is thus alluded to:—

"The Essex Field Club, who, with the consent of the Corporation, are the custodians of the exhibits in the Museum, asked us to provide a room for the Curator, and agreed to contribute £50 towards the cost. To this we assented. We have now to report the completion of the alterations and additions to the Lodge at a total cost of £1,008 16s. 8d., less the £50 provided by the Essex Field Club. The restorations have given great satisfaction, and the Museum is now in course of re-arrangement, not only in the Banqueting Room, where it has existed for some years, but also in the renovated Oak Room on the first floor, to which it corresponds in dimensions.

"We have also the pleasure to report that the old Tapestry is being cleaned and renovated with very beneficial result."

The modifications in the plan of the Museum necessitated by the desire of the Committee that no tall cases should be placed in the centres of the rooms, are explained in the report of the meeting held on December 8th last (Essex Naturalist, xi., pp. 300-303). The building is now open to the public so that the renovated rooms may be inspected, but a notice has been issued by the Curator pointing out that the museum is in course of re-arrangement. The old cases are being altered and new ones fitted by Mr. Chiswell, of Chingford. The work will be pushed on during the autumn and winter, and it is hoped that the formal re-opening of the museum may take place in the spring of 1902.

The most grateful thanks of all well-wishers of the Forest will be given to the Corporation of London for this careful restoration of one of the most precious buildings in the district, and members of the Club as well as naturalists generally will be pleased in the possession of two such excellent rooms for the museum as those now devoted to the purpose.

PALÆOLITHIC IMPLEMENTS FROM THE LOW-LEVEL DRIFT OF THE THAMES VALLEY.

CHIEFLY FROM ILFORD AND GRAYS, ESSEX.

By J. P. JOHNSON.

At a meeting of the Essex Field Club held on January 26th, 1901, I described some flint implements which had been obtained from the recent excavations on the site of the famous Uphall Brickyard, Ilford, Essex. Owing to the comparative rarity of contemporaneous implements in the low-level drift of the Thames Valley, especially in the Essex portion, I have thought it desirable, while describing them here, to give in addition an account of some specimens which I obtained from the brickearth at Grays, together with others from Crayford. Moreover, they belong to the generally little known group of flake-tools, and have a further interest in that they well exhibit the dexterity and neatness in the art of flaking which Palæolithic man had attained at this late epoch of his reign in Britain.

The first discovery of implements in the low-level drift of the Thames Valley was made at Crayford,[1] where, beneath the chalk cliff against which the fossiliferous brickearth abuts, Mr. F. C. J. Spurrell came across a dense layer of flakes :—

"The uppermost edge of the area covered by them is about 36 feet from the present surface, the lowest nearly six feet lower. This area was thickly covered with chips for the space of about 10 feet north and south, and, as far as I know at present, 15 feet east and west . but I expect that it will be found to extend further . . . The fragments of flint lay touching each other, in parts to a thickness of several inches. . . The flakes are in most cases quite new and clean, always so on the lower side, very slightly discoloured on the upper. . . I have been able to piece together many of these flakes, and to demonstrate that the object sought was the manufacture of hâches, which has been confirmed by my digging out the broad end of a flint hâche in the presence of Prof. Boyd Dawkins, whom I had asked to visit the place; and later I recovered the rest of the implement. . . Some of the smaller chips leave no doubt that besides these coarser operations of blocking out, very fine work indeed was attempted. . . A few small pieces of bone were found immediately beneath the layer; but above could be seen fine specimens, and smaller ones in abundance. . . Numerous splinters of the large bones lay around and suggested their having been broken for food."

This locality has also yielded a large number of designedly shaped flakes, a characteristic example of which is shewn in Fig. 1. There can be no doubt that this was meant to be used as a knife, the thick end probably being bound round with vegetable fibre or animal sinew, after the style of the Australian knife figured by Sir John Evans,[2] and as such one cannot but admire its effectiveness. It well illustrates the clever way in which the later Palæolithic people manipulated the flint. Even more eloquent of their ability is the testimony of the spear-heads, one of which is represented by Fig. 2, for their shape is an indisputable indication of forethought and skill in execution.

1 F. C. J. SPURRELL, "On the Discovery of the Place where Palæolithic Implements were made at Crayford." *Q. Journ. Geol. Soc.*, *vol. xxxvi.* (1880).

2 *The Ancient Stone Implements . . . of Great Britain.* 2nd edition, London. (1897).

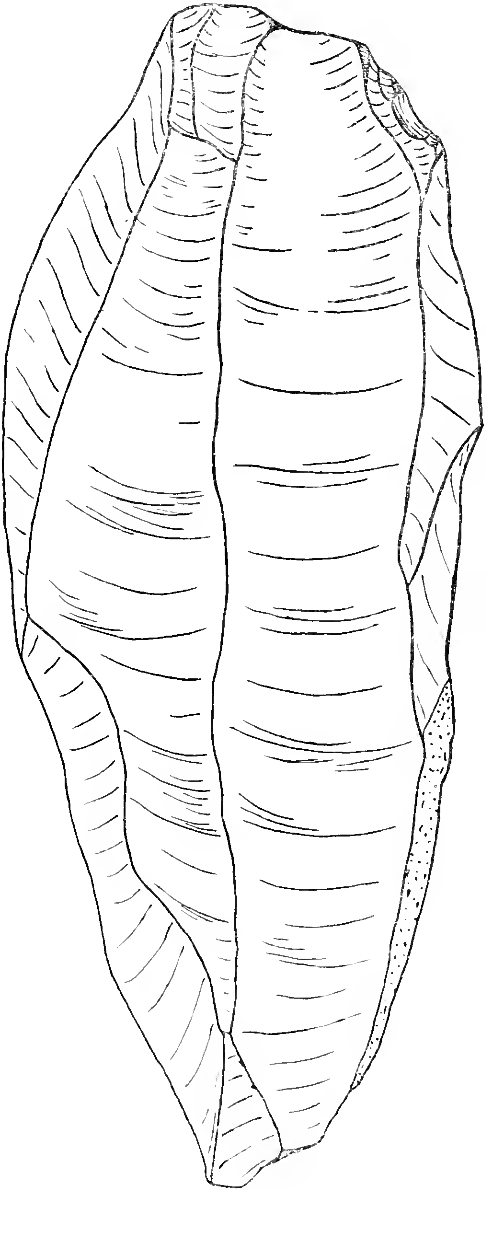


FIG. 1. Flint Knife from the Crayford Brick-earth. Nat. size.

Despite the thorough investigation of the fossil vertebrate fauna of the Uphall Brickyard undertaken by Sir Antonio Brady and others, it had not yielded any traces of man up to the time of its abandonment ; and it was not until the early part of last year, when I discovered some flint flakes[3] in the pits which had then lately been opened on the classical site, that *Homo sapiens* was known to be a member of that fauna.

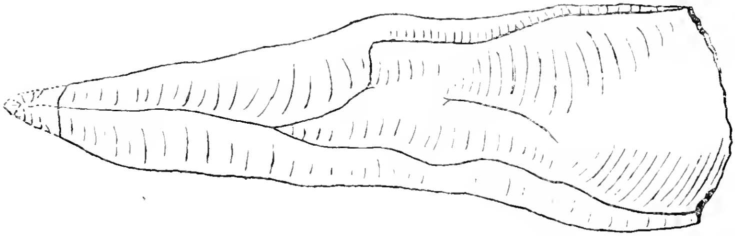


FIG. 2. Flint Spear-head from the Crayford Brick-earth. Nat. size.

One of these flakes is shewn in Fig. 3, and is another excellent sample of the neat work of the men who inhabited the Thames Valley during the low-level epoch. The best specimen however (Fig. 4), is a flake of slate-black flint which has been carefully serrated along the edge ; the secondary trimming is very

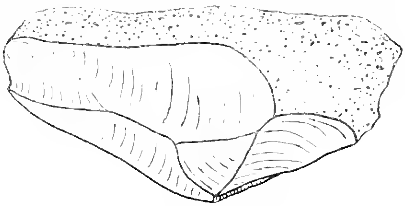


FIG. 3. Flint Flake from the Gravel at Ilford, Essex. Actual size.

fine and far superior to any I have seen from the high-level drift. I found these flakes all *in situ* in the upper part of the gravel, with which they were clearly contemporaneous, being little, if at all, worn, and quite free from ochreous stains. This same bed yielded bones of rhinoceros, together with land and freshwater shells, some of which are no longer living in this country.

While exploring the Grays district, together with my friends Messrs. Hinton and Kennard, I obtained several flint tools from

3 J. P. JOHNSON, "Additions to the Palæolithic Fauna of the Uphall Brickyard, Ilford." ESSEX NATURALIST, vol xi. (1900), pp. 209-212. I can now also add *Vitrea radiatula* (Ald.), some shells of this Gastropod being in the collection of my friend Mr. G. White.

the shell-beds of the Orsett Road section.[4] They include, besides a neat little scraper, the well-formed flake represented by Fig. 5, the edges of which have been remarkably notched through use.

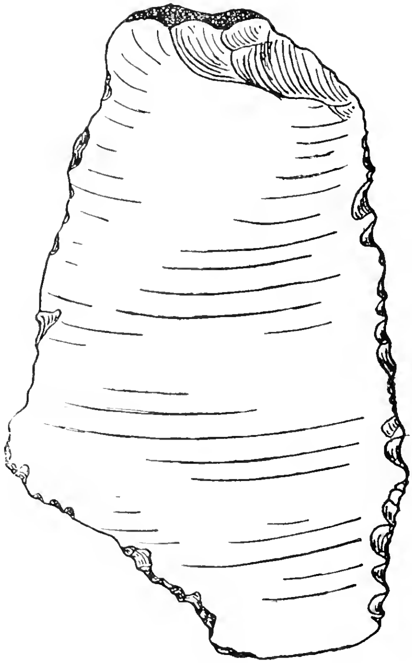


Fig. 4. Flint Saw. From the Gravel at Ilford, Essex. Actual size.

The deposits of gravel, sand and loam, which constitute the low-level drift of the Thames Valley, have yielded the remains of one of the most remarkable fauna ever gathered together in so

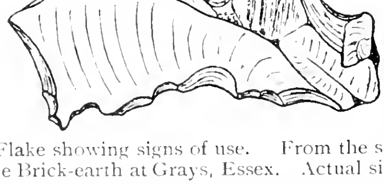
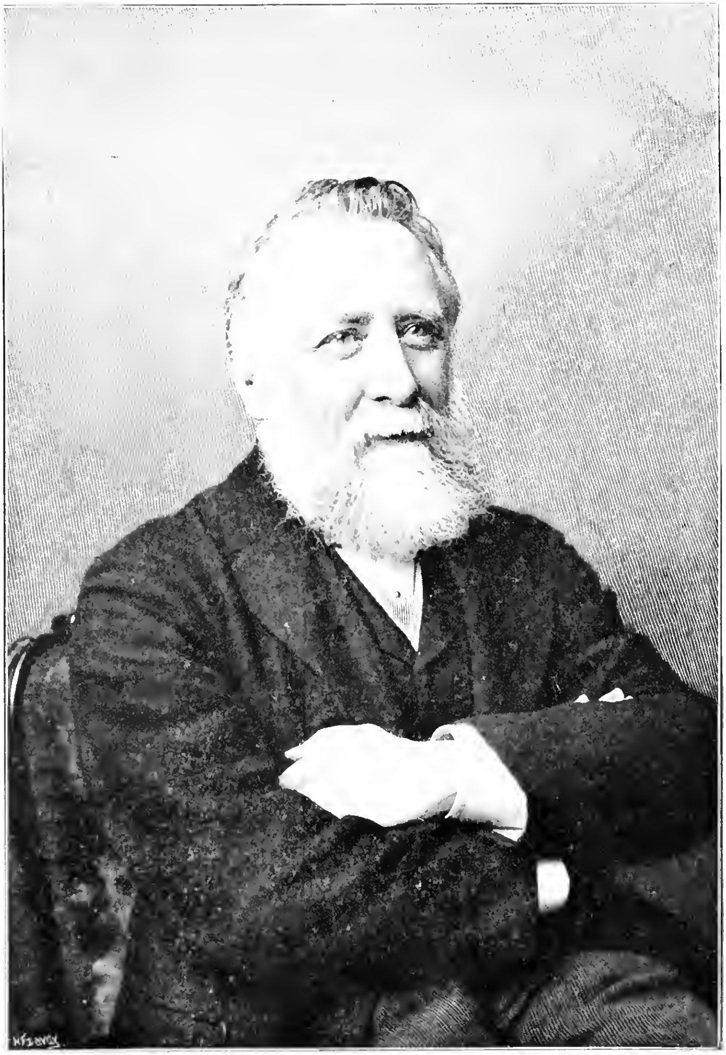


Fig. 5. Flake showing signs of use. From the shell-beds in the Brick-earth at Grays, Essex. Actual size.

4 See Hinton and Kennard, "Contributions to the Pleistocene Geology of the Thames Valley." Part I. Essex Naturalist, vol. xi. (1901), pp. 336-370.



G. J. Symons, *President R.Met.S., Hon. Member, Essex Field Club.*
Born August 6, 1838. *Died March* 10*th*, 1900.

small an area. Bones of animals which are now only met with in different and widely separated parts of the world are mingled with those of extinct species of elephant and rhinoceros and with the primitive flint implements of the men who were their contemporaries.

What the makers of these implements were like, however, is quite unknown, as no human remains have ever been discovered, but in point of culture they could not have differed much from the more primitive of existing savages.

[I have drawn all the above figures to actual size, and have given the Essex specimens represented to the Essex Field Club's Museum at Stratford.]

OBITUARY NOTICES.

THE LATE GEORGE JAMES SYMONS, F.R.S.

[*With Portrait, Plate II.*]

It was with sincere regret that all students of science heard of the death on March 10th, 1900, of one of the greatest meteorologists that England has ever produced. By the death of Mr. Symons the Essex Field Club lost a highly esteemed Honorary Member, one always willing to give advice and assistance in the work of the Club, while his genial personality and stores of information were thoroughly appreciated on those occasions when his numerous employments permitted him to attend our meetings.

His co-adjutor and fellow-worker for nearly 30 years, Mr. H. Sowerby Wallis, has most kindly furnished us with the published memoirs of Mr. Symons from which to select materials for this notice. We have chosen that in *The Times* for March 13th, 1900, as the basis of the following, supplemented by information given in the *Quarterly Jour: Roy. Meteorological Society* (April, 1900) and in *Symons's Monthly Meteorological Magazine*, which was founded by its editor and proprietor in 1866. We have to thank the Council of the Royal Meteorological Society and the Secretary, Mr. W. Marriott, for the *cliche* of the excellent portrait accompanying this notice.

George James Symons was born in London on August 6th, 1838, the only child of Joseph and Georgina Symons, of Pimlico. He was educated at St. Peter's Collegiate School, Eaton Square, and by a private tutor in Leicestershire. From his boyhood he exhibited a love of natural science, and it is said that he offered his services as an assistant at the age of 16 to Mr James Glaisher, who, however, attempted to dissuade him from pursuing scientific investigation on the ground that it did not pay. Symons, nevertheless, persisted in his aim. At the age of 18 he joined the Meteorological Society, which Mr Glaisher had founded, and in the course of another 12 months found employment as one of the Registrar General's meteorological reporters, an office which he continued to hold to the time of his death. For a few years he was an assistant in the Meteorological Department of the Board of Trade under the late Admiral FitzRoy, who was then organizing his system of storm-warnings.

In addition to his official duties, and possibly in collision with them, Mr. Symons was already collecting records of the fall of rain, a pursuit the value of which Admiral FitzRoy failed to appreciate very highly, and being compelled to make choice between the one branch of work and the other, Mr. Symons adhered to his own course. He foresaw the importance of a study of the rainfall in view of the increasing demand upon the water resources of the kingdom, necessitated by the growth of population, improved and more systematic sanitation, and the additional demands of growing industries. In 1860 he published his first annual volume of the *British Rainfall*, which contained records from 168 stations—namely, 163 in England and five in Wales, there being none for Scotland or Ireland. With persistent energy he continued for 40 years to develop this unique organization of voluntary observers, His last published *British Rainfall* for 1898, contained records from 2,545 stations in England, 237 in Wales, 436 in Scotland and 186 in Ireland—a total of 3,404 stations. It is claimed for him that at the time of his death he was the head of one of the largest purely volunteer organizations in existence, having over 3,000 observers iu all parts of the kingdom. His annual digest of their records is a standard work in which not only meteorologists but civil engineers, sanitary experts, and others, place unquestioning confidence.

A determining factor which encouraged Mr. Symons to persevere with studies which were then imperfectly understood and little appreciated was the recurrence of the terrible outbreaks of cholera which afflicted England and Europe throughout the middle part of the century. He was among the first to perceive in this connection the necessity of determining the amount and distribution of the water supply. His first step was to ascertain what records of rainfall were already in existence. These he found to be very much scattered. While some parts of the country were more or less covered, other very large districts were entirely without them, and such records as there were related to varying periods of time, and could not be correlated. This was the cause of his setting to work to organize a band of observers who would undertake to observe the amount of the rainfall each day, using tested gauges satisfactorily exposed and capable of giving accurate results. The need of precautions to ensure these conditions was apparent to all as soon as they were put into practice, for the *data* already in existence were proved to be frequently valueless. One gauge was discovered which had been ornamented with a small roof to protect it from the rain, which it was its purpose to measure. Others were placed where water could drip into them from over-hanging trees, and so forth. Mr. Symons visited personally and tested every gauge. The proper distribution of the gauges over the kingdom was also a part of his task. Private individuals were induced to take up the work, procure gauges at their own cost, and make the observations methodically from no motive but the public good. The result of these labours has been the accumulatiom of a mass of *data* such as exists in no other country, and which is now available for use in connexion with a variety of questions relating to the sanitary and hygienic needs of the country. Mr. Symons told of one case in which a municipality was put to the expense of many thousands of pounds in rectifying a blunder in the calculation of the water available from a selected area, the mistake being due to the fact that a rod had been left projecting over the single gauge which formed the basis of the calculations, and that the rain dripping from the rod into the gauge was responsible for the district being credited with an absurdly exaggerated capacity for supplying water.

The rainfall was not, however, the only branch of meteorology in which Mr. Symons interested himself. To the kindred subjects of evaporation and percolation he also devoted his attention so far as they affected the underground stores of water. The use of lightning conductors was another matter in which he took interest, and, as a member of the Lightning-Rod Committee of the Royal Meteorological Society, he had much to do with the valuable report of the Committee which was the product of four years' labours. The existence of the "thunderbolt" was another subject of Mr. Symon's characteristically persistent attention. Whenever and wherever such a phenomenon was said to have been seen, Mr. Symons, if it was at all possible, himself visited the spot and investigated the evidence, with the invariable result that he could get no proof of an electric meteor having existed.

Throughout the 40 years of his work, Mr. Symons, whenever possible, adhered to his custom of giving in *The Times* a summary of his *data* respecting the year's rainfall. These observations became especially valuable during a cycle of dry years, such as 1890-99. He allowed few atmospheric phenomena of any interest to pass without some useful comment. A remarkable sunset, an abnormal barometric pressure, or a prolonged drought, were a few among many such subjects, He was for some years a member of the Council of the Royal Botanic Society. He also served on the Council of the Sanitary Institute.

Mr. Symons was a great authority on bibliography. He collected the titles of all books and pamphlets bearing on meteorology of which he could gain intelligence, and at the time of his death these titles amounted to about 60,000. In 1882 he furnished about 20,000 to the Chief Signal Office, Washington, U.S., with a view to their being printed, but this was not fully carried out. It is to be hoped that this bibliography may come into the possession of the Meteorological Society.

He was elected a Fellow of the Royal Society in 1878, and was chosen as Chairman of the Committee appointed by the Society to report upon the eruption of Krakatoa. In 1899 he was appointed a member of the Committee in connexion with the scheme for the establishment of a national physical laboratory at Kew. He was President of the Royal Meteorological Society in 1880, and he filled the office of secretary for many years up to the close of 1899. In view of the approaching commemoration by the Society early in April next of its 50th year, it sought to honour him by re-electing him President. The attack of paralysis, which intervened between his election and the subsequent meeting of the Society, prevented him from retaining the position.

For the last 30 years he has been assisted in the compilation of rainfall values by Mr. H. Sowerby Wallis, who, it is understood, will carry on the work according to the wish expressed by Mr. Symons. The Council of the

Society of Arts in 1897 awarded him the Albert Medal "for services he rendered to the United Kingdom by affording to engineers engaged in the water supply and the sewage of towns a trustworthy basis for their work by establishing and carrying on during nearly 40 years systematic observations (now at over 3,000 stations) of the rainfall of the British Isles, and by recording, tabulating, and graphically indicating the results of these observations in the annual volumes published by himself." In 1891 he was made a Chevalier of the Legion of Honour.

His energy in the pursuit of physical truths and his capacity for organizing and retaining the services of his helpers, as well as of stimulating the interest of beginners in his favourite studies, were combined with great kindliness of disposition and unaffected reticence. By none will he be more regretted than by the rank and file of his small army of 3,000 observers.

Mr. Symons married in 1866 Miss Elizabeth Luke, who helped him very considerably in his clerical work. The only child of the marriage died in infancy, and Mrs. Symons died in 1884.

His death took place on Saturday afternoon, March 10th, 1900, at his house in Camden Square, after an illness of little over three weeks. Although suffering somewhat from overwork he appeared to be in a fair state of health until February 14th, when he was seized with paralysis, from which he never rallied. He was buried in Kensal Green Cemetery on March 16th, after a Memorial Service had taken place at Holy Trinity Church, Marylebone, at which a large number of friends, and many eminent representatives of science were present, including Lord Lister, the President of the Royal Society.

A Committee was formed in June, 1900, to establish a memorial to Mr. Symons, in the form of a Gold Medal to be awarded from time to time by the Council of the Royal Meteorological Society for distinguished work in connection with meteorological science. We understand that this object has been attained and a sum of about £750 collected.

THE LATE MR TOM HAY WILSON.

Readers of the ESSEX NATURALIST will regret to hear of the death of Mr. T. Hay Wilson, in his 60th year, on May 10th, 1900, at Bushey Herts.

A native of Newcastle-on-Tyne, and long a resident there, he settled in the London district more than twenty years ago. He was for many years connected with, and latterly a member of, the firm of Crossley Bros., the manufacturers of the Otto gas engine. He became a member of the Geologists' Association in 1881, and contributed to *Proc. Geol. Assoc.*, vol, xi., p. 194 (1889), a short paper entitled "Notes on the artificial unmaking of Flints." In this paper he gives his experience of "the behaviour of Flint Shingle when exposed to the action of hot gases, and the following destructive agents: percussion, attrition, heat, with pressure, moisture, and acid." The gases are those discharged from the cylinder of a gas engine. They are driven through a chamber filled with shingle; the gases entering at the bottom of the chamber and escaping quietly through a ventilating pipe at the top. This greatly reduces the noise which would otherwise be made by the engine when at work. Flint he found to be the only shingle which could withstand the influences to which it was exposed for any length of time, limestone being destroyed with remarkable rapidity. In one case at Oxford, where the shingle largely consisted of limestone, he states that, after the chamber had been in use only three days, "I found over two tons had almost disappeared, as a fine powder, and had been deposited over the adjacent roofs. The chamber was refilled with good flint shingle, and has not been touched for about three years." He adds that flint ultimately becomes reduced to mud, not sand. The geological bearing and interest of experiences of this kind scarcely need pointing out.

The late Mr. T. H. Wilson.

Mr. Wilson began to reside at Chingford shortly before he joined the Essex Field Club in 1886, and continued to live there till between two and three years ago. He always took a keen interest in the work of the Club, and, when he died, had been for some years a member of its Council. Though his business engagements occupied most of his time, he was a diligent student of the geology and archæology of Essex, more especially of that portion of the county within or on the borders of Epping Forest, to which he was strongly attached. He contributed many useful geological and other notes on this district to the pages to the Essex Naturalist, and the present writer has been greatly indebted to him from time to time for information as to the opening of new geological sections there or the re-development of old ones. He was also one of the most active members of the Epping Forest Museum Committee, and contributed to the Chingford Museum a small collection of rock specimens from the gravels of the Forest and of fossils from the Boulder Clay towards its northern border. He will be much missed by all who knew him, not merely on account of his scientific ability and energy, but as one of the most kindly, considerate, modest and sincere of men.

T.V.H.

THE LIBRARY TABLE.

Report on the Water Supply of the County of Essex. By Dr. J. C. THRESH, County Medical Officer of Health, &c. Pp. xv, 168; 12 plates. 8vo., Chelmsford, n.d. [1901.]

It is many years since Dr. Thresh, who had already made his mark in scientific literature, brought his trained abilities to Essex, and several most valuable reports and other works have since appeared from his indefatigable pen. That before us is a compendium of information, indispensable to all who would study the question of the supply of that prime necessity of life, potable water, to the inhabitants of our county.

The work opens with a brief geological summary of the several water-yielding formations and associated impervious strata occurring in Essex, followed by a classification of their products as (1) Surface-waters, (2) River-waters, (3) Subsoil-waters, and (4) Deep-well-waters. The first are promptly condemned as all more or less contaminated with manurial or other organic substances, and occasionally with mineral ingredients such as sulphate of magnesia, derived from the surface-soil. River-waters have this objectionable feature modified by partial oxidation of the organic matter, but require further purification by filtering, at least for domestic purposes. Subsoil-waters, extensively used for isolated houses, hamlets and villages, are notoriously liable to similar or worse contamination. Unfortunately, such are utilized for the partial or entire supply of Witham, Clacton, and even Chelmsford. It may be remarked in passing that the hydrogen sulphide present in the water of newly-made wells in the Boulder Clay originates in the alteration of the iron-pyrites abundant in that clay. It is of but temporary formation, and harmless, though offensive whilst its production continue. Belief in the medical efficiency of such waters is not yet wholly extinct.

Deep-well waters, as the only satisfactory source of large supply, necessarily occupy the bulk of the report. The inter-communication of the waters of the Tertiary sands and of the underlying Chalk has been fully established, and probably the progressive deterioration by sea-water of the supply from the Chalk-wells of the Essex and Suffolk coasts is due, not to actual outcrop of the Chalk in the sea-bed (though it crosses the estuary at Grays), but to connection of the Lower Tertiary sands with those of the North Sea, where the London Clay has been removed. The many wells now drawing upon the Chalk, to an extent exceeding the supply from Kent and Cambridgeshire, induce a flow of sea-water to make up the deficiency.

Nevertheless, until the development of the Essex coalfields makes it worth while to convey water from other counties more richly endowed therewith, the Chalk constitutes the only available source for large supplies, and the depth at which this formation lies from district to district is therefore a matter of primary importance. We do not, in saying this, ignore the speculative element involved. That a boring may pass very near to a water-charged fissure in the Chalk, and yet obtain no yield from it, is demonstrated by the few cases in which enlightened engineers have used explosives (preferably roburite) to shatter the rock around the lower part of a boring, with the result of effecting communication with such fissures, and securing their yield. This very usual practice for petroleum-wells, is, however, but little in vogue in England, though the Chalk is a rock pre-eminently suitable for such procedure. The proportion of fruitless borings in the Chalk is, moreover, very small, in comparison with the successful operations, even if we include in the failures those in which the water has in course of time become too salt for use, as mentioned above.

On pp. 20, 21 is given a table of the level of the Chalk-surface, referred to Ordnance Datum, at over 100 localities. Unfortunately this contains many clerical errors, perceptible only by reference to the records published in various works, since there are given here merely the differences between depth to chalk and elevation of site above datum. Though the author solicits correction it is impossible to deal here with more than two or three salient instances. Any traveller by the Tilbury line can see that the Chalk-surface at Purfleet is not 30 to 40 feet below sea-level, but some 50 feet above it. At Mistley, on the other hand, it is 75 feet below datum, but is given as 25 feet above it. At Bishops Stortford it is given as 328, the surface-level at the Waterworks, instead of 213, 115 feet down the well. These and many similar instances largely detract from the value of the table, a corrected re-issue of which is emphatically desirable, as is the recording in the ESSEX NATURALIST of details of all wells not yet published. Our pages will constitute the recognised storehouse and source of information for future labourers in the same field, and there are many wells mentioned in the work before us of later date than Mr. Whitaker's last series (No. iv), published in 1896 in the E.N.

In dealing with the gradual lowering of the hydrostatic level in various parts of the county, Dr. Thresh regards the bulk of water in the chalk as stationary ("stagnant" suggests unpleasant ideas), and as having little or no free communication or definite flow. The area of each "hydrological unit," represented by a single water-charged fissure, or connected group of fissures, is a matter for speculation. It does not follow that because the Southend wells are such-and-such distances apart, therefore intervening wells would be either futile or detrimental to those existing. Everything depends on the general trend of the Chalk-fissures. If, for instance, this is north-westerly, the Southend and Oakwood wells might be on one fissure of three miles length, and the Prittlewell, Eastwood, and Noble's Green wells on another and wholly independent fissure, of about the same length and half a mile distant from the first. With a different general trend each well might be a separate fissure, and in no case can it be asserted positively that wells at intervening points would affect them.

Nor, in so fortuitous a matter as fissures in chalk, can it be laid down as established that headings driven from a shaft will of necessity exhaust a larger area than the shaft itself or even than a boring on the site. If the Chalk there is sufficiently fissured, the yield is a mere question of pumping power, and the shaft and headings are wasted labour; whilst if the rock is compact the fissures may be too far apart to be reached by headings. On the open chalk-downs, when the whole rainfall is absorbed to fill the fissures, and where the trend of the main joints is visible, the conditions render the system of shafts and headings far less speculative than would be the case in South Essex at least, where several hundred feet of Tertiary deposits overlie the Chalk. But the system would answer well enough in North Essex, and may be decreed in the Book of Fate as the ultimate general means of supplying the whole county with water, all taken above sea-level, and of incontestable purity.

For the saline ingredients of the Chalk-water, as already suggested, the Tertiary sands are probably responsible. These are of insignificant thickness on the northern outcrop, from Roydon to Sudbury, but reach 150 to 180 feet in the Southend district, and necessarily crop out in the estuary above Thames Haven. The faults traversing the southern part of the county are of insufficient magnitude to cut off the connection, with the exception of the two that, meeting near Romford, form an angular projection of what may be termed unsalted chalk, into the area susceptible of marine influence.

A comparison of Dr. Thresh's map of calcareous and saline waters (p. 34) with that of the sub-Tertiary contour of the Chalk (p. 16, taken from the ESSEX NATURALIST, vol. v, pl. iii., 1891) will shew that the boundary, except at the projection referred to, is approximately along the line at which the Chalk-surface rose above sea-level before the latest movement of depression. In other words, the limit of marine influence is on or near the line —70 of the contour of the Chalk-surface, with the exception indicated. This projection is bounded by a triangle of faults of considerable magnitude, the enclosed mass having been compressed into anticlinal arch and synclinal trough, discordant in strike with the surrounding less-disturbed areas, from which it is separated hydrologically by clay crushed into impervious walls along the faults. Dr. Thresh has thus, on purely chemical evidence, confirmed deductions from geological premises. But we must point out that the boundary is not a fault, except at that part of its course, but an old subterranean shore-line, and that faults, though not rigidly straight lines, are more angular than the gracefully-sinuous dotted line on Dr. Thresh's map, more or less diagrammatic in its character.

In the useful table of analyses (p. 37) from over forty different wells, the initials "T.S." stand for Tertiary sands, in many cases beds in, or immediately at the base of, the London Clay; in only a few instances is the supply from Thanet Sands, which the initials might equally represent.

After these generalisations, Dr. Thresh takes in succession the several Water Companies and District Councils, describing their works and the nature of private supplies utilised within their respective areas. For the clay districts generally the supply may be said to be deficient in quantity and quality, repeated mention being made, with skilful avoidance of tautology, of rainwater, ponds, ditches, shallow wells little better than cesspits, cartage for a mile or two from source, sale by the pailful, &c.

But the charges of the Companies, occupying pp. 145-167, though perhaps justified by the heavy cost of providing proper supplies, largely explain the reluctance of local authorities to close even badly-contaminated sources, and compel resort to the costly, and not always absolutely unexceptionable, alternative. In the strait between highly probable danger to life in the natural, and certain injury to the purse in the artificial, purveyance of water to the home of the peasant, there is a tendency to evade the difficulty by a policy of "masterly inactivity," not refusing to move, but—not moving.

In a subsequent number we shall hope to summarise some of the valuable particulars which crowd this very excellent and interesting Report.

W. H. DALTON.

A Handbook of British Birds; showing the Distribution of the Resident and Migratory Species in the British Islands; with an Index to the Records of the Rarer Visitants. By J. E. HARTING, F.L.S., F.Z.S., Member of the British Ornithologists' Union. New and Revised Edition; with 35 coloured Plates, carefully reproduced from original drawings by the late Professor Schlegel. London: J. C. Nimmo, 1901 31 + 520 pp. demy-octavo. (Price two guineas nett.)

Mr. Harting's *Handbook of British Birds* has been, for more than a quarter of a century, a standard work of reference with working British ornithologists. To say this is to say, in effect, that it has been long out of date; for our knowledge of the natural history of British Birds has advanced enormously within the last quarter of a century. Now, however, comes a new edition which is almost incomparably superior to the old. The scope and general arrangement of the work remain the same, but illustrations have been added, and, in respect of matter also, the new edition is so much larger than the old as to constitute almost a new work. Certainly it is by far the most important work on British Birds which has appeared for some years.

There is, unquestionably, an opening for a volume of this kind, written by an acknowledged authority and furnished with *coloured* illustrations. The splendidly-illustrated works of the late Lord Lilford, Messrs. Sharpe and Dresser, and others have been published, necessarily, at a price which places them above the reach of the average ornithologist. Of those works of real scientific value which have been within his reach, none have had coloured plates—for instance, Newton and Saunders' *Yarrell*, Seebohm's *British Birds*, and Saunders' *Manual*. Almost the only work on British Birds which is at once fairly complete, moderate in price, and provided with coloured plates is "Morris"—a pretentious treatise which never had any great scientific value and has long been hopelessly out of date. There has been, therefore, a long felt want for a really authoritative book on British Birds, in one volume, with good coloured illustrations, and at a moderate price. This want the present work meets admirably.

Mr. Harting's book must not be mistaken for an ordinary "History" of British Birds. It scarcely notices habits, nidification, changes of plumage, and such matters. The author's chief aim has been (as he explains) to show "the "precise status of every so-called British bird, distinguishing the rare and "accidental visitors from the residents and annual migrants." He errs, however, in claiming that this kind of information is "not to be found in any "other work on British Birds." He meant, doubtless, to claim that it was not to be found in anything like so clear and ample a form in any other work; and he would have been fully justified in making such a claim. In this respect, indeed, his book is practically exhaustive.

The volume consists of an "Introduction," two "Parts," and a "Summary."

In the introduction we have an explanation of the scheme of the book; a general survey of the subject, including an examination of the claims of certain casually-occurring species to a place on the British list; a catalogue of the more important County or other local Avifaunas which have appeared since 1866, when Mr. Harting's well-known *Birds of Middlesex* appeared; some sensible remarks upon the much-debated subjects of classification and nomenclature, in the course of which Mr. Harting opposes (we are glad to see) the blind application of the generally-useful "priority" law; a brief "consideration of "the terms employed to designate the various groups of birds which are "placed in Parts I. and II."; and, finally, an acknowledgment of help received, from which it appears that Prof. A. Newton, Mr. Howard Saunders, and Mr. J. A. Harvie-Brown have been good enough to read through the proofs. No author could desire more competent help.

It is interesting to note that our author groups British birds as follows:—

(1)	Residents	130
(2)	Periodical Migrants	100
(3)	Annual Visitants	32
(4)	Rare and Accidental Visitors ..	167
	Total	429

Part I. of Mr. Harting's *Handbook* treats of "British Birds properly so-called"—those, that is, included in the first three of the four "groups" mentioned above. Under each species, four dimensions or measurements are given—the total length, the length of bill, the length of wing, and the length of tarsus. Then follows information as to the status of the bird in Britain—its abundance, distribution, the time or times of its appearance, if not resident, and so forth. Frequently, information is added on other points—some of them, one cannot help thinking, somewhat unnecessary in a "Handbook" of the kind, though always interesting. To the working ornithologist, a very valuable feature of Part I. is found in the large number of references Mr. Harting gives to discussions of, or articles on, interesting ornithological points which have appeared in scientific journals. In these references, one sees Mr. Harting's almost-unrivalled knowledge of the literature of British ornithology.

Part II. deals with the "Rare and Accidental Visitants." Here, again, we have, under each species, the same four dimensions or measurements, for purposes of identification; together with a brief reference to the region each species inhabits, and a few critical remarks on its occurrences in Britain. The chief feature, however, of Part II. is its lists of occurrences, given under each species, with references to published authorities for each occurrence. These lists are, in style, the same as those which appeared in the well-known first edition; but they are, of course, amplified and brought up to date. They are as complete as might be expected, in view of the fact that Mr. Harting has now spent some thirty years in perfecting them.

The Summary consists merely of a useful classified List of British Birds, in which the residents and migrants are distinguished from the rare visitants.

The illustrations, from drawings by the late Prof. Schlegel, are among the best of their kind that have yet appeared. They show, it is true, no more than the head and foot of each species; but these portions are sufficient for identification in, practically, all cases; and it will be obvious that, had the whole of each bird been shown, the book could not have been issued in one volume or at the price.

In general respects, there is little to criticise. Mr. Harting's "Introduction" shows, however, considerable (though by no means uncommon) confusion of idea as to the respective natures of a "Preface" and an "Introduction," being, in truth, both rolled into one. In the text, too we occasionally meet (especially in Part I.) with remarks which, though admirable in themselves, seem slightly foreign to the author's general plan; whilst here and there, points might have been, we think, somewhat more concisely expressed. These matters are, however, comparatively-unimportant trifles which the critic would not think worthy of notice in any but a book of the highest standing.

The *format* and "get-up" of the volume may be commended as highly as its subject-matter. The printing is excellent; the binding is plain, but in admirable taste; and there is a good index. The new edition is indispensable to every British bird-student. Within its limits, it approaches perfection. It would be hard, indeed, to imagine any very serious blemish in a work by so competent a writer, the proofs of which had been criticised by the three gentlemen named above.

We may add, in conclusion, that the Essex Field Club is indebted to Mr. Harting (one of its Honorary Members) for a copy of his work, which he has generously presented to the Library.

NOTES—ORIGINAL AND SELECTED.

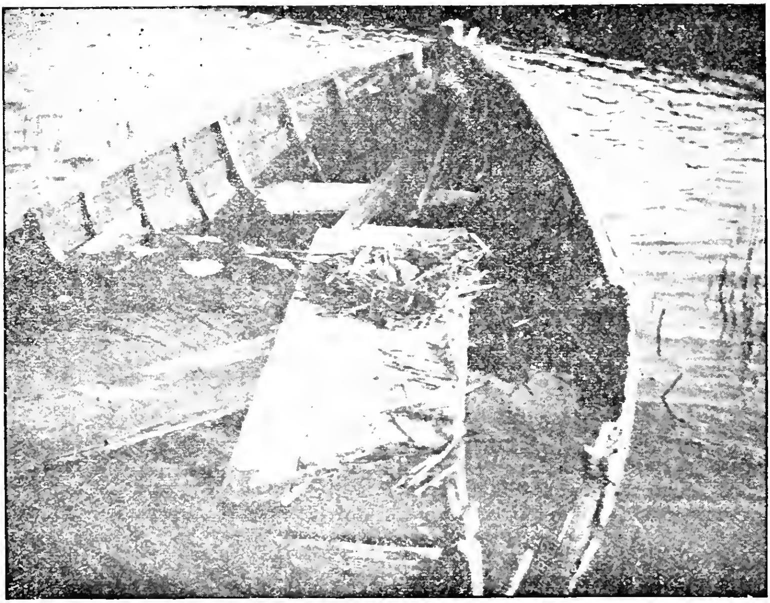
ZOOLOGY.

MAMMALIA.

The Long-eared Bat (Plecotus auritus) flying by Day.—On May 16th, 1901, going into my garden just before one o'clock, I noticed what I took at first for some kind of bird fluttering about in a sheltered spot between some trees close to the house. Going nearer, I saw at once that it was a Long-eared Bat, hawking for flies. While I watched it, it had a short chase after a small white Butterfly, which escaped; but it was engaged chiefly in hawking for the insects gathered round the flowers of a horse-chestnut tree. Once I saw it snap at a Humble Bee that was visiting the flowers. Its flight seemed feeble and it kept low down among the trees at one spot, but it did not seem particularly incommoded by the light, though it was so, probably, in reality; for it settled several times on the trunk of an adjacent fir-tree, clinging with its hind claws, head downward, with its ears fully extended. Once, whilst so settled it allowed me nearly to catch it. Once, too, I saw it fly into a large sequoia, where it clung to a twig by its wing-hooks, but flew away after half-a-minute or so. On the 18th May, about one o'clock, I saw the Bat again flying about over the lawn. It seemed to fly more feebly than before, with a fluttering moth-like flight. I went out to watch it, but soon lost sight of it. It had a most strange out-of-place look as it flew about with its ears fully extended. Both days were fairly bright, but with a cold wind blowing. The only suggestion I can make to account for this persistent flying in the day time is that the bat was prevented from flying at night, as usual, by the fact that several preceeding nights had been very cold, with frosts; but I saw both Noctules and Pippistrelles on the wing, notwithstanding the cold.—MILLER CHRISTY, Pryors, Broomfield, Chelmsford.

[I have on several occasions, in Essex and Hertfordshire, seen Bats flying by day, but could not be certain of the species; they were not the Long-eared Bat.—W. COLE.]

AVES.

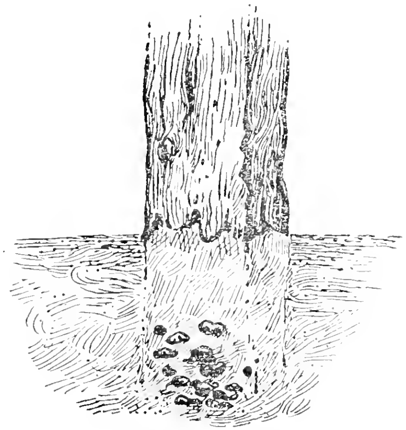


Nest of a Black-headed Gull in an old boat.

Nesting of Black-headed Gulls in Essex.—Our member, Mr. Charles E. W. Hawkins, of Old Hous, Great Horkesley, has for two years kindly sent us photographs of Blackheaded Gulls nests made in an old boat in the marshes. In sending the pictures this year, Mr. Hawkins remarks:—"The enclosed photographs are of a Black-headed Gull's nest, which I took on May 12th on one of our Essex Marshes, may be of interest. I am glad to say that there are more nests than I have known for the last twelve years." In response to further inquiries Mr. Hawkins adds:—"The nests were photographed *in situ*, and were in the same boat as those last year. I have no doubt that the same birds chose the boat each year, as the eggs were of the same variety. On the marsh where the photographs were taken I am glad to say that there is a very marked increase in the number of nests. In one place on one of the larger "fleets" I could have covered three nests at one time with an ordinary bath towel; in fact, where there were 17 nests last year, I should say that there are more than 70 now. I noticed a rather curious thing, that where eggs had been taken from a nest, a fresh pair of birds will secure it at once." On the 27th of June Mr. Hawkins wrote:—"I was on the same marsh last Sunday and found the young gulls hatched out in the boat. Then I suppose they will have to stay for the present, unless the old birds carry them, moorhen fashion."

BATRACHIA.

A "Happy Family" of Batrachians.—Having occasion to underpin and spur a gate-post in an old garden, at a foot below the ground, I came



across a happy hibernating family which may be worth recording. I have seen large families in various situations but never so mixed a colony—three frogs, two toads, three snails, and six or seven common smooth newt or eft (*Molge vulgaris*). The wood of the post had rotted below the surface line and the mixture of soil with decayed wood probably afforded suitable bedding for a long sleep. The frogs were a few inches apart from one another, as were the toads, but the efts were curled up in close proximity, pretty much as one may occasionally see snakes hibernating in an old manure heap. One of the frogs was of the brightest yellow, with brown markings, more brilliant in appearance than any specimen I have noticed. The toads and newts showed no activity when unearthed but the frogs appeared rapidly to recover from their torpid condition. The remarks made by the workmen were illustrative of the common misconception as to innocent reptiles. The digger handed out the frogs, whereupon his companion remarked, "I wouldn't do that for something." The toads were more gingerly touched, but neither man would handle the efts; they were left for the writer to remove.—I. CHALKLEY GOULD, Loughton, February, 1901.

PISCES

New Records of Fish in Essex Rivers.—Mr. Edward Hesse, the well-known Fish Taxidermist, who as an angler is acquainted with our Essex rivers, has furnished some notes (dated March, 1901) which supplement the lists given in Dr. Laver's *Mammals, Reptiles, and Fishes of Essex*.

Of the RIVER CAM Dr. Laver remarked that he had been "unable to get any list or specimens of the fish of the Essex portion of this river. This is more to be regretted, as, in some parts of its course, it holds two species apparently naturally absent from all the rest of our Essex rivers . . . these two species are the Grayling, lately introduced into the Lea, and the Spined Loach." Mr. Hesse records the following as occurring in the Cam at Great Chesterford, Essex:—"Pike, Perch, Roach, Dace (very large specimens, up to 1lb. 4oz.), Chub, Minnow, Loach, Miller's Thumb, and Eel. I have not found Grayling, but the stream is quite suitable for the fish."

Of the River BLACKWATER he remarks:—"The Bronze Bream is very plentiful in the Langford Hall Fishery, near Maldon, but is not found higher up the river. It is also plentiful in the brackish water at Beeleigh Weir, where the Chelmer joins the Blackwater."

Adding to Dr. Laver's 26 fishes of the LEA Mr. Hesse records the Bleak for that river.

Of the Grayling in the Lea resulting from the introduction of fry in 1863, and concerning which Dr Laver remarks "I have not heard of the capture of any of them, but we must hope they are still doing well," Mr. Hesse says:—"A few Grayling are to be found in the Mill Pool at Hertford; fish have been caught, but they do not seem to increase."

In the RODING (no list for which is given by Laver) he finds:—"Pike, Perch, Chubb, Roach, Dace, Bleak, Rudd, Gudgeon, Minnow, Stickleback, Ten-spined Stickleback, Miller's Thumb, Eel. The river may contain Carp and Tench, but I have never seen or caught any. The Roding would be a greater favourite with anglers if it was not poached so much by the countryman."

Of the occurrence of the Barbel in Dagenham Lake, mentioned by Laver (pp. 23 and 109) he remarks:—"This, I think, must be a mistake; probably a carp in poor condition was mistaken for barbel. I have never before heard of Barbel being in the lake." It should be noted that in the list of fish given in Mr. Hilliar's paper "An Angler's Notes on Dagenham Lake," in the ESSEX NATURALIST (vol. vi., p. 146) the Barbel is not mentioned.

ARACHNIDA.

Epping Forest Spiders.—The following additions should be made to the lists of the spiders of the Forest in the *Trans. Essex Field Club* (iv. pp. 41-49) and ESSEX NATURALIST (vol xi., pp. 315-318):—*Amaurobius fenestralis*, Stroem, abundant in winter. *Stemonyphantes lineatus*, L., a few specimens. *Araneus triguttatus*, , uncommon, Loughton. *Euryopis inornata*, Cb., a rare species; several males on a heathy ridge near Loughton.—FRANK P. SMITH.

BOTANY

Cystopus lepigoni, De Bary, in Essex.—This rare species of Micro-fungus was found on the leaves of *Spergularia marina* at Deadman's Point, Canvey Island, on June 23rd, by Mr. Whitehead, the Assistant in the Essex Museum of Natural History. The species was first recorded for Great Britain in September, 1864, by Mr. R. G. Keeley, who found it growing upon *Spergularia rubra* in Swanscombe Marshes. It was also recorded by Mr. F. J. Warren in 1872, who detected it upon *S. marina* at Fareham, Hants. Mr. George Massee, F.L.S., was kind enough to confirm the determination of the Essex specimens.

METEOROLOGY.

The Weather of 1900.—The following interesting summary of the weather in the United Kingdom during 1900 is re-printed from the *Standard* of January 4th, 1901 :—

"The character of the weather was exceptional in many respects during the past year, although there were but few features of striking interest. There was a remarkable freedom from spells of cold, and very little frost; whilst fog was comparatively rare. Rain was more than usually frequent, although the total measurement was not everywhere above the average, and a greater degree of warmth than usual has prevailed during the winter months. Wind storms were not at all frequent, and, with a very few exceptions, those experienced were not severe, although, towards the close of December, heavy gales occurred over the whole of the British Islands. July was the only summer month with especially high temperatures, and, although thunder-storms were fairly frequent, they were not generally heavy. The aggregate rainfall for the year was in excess of the average over the greater part of the Kingdom, the greatest excess being about 8in in the west of Scotland and in the south of Ireland. In the western districts of England the excess amounted to 3in., but in the Midland districts the total rainfall was in agreement with the average, while in the east and south of England there was a deficiency of about 2in. The number of days with rain ranged from 255 in the north of Scotland to about 180 in the Midland Counties and in the south of England. The temperature was nearly everywhere in excess of the average. There was rather a larger amount of bright sunshine than usual, the excess on the average being more than 100 hours in the south of England and in the Channel Islands.

"In the neighbourhood of London, as shown by the observations made at Greenwich, the total rainfall for the year was about 2in. less than the average of the previous 60 years. The total measurement was 22·3in., and during the last 18 years there have only been three years with an excess of rain. The wettest month of the year was February, with a total fall of 3·61in., which is 2·12in. above the average. The only other wet months were January, with an excess of 0·40in.; June, with an excess of 0·78in.; and December, with an excess of about 0·6in. The driest month was September, with a total rainfall of 0·76in.; and in both March and April there was less than an inch of rain. The greatest deficiency was 1·43in. in September and 1·24 in October. In the five months July to November the deficiency amounted to 4·1in. Rain fell in 182 days, and with practically the same rainfall as 1899 there were in 1900 about 40 more days with rain. In January rain fell on as many as 22 days, and in both November and December on 20 days. In July there were only six rainy days, and in September seven, but these was no other month with fewer than 13.

"The mean temperature for the year at Greenwich was 51deg., which is about 1deg. above the average of the last 60 years There were seven months with an excess of temperature, and in December the mean was 45·3deg., which is nearly 6deg. above the average. In July, which was by far the hottest month of the year, with a mean of 67·7deg., there was an excess of 4deg. Of the months with the mean temperature below the average, the greatest deficiency was 3deg. in March, and in no other month did the deficiency amount to 1·5deg. The coldest month of the year was February, with a mean of 38·5deg., while in March the mean was only 39·4deg. The absolutely highest temperature in the shade was 94deg. on July 16, and there were four days above 90deg. in July between the 16th and 25th. In June the shade temperature registered 89·4deg., while in August and September there is no reading as high as 83deg. The absolutely lowest temperature was 18deg. on Feb. 9, and the greatest number of frosts—eleven—occurred during that month. The greatest range of temperature in any month was 50·4deg. in April, the least 25·6deg. in December. The temperature was above the mean in the Metropolis on 210 days, and below the mean on 155 days. In December there were as many as 29 warm days, and in July and November 24 warm days, while in March there were 23 cold days."

British Rainfall, 1900.—Referring to the hope expressed in the notice of the late Mr. Symons on page 59 *ante*, we are glad to announce that the work of registering the rainfall in the United Kingdom will be carried on. The volume for 1900 has now (September, 1901,) been issued, edited by Dr. H. R. Mill and Mr. H. S. Wallis, for many years Mr. Symons' assistant. The work is published by Mr. Stanford. ED.

THE ESSEX FIELD CLUB.

List of Council and Officers for 1902-3.

Patron :
H.R.H. THE DUKE OF CONNAUGHT AND STRATHEARN, K.G.
(Ranger of Epping Forest).

President :
PROF. R. MELDOLA, F.R.S., F.R.A.S., F.C.S. F.R.M.S. *(ex-officio)*

Vice-Presidents :
E. NORTH BUXTON, J.P., ALD. C.C., D.L.
WALTER CROUCH, F.Z.S.
I. CHALKLEY GOULD.
J C. SHENSTONE. F.L.S.

Permanent Vice-Presidents :
(Constituted under Rule IV.)
PROFESSOR R. MELDOLA, F.R.S.,
(President, 1880—82).
PROFESSOR G. S. BOULGER, F.L.S., F.G.S.
(President, 1883—84).
THOMAS VINCENT HOLMES, F.G.S., M.A.I.
(President, 1885—87).
EDWARD A. FITCH, C.C., F.L.S., F.E.S.
(President 1888—91).
HENRY LAVER, J.P., M.R.C.S., F.L.S., F.S.A.
(President, 1892).
FREDERIC CHANCELLOR, J.P., F.R.I.B.A.
(President, 1893—94).
DAVID HOWARD, J.P., F.I.C., F.C.S.
(President, 1895—1900).

Other Members of Council :
JOHN AVERY, C.A.
CHARLES E. BENHAM.
MILLER CHRISTY, F.L.S.
PERCY CLARK, B.A.
F. W. ELLIOTT.
JOHN A. FINZI. F.E.S.
J. E. HARTING. F.L.S., F.Z.S.
REV. W. C. HOWELL, M.A.
A. JOHNSTON, CHAIRMAN C.C., J.P
REV. W. S. LACH-SZYRMA, M.A
HUGH McLACHLAN, F.R.I.B.A.
ALFRED LOCKYER,
HUGH H. MASON. F.R.C.S.. L.S.A., C.C.
PRIMROSE McCONNELL, B.Sc., F.G.S.
RIGHT HON. LORD RAYLEIGH, F.R.S.
F. W. READER.
C. B. RUSSELL, M.A., J.P., C.C.
JOHN SPILLER, F.I.C., F.C.S.
FREDK. H. VARLEY, F.R.A.S.
GEORGE E. VAUGHAN.

Hon. Treasurer :
DAVID HOWARD, D.L., F.I.C., F.C.S.

Hon. Secretary and Curator :
WILLIAM COLE, F.L.S., F.E.S., Buckhurst Hill, Essex.

Assistant Hon. Secretary :
BENJAMIN G. COLE, Buckhurst Hill, Essex.

Hon. Librarians :

Hon. Counsel :
W. C. DARE, B.A., *Barrister-at-Law.*

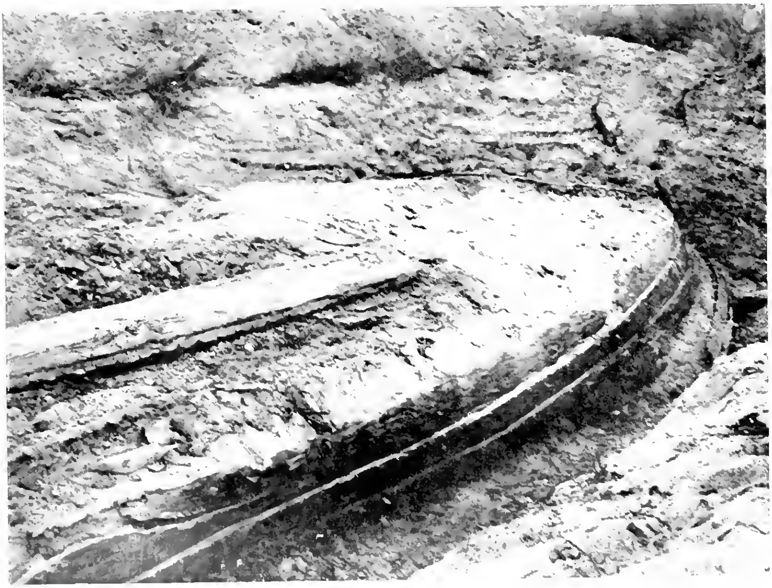
Hon. Solicitor :
HENRY I. COBURN.

Auditors :
WALTER CROUCH, F.Z.S., and JOHN D. COOPER.

Bankers :
LLOYD'S BANK, 72, Lombard Street, E.C.

Headquarters :
ESSEX MUSEUM OF NATURAL HISTORY (PASSMORE EDWARDS MUSEUM), ROMFORD ROAD, STRATFORD, E.

Museums and Library :
QUEEN ELIZABETH'S LODGE, CHINGFORD.
ESSEX NATURAL HISTORY MUSEUM, STRATFORD, E.



Ancient Boat found in Excavating the Reservoirs in the Marshes of the Lea Valley, Walthamstow, Essex

THE COMING OF AGE OF THE ESSEX FIELD CLUB. A RECORD OF LOCAL SCIENTIFIC WORK; 1880—1901.

By RAPHAEL MELDOLA, F.R.S., V.P.C.S., F.R.A.S., F.I.C., V.P.R. PHOTOG SOC., *Professor of Chemistry in the Finsbury Technical College, City and Guilds of London Institute; Member of the Faculty of Science, University of London. President of the Club, 1880-1882 & 1901-1902.*

[Being the Presidential Address delivered at the 22nd Annual General Meeting of the Club on March 22nd, 1902.]

"Our Society, in general terms, may be said to have for its scope the study of Nature in the field. . . . . .

"In forming a Society such as the present Field Club our primary object is, of course, the furthering of Science—the annual addition of something, however humble, to the general stock of human knowledge. In Epping Forest and the County of Essex we have a fine area to work in. . . . .

"Thus, in addition to the acquisition of new knowledge, field clubs are capable of doing good work in the way of education. The faculty of paramount importance to the scientist is that of *observation*, and no study is better calculated to develop this faculty than that of Natural History."

[From the Presidential Inaugural Address, Feb. 28th, 1880.]

Not often in the annals of a scientific society does it fall to the lot of the same individual to be called upon to occupy the presidential chair after an interval of twenty-one years. I acceded to the wish of your Officers and Council that I should again take office as President in celebration of our coming of age, partly on the unsubstantial ground of sentiment and partly because I may claim to have taken an active interest in the welfare of the Club and to have kept in touch with its proceedings from the time of the foundation meeting on January 10th, 1880. Twenty-one years measure a serious gap in the lifetime of an individual, and many whose names appeared in our first list of members have passed away during that interval. But it is satisfactory to be able to state that the hand of death has dealt lightly with our officials. With the exception of Mr. E. Durrant, every member of the Society who has ever held office—either as President, Vice-President, Treasurer, Secretary, or Librarian, is still with us in full vigour although in some few cases no longer on our list of members. This continuity of association between past and present officers and the existing Club, composed largely of a newer generation, is certainly a remarkable feature in our history and is the best guarantee of future stability.

The fact that our list of members is now being recruited by the younger generation that has arisen since the time of our foundation is to me one of the healthiest signs of progress. Those who have only joined our ranks in recent years, and who are not familiar with our early history, may be interested to have from one who has been for so long intimately associated with the work of the Club a summary of the results which we have given to the scientific world in justification of the position which we assumed at the outset of our career. The inaugural address which I had the honour of delivering from this chair on February 28th, 1880, and from which I have taken the liberty of quoting the few extracts above, clearly defined our position as a scientific society. I now claim the privilege as the deliverer of that first presidential address, and by virtue of the office which you have again conferred upon me, of summing up our achievements during the past twenty-one years for the information of our newer members, for the encouragement of our old and tried colleagues and for the benefit of the future prosperity of the Society.

It is not my intention on the present occasion to recapitulate the steps in the history of the development of the Club, since a concise summary was given in the Council Report for the year 1900, and published in the ESSEX NATURALIST (vol. XII., p. 37). Neither do I intend to trouble you with the usual statistical statements showing the fluctuations in the numbers of our members, since these will be found in the various annual reports of the Council. But with regard to the *personnel* of the Club I should like to take advantage of the present opportunity of going over the death roll of our members in order to emphasize our scientific strength in the past with a view to handing on to the future that same scientific ideal which we have always endeavoured to maintain. The list of Honorary Members as it now stands, and which we have at this meeting strengthened by the names of Sir Wm. Thiselton Dyer, Profs. E. Ray Lankester, Marshall Ward, G. B. Howes and J. B. Farmer, Messrs. C. H. Read, H. B. Woodward and W. H. Dalton, is sufficient guarantee of the interest in our work taken by many of the leading men of science of our time. Reverting to the past, we find that we have had on our list of members Charles Darwin, whose life-work formed the subject of my presidential address in 1883 (*Trans. E.F.C.*, vol. III., 59), Sir Antonio Brady (*Ibid.*, 94), George Stacey Gibson and John Eliot Howard whose life and work were referred to by Prof. Boulger in his presidential address for 1884 (*Trans.*, vol. IV., 1 and 8); Prof. John Morris, the geologist, referred to by Mr. T. V. Holmes in his presidential address for 1886 (*Proc.*, vol. IV., clxxxiii.); the Rev. Thomas Benson, the botanist, and Lt.-Col. Champion Russell, of whom notices appear in the Essex Naturalist for 1887 (vol. I., 138-139),[1] by Mr. E. A. Fitch and Mr. Walter Crouch; E. G. Varenne, of Kelvedon, whose life and work formed the subject of a memoir by Prof. Boulger in 1890 (Essex Naturalist, V., 42); Sir Richard Owen; Sir William Flower, whose biography written by Mr. Crouch was published in 1900 (*Ibid.* XI., 243); General Pitt-Rivers, whose biography was written by Mr. Reader (*Ibid.* 245); George James Symons, the well-known meteorologist, of whom an obituary notice appears in the last part of the Essex Naturalist (XII., p. 57) and Mr. T. Hay Wilson, of whom a notice from the pen of Mr. T. V. Holmes appears in the same part (*Ibid.* 60).

The actual work accomplished down to the present time will be found in the nineteen volumes of our publications; five volumes of *Transactions* and *Proceedings*, and, commencing in 1887, eleven volumes of the Essex Naturalist together with the three volumes of *Special Memoirs*. It is not only by the number of printed pages, however, that our work will be judged in the future. A study of the contents of these nineteen volumes will show that we have on the whole kept faithfully to the programme as set forth in our original Rules:—

> "The investigation of the natural history, geology and archæology of the County of Essex (special attention being given to the fauna, flora, geology and antiquities of Epping Forest); the publication of the results of such investigations, &c."

Under the various headings adopted in this earliest definition of our functions, I now propose to pass in review the more important pieces of work which have been placed upon record in

[1] I gave an account of Col. Russell's work as a photographer in 1888 (Essex Naturalist III., p. 117.)

our volumes, the subject of natural history resolving itself most conveniently into zoology and botany.

I.—ZOOLOGY.

In zoology, as in other branches of science, two kinds of work may be and should be carried on by a local society. There is work of an educational or pioneering character which consists in the exposition by a master specialist of the natural history, in the broadest sense, of some particular group of organisms with a view to the creation of an interest in that group so as to induce working members of the Society to take up its serious study. The other kind of work is the systematic recording of the species with the object of preparing lists of the present native inhabitants of the County—in other words, the compilation of a County Fauna. Such faunistic lists are valuable in proportion as they contain original notes and observations on the species recorded, but even bare lists are of value as showing for the use of future naturalists what species occurred in the district at a certain period. We can lay claim to have carried on both branches of work, although it does not appear that the efforts of those who have endeavoured to arouse enthusiasm with respect to the study of particular groups have met with much practical response. I learn that this experience is, however, pretty general among local societies, and it would be unjustifiable to draw the conclusion that Essex workers are less receptive than those in other counties. One of the first addresses of the pioneering kind given to our Club was that on the Infusoria, by Mr. Saville Kent, in 1881 (*Trans.*, II., 44). Mr. Kent also gave an address on the water-mites, Hydrachnida, in 1882 (*Proc.*, III., xliv.) and Mr. Brunetti and Mr. Verrall on Diptera in 1889 (Essex Naturalist, IV., 85). The Rev. Hilderic Friend also has published a series of no less than seven papers on Annelids which were intended to raise an interest in this group (Essex Naturalist, V., 193, 237; VI., 31, 60, 107, 169, 185) and which likewise comprise lists of Essex species. The first of Mr. Scourfield's series of three papers in 1897 on the Entomostraca of Epping Forest may also be regarded as an excellent representative of this class of pioneering work (Essex Naturalist, X., 193, 260, 313) and Mr. Lovett's address in 1900 on the Stalk-eyed Crustacea (*Ibid.* XI., 252) comes under the same category. The addresses on Arachnida by Messrs. F. P. Smith and F. O. Pickard-Cambridge in 1900, although not published *in extenso*, will no doubt linger in the memories of those who were present at the meeting (*Ibid* XI., 294.)[2]

Such papers as those referred to have in many cases also comprised most important contributions to the County Fauna, but most of our purely faunistic work appears in the form of special memoirs, local lists, notes communicated to our Editor or in reports of field-meetings. I have not attempted to collate all the records contained in the stray notes scattered throughout our publications, but I may call attention to the larger systematic works and papers. In the first place two of our Special Memoirs are faunistic in character, the *Birds of Essex*, by Mr. Miller Christy, published in 1891, and the *Mammals, Reptiles and Fishes of Essex*, by our former President, Mr. Laver, published in 1898. These two volumes together furnish a complete list of the Vertebrate animals of our County. A preliminary list of the Mammalia was communicated to the Club by Mr. Laver in 1881 (*Trans.*, II., 157). In addition to these two Special Memoirs many papers and notes relating to the Vertebrate Fauna of Essex will rank as permanent contributions to local natural history. The Epping Forest deer formed the subject of a paper by Mr. Harting in 1884 (ESSEX NATURALIST, I., 46) and the so-called "wolf" of the Forest had his true history narrated and stripped of romance by our Hon. Secretary in a supplement to the fourth and last volume of the *Proceedings* (IV., cciv). Those casual visitors to our shores, the whales, have also been duly recorded, the first Rudolphi's Rorqual by Sir Wm. Flower in 1883 (*Trans.*, IV., iii.), the second by Mr. Walter Crouch in 1887 (ESSEX NATURALIST, II., 41), and the third, also by Mr. Crouch, in 1891 (*Ibid.* V., 124; VII., 50). The bats of Epping Forest are recorded from the late Mr. Edward Newman's list in an appendix to the inaugural address (*Trans.*, I., 23) and again in the ESSEX NATURALIST with descriptive notes by Mr. Cole (IX., 134.)

The birds of Essex have been kept well under observation since the foundation of the Club. The occurrence of the Great Bustard and the Rough-legged Buzzard, near Chelmsford, was the first ornithological contribution from Mr. Miller Christy in 1880 (*Proc.*, I., v.; *Trans.* I., 59). Mr. Christy's Special Memoir above referred to is universally regarded as the standard monograph on our avifauna. You will be glad to learn that

2 Mr. Smith's first paper on the Spiders of Epping Forest was read at the meeting of the Club on March 8th, 1902.

Mr. Christy has kept this work well up to date by preserving all the later records, and these will in due course be communicated to the Club. It must always be a matter of satisfaction to us in turning over the records of our past work to know that the Essex Field Club has borne no inconsiderable part in that movement which has led to the protection of wild birds of the County under the Acts of Parliament of 1880 as amended in 1894. The matter was first brought before our Council by Mr. Christy in 1895, and a petition was drawn up by our Hon. Secretary on behalf of the Council and sent to the Essex County Council the same year. The County Council appointed a Committee under the Chairmanship of Mr. Champion Russell to consider our proposals, which proposals were subsequently accepted (ESSEX NATURALIST, IX., 42) and Mr. Russell brought the subject under the notice of our members in a paper (*Ibid.* 218) in which he stated that an "Essex Bird Protection Society" had been called into existence at a public meeting held at Chelmsford in 1896. That Society is still in existence and is doing good work—especially in relation to the coast birds, and its labours have from time to time been recorded in our pages (*Ibid.* IX., 255; X., 274). The later working and developments of the Act have also been duly noted (*Ibid.* X., 133; XI., 10) and the special and successful efforts made by Mr. Edward North Buxton to secure absolute protection for the birds of the whole of the Epping Forest district were recognized by the Club and acknowledged in a formal vote of thanks passed at the 17th Annual General Meeting in 1897 (*Ibid.* X., 15; see also pp. 56 and 276 and XI., 10). Among other contributions to Essex ornithology I may recall the very interesting discussion on the sparrow as an agricultural depredator opened at a meeting of the Club on May 20th, 1882, by the late Lt.-Col. Russell (*Proc.* III., xx-xxvii), the paper on the re-appearance of Pallas's Sand Grouse in 1888, compiled by our Secretary (ESSEX NATURALIST, II., 61), Mr. Harting's paper on the introduction of the *Tinamu* into Essex (*Ibid.* 102), Mr. Fitch's papers on Essex Heronries (*Ibid.* 171) and on the gulls and other birds frequenting the Tollesbury marshes (*Ibid.* 193), and Mr. Percy Clark's visits to the Black-headed Gulls in 1898, 1899 and 1900 (*Ibid.* X. 388; XI., 184; 312). The general subject of bird-migration was dealt with by Mr. Fitch in his presidential address in 1890 (*Ibid.* IV., 1).

Of the Essex Invertebrate Fauna, the Mollusca have, perhaps, received the most attention. One of our first contributions to this subject was Mr. Laver's list of the land and fresh-water Mollusca of the Colchester district (*Trans.* II., 88). The later papers relating to the recent and fossil Mollusca of the County are given below in chronological order:—

"Preliminary List of the Land and Fresh-water Mollusca occurring in the neighbourhood of Felstead"; J. French, ESSEX NAT., II., 1 and 46.

"List of Mollusca occurring in an alluvial deposit of the Cann Valley"; R. W. Christy; *Ibid.* III.; 7.

"On the Mollusca of the Shell Marl occurring at Felstead and in other parts of Essex"; J. French, with remarks by W. H. Dalton, *Ibid.* III., 11.

"List of Land and Fresh-water Mollusca from the Alluvial Deposit at Roxwell"; R. W. Christy and B. B. Woodward, *Ibid.* III., 176.

"On the occurrence of *Cyclostoma elegans* in a living state at Felstead": J. French, *Ibid.* IV., 92.

"On the Land and Fresh-water Mollusca collected in Wanstead and the neighbouring Districts in the Becontree Hundred"; W. Crouch, *Ibid.* IV., 202.

"List of Land and Fresh-water Mollusca occurring in the neighbourhood of Bishop's Stortford"; E. G. Ingold, *Ibid.* IV, 215 and V., 202.

"Note on *Hydrobia jenkinsi*"; Edgar A. Smith, *Ibid.* IV., 212.

"Notes on the Mollusca of the Thames Estuary, with a list of Species observed"; A. J. Jenkins, *Ibid.* V., 220.

"On the occurrence of *Crepidula fornicata*, L. off the Coast of Essex"; W. Crouch, *Ibid.* VIII., 36; X., 353.

"Pleistocene Non-marine Mollusca from Walton-on-the-Naze"; W. M. Webb, *Ibid.* VIII., 160.

"Note on the Shells from the Brick Earth at Chelmsford"; W. M. Webb, *Ibid.* IX., 19.

"The Non-marine Mollusca of Essex"; W. M. Webb, *Ibid.* X., 27; 65.

"The Post-Pliocene Non-marine Mollusca of Essex"; A. S. Kennard and B. B. Woodward; with contributions by W. M. Webb, *Ibid.* X., 87.

"Notes on the Mollusca (Post-Pliocene and Recent) of Felstead"; A. S. Kennard and B. B. Woodward, *Ibid.* X., 185.

"The Post-Pliocene Non-marine Mollusca of Ilford"; A. S. Kennard and B. B. Woodward, *Ibid.* XI., 213.

"The Non-marine Mollusca of the Walton Crag"; A. S. Kennard and B. B. Woodward, *Ibid.* XI., 216.

"Pleistocene Non-marine Mollusca from Clacton-on-Sea"; W. M. Webb, *Ibid.* XI., 225.

"Notes on the Mollusc *Paludestrina jenkinsi*, Smith, in Essex and elsewhere"; A. S. Kennard and B. B. Woodward, *Ibid.* XI., 288.

I think this remarkable series of contributions speaks well for the activity of the malacologists. Our entomologists have also shown considerable activity, but there is yet an immense amount of work to be done with respect to our Insect Fauna. Mr. Fitch's admirable paper on the "Galls of Essex" read in 1881 (*Trans.* II., 98), and supplemented in 1887 by a paper on two new Essex gall-makers (ESSEX NATURALIST, I., 177) furnishes us with an excellent example of a monograph on a most interesting group of insects, and when Mr. E. J. Lewis's paper on the "Oak Galls and Gall Insects of Epping Forest" (ESSEX NATURALIST, XII., 41) is published we may congratulate ourselves on having been the means of giving to naturalists a very substantial body of authentic observations. The Lepidoptera, always a favourite order with collectors, have formed the subject of several communications of which the first was Mr. Gilbert Raynor's paper in 1882 on "The Macro-Lepidoptera of the District around Maldon" (*Trans.* III., 30). In 1889 the late Mr. Howard Vaughan gave us his "Notes on the Lepidoptera of Leigh and its neighbourhood" (ESSEX NATURALIST, III., 123). No general list of the Lepidoptera of the County has as yet been compiled, although the first instalment, the list of butterflies, was prepared and published by Mr. Fitch in 1890 (ESSEX NATURALIST, V., 74) and in the same year I published a list of the species taken at Leyton and in the neighbourhood (*Ibid.*, 153 and supplementary records, VIII., 128). The materials for a complete list are in existence, and it is to be hoped that Mr. Fitch will be induced to complete the work which he has commenced so well. A preliminary list of the Arachnida of Epping Forest was contributed in 1883 by the Rev. O. Pickard-Cambridge (*Trans.* IV., 41) and a further contribution by Mr. F. O. Pickard-Cambridge in 1900 (ESSEX NATURALIST, XI., 315).

Natural history observations of value are incorporated with much of the faunistic work above referred to. The preparation of lists of species is undoubtedly an important and necessary part of the work of a local society—especially during the early period of its existence. No less important is the observation of life-histories, habits, and the general relations between the living organism and its environment known under the comprehensive designation of Bionomics. Many notes and papers on Bionomics and on general natural history appear in our volumes although, as might be expected, such communications are few as compared with the purely faunistic papers. As coming under this heading I may refer to Mr. Fitch's paper on the Bean Beetle, *Bruchus* *rufimanus* (ESSEX NATURALIST, II., 48), the natural history of the "Essex Emerald" moth, *Euchloris (Phorodesma) smaragdaria*, compiled by our Secretary (*Ibid.* I., 120) and supplemented by Mr. Fitch (*Ibid.* 204), my own observation on the tarsal scent-tufts of the Deltoid moth, *Herminia (Aethia) tarsipennalis* (*Ibid.* II., 113), Mr. Kerry's observation on the migration of *Pieris brassicæ* at Harwich (*Ibid.* VI., 205), Dr. H. C. Sorby's notes on the food of oysters in Essex (*Ibid.* X., 169), and, among our first contributions, Mr. Arthur Lister's note on the parasitism of Rotifers in cysts on *Vaucheria* (*Proc.* III., xlv.). An interesting paper on the worm-eating slug, *Testacella scutulum*, Sowerby, was published by Mr. W. M. Webb in the *Zoologist* in 1893 (XVII., 251) and in the ESSEX NATURALIST (VII., 120). The slug itself had been found at Buckhurst Hill and elsewhere in Essex and had been exhibited by Mr. H. C. Snell at our meeting on March 14th of that year (*Ibid.* 46).

In connection with this subject it will be found also that we have not neglected our duty as regards the registration of new and rare species which have occurred in the County. The first occurrence observed in Essex, and, in fact, in England, of the Rhizopod, *Clathrulina elegans* was recorded by our late member, Mr. Charles Thomas, in 1884 (*Trans.* IV., 50), the new Butterfly, *Hesperia lineola* was duly noticed (ESSEX NATURALIST, IV., 191), two new Essex worms, one new to Britain and another belonging to a genus and species new to science had their names and addresses recorded by the Rev. Hilderic Friend in 1896 (*Ibid.* XI., 110) and the same writer has also noted the occurrence of a unique species of well-worm at Chelmsford (*Ibid.* XI., 1), prefaced by a most valuable general introduction to the study of the *Phreoryctes*. The discovery of the hitherto unknown male of the remarkable Hymenopterous insect, *Prestwichia aquatica*, in a pond in Epping Forest, was recorded in 1896 by Mr. Frederick Enock (*Ibid.* X., 10), while Mr. W. M. Webb notified in 1899 the occurrence of a species of woodlouse (*Porcellio ratzburgi*, Brandt.) new to Britain, from Warley and (possibly) Brightlingsea (*Ibid.* XI., 127).

Some of the communications which have been published by the Club deal with the marine zoology of particular trawling and dredging excursions or cruises, such, for example, as Mr. E. A. Fitch's interesting report on "A Day on the Crouch River," Mr. Crouch's further notes on the River Crouch

(Essex Naturalist, VI., 81) and Dr. H. C. Sorby's "General Remarks on the Marine Natural History of the Colne Estuary" (*Ibid.* X., 166). A few of our members have also dealt with the very interesting question of local changes in the fauna and flora observed within the period of their own experience. Mr. Laver gave us his reminiscences of the Rochford Hundred in 1888 (*Ibid.* III., 27). Mr. French has treated of the same subject with respect to the neighbourhood of Felstead (*Ibid.* VI., 191) and has published a more general paper on the local extinction and diffusion of Essex Molluscs (*Ibid.* XI., 86), while Dr. H. C. Sorby has quite recently enriched the Essex Naturalist with a paper "On the Variations in Numbers and Habitat of Marine Animals on the Coast of Essex during the last ten or twelve years" (*Ibid.* XII., 17). Mr. Laver's presidential address of 1893 on the periodicity of organic life raises some interesting questions in general biology (*Ibid.* VII., 51).

One other aspect of our zoological work may be considered here, although it equally affects the botanists. I refer to the subject of collecting specimens. The policy of the Club in this matter was declared in unmistakeable terms in our original Rules :—

"The Club shall strongly discourage the practice of removing rare plants from the localities where they are to be found or of which they are characteristic, and of risking the extermination of birds and other animals by wanton persecution ; and shall use its influence with landowners and others for the protection of the same and to dispel the prejudices which are leading to their destruction." Additional remarks in the same sense were made in my Inaugural Address (*Trans.* I., 11) and the action taken by us with respect to the protection of wild birds is the direct outcome of this policy. I may remind you furthermore that a special meeting of the Club on Feb. 25th, 1882, was devoted entirely to this question of the protection of wild animals and plants, and the discussion and papers on the subject by experts were all brought together and printed as an appendix to the third volume of our *Proceedings* (vol. III., *Appendix* I). More recently, in 1897, it will be remembered that another meeting, held at Easton Lodge at the invitation of our member, the Countess of Warwick, was also devoted to the consideration of the whole question of "the protection of our native Fauna and Flora from the destruction and actual extermination which now threaten many interesting species." (ESSEX NATURALIST, X., 179). On this occasion Mr. C. G. Barrett, Mr. Harting and Prof. Boulger dealt with the necessity for protecting the rarer insects, birds, mammals and plants respectively. It is to be hoped that this policy will be strenuously maintained during the future career of the Club. Since the year 1880, when the original rule was framed, new sources of danger have arisen which make the protection even of our commoner animals and plants (unless absolutely destructive) a matter of serious importance. I refer to the introduction of "nature-teaching" into rural schools, an innovation in educational methods at which nobody can rejoice more than I do, but which, unless kept well in check at the outset, is liable to lead to wanton destruction by the undisciplined raids of uninstructed school children (see ESSEX NATURALIST, XI., 236, and *Nature*, Vol. LXIV., p. 394, August 22nd, 1901).

II.—BOTANY.

Many contributions to the local lists of plants will be found throughout our publications. Among general lists I may refer to Mr. Shenstone's reports on the flowering plants of the Colchester district (ESSEX NATURALIST, I., 22; III., 222), Mr. Powell's paper on the flowering plants of Epping Forest (*Ibid.* VI., 1) and Mr. F. W. Elliott's paper on the trees and shrubs of Epping Forest (*Ibid.* X., 377). As Essex is the home of the rarest British *Primula*, *P. elatior*, it is but natural that this genus should have received special attention, and our first botanical contribution of importance was Mr. Miller Christy's paper in 1882-83 on the species of the genus *Primula* in Essex (*Trans.*, III., 148), followed in 1891 by Mr. French's paper on the range of *P. vulgaris* and *P. elatior* in N. Western Essex (ESSEX NATURALIST, V., 120), and in 1898 by Mr. Miller Christy's notes on a phyllodic aberration of *P. acaulis* and on a hybrid between *P. elatior* and *P. veris* (*Ibid.* X., 307). Mr. Shenstone's paper on the more remarkable oak trees in Essex (*Ibid.* VIII., 89), richly illustrated as it is by prints taken from photographs, must be regarded as a valuable contribution to Essex botany. Among other local records attention may be called to Mr. Arthur Lister's note in 1882 "On the occurrence of *Carex pseudo-cyperus* and the flowering of *Lemna gibba* in Wanstead Park." (*Proc.* III., xlviii.), Mr. E. M. Holmes' notes on the occurrence of the rare moss, *Zygodon forsteri*, Mitten, in Epping Forest (*Ibid.* lxii.; from *Journ. of Botany* for Nov., 1882) and on a new British Alga (*Vaucheria sphærospora*) found near Maldon (ESSEX NATURALIST, I., 151), Mr. Joseph Clarke's paper on some plants peculiar to Essex and on some plants of Saffron Walden and neighbourhood (*Ibid.* III., 274) and Mr. Robert Paulson's notes on the Carices of the Epping Forest area (*Ibid.* IV., 135).

Since in Gibson's *Flora of Essex* we have already a standard work on the Flora of the County, it may be considered that all the local lists and records scattered throughout our pages are additions and corrections to or emendations of statements in that well-known work. Looking through our pages one cannot but be struck with the large share of attention bestowed upon the cryptogamic plants of our County. This is, doubtless, due to the popularity of these plants as subjects of study and perhaps no less to the circumstance that from the very beginning of our career we have had the invaluable co-operation, advice and assistance of Dr. M. C. Cooke and other distinguished mycologists, while the unrivalled keenness as a collector of the late James English, of Epping, has helped to enrich our lists of Epping Forest species by many notable additions. The first "Preliminary List of the Hymenomycetal Fungi of Epping Forest," by Dr. Cooke and Mr. English appeared in 1881 (*Trans.* II., 181); Cooke's "Preliminary List of the Microscopic Fungi of Essex—Ustilaginei and Æcidiomycetes" in 1887 (ESSEX NATURALIST, I., 184); his list of Discomycetes in 1888 (*Ibid.* II., 189) and his catalogue of the Hymenomycetal Fungi of Epping Forest in 1889 (*Ibid.* III., 248). Since this last-named list hardly a year has passed without some additions being announced at our annual "Fungus-forays," the species observed at the foray of 1900 having formed the subject of a paper by Mr. G. Massee, and comprising two species new to Britain and several new to Essex (*Ibid.* XI., 313). A list of the Fresh-water Algæ of the Forest was communicated by Dr. Cooke in 1883 (*Proc.*, IV., xlvii.) and a complete preliminary catalogue of species recorded in Essex generally was published by the same author in the ESSEX NATURALIST in 1893 (VII., 170). The lichens of Epping Forest were catalogued in 1883 by the Rev. J. M. Crombie (*Trans.* IV., 54). In 1890 the annual

Fungus Foray in Hatfield Forest enabled Dr. Cooke and his coadjutors Messrs G. Massee and E. M. Holmes to publish preliminary lists of the Fungi, Mosses, Lichens and Liverworts of that hitherto unworked district, and to add some twenty-five species to the Essex Flora (ESSEX NATURALIST, IV., 219-221).

The late Mr. E. G. Varenne having left a rich herbarium of cryptogamic plants collected by himself over a period of forty years at and around Kelvedon, these were catalogued and a valuable paper published on the whole collection by Mr. Marquand in 1891 (ESSEX NATURALIST, V., 1-30). This list comprises a few coast species and Mr. E. M. Holmes has published in the same volume (*Loc. cit.* 263) a note on the marine algæ and flowering plants observed between Harwich and Dovercourt. A complete provisional list of the marine Algæ of Essex was drawn up and communicated to the Club three years later by Mr. E. A. L. Batters (*Ibid.* VIII., 1-25). In 1896 Mr. Arthur Lister gave an address on the Mycetozoa at our annual Fungus Foray in which he ieferred to the species observed in Epping Forest (*Ibid.* X., 23).

Our botanical labours have thus on the whole been of the nature of species recording--a branch of work which, as in zoology, it is most appropriate for a local society to undertake. Mr. Shenstone, who is writing the chapter on Botany for the *Victoria History of Essex*, informs me that his article is an epitome of the work of the Club. The wider problems of botany have not, however, been altogether neglected, and many of our experts have from time to time addressed our meetings on the general biology of certain groups. I may remind you that Prof. Boulger gave us his views concerning the evolution of fruits in 1881 (*Trans.* II., 1) and that he first published his suggestion concerning the adoption of the river-basins of Essex as natural history provinces in a paper read at a meeting of the Club the same year (*Trans.* II., 69). The following year this same author read his first paper on the history of Essex botany (*Proc.* III., vii.), the first part of which, dealing with the botanists of the sixteenth and seventeenth centuries, has now been completed, and three instalments have appeared in the ESSEX NATURALIST (XI,, 57, 169, 229). As a valuable contribution to economic botany Mr. Paulson's paper on the disease affecting the birch trees must be specially mentioned (ESSEX NATURALIST, XI., 273).

It is to be regretted that the contributions to plant-biology have not been more numerous, but there are many reasons telling against the prosecution of this kind of work by the members of local societies. It is a subject requiring close and constant application and is thus generally beyond the powers of the amateur botanist who is too busy with his ordinary occupations to attend to such work. The necessary experimental investigations also demand much skill and originality as well as a certain command of appliances which are not always available to the amateur. Expert botanists belonging to local societies who do work in this field generally publish their results through some central learned society, and so the botanical work of field clubs must necessarily be of the nature of species recording to a preponderating extent. I still think, however, that the suggestions made by Prof. Bayley Balfour at the Manchester Conference of Delegates of the Corresponding Societies of the British Association in 1887 concerning the study of life-histories should not be allowed to fall into oblivion in Essex (ESSEX NATURALIST, I., 200, 278). Among the few notes referable to botanical bionomics is that by Messrs. Rosling and Miller Christy in 1884 on the transmission of "form" in heterostyled plants (*Proc.* IV., cxxvii.) and Mr. Joseph Clarke's "Hint on the Vitality of Seeds" (*Ibid.*, cxxix.).

The remarks made under Zoology with reference to collecting apply with equal or even greater force to plants. The subject of plant preservation was specially discussed at our meeting on Oct. 31st, 1885, and a series of resolutions were passed by those present which it is to be hoped will be always considered as expressive of the policy of the Club throughout the future (*Proc.* IV., clxxviii.; ESSEX NATURALIST, II., 47, and report of Easton Lodge meeting, *Ibid.* X., 179).

III.—GEOLOGY, PALÆONTOLOGY, PHYSIOGRAPHY AND SEISMOLOGY.

In this department we may claim to have carried out our programme with marked success. I will venture to quote a passage from an advanced proof of the article on the Geology of Essex, written by Mr. Horace B. Woodward for the *Victoria History* of the County :—

"Our knowledge of Essex Geology, due chiefly to the labours of Prestwich, Searles V. Wood, jun., Prof. W. Boyd Dawkins and Mr. Whitaker, has been augmented by the workers of the Essex Field Club and of the Geologists' Association, and notably by Mr. T. V. Holmes."

We were fortunate at a very early stage in our career to have secured Mr. Holmes as a member and later as President; Mr. Whitaker was among our first Hon. Members, and the late Mr. Searles V. Wood has been a contributor to our publications. The first original observation in geology published by the Club was by Mr. W. H. Dalton in 1881 on the Blackwater Valley (*Trans.* II., 15) in which he made known as the result of a boring for an Artesian well at Tiptree Heath the apparent existence of a faulted undulation in the underlying chalk, which subject was further developed in a later paper by Mr. Dalton in 1890, entitled "The Undulations of the Chalk in Essex" and accompanied by a valuable map. In this paper the author dealt incidentally with the question of the existence of coal under Essex (ESSEX NATURALIST, V., 113). Among the early geological publications of the Club reference may be made to Mr. N. F. Robarts' "Notes on the London Clay and Bagshot Beds at Oakhill Quarry, Epping Forest" (*Trans.* III., 231) and Mr. Searles V. Wood's paper "On the Sand-pit at High Ongar" (*Ibid.* IV., 76) to which is appended a note by that author relating to Mr. Dalton's paper on the Tiptree Heath boring and suggesting instead of a faulted undulation a simple sinuosity in the fold of the underlying chalk (*Ibid.*, p. 85).

The deep geology of our County can of course only be studied by means of borings, and here again we have been fortunate in securing the co-operation of that most distinguished of all authorities on the geology of the London Basin, Mr. Whitaker, who has kept an ever watchful eye on the well-sections, some 326 of which he has recorded in a series of four papers published by the Club between 1885 and 1895 (*Trans.* IV., 149; ESSEX NATURALIST, III., 44; VI., 47; IX., 167). Mr. Whitaker informs me that since his last communication he has records of some six dozen other Essex well-sections ready for publication. The part taken by the Essex Field Club in developing the geological knowledge of this part of the country is also well brought out by Mr. Whitaker in his annual presidential address to the Geologists' Association, delivered February 8th, 1901, under the title "Twelve years of London Geology" (*Proc. Geol. Assoc.*, XVII., 81). While dealing with Mr. Whitaker's contributions to our publications I may point out that in 1887, in a paper entitled "What is the use of the Essex Field Club?" (ESSEX NATURALIST, I., 180), he emphasized in his forcibly humorous style the necessity for the members of a local society such as this looking out for temporary sections exposed by railway cuttings, &c. In 1889 Mr. Whitaker, in conjunction with Mr. Dalton, contributed a most valuable bibliographical paper to the ESSEX NATURALIST (III., 61-86), viz., a "List of Works on the Geology, &c., of Essex," this list comprising the Geological Survey Publications, and books, papers, &c., chronologically arranged from 1701 down to 1888. In the same volume (p. 140) he sanctioned the publication of an abstract of a paper "On a Deep Channel of Drift in the Valley of the Cam, Essex" read at the Newcastle meeting of the British Association, and since published by the Geological Society (*Quar. Journ.*, 1890, p. 333; ESSEX NATURALIST, IV., 117).

The Rev. A. W. Rowe, who has since made notable contributions to geology, gave us in 1885 a paper on some crystalline rocks from the Drift in the neighbourhood of Felstead (*Proc.* IV., cxl.) which, after further elaboration, was published *in extense* by the Geological Society (*Quar. Journ.*, Aug., 1887, pp. 351-363). A later contribution on Essex boulders was made by Mr. Rowe in 1887 (ESSEX NATURALIST, I., 117) in extension of a note on this subject by Mr. Worthington Smith (*Ibid.*, p. 8).

The contributions to Essex geology with which our publications have been enriched by the work of Mr. T. V. Holmes are so numerous and important that it is only possible to do justice to them by giving a special list:—

"On the Subsidence at Lexden, near Colchester, in 1862." ESSEX NAT., I., 1-8.

"Notes on Drift Maps, with special reference to those of Essex." *Ibid.* II., 21-32.

"The Subterranean Geology of South-Eastern England"; Presidential Address for 1888; *Ibid.* II., 138-158.

"Notes on the Geology of Maldon and the Blackwater Estuary"; *Ibid* III., 111-115.

"On some recent Subsidences near Stifford, Essex"; *Ibid.* 183-188.

"Chelmsford Water Supply"; *Ibid.* IV., 82-84.

"On some Sections between West Thurrock and Stifford on the Grays and Upminster Railway"; *Ibid* 143-149.

"The Geology and Scenery of the Club's Voyage from Maldon to Chelmsford, August 8th, 1891"; *Ibid.* V., 197-202.

"The Geology of the District around Dagenham Breach, Essex;" *Ibid.* VI., 142-146.

"The New Railway between Upminster and Romford. Boulder Clay beneath old River Gravel at Hornchurch. Conclusions therefrom"; *Ibid.* VII., 1-14.

"Notes on the Geology of the Neighbourhood of Chelmsford"; *Ibid.* 65-66.

"Coal under South-Eastern England." Reports by T. V. Holmes and W. Whitaker; *Ibid.* VIII., 142-150.

"The Geology of the Lea Valley"; *Ibid.* 198-201.

"Notes on the Geological Section at Chelmsford, in which Mammoth and other Remains were discovered in November, 1894"; *Ibid.* IX., 10-16.

"Notes on a Map including the greater part of South-Eastern England, recently issued by the Geological Survey"; *Ibid.* IX., 112-115.

"Discovery of Mammalian Remains at Great Yeldham, Essex," by T. V. Holmes and E. T. Newton; *Ibid.* 115-118.

"A Sketch of the Geology of Epping Forest"; *Ibid.* 160-165.

"Notes on the Ancient Physiography of South Essex"; *Ibid.* 193-200.

(This paper is accompanied by a map shaded so as to represent elevations)

"Coal under South-Eastern England; Reports by T. V. Holmes and W. Whitaker"; *Ibid.* 213-218, 253-255; X., 9-10, 136-139.

(These papers on the search for Coal under Essex have been compiled by the Editor from the reports of Messrs. Holmes and Whitaker.)

"The Geology of Ilford," from *Proc. Geol. Assoc.* (ESSEX NAT., XI., 149).

"Geological Notes on the New Reservoirs in the Valley of the Lea, near Walthamstow"; *Ibid.* XII., 1-16.

This list does not include the many short notes with which Mr. Holmes has supplied our Editor, nor does it adequately express the extent of his services to the Club by his numerous attendances at field meetings and his expositions of local geology on the spot. It must be borne in mind also that much of the work above catalogued has often necessitated frequent visits to the places where sections were exposed and constant supervision where excavations were in progress.

The vigilance of our local observers has also contributed much towards the success of this branch of our work. The Rev. O. Fisher sent a note in 1887 relating to the subsidence near Lexden in 1862, dealt with by Mr. Holmes in his paper above referred to (ESSEX NATURALIST, I., 39). In 1899 Mr. Miller Christy published "Notes on an Alluvial Deposit in the Cann Valley, with a list of the Mollusca," to which notes were added by Mr. Dalton (*Ibid.* III., 1), and Mr. R. W. Christy a paper, "Notes on the Geology of the District around Chelmsford" which has already been referred to in connection with the lists of Mollusca (*Ibid.* III., 171). Mr. Dalton dealt with the Geology of Fowlness at our Southend meeting in 1889 (*Ibid.* III., 239) and the following year he published his "Notes of Geological Rambles in the Braintree District in connection with the Easter Excursion of the Club" (*Ibid.* IV., 79). As a contribution to local physiography the silting up of the River Roding, as reported upon by the County Surveyor, has been duly noted in our pages (*Ibid.* IV.,94).

Among recent workers in Essex geology Mr. H. W. Monckton must be mentioned as a contributor of valuable papers to the ESSEX NATURALIST. His first communication on the Boulder Clay in Essex was published in 1890 (ESSEX NATURALIST, IV., 199). At a field meeting on July 11th, 1891, he read "Notes on the Glacial Formation near Chelmsford" (*Ibid.* V., 191); in 1893 we published his "Geological Notes in the Neighbourhood of Ongar" (*Ibid.* VII., 87) and the same year his paper read at the Barking Side meeting on July 1st "On the Gravels near Barking Side, Wanstead, and Walthamstow" (*Ibid.*, 115). We have also reaped the benefit of the presence of that zealous worker at Felstead, Mr. J. French, who in 1891 called attention to the occurrence of Westleton Beds in North-west Essex (*Ibid.* V., 210), and in 1892 contributed a paper "On some Plateau Deposits at Felstead and Stebbing" in which he discusses some interesting points in Post-Glacial Geology (*Ibid.* VI., 132). Our late member, Mr. T. Hay Wilson, also has given us the benefit of his local vigilance. In 1893 he published his notes on the gravels of Epping Forest, being the result of his observations of sections at Copt Hall, High Beach, Chingford and Buckhurst Hill (*Ibid.* VII., 74), and four years later he gave us a note on sections in the Lea Valley exposed at South Tottenham during the construction of the new reservoirs (*Ibid.* X., 110). The question of the occurrence of coal under Essex has, on account of its possible economic bearings, naturally engaged considerable attention and given rise to much controversial writing. The Rev. A. Irving published a newspaper article on this subject in 1894, which was reprinted in the ESSEX NATURALIST (VIII., 130), and Mr. Dalton's paper of 1890 and the reports by Messrs. Holmes and Whitaker have already been referred to. As a contribution to economic geology Dr. Thresh's paper on the shallow and deep well-waters of Essex, accompanied as it is by tables of analyses of the waters, is one of the highest value (*Ibid.* VII., 28-40). In his recent work, *Report on the Water Supply of the County of Essex*, of which a notice by Mr. Dalton appears in the ESSEX NATURALIST (XII., 62), Dr. Thresh repeatedly acknowledges his indebtedness to our publications. Mr. T. S. Dymond's interesting note and analysis of the manganiferous conglomerate found at Tendring (*Ibid.* X., 210) was, until Miss Thresh's recent paper on the same subject, our only original contribution to mineralogical geology. Mr. Percy Clark's paper on the encroaching sea on the east coast is a record of the effects of the high tide of Nov. 29th, 1897 (*Ibid.* X., 297). Mr. Monckton's criticism of the official report by Mr. Hunter Pringle on the land that had gone out of cultivation in Essex (*Ibid.* IX., 70) may be regarded as a contribution to economic geology

Palæontology and stratigraphy are necessarily treated of together in many of the communications which we have received and published. Some of the papers on the Mollusca of Essex catalogued under Zoology belong to both divisions. The popular lecture on "A Day's Elephant-hunting in Essex," by the late Henry Walker (*Trans.* I., 27), was the first paper published by the Club after the Inaugural Address. Later, in 1882, Dr. Henry Woodward, F.R.S., gave us an admirable lecture on "The Ancient Fauna of Essex" to which he appended a list of the Mammals from Ilford collected by Sir Antonio Brady and now in the British Museum of Natural History (*Trans.* III., 1-29). The services rendered by our Hon. Member, Mr. E. T. Newton, F.R.S., in connection with our palæontological work have been acknowledged from time to time in our pages, and it may be generally said that every important find of vertebrate remains in Essex has had the advantage of being submitted to his critical knowledge. Although Mr. Newton's contributions to our work have not often taken the form of separate publications, they are none the less valuable, and any record of our past achievements would be incomplete without some acknowledgment of the part he has taken therein. A paper by him on the

Pleistocene Mammals from the neighbourhood of Chelmsford was published in 1895 (ESSEX NATURALIST, IX., 16). The eleventh volume of the ESSEX NATURALIST for 1899-1900 is quite remarkable for a number of geological papers comprising palæontological contributions. Taking these in order we have:

"Some New Sections in, and contributions to, the Fauna of the River Drift of the Uphall Estate, Ilford, Essex," by J. P. Johnson and G. White, ESSEX NAT., XI.; 157.

"On the Pleistocene Deposits of the Ilford and Wanstead District," by Martin A. C. Hinton; *Ibid.*, 161.

"Additions to the Palæolithic Fauna of the Uphall Brickyard, Ilford," by J. P. Johnson; *Ibid.*, 209; also XII., 52.

(This paper is noteworthy as containing a record of the discovery of flint implements in the Uphall series of deposits associated with extinct species of animals).

"The Eocene Flora and Fauna of Walton-Naze, Essex," by J. P. Johnson; *Ibid.*, 284.

"Contributions to the Pleistocene Geology of the Thames Valley, I., The Grays Thurrock Area, Part I.," by Martin A. C. Hinton and A. S. Kennard. With a Sub-Section on the Fossil Fishes, by E. T. Newton; *Ibid.*, 336-370.

This last paper is certainly a most important contribution to Essex Geology, being the result of field work and personal observation. It comprises also a very valuable bibliographical list of 75 references, among which it is gratifying to find several references to work published in our pages. The second part of this paper was read at a recent meeting of the Club, and is of equal or even greater interest as a contribution to ancient physiography. It is hoped that this part will shortly appear in the ESSEX NATURALIST.

Seismology is a subject which, happily for this country, does not often force itself in its most obtrusive form upon the attention of our local Societies. We had our big earthquake, however, on April 22nd, 1884, and on Feb. 28th, 1885, I presented to the Club the detailed report on this occurrence prepared by myself and Mr. William White (*Proc.*, IV., cxxxvii). The volume was published the same year as the first of our *Special Memoirs*, and in fact inaugurated the system of Special Memoirs. Of course it is not for me to say anything about the value of this work, but it was undertaken in fact by way of example in order to emphasize the duty of local societies in scientifically recording such uncommon phenomena when they occurred. From this point of view it was well received by the scientific public and by the Press, and at the time of its publication was the only complete monograph of a British earthquake. The Herefordshire earthquake of Dec. 17th, 1896, was also felt in our County (ESSEX NATURALIST, IX., 258; X., 240) and formed the subject of an excellent monograph by Dr. C. Davison published in 1899 by the aid of a grant from the Royal Society. This memoir is cast on very much the same lines as our Report, but is worked out much more exhaustively, the author coming to the same conclusion respecting the origin of the earthquake that we had arrived at concerning the Essex earthquake, viz., that it may have been connected with the process of "faulting" in the geological sense. It is of interest to note also that Dr. Davison estimates that in "concentrated severity the Essex earthquake far exceeded the Hereford earthquake," although the total area disturbed was greater in the case of the latter.[3]

IV.—ANTHROPOLOGY.

At the beginning of the Club's existence we decided to restrict our actual work in the domain of archæology to the study of that period which, although perhaps not definable within any rigid limits, is known generally as the pre-historic or non-historic (Inaugural Address, *Trans.* I., 18). The later archæology had been and still is well looked after by the Essex Archæological Society, and although we have generally made a point of visiting places of archæological interest in the course of our field-meetings we have not laid ourselves out for the publication of detailed archæological papers. Some small amount of unavoidable overlap may have occurred, but I do not think that we have encroached very seriously upon our neighbour's domain. It has been and will I hope always continue to be the policy of the Club to treat archæology rather in its scientific aspect as a branch of the modern science of anthropology.

With respect to pre-historic archæology we may take credit for having made substantial contributions during the past twenty-one years. The chapters on the archæology of Essex for the *Victoria History* of the County which have been written

3 *The Hereford Earthquake of December 17th*, 1896. By Charles Davison, Sc.D., F.G.S., Birmingham, Cornish Bros., 1899, p. 224.

by our members, Messrs. G. F. Beaumont and I. C. Gould, and of which I have been favoured with an advanced copy, bear ample testimony to our activity. We were very fortunate at the outset in having secured the active interest of that great pioneer in modern archæological research, our late Hon. Member, Gen. Pitt-Rivers. It was at his instigation that systematic excavations into the Epping Forest earthworks were first undertaken, the suggestion having been brought before the Club at a meeting held on July 3rd, 1880 (*Proc.* I., xxiv.) and at another memorable meeting held at Ilford on July 24th, 1880 (*Ibid.*, xxxii.; see also pp. l. and liv.). The report on the excavations at Ambresbury Banks was drawn up by Gen. Pitt-Rivers and read in 1881 (*Trans.*, II., 55; see also *Proc.* II., xxviii., for official report and bibliographical history by the Secretary, Mr. W. Cole). The exploration of the Loughton Camp was taken in hand the following year, the British Association having recognized our work by appointing a Committee and making a grant in aid of the expense of excavation. The full report, drawn up by our Secretary, was presented by me on our behalf at the Southport meeting of the Association, and was also read before the Club on Sept. 29th, 1883 (*B. A. Rep.*, 1883. pp., 243-252; *Trans.* III., 212; *Proc.* III., li., and Appendix No. 2, p. vi.). The conclusions to which this, our first piece of archæological exploration, has led, are too well-known to need recapitulation. It may be desirable to point out, however, that although we have replaced antiquarian lore by more substantial information, there still remains much to be done, even in connection with these "camps." More especially may I emphasize the necessity for cutting further sections through and across Ambresbury Banks, since the evidence as to the age of this earthwork, although conclusive as far as it went, was derived from one section only.

One other piece of archæological research which we have made essentially our own is the exploration of the "Dene-holes" in Hangman's Wood near Grays. These interesting excavations were first brought prominently under the notice of the Club by Mr. Worthington Smith at a joint meeting held with the Geologists' Association at Grays, on May 14th, 1881 (*Proc.* II., xviii.) Both the conductors of that remarkable meeting, Prof. John Morris and Mr. Henry Walker, were Hon. Members of the Club, and Mr. Worthington Smith, whose name still graces —and may it long continue to grace—our list, has since helped to make the publications of the Club famous in the annals of pre-historic archæology. The curiosity aroused by our first visit to the dene-holes led to further visits by the Club on June 17th and Sept. 9th, 1882 (*Proc.* III., xxviii., lviii.), the outcome of these meetings being a paper by Mr. T. V. Holmes (*Trans.* III., 48) and a very full bibliographical history of the subject by our Hon. Secretary, Mr. W. Cole (*Proc.* III., xxviii—xxxiv). The raising of a fund for the systematic exploration of these remains was suggested at our meeting on Oct. 28th, 1882 (*Ibid.* LXXXIV.); there were further visits to Hangman's Wood by the Club and the Geologists' Association on June 15th and 16th, 1883 (*Proc.* IV., xx.) and Mr. T. V. Holmes as the result of this further inspection published his "Miscellaneous Notes on Dene-holes" in our *Transactions* for that year (IV., 87). A committee of exploration was appointed by our Council on March 31st, 1883, and a sufficient fund raised to enable Mr. Holmes and Mr. W. Cole, to whom had been entrusted the practical work of superintending the excavation, to commence operations in October of that year (*Proc.* IV.,cxxiii.) The work was discontinued on Nov. 10th, and the results withheld till further evidence had been obtained, for which purpose work was resumed by Mr. Holmes and Mr. W. Cole and his brothers on Sept. 26th, 1887, and continued till October 10th of that year (ESSEX NATURALIST I., 202). The full report was drawn up by Mr. Holmes, read on Nov. 12th, 1887, and published shortly afterwards (ESSEX NATURALIST I., 225). This report may fairly claim to embody all that is authentically known concerning these mysterious remains down to the present time, and if, owing to the absence of positive evidence, the problem of their age and purpose has not been finally solved, we have the satisfaction of knowing that we have at least advanced the knowledge of the subject by a very marked step, and that such conclusions as have been arrived at by Mr. Holmes and his colleagues are based upon the solid ground of scientific evidence. One valuable feature of the report is the series of papers contributed in the form of appendices by Messrs. E. T. Newton, F. W. Rudler, F. J. Bennett, H. B. Woodward and F. C. J. Spurrell. It is probably within the recollection of most of those present that the dene-holes have been visited by the Club several times since the issue of the report, but no fresh discoveries of note have been made and the matter rests where it was left by our reporters fifteen years ago. Possibly the renewal of this investigation may be undertaken at some future period by the Club.

In the annual presidential address which I had the honour of delivering on Jan. 27th, 1883 (*Trans.* III., 62), I ventured to put forward the suggestion that we should undertake to prepare a complete catalogue of the pre-historic remains of our County. This suggestion was further elaborated and read at the Southport meeting of the British Association the same year (*Trans.* IV., 116), and our Hon. Secretary, Mr. Cole, commenced to collect materials for such a catalogue. Owing to pressure of other work but little progress has been made by the Club in this matter, and in the meantime the Society of Antiquaries has set the scheme practically going by inaugurating a system of registration of ancient remains on the existing Ordnance Maps (ESSEX NATURALIST, III., 91). The necessity for carrying out systematic archæological surveys of the Counties was quite recently brought before us by Mr. C. H. Read, and that is why I have ventured to refer to it again. The modern publication of the *Victoria County Histories* has also been the means of emphasizing the necessity for archæological surveys, and our own County has been undertaken for this work by our Members, Messrs. G. F. Beaumont and I. C. Gould, who have prepared two maps registering respectively by means of symbols the remains of the stone, bronze and iron ages, and the ancient earthworks, camps, mounds, tumuli, &c. The Roman and later remains will also be dealt with, but these do not come within our province. Large numbers of the records entered by the authors above mentioned are taken from our pages and these will serve as vouchers for our utility in connection with pre-historic archæology.

I have already referred to our indebtedness to Mr. Worthington Smith. We have had the benefit of his co-operation as mycologist and archæologist as well as in his capacity of artist and engraver. The first of his series of papers on "Primæval Man in the Valley of the Lea" was read in 1882 and revised for publication in 1883 (*Trans.* III., 102) and followed by three communications on the same subject in 1887 (ESSEX NATURALIST, I., 36, 83, 125). All these papers are profusely illustrated by the author's own engravings of implements, &c. Other papers from his pen, and also illustrated by his pencil, "On Neolithic and Palæolithic Scrapers, replaced and reworked" and on "Palæolithic implements—large and heavy examples" were published in 1888 (*Ibid.* II., 67, 97). In the same volume (p. 4) appear his figure and description of the stone "pestle" from Epping Forest. In 1898 he described and figured an implement made from a stag's antler found at Wormingford (*Ibid.* X., 310), this paper having called forth a communication on the same subject by Mr. Edward Lovett (*Ibid.* 351). Those who wish to form an appreciation of Mr. Worthington Smith from his humorous side will do well to peruse his "Lepores Palæolithici," read in 1884 and published in 1888 (Essex Naturalist II., 7). Among other relics of early human workmanship referred to in our publications attention may be called to Mr. H. Corder's paper on "Stone Implements from the Neighbourhood of Chelmsford" (*Trans.* II., 29), the paper on two pre-historic weapons from near Epping (Essex Naturalist VIII., 162), Mr. Mothersole's "Notes on some Relics of early Man in the Neighbourhood of Chelmsford" (*Ibid.* X., 305) and Mr. J. P. Johnson's paper on "Palæolithic Implements from tho low-level Drift of the Thames Valley, chiefly from Ilford and Grays" (*Ibid* XII., 52), this last paper having been already referred to under our palæontological contributions. Mr. Laver's note on the discovery of Celtic urns at Colchester (Essex Naturalist III., 116) brings us down to a later period.

The human skeleton found during the excavations at the Tilbury Docks, formed the subject of a paper read before the Royal Society by Sir Richard Owen in 1883, and afterwards published as a separate work (Van Voorst, August, 1884). The distinguished author, who was one of our Hon. Members, had come to the conclusion that this skeleton was of Palæolithic age, but at a meeting of the Club held on February 23rd, 1884, Mr. T. V. Holmes and others expressed their belief that the evidence of extreme antiquity was unsatisfactory (*Proc.* IV., lxxviii.) and a meeting of the Club, in conjunction with the Geologists' Association, was held at Tilbury on May 17th of the same year (*Ibid* xcviii.) In a paper by Mr. Holmes, published by us in 1884 (*Trans.* IV., 135), the "antiquissimist" view (to use Mr. Spurrell's expression) of the skeleton was disposed of. The value of geological judgment in connection with archæological reasoning is well brought out in other papers communicated to Club, such as Mr. Goodchild's "Notes upon some Mounds near the Estuary of the Thames" (Essex Naturalist I., 210) and

Mr. Holmes' "Geological Notes on a supposed Earthwork near the Railway Station at Harlow" (*Ibid.* IX., 59) which led to a friendly controversy with Mr. I. C. Gould (*Ibid.*, 65 and reply p. 68).

Many other contributions to the records of the existence of early man in Essex appear in our pages. In 1891 Mr. J. French called attention to the existence of ancient lake remains at Felstead and in the neighbourhood (ESSEX NATURALIST VI., 34), and the Rev. J. W. Kenworthy gave us in 1899 his most interesting paper on "A Supposed Neolithic Settlement at Skitt's Hill, Braintree," the value of which is enhanced by Mr. Reader's remarks on the archæological remains, Mr. Holmes' notes on the geology of the district and Mr. Newton's remarks on the osteological specimens (*Ibid.* XI., 94—126). The notes by Mr. Holmes on the ancient cemetery at Saffron Walden (*Proc.* IV., cc.) bring us down again to a later period in human history. The mysterious "Red Hills" or "Salting Mounds" so numerous about the estuaries of the Essex rivers were referred to at a meeting held at Colchester and Mersea in 1884 (*Proc.* IV., cxiii.) and a paper on these remains was published by Mr. Stopes in 1887 (read in 1884; ESSEX NATURALIST I., 96). Our Hon. Secretary, Mr. W. Cole, is among those who have given latest attention to the subject, having explored several of these mounds, and has come to the conclusion that they may have been the sites of ancient potteries. This view is most probable, but the final answer to the questions as to their age and object can only be solved by further systematic excavation, and, as Mr. C. H. Read urged in his recent address, it is to be hoped that this work will be undertaken by the Club.

A glance at the map indicating the distribution of ancient earthworks throughout Essex will show that we have visited many, published good accounts of some, and explored none with the exception of the two Epping Forest camps above referred to. Four "camps" are described in great detail in the ESSEX NATURALIST, viz., Withambury by Mr. F. C. J. Spurrell (I., 19), Danbury by the same author (IV., 138), Hæsten's Camp at Shoebury by the same author (IV., 150) and the Uphall Camp, Barking, by Mr. Walter Crouch (VII., 131). In 1897 Mr. T. V. Holmes communicated his "Notes on Ancient Defensive Earthworks in connection with those of Rayleigh 'Castle,' Essex"

(*Ibid.* X., 145). These papers, all useful in their way, may be considered as dealing with the external morphology of earth-works; Mr. Holmes take us a step further and deals with their comparative morphology. But there still remains before us for future work the systematic excavation of these relics of past ages, and by this method alone can we ever hope to unravel the mystery of their origin. The necessity for this work is as pressing now as when I brought it before the Club in 1883 (*Trans.* IV., 116) as there is always the danger of their removal by agricultural and building operations. That this is a real danger from the anthropological point of view may be gathered from the account given by Mr. Holmes in his presidential address of 1887 (ESSEX NATURALIST I., 79) in which he describes the destruction of the "Pictsbury Ramparts" witnessed by himself and Mr. Cole. A large mound at Wormingford was destroyed about 1836 (Jenkins, as quoted in ESSEX NATURALIST I., 82); Stukeley's so-called "Alate Temple of the Druids" on Navestock Common, the site of which was identified by the Rev. Coode Hore and myself in 1894 (ESSEX NATURALIST VIII, 213) has practically been obliterated; the "Red Hills" have in nearly every case been ploughed down or otherwise tampered with, and the Uphall Camp at Barking described by Mr. Crouch is but a fragment of a large camp. I am glad to learn that there is a prospect of this remnant being systematically investigated in the course of this present year.

The field covered by anthropology is so wide that large numbers of apparently disconnected subjects dealt with by our Society can be fairly classified under this heading. Thus the presidential address by Mr. T. V. Holmes entitled "Notes on the evidence bearing upon British Ethnology" (*Trans.* IV., 189) and Mr. F. Chancellor's presidential address in 1894, "A Sketch of the Development of Architecture in Essex" (ESSEX NATURALIST VIII., 165), which deals with the subject from an evolutional point of view, are both contributions to anthropology. In the same volume (p. 71) is published Mr. George Day's "Notes on Essex Dialect and Folklore, with some account of the Divining-Rod," the only contribution to Essex Folk-lore that we have hitherto received. Mr. Laver's presidential address of 1888, "Fifty Years Ago in Essex" (*Ibid.* III., 27) contains records of old customs and beliefs that may be regarded as anthropological contributions. In fact all notices of ancient sports, customs, beliefs and industries are worthy of record from the anthropological point of view and many such contributions have appeared in our pages. I give a selection of the more prominent communications :—

Mr. Joseph Clarke's paper in 1887 on the Saffron Plant in connection with the name of Saffron Walden (ESSEX NATURALIST I., 9) relates to an extinct industry. Mr. Harting's paper on "Wild-fowl Decoys in Essex" relates to a sport and an industry which is in its last stage in this country. An ancient sport is dealt with in Mr. Harting's paper on "Hawks and Hounds in Essex in the Olden Time" (*Ibid.* III., 189) while the "Maze" at Saffron Walden described by Mr. G. N. Maynard in 1889 (*Ibid.* 244), is of unknown origin and purpose. In ancient histories of Essex many of the towns are described as being celebrated for "Bays and Says." References to this extinct manufacture are given by Major Bale for Colchester (*Ibid.* VI., 141) and the old "Bay and Say" mill at Dedham visited by the Club in 1893 is figured in the account of that meeting (*Ibid.* VII., 111.) Accounts of extinct industries are contained also in Mr. Laver's paper on "Potash-making in Essex" (*Ibid.* IX., 119), in Mr. Lovett's papers on wooden fish-hooks (*Ibid.* X., 300; XII., 28) which relate to the survival of an ancient industry, in Mr. Miller Christy's paper on "Essex as a Wine-producing County" (*Ibid.* XI., 34) and in Mr. Littler's "Notes on the Hand-printing Silk Works at Waltham Abbey and West Ham" brought under our notice last year (*Ibid.* XII., 43).

V.—METEOROLOGY.

Although weather reports have from time to time been recorded in our pages the Club has never attempted systematic observations. In view of the activity and efficiency of such central organizations as those established by the late Mr. G. J. Symons and by the Meteorological Office it may fairly be doubted whether local societies should be called upon to burden the pages of their journals and to incur the expense of printing long tables of readings of meteorological instruments. The most useful work that such societies can do in connection with this subject would rather appear to be the stimulation of local observers and the establishment of local stations where required for the purpose of supplying records to the central organization. An excellent address having this object in view was delivered at a meeting of the Club in May, 1888, by Mr. Symons (ESSEX NATURALIST II., 88) who, on that occasion, dwelt more especially upon rainfall observation. A paper on "The use of the Hygro-Spectroscope" was read before the Club in 1883 by Mr. F. W. Cory (*Trans.* IV., 123). On the other hand exceptional meteorological phenomena—and more particularly those which may be considered as having any direct influence upon physiographical conditions—should always be fully recorded, and in this respect it will be found that we have not failed whenever our County has been subjected to such visitations. Thus the great flood of August, 1888, was fully recorded by Mr. Radford Sharpe (*Ibid.* II., 199); the prolonged frost of 1890-91 formed the subject of papers by Dr. Thresh (*Ibid.* V., 64), Mr. French (*Ibid.*, 66) and Mr. Harding (*Ibid.*, 117). Mr. French also has written on the seasons of 1893 (*Ibid.* VII., 188). An account of the great storm of June 24th, 1897, was compiled by our Editor from materials supplied by Mr. Symons and others (*Ibid.* X., 112). The high tide of Nov. 29th of the same year also formed the subject of an editorial compilation and of the paper by Mr. Percy Clark already referred to under geology (*Ibid.* X., 277, 355). The results of the investigations of the effects of this tide upon the soil of the inundated lands by Messrs. Dymond and Hughes were duly noted in our pages (*Ibid.* XI., 83). Records of brilliant meteors were also noted in 1890 (*Ibid.* IV., 231) and 1894 (*Ibid.* VIII., 158). The evidence that the supposed earthquake shock of November 20th, 1887 (*Ibid.* I., 277) was due to the explosion of a meteorite was summarised from Mr. Fordham's observations and published in 1891 (*Ibid.* V., 44, from *Trans. Herts. Nat. Hist. Soc.* IV., 33-62).

VI.—EDUCATIONAL WORK.

In a broad sense the whole work of a local society may be regarded as educational inasmuch as any organization for bringing scientific activity to a focus must be regarded as a power making for general intellectual enlightenment. In many ways during the twenty-one years of our existence have we made the influence of the Club felt as an educational body. Many lectures, addresses and demonstrations in the field or in museums have been given which could not fairly be described as direct contributions to local scientific investigation, but which might be considered as pioneering efforts having for their object the stimulation of original local work in various branches of natural science. Such lectures and addresses, although in many cases delivered by acknowledged masters of the various subjects, could not very well be published *in extenso* by the Club, and so the records of this branch of our work do not figure very prominently in our printed pages. Nevertheless this work is in its way both useful and important, provided it is kept in abeyance as a secondary branch and not allowed, as is the case with many local societies, to become the main object of the Club's existence. A long course of experience in connection with the working of local societies throughout the United Kingdom, derived from my association with the Corresponding Societies' Committee of the British Association, has served to convince me that the work of a local society is weak in proportion as it has to depend upon popular lectures for keeping it alive.

Quite early in the history of the Club educational work of this kind was undertaken and the system of popular lecturing inaugurated by a lecture by Mr. Harting on Nov. 10th, 1880, on Forest Animals (*Trans.* I., 74). The second lecture in this series on January 4th, 1881, was a memorable one, as Mr. Alfred Russel Wallace, our distinguished Hon. Member, gave an abstract of the main conclusions at which he had arrived concerning insular faunas and floras (*Proc* I., lxvi.), the subject of the great work, afterwards published under the title *Island Life*. Again, on October 2nd, 1886 (*Proc.* IV., cxcii.) my friend, Mr. Wallace, favoured the Club with an advanced chapter of his work on *Darwinism*, then in course of preparation. But time will not admit of a detailed list of lectures, addresses and demonstrations given before the Club at head-quarters or elsewhere. I need only justify this branch of our work by reminding you that we have had the privilege of hearing in this capacity Sir Richard Owen, Gen. Pitt-Rivers, Sir Wm. Flower, Dr. Henry Woodward, Mr. F. W. Rudler, Prof. E. B. Poulton (whose recent appearance on February 22nd, 1902, was his third lecture to the Club), Mr. Arthur Lister, Dr. M. C. Cooke, Mr. G. Massee, Mr. D. J. Cunningham ("Transformations of Marine Animals," ESSEX NATURALIST VII., 182), Prof. Charles Stewart, Mr. Frederick Enock and others. Perhaps also the address on "The Mechanical Questions involved in the Flight of Birds," delivered by Lord Rayleigh on the occasion of the Club's visit to Terling Place in 1885 (*Proc.* IV., clxxiii.) may be looked upon as belonging to this category. I find also that I have myself contributed on some occasions to this kind of work.

In yet another direction has the Club been enabled to assist in the work of education. The Technical Instruction movement set going under the Acts of 1889 and 1890 led the Council of the Club to come forward in 1890 with a scheme which was submitted to the Essex County Council (Essex Naturalist IV., 259) and supported by a deputation invited to wait upon the Technical Instruction Committee on Feb. 2nd, 1891 (*Ibid.* V., 34). The deputation comprised, among others, our Hon. Members, Sir Henry Roscoe, one of the chief promoters in Parliament of the Acts in question, and Sir William Flower. The final outcome of our application was the co-opting of six representatives of the Club as Members of the Technical Instruction Committee, the gentlemen proposed and accepted being Sir Henry Roscoe, Mr. G. J. Symons, Mr. F. Chancellor, Mr. J. C. Shenstone, Mr. John Spiller and myself. The later history of our connection with technical education in Essex was related by Mr. Chancellor in his presidential address for 1895 (*Ibid.* IX., 30), and to this I must refer you for details. It would not be fitting for me to attempt to weigh our utility or to form any estimate of our services to our colleagues of the Technical Instruction Committee. It was extremely difficult for us in the first stages of the movement to find men with the necessary educational qualifications and willing to give their time to the very exacting duties associated with the launch of a scheme so totally new to the people of this country. Changes in the Club's representation have been made from time to time, but of the original list Mr. Chancellor, Mr. Shenstone, Mr. Spiller and myself still remain as members of the Committee. If I may for once venture upon a personal statement I should like to place upon record my own sense of obligation to the Technical Instruction Committee for having given me the opportunity of studying the practical working of the Acts in Essex during the last decade.

VII.—MUSEUM WORK.

The idea of having a museum associated with the Club has, as you are aware, been present from the beginning of our existence. "The formation of a Museum" was contemplated in the original Rules and its general scope defined in my "Inaugural Address" (*Trans.* I., 12—13). The nature of the contents of local museums was again brought before the Club by Mr. Harting in 1881 (*Trans.* II., 36; also *Proc.* II., xxii.) and we have since had many contributions from other authorities on this subject. I may refer you to the "Introductory Remarks to the Papers on the Museum and Technical Instruction Schemes" prepared when the establishment of our Museum at Chelmsford was contemplated in 1890 (ESSEX NATURALIST IV., 234) and to the reprints of valuable papers on local museums by Mr. Rudler and Prof. Traill (*Ibid.* 242, 252). We may I think flatter ourselves that the original programme so far as concerns the nature of our collections has been faithfully adhered to. That such museums, when properly stocked and arranged, are of great educational value has long been recognized by all who have given attention to the subject, and Sir Wm. Flower addressed the Club on this point at a meeting held at Chelmsford in 1891 (*Ibid.* V., 71). We have certainly—thanks to the wise policy adopted by our Curator—kept the contents of our museums well within the prescribed limits and have avoided the temptation of converting them into old curiosity shops, a danger foreseen at the outset and evidently familiar to all who have had opportunities of seeing many provincial museums. It may be of interest to quote in this connection a letter from the late Prof. Huxley referring to a scheme for a museum in Manchester which he had been requested to draw up:—

"I have no hesitation whatever in expressing the opinion that, except in the case of large and wealthy towns (and even in their case primarily) a Local Museum should be exactly what its name implies, viz., 'local'—illustrating local Geology, local Botany, local Zoology and local Archæology.

"Such a Museum, if residents who are interested in these sciences take proper pains, may be brought to a great degree of perfection and be unique of its kind. It will tell both natives and strangers exactly what they want to know, and possess great scientific interest and importance. Whereas the ordinary lumber-room of clubs from New Zealand, Hindoo idols, shark's teeth, mangy monkeys, scorpions and conch shells—who shall describe the weary inutility of it? It is really worse than nothing, because it leads the unwary to look for the objects of science elsewhere than under their noses."—*Life and Letters*, vol. I., p. 136.

The history of our own museums requires but very brief recapitulation. The first attempt to establish a Forest Museum dates from 1883, when, at the suggestion of Mr. Cole, a meeting was held at Knighton in order to confer with Mr. Edward North Buxton, with the object of ascertaining whether Queen Elizabeth's

Lodge, at Chingford, would be available for this purpose (*Proc.* IV., lxvi.) Eleven years elapsed before another effort was made and the meeting held at Chingford, on Feb. 24th, 1894 (ESSEX NATURALIST VIII., 44), may be said to have inaugurated the present state of affairs as regards the Chingford Museum which was formally opened on Nov. 2nd, 1895, by Mr. Deputy Halse, Chairman of the Epping Forest Committee of the Corporation of London (*Ibid.* IX., 101). The later restoration of the Lodge and the re-arrangement of the museum bring us down to recent history, and I need only add that the Club is greatly indebted to Mr. Cole on the one hand for all the labour and trouble which he has taken, and on the other hand to the Epping Forest Committee, and especially to Mr. E. N. Buxton for the sympathetic response with which our efforts to establish this museum have been met by the Corporation of London.

The vicissitudes of the central (County) museum are also too well known to require more than a passing reference. The first announcement of Mr. Passmore Edwards' munificent offer to build the museum, which now houses our collections and library was made by the Secretary at the meeting on Nov. 27th, 1897 (ESSEX NATURALIST X., 231), and the foundation-stone was laid by Mr. Passmore Edwards on Oct. 6th, 1898 (*Ibid.*, 340). The subsequent history is traced and the agreement with the West Ham Corporation given in the same volume (p. 337) and further details concerning the history of the Museum and its collections are printed in our series of *Museum Handbooks* (*No.* 3; Oct., 1900). After a nomadic existence of nearly twenty years the Club has at length found its present home, and the future stability of the museum is assured by its association with the Municipal Technical Institute in which we are now assembled. The advantages arising from that association and the part played by the Museum in the work of the Club were forcibly dwelt upon by the Countess of Warwick in her address delivered at the opening ceremony on Oct. 18th, 1900 (ESSEX NATURALIST XI., 323).

One result of the establishments of our two museums has been the issue of another set of publications, the series of *Museum Handbooks*, one of which has been referred to above. It will be admitted that these pamphlets are most useful as popular guides to the various groups of objects contained in our collections, and the Club is much indebted to those who have contributed to the series :—

1. *General Account of the Epping Forest Museum, with a Description of Queen Elizabeth's Lodge.* By W. Cole (in preparation).

2. *Notes on the Romano-British Settlement at Chigwell, Essex, with a Description of the Articles exhibited in the Epping Forest Museum.* By I. Chalkley Gould-

3. *The Essex Museum of Natural History. A Short Statement of the Constitution, Aims and Methods of the Museum.* By W. Cole.

4. *A Brief Sketch of the Crag Formation of East Anglia. An outline of the nature, position, &c., of the beds which have furnished the collection of Crag Fossils in the Essex Museum of Natural History.* By W. H. Dalton.

5. *A Handbook to the Collection of Pre-historic Objects in the Essex Museum of Natural History.* By F. W. Reader.

Although I have undertaken in this address to give an account of work actually accomplished rather than attempt to point out the future needs of the Club, I cannot refrain from drawing attention briefly to the requirements of our museums. Although the collections brought together by the unflagging zeal of our Curator and the generous contributions of our members and friends may be fairly described as both rich in material and most thoroughly appropriate, there still remains very much to be done to bring the museums up to that standard of excellence which the past record of the Club leads us to look for. There is still scope for that organised and co-operative system of collecting which I advocated in 1880 (*Trans.* I., 20) in order to help fill the gaps yet existing in our series. Still more may we plead for the means to enable us to classify and arrange the collections with the greatest effect, for which purpose more cabinets and fittings are required for both and especially for the Epping Forest Museum, the re-equipment of which has been made incumbent upon us by the recent restoration of the building.

VIII.—THE CLUB IN ITS RELATIONS TO EPPING FOREST.

Established as we were in the year 1880 in the Forest District, and about the period when that splendid tract of country had been rescued from the hands of its depredators by the public spirit of the Corporation of London, it is but natural that we should have taken, as in fact it was our duty as a body of naturalists to take, the greatest interest in its welfare. Looking back to the history of our connection with the Forest in our collective capacity as a scientific organization we may, I think, feel satisfied that our influence has made itself felt on many occasions for the benefit of the Forest and its frequenters. Sometimes we may have found it our duty to take side against the Conservators; at other times to support their policy with equal vigour. Whatever action we may have taken has been solely in the best interests of the Forest as far as knowledge and judgment could lead us. On the whole I venture to think that such action as we have from time to time felt called upon to take has resulted in nothing but good from the naturalists' point of view. I may remind you that very early in our career we felt bound to organize an opposition to a projected railway extension across the Forest by the Great Eastern Railway Co., and a resolution of the Council of Jan. 8th, 1881, was brought before the Club on Jan. 22nd (*Proc.* I., lxvii.). On Feb. 4th deputations from the Club and other Societies waited upon the Metropolitan Board of Works and the Epping Forest Clauses of the Bill were ultimately withdrawn (*Ibid.* II., v.) Again, in 1881, the proposed extension of the tram-line along the "Ranger's Road" was opposed by the Club (*Ibid.* lxxxiv.) and that Bill was also withdrawn (*Ibid.* lxxxvii.). On May 6th, 1882, the Forest was formally dedicated to the public by our late revered Sovereign, Queen Victoria, and shortly after this ceremony the Club had again to take action in opposing another and more serious attempt at railway encroachment (*Ibid.* III., xcviii.) The agitation in this case assumed more than local significance, and our action was watched, approved of and supported by large numbers of natural history societies and by individual men of science throughout the country. Deputations convened by the Club were received at the House of Commons on Feb. 20th, 1883, by Sir John Lubbock, and on March 9th, by Sir Selwin-Ibbetson and Lord Eustace Cecil, and three days later, on the motion of Mr. James Bryce, the Bill was thrown out on its second reading by a majority of 148 (*Ibid.* IV., viii.) The story of these polemics is buried in our archives and may be regarded as ancient history. It does not often devolve upon a scientific society to assume the functions of a body militant, but it must be remembered that we looked upon the Forest as a natural-history preserve which it was our duty to guard most jealously from unnecessary molestation. It is to be hoped that this policy will be maintained by the Club and that our fighting forces will be always found ready to take the field should any similar dangers threaten the Forest in the future.

More in harmony with the work of a Society such as ours is legitimate criticism, discussion and advising in connection with the management of the Forest in so far as forest management is a question of applied science. Very early in the history of the Club we had occasion to take alarm at certain indications of policy with respect to the management, and a discussion was held at a meeting in February, 1882, when the general question of the management of the Forest and the necessary measures for the protection of its animals and plants were considered by many experts, the Verderers being represented on that occasion by Mr. Andrew Johnston (*Proc.* III., *Appendix No.* I., pp. ix. *et seq.*). A conference with Mr. E. N. Buxton and his brother Verderers was subsequently held in June, 1882, at Knighton (*Ibid.* III., xxviii.) The full report of the discussion and the papers communicated at the meeting in February, together with the opinions of experts and the statement prepared in connection with our opposition to the railway scheme of 1883 were all brought together as a contribution to the general subject of the Forest management in an Appendix (*No.* I.) to the third volume of our *Proceedings*. That Appendix contains an Editorial introduction giving an excellent historical summary of the state of affairs down to that period and papers by Dr. M. C. Cooke, Prof. Boulger, Mr. Harting, Mr. Burrows and myself.

A few years later, in 1889, the management of the Forest formed the subject of a series of virulent attacks in certain newspapers. Without committing the Club collectively to any action in connection with this anonymous and irresponsible agitation, a meeting was held in April of that year in order to inspect the portions which had undergone thinning, and a discussion took place, in the course of which Prof. Boulger made some valuable criticisms and suggestions concerning certain details of the operations of which the results had been inspected. No formal action of the Club was considered necessary on that occasion, and the general policy of gradually removing the old pollards and allowing them to be replaced by young trees was in no way opposed (ESSEX NATURALIST III., 164). In 1894 the thinning operations again drew forth newspaper criticisms, at first from writers whose opinions were worthy of serious consideration, but who were apparently uninstructed as to the true condition of the Forest, and ultimately from the Press at large, fomented into rancorous activity by irresponsible scribblers and condemning the action of the Verderers with that vehemence and assurance which are so generally found in association with a profound ignorance of the subject under criticism. It appeared that the time had arrived for formal intervention by the Club on behalf of the Verderers, whose case had been so grossly misrepresented in the course of the newspaper controversy, and the great meeting of April 28th, 1894, will always remain memorable in our annals as having been the occasion for the free discussion of the action of the Verderers after having given our members and the public the opportunity of seeing for themselves the places where thinning had been going on, and of hearing from Mr. Buxton on the spot the reasons for carrying out these operations (ESSEX NATURALIST VIII., 52—71). That meeting as you all know resulted in what was practically a vote of confidence in the Conservators, and marked the beginning of the turn of the tide of popular opinion. In this we may, I think, take credit for having done a good piece of work for the benefit of the Forest, for if the ignorant clamour that had been raised had been allowed to take practical form by paralysing the hands of the Conservators, the Forest would have lost the valuable supervision of the best informed and most skilful of its Verderers to its everlasting detriment. The first report of the experts appointed by the Corporation of London to examine into the operations in progress was made on June 4th, 1894 (ESSEX NATURALIST VIII., 117) and in substance shows that the vote of confidence passed at our meeting in April was justified (see *Nature*, July 5th, 1894). The agitation was renewed the following year, and resolutions passed at a public meeting of the complainants held at Wanstead were presented to the Epping Forest Committee of the Corporation of London by a deputation on May 13th, 1895. It was not thought necessary on this occasion to bring further organised resistance from the Club to bear upon the controversy as no new arguments or facts had been adduced by the agitators, but I ventured to collect on my own responsibility a large body of expert evidence and of opinions from representative men, all of whom had personally inspected the Forest, and also from many leading inhabitants of the Forest district, all expressing approval of the action of the Conservators. The two memorials were presented by me at a meeting of the Epping Forest Committee on May 10th, 1895, the deputation having been introduced by Mr. Andrew Johnston, and having consisted of several representatives of the Club in addition to Mr. Joslin, the High Sheriff of Essex, and Sir Robert Hunter. The outcome of this second agitation was the appointment by the Corporation of a second Commission of inquiry by the same experts, and their report was presented in November, 1895. This second report practically endorses their first, and has convinced the public that no danger need be apprehended from the action of the Conservators. The memorials and the final report of the experts will be found in the ESSEX NATURALIST (IX., 74–80) and in the same volume Mr. Edward North Buxton published his views concerning the principles governing the management of the woodland in the Forest (pp. 233–236). On many occasions since the decisive meeting of 1894 have we given our members opportunities of seeing for themselves the actual results of the judicious attempts of the Conservators to naturalise that tract of most unnaturally pollarded woodland which was committed to their care by the Epping Forest Act of 1878. That their policy was sound and that their efforts have been and are being crowned with all the success that can be reasonably expected is amply justified by the present condition of the Forest. There remains much to be done to insure its perpetuation as a forest for the generations to come, since there are still very serious dangers threatening the growth of the new vegetation from which is to be developed the forest of the future. But this address deals rather with the past than with the future, and any expression of opinion concerning methods that may yet have to be adopted would be out of place on the present occasion.

In one other respect since the dedication of the Forest in 1882 have we reason to rejoice in the association of the Buxtons with that district. In that year some twelve acres of land known as the Oakhill Enclosure on the Theydon Road were threatened by the builder, and attention was called to this danger by our Secretary (*Proc.* III., xi.) In May, 1889 the Lord Mayor of London, at a dinner of the Epping Forest Committee, read a letter from Sir T. Fowell Buxton which practically amounted to an anouncement that he and his brother, Mr. E. N. Buxton, has purchased the plot of land in question and had presented it to be kept as part of the Forest for ever. This generous addition was acknowledged by a resolution passed by the Club at the meeting held at Writtle Park in that same month (ESSEX NATURALIST III., 57). Again, in 1890, Mr. Andrew Johnston announced at a meeting held in Epping Forest on May 17th, that Sir Fowell and Mr. E. N. Buxton and a relative had made an offer of contributing towards a fund of £6,000 which was required for the acquisition of a portion (over 30 acres) of Highams Park at Woodford (*Ibid.* IV., 127). Of the total amount required the sum of £3,000 was provided by the Corporation of London, and of the £3,000 which it was required to raise locally the Buxtons offered £1,800, the remainder having been subsequently raised as set forth in the history of this addition to the Forest printed in full in the ESSEX NATURALIST (V., 137). It was again the pleasant duty of the Club in Dec., 1890, to pass a resolution thanking the Buxtons for their munificent action in connection with this matter (*Ibid.* IV., 230) and a meeting was held in March, 1891, to enable our members to see this latest addition to the Forest (*Ibid.* V., 129). Once again, in October, 1898, Mr. E. N. Buxton presented as a further contribution to the Forest the picturesque elevation known as Yardley Hill, an addition of some 28 acres in extent (*Ibid.* XI., 78; see also p. 268). A meeting held in June, 1899, enabled our members to realize the extent of public indebtedness to Mr. Buxton, to whom a vote of thanks was again accorded on behalf of the Club (*Ibid.* XI., 129).[4]

A few papers concerning the history and topography of the Forest district have been contributed to the Club, such, for example, as Mr. W. C. Waller's notes on the old track from London to Epping (ESSEX NATURALIST VI., 206), on old Loughton Hall (*Ibid.* VII., 14), on the Epping Hunt (*Ibid.* VIII., 31), and on the Barclay-Johnston MSS. and Papers relating to Epping Forest (*Ibid.* IX., 157), and Mr. I. C.

4 With reference to the history of the rescue of the Forest for the public, Mr. E. N. Buxton writes to me under the date of February 27th :—"My services are as nothing to my brother Fowell's. By backing up Willingale against the Lords of Manors long before the City came in, and when the cause was unpopular, he not only did a thing which required the highest moral courage, but without it there would have been no Forest to preserve. Single-handed he arrested the wave of enclosures . . . . . of the little bits I have been able to add the Highams Park was the most difficult transaction and the most interesting." While this Address was passing through the press it was announced at the Court of Common Council that Mr. Gerald Buxton had purchased and presented as another addition to the Forest, the greater part of Bell Common, Epping, and the waste land along the Ivy Chimnies Road.

Gould's note on a Forest Document of the Eighteenth Century (*Ibid.* IX., 72). We have had also special communications on the Forest Lodges by Mr. Waller (*Ibid.* VII., 82) and on Queen Elizabeth's Lodge, the headquarters of our Epping Forest Museum, by Mr. James Cubitt (*Ibid.* IX., 166) and Mr. W. W. Love (*Ibid.* XI., 153). I will venture also to remind you that in 1894-95 I succeeded in re-discovering most of the old boundary stones on the eastern side of that wide expanse of country which constituted the Great Waltham Forest of early times, the area which we now propose to accept as the Forest district in connection with the Chingford Museum. The stones in the Navestock district were visited by the Club on July 28th, 1894 (ESSEX NATURALIST VIII., 213) aud the complete story of the boundary stones published the following year (*Ibid.* IX., 1). The account of the perambulation of 1641 when these stones were set up was reprinted in a paper "On the Area of Epping Forest for Faunistic purposes," published by our Secretary in 1892 (*Ibid.* VI., 10). The work of the Club is recognized also in Mr. E. N. Buxton's excellent little book *Epping Forest*, which contains many references to our publications as well as several contributions from our members.

IX.—MISCELLANEOUS WORK.

Much of the work done by our Club, as in the case of other local societies, does not admit of being exactly pigeon-holed. Field meetings naturally call forth communications concerning the history of the places visited and of their more interesting buildings and antiquities, as well as biographical sketches of any past inhabitants who may have made the place famous. Thus much topographical and biographical information has found its way into the reports of our field meetings, adding very much to their interest, although such information does not strictly speaking come within the province of a scientific society. The biographies of famous Essex people who have made their mark as workers in science must, however, always be regarded as legitimate matter for publication in our pages, and I am glad to be able to refer to many such communications. The purely antiquarian and topographical interests centreing in our County are already well catered for by the Essex Archæological Society and the *Essex Review*, and their is no occasion for any unnecessary duplication of work in this direction.

Biographies. Among the biographical notices of Essex scientific worthies I may refer to Professor Boulger's presidential address in 1885, dealing with the life and work of our most illustrious naturalist, John Ray (*Trans.* IV., 171), supplemented by another paper on the domestic life of John Ray at Black Notley, also by Prof. Boulger (*Proc.* IV., clix.), and by another on John Ray as an entomologist, by Mr. Fitch (*Ibid.* clxv.) A notice of Benjamin Allen, of Braintree, the contemporary of Ray was published by Mr. Fitch in 1890 (ESSEX NATURALIST IV., 192). Prof. Boulger also gave us in 1888 a paper on the life and works of the celebrated Dr. Derham of Upminster (*Ibid.* II., 133), but this does not appear to have been published. A meeting in conjunction with the Gilbert Club at Colchester, in 1890 (*Ibid.* IV., 174), gave an opportunity for the communication to the Club by my colleague, Prof. Silvanus P. Thompson, of a life of Dr. William Gilbert, the author of the great work on *The Magnet* and founder of the science of electricity (*Ibid.* V., 50). Prof. Thompson, I may add, had previously in 1887 lectured to the Club on Gilbert's magnetic work (*Ibid.* I., 94). Christopher Saxton, the draughtsman of the oldest known map of Essex, formed the subject of a notice by Mr. Avery, in 1898 (*Ibid.* XI., 240). Izaak Walton's association with the River Lea formed the subject of a paper read by Mr. Harting in 1894 (*Ibid.* VIII., 186). Among Essex scientific worthies of later times I may refer to Christopher Parsons, noticed by Mr. Fitch (*Ibid.* III., 55), and John Brown, of Stanway, whose life was published by Mr. A. P. Wire in 1890 (*Ibid.* IV., 158) and supplemented in 1898 by a note by Messrs. Kennard and Woodward on a manuscript note-book left by that famous old naturalist and now in the library of the British Museum of Natural History (*Ibid.* X., 288).

A visit of the Club to Constable's country, the vale of Dedham, in 1893, enabled us to receive from Mr. Charles Benham a paper on "John Constable as a Naturalist" (*Ibid.* VII.; 112).

Topography. The conductors of our field meetings have in many cases been at great pains to draw up interesting accounts of the places visited, and we have thus published some few papers and many notes which may be classed as topographical contributions. A meeting at Chigwell in July, 1881, produced a most interesting history of that place from the pen of Mr. T.

Fisher Unwin (*Proc.* II., xxxiv.) In like manner we have received and published "An Angler's Notes on Dagenham Lake," by Mr. John Hillier (ESSEX NATURALIST VI., 146), and a paper on Dagenham Breach by Mr. Walter Crouch (*Ibid.*, 155). The voyages down the River Lea on the Conservancy barge under the conductorship of the late Major Lamorock Flower, have also led to the publication of much information about that river. Thus, in July, 1894, Major Flower gave an address (*Ibid.* VIII., 206); subsequent meetings on the Lea in June, 1895, and June, 1896, gave rise, among other contributions, to Mr. Crouch's "Notes on the River Lea; Bromley, Bow, Old Ford" (*Ibid.* IX., 89; see also report of second voyage from Hertford to Waltham Abbey, *Ibid.*, 208) and to Mr. W. C. Waller's "Episode in the History of the River Lea" (*Ibid.*, 190). An excursion from Maldon to Chelmsford in 1891 gave us Mr. Fitch's "Notes on the History of the Chelmer and Blackwater Navigation" (*Ibid.* V., 248); a meeting at St. Osyth and Brightlingsea the same year gave us Messrs. Shenstone and Laver's "Notes on the Colne Oyster Fishery" (*Ibid.*, 257). A famous visit to Maldon and the Blackwater Estuary, under the conductorship of Mr. Fitch in September, 1888, resulted in a report replete with the topography, archæology, geology and natural history of that district (*Ibid.* II., 229-250) to say nothing of an illustrated versified account of the excursion by Mr. F. Carruthers Gould, whose *New Song of Maldon* cannot, however, be claimed as one of the Club's publications. As contributions to antiquarian topography we may consider Mr. I. C. Gould's paper on "A Naturalist in Essex a Century and a half ago" (*Ibid.* VI., 112) and Mr. Crouch's "Astronomy in Wanstead" (*Ibid.* VII., 151), while the Rev. S. Coode Hore's paper on "Navestock in Olden Days; stray notes, Pre-historic, Saxon and Norman" is a masterpiece of local history (*Ibid.* VIII., 220).

Sanitation. In a few directions our work has come into contact with sanitary science. In 1890 Mr. William Rome sounded a note of alarm concerning the proposed discharge of the London sewage into the sea at Fowlness and Southminster and the effect upon the Essex oyster culture (ESSEX NATURALIST IV., 41), a proposal which was fortunately afterwards withdrawn (*Ibid.*, 125). Dr. J. C. Thresh gave us a paper on "The Sanitary Condition of Essex," in 1890 (*Ibid.* 97), and another in 1891 on "Vital Statistics for the County of Essex" (*Ibid.* V., 47), and in his presidential address for 1896 Mr. David Howard gave us a chapter on the water supply of the River Lea viewed in the light of recent researches (*Ibid.* IX., 150).

CONCLUSION.

The record of work now summarised is the sequel to the "Inaugural Address" of 1880. We may claim to have carried out our programme, and, considering the slender means at our disposal, I venture to think that our achievements are such as to reflect credit upon our contributors and upon the Society as a working body. The *Victoria History* of the County when completed will bear testimony to the value of our labours; the annual catalogue of papers published by the Corresponding Societies Committee of the British Association bears witness to our having taken a leading position among the local societies of this country. Not only is the Club indebted to those members who by their work have enabled us to realise the objects which we had in view at the outset, but our obligations to those of the executive officials who have undertaken the arduous labours of administration during the past twenty-one years are too great to be allowed to pass unnoticed on the present occasion. Many have taken part at various times in this administrative work, but it will not, I am sure, be considered invidious if I refer to the fact—well known to you all—that the whole labour of editing the publications referred to in this Address has been carried out by Mr. William Cole, who has also acted as Hon. Secretary during the entire period of our existence. In addition to these duties, Mr. Cole has been Curator of both our museums, and his brother, Mr. B. G. Cole, has also given his services as Assistant Hon. Secretary, while the artistic skill of Mr. Henry A. Cole has been freely placed at the disposal of the Club for the illustration of the pages of our publications. Without this valuable assistance it would have been impossible for us to have given our members so many illustrations as we have been enabled to through Mr. Henry Cole's gratuitous contributions.

The record of twenty-one years as herein set forth should encourage us to look forward with every confidence to a period of equal or even greater activity in the future. It might, perhaps be urged that we should have done more. Possibly this may be the case, but I do not think that we have reason to be dissatisfied on the whole with our output. It must be remembered that the chief source of expenditure in a society such as this is publication. By this is our utility made manifest to our members and to the public at large. But publication is limited by income, and the latter is dependent upon our membership. We have, like most other societies, seen periods of elevation and depression – we have passed through our crises and we may now flatter ourselves that the Club has found a home where its labours can be carried on peacefully and uninterruptedly. In view of our past achievements we are at any rate justified now in pleading for further support. A list of Members of under 300 means an income of about £150 to £200 per annum, out of which we have to meet the cost of publication and to furnish our contribution to the curatorial expenses of the museum. If our members would like to have a larger volume of the ESSEX NATURALIST every year—and this is a consummation devoutly to be wished—we must increase the numbers of our subscribing members. Our subscription is not ruinous; I know of no society of a like nature from which its members get so much in return for their subscription in the way of meetings and publications. I certainly think that our journal might be issued more frequently and more regularly, and now that the chief burden of organizing the museums is off our Editor's shoulders we may look for improvement in this respect. But the total amount of printed matter—apart from the frequency of issue—cannot very well exceed our present volumes with the income at present available. It is an encouraging indication that we have discharged our functions towards the scientific world that the supply of original contributions has practically never failed during the twenty-one years of our existence. That seems to me one of the very healthiest signs of our vitality, and I confess that it is an experience which, in view of the history of many local societies, has caused me no little surprise. Our position has generally been that we have had more material in hand than we have been able to afford to publish. That is the state of affairs at the present time. Much as we have accomplished during the twenty-one years passed under review there yet remain vast fields for future workers. To encourage this work by joining our ranks, if only out of public spirit for the credit of the County, is assuredly the duty of all who have the intellectual and scientific welfare of that County at heart.

NEOLITHIC IMPLEMENTS FROM THE NORTH DOWNS NEAR SUTTON, SURREY.

By J. P. JOHNSON.

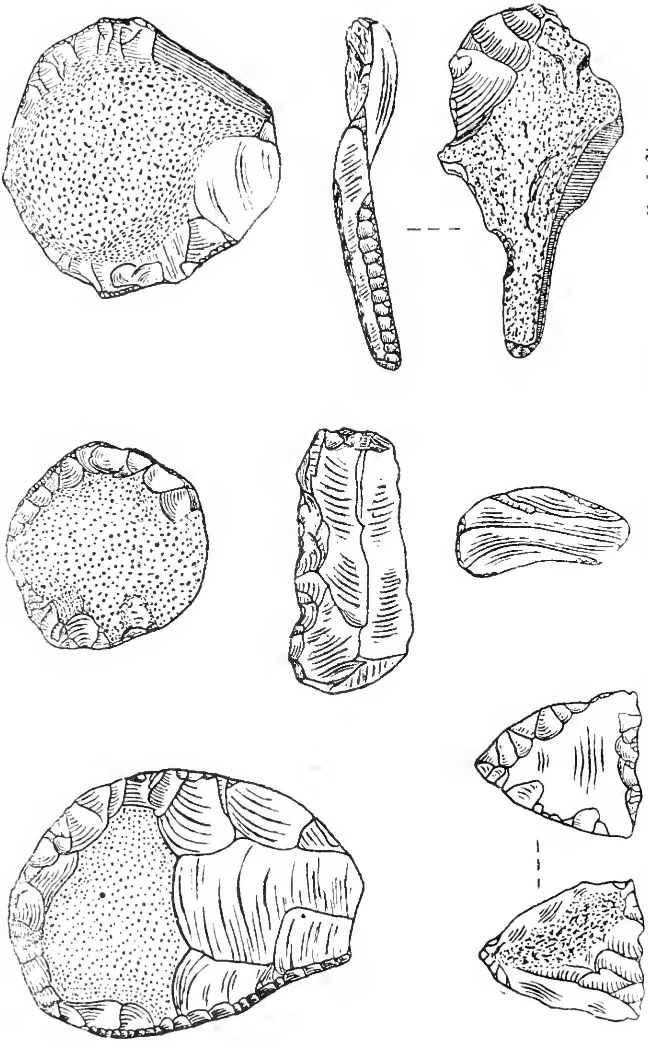
Judging from the vast quantity of flakes and chips with which they are strewn, the North Downs, in the neighbourhood of Sutton, must once have been the site of a great flint implement industry, which no doubt owed its position to the amount of raw material at hand.

The majority of these flakes are as sharp and translucent as any freshly produced specimens, from which they differ, however, in being, without exception, highly lustrous. Those that have lain long on the surface, exposed to the direct action of atmospheric agencies have become opaque, and many are discoloured with rust due to the oxidation of the streaks of iron gained by contact with the plough, while a small proportion are patinated, that is, the surface of the flint has undergone some change which has given it a glazed appearance. They are mostly small, few reaching the size of the average Palæolithic flake. In colour they range, in glassy specimens, from amber to black, and in porcellaneous examples, from white, through mottled blue and white to blue, with every intermediate tint imaginable.

While the greater number of flakes are merely chips that have been struck off in the manufacture of implements, many, on the other hand, are designedly shaped, and are such as require great skill in their production. Such are the minute thin narrow flakes, one of which is shewn in the set of figures on page 118 with three or more faces and a well-developed bulb of percussion. Miscellaneous flakes were largely employed by pre-historic man for various purposes Nearly all have their edges notched through use.

These flakes are not all of the same age. Sometimes one comes across specimens that have been re-trimmed at a later period. In cases where the original flake is externally mottled and opaque, the newer chipping is black, having penetrated the semi-transparent interior.

The cores from which the flakes have been struck are frequently met with. I have one very beautiful example, con-



Neolithic Scrapers, Fabricator, Arrow-head, Borer and Small Flake ; all of flint.
From the North Downs, Sutton. (Actual size).

sisting of the half of a small nodule of jet-black flint, from which numerous long narrow flakes have been driven. Calcined flints are extremely abundant.

Together with the chips of flint one occasionally finds well-fashioned implements. I have made outline drawings, which are reproduced in the annexed plate, of my choicest specimens.

The three implements at the top are very neatly finished scrapers. Similar implements, mounted in handles, are used by the Eskimos for scraping skins, hence the name. They are the only three of the kind that I have found. Rough, concave and irregularly shaped scrapers are common.

The central figure is either another form of scraper, or else it is a fabricator, *i.e.*, an instrument employed in producing the very fine flaking on arrow-heads, etc.

The drawing in the lower left-hand corner represents the two sides of a chipped arrow-head—the only one I have obtained. I have also a very beautiful flake arrow-head. Small triangular flakes that were probably used as arrow-heads are abundant.

The adjacent figure shews one of the pigmy flakes referred to above.

The instrument of which two views are given in the lower right-hand corner, is a remarkably fine borer. It does not appear to be quite finished, one edge of the boring portion being only partly chipped.

The above-described implements are all in the same fresh condition and seem to be of the same minor age. With the exception of the arrow-head, they are all fashioned out of flakes, the reverse side consisting in each case of a smooth surface, with a prominent bulb of percussion at the untrimmed end.

I think one is justified in assuming that these highly finished implements were made for the purposes of barter to other people who were neither so skilled in their manufacture, nor so favoured with a supply of siliceous material. Considering the amount of flint *débris* scattered over the Downs, an enormous number of implements must have been produced. If they had been used by the makers only, one would expect to find them on the site of manufacture, where, however, they are really rare.

NOTES ON THE BLACK-HEADED GULL IN ESSEX IN 1901.

By PERCY CLARK, B.A.

To the casual visitor up the muddy Essex estuaries, perhaps little annual change in their state and condition is apparent, and yet constant forces are at work in those regions, which sometimes more or sometimes less must make their inevitable mark.

A tidal wave comes up from the North Sea, such as in November, 1897, and swamps an island or a marsh, leaving deposit behind which tells a tale for years after; perhaps a portion of the coast is abandoned to the ever-encroaching wave, which has happened here and there, and the waters of the sea in places permanently enlarged their sphere.

But even in its ordinary and normal rotation the regular ebb and flow of the tide, carrying its volume of mud in solution, as it overswells the tangled foreshore will by imperceptible degrees gradually raise its level, so that the flats even recently reclaimed and enclosed by sea walls, are already distinctly sunk below the higher portions of the saltings that remain outside them.

This will be noticed all along the Essex coasts, and as the sea is still gaining on those shores, and when unhindered by artificial means, working a relentless devastation and ruin; it proves that on the whole the land has a tendency to sink, notwithstanding the amount of deposit that is left after every flood.

The working of this law is perhaps seen clearest in the Broad district of Norfolk and Suffolk, where the path of the tidal rivers has become in this way so raised above the surrounding marshes that sailing along them, is like travelling on an elevated canal

But be this as it may, the Black-Headed Gulls for the last few years seem more and more inclined to build their nests and breed on the stretch of saltings that border our tidal channels. Possibly they may have found that in some places the relative height of the saltings is increasing, and that for the present, only abnormal spring tides submerge the higher parts.

This habit of the birds is nothing really new, for a century ago (roughly speaking) many of the salting islands in the Essex Rivers were even then famous as their breeding haunts.

But whether owing to a subsequent and more rapid submergence of the land, or owing to the persecutions of egg collectors and others, this custom was abandoned by the gulls, it is certain that just now they are reverting to their former instincts.

Such is the case, for instance, in Hamford Water, where, as I have previously noted,[1] of late years a large and flourishing colony of Black-Headed Gulls seems to have permanently established itself.

In the summer of 1901 I found that the gulls had settled their nursery on much the same stretch of saltings as they had done the year before, but this time to the west of the creek leading to the hard on Horsey Island, instead of to the East of it, and paying a visit there on June 6th last I soon discovered about 30 nests, most of them containing three eggs.

The little islets in the muddy creeks were especially patronised, and were beyond my reach, but the nests I came across elsewhere were all, as usual, among the thick weeds and grass at the highest point of the saltings, and were of the low and scanty construction which I have previously described. I calculated that there were about 100 birds flying around, much the same numbers as in 1900.

At the hard on the island close by I met a farmer's boy who asked me if there were any birds breeding on the saltings, and informed me he had never yet seen a gull's egg ; a remark which I considered very satisfactory, though I rejoined that if ever he did happen to do so, it was penal to remove it.

From Hamford Waters I sailed the next day, June 7th, to the Colne, and on the St. Osyth Marshes by "Bricclesea" I found the Black-headed Gulls as busy and numerous as ever.

Here also there were about 100 birds wheeling overhead and I soon discovered without any difficulty about 30 to 40 nests; indeed the birds make no attempt at concealment, as the saltings here are very open, entirely lacking even the slight protection afforded by the denser growth of grass and herbage which characterises Gullery No. 1.

Though early in the summer (I was a month sooner than usual in my visit), there were several young birds just hatched in

[1] Essex Naturalist, Vol. xi., p. 312, Mr. Clark's previous papers on the Essex Black-Headed Gulls will be found in Vol. x., p. 388 and Vol. xi., p. 184.—Ed.

the nests, and others were cracking the shells and hatching, and there were many eggs in pairs and single ones.

I had landed from a boat at the far side of the creek, but was not to pass unnoticed, for before long I was espied by Mr. Cross of the adjoining farm, who came riding down across the flats to see what I was doing, proving that any pillagers with bad intent would with difficulty escape his keen watchful eye. We two, however, had met before, and he readily forgave me my intrusion on his property.

On May 20th, he informed me, he had counted 60 nests of Black-Headed Gulls upon the saltings, and he thought the birds had certainly increased during the last year or two, although the spring tides still wash and carry away many of the eggs.

The gulls, he said, had now almost deserted the fresh water fleets farther inland, amid the thick flags and weeds of which they were formerly wont to make their nests, and nearly all of them had migrated to the neighbouring saltings.

I was much pleased with the account he gave, and left Gullery No. 2 feeling well satisfied with the condition of affairs ; sailing the next day to West Mersea where I hoped to encounter on Tollesbury Marshes a similar pleasant experience.

But I am sorry to say there were no gulls there this year (1901). In 1898 there were only a very few, in 1899 there was a good-sized colony, on one of the large fresh water fleets, but the spring of 1901 was a remarkably dry one, and already early in June the water was extremely low in the ponds and ditches. This might account for the desertion of the birds, but my own impression is, as I have said before, that the gulls are reverting to an old habit, and prefer nesting on the saltings, and doubtless the colony from Tollesbury had followed suit. There was not a Black-Headed Gull to be seen on those dreary level flats, and I spent the best part of an afternoon in a fruitless search; so Gullery No. 3 must be erased this year out of my list, and very probably will not appear again.

The result then of these investigations for 1901 consists in my being able to report, that two strong Gulleries, instead of three, are still flourishing in the county, with every promise that they will thrive and further increase in the future; my only regret being that Gullery No. 1 in Hamford Water can boast of no kindly guardian like Mr. Cross, who presides with such efficient care over the destinies of the one near Brightlingsea.

POSTSCRIPT—

Since writing the above, I have been in correspondence with Mr. Charles Dawkins, who has kindly given me information of a large colony of Black-Headed Gulls on the Wick Marshes near Tollesbury.

These are not far from the Hall Marshes which I drew blank this summer, but Mr. Dawkins informs me, he has known the Wick Gulleries for 13 years, and though the birds and nests have annually fluctuated considerably in numbers, they have at no time been completely absent.

It appears that in this locality the gulls still build their large clumsy nests among the reeds of the bigger fleets, and Mr. Hawkins writes that he might have put the numbers of them this year considerably above the figure he quotes in the last number of the ESSEX NATURALIST (*ante* p. 69). He says the marshmen take very good care of the nests, and his account generally is most satisfactory, so I must now add another prosperous gull colony in Essex to my list.

Perhaps bye-and-bye we may even hear of more among the islands at the mouth of the Crouch.

ORCHIS MACULATA, SUB-SPECIES ERICETORUM, LINTON, IN EPPING FOREST.

By C. E. BRITTON.

Three or four years ago my friend, Mr. James Holloway, expressed to me his opinion, that the Spotted Orchis of Epping Forest was somewhat different from the usual form of *Orchis maculata* found growing elsewhere. Last year (1900) the Epping Forest form of *Orchis maculata* was again mentioned by Mr. Holloway, and it then occurred to me, that, in all probability, this plant was the recently described sub-species, *Orchis ericetorum*, Linton. During the present season, we have both paid a certain amount of attention to the Spotted Orchis in Epping Forest, with the result that the occurrence of *O. ericetorum* as a Forest plant is firmly established. Indeed, we have seen no Spotted Orchises that seem referable to *O. maculata* in a restricted sense. A number of our plants were sent to the Rev. E. F. Linton for verification, who wrote in reply, "All the specimens you sent two days ago were my *Orchis ericetorum*." The plants forwarded were gathered at High Beach and over St. Thomas's Quarters. Perhaps it may be useful to give the original description of *O. ericetorum*, Linton, from *The Flora of Bournemouth* (1900), pp. 208-9:—

"More slender than the type; stem usually somewhat purplish above; leaves narrower, more or less recurved, even the lower cauline more or less acuminate, carinate and folded; spike 1 to 2 inches, broadly pyramidal, at length oblong; bracts purplish; flowers pale, scentless, with rose-purple markings, ground commonly white or tinged with pink, but sometimes of deeper colour; outer line of markings nearly or quite complete; nectary slender, slightly enlarged or not at all upwards, throat narrow; lower lip sub-orbicular, rounded in outline, rather spreading; mid-lobe much smaller than the broad obliquely truncate or crenate lateral lobes, not exceeding them in length and usually shorter or somewhat recurved.

"Compared with this sub-species, or rather species, if a sufficient number of these distinctions are found on further examination to hold good, the type is rather a stouter and commonly bigger plant, with broader, straighter leaves, less carinate and folded, frequently flat; spike 1½ to 2½ inches, ovate-oblong in flowering, oblong at length bracts more usually (? always), green; flowers with dark rose-purple markings (the outer line *pl. m.* disjointed) on a pale rose-purple ground; faintly aromatic (? always); nectary stouter, enlarged upwards, throat gaping obviously, lip deeply 3-cleft, vertically pendent; lobes sub-equal, lateral obliquely oblong crenulate; mid-lobe deltoid-oblong or deltoid-acuminate, distinctly exceeding and not much if at all narrower than the lateral, usually straight.

"These two plants have a wide distribution in Britain: sub-species *ericetorum* has been noted from Caithness and Sutherland to the South Coast and Guernsey, and also from Co. Wicklow. A supposed hybrid between the two occurred in Glen Lockay, Perthshire, but they seldom are found in the same locality."

"Moist places and bogs on heaths" are the habitats given. There can be no doubt that of the characters ascribed to *O. ericetorum*, some are of questionable value. Thus, some of the Epping Forest plants possess a pleasant odour; the bracts and stems are more frequently green than purplish, and though some plants show the lip with the outer line of purple markings complete, these are in the minority. The characters which to me seem most helpful in determining *O. ericetorum*, are the narrow leaves, small spike of pale flowers, mid-lobe of lip smaller than the lateral, general slender habit and its heathland habitat. Typical *O. maculata*, whilst it may be present in the Forest, I have not encountered, and, on the open heathy parts, *O. ericetorum* seems to be the only form present.

SEA-SIDE PLANTS.

BEING THE SUBSTANCE OF AN ADDRESS DELIVERED AT CANVEY ISLAND, JUNE 15th, 1901.

By PROF. G. S BOULGER, F.L.S., F.G.S., V.P.E.F.C.

Although not myself a total abstainer, I can feel for the inhabitants of this island, animal and vegetable alike, who may be said, in the words of the poet, to be surrounded by

"water, water everywhere,
Nor any drop to drink."

As we have walked along the sea-wall and beach we have noticed a variety of flowering plants, members of several widely differing Natural Orders, which agree in the common property of succulence, succulence both in stem and leaf, accompanied for the most part by a smooth surface, and in some cases by a blue-green waxy "bloom." The Marsh Samphire or Glass-wort (*Salicornia herbacea*), the Sea-blite (*Suæda maritima*), and the Crab-weed (*Atriplex portulacoides*), which grow on the "saltings," where they are overflowed at high tide, are, it is true, members of one Order, the *Chenopodiaceæ*; but the Yellow Horned Poppy (*Glaucium flavum*), the Stone-crop (*Sedum acre*), which we found so luxuriant, the Sea Sandwort (*Alsine marina*) and the variety of the Carrot (*Daucus carota*, var. *gummifer*), which occur a little farther inland, belong to very diverse groups; yet all agree in these outward characteristics, as do many other sea-side plants, such as the Sea-Kale (*Crambe maritima*), which we have not come across to-day. If we examine the structure of these plants microscopically we shall find that this succulence is largely produced by a thick, almost leathery outer wall to the epidermal cells and the presence of a large amount of water (salt-water) in the internal cellular tissue, while it is accompanied by a very small number of stomata or transpiration-pores. This thick impermeable cuticle and this internal store of water are precisely similar to the structures that we find in desert plants We have, in fact, in these plants growing close to the water's edge special adaptations to check transpiration, to economise water. Why is this? A familiar laboratory experiment throws light upon the question. If we place a thin section of fresh beetroot—a plant of sea-side origin, by the way—under the microscope and bathe it with a 5 per cent. solution of salt, we find that the red protoplasmic contents of the unbroken cells contract and withdraw from the cell-walls, the space between the walls and the contracted cell-contents being occupied by the solution of salt. In fact the living protoplasm is unable to absorb the salt and has actually to give up some of the water with which it is saturated to the hygroscopic salt-solution around it. If, on the other hand, we kill the protoplasm, by boiling or by the application of acid, before applying the salt solution we find that the latter diffuses readily into the dead cell-contents and there is no such contraction as in the first case.

This indicates that plants whose roots are supplied with salt-water are able to assimilate for purpose of nutrition but a very little of the water which reaches them: they are to a great extent subjected to a water famine; and they have developed—in many different Natural Orders — water-saving structures. Chemical analysis shows us that the plants have no choice in this matter. As the sea water is rich in salts of soda, so the ash of these sea-side plants is rich in soda; but it can readily be demonstrated that most, if not all, of this soda is physiologically useless to the plant, which cannot, however, refuse to absorb it. Not only do experiments in growing plants in prepared solutions demonstrate that they can maintain their full health and vitality while dispensing with soda; but when a sea-side plant, such as *Asparagus*, which occurs on another part of our Essex coast, is transferred into ordinary inland garden mould, which is rich in potash but poor in soda, the soda in the plant-ash rapidly becomes replaced by potash. It is, however, important to bear in mind that the converse of this experiment, the replacement of potash by soda, cannot be performed, some potash being apparently essential to the life of every flowering plant.

Succulence is not, however, the only adaptation to the economising water of which we have seen examples to-day. In several species of grass, such as the Marram (*Psamma arenaria*) and the Lyme Grass (*Elymus arenarius*), which grow near the sea, we find the leaves are rolled up and their surface, not only "glaucous," or covered with grey bloom, but marked by deep longitudinal grooves. To these grooves the few stomata are confined, and, in some cases, hairs lining the grooves would seem to be a special contrivance to re-absorb the moisture directly it has been transpired by the protected stomata.

We have then in this assemblage of sea-side plants, or "halophytes," as the physiologist terms then, of widely differing kinship, a response to the nature of their environment, producing structural modification in more than one direction, though for the same physiological purpose.

[At the delivery of the above address in response to remarks by Prof. Meldola, Mr. Boulger added that :—

He quite recognised the important bearing that the subject to which he had directed attention had upon the much debated questions of the direct action of the environment and the inheritance of acquired characters. He was afraid that botanists could not feel themselves in a position to decide these questions at present. Experiment—long continued experiment—was necessary; but, though, perhaps, all the facts to which he had alluded that day might be explicable by special adaptation of each individual and the elimination of the unadapted by natural selection, he thought it possible, if not probable, that, after many generations of such influence, adaptational characters might become fixed, so as to be inherited without liability to loss by reversion.

EPPING FOREST FUNGI: REPORTS ON THE SPECIES OBSERVED AT THE FUNGUS FORAY ON OCTOBER, 12th, 1901.

[As on previous occasions, Dr. Cooke and Mr. Massee kindly undertook to determine the more interesting species gathered, and their reports follow. Attention should also be called to Mr. Massee's note on the new *Amanita* in the present part of the Essex Naturalist.]

NOTES ON THE LARGER FUNGI OBSERVED.

By M. C. COOKE, M.A., LL.D., A.L.S., &c.

I found an *Agaric* at High Beach eleven years ago (1880) and could not satisfy myself at the time of its name and situation. Looking over my drawings, which have not been published, I find this species, and now I am able to place it as follows :—

Collybia pulla, Schœff t., 250. Bolton t., 15.

Pileus fleshy, thin, campanulate then expanded, obtuse, even, smooth, hygrophanous; stem usually hollow, twisted, rather striate, soft, naked, gills adnexed, rather broad, transversely pellucid striate, whitish. *Sacc. Syll.*, No. 767.

On Beech trunks, stem abruptly rooting, cuticle soft and polished. Pileus purplish bay, almost black, dusky when dry, about an inch across, before expansion, stem two or three inches long.

Amongst the specimens found and exhibited on the 12th Oct., were :—

Amanitopsis fulva, Schœff, which resembles the ordinary *Amanitopsis vaginata*, but, instead of being grey, the pileus is bright brown, and instead of being edible, the fungus is suspected of being deleterious.

Pleurotus pantoleucus, Fr. Cooke, *Illustrations* t. 275a, described in Cooke's *Handbook*, 2nd Ed., No. 368. Growing on trunks.

Russula azurea, Bres. Cooke *Illus.* t. 1088, on the ground.

Boletus aurantiporus, Howse. A fine species with large bright yellow pores.

Calocera stricta, Fries. On dead wood and branches. First time, Epping.

Entoloma porphyrophœa, Fr., on the ground, possibly recorded before under the name of *Entoloma jubata*, Fr.

Mr. W. G. Smith has also reported **Lactarius obliquus** for the Forest District.[1]

Amongst rare species, which have been recorded in previous years, were *Russula cutefracta*, Cooke, and *Russula armeniaca*, Cooke, found again in 1901.

Add also for the first time at Epping **Tricholoma circumtecta**, Cooke. *Illus.* t., 1182.

I fancy this to be the best record of new and rare Forest Fungi for at the least ten years.

LIST OF THE MICRO-FUNGI OBSERVED.

By GEORGE MASSEE, F.L.S.

The following minute species of Fungi were found, principally on dung. Those marked with an asterisk are new to the Forest Flora. Concerning those unmarked, I am uncertain as to their having been recorded before or not.

1 See page 134 of present part.

BASIDIOMYCETES.

*Grandinia crustosa, Fr. On old rotting cast-off clothing.

ASCOMYCETES.

Ascobolus immersus, Pers.
*A. brunneus, Cke.
A. furfuraceus, Pers.
A. glaber, Pers.
*Saccobolus kerverni, Boud.
*S. neglectus, Boud.
*S. depauperatus, Phil.
*Ascophanus microsporus, Phil.
*Ryparobius pelletieri, Sacc.
*R. parvisporus, Phil.
*R. sexdecemsporus, Sacc.
*R. argenteus, B. and Br.
*Bisporella monilifera, Fckl. Both ascigorus and conidial condition. On cut surface of the stump of a tree.

HYPHOMYCETES.

*Stachybotris atra, Corda. On damp paper.

AMANITA CITRINA, GON. AND RAB., A FUNGUS NEW TO BRITAIN, IN EPPING FOREST.

By GEORGE MASSEE, F.L.S. (*Royal Herbarium, Kew*).

This rare species was established and beautifully figured by Gonnermann and Rabenhorst in the *Mycologia Europæa*, p. 2, tab. 4 (1869), from German specimens. From that time up to the present, the fungus has not been observed either in Germany or elsewhere.

A. citrina is the same size, and has the same general habit as the "Fly Agaric"—*Amanita muscaria*, L.—but the pileus instead of being crimson is a clear deep lemon-yellow, with white patches. The species is very poisonous.

I had occasion to visit the Forest during the week following the last "Fungus Foray" (October 12th, 1901), for the purpose of securing some specimens found immature during the Foray, and was fortunate enough to discover two specimens of *Amanita* *citrina* on the bank of the little stream behind the "Robin Hood" Inn. I have made a drawing of this very interesting species, which I understand will be placed along with the illustrations of other Forest fungi in the Epping Forest Museum.

A FUNGOID CUCUMBER DISEASE IN ESSEX.

By M. C. COOKE, M.A., LL.D., A.L.S., &c.

It is now five years since I received from Totteridge leaves of Melon which were affected with a new form of Fungus disease, and this was described in the *Gardeners' Chronicle* for the 5th September, 1896, under the name of *Cercospora melonis*.

During the past month (September, 1901) I have had leaves of Cucumber sent to me from Chelmsford, affected with the same disease, and although my query to the sender has never been answered, I presume that the locality is Essex, if it is not really Chelmsford, and therefore comes within the limits of the Essex Field Club.

The leaves are spotted with distinct circular bleached spots, of a pale ochre colour, and about half an inch in diameter. Such spots are brittle and soon break out and fall away, the tissues being quite dead. The dead tissue is traversed by a plentiful mycelium, from which arise darkish olive threads or hyphœ, which are unbranched and septate, about 150 mm. long. These hyphæ bear long conidia, which are almost cylindrical, slightly attenuated upwards, obtuse at the extremities, a little curved, and at first multi-nucleate, ultimately five to seven-septate, faintly coloured, from 80 to 120 mm. long and about 7 mm. thick.

This fungus belongs to the Black Moulds, and most of the species are parasitic upon, and destructive to living plants. As the disease is truly endophytic and is established within the tissues before the spots appear, there are grave doubts whether there is any hope of cure. All that can be done is to prevent its spreading by destroying the infected plants.

NOTES ON FUNGI, FORESTAL AND OTHERS.

MAINLY CORRIGENDA TO THE *ILLUSTRATIONS OF BRITISH FUNGI*.[1]

By M. C. COOKE, M.A., LL.D., A.L.S., &c.

[*Read at the "Fungus Foray," October 12th, 1901.*]

I take advantage of this opportunity to address a few words to my mycological friends, not only those who may hear my voice, but those absent ones who will rest content to hear the echoes through the press. Now that, for the past fifteen years, the fungus forays of the celebrated Woolhope Club have practically ceased, opportunities are few for intercommunication with those most interested in the study of Fungi. Notwithstanding all the laudable efforts to infuse life and vigour into the British Mycological Society, I am much afraid that the labour is greatly in vain, and that gradually, since the cessation of the Woolhope Forays, and the decease of the great moving spirit, there has been a gradual, but certain, decadence in interest, in the subject, and the number of students, has been slowly becoming less and less. To me it has been the source of great regret, not only that so many have been removed to a higher sphere, but that of those which were left, so many have become lukewarm and indifferent, and so few young students have come forward to fill the vacant places. I am forced to the conclusion that the study and interest in the larger fungi has subsided into much the same condition in which it was nearly half a century ago. This I attribute largely to the falling away of the old school of mycologists, by death or otherwise, supplemented by the collapse of the Hereford Forays. It proves, if proof were needed, how much the prosperity of our local societies depend upon the enthusiasm and self sacrifice of one or two active and energetic men.

By your permission I will devote a few minutes to what may at first appear to be a personal subject, although I shall endeavour to avoid treating it in a personal manner. You are all aware that I had the good fortune to print and publish a book of figures of fungi, containing portraits, or what were meant to be portraits, of upwards of a thousand species of Gill-bearing Fungi. With whatever success or failure, this was associated, I

1 These notes, although somewhat foreign to our plan, are printed in our Journal inasmuch as they will be useful to students consulting Dr. Cooke's great work, and they also contain several corrections and additions to our Epping Forest "Fungus Flora."—Ed.

flatter myself that I still hold the record. I often look back with something of surprise as well as gratification, that I was able to accomplish so much. However, it was done with great difficulty, from which I should shrink in these latter days. Nevertheless all human work is to a certain extent imperfect, and I have never laid claim to absolute perfection in anything that I have ever done, least of all in a work of so much difficulty as that which I have alluded to. Now and then I am kindly reminded by some one or other of my friends of a few of my failures, and I suppose that they are rather surprised that I do not accept their strictures with a more grateful heart. Moreover I can say with confidence that I am better pleased at the vindication of truth than the gratification of my own vanity. I think that my days of vanity are all spent, and I am ready to confess my errors, as soon as I become convinced that they are errors. Already I have admitted some in the past, and still one of the most persistent of my critics has lately called on me to make further confession, which I will proceed to do—as far as I can consistent with what I believe to be the truth.

Of the species of *Amanitæ* I have nothing to say, except that I think *A. strobiliformis* was present when the original of Pl. 8 was drawn, and that the execution was faulty and the colour more so, hence the result was a caricature.

As to *Armillaria* the plate called *A. focalis, minor* (pl. 245) can scarcely be any form of *focalis*, but rather of *A. caussetta*, from the scaly stem.

In *Lepiota* I think pl. 1180 fairly represents *L. hispida* but pl. 27 does not, and may be referred to *L. clypeolaria*.

Concerning *Tricholoma* I have but few confessions to make, and of these *Ag. portentosus* Fr. comes first, of which Fig. 54 is not a type, indeed I am disposed to let it go as *Collybia platyphylla*, and not very good at that. It was not a drawing of my own, and I never saw the specimens.

I think that *T. argyraceus*, and its varieties, is entitled to rank as a species, distinct from *T. terreus*.

The gills in pl. 49, *Ag. murinaceus* should certainly be grey, which is omitted in the plate.

Pl. 167. *Agaricus virgatus* is a failure inasmuch as the striæ of the pileus should have been of the faintest kind. This plate was spoiled in the printing, and could not be remedied.

As to *Agaricus sadleri*, pl. 127, I have little to say, except that it had the sanction of the Rev. M. J. Berkeley, and at the time I protested strongly that it was only a peculiar condition of *Hypholoma fasciculare*, which view is now accepted.

I fancy that pl. 110 cannot properly be referred to *Clitocybe senilis*, although the Rev. M. J. Berkeley considered it to be so. Certainly it is far from the type.

Collybia pulla, Schft., was found at High Beach, Epping Forest in 1880, but has never yet been recorded as British. I made drawings of it, at the time, which may be published some day.[1]

The little Agarics attached to a yellow sclerotium, published as *Collybia cirrhata*, are doubtless also *Collybia tuberosa*, as no sclerotium is attached to *C. cirrhata*, therefore the whole of plate 144 is *tuberosa*.

A curious *Agaric* was figured at the bottom of pl. 422 under the name of *Agaricus* (*Pluteus*) *phlebophorus*, variety *reticulatus*, which is not a *Pluteus* at all, but a species of *Entoloma*, which has been named *Entoloma cookei* by a Frenchman and doubtless he is nearer the truth.

The fungus figured on plate 317 and called *Entoloma jubata* is not that species, although it somewhat resembles it, but should be called *Entoloma porphyrophæa*.

I don't know what to say about *Ag.* (*Entoloma*) *bloxami* figured on plate 327, but I strongly suspect that it does not differ from *Agaricus madidus*, Fries.

When I first found the species which is figured on pl. 354, I sent a drawing and fresh specimens to Fries, asking him if it was not a slender form of *Ag. terrigenus* but in reply, he informed me that it was not his species, but a new one which he should call *Ag.* (*Pholiota*) *cookei*, and it was figured under that name. Afterwards I found the specimens figured on pl. 349 at Chingford, and these I called *Ag. terrigenus*. Anyone comparing the two plates will I think come to the conclusion that both are really the same species, notwithstanding the slight differences.

As far as I can make out, my original suspicion has been confirmed and endorsed, that *Pholiota comosa* and *P. heteroclita* at least, as far as we know them, are but two names for the same species. Compare plates 366 and 600.

Somehow the names of *Ag. fimiputris* and *A. phalænarum* got exchanged on the plates, so that they need correcting.

Although I am jumping from one end of the book to the other in these remarks, I must not forget to call attention to what is now called *Amanitopsis vaginata*, which is very common in the Epping Forest. There are three very well marked forms, the most common being of a greyish colour, and has been named *livida*. I have eaten this and found it to be very delicate and digestible. The same can be said of the more scarce white variety, the *nivalis* of Greville. The last of the three forms is bright brown, and has been known both as *spadicea* and *fusca*. This is, I consider, entitled to rank as a distinct species I tried to eat it once, and I do not intend to try it again, and I am bound to caution all persons concerned that it is not good to eat. For this, as well as other reasons I suggest that we should mark the difference in future, by calling the brown form *Amanitopsis fusca*.

There are two species of *Hygrophorus* figured, one of them called *H. lætus* (pl. 938) and the other *H. houghtoni* (pl. 936), but I cannot find any difference between them. It has not been uncommon in Epping Forest, whichever name has been given, but I think that *H. houghtoni* must be dropped.

1 See description of this species by Dr. Cooke, *ante.*, page 127.—ED.

I have been informed recently, that the curious *Lactarius obliquus* has been found, and is to be recorded for Epping Forest. I am very glad of this, because no one but myself ever found it previously in this country, and I am confident its determination was looked upon with suspicion, in some quarters. It is the only species of *Lactarius* we have with a lateral stem.

Now we come to the great sphinx which has been the major conundrum for years, and I do not intend, or pretend, to solve it. Of course it is represented by *Hypholoma lacrymabundus* and the supposed *Agaricus storea.* Let anyone who pleases hunt up all the pages that have been written, but I shall not quote them here. I am convinced that M. J. B. led me into error in assuring me that what I figured as *H. lacrymabundus*, was that species according to Fries. I am now satisfied, for several reasons, that it was not, and was doubtless only a form of *H. velutinus*, with a scaly, instead of a silky pileus The next point is this—what is the fungus which has been called here *Agaricus storea* ? and figured as such in the *Illustrations*. It is very certain that it is not the *Agaricus storea* of Fries., whatever else it may be. At present I do not feel quite satisfied that it is the veritable *Hypholoma lacrymabundus* of Fries. I cannot swallow the whole pig at once.

Pl. 703 which was sent to Fries, also with fresh specimens, was declared by him to be *Cortinarius saginus*, and was published under that name. Doubtless it was a lapse of memory on the part of the author, since the figure is only *Cortinarius triumphans*, yet perhaps not quite typical, as the stem in the figure does not "imitate a triumphal column" neither is it encircled by tawny scales, disposed in numerous circles or rings. This is depicted better in plate 692, than in pl. 703, which latter has been characterised as "one of the best figures in Cooke's *Illustrations*." However critics are sometimes permitted to make mistakes, to prove themselves human.

Cortinarius torvus has long been a bogie to most of the Continental mycologists, who certainly have fallen into error in regarding *Cortinarius berkeleyi* as the genuine *Cortinarius torvus* of Fries. The figure in Fries' *Icones* is quite enough to show that there is no affinity between them

I ought to feel extremely grateful for your kindness this evening in listening to me so patiently, more so than ever, because I have done so little to deserve it, except to bore you and tantalize you with the most uninteresting and unattractive paper I ever had the effrontery to read before you. My only excuse is that it had to be done. Some victims had to be found, and I hoped you would be good natured ones, and in this I have not been disappointed.

[Dr. Cooke continued his address in the form of one of his humorous analyses of the persons attending "Fungus Forays," especially urging the value of the social element of such gatherings.—Ed.]

NOTES ON A MANGANIFEROUS SEAM IN THE THAMES VALLEY DRIFT AT ILFORD, ESSEX.

By J. P. JOHNSON.

The continued erection of houses on the site of the old Uphall Brickyard has necessitated the opening of several new pits for the supply of building material, since those described in an earlier paper[1] were filled in. As a rule the sections thus exposed shew no additional features of interest and further back attraction in that they have not yielded any fossils.[2]

However, there are exceptions to every rule and the following section which is situated between the "Hunter," "Uphall" and "Harvey Roads," is well worth noting:—

Fine Ochreous Gravel		..	4 ft.
Ochreous Sand	..	..	3 ft.
White Sand	..	..	1 ft

For between the gravel and sand, which pass into one another, there is a lenticular seam coloured black with hydrated oxide of manganese, which occurs in the amorphous form of psilomelane, coating the grains and pebbles

I took three samples from different parts of the seam with the object of determining the percentage of manganese present. Sample i. was estimated by my friend, Mr. W. G. Rumbold, to contain 2·7 per cent. Sample ii., which was kindly analysed by my friend Prof. Geo. Patchin, A.R.S.M., and by Mr. F. A. Zurcher, yielded ·975 per cent., while sample iii., which was assayed by myself, contained only ·68 per cent. All three samples were assayed gravimetrically by the "basic acetate" process, and very carefully checked by duplicate assays.

It will be seen that the results vary somewhat, but their difference is not greater than might have been expected from the nature of the deposit, because, since the psilomelane occurred only as a film on the exterior of the pebbles and grains, the sandy portions of the seam would naturally contain more manganese than the pebbly portion.

1 J. P. Johnson, 'Additions to the Palæolithic Fauna of the Uphall Brickyard, Ilford." ESSEX NATURALIST, vol. xi. (1900), pp. 209-215.

2 I have, however, obtained the greater part of a large hâche which I have handed over to the Essex Field Club's Museum at Stratford. It is very much abraded and is probably derived from the high-level drift of this valley.

Like the rest of the gravel, the manganiferous seam contains a quantity of oxide of iron. The amount present in sample ii. was determined by Mr. Zurcher to be 2·7 per cent., while that in sample iii. was estimated by myself as 2·5 per cent. One would expect the amount of iron in the different samples to be more uniform than the manganese, as, while the latter is on the outside of the pebbles only, the former occurs inside as well, which also explains why the psilomelane, though really present in smaller quantity than the oxide of iron, should nevertheless give the colouration to the seam.

The psilomelane was clearly deposited contemporaneously with, and must have been brought down by the river (Thames) which deposited, the drift in which it occurs. But there are no ores of manganese in the rocks over which the Thames and its tributaries flowed. Nearly all iron ores, however, contain a minute proportion of manganese, and it is from these iron ores, of which there are plenty in the Thames Basin, that the manganese has been derived. It is quite easy to understand how the manganese was taken into solution together with the iron and precipitated separately at places where the conditions were favourable.

During the recent excursion of the Essex Field Club to the excavations in Tottenham Marshes, in the Lea Valley, I noticed an extensive manganiferous seam, in the sections in the Palæolithic gravel over-looking the new reservoirs.

A good test for the presence of manganese in any material is to fuse it with sodium bicarbonate, to which it imparts a green colour.

P.S.—Since writing the above Mr. Cole has drawn my attention to an interesting paper by Mr. T. S. Dymond, F.I.C., on the occurrence of manganiferous conglomerate in gravel at Tendring (ESSEX NATURALIST, vol. x. (1897), pp. 210-12), in which another explanation is given of the derivation of the manganese. The conditions under which the deposit occurs at the two places would, however, appear to be very different.

MANGANIFEROUS NODULES IN THE BOULDER-CLAY OF ESSEX.

By [MISS] MAY THRESH.

[*Read December 14th, 1901.*]

Some time ago it was remarked that in certain soils in Essex there occurred small nodules which in appearance bore so close a resemblance to seeds that they were almost indistinguishable *in situ*. It was observed that these nodules were only found in soil overlying the Essex boulder clay. They are brown in colour, often almost a perfect sphere in shape, and very hard. In size they vary considerably, the largest being about five millimeters in diameter and the smallest exceedingly minute.

A sample of the soil containing these nodules was taken; they were carefully sorted out and weighed, and it was found that they formed about ·1 per cent. of the total weight of soil examined. The nodules were then submitted to a qualitative analysis and were found to contain iron in considerable quantities. It was noticed on the addition of hydrochloric acid that chlorine was given off, proving the unexpected presence of the peroxide of manganese. On separating the insoluble part from the soluble filtrate it was seen that the former consisted of a sandy whitish residue of silica.

The presence of manganese dioxide rendering the nodules of greater interest, a quantitative analysis was made. The substance was first powdered and a weighed portion was heated to 200° C. in order to drive off any water present and determine the percentage of moisture. The dried substance was then digested with strong hydrochloric acid and the metallic compounds were thus separated from the insoluble silica, which was dried and weighed. The soluble portion containing the chlorides of the metals was next neutralised with ammonium carbonate and the iron was precipitated by means of ammonium acetate, washed, dried, and weighed as ferric oxide.

The manganese left in the filtrate was precipitated by means of ammonia and a saturated solution of bromine water, dried, and weighed as manganese tetroxide. The calcium left in the filtrate was precipitated by ammonium oxalate, dried and weighed as lime.

The manganese peroxide was estimated in the usual manner. The weighed substance was placed in a small flask with some hydrochloric acid and heated. The chlorine given off was led through some bulb tubes containing potassium iodide solution and the amount of iodine liberated was estimated by deci-normal thiosulphate solution.

Later, a second sample was taken and subjected to a similar analysis. The following are the percentage results of the examination of the two samples :—

	1	2
Moisture	7·00	5·60
Silica	47·90	51·86
Oxide of iron	29·91	23·89
Manganese peroxide	5·12	9·35
Manganese protoxide	3·44	2·07
Calcium oxide	2·45	3·54
Phosphates, carbonate, &c.	4·18	3·69
	100·0	100·0

From the above figures it will be seen that the nodules differ in composition, some being richer in manganese, and the manganese being in some in a more highly oxidised condition than in others. The nodules appear to be formed of a silicious material cemented together by the oxides of iron and manganese with some phosphate and carbonate of calcium and a quantity of moisture varying in proportion to the iron present, since 5·6 bears the same ratio to 23·9 as 7 does to 29·9.

It is remarkable that the manganese protoxide and lime in the first sample are exactly *equivalent* to the protoxide and lime in the second sample, in fact, the two oxides have evidently been able to replace each other in the nodules.

This somewhat remarkable material has a great similarity to that already described to the Essex Field Club in a paper read by Mr. T. S. Dymond at the meeting held Dec. 11th, 1897 (ESSEX NATURALIST, Vol. X., pages 210-12).[1] This paper referred to the hard masses of cemented gravel found in some parts of Essex, chiefly round Tendring, and which were used for building purposes. The cement proved to be "ferric oxide mixed with the peroxide and protoxide of manganese, together

1 Reference should also be made to the paper by Mr. Johnson on a Manganiferous Seam in the Drift at Ilford, printed in the present part of ESSEX NATURALIST, which was received by the Editor previous to the reading of Miss Thresh's paper.—ED.

with a large quantity of sand." It is possible that the two materials have a similar source; both are found only in soils overlying clay and which contain chalk. Probably an abundance of chalk is necessary for the formation of the nodules, as it is well known that whereas in the presence of acids manganese exists in its stable compounds in the mangan*ous* state, in the presence of alkali it becomes oxidised and forms the mangan*ic* compounds. Therefore in an alkali or chalky soil alone could nodules or cement, in which manganese exists as the peroxide, be formed. Manganese peroxide is usually found, as in these cases, associated with ferric oxide and the lower oxide of manganese.

The following may be the explanation of the occurrence of these nodules:—Surface soil contains the silicates of iron and manganese, but these are decomposed by the soil acids, and salts of iron and manganese are formed in solution. In the presence of an alkali these salts decompose and precipitate the oxides of the metals. At the same time the manganese being in the condition of a free oxide would become more fully oxidised by the action of the air in the soil. To prove the truth of this supposition a solution of manganese sulphate was taken and on the addition of ammonia or other alkali, oxidation at once took place in the presence of air, the white precipitate first formed becoming brown, and in the course of 24 hours almost black. This precipitate on examination was found to consist partially of the higher oxide of manganese liberating chlorine from hydrochloric acid. The slightest acidity, even that caused by excess of carbonic acid in the solution, was sufficient to prevent this oxidation even when so powerful an oxidiser as hydrogen peroxide was employed. This precipitation may resemble crystallization, in taking place from a particular point, and the sand adhering to the growing particle would become cemented up into the nodule.

[At the reading of the paper, Mr. T. S. Dymond, F.I.C., F.C.S., made some remarks, which are printed as follows in the form of a Note :—

Manganiferous nodules are not infrequently met with on the bed of the deep sea. They have been found near the Canaries, to the south west of Australia, in the Northern Pacific Ocean and elsewhere. These nodules are said to have the appearance of urinary calculi, are brown in colour and have a structure shewing superposed layers of clay. Analysis shews that they consist chiefly of the oxides of iron and manganese, the latter peroxidized, together with silicate of alumina and combined water, and minute quantities of other materials. The best account of these marine nodules with drawings occurs in M. J. Thoulet's *Oceanographie*, 1890.

Both in appearance and composition it is clear that the nodules described by Miss Thresh have the closest resemblance to these marine nodules. This suggests a common origin and that the former were not formed *in situ*, but that during the ice age they were picked up by floating icebergs from the sea bottom along with other material and transported to and deposited in their present position. This being so, their occurrence in the Boulder-clay and not in the London-clay soils is owing, not to the necessity of chalk for their production as suggested by Miss Thresh, but to the fact that the Boulder-clay is a glacial deposit and the London-clay is not.

The explanation given by Miss Thresh of the formation of the nodules is that which has been advanced by Dieulafait (*Comptes Rendus*, 1883, p. 718) for those of marine origin, who states that solution of manganese carbonate exists in sea water and that this is attacked by the dissolved oxygen with liberation of carbonic acid gas and deposition of manganese peroxide.

The importance of the matter lies in the fact that if the nodules are of marine origin, valuable light is thus thrown upon the source of the Boulder-clay in which they occur.

T. S DYMOND.

[*County Technical Laboratories, Chelmsford, December, 1901.*]

THE CORRESPONDING SOCIETIES COMMITTEE OF THE BRITISH ASSOCIATION, GLASGOW, 1901.

REPORT OF THE CLUB'S DELEGATE,

F. W. RUDLER, F.G.S., *Chairman of the Conference.*

The Lecture Theatre of Medical Jurisprudence, in the University Buildings, was placed at the disposal of the Delegates throughout the Association week. Two meetings of the Delegates were held here—one on Thursday, Sept. 12th, and the other on Tuesday, Sept. 17th. The Chairman at these Conferences was the delegate of the Essex Field Club, Mr. F. W. Rudler; the Vice-Chairman was Mr. W. Whitaker, F.R.S., and the Secretaries were Dr. J. G. Garson and Mr. A. Somerville. The meetings were well supported, no fewer than 42 societies having sent delegates.

The Chairman opened the proceedings with an informal address, in which he suggested the local societies should regard it as part of their duty to seek, register, and record in a systematic manner all types and figured specimens of natural history objects within their respective spheres of influence; and he urged the propriety of extending such work to pre-historic antiquities.

[Some of Mr. Rudler's suggestions were so pertinent to the case of our own Club, that we cannot refrain from quoting in full two or three passages from the address which his modesty has led him to summarise in a few lines. Referring to the important question of the registration of type-specimens, he remarked:—

"So far as concerns the types which are preserved in provincial museums it may be said, probably, that the work should be done either by the museum itself or by that excellent institution, the Museums Association, an association which has recently increased its usefulness by the issue of a monthly journal, which I may commend to the attention of local societies. It is true that some of the larger museums have already published, or are now engaged in publishing, lists of their type-specimens, or at least certain classes of types. But most museums fail to possess the means of carrying out such work and properly publishing the results, and therefore could hardly resent the interference of a local Society. Moreover a museum could not be expected to take cognisance of specimens in private hands, whereas a committee of the local scientific society could make it its business to seek out all the type-specimens within its sphere of influence, whether in the local museum or in private collections, and could give permanence and publicity to the information thus acquired by printing the schedules of types in its proceedings."

Mr. Rudler proceeded in this connection to make a valuable suggestion for local work, and one that is quite within the powers, as well financial as scientific, of most societies:—

"The same kind of research might, in my opinion, be extended with advantage to local antiquities, at least to those of pre-historic age. Each society might fitly publish lists of the antiquities which have been discovered within its own district, and which have been described and figured. Where the specimens remain in private hands, it is often difficult, and sometimes impossible, to trace them, but no one is likely to be more successful in the search than the members of the local society. The advantage of knowing, when working at any particular subject, where the original specimens are located is so obvious that I venture to hope that the Delegates may see their way to urge the societies which they respectively represent to move in the direction which I have indicated."

Many of those connected with local societies have been almost appalled by the multitudinous schemes of work which have from time to time been put forward by the Committee. Mr. Rudler made some observations anent this matter which are well worthy to be kept in mind:—

"It seems to me doubtful whether it is desirable to suggest at this Conference many new lines of work to be taken up by our local societies. In most cases they already possess programmes which are pretty heavily weighted, some societies perhaps undertaking even more than they can satisfactorily accomplish; and I believe it would probably be better in most cases to systematise and improve the existing work than to attempt the introduction of new departments of study. The governing body in each society might well be charged with the duty of seeing that the work is worthy of the present position of science. The steady growth of scientific education in this country during recent years ought to tell most favourably upon the character of our local societies. New members come prepared with a groundwork of scientific training unknown to most of the older members at the time they entered, and as a consequence the work of the society should be lifted to a higher level than that on which we were formerly content to let it rest. It is satisfactory to note that in many cases this has been thoroughly realised, and indeed a review of the proceedings of the various local societies at the present day shows that a high standard of excellence is often attained."—ED.]

The Rev. J. O. Bevan, M.A., read a paper in support of the following resolution:—

"That the Committees of the Corresponding Societies be invited to lay before their members the necessity of carrying on a systematic survey of their counties in respect to ethnology, ethnography, botany, meteorology, ornithology, archæology, folklore, &c."

In the course of his communication he spoke as follows:—

"It is hereby suggested that the Conference of Delegates should select one or more subjects of pressing interest, and undertake to bring before the respective societies the advisability of undertaking systematic work (each in its own district) in these directions. The affiliated societies, through their Delegates, would be expected to make a return of the results—partial or complete—at the ensuing meeting of the British Association

In the choice of subjects three considerations (at least) present themselves:—

(a.) They should be of a general kind, capable of being worked up by the local societies in their respective districts.

(b.) Preliminary arrangement should be arrived at whereby may be determined the lines and limits of investigation, the mode of tabulation of results, the scale of chart or map, the scheme of symbolical representation, coloration, nomenclature, conventional arrangement of detail, the method, form, size of publication, and the like.

(c.) A special society or expert should be indicated as ready to advise in regard to each of the particular subjects.

"The ends to be gained are these: The taking stock of all facts by a connected series of methodical surveys; their registration before the corroding effect of time, the amalgamation of race, or any other cause, puts it beyond the reach of effort; the full completion of surveys already begun; the setting forth of results in a manner directly susceptible of useful comparison. A collateral advantage would be the discovery of a considerable amount of work already elaborated, and (with necessary revision and reduction to the common scale) its inclusion in the General Survey.

"A beginning or an extension of past work might be made in respect of:—

Meteorological and seismological phenomena.
Life zones.
Registration of type specimens.
Photographs of sections; records of well-borings, &c.
Phenomena of glaciation; erratic blocks.
Origin of lakes; changes of area and depth.
Coast and river erosion.
Pond, cavern, and underground life.
Ethnographical, ethnological, and archæological surveys.
Botanical survey, to include fungi and algæ.
Phenological observations.

"It will be understood that this list is provisional, but it is selected by reason of the fact that the field has been already entered upon, and that little further organisation is needed.

"The Conference will make it clear that there is no intention to dictate to the various Societies involved. The suggestions are tentatively put forth in the interests of scientific research, and in response to the demand frequently made by Delegates. Each Society will consider the matter, and, in its wisdom, deal with the subject which seems the more nearly to come within its purview."

Mr. Bevan's communication gave rise to prolonged discussion and resulted in the appointment of a small committee of Delegates for the purpose of formulating a scheme for systematising and co-ordinating the work of local societies. This Committee was appointed at the instance of Prof. W. W. Watts, and at the second Conference the Report was submitted to the Delegates and adopted. The recommendation of the Committee was as follows:—

"The following provisional list of subjects, together with the names of some of the Societies which have already done work in connection therewith, and the names of persons who would be willing to receive communications thereon, is recommended by the Conference of Delegates for adoption by the Corresponding Societies Committee of the British Association, and to be issued by them to the Corresponding Societies in the hope that those societies not already engaged in similar work may take part in so much of it as comes within their scope, in order that the work may be extended over a wide area, and be done as far as possible upon a uniform system.—

'Registration of Type Specimens,' Dr. A. Smith Woodward.

'Coast Erosion,' Mr. W. Whitaker.

'Record of Bore Holes, Wells, and Sections,' North of England Institute of Mining and Mechanical Engineers, and Prof. J. H. Merivale.

'Tracing the Course of Underground Water,' Yorkshire Geological and Polytechnic Society, and Mr. A. R. Dwerryhouse.

'Erratic Blocks,' Yorkshire Naturalists' Union, and Professor P. F. Kendall.

'Geological Photographs,' Belfast Naturalists' Field Club, and Professor W. W. Watts.

'Underground Fauna,' Rev. T. R. R. Stebbing.

'Variations in the Course of Rivers and Shape of Lakes,' Dr H. R. Mill.

'Archæological Survey by Counties,' Woolhope Field Club, and Rev. J. O. Bevan.

'Ethnographical Survey,' Anthropological Institute.

'Botanical Survey by Counties,' Mr. W. G. Smith.

'Photographic Record of Plants,' Mr. A. K. Coomara-Swamy."

In the course of discussion at the first Conference, Dr. Vaughan Cornish suggested that a Report should be presented each year, explaining what had been done by local societies in carrying out suggestions made at the preceding Conference. This appeared to be the general desire of the Delegates; and at the second Conference Captain Dubois Phillips, R.N., moved the following resolution, which was carried unanimously:—

"That the Corresponding Societies Committee be requested in future to bring before the Conference of Delegates some account of the outcome of the Conference of the preceding year."

Representatives of most of the Sections of the Association attended the second Conference and explained the kind of work in which their respective Committees might be assisted by local societies. Prof. Watts called attention to the valuable work carried on year after year by the Committee on Geological Photographs; Prof. Percy Kendall explained the work of the Committee on Erratic Blocks. Dr. Vaughan Cornish pointed out the kind of investigations on Limnology which might be carried on by societies located in the neighbourhood of lakes; Mr. Henry Balfour advocated the collection of photographs of anthropological and archæological interest, and enlarged on the value of observing and recording the survival of primitive customs, &c.; Mr. Harold Wager suggested that assistance might be given to the Committee for investigating the structure of blue-green algæ, as also to that appointed to collect, preserve and systematically register photographs of botanical interest; Prof. Dalby referred to Committees of the Mechanical Section on Screw-threads and on Road Traction, which might possibly receive local assistance; and Prof. McLeod explained that a Committee of the Chemical Section would be glad to hear of the names of scientific chemists who are at work at different manufactories, with the view of ascertaining the extent to which trained chemists are employed in British industries.

It will be seen from the foregoing sketch that the meeting of the Delegates at Glasgow led to certain definite results, which it is hoped may tend to improve the work of some of our local scientific societies.

ANENT A FOREST LODGE IN 1444.

By W. C. WALLER, M.A., F.S.A.

On several occasions short articles on the Forest Lodges have appeared in the ESSEX NATURALIST, and when, a short time ago, an ancient document referring to one of them chanced to pass through my hands, it occurred to me that it might most conveniently make a public appearance in the pages of the same serial.[1]

It so happened that Mr. St.Clair Baddeley, a prominent member of the Bath and Cheltenham Archæological Society, in examining some ancient MSS. belonging to a Gloucestershire neighbour, Mr. Hyett, came upon a small, stout volume, in a 15th century hand, which seemed, on a cursory examination, likely to prove serviceable for Essex history: and with that in view he courteously and most kindly opened communications with an official of the county society. When the book ultimately came to me for examination I found that, so far as Essex was concerned, its contents, as a whole, failed to bear out the rich promise of its earlier pages. The first of these—it had no title page—proved to be the beginning of a copy of the Perambulation of the Forest of Essex made in 1301, of which a translation is given in Mr. W. R. Fisher's *Forest of Essex*. One or two other documents of like nature, relating to parts of the same Forest, followed, and then the volume gradually revealed itself as a handbook of legal practice, precedents, and formulæ, some manorial and some forestal. Of these latter a few were interesting, as furnishing details of procedure, and that of which I am about to give an English version, relates to Essex. Whether or no the original document provided the initial stage in the erection of what is to-

1 ESSEX NATURALIST, vi., 206; vii., 82; ix., 166; xi. 153.

day known as 'Queen Elizabeth's' Lodge—a building already, from internal evidence, assigned to the century previous to that in which she lived—or to one at Stratford, Hainhault, or elsewhere, there is unfortunately no means of determining. But, however that may be, it is still interesting to know definitely how, and when, and why, one of these lodges came into being, and the means adopted to raise money for its construction.

The warrant for the proceedings issued under the hand of Humphrey, Duke of Gloucester. His 'quality,' more or less pompously set out between his name and his titles, sums up his relationship to the three Henrys who ascended the English throne in succession. His name does not occur in the list of Wardens furnished by Mr. Fisher, whose enumeration leaves blank the years between 1379 and 1489; and the name of one Steward of the Forest of Essex is separated by a like gap from that of the next mentioned by him.[2] Thus much having been said by way of introduction, the document shall be left to speak for itself.

Humphrey, the son, brother, and uncle of kings, Duke of Gloucester, Earl of Pembroke, &c., and Chief Warden of the Forests of my Lord the King on this side Trent, to the Steward of the Forest of Essex, or his Lieutenant in the same, greeting. Since lately, at the last Session of the said Forest, held before us, it was found and presented that there is not in the said forest any lodge [*logia*] for the convenience of the ministers [*ministrorum*] of my Lord the King of the same forest, which was very necessary and convenient for them; nor any pound [*pimfold*] for impounding and keeping cattle, swine, and sheep, trespassing within the said forest, or strays coming into the same; which cattle, swine, sheep, and strays, and other forfeits, albeit they were seized for the lord King, have, owing to the lack of this custody, for a very long time continually got away, and do daily get away, to the no small damage of the same my lord the King, for which we desire, as we are bound, to provide a remedy. Wherefore, on the part of the said my lord, we charge you that, by view of the Verderers and of two or three of the Regarders of the said Forest, you cause to be newly constructed and suitably raised without delay a lodge and a pimfold, within the said Forest, on the soil of the same my lord the King, and that you take so much of the wood, underwood, and brushwood from the wood of my said lord the King as may be necessary for the timber of the said Lodge and Pimfold, and the construction of the same; and also of one pair of stocks for the punishment of evildoers in the Forest; and also that you, by view of the aforesaid Ministers within the same Forest, take oaks to be exposed for sale wherever you see that they may be best taken for the advantage of the same my lord the King, so as the said wood of my lord the King may be able to bear without waste; [and] that you cause to be felled and sold so much as is necessary, sufficient, and opportune, for the new

2 *The Forest of Essex*, pp. 110, *et seq.*

construction thereof, making indentures between yourself and the aforesaid Ministers concerning the sale aforesaid. And you shall an account render of the sale and repair aforesaid before us or our Lieutenant at our next coming to the Forest aforesaid, or in the interval elsewhere, whensoever you shall be called upon.

Given at London, on the 4th day of December, in the 23rd year of the reign of my said lord the King, Henry, the Sixth after the Conquest. [1444.]

THE ESSEX FIELD CLUB.

SATURDAY, APRIL 13TH, 1901.

A circular had been issued by the Secretary calling a "Field Demonstration meeting" this afternoon; subject, the observation of mosses in their forest stations. Mr. E. M. Holmes, F.L.S., was the "conductor." But the day turned out a depressingly wet one, and only Mr. Holmes, Mr. E. S. Salmon, F.L.S., Miss Read, the Hon. Secretary, and Mr. H. A. Cole faced the steady downpour of rain experienced in the walk from Chingford to High Beach, the appointed *rendezvous*. Mr. Holmes and Mr. Salmon collected and determined several mosses and lichens under the imperfect shelter of umbrellas. But even the enthusiasm of the brave little party faded somewhat before Monk Wood was reached; they sought refuge in the "Wake Arms" and took possession of the tea ordered for the Club The ORDINARY MEETING appointed, and indeed all formal business, was necessarily postponed.

FOREST RAMBLE AND DEMONSTRATION MEETING.

SATURDAY, MAY 18TH, 1901.

The weather at this spring ramble compensated in its brightness and warmth for the dismal meteorological conditions of the preceding one. It was intended to allow of an inspection of some parts of the Forest which have been thinned by the Conservators in recent years, so as to afford a demonstration of the effects of this treatment.

The "Conductors and Referees" were Prof. J. B. Farmer, M.A., F.R.S. (*Professor of Botany, Royal College of Science*), Prof. H. Marshall Ward, D.Sc., F.R.S. (*Professor of Botany, University of Cambridge*), the President (Prof. Meldola), and the Hon. Secretary.

Mr. E. N. Buxton, Verderer, and Sir Fowell Buxton, Verderer, had intended to be present to point out and explain the work which had been done, but most unfortunately as they were awaiting the party at the foot of Oak Hill, Theydon, Sir Fowell Buxton was knocked down by a bicyclist and though happily it was found that he was not seriously injured, both he and Mr. E. N. Buxton were necessarily absent from the meeting.

The main party met at Theydon Bois Station at 2.25, and the route led through the Theydon High Woods, Epping Thicks, Ambresbury Banks (where Mr. W. Cole gave a short address on the construction of these earthworks and on the facts as to their probable date ascertained during the Club's explorations in 1881) and so on to Monks Wood. There, by the kind permission of Mr. McKenzie, the Superintendent, a tent had been erected under the shade of the beeches, in which tea was served.

Full opportunity was taken during the ramble to demonstrate to those interested the effect of the thinning operations, and, by way of contrast, the condition of a few acres of woodland which had been left very much in their early forlorn condition, as an object lesson for those who ask for an "unimproved" forest. Many of those present were much struck with the abundance of young seedling oaks, beeches, hornbeams and hawthorns which were to be seen in many places. But it was pointed out that almost all these were doomed to destruction by the cattle (and perhaps the deer, which are certainly now too numerous) and that the prospect of the forest renewing itself, unless some very drastic measures were taken to preserve and encourage the growth of these seedlings, was extremely doubtful. The old pollards are dying off—and a constant uprearing of vigorous young wood is the thing above all others to be desired.

After tea, a short ORDINARY MEETING (the 203rd) was held in the tent, the President in the chair.

The following were elected members of the Club:—Mr. Harold L. Barnard, Mr. John Boardman, Mrs. Boardman, Mr. P. Anderson Graham, and Mr. J. Thompson.

Prof. Meldola expressed the regret of all present at the lamentable accident which had befallen Sir Fowell Buxton, which had deprived them of the pleasure and benefit of his presence and that of Mr. E. N. Buxton.

At the request of the President, both Prof. Farmer and Prof. Marshall Ward gave short addresses on the state of the Forest as it had come under their observation that afternoon—and both emphatically insisted on the necessity of some steps being taken to insure the growth of young trees, so that the forest might be renewed in the years to come.

The President also made some remarks on this subject, and proposed that a cordial vote of thanks should be passed to Prof. Farmer and Prof. Marshall Ward for their attendance and the addresses they had made.

Sir Frederick Young, as an old friend of the Forest, and as one who had known it in the days long before it had come into the hands of the Corporation, expressed his pleasure at the improvement manifested. He warmly congratulated all present, and indeed all residents of the London district, upon the magnificent heritage upon which they had entered. He seconded the votes of thanks, which were carried by acclamation.

The walk back was over the Furze Ground, by Broadstrood Lodge, and through what was formerly "Oak Hill Enclosure," and over Theydon Green to the station.

THURSDAY, JUNE 6TH, 1901.

The Conference Meeting and visit to Dunmow and Bigod's, held this day, is reported under a separate heading in the present part (p. 157).

VISIT TO CANVEY ISLAND, ESSEX.

SATURDAY, JUNE 15TH, 1901.

This meeting was planned to continue the survey of Canvey Island, following up that held on June 30th last year (see report in ESSEX NATURALIST, Vol. xi pp. 261-264, where a sketch of the geology of the district by T. V. Holmes, F.G.S., will be found). On the former occasion the island was approached from the sea front, but on this, the assembling-place was the old village of Benfleet, and the time, noon.

The conductors were Dr. James Murie, LL.D., F.L.S.. Prof. G. S. Boulger, F.L.S., the President, and the Hon. Secretary. The tide was up at Benfleet, and the party was ferried across by the old boatman. Some of the party walked through the island; others were carried in a very primitive cart which had been hastily fitted up for their accommodation. During the ramble the botanists and entomologists were busy determining the plants and insects met with. Caterpillars were plentiful and *Clisiocampa lanestris* and *C. neustria* were again met with commonly. The fine large larvæ of *Gastropacha quercifolia* were found on the blackthorns, and the pretty caterpillars of *Trichiura cratægi* were seen. On the grass, the handsome larvæ of *Bombyx quercus* were often observed. Members of the party had brought luncheons with them, so that no time was lost in getting on to the sea wall. It was a very regrettable sight to find Canvey in the hands of the speculative land-jobber—most of the island bordering the estuary is being parcelled out in small plots, for the erection of bungalows, and the prospective creation of a "Canvey-on-Sea." We fear that Canvey, as a locality for many good insects and uncommon seaside plants, is doomed to be "improved away."

On the coast the botanists found ample employment. The characteristic and deeply interesting maritime plants afforded Prof. Boulger texts for short demonstrations The beautiful Yellow-horned Poppy (*Glaucium luteum*) was in abundance, but will probably soon be a joy of the past in view of the tribes of children invading its sandy haunts. Dr. Murie pointed out the salient features of the geology of the coast line, particulars of which were amplified in his address delivered later in the afternoon.

Many members came down by a later train, and quite a large party gathered for tea in one of the more spacious bungalows, the caterers being the "Hoy" Inn, Benfleet.

Afterwards a meeting was held, Prof. Meldola, President, in the chair.

Prof. Boulger gave a short address on "Estuarine Flowering Plants, with special reference to the coast of Essex" the main substance of which is embodied in the paper on "Sea-side Plants" printed in the present part (*ante* pp. 125-27).

Dr. Murie delivered, *vivâ voce*, an address on "Canvey in its relation to the Thames Estuary and marine life around." [Dr. Murie has promised to prepare the substance of this most interesting address as a paper for the ESSEX NATURALIST, but pressure of other work has delayed this up to the time of going to press.]

The President made some remarks on the subjects taken by both speakers, and Prof. Boulger and Dr. Murie were warmly thanked for their addresses and for the trouble they had taken during the day to render the meeting pleasant and profitable.

The archaic cart was again requisitioned by some of the party back to Benfleet, while others (more wisely) walked, and collected insects and plants by the way.

VISIT TO THE EXCAVATIONS AT THE EAST LONDON WATER COMPANY'S NEW RESERVOIRS, TOTTENHAM AND WALTHAMSTOW.

SATURDAY, JUNE 29TH, 1901.

At the kind invitation of Mr. Charles W. Sharrock, the Superintendent of Messrs S. Pearson and Son's works at the new Storage Reservoirs, a very interesting meeting was held on this afternoon, and its announcement attracted a large assembly of members and friends The party was met at the gates of the works in "Ferryboat Lane" by Mr. Sharrock and Mr. Traill, his assistant, and by Mr Marsh, the Assistant Engineer of the Water Company. Col. Bryan, the Chief Engineer, was unavoidably, and at the last moment, prevented from being present.

A locomotive, with three trucks fitted with seats, took the party over the bed of the new reservoirs, and at various points Mr. Sharrock explained the engineering aspect of the works, the diversion of the old river Lea from its channel and the formation of the new water-way. He mentioned incidentally that there was plenty of water in the river, and if the new reservoirs did not prove adequate, it was proposed to construct others higher up the Lea valley. Owing to Mr. Sharrock's excellent arrangements the sections exposed throughout the extensive works were inspected without fatigue.

Mr. T. V. Holmes, F.G.S., demonstrated the points of geological interest—the sections of the Lea alluvium, the shell-marl and peat, and remarked, in the first place, on the unique interest of the sections exposed in making the new reservoirs. Probably to the geologist the most interesting sections were those of new railways. Railway cuttings, however, in soft strata, were liable to be speedily spoiled as geological evidence, both by the ordinary action of the weather, and by the practice of sloping them. Still they were there, though latent, and liable to be re-disclosed whenever a widening of the line became necessary. But sections such as those before them were such as railways never revealed; for railways never made cuttings through marshes, though they often crossed them by means of embankments or viaducts. Then the sections made during the formation of those reservoirs would not be simply sloped, but would be swept out of existence, the completion of the reservoir implying their annihilation. As to the nature of the beds displayed there and their mode of formation; they were simply the work of the river Lea. Rivers had a way of perpetually tending to erode their banks on one side and to deposit material on the other, the bank on which erosion was taking place at any given spot, being the bank which was gaining through the deposition of material a few yards, or a few hundred yards, higher up or lower down the stream. In this way a river flowed, at one time or another, over every square foot of ground occupied by the marshes adjacent to it. As to the natnre of the strata found in these alluvial or marsh sections, gravel was always seen towards their base and loam at their surface, and sometimes they were the only beds visible. But in other places, between the gravel and the loam were mud, peat and irregular deposits of shell-marl. Sections there showed how very frequent had been the changes of channel in certain spots, as compared with others. Thus human relics or other remains found, which had evidently been deposited in an old channel at one spot, might easily be hundreds or even thousands of years older or newer than others similarly deposited but a few yards away. The dug-out canoe, for example, seemed to him to be more likely of greater rather than of less antiquity than the year B C. 500. The supposed Viking ship—if not of much later date—was perhaps a vessel of the Danish fleet blockaded up the Lea by King Alfred in the year A.D. 896. Sections of this kind also threw much light on the way in which the older river deposits, now existing as comparatively obscure fragments, had been formed, a matter on which more light certainly seemed desirable in view of the very discordant opinions expressed by various geologists about them and their fossil contents.

[Reference should be made to Mr. Holmes' paper in the last part of the ESSEX NATURALIST, *ante.*, pp. 1-16].

The remains of the so-called "Viking Ship," which had been uncovered in what at one time had been a backwater in the old river channel, were inspected with much interest. Some archæologists of the party were, however, unwilling to allow for this relic the antiquity suggested by Mr. Holmes in his remarks above quoted, and in his paper (*ante.*, p. 13), viz., that it might have been a member of the Danish fleet which went up the Lea in A.D. 895 and was destroyed by King Alfred. The "ship" was found with the bottom upwards, and was in a very decayed state. It was probably about 40 feet long, and what is called "clinker-built," with metal nails, and in some places the remains of hair (? cow) were found, probably used in caulking the boat.

The information concerning the ship was very meagre, and it was most unfortunate that nothing but fragments could be kept; several pieces are in the Epping Forest Museum. To preserve the boat properly would have been a difficult and costly work, and its great size would not have permitted its retention in any ordinary museum. We are greatly indebted to Mr. Sharrock for some photographs of the "ship" *in situ*, from which the two illustrations in the accompanying Plate were taken. It appears that this is not the first instance of such an occurrence in the alluvial deposits of the Lea. About 1830 a large boat was unearthed in excavating for the East London Water Company's Reservoirs near Temple Mills, and another is mentioned by Camden as having been found near the same place. See extracts from Robinson's *History of Hackney* in the "Notes" in the prese t part.

Mr. Traill pointed out the site of the discovery of the "Dug-out Canoe" at the depth of about 6 feet from the surface. The details will be found in Mr. Holmes' paper above referred to, and some particulars of a "Dug-out," found in the old bed of the Thames, will be printed in the present part. The Dug-out itself was inspected in the shed in which it had been placed previous to its removal to the British Museum.

Mr. Sharrock showed a large photograph of the canoe, in its original position, from which the plate in the last number of the ESSEX NATURALIST was copied. An enlarged and framed copy of this photograph has been presented by Mr. Sharrock to accompany the objects from the excavations to be placed in the Epping Forest Museum.

At the close of the inspection the large party was most hospitably entertained at tea by Mr. and Mrs. Sharrock

Afterwards a short meeting was held (being the 204th ORDINARY MEETING), Prof R. Meldola, President, in the chair.

The following were elected members of the Club:—Mr Harry H. Brothers, Mr. Phillip W. P. Carlyon-Britton, J.P., D.L., F.S.A., &c., Mr. W. S. Page, Mr. G. H. Menhenick, and Her Grace the Duchess of Sutherland.

The President proposed that they should pass a very hearty vote of thanks to Mr. and Mrs. Sharrock for their kindness and hospitality, and for the excellent arrangements made for the comfort of the party that afternoon. This was passed by acclamation.

Mr. Sharrock replied, and then, at the request of the President, gave some interesting details of the engineering features of the works, illustrating his remarks by maps and plans,

The company was photographed and were shown the various relics, bones of animals, pottery, and Saxon and other implements, which had been found during the excavations, and carefully preserved by Mr. Sharrock, Mr. Traill and Mr. Marsh. Most of these are now (March, 1902) in the Epping Forest Museum, and descriptions will be published later.

At the close the party was taken back by the extemporised railroad to the point of entrance near Tottenham, and so ended a very pleasant and instructive visit.

WEDNESDAY, JULY 24TH, 1901.

The Countess of Warwick very kindly invited the members of the Club to the Annual Prize Distribution at her "Secondary and Technical Science School" at Bigods, near Dunmow, which took place on this day, and a large number of members availed themselves of the opportunity of inspecting this very interesting experiment in practical elementary teaching where science is made an integral part of each child's education. Bigods is well known to many of us, Lady Warwick's hospitality having more than once been extended to the Club.

A very large party of friends of education from Essex and the Metropolis assembled at luncheon in the large marquee in the grounds at Bigods, and afterwards at the meeting held, Lady Warwick presiding. Following the presentation of the report by Mr E. E Hennesey, B.Sc. and the presentation of the prizes by Lady Rosslyn, Sir Philip Magnus delivered a very interesting address. Other speakers were the Earl of Warwick, Mr. E. N. Buxton, Mr.

Elliott (Board of Agriculture), Prof. James Long, Dr. Wormall, and Sir Edward Verney.

At the close of the meeting the guests had an opportunity of inspecting the School buildings and appliances, and tea in the gardens concluded a very pleasant and instructive visit. Lady Warwick's experiment has proved to be most successful, and is one that should be attentively studied by all interested in the pressing problem of rural and secondary education.

THE ANNUAL CRYPTOGAMIC MEETING AND 205TH ORDINARY MEETING.

SATURDAY, OCTOBER 12TH, 1901.

This meeting was held at High Beach and surrounding parts of the Forest. The arrangements were precisely those of last year; the "Head-quarters" being at the "King's Oak" Hotel, where the large exhibition and meeting-room had been engaged.

The Referees were:—Dr. M. C. Cooke, E. M. Holmes, Esq., F.L.S., George Massee, Esq., F.L S. (*Kew Herbarium*), and Prof. H. Marshall Ward, D.Sc., F.R.S. (*Professor of Botany, University of Cambridge, and President of the Mycological Society*).

The botanists reached the assembling place at various times throughout the day, and parties explored the woods at Woodford, Buckhurst Hill, Loughton, High Beach, and the Theydon Woods. A very large and varied collection of specimens was made, which were exhibited in the room and determined by the experts pre-ent. Dr. Cooke's and Mr. Massee's reports will be found in another part of this issue (pp 127-30).

Amongst the other interesting things shown were a series of beautiful coloured drawings of some species of Micro-Fungi occurring in the Forest, drawn and exhibited by Mr. Massee. Mr. Cole exhibited a selection from the Cryptogamic Herbarium formed by the late George Varenne, of Kelvedon, recently acquired by the Club. Mr. H. Whitehead exhibited some specimens of Micro-Fungi (leaf-fungi) recently collected in Essex.

Tea was taken about 5.30 o'clock, and afterwards an ORDINARY MEETING (the 205th) was held, the President, Prof. R. Meldola, F.R.S., in the chair

The following were elected members of the Club:—Miss A. E. Baxter, Miss Camilla Jebb, Mr. F. T. Norris (*Saga-Master, Viking Club*), Mr. W. B. Parsons, M.R.C.S., and the Right Hon. the Earl of Warwick, Lord-Lieutenant of Essex.

Dr. Cooke and Mr. Massee reported on the results of the day's work. These reports will be found in the present part of the ESSEX NATURALIST (*ante* pp. 127-130). Dr. Cooke was of opinion that the "bag" was the best for the last 10 years

Dr. Cooke also delivered an address; the first part of it, consisting of corrigenda to his *Illustrations*, with indications of new species to the Forest, or corrections in the nomenclature of old ones, is printed in the present part (*ante* pp. 131-34). The second part of his speech consisted of humorous descriptions of the utility and social aspect of these annual forays.

Prof. Marshall Ward, F.R.S., then gave an address on the Scientific Study of Fungi. The Professor urged the importance of studying the "life-histories" of these plants, and said that he would be pleased to see any member desiring to take up the study at Cambridge, and to show the methods of investigation there adopted.

The Curator had prepared a report on the Varenne Cryptogamic Herbarium, which was taken as read, and which will be found in the "Museum Notes" in the present part.

Cordial votes of thanks were passed to Prof. Ward, to Dr. Cooke, and to Mr. Massee, and also to the other botanists who had assisted in various ways in aid of the meeting.

The meeting was a very large one; about 100 members and friends attending it.

THE 206TH ORDINARY MEETING.

SATURDAY, OCTOBER 26TH, 1901.

The first meeting of the Winter Session, being the 206th ORDINARY MEETING, was held in the Physical Lecture Theatre of the Municipal Technical Institute, West Ham, at 6.30 p.m., the President, Prof. R. Meldola, F.R.S., in the chair.

Mr. Edmond J. Boake, B.A., and Mrs. W. D. Cansdale, were elected members.

Mr. Cole exhibited some sets of specimens which he had arranged for the Museum in illustration of the subject of "Protective Resemblance" amongst insects.

He also exhibited specimens of *Sphinx convolvuli*, which had been taken at the electric lamps in the Romford Road, near the Museum. Several others had been brought into the Museum in a mutilated condition, and he had heard of the capture of many specimens in Essex Indeed the insect had occurred in numbers in many parts of England, and 1901 would merit remembrance by entomologists as one of the great "*convolvuli* years"

Mr A. Harrison sent for exhibition six fine specimens of *Sphinx convolvuli* taken on September 24th and 25th, also in the Romford Road, Stratford.

Mr. Cole also exhibited a specimen of *Limenitis sibylla*, the "White Admiral Butterfly," which had been caught in August in Mr. Cole's garden at East Mersea, by Master Harold Elliott, who reported that he had seen another also. Mr. Cole said that the butterfly still occurred in the woods near Colchester, and there was a series in Dr. Laver's collection, but as far as he knew Master Elliott's specimen was the first recorded for Mersea. Master Elliott had kindly presented the butterfly to the cabinet of the Club.

Mr. John Spiller exhibited a fine crystal of Selenite from Aylesbury.

Mr. Cole said that small crystals of Selenite were to be seen very abundantly in the London Clay exposed during the excavations now being carried on in constructing the new railroad across the Roding Valley from Woodford to Chigwell, but he had not seen any equal in size to Mr. Spiller's specimen.

He remembered that when the sewers were being dug at Chingford and Walthamstow some years back, many fine crystals were obtained by the workmen. They used to call them "frozen" or "congealed" water.

Mr. Scourfield, Mr. Elliott, and Dr. Auden confirmed these statements.

Mr. F. H. Varley, F.R.A.S., having, as a member of the Council, taken the chair.

Prof. Meldola delivered a most interesting lecture upon "Mimetic Insects." The subjects treated were, the production of colour in the living organism—Adaptation in colour and pattern to the environment Protective and aggressive resemblance—Wallace's theory of "warning colours"—The parallelism between protective resemblance and mimetic resemblance—The Batesian theory of mimicry and its limitations—Extension of the theory by Fritz Müller—Later researches on the subject of "Common warning colours."

The lecture was beautifully illustrated by natural-colour photographs taken by the Sanger-Shepherd process, the specimens being chiefly from the collections in the Hope Museum, and arranged for the present lecture by Professor E. B. Poulton, F.R.S., Hope Professor of Invertebrate Zoology, University of Oxford. These unique photographs were shown by means of the electric lantern.

The lecture was listened to with marked attention by the large audience, and was frequently applauded.

The Chairman in moving a cordial vote of thanks to the lecturer, congratulated him on having delivered an admirable exposition of one of the most striking theories of modern biology, and also on his re-appearance in the Presidential Chair after an interval of 18 years. Mr. Varley also alluded to the excellent examples of the new art of producing natural-colour photographs which had been made by Mr. Sanger-Shepherd, which proved the value of the process as a means of illustrating lectures such as that to which they had all listened with so much profit and pleasure.

The vote of thanks was seconded by Mr. T. Spiller, F.C.S., and carried amid applause.

Prof. Meldola, in responding, expressed his indebtedness to Prof. Poulton for the beautiful examples selected from the Hope Museum. That Museum under Prof. Poulton's enthusiastic curatorship, had gradually acquired what was probably the finest collection illustrating "mimicry" and "protective resemblance" in Europe. He was also much obliged to Mr. Sanger-Shepherd for the care and skill shown in making the lantern slides.

THE 207TH ORDINARY MEETING.

SATURDAY, DECEMBER 14TH, 1901.

The 207th ORDINARY MEETING was held in the Physical Lecture Theatre of the West Ham Technical Institute, at 6.30 p.m., the President, Prof. R. Meldola, F.R.S., in the chair.

Mr. Frank P. Smith was elected a member of the Club.

Mr. W. Cole exhibited some examples of a series of species of butterflies which were intended to be placed in the Museum to illustrate the theory of Mimicry amongst insects.

He also exhibited some specimens of the curious mollusc, *Petricola pholadiformis*, which had been presented by Mr. J. E. Cooper and Mr. A. S. Kennard. Mr. Cole and Mr. Kennard made some remarks upon the species, which are embodied in a "Museum Note" in the present part of the ESSEX NATURALIST.

Dr. Thresh read a paper by Miss May Thresh on "Manganiferous Nodules in the Boulder-clay of Essex." This paper is printed in the present part, *ante* p. 137.

Mr. T. S. Dymond, F.I.C., made some extended remarks upon this paper which are printed *ante* p. 139, and a short discussion upon it was carried on by Mr. Dalton, F.G.S., Mr. D. Howard, F.C.S., and Mr. J. W. Salter.

The Secretary said that he had received some little time back a paper by Mr. J. P. Johnson on a Manganiferous Deposit in the Thames Valley Drift at Ilford, which was already in print, and which would appear at the same time as Miss Thresh's paper (*ante* pp. 135-6).

On the proposal of the President, who remarked that the paper was a most interesting piece of work, a cordial vote of thanks was passed to Miss Thresh.

Mr. Martin Hinton read a paper prepared by himself and Mr. A. S. Kennard entitled "Contributions to the Pleistocene Geology of the Thames Valley. I. The Grays Thurrock area, Part II.," being the continuation of the paper already published in the ESSEX NATURALIST, Vol. xi., pp. 336-370.

A discussion on the paper took place, carried on by Mr. T. V. Holmes, F.G.S., Mr. Dalton, F.G.S., Mr. Rudler, F.G.S., Mr. J. W. Salter, F.G.S., and the President. Mr. Hinton replied, and the authors were unanimously thanked for their communication.

In the absence of the author, Mr. C. D. Soar, F.R.M.S., Mr. Scourfield read a paper on "The Water-Mites (*Hydrachnidæ*) of Epping Forest."

The paper was illustrated by many beautiful coloured drawings, done from nature by Mr. Soar, and Mr. Scourfield exhibited some specimens of Water-Mites under the microscope.

Both Mr. Soar and Mr. Scourfield were thanked for the paper, and the meeting ended.

CONFERENCE OF THE EAST ANGLIAN NATURALISTS' SOCIETIES, VISIT TO DUNMOW AND TO LADY WARWICK'S SECONDARY AND SCIENCE SCHOOL AT BIGODS.

THURSDAY, JUNE 6TH, 1901.

This meeting was designed to admit of a visit to a very pleasant district; to hold a second preliminary Conference with the representatives of the East Anglian Natural History Societies, with a view to combined action in the future; and to visit "Bigods" at the kind invitation of the Right Hon. the Countess of Warwick.

The London-side party travelled by the 9.10 express from Liverpool Street, slip carriages being detached at Bishop's Stortford, where the assembly of all attending the meeting (a large party) was called at the Chequers Hotel at about half-past ten. Here carriages were awaiting the party, and no time was lost in getting on the road to Easton Park and Dunmow. An excellent report of the meeting was given in the London *Standard* on June 7th, and we cannot do better than quote a few paragraphs, making some corrections and additions where the reporter fell into error or was unacquainted with the facts :—

"For some time there has been a feeling that it would be well if something could be done to bring about combined action on the part of the Natural History Societies in the three counties which constitute East Anglia in the widest sense of the term. In 1898 a Conference between the members of these Societies was held at Witham, and since then a good deal has been written on the subject. Yesterday, a second Conference took place at Dunmow, which was arranged by Mr. W. Cole, F.L.S., the Secretary of the Essex Field Club [also by Prof. Meldola, the President], and it was preceded by an excursion through one of the prettiest parts of the district under consideration. Essex and Norfolk have well-established Societies, each publishing a record of work, with distinctive features. The Suffolk Natural History Society in Bury has no publication, and this is also the case with the Ipswich Scientific Society. The two first-named bodies have a pretty large membership, and for their benefit a very pleasant excursion was arranged. An early start was made from Liverpool Street Station, whence the ride through the Stort Valley is distinctly pretty. It has no pretensions to grandeur, but for beauty of a calm, pastoral kind, it is hard to beat. If it has not the massed timber of the Midlands, there is a sufficiency of trees to give charm to the landscape, and the small clumps and lines show up the foliage against a summer sky with an effect as good as, if not better than, that produced by thicker planting. One might travel miles before one could see such masses of colour—pink chestnuts and hawthorns, the laburnum with its golden tassels, white lilac, and the dark metallic foliage of the copper-beech; and over all there is an air of peacefulness, so that one of the party was probably not far wrong when he compared the valley of the Stort of to-day to the valley of the Lea in the days of Izaak Walton."

"From Stortford the members drove along the old Roman stone street, with a stop at the church of Little Easton, notable for its half-effaced wall-paintings in the nave—the Crucifixion, the Burial, and some others on the South side, and a St. Christopher on the North. There is a peculiarity about ancient wall paintings—they grow upon one, and become more distinct the longer one gazes, till the half-effaced figures seem so familiar that one wonders

Oak Tree in Easton Park, Essex.
From a Photograph by Prof. Meldola

there was ever any hesitation as to deciding what they represent. This church contains one of the few brasses which remain of a Knight wearing the Garter badge, and in the Maynard Chapel are some fairly good monuments—one of them occupying the site of the old altar, as is evidenced by the piscina on the South side. Opposite the church are the old stocks, with an upright post fitted with iron holdfasts to confine the hands also."

At the church the party was received by the Rector, the Rev. A. L. Whitfield.

Our member, Mr. G. E. Pritchett, F.S.A., very kindly gave a demonstration of the numerous monuments, very many being those of members of the

Maynard family, the ancestors of Lady Warwick. A full description, with plates of the more notable monuments, will be found in Mr. Chancellor's great work *The Ancient Sepulchral Monuments of Essex*. At Easton the party was met by Mr. John F. Rogers, Agent to the Easton Estate, and the drive through this beautiful park was much enjoyed. Herds of fallow deer were seen, and some remarkable trees were pointed out. Two in particular, an oak and a hornbeam, were measured by Mr. Rogers, and the dimensions are worth recording:—

Oak Tree in Easton Park.

Height from ground to the crown of the butt	..	24 feet.
Girth at bottom of tree ..	.. ..	42 ,,
,, 3 ft. from ground	.. ..	33 ,,
,, 8 ft. ,,	.. ..	30 ,,

Hornbeam Tree in Easton Park,

Height from ground to crown of butt	..	10 feet.
Girth at bottom of tree ..	.. ..	34 ,,
,, 5 ft. from bottom	. ..	27 ,,
,, 10 ft. ,,	.. ..	34 ,,

Prof. Meldola had been staying at Easton Park Cottage and had photographed both these trees, and we are thus enabled to give illustrations of them. It is much to be desired that members photographically inclined would follow the President's example, and thus insure the preservation of pictures of interesting trees which may be noticed in various parts of the County.

The drive was continued to the ancient village of Dunmow, where luncheon awaited the party at the "Saracen's Head" hotel.

The Conference was quite arcadian, taking place in the pretty little garden of the hotel. Prof. Meldola took the chair. Unfortunately, but few members of "East Anglian" Societies other than the Essex Field Club were present. Mr. Southwell, F.Z.S., and Mr. H. Scherren, F.Z.S., well represented the Norfolk and Norwich Society, but no official member of the Ipswich Scientific Society attended.

Mr. W. Cole re-called what had passed at the first Conference held at Witham on July 23rd, 1898,[1] and advocated the initiation of some scheme of "Systematic Biological and Pre-historic Archæological work in East Anglia." He alluded to the close connection of the three counties of Norfolk, Suffolk and Essex, from the point of view of their Natural History and Geology, and the similarity of the coast-line. The Essex and the Norfolk Societies had done a great deal of faunistic work, of value to the student of geographical distribution, but there was still ample opportunity for further investigations, pursued year by year. This was especially the case with respect to the marine zoology of those regions of the North Sea bordering the counties, where of late years there had been considerable changes in the fauna. These should be carefully recorded, as also should be the variations in the coast-line. He was not alluding to the higher and more difficult work of biological investigation into the life-histories of the marine organisms of the North Sea.

1 A full report was printed in the *Essex Naturalist*, vol. x., pp. 360—368.

Hornbeam Tree in Easton Park.
From a Photograph by Prof. Meldola.

This would necessitate a marine station, and much more elaborate provision both of skilled workers and appliances. A little might be accomplished on this higher plane, but the work immediately in front of them was faunistic, and this was certainly well within the powers of the East Anglian Societies. There was sometimes a great waste of energy in working independently, and without reference to what other societies had done or might do. He should like to see some arrangements by which each society should work in conjunction with the others, so that any subject taken up might be thoroughly investigated, without the disadvantage of members going over ground that had been already explored, or taking up questions that had been threshed out. Each of the counties concerned had now excellent museums—but to insure that the collections should worthily illustrate the rich East Anglian district, long-continued *systematic* collecting was necessary. This work, especially the marine dredging, &c., might often be costly and difficult. Combined effort by the three counties might furnish funds and expert assistance which would be beyond the means of any one of the societies working separately.

Mr. Cole also advocated the establishment of a quarterly journal of natural history, geology and pre-historic archæology for East Anglia, to be published by the societies of the three counties. At present they had the *Essex Naturalist* and the *Transactions of the Norfolk and Norwich Natural History Society*, but he had not heard of any publication efforts in Suffolk. The quarterly "East Anglian Naturalist" might be edited by three gentlemen nominated by the societies The main difficulty in the way of such a project was the varying rates of subscriptions of the three societies, but this might be surmounted. He was aware that in advocating the issue of one journal for the district he was not in accord with the views of some local naturalists, and it must be admitted that the "county" as a unit for local work was yearly becoming more important, in consequence of recent political and social changes.

Possibly some of them had read recently in leading newspapers letters advocating greater attention being paid to what had happily been termed "the buried history of Britain." In his opinion this most interesting and instructive work of archæological investigation could best be carried on by the local societies. They had the machinery, but the *funds* were wanting. Mr. Cole suggested that it might be possible for the British Association to bring the matter before the Government, who could put it in the power of the County Councils to allocate a very moderate annual sum towards the expenses of such systematic exploration work in biology, geology and archæology, the prosecution and accomplishments of which would in any case afford object lessons of very considerable patriotic and educational value, and sometimes even confer direct practical benefits upon the districts concerned.

Prof. Meldola spoke of the advantages to be derived from co-operation and combining forces, but admitted the difficulties that stood in the way. The British Association had not been successful in its attempts to promote federation among local societies, for the members of some maintained that better work was done independently than could be done when a number of societies were working together. There were two schools of thought—one in favour of independence, the other in favour of co-operation; and on the whole he was disposed to believe that the balance of evidence was in favour of the latter.

Mr. Southwell, F.Z.S., said that he, and, he believed he might add, all the members of the Norfolk and Norwich Naturalists' Society would welcome any scheme by which co-operation between the scientific workers of East Anglia could be brought about, and mentioned at least one line of work which seemed to have been neglected in the Norfolk district. He was strongly in favour of adding Ethnology to the subjects to be covered by the Norfolk Society or by the united Societies, and mentioned that near Cromer there were people possessing racial peculiarities which would well repay special study. The establishment of a fresh-water biological station had been advocated by one of their members, who thought that a floating station could be equipped for a small sum, and made self-supporting, and he agreed with Mr. Cole that everything possible should be done in the way of investigating the continually changing fauna of the coast, especially in he estuaries.

Mr. Scherren, F.Z.S., also spoke in favour of the proposal for combined work in the directions indicated.

Mr. Adair Roberts thought that perhaps they might nominate members of the different societies to prepare some scheme of work, but Prof. Meldola said that that had already been done. It was eventually agreed that it should be an instruction to the Council of the Essex Field Club to take such steps as may appear necessary to bring about some kind of co-operation between the Natural History Societies of East Anglia, with a view to promoting systematic action in biological work and in all matters concerning prehistoric archæology.

At the invitation of the Chairman, Mr. E. E. Hennesey, B.Sc., then gave some particulars of the scheme of education carried on at the Countess of Warwick's School at Bigods, which the party were to visit that afternoon.

Prof. Meldola proposed that votes of thanks should be passed to all who had assisted in the conduct of the meeting, specially mentioning Mr. Rogers, the Rev. A. L. Whitfield, and Mr. Pritchett. He said that Lady Warwick had hoped to be present and to have personally welcomed them at Bigods, but an engagement that could not be put off prevented her having the pleasure of meeting the members, whom, in her name, he invited to visit the school.

The carriages were then again put into requisition for a pleasant drive through the lanes to Bigods, where the company was received, in Lady Warwick's absence, by Mr. and Mrs. Hennesey. This was the second visit of the Club to the School, which was started at the time when the County Council had not taken into serious consideration the question of education in rural districts, and the course of work has been so planned as to be of special service to pupils who intend to adopt farming or kindred pursuits as their occupation in after life. Mr. Hennesey conducted the visitors round the workshops, laboratories, class-rooms, and poultry runs. All are of the most modern design, and Mr. Hennesey explained the working of the scheme. The apiary and garden plots were also visited, Mr. Thomas Hacking explaining the agricultural portion of the curriculum.

Much interest was taken in the demonstration, and there was a general expression of opinion that Lady Warwick's experiment went a long way to solve the difficulty of technical instruction in rural districts.

The visitors were afterwards entertained to tea, the appreciation of it being inhanced by the rumour that the excellent light refreshments had been made by the cookery students in the school itself.

NOTES ON "DUG-OUT" BOATS IN THE ANCIENT MARSHES OF THE LEA AND THE THAMES.

Referring to Mr. T. V. Holmes' paper, "Geological Notes on the New Reservoirs in the Valley of the Lea, near Walthamstow," in the last part of the ESSEX NATURALIST, it seems desirable to add to the account of the "dug-out" canoe therein given (*ante* pp. 11, 12), some details extracted from Mr. W. Traill's paper in *The Reliquary and Illustrated Archæologist* for January, 1901, and to supplement this by an account of a similar boat found in the mud of the old Thames a few years ago.

The Lea boat was found on October 30th, 1900, at a depth of about six feet from the surface, lying almost due north and south, with the bow towards the south, and seems to have been drawn up on the bank of an old river. It was resting on a bed (5 ins. thick) of fine, sandy silt mixed with fresh-water shells, at a level of 21 ft. above ordnance datum. The geological position in which the canoe lay has already be stated, and its appearance both *in situ* and when placed on the trolley for removal, is well shown in the illustrations accompanying Mr. Holmes' paper.

It had evidently been hollowed out of the trunk of an oak tree. Mr. Traill took the principal dimensions as follows:—Extreme length, 14ft. 10in.; extreme breadth, 2ft. 4in.; extreme depth, 1ft. 4ins.; extreme depth inside, 1ft. 1½ins.; thickness of timber at gunwale, ⅜in.

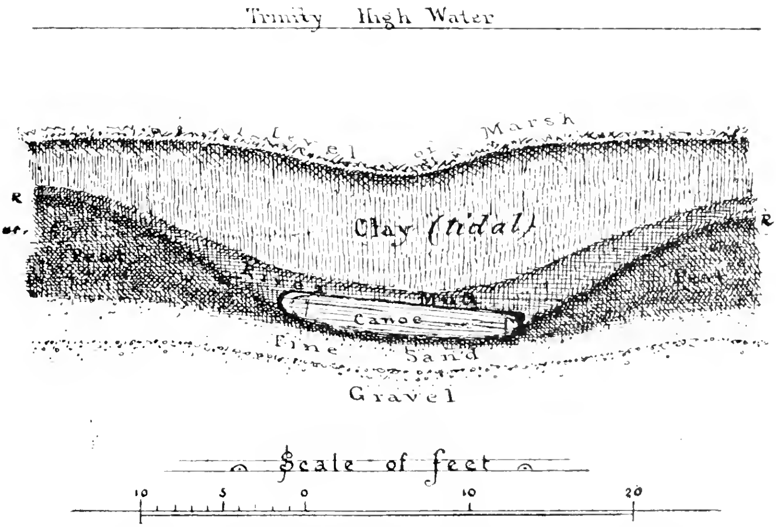
"Both ends are rounded, but the sides are almost at right angles to the flat bottom. Eight feet from the stern a strengthening rib has been left in, 6ins. wide and 7ins. deep, and 3ft. 8ins. nearer the bow a small rib has also been left in. On the right side of the stern a hole ⅞ of an inch in diameter has been drilled vertically through the gunwale. An oak peg has been fitted into this, and cut off to the slope of the outside and either cut or broken off flush with the gunwale, which at this point is slightly hollowed, as though worn. There is an identically similar hole on the same side of the bow. Unfortunately, the corresponding parts of the left side of the boat are gone."

The only object found that could be identified as an implement was a piece of oak, sharpened to a point, which can be seen lying inside the boat in the plate given in the last part. "This was got below the boat, in a similar position to the one it occupies in the plate, and may possibly have been part of a punting pole. Unfortunately, the rest of it, along with the bow and part of the side, had been broken off by the workmen before they had realised the nature of their find."

The boat has now (March, 1902) been removed to the British Museum at Bloomsbury. Mr. Traill adds, "it may be interesting to note that several pieces of Roman pottery and a well-made iron spear-head have been found at points ranging from fifty to a hundred yards from where the dug-out was lying, and in practically the same stratum." These last mentioned specimens, together with others found in the excavations, are now deposited in the Epping Forest Museum of the Club, by the kindness of Mr. Sharrock, Mr. Traill and Mr. Marsh, the engineers superintending the works.

In 1878, when the marshland on the northern side of the Thames was being excavated across the Plaistow and East Ham level for the construction of the Royal Albert Docks (Victoria Docks extension), the workmen uncovered a "dug-out" canoe, which from the description appears to be similar to that found in the Lea deposits. Fortunately the geological sections in these excavations were examined and described by Mr. Whitaker, F.R.S. (*Geology of London, &c.*, I., pp. 461-2), and Mr. Flaxman C. J. Spurrell, F.G.S., F.S.A. had an opportunity of seeing the boat *in situ*. His observations were published in the *Archæological Journal* for 1890 (vol. xlvii., p. 170), and from that paper we compile the following account. Mr. Spurrell made a drawing of the section in his note-book at the time, and as this has not hitherto been published we are glad, by his kindness, to engrave it now.

The "dug-out" vas in a fairly good state of preservation and made out of a single trunk of oak and carefully fashioned into a regular form, and planned to measure. The length from bow to bow (for both ends were exactly alike) was 17 feet; the width outside abeam between 24 and 25 inches, and so continued with the exception of the last 12 inches of both ends; these sloped inward 8 inches, the ends being straight (not rounded) and about 8 inches wide. The sides and bottom were flat and rectangular. At the thinnest part above the sides were little more than half-an-inch thick, but about 3 inches below at the junction with the bottom. And the bottom thinned to less than 2 inches in the middle. There was a peculiar arrangement at each end, perhaps a kind of raised seat. There was no keel, no ribs or stretchers at bottom, and no rowlocks. Nothing was found with the boat.



Section showing the position of the Dug-out Canoe in the Thames Marshland. Drawn by F. C. J. Spurrell, 1878.

Mr. Spurrell speaks of the old peat surface at the spot where the boat was found as that on which Romans lived and died. "Roman black pottery (I saw some Samian) and food refuse, with tiles, were found between 8 and 9 feet below the surface (which was 5ft 6in. O.D.) on and in the top of a layer of peat; this was covered by tidal mud."[1] The section reproduced here, he describes as "showing that in the peat layer a stream

[1] "Early Sites and Embankments on the Margins of the Thames Estuary," *Archæol. Journal*, vol. xlii. (1885).

(fresh-water) had excavated a small channel; that this stream was accustomed to carry boats was evident, because in its own mud and not in the peat itself, the boat was found. The surface of the peat was the shore of that day, and the existence of the stream must have been prolonged to the later part of that period which was occupied in the accumulation of the tree's growth and their *débris*. Therefore, the stream was apparently in full run about 1700 years ago, and the boat apparently belongs to that age. Since the boat was lost, the deposit of tidal mud had almost obliterated any sign of the channel"

Mr. Spurrell records in his paper on "Early Sites and Embankments on the Margins of the Thames Estuary" (*Archæological Journal*, vol. xlii., p. 302, *note*) that near a spot in the Erith Marshes by Belvedere Station where moor-logs of the old forest might then (1885) be seen projecting into the ditch, a "dug-out" boat was found. It was low down in the peat, which rises to zero O.D. and was cut through in making a ditch, the ends of the boat being left in either bank. "From out of this boat a polished flint axe and a very beautiful flint scraper were obtained. Another polished axe of large size was dredged out of the same peat bed in the river off Prices' works close by."

The Albert Docks boat was secured for the British Museum (by Mr. Whitaker's intervention) where, Mr. C. H. Read informs us, it is still preserved. As the Museum now has the two "dug-outs" (one from the Lea and the other from the Thames) it is much to be desired that careful descriptions and a comparison of them should be published. Meanwhile our readers will doubtless welcome the above records of "dug-out" boats found in the district.

NOTE ON A SMALL SHARK (*? Galeus vulgaris*) SEEN IN BRIGHTLINGSEA HARBOUR.

By H. C. SORBY, LL.D., F.R.S., F.L.S., &c.

When walking on the deck of my yacht, lying in Brightlingsea Harbour on August 23rd, 1901, at about 4.15 p.m., I heard a loud splashing, and, on looking to see what was the cause, I saw a small shark, about ten yards off, with its tail curled round and flapping it on the surface of the water. It then straightened itself out and swam towards the yacht, but, at the same time, sank down out of sight. I clearly saw that it had a heterocercal tail, the upper part being rounded and not very long, and that its body was of grey colour, and apparently about five feet long. Taking all into account, it seems most probable that it was *Galeus vulgaris* or the "Toper"; but, under such circumstances, it was impossible to see and examine detailed characters, so as to be quite sure of the species According to Dr. Laver's book on the Vertebrata of Essex (p. 119), this small shark has previously been met with on two occasions on the coast of Essex, but yet is sufficiently rare to make it desirable to record the occurrence for another individual seen in the estuary of the Colne.

MUSEUM NOTES. No. III.

VI.—THE CRYPTOGAMIC HERBARIUM OF THE LATE MR. E. G. VARENNE.

In 1891 we published in the ESSEX NATURALIST a valuable paper on the "Cryptogamic Flora of Kelvedon and its neighbourhood," which had been compiled by Mr. E. D. Marquand from the herbarium and notes made by our late member, Mr. E. G. Varenne, M.R.C.S., of Kelvedon.

At Mr. Varenne's death in 1887 these materials had, at his request, been handed over to Mr. Marquand by Mrs. Varenne. In March of the present year (1901) we had great pleasure in acquiring the Cryptogamic Herbarium and some of Mr. Varenne's botanical books for the Essex Field Club, by purchase from Mr. Marquand, who thought they would fittingly find a resting-place in the County Museum. Very many of the specimens had been collected in Essex, and these supplied the *data* for the paper above referred to. Unfortunately Varenne's Phanerogamic Herbarium perished in the way thus stated by Mr. Marquand:—

"The whole of my Natural History collections had to be warehoused when I went abroad (that was after my paper in the ESSEX NATURALIST was written) and on my taking them out again some four years afterwards, I discovered to my great sorrow that very nearly the whole of my phanerogamic herbarium was *ruined* by the attacks of insects! so that it had to be burnt. The great bulk both of my own large herbarium and of Varenne's collection was thus destroyed. What could be saved out of the wreck I packed up and gave away to a botanical friend who is now in Australia. Varenne's cryptogamic collections were uninjured (with the exception of some of the Lichens) and so you have them.

"Varenne did not keep his Essex plants distinct; they were inserted in their proper places amongst others in his herbarium, nor did he trouble to preserve an Essex specimen if he had a sufficiently characteristic one from elsewhere. The great value of his collection of flowering plants consisted—not in its completeness as a county collection, nor even in the number of his own personal gatherings—but in the authentically named critical species which he had received from British specialists. Although an excellent 'all-round' botanist, Varenne had a special liking for the cryptogams rather than phanerogams, and nearly all the specimens in his collection of the former were gathered by him."

The Varenne Cryptogamic Herbarium, thus rescued from further destruction, consists of the following, in round numbers:—

350 Mosses	450 Lichens
150 Hepaticæ	100 Sea-weeds
200 Fungi (Leaf-parasites)	250 Fresh-water Algæ
	1,500

And two quarto volumes of Essex Mosses, neatly mounted and in good preservation.

The books are, Gibson's *Flora of Essex*; Hassell's *British Fresh-water Algæ* (2 vols); Mudd's *Manual of British Lichens*; Wilson's *Bryologia Britannica*, and Leighton's *British Lichen Flora*. All these books were Varenne's working copies, and they contain many marginal notes of Essex and other localities in his handwriting.

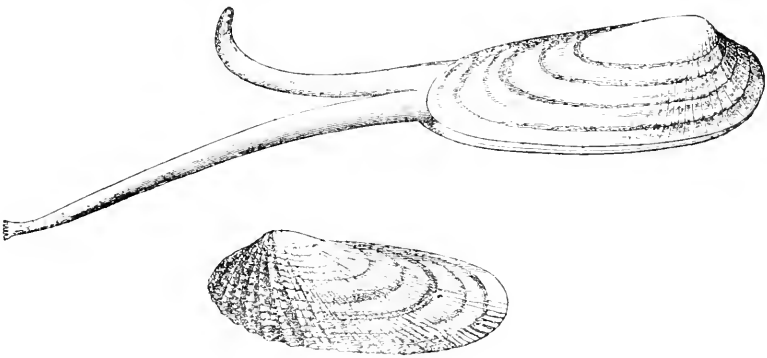
Essex botanists will regret to hear of the destruction of the Varenne flowering-plants. It is an instance of what so commonly happens in such cases. The proper home of local collections is the nearest local Museum. How many specimens and collections are there, now mouldering away in country houses in Essex? The owners are tired of them, but they cannot summon up courage to place the specimens where they would be cared for and valued, and where they would be of use to those studying the natural history of the County.

VII.—PETRICOLA PHOLADIFORMIS IN ESSEX AND KENT.

For some years past conchologists have been aware of the existence in England of a shell whose true home is on the east-central coast of North America. It was first noticed, probably, by Mr. Walter Crouch, F.Z.S., about 1890, when he obtained a dead shell from the Crouch river near Burnham, and living specimens have since been found there. We have in the Museum two valves sent, with other things, by a dredgerman from the same locality. And Mr. J. E. Cooper and Mr. A. S. Kennard have since presented to the Museum a set of Kentish specimens, together with some notes, from which a portion of the following account is compiled.

The original record of the mollusc in England was by Mr. Cooper in the *Proc. Malacological Society*, June 14th, 1895:—

"In April, 1895, I found at Burnham-on-Crouch, Essex, a shell which Mr. E. A Smith identified as *Petricola pholadiformis*, Lam. It was picked out of a large heap of oyster and whelk shells which had been dredged in the river. One valve was considerably broken, but this was probably owing to



Petricola pholadiformis, Lam. From the *Report of the Invertebrata of Massachusetts*, by Dr. A. A. Gould.

rough usage; the fresh condition of the specimen points to its having lived in the river, where it was probably introduced with oysters. Mr. W. Crouch has also found an example of this species at Burnham."

And in the same journal, under date the 8th of May, it is recorded that:—

"Mr. W. Crouch exhibited specimens of *Petricola pholadiformis* from the River Crouch, Essex, and remarked that two living specimens had to his knowledge been taken in that river, both at Cricksea, a mile west of Burnham, in association with *Pholas crispata*."

And at the same meeting Mr. J. E. Cooper and Mr. A. S. Kennard, exhibited the first Kentish specimens, obtained in the spring at Herne Bay and near Sandwich. Mr. Cooper published a short note (with a figure) in *Science Gossip* for 1896 (Vol. III., N.S. p. 147).

Mr. Kennard says that at Herne Bay it is by far the most abundant mollusc, "living in burrows, about six inches deep, in the London Clay. Associated with it is the well-known form, *Pholas candida* which it (superficially) closely resembles, but the *Pholas* is by far the rarer. It is probable that the *Petricola* will be the cause of the greater denudation of the foreshore, since its burrows break up the London Clay, and thus enable the waves to act in a more destructive manner than hitherto. There can be no doubt that the mollusc has been established at Herne Bay for many years, and that it has been overlooked through its outward resemblance to *Pholas candida*. It may readily be distinguished by the fact that the latter form possesses only one siphon, whilst *Petricola pholadiformis* has two, and it was this which first drew my attention to it. I believe that the species will eventually become a common denizen of those parts of our coast where there is a suitable habitat."[1]

The accompanying figures of *Petricola* are copied from the *Report of the Invertebrata of Massachusetts*, by Dr. A. A. Gould, edited by W. G. Binney (Boston, 1870). Although at first glance the resemblance to *Pholas candida* is striking, it really belongs to the Veneridæ, a family most members of which are very unlike *Petricola* superficially. The animals differ; in *Pholas* the respiratory siphons are united nearly to their ends; in *Petricola* they are united only at the base. *Pholas candida* has a small plate (or additional valve) over the hinge line and the ligament is not visible externally. In *Petricola* the valves fit close at the hinge, and there is a strong external ligament.

The habits of *Petricola* in America are similar to those described above by Mr. Kennard. Dr. Gould says "On various parts of our coast; at Chelsea and Nahaut beaches it is found abundantly, imbedded in jutting fragments of a marsh which once existed there, but which has been washed away by inroads of the sea, and now only an occasional remnant lifts its head above the surrounding sand. Also found in great quantities boring into hard blue clay, at low-water mark on Phillip's Beach."

It is an interesting biological question, how came it about

1 A. S. Kennard *in litt.*

The late EDMUND DURRANT,

Hon. Librarian to the Essex Field Club.

Born February 19th, 1843.
Died August 30th, 1900.

that *Petricola* has departed so much in external form from the other members of the family (Veneridæ) to which it belongs? Must we adopt Lamarckism for the nonce, and hold that it is community of habits and environment which has produced the close resemblance in these soft-rock burrowing genera, *Petricola* and *Pholas*?

OBITUARY NOTICES.

THE LATE EDMUND DURRANT.

Honorary Librarian to Essex Field Club.

[*With Portrait, Plate IV.*]

It was with very great regret that many old members of the Club heard of the death of Edmund Durrant, a man highly respected from his prominence in many intellectual movements in the County, and, perhaps, the last in Essex of the grand old race of "literary booksellers," who knew something more of the books they dealt in than their bindings and prices. He died on August 30th, 1900, after a painful illness of several months' duration.

The materials existing for a memoir of Mr. Durrant are but scanty, and they have been utilised in the biographical notices in the local papers and in an article in the *Essex Review*; from these articles the following notes are mainly compiled.

Edmund Durrant came of a family which had settled in Chelmsford for many generations. His father was George Hill Durrant, actuary to the old Savings Bank; his mother before her marriage was a Miss Francis, daughter of an Essex farmer. After a school-boy life at the Grammar School, he went to Brighton as an apprentice, and then came to complete his business training at Hatchetts and elsewhere, and for some time was in business for himself at Walworth. About 1875 he came back to Chelmsford to settle for life at 90, High Street, in the bookselling and publishing house which had been established there for more than a century. Durrant quickly gave a literary tone to the business by the publication of works of local interest, and his shop was a delightful meeting-place, as all new books were placed on counters for folk to look at and talk about, quite in the style of the 18th century booksellers of the days of Johnson and Goldsmith.

Mr. Durrant founded, in January 1888, "Ye Chelmsford Sette of Odde Volumes," a literary and social club which met fortnightly at his house for lectures and discussion. It consisted of forty-nine members and a few "large-paper" copies. As "Volume One" Durrant was virtually President of the society, and he took great delight in the "Sette," obtaining for it the aid of many clever lecturers and speakers from town and country to meet on the "accustomed shelf" under his genial and hospitable guidance.

The Essex Beekeepers' Association was also another organisation of which he was the chief promoter. For many years he was its secretary, and he often lectured on Bees and Beekeeping. He was also engaged by the Technical Instruction Committees of Essex, Suffolk and Yorkshire for the same work. He took an active part in the management of the Chelmsford Museum as secretary, and established there a series of lectures in connection with the University Extension movement. When the Essex Field Club made the attempt to re-establish the Museum on a scientific basis he acted as Librarian, and did all in his power to promote the welfare of the institution. But the deadly apathy of the town in such matters doomed the scheme to failure from the very beginning, and the Field Club was compelled to move its head-quarters to a more promising sphere of work. Mr. Durrant always took great interest in the Club and in the Essex Archæological Society, and he was a frequent attendant at their meetings when held in his part of the county.

In 1892 he established the *Essex Review*, which has been so ably edited from its commencement by our Vice President, Mr E. A. Fitch, but which owed much of its early success to the energy and enthusiasm which Durrant threw into the work He frequently contributed to it, and was always active in securing local matter for the enrichment of its pages. The whole pecuniary liability of this venture also rested with him. It is pleasant to know that both his pet hobbies will be continued on the lines he laid down. The "Odde Volumes" still flourish, and the *Review* will be continued under its present directors as a limited liability company.

Mr. Durrant was a consistent churchman, a synodsman of the parish church, an active member of the Ruridecanal Conference, and for the last few years one of the lay representatives of the Chelmsford Deanery at the Diocesan Conference. He was one of the managers of the Victoria Schools, and helped to found the present Church of England Institute at Chelmsford. In short, all good movements found in him a fervent partisan, but curiously enough he took no active part in municipal matters—it was the intellectual and educational phase of life which attracted him.

Durrant was a voracious reader, and in his little study, which his friends knew so well, he surrounded himself with many choice books and a very fine set of works relating to the history and productions of the County. It is rumoured that these have been left in trust for the benefit of his native town, when one of his aspirations, a public library, shall have been realised. His personal appearance was curiously clerical, with the slight stoop of the student, and utter absence of ostentation, and with every indication of a quiet, reserved, but withal amiable and courteous disposition He lived in Chelmsford in philistine times, but it is to be hoped that one day some of his ideals may be reached; meanwhile the town has lost a familiar figure, a kindly friend, and a worker whose energies it will be difficult to replace.

For the loan of the characteristic portrait, from which our plate is taken, we are indebted to the courtesy of Mr. J. H. Nicholas.

HENRY WALKER, F.G.S.
Hon. Member, Essex Field Club.

THE LATE HENRY WALKER, F.G.S.

Honorary Member of the Essex Field Club.

[*With Portrait, Plate V.*]

In the honourable roll of those who have by their writings and example popularised the study of geology and natural history in the field, the name of Henry Walker will always be prominently inscribed. We of the Essex Field Club have special reasons for cherishing his memory—he aided our earliest efforts by the delivery of several excellent addresses, and his genial presence as a "Conductor" and Demonstrator at Field Meetings greatly enhanced the popularity and interest of these gatherings in the first few years of the Club's work. Perhaps one of his happiest efforts was almost the first publication of the Club—"A Day's Elephant Hunting in Essex" served admirably to direct the attention of amateurs to the fascinating history of the Thames Valley as revealed by the discoveries of Sir Antonio Brady of Mammoths at Ilford, and several graphic reports from his pen in his own newspaper (the *Bayswater Chronicle*), the *Leisure Hour* and the *City Press*, made our Club widely known and appreciated. At the close of the first year's work, Mr. Walker was unanimously elected an Honorary Member in grateful recognition of the services he had rendered to the infant society. In late years the pressing claims upon his time as a journalist allowed him fewer opportunities of attending the Saturday afternoon meetings, but he was always to the fore with his pen and purse in any investigations or plans interesting to the Club, and his death on February 13th, 1900, came as a great shock and grief to his numerous friends both within and without our ranks.

As a summary of Mr. Walker's public career we cannot do better than reprint the appreciative notice from one who knew him well, which appeared in the *Bayswater Chronicle* at the time of his death :—

"It is above all things as a citizen and a believer in 'the religion of humanity' that Mr. Walker would wish to be remembered among his neighbours and friends. Citizenship was to him a part of personal religion, and he counted among his friends the ministers of the Jewish Church, members of the Roman Catholic communion, Anglican clergy and missioners, and Nonconformists of every kind. He was the friend of all sincere enthusiasms which made for social freedom and order and for a broad and many-sided life. He was keenly interested in modern Biblical criticism, and was a pioneer of liberal thought in the realm of science; espousing the principle of evolution at a time when its acceptance was regarded as heterodoxy of the most dangerous kind. The present writer well recalls public lectures and meetings at which antagonism between modern science and evangelical doctrine was still sharp and sore; and it was on such occasions that Mr Walker would throw himself into the breach and defend the former both from the Christain and the human standpoint, with an earnestness which showed that he held the new truth as passionately as he had once held the old. Sharing with his brother (Mr. Thomas Walker, of the *Daily News*), the heritage of a Puritan temperament and ancestry, he knew deeply and intimately the struggle between the new and old forms of faith, and was full of wise sympathy for those passing through phases of intellectual and spiritual doubt.

"He was born on March 14th, 1833, and his boyhood was spent at Northampton, at a time when the regular appearance of the green-covered numbers of Dickens' earlier novels began to loom as large as those of Scott's on the mental horizon of the schoolboy. In early youth he came to London, and laid up vivid memories of the acting of Phelps in Shakespearean tragedy at Sadler's Wells. But social and educational movements soon made an imperative claim upon his heart, and for forty-five years he devoted the best of his leisure and energy to the promotion of scientific knowledge and culture, especially among the young and those deprived of collegiate advantages. He threw himself heartily into the work of the Early Closing Association, of which he was for some years secretary, and at the same time pioneered the Saturday Half-Holiday movement in the direction of natural history and archæological research. His little volume, *Saturday Afternoon Rambles Round London*, is a delightful memorial of some of the first excursions of this kind. He mastered the geology, botany, and entomology of London and the home counties, kept pace with every step of modern astronomy, the exploration of Egypt, and many other departments of antiquarian lore. He was one of the most popular conductors of natural history excursions, or, indeed of visitors to any shrine sanctified by the beauty of nature, or the history of the past. In 1874 he came to this neighbourhood to take up the editorship of the *Bayswater Chronicle*, which he only relinquished within a few months of his death. He founded the West London Scientific Association and Field Club, lectured frequently at clubs and institutes of all denominations, and took an unflagging interest in every development of municipal life. He rejoiced in the progress of the education of women, and their entrance into the higher scholarship and science. Himself a staunch Gladstonian in politics, feeling, too, strong sympathies with collectivist ideals, he never failed in justice or courtesy to the representatives of other political creeds, and was always ready to find common ground with them in any scheme for the benefit of the helpless and oppressed. He was a Fellow of the Geological Society and a member of the Essex Field Club, and was for many years on the Council of Westbourne Park Institute. In 1880 his vigorous crusade in the columns of this paper against a well-known gambling saloon in Monmouth Road, which had entrapped many inexperienced young men in business in the district, landed him in a criminal prosecution for libel, which formed a memorable and interesting episode in his career. It resulted in the complete triumph and vindication of the journalist and the abolition of the nuisance in question. A presentation was afterwards made to Mr. Walker by residents in the neighbourhood in recognition of his public-spirited action. For the past two years he had gradually failed in health, and he passed away at an early hour on Tuesday morning, in the presence of his wife and daughter."

To a later issue of the same journal, the Rev. Dr. Clifford communicated some interesting reminiscences with which we may conclude this notice of our deeply regretted member:—

"It was in these pages I first made the acquaintance of my dear friend Henry Walker, now nearly a quarter of a century ago. He had visited Praed Street Chapel and given a sketch of the sermon he heard. When Westbourne Park Chapel was opened I came into closer acquaintance with him, and soon learned to appreciate very highly the fine qualities of his strong, balanced and noble character.

"First of all, I was attracted by his wide and accurate knowledge. He had an open mind, and was an eager and strenuous student. To the study of Nature he was devoted with the ardour and insight of a lover. If geology stood first amongst the sciences in his esteem, his lectures on that subject showed that it was first because of its manifold relations to other branches of inquiry. His library forms, to some extent, a history of his mind. It is distinctively choice. Its range is wide; but its treasures are the best on its specially selected themes. Still, his keenest interest was in questions of Biblical criticism and interpretation. I have known few men who were more 'up to date' in the knowledge of all matters pertaining to the history of the growth of the Bible, and the scientific exposition of its contents. He was fully conversant with the best work in this department, and had no misgivings as to the results of that work in the end of the day. Most likely he had known and felt the severity of the conflict between the older and the newer forms of faith; but it was manifest that he had reached the perfect calm of an unhesitating reliance on the infinite love.

"All his studies were dominated by a keen sympathy with human progress. His book on the condition of the people in the East End of London, and his papers on Liverpool, show the absorbing interest he had in everything human. For his was an intrinsically religious spirit: and his motives sprang from divine ideals for himself, for the individual man, for the city and for the race.

"The readers of the *Bayswater Chronicle* need not be told that what he knew and felt he could express with lucidity and strength. He was a master of style. His tastes were literary; and his speeches at the Westbourne Park Institute, and in connection with our Rambling Club will be remembered not only for their fulness of information and rich allusiveness, but also for purity and grace of expression. Nor shall we ever forget his unfailing courtesy and gracious consideration for others. He made me think of Emerson's saying, 'Good manners are made up of petty sacrifices. Temperance, courage, love, are made up of the same jewels.' Such jewels he wore with a naturalness that added to their charm and an unconstraint that became their commendation.

"In the removal of Henry Walker, Bayswater has lost one of its best citizens, a man of blameless character, serene spirit, solid work, and high ideals."

We are indebted to Mrs. Walker for the loan of the excellent photograph from which the plate was taken

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

Otters in the Essex Salt-marshes.—In the local journals of Oct. 1st, 1901, a paragraph concerning the capture of an otter was headed with the sensational line "Sea Otter in the Blackwater." "In the river Blackwater on Friday, not far from where the shark was recently captured, a Mersea fisherman named Reuben Mussett shot a sea otter, a creature never known to have been brought ashore before in the neighbourhood. It is a capital specimen, turning the scale at 27lbs." We allude to this mainly as an excuse for inserting an extract from a letter of Dr. Laver's written at the time:—"The 'sea otter' was a very fine specimen, 4ft. 1in. long, a male, and was shot on the ooze or saltings at Tollesbury. The skin has been preserved by Pettitt for Mr. Stuart-Wortley, of Orleans Cottage, West Mersea. It had been no doubt living on Tollesbury Marshes and in the habit of making excursions into the tide-way. I dare say you are aware that there are now otters on nearly all the marshes round the coast. This is as it was in the early years of 1800, when the otter was a very common beast. I am glad to say that there is a prospect of this interesting animal again being much more abundant than it was some years ago."

Capture of a Porbeagle Shark (Lamna cornubica) near Tollesbury. In the *Essex Herald* for October 1st, 1901, the capture of a shark was reported as follows:—"On Tuesday afternoon, when the Tollesbury fishermen were returning home, a shark was seen swimming near the Naas End. Several attempts were made to capture it, and William Lewis, jun., accompanied by William Lewis, sen., and Garrod, succeeded in getting a noose over his head and fixing it in his gills. He was towed for some distance to the landing stage at the 'Leavings,' frequently turning on his back ready for battle. When dragged upon the mud the shark went through many frantic evolutions, but was at length killed. There is an abundant supply of fish in the Blackwater just now, and the shark is supposed to have followed them. The fish was 6ft. 10in. in length, and was on exhibition at Tollesbury on Tuesday evening. On Wednesday his captors tried their fortune as showmen by taking the shark to Maldon for exhibition." Dr. Laver wrote to us respecting this fish:—"The shark you mentioned is now at Ambroses, the Bird-Stuffer's. I have seen it to-day; it is 7ft. 3in. long, and it is an example of the Porbeagle Shark (*Lamna cornubica*) as you suggested."

Pomatias elegans in a living state near Wormingford.—Dr. H. Laver has kindly forwarded to us a letter recently received from Mr. George T. Rope in which the writer says:—"I have not your list of the Mollusca of the Colchester district by me just now, but as far as I can recollect *Cyclostoma* (*Pomatias*) *elegans* is not included. Having met with this species last autumn at or near Wormingford, I thought it might possibly interest you to know of it. On the 8th of last September (1901) I came upon several 'dead shells' at a spot which I have no doubt you know, about two miles or so from Bures. And with them was a single specimen of *Helix* (*Helicella*) *ericetorum* and

Helicigona lapicida I had no opportunity of searching the spot again until October 2nd, after a heavy rain, and then found three or four *living* examples of *P. elegans*, as well as several more dead shells." [The first record of *P. elegans* in a *living* state in Essex, was by Mr. J French in the ESSEX NATURALIST for 1890 (vol. iv., pp. 92-93) who found the mollusc at Felstead in a very limited area of about 100 yards in diameter. Recently dead shells have been recorded by Christy at Saffron Walden, and specimens are in the Saffron Walden Museum from Wicken Bonhunt. Semi-fossil shells are common in many localities in the Post-Pliocene deposits. By Mr Rope's kindness the Essex Museum now possesses specimens of the Wormingford *Pomatias* —ED.]

Variety of Arion ater near Bures.—On September 21st, 1901, I saw a curious variety of *Arion ater*, on the Suffolk side of the Stour, near Bures. The fore-parts, including the shield, were of a delicate cream or ivory tint; the rest of the upper surface pale silvery grey, almost white. The foot was of the colour of an ordinary red cheese The slug was about full grown and was a beautiful object. I am not at all "well up" in the slugs, but have noticed many striking varieties of this species, differing widely from one another.—G. H. ROPE, Blaxhall, Tunstall, Suffolk.

Aphodii in Epping Forest.—The coleopterous genus *Aphodius*, the members of which live in dung, is well represented in Epping Forest, nineteen species (or exactly half the total number found in the British Islands) having occurred to me during the four years I have been collecting beetles in the Forest district. Many of these are common everywhere, but others are decidedly local It is unnecessary to give a complete list of the Forest Aphodii here, but I may mention the following species as being the most interesting of my captures:—

A. constans, Duft, common from March to May in horse-dung in various parts of the Forest. I have also taken a few specimens in October. Its near ally, *A. ater*, De G., which is generally supposed to be a much commoner species, is, as a matter of fact, comparatively scarce in the Forest. *A. rufescens*, F., not uncommon in some of the outlying fields. *A. conspurcatus*, L., in numbers in a field near Chingford in the late autumn of 1898, and a few have occurred at High Beach; it is also recorded from Loughton in Canon Fowler's *Coleoptera of the British Islands*. *A. sticticus*, Payk, several in horse dung in a space of a few feet only between Chingford and High Beach, May, 1900. *A. zenkeri*, Germ., seven specimens in deer dung not far from the Wake Arms, and one in horse dung at High Beach, July, 1899. *A. luridus*, F., this handsome species is apparently by no means common in the London district, and has hitherto been very scarce in the Forest; I took a male in a field between High Beach and Sewardstone in May, 1898, and two females at Chingford in April, 1900. *A. depressus*, F., a few in a ride between Chingford and Fairmead, July, 1899.—F. B. JENNINGS, F.E.S., Upper Edmonton, October, 1901.

The Blister-Beetle (Lytta vesicatoria) near Colchester.—In the *Times* for September 3rd, 1901, Mr. W. H. Harwood, of Colchester, had the following note, dated August 31st:—"Among the many notable insects which have occurred in unusual numbers this year the blister beetle, or Spanish fly

(*Lytta vesicatoria*), seems worthy of special mention. This splendid species is usually extremely rare in Britain, but in 1837 was found in considerable numbers in Essex, Suffolk and Hampshire. About 1875 it was again taken near Colchester by Mr. J. G. Grapes, and more recently it has been found sparingly in Cambridgeshire by the Hon. N. Charles Rothschild and others. Mr. Donisthorpe also obtained 11 specimens in the same county this year, after spending a considerable time in searching for them. Near Colchester, a working man who was out with his butterfly-net one summer morning chanced to notice several ash trees which had been almost entirely denuded of their leaves, and while he was examining into the cause he saw one of the beetles flying towards him, its glittering armour resplendent in the sunshine. This he netted, and presently came to another tree, upon which were a large number of specimens within easy reach, and proceeded to bottle some eighty of them. Unfortunately, he did not know what an important capture he had made, and left most of the specimens in the bottle till they were spoiled, but pinned a few and recently brought them to me to determine. Having been told by the late Dr. Churchill where he had principally noticed the species in 1837, I visited the district, and found that scores of trees over a wide area showed unmistakable signs of its ravages. To account for the amount of feeding the beetles must have been present in enormous numbers, as many of the trees are of considerable size, and nearly all had been extensively eaten. I have frequently looked for them in the same locality myself in previous years, but never had the good fortune to find them, and felt more than a little disappointed when I saw that I had this year missed such an opportunity as I shall probably never have again."

BOTANY.

Centaurea solstitialis and Triglochin palustre near Witham.—Possibly the two following records may be of interest to the readers of the ESSEX NATURALIST :—

Centaurea (*Calcitrapa*) *solstitialis*.—Star-Thistle. This occurs as a casual in fields of lucerne, but although I have searched such localities for many years, it did not come under my notice until the August of 1901, when it was found in plenty at Witham.

Triglochin palustre was also found about the same time in the above parish.

EDWIN E. TURNER, Coggeshall, Essex.

METEOROLOGY.

Meteorological Statistics at Colchester.—Mr. H. Goodyear, the Borough Surveyor at Colchester, states that meteorological readings have been taken in his office for the last 15 years, and he gives some interesting statistics. The rainfall for the year 1901 was only 14·11 inches, the smallest annual rainfall ever recorded in Colchester, and for that matter in any town in England, and excluding towns of less than 30,000 inhabitants, Colchester is the dryest town in England.

The weather has been exceptionally bright also, as there were only 105 days on which rain fell; and this is also unprecedented.

The following is a table of statistics for the last 15 years, the record readings being distinguished by an asterisk :---

Date.	Tl. depth of rain for the year.	Number of wet days.	Greatest rainfall in 24 hours.	Greatest Cold.	Greatest Heat.	Highest Barometic Reading.	Lowest Barometic Reading.
1887	17·25	152	0·73	20°	90°	30·85	28·55
1888	23·40	173	1·01	17°	86°	36·85	28·66
1889	23·31	159	1·15	10°	86°	30·78	28·84
1890	22·05	166	0·78	11°	78°	30·70	28·47
1891	23·82	168	1·00	12°	79°	30·78	28·40*
1892	26·68*	136	1·60	7°	79°	30·62	28·86
1893	19·20	148	1·30	11°	87°	30·80	28·63
1894	23·70	188*	0·85	14°	87°	30·65	29·08
1895	19·90	131	0·85	Zero*	82°	30·73	28·75
1896	22·84	146	1·35	22°	91°	30·90*	28·45
1897	24·50	139	1·76*	20°	91°	30·79	28·55
1898	18·12	128	0·76	19°	92°	30·77	28·73
1899	19·60	129	1·06	18°	90°	30·88	28·64
1900	15·12	144	0·67	15°	92½°*	30·66	28·77
1901	14·11*	105*	0·85	19°	89°	30·77	28·45

MISCELLANEA.

Queen Elizabeth's Lodge and Epping Forest.—By a strange coincidence I had occasion to-day to refer to a volume of *Household Words* for 1851. Under date May 10th—just half-a-century ago to the day—wherein is an article on "Epping Forest" which from its internal evidence is from the pen of Charles Dickens. No railway then passed through the district, Hainhault Forest was yet undisturbed and unstubbed, though but two years later it was speedily and ruthlessly destroyed ; and the nearest station was at Ilford, some three miles distant. Some years ago I had marked this in my copy for a notice in the ESSEX NATURALIST, but had quite forgotten it, but I think the extract concerning Queen Elizabeth's Lodge is worthy of reiteration in our journal. It is, however, not a portion of the article itself, but a quotation from William Howitt's *Year Book of the Country* :—

"We take one long view from a hill top of the far spread country, and mount our own vehicles, and away. Away ! but whither ! To the Old Lodge of Queen Bess. Old Lodge! the hand of the past is impressed upon thee! and has given thee a character. It has invested thee with the poetry of nature. Storms roaring through the huge elms that stand near—old companions ; fierce winters beating on thy steep, gabled roof, and tinting thy framed walls ; autumns and springs and hot-baking summer—a long series—come across the imagination, as we think of thee. The broad easy oaken staircase up which the heroine of the Armada, and the Queen of Scots tragedy, is said to have ridden to her dining room, the tapestried chamber, and the banqueting hall please me ; but, far more, the ancient desolateness without and around ! . . . . We walk for miles in green glades, and beneath the close covert of the green boughs of the hornbeam trees. . .

. . . . We walk and dream—and miles of profoundly solitary woods, and old solitary Jäger-houses, and primitive villages in deep remote glens, and antiquated towns in rarely visited regions, rise before us as we go." How changed is all this now!

The whole article (some eight columns) is full of interest, and was written in view of a Bill in Parliament for the enclosure of Epping and Hainault Forests. The concluding paragraph is as follows:—"The Commissioners of Woods and Forests may, perhaps, think they are acting quite poetically in saying with Milton, in 'Comus.' 'To-morrow to fresh fields and pastures new': but 'fresh fields and pastures new' obtained by the destruction of the only metropolitan forest, would be a metamorphosis which the London public would never cease to deplore."

At that date (1851) and later, the writer, though then a mere boy, can well remember yet, the Forest district as it was; having frequently accompanied his grandfather in various drives; when the "Cherry Pie House" in Wanstead "Town" and the Eagle at Snaresbrook, were the most quiet and primitive of inns, for the entertainment of "man and beast"—where hundreds of acres of land now built over were dense and open forest, which extended beyond the High Stone nearly up to Leytonstone and right away to Bushwood; while the triple avenues of the latter stretched nearly as far as Cannhall.—WALTER CROUCH, Wanstead, May 10th, 1901.

Ancient Boat found about 1830 in the Lea River Deposits near Temple Mills.—In connection with the finding of the so-called "Viking Ship" at the excavations at Walthamstow (ante p. 151 and plate III.) it may be interesting to recall the account of the discovery of an ancient boat given in Robinson's *History of Hackney*.[1] It was found (*circa* 1830) in excavating the East London Company's Reservoirs a little to the north of Temple Mills, between those marshes and Lea Bridge. The boat lay at a depth of about 4 feet below the surface of the marsh; it was "embedded in a stratum of black-clay with shells intermixed: this stratum continues of the same quality to the depth of 5 feet; above the boat there was a stratum of yellow clay about 4 feet deep. The bottom of the boat was decayed, and at the end nearest the bow it was very imperfect, and broke into pieces when it was attempted to take it out of the place of its deposit, but left an impression from which a sketch was taken. Its dimensions were 20 feet from head to stern, 6 feet wide, and 18 inches deep; it was what is termed clinker-built, the joints being made tight with a cement in which cow-hair was used." A plate of sections is given, with a plan of the river, showing the spot at which the boat was lying. The details of the sections are examined by Mr. Whitaker in his *Geology of London*, vol. i., pp. 473-4. Maitland (*History of London*) talks of a boat having been found in "Stanstead" at the erection of Stanstead Bridge, but Camden in his *Britannia* fixes the point near the place where the boat is above stated to have been unearthed, by saying that the boat was found, "north of Temple Mills."

1 *The History and Antiquities of Hackney, in the County of Middlesex.* By Wm. Robinson, LL.D., F.S.A., 2 vols., Lond., 1842.

Honorary Members of the Essex Field Club.

Year of Election.

1884 Britten, James, K.S.G., F.L.S., (*Department of Botany, British Museum of Natural History).*

1881 Cooke, M. C., M.A., LL.D., A.L.S.

1902 Dalton, W. H., F.G.S. (*late of the Geological Survey*).

1901 Edwards, J. Passmore.

1889 Evans, Sir John, K.C.B., D.C.L., LL.D., D.Sc., F.R.S., V.P.S.A., F.L.S., F.G.S.

1902 Farmer, Professor J.B., M.A., F.R.S. (*Professor of Botany, Royal College of Science*).

1897 Greenhill, J. E., *Member of Geologists' Association.*

1881 Harting, J. E., F.L.S., F.Z.S. (*Member of the British Ornithologists' Union).*

1889 Holmes, E. M., F.L.S. (*Curator to the Pharmaceutical Society*).

1902 Howse, Professor G. B., LL.D., D.Sc., F.R.S., *Secretary to the Linnean Society, Professor of Zoology, Royal College of Science.*

1882 Kent, W. Saville, F.L.S., F.Z.S., F.R.M.S.

1902 Lankester, Professor E. Ray, M.A., LL.D., F.R.S., F.L.S., &c. (*Director of the British Museum of Natural History*).

1885 Newton, E. T., F.R.S., F.G.S. (*Palæontologist, Geological Survey*).

1902 Read, C. H., F.S.A. (*Keeper of the British and Mediæval Antiquities, British Museum.*)

1891 Roscoe, Sir Henry E., LL.D., D.C.L., F.R.S., F.C.S.

1884 Rudler, F. W., F.G.S. (*Curator of the Museum of Practical Geology*).

1881 Smith, Worthington G., F.L.S., M.A.I.

1893 Stewart, Professor Charles, M.A., F.R.S., F.L.S. *Fullerian Professor, Royal Institution, and Hunterian Professor and Conservator of Museum, Royal College of Surgeons.*

1902 Thiselton-Dyer, Sir W. T., K.C.M.G., LL.D., F.R.S., F.L.S. (*Director of the Royal Gardens, Kew.*)

1880 Wallace, Alfred Russel, D.C.L., F.R.S., F.L.S., F.Z.S., F.E.S.

1902 Ward, Professor H. Marshall, D.Sc., F.R.S., F.L.S. (*Professor of Botany, University of Cambridge.*)

1880 Whitaker, William, B.A., F.R.S., F.G.S. (*Assoc. Inst. C.E.*) &c.

1883 Woodward, Henry, LL.D., F.R.S., P.G.S., &c.

1902 Woodward, Horace W. B., F.R.S., F.G.S., &c. (*Geological Survey*).

Nos. completing Vol. XII.] *Price* 4s. 0d. [DECEMBER, 1902.

The *Essex Naturalist:*

BEING THE

JOURNAL

OF THE

ESSEX FIELD CLUB.

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary and Curator.

Contents.

This part completes Volume XII.

[*Title-page and Index to Volume XI. is inserted loosely.*]

The authors alone are responsible for the statements and opinions contained in their respective papers.

PUBLISHED BY THE CLUB, AT THE ESSEX MUSEUM OF NATURAL HISTORY, STRATFORD, ESSEX.

Ent. Stationers' Hall.] [Published Dec., 1902.

COMMUNICATIONS *and* ADVERTISEMENTS *should be addressed :—*

The Editor of "THE ESSEX NATURALIST,"

"Springfield," Buckhurst Hill, Essex.

A SHORT PROSPECTUS OF

THE ESSEX FIELD CLUB.

(Founded January 10th, 1880.)

Patron:

H.R.H. The Duke of Connaught and Strathearn, K.G., Ranger of Epping Forest.

President:

Prof. R. Meldola, F.R.S., F.R.A.S., F.C.S.

Permanent Vice-Presidents:

Professor G. S. Boulger, F.L.S., F.G.S.
Frederic Chancellor, J.P., F.R.I.B.A.
Edward A. Fitch, F.L.S., F.E.S.
T. V. Holmes, F.G.S., M.A.I.
Henry Laver, M.R.C.S., F.L.S., F.S.A.
Professor R. Meldola, F.R.S, F.R.A.S.

Treasurer

David Howard, J.P., F.C.S., *Devon House, Buckhurst Hill.*

Hon. Secretaries

W. Cole and B. G. Cole, *Buckhurst Hill, Essex.*

Librarians:

Vacant (!)

Museums, Head-Quarters, and Library

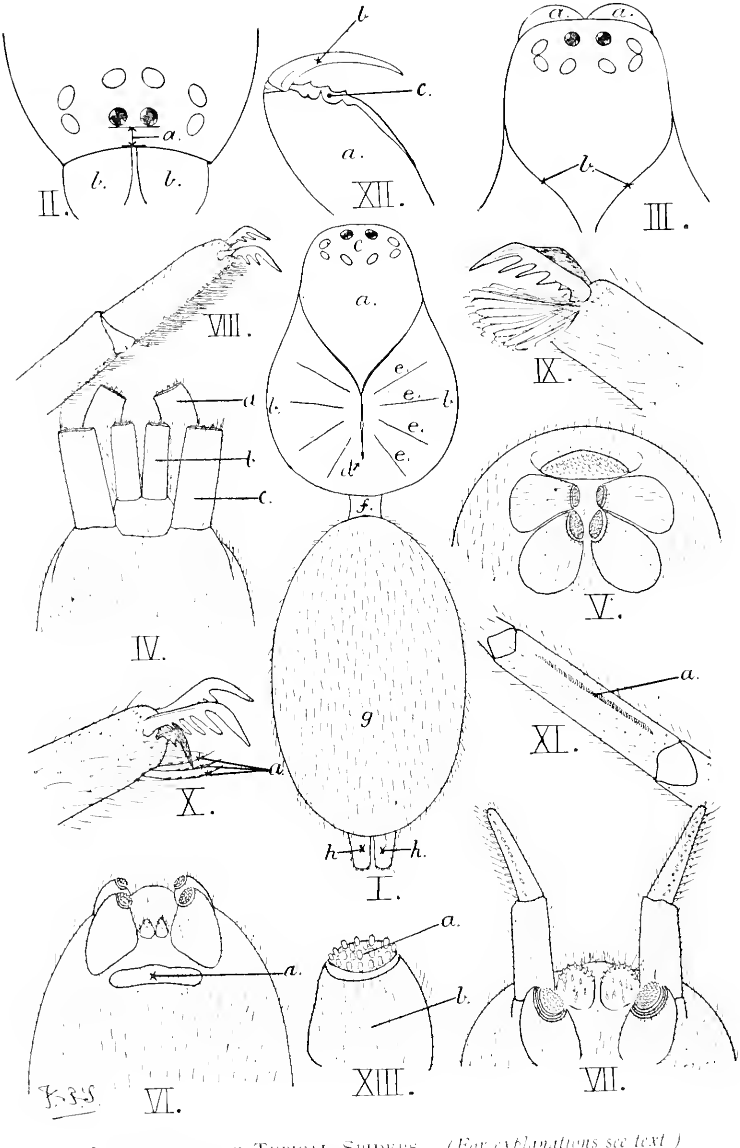
Queen Elizabeth's Lodge, Chingford, Essex.
Essex Natural History Museum, Stratford, Essex.

Curator:

W. Cole, F.L.S., F.E.S.

The Essex Field Club is intended to band together those taking an interest in Natural Science residing within or near the borders of Essex, as well as those in London, with the aim of creating and fostering a taste for the study of Nature in the field as well as in the study.

The Publications of the Club have gained general estimation, because of the care which has been taken to confine them to their original purpose. the record of investigations and elucidations of the Natural History (in its widest sense), the Topography and Pre-historic Archæology, of the County of Essex and the lands and sea bordering thereon. Since the foundation of the Club in 1880, many thousand pages of such material have been published, and a large proportion of the articles are of value to students residing outside the Club's limits.



DISSECTIONS OF TYPICAL SPIDERS (For explanations see text)

THE SPIDERS OF EPPING FOREST.

By FRANK P. SMITH.

Part I.

Influenced by the memories of many pleasant days spent within the leafy glades and upon the sunny heaths of Epping Forest, it is with something like a sense of duty that I enter upon the task of compiling a descriptive list of the spiders indigenous to this lovely district. I need in no wise eulogise upon the natural beauties of the Forest, for they must be familiar to every resident in the northern portion of the Metropolis, and, for the benefit of the stranger, we have more than one good guide-book dealing with the attractions of the neighbourhood. We constantly hear it remarked that for certain groups of insects the Forest is not so remunerative a locality as it used to be; but we must admit that it would be an absolute impossibility for a well-studied order, such, for example, as the Lepidoptera, to hold its own in a collecting ground within so short a distance of the Metropolis. In many parts of the Forest, too, the London-clay, with its somewhat limited flora, comes to the surface, thus tending to decrease the variety of insect life in those localities. To-day, however, in spite of the attentions of energetic collectors and the depredations of thoughtless excursionists, this district may be relied upon to furnish treasures innumerable for the earnest student of nature who is willing to enter upon the task of investigating those orders of the animal kingdom which have been for one reason or another more or less neglected. Foremost amongst these must be placed the ARANEAE, or SPIDERS, with which I wish to deal in the present series of papers. The list of species as it now stands, although in many respects a good one, will no doubt be materially augmented by further search, and it is hoped that these notes may not be regarded as "something attempted, something done," but rather as an incentive to the enterprising collector to avail himself of every opportunity of gathering specimens of spiders in this interesting locality.[1] I am confident that one of the greatest obstacles to the advancement of British Araneology is the lack of up-to-date literature in the

1 The previous papers on Spiders in our publications are only two in number, viz.: "A contribution towards a knowledge of the Arachnida of Epping Forest" by the Rev. O. Pickard-Cambridge (*Trans. E. F. Club, Vol. iv.*, pp. 41-49) and "Further contributions" on the same subject, by F. O. Pickard-Cambridge, ESSEX NAT., vol. xi., pp. 315-318. ED.

English language. True it is that the study can boast of abundance of valuable embellishments bestowed by such well-known scientists as Mr. F. O. Pickard-Cambridge, the Rev. John Hull, Dr. G. Carpenter, etc., but the foundations laid in this country by the untiring industry of Mr. John Blackwall and the Rev. O. Pickard-Cambridge can hardly be expected to support the rapidly-increasing structure of araneological science superimposed by a few earnest students of this much-neglected order. A practical difficulty, too, presents itself in the scarcity of copies of Mr. Blackwall's *Spiders of Great Britain and Ireland* and the Rev. O. Pickard-Cambridge's *Spiders of Dorset*, and in the face of such facts I may be allowed, perhaps, to add my iota to the splendid efforts of these veteran araneologists.

In the hope of affording assistance to prospective students of the order I feel justified in devoting a considerable portion of the space at my disposal to the consideration of the anatomy and classification of the Araneae, trusting that opportunities will arise later for the publication of more detailed generic and specific descriptions. It will be obviously impossible to publish full drawings of all the species enumerated, but I hope to illustrate many of the more important specific distinctions, by means of which the collector will be enabled to recognise at least the commoner and more striking of the Epping Forest Spiders. I find from experience that simple, diagrammatic drawings are of far greater practical value than heavily shaded productions of a more pretentious character, and I propose to model the present illustrations in accordance with this belief. In generic and specific descriptions, similarly, style and effect must be sacrificed to clearness, even at the risk of frequent iteration and monotony of expression.

In order to facilitate reference the subject matter might, I think with advantage, be arranged as follows :—

I. *Anatomy*, including description of anatomical terms.

II. *Classification*.

III. *Practical Work*, including collection, examination, and preservation of specimens and noting of habits.

IV. *Literature*.

V. *A Systematic List of the Spiders of Epping Forest,* including brief descriptions of families, genera and species.

I.—*ANATOMY.*[2]

Body. The body or trunk consists of two well-defined parts, *Cephalo-thorax* and *Abdomen*, connected by a slender *Pedicle* or waist.

Cephalo-thorax. This is the anterior great division of the body, consisting of the *Caput* or head, and the *Thorax*. These two parts are fused together, a more or less distinct linear impression usually indicating the junction. Traces of original segmentation of the thorax are as a rule apparent in the form of depressed lines termed *lateral impressions* which converge upon a more or less distinct *central impression* (occasionally absent). The integument of the cephalo-thorax is of a more or less firm and resistant character; but in the case of some species in which the abdomen is protuberant anteriorly, the posterior portion of the thoracic integument becomes of a somewhat pliant nature. The caput is more or less wedge-shaped posteriorly. Upon the posterior portion of the upper surface of the thorax is occasionally found a stridulating organ The length of the cephalo-thorax should be taken as implying the direct distance between the lower edge of the clypeus and the central part of the posterior margin of the thorax. This measurement is best made by means of an accurate divider with curved needle points.

Connected with the cephalo-thorax are the following structures, which are described separately:—Eyes, Sternal-plates, Falces, Palpi, Legs.

Eyes. The eyes of spiders are invariably simple and are normally eight in number. In a few British species only six are present, whilst in some exotic spiders the number is still further reduced to four or occasionally two. Two forms of eyes are found, which Mons. E. Simon, conceiving a difference in their respective functions, designates *diurnal eyes* and *nocturnal eyes*.

2 See Plates VII. and VIII., with the explanations thereof on pp. 189-90 post.

With the belief that these two forms are respectively co-existent with diurnal and nocturnal habits I am quite willing to concur; but whether the eyes of the nocturnal type are specially adapted for viewing objects in a dim light or whether these organs are impaired by disuse, it is rather difficult to determine. Be this as it may, the two forms are in the majority of cases very distinct and are of some use in the separating, at any rate, of the more highly specialised species of several families. As might be expected many forms are found intermediate between the distinct diurnal eye and the nocturnal type. The diurnal eyes are perfectly, or almost perfectly round, usually of dark colours, or black, and of a strongly convex form. The nocturnal eyes are sometimes round, more often oval or even angular, of a pearly white tint and rather flattened. In some species the eyes are homogeneous (*i.e.*, all of one type, either diurnal or nocturnal); but in other cases they are heterogeneous, both types being co-existent in one species. The tract bounded by the eyes is known as the *ocular area* and the portion between the foremost eyes and the anterior edge of the caput is termed the *clypeus*. The expression "length of the ocular area" must be regarded as implying the measurement in a direction parallel to the main axis of the body. It will be noticed, therefore, that in the majority of spiders the ocular area is broader than long. Statements as to the straightness or curvature of a row of eyes are based upon measurements made from the centre of the eyes in question. It will be easily seen that the apparent curvature of a row of eyes upon a convex or uneven surface will depend greatly upon the position in which the creature is viewed. It should be understood that details as to the straightness or curvature are, as a rule, founded upon observations made in a line at right angles to the integument at the central portion of the row of eyes in question. The expression *recurved* indicates that the convexity of the curve is directed forwards, curvature in the opposite direction being denoted by the term *procurved*.

Sterinal Plates. These are two strong chitinous pieces placed below the cephalo-thorax, one between the coxal joints of the palpi, the other between the coxæ of the legs. The former is known as the *Labium*, the latter as the *Sternum*. The Labium is a small plate, usually of a somewhat oblong or semi-oval shape, sometimes plane, at other times having its anterior edge turned outwards or thickened along its external surface, this form being known as *recurved*. The Sternum is a rather large plate, usually more or less oval or cordiform, which occupies the central portion of the inferior surface of the cephalo-thorax. To this structure the true legs are attached. In a few cases projecting portions of the sternum pass beyond the attachments of the coxæ, thus forming a kind of socket for the reception of each leg.

Falces. The falces are a pair of appendages situated beneath the anterior extremity of the cephalo-thorax. Each falx consists of a stout *basal joint* surmounted by a movable *fang*, this latter being pierced by a channel whose opening is near the point of the fang. Connected with each channel is a poison gland, sometimes placed within the basal joint, sometimes within the cephalo-thorax and sometimes partly in each. Upon the external surface of the basal joint is often found a smooth raised portion or *basal protuberance*, and in some species the falx is externally striated. This structure is apparently employed as a stridulating organ, being actuated in this capacity by a process upon the inner surface of the palpus. The fang, when at rest, lies in a depression at the extremity of the basal joint, known as the *fang-groove*: this latter is often provided, at one or both of its edges with teeth or *denticulations*. The basal joint is sometimes furnished towards its extremity with a dense tuft of hairs, known as a *scopula*.

Palpi. The palpi are a pair of limbs which are attached to the underside of the cephalo-thorax, one upon each side of the labium. Each palpus consists primarily of five distinct joints, *Coxa*, *Trochanter*, *Femur*, *Tibia* and *Tarsus*. These parts are also known amongst various authors as exinguinal, humeral, cubital, radial and digital joints respectively. Each palpal coxa is furnished with an appendage in the form of a well developed plate known as a *Maxilla*. The maxilla often appears to be simply an enlargement of the coxal joint itself, but a transverse striation is usually evident, indicating the real distinctness of the two parts. The tibia of the male palpus is often furnished with one or more processes, known as *Apophyses*, and a patellary or femoral apophysis is occasionally present. In the female the palpus is more or less pediform, sometimes with and sometimes without, a terminal claw. In the male, however, a most curious modification of this organ is observed. The tarsal joint is as a rule more or less split or excavated, and connected with it is the external reproductive organization of the spider. The cup-like depression formed by the excavation of the tarsus is often termed the *Alveolus*. The spermal secretory glands are of an exceedingly simple structure, and their external opening, which is small and only detected with difficulty, is situated upon the underside of the abdomen, some distance in front of its central part. From this aperture the spermal fluid is absorbed, directly or indirectly, by means of the palpal organs and thence injected into the ovaries of the female. To the araneologist the palpi of male spiders are of paramount importance not only as reliable indications of specific identity but as characters upon which much of our systematic classification may with advantage be based. More detailed descriptions of the palpi will be given when the limitations of the groups founded upon the variation of these curious structures claim our consideration. It should be remembered that statements as to the position of certain parts of the palpus are made on the understanding that the limb is extended horizontally forward.

Legs. These are invariably eight in number, attached to the sternum, and each consists of seven joints termed respectively *Coxa*, *Trochanter*, *Femur*, *Patella*, *Tibia*, *Metatarsus and Tarsus*. The term "Protarsus" has been suggested as more accurately describing the position of the joint here termed the metatarsus. Theoretically this is so; but as this latter denomination has been almost universally adopted by arachnological writers I see no pressing necessity for the alteration. The legs are terminated by two or three curved and usually pectinated *Tarsal Claws*. These are almost always attached to the tarsus itself, but occasionally to a small supernumerary joint known as the *Onychium*. In some species a dense cluster of hairs is found beneath the extremity of the tarsus, known as a *Claw-tuft*, and a similar structure sometimes extends along the inferior surface of the joint, it being then known as a *Scopula*. In some families the metatarsi of the fourth pair of legs are each furnished with two closely set rows of short curved bristles, forming a kind of comb. This organ, known as the *Calamistrum* is always co-existent with a supernumerary spinning organ, and by its aid a peculiar flocculent web is drawn from this spinner and spread upon the snare. The calamistrum is absent in the adult male, whose spinners, however, are similar to those of the female. The relative length of the legs is often of some importance in classification, and is usually expressed by a formula. Thus IV., I., II., III., would indicate that the fourth leg was the longest, the first coming next in length, and the third the shortest. When two legs are of equal length the numbers denoting them are connected by a hyphen. Tibia I., tarsus IV., and similar expressions are often used, denoting the tibia of a leg of the first pair, tarsus of a fourth leg and so on. The legs are furnished with hairs, and usually with spines also.

Abdomen. The posterior great division of the body is known as the abdomen. With the exception of one rare exotic species it exhibits no distinct segmentation, unless, indeed, the small *Anal Tubercle* which is often present may be regarded as a segment. The abdominal integument is usually pliant and non-resistant, but occasionally it becomes more or less coriaceous.

Spinners. Towards, or at the posterior extremity of the abdomen are several pairs of appendages known as the spinners. These organs vary in number in different species, three pairs, however, being usually present. The spinners are more or less cylindrical, conical or mammiform and each is furnished with numerous small *Spinning Tubes*, each of which is capable of emitting a single silken thread. In some species an extra or supernumerary spinner, termed a *Cribellum*, is present. This organ is of a type different from the normal spinners, in front of which it is placed. Its form is very constant in the various families in which it occurs, being a transverse strip often with a central constriction, this latter indicating, apparently, that it has been formed by the fusion of a pair of abdominal appendages.

Spiracular organs. Two forms of respiratory organs are found in the Araneae—*Laminal Tracheae* and *Tube Tracheae*. The laminal tracheae, sometimes termed sac-tracheae, lungs, lung-sacs, or lung-books, are situated beneath the integument of the inferior surface of the abdomen. The organs themselves each consist of a number of exceedingly delicate laminae plentifully supplied with very minute vessels and communicating by a narrow transverse aperture with the atmosphere. The integument covering each laminal trachea is often of a different tint from the surrounding portions, and these parts are termed the *Spiracular-plates*. The tube tracheae open sometimes in one aperture and sometimes in two apertures, usually close to the spinners, but occasionally upon other parts of the under surface of the abdomen.

Reproductive organs. The sexual secretory glands of the male and the entire reproductive system of the female are situated within the abdomen, their external openings being placed with few exceptions, between those of the laminal tracheae. In the male the opening is very minute and inconspicuous, but in the female it is often provided with variously formed *Epigynal Plates*. In some cases the integument upon the anterior side of the female genital aperture is chitinised, produced downwards and backwards, and more or less modified in form, the resulting structure being known as the *Clavus*. The genital armature of the female is usually a most important criterion in the differentiation of obscure and closely allied species.

Fig. V. Caput in profile, showing striæ on falx.
Fig. VI. Caput in profile, showing basal protuberance of falx (*a.*)
Fig VII. Leg *a. Coxa.*

b.	*Trochanter.*	*e.*	*Tibia.*
c.	*Femur.*	*f.*	*Metatarsus.*
d.	*Patella.*	*g.*	*Tartus.*

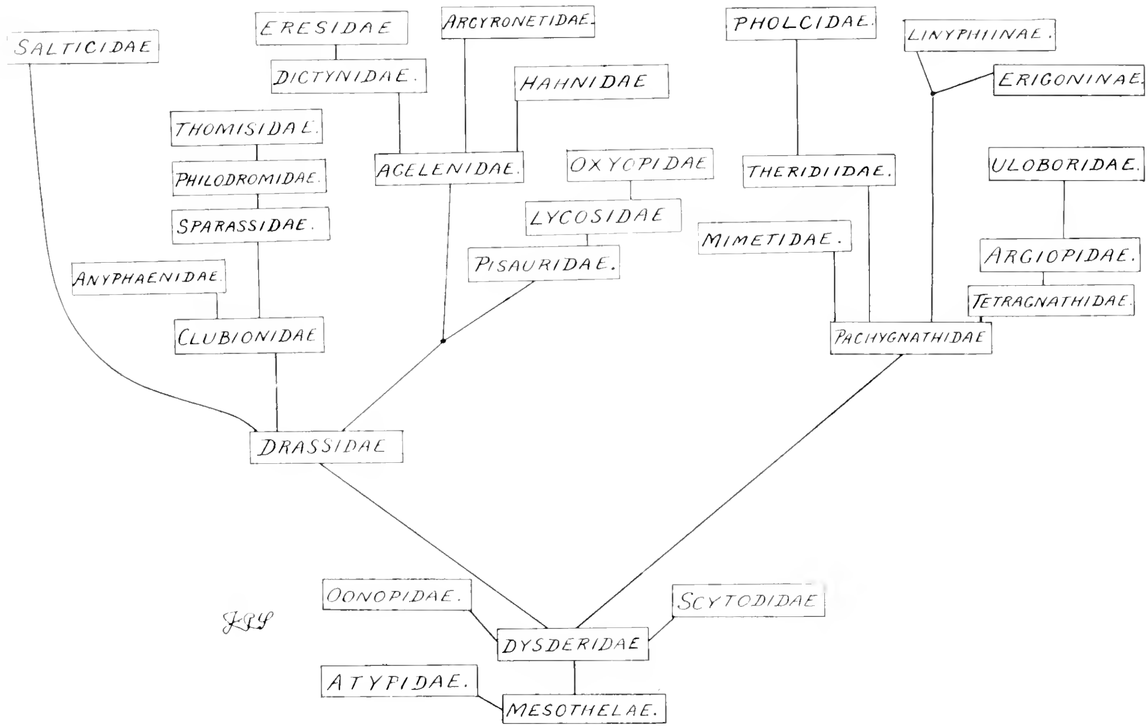
Fig. VIII Palpus, male.

a.	*Maxillary plate.*	*e.*	*Tibia.*
b.	*Trochanter.*	*f.*	*Tarsus.*
c.	*Femur.*	*g.*	*Palpal organs.*
d.	*Patella.*		

Fig. IX. Vulva, without clavus.
Fig. X. Hind portion of thorax of *Phyllonethis*, showing striations
Fig. XI. Vulva with *Clavus* (*a.*)

II.—CLASSIFICATION.

In order to satisfactorily sub-divide this difficult and complex Order it becomes absolutely necessary to enter into the consideration of certain exotic forms. A system founded upon a limited fauna, such as that of the British Isles, would of necessity be more or less artificial and misleading, and certain groups which might then appear quite distinct, would become almost inseparable upon the insertion of exotic species. The difficulty of establishing a satisfactory system of classification is vastly increased by the widely diverse opinions held by various authorities as to the comparative importance of certain portions of the structure of the creatures under consideration. Again, unless certain links in the chain of evolutionary development have disappeared, classification becomes an impossibility, species, genera and families merging into each other to form perplexing and almost unmanageable series. In the case of the Araneae so many of the earlier forms remain, that groups whose more highly specialised representatives are totally dissimilar become inseparably linked by intermediate species and defy any attempt at a satisfactory broad sub-division by reason of the gradual development and elimination of those structural characteristics upon which our systems are based. With the discovery of new species the classification of a group becomes as a rule more complex and difficult, forms being thus found to bridge over the gaps between previously distinct genera and families. Were our knowledge of any group absolutely complete, both in regard to modern and extinct forms, *classification would become quite impossible*, as we should



Suggested Development of the British Spider Families.

find perfect gradations from the most ancient stock to the most highly specialised species. The early attempts at a systematic classification, not only of the Araneae but of almost all the Natural Orders of animals, were more or less of the nature of an arrangement, founded upon the most evident structural differences, intended to facilitate the conversion of a visibly heterogeneous order into several groups possessed of something like homogeneity. With the general acceptance of the various theories of evolutionary science, the systematist has not only endeavoured to elucidate the relation existing between order and order, or family and family, but has essayed to trace the development, through successive stages, of the most highly specialised creatures from the primary representatives of the group under his consideration. The order Araneae is, broadly speaking an exceedingly homogeneous one and the difficulty of satisfactorily characterising the various groups is exaggerated by the simplicity of structure exhibited. It should be borne in mind that the development of a group of animals from an original stock cannot be truly represented by any linear arrangement but rather by a genealogical "tree," the "root" corresponding to the elementary, and the "twigs" to the most highly specialised forms. In dealing with the evolutionary development of the Araneae I am aware that I am venturing upon dangerous ground. In this matter modern araneologists are not by any means agreed, as a very cursory glance at the more recent English and Continental publications will show; and I trust, therefore, that the accompanying diagram (Plate IX.) may be regarded simply as expressing the opinion of a single individual.

ORDER ARANEAE.

Head and thorax fused to form a single piece. Eyes simple. Abdomen almost invariably non-segmented, connected with the thorax by a slender pedicle, terminated by several pairs of spinners, each furnished with numerous spinning tubes. Respiratory organs consisting of laminal tracheae and tube tracheae, both kinds being usually found in one individual. (The tube tracheae are occasionally absent; and, very rarely, the laminal tracheae are wanting). Reproductive organs of both sexes situated between the anterior spiracular openings, but the ejactorial apparatus of the male is connected with the terminal joint of the palpus. Falces consisting of a stout basal joint and a movable fang, pierced with a channel and capable of injecting a poisonous fluid. Sternal plates two in number. Palpus of the female pediform. Legs eight, each consisting normally of seven joints.

The Araneae are oviparous creatures, without metamorphoses, feeding upon insects or other small animals which they capture either with or without the aid of a silken snare.

SUB-ORDER MESOTHELAE (Pocock).

Upper surface of abdomen with traces of segmentation in the form of distinct transverse plates. This small sub-order, of which we have no British representative, may be regarded as a transitional group, visibly approximating the Pedipalps, and, therefore, as the probable ancestral stock from which the various spider families have developed.

SUB-ORDER OPISTHOTHELAE (Pocock).

Abdomen apparently non-segmented. A small anal tubercle is often present which may reasonably be regarded as a vestigial segment, but no known representatives of this sub-order possess any structure which could be mistaken for the dorsal plates of the Mesothelae.

SECTION I. MYGALOMORPHAE.

Spiders with four laminated tracheae and with the fangs articulated so as to permit of motion iu a vertical plane.

The more ancient spiders included in this section exhibit striking affinities with the Mesothelae. The Mygalomorphae are of large size and, as a rule, not brilliantly coloured. One rather aberrant family is represented in this country, namely, *Atypidae.*

SECTION II. ARANEOMORPHAE.

Spiders with two laminated tracheae (with rare exception) and with one or occasionally two openings leading to tube-tracheae (absent in a few cases). The fangs are articulated so as to permit of motion in a horizontal or oblique plane.

Although apparently developed from a group identical with or closely allied to the Mesothelae, the earlier forms of Arachnomorphae do not approximate the ancestral type so closely in some respects as do the Mygalomorphae.

We may conveniently divide the Araneomorphae into three series, Dysderiformae, Drassiformae and Argiopiformae.

SERIES I. DYSDERIFORMAE.

Spiders of an early type with six nocturnal eyes and generally two tube-tracheal openings situated close to the laminal tracheae. The tarsus of the male palpus closely resembles that of the female, the joint being entire or occasionally very slightly hollowed. The palpal bulb is of extremely simple structure, usually more or less of a flask-like form and containing a spiral sperm tube. Palpal apophyses are not present. The genital aperture of the female is a simple transverse opening provided with neither epigynal plates nor clavus. The tarsal claws are sometimes two and sometimes three in number.

These spiders as a rule spin no snare, but usually fabricate silken tubes in crevices or beneath loose bark.

Three families are represented in Britain — Dysderidae, Oonopidae, Scytodidae.

SERIES II. DRASSIFORMAE.

Spiders with usually eight eyes and with the tube tracheae opening in a small transverse slit either just in front of the spinners or more rarely in the centre of the abdomen. In one family *Argyronetidae*, two tube-tracheal openings are present, placed very much as in the Dysderiformae. The eyes are sometimes heterogeneous and sometimes homogeneous being then of the diurnal type. The tarsus of the male palpus is more or less enlarged and hollowed to receive the palpal organs. In the case of many of the more primitive types the alveolus is small and the joint only slightly enlarged, whereas in most of the highly specialised families the joint is greatly expanded and the alveolus often occupies the greater part of its lower surface. In many cases where these organs are of great complexity it is rather difficult to recognise the exact condition of the joint, but careful examination in different positions, aided occasionally by the use of the dissecting needle will convince one that the form of the tarsus itself, however modified it may be, has been produced by the hollowing out of the under surface of the more or less enlarged joint. It will be noticed as a consequence that the alveolus points directly downwards. The tibial joint of the male palpus is usually furnished with one or more apophyses. These are usually in the form of strong, chitinous projections, and are very often of a darker colour than the general surface of the joint. When only one apophysis is found it generally springs from the anterior external angle of the joint. and when several are present the most highly developed one will usually occupy this position Patellary and femoral apophyses are occasionally present. The genital aperture of the female is provided with more or less developed epigynal plates but is without a clavus. The tarsal claws are sometimes two and sometimes three in number.

These spiders as a rule spin no true snares, but a few species surround the extremity of their tubular retreats with a more or less extensive sheet of web and lie in wait for insects which may be unfortunate enough to alight upon this structure. A well known example of this form of web is found in the "cobweb" with which the corners of our rooms are adorned (?)

Fifteen families of Drassiformae are represented in this country, namely Drassidae, Clubionidae, Anyphaenidae, Sparassidae, Philodromidae, Thomisidae, Salticidae, Agelenidae, Hahnidae, Argyronetidae, Dictynidae, Eresidae, Pisauridae, Lycosidae, Oxyopidae.

SERIES III. ARGIOPIFORMAE.

Eight-eyed spiders with one pair of laminal tracheae and an indistinct opening leading to tube-tracheae placed not far from the spinners. In one or two instances tube tracheae are apparently absent. The tarsal claws are three in number, and in some species a number of minute supernumerary claws are found, opposed to the ordinary ones The eyes are sometimes heterogeneous and sometimes homogeneous, in that case being of the diurnal type. In some species the caput of the male is elevated in a most remarkable manner, several of the eyes being often placed upon the raised portion. The development of the tarsus of the male palpus from the simplest forms to the most complex is very curious and interesting. Instead of the joint being modified by a hollowing process to receive the palpal organs, it is split longitudinally, this structure being very clearly seen in *Pachygnatha*, the genus from which apparently the argiopiform spiders have developed. In this case we find both branches of the split joint very distinct and between them the bulb of a very simple form and provided with but few appendages. From this genus we can trace four distinct lines of development. The first series, developing through Tetragnatha and Meta, gives rise to orb-spinning spiders such as those of the genus Aranea and, possibly, the cribellate family Uloboridae. The second terminates in the spiders of the "Walckenaëra" type, the males of which possess, as a rule, curious cephalic prominences and tibial apophyses upon the palpi. The third tends towards the higher types of the "Linyphia" group with well developed spines upon the legs and highly complex palpal organs. From the fourth we may trace the Theridiids, with the aberrant family Pholcidae. With the structural development of these various types the palpus has undergone great modifications, notably in the gradual elimination of the external branch of the tarsus. The remaining branch (*i.e.* the internal one) often becomes of a cup-shaped form, reminding one strongly of the palpal tarsus of some of the Drassiform spiders, but with the most important difference that the palpal organs are placed upon the external surface of the joint instead of upon its under side. The palpal organs, too, are usually far less enclosed by the tarsus than in the Drassiformae, the joint being often reduced to very small portions. The modified external branch of the divided tarsus is found in several groups of Argiopiform spiders. It is rather conspicuous in many of the representatives of the sub-family Linyphiinae of the family Linyphiidae and has been often referred to under the term "falciform process."

The Argiopiformae are for the most part deprived of tibial apophyses, but in some groups, notably the sub-family Erigoninae these structures are very strikingly developed. They are, however, of a form very different from that exhibited by the Drassiformae. In the first place they are not nearly as distinctly defined, being, as a rule more or less of the nature of expansions of the joint itself, thus rendering it in many cases a matter of some difficulty to decide exactly where the joint terminates and the apophysis commences. Their position, also, is very characteristic, for they are usually placed upon the superior anterior portion of the tibia, projecting considerably over the tarsus and thus precluding any great vertical motion of the joint. The lateral motion, necessitated by the external placing of the organs, is thus in no way impeded. The genital aperture of the female, except in a few primitive types, is furnished with epigynal plates, and often with a clavus also.

The Argiopiformae almost invariably fabricate some form of snare. In the majority of cases it consists of a horizontal sheet of irregular threads upon the under side of which the spider clings in an inverted position. The ensnaring capabilities of this sheet are often greatly increased by the presence of numerous fine threads crossing and recrossing some distance above it, and intended to trip up any unlucky insect which happens to fly against them. Many argiopiform spiders spin orbicular snares, the "garden spider" (*Aranea diademata*, Clk.) being a familiar example.

Eight argiopiform families are represented in this country, namely, Pachygnathidae, Tetragnathidae, Argiopidae, Uloboridae, Mimetidae, Theridiidae, Pholcidae and Linyphiidae.

This arrangement may be summarised for British species as follows:—

ORDER ARANEAE.

SUB-ORDER MESOTHELAE (no British representative).

SUB-ORDER OPISTHOTHELAE.

Section I. MYGALOMORPHAE.

Family Atypidae.

Section II. ARANEOMORPHAE.

Series I. *Dysderiformae.*

Family Dysderidae.
,, Oonopidae.
,, Scytodidae.

Series II. *Drassiformae.*

Family Drassidae
,, Clubionidae
,, Anyphaenidae
,, Sparassidae
,, Philodromidae
,, Thomisidae
,, Salticidae
,, Agelenidae

Family Hahnidae
,, Argyronetidae
,, Dictynidae
,, Eresidae
,, Pisauridae
,, Lycosidae
,, Oxyopidae

Series III. *Argiopiformae.*

Family Pachygnathidae
,, Tetragnathidae
,, Argiopidae
,, Uloboridae

Family Mimetidae
,, Theridiidae
,, Pholcidae
,, Linyphiidae

It will be noticed that many of the primary divisions of the order are founded upon characters which, although systematically of paramount importance, are very obscure and, in some cases, confined to one sex. The differentiation of the spiracular systems, for example, would be certain to utterly confuse the beginner, necessitating as it does the most delicate methods of dissection. I propose, therefore, to insert the following tables which, although founded primarily upon the most obvious rather than upon the most important characteristics, and intended only for the identification of British species, will no doubt assist the beginner in his endeavours to decide the systematic position of his captures. Conclusions drawn from this table, however, should be checked by reference to the short descriptions of the families which will be given in their proper position in the classified list. This remark should be taken as applying to all analytical tables, for without some such precaution they become a source of grave danger. To pin one's faith to such scanty details as can be included in them is to court inaccuracy, and the conclusions drawn from such a procedure, although arrived at with comparative ease, do not in any wise convey that feeling of satisfaction which is experienced when the structural characteristics of a specimen are found to coincide, one by one, with the details of a well-written description.

TABLE OF FAMILIES OF BRITISH ARANEAE.

1.	Eyes six	2
	Eyes eight	4
2.	Eyes in three widely separated groups, these groups forming a triangle with its apex in front	Scytodidae
	Eyes in one group	3
3.	Openings of tube tracheae close to laminal tracheae and very distinct. Eyes of moderate size. Falces rather powerful ..	Dysderidae
	Openings of tube tracheae well separated from laminal tracheae and very obscure. Eyes very large. Falces weak	Oonopidae
4.	Eyes arranged in three groups of 3, 2, 3, placed transversely	5
	Eyes either in three groups of 2, 4, 2 or in two, three or four transverse rows	6
5.	Falces very powerful. Legs short and strong	Atypidae
	Falces very weak. Legs very long and slender	Pholcidae
6.	Cribellum present	7
	Cribellum absent	9
7.	Cephalic region narrow	Uloboridae
	Cephalic region more or less broad and massive	8
8.	Eyes in two rows, more or less parallel, and fairly closely grouped	Dictynidae

	Eyes small, very widely separated, the posterior laterals being placed far back upon the caput	Eresidae
9	Width of ocular area greater than its length. Eyes not greatly unequal in size ..	10
	Width of ocular area not greater than its length Eyes very unequal in size ..	24
10.	Tarsal claws 2	11
	Tarsal claws 3	16
11.	Inferior spinners well separated at their bases..	Drassidae
	Inferior spinners set close together at their bases	12
12.	Eyes homogeneous, of the diurnal type. Posterior row recurved. Legs of second pair longer than those of the first aud often than those of the fourth. Clypeus moderately high	13
	Eyes usually distinctly heterogenous (except *Sparassidae*). Posterior row often procurved. Legs of second pair shorter than those of the first and fourth pairs. Clypeus low	14
13.	Legs I and II much longer than legs III and IV. Tarsi without scopulae	Thomisidae
	Legs not greatly unequal. Tarsi with scopulae	Philodromidae
14.	Tube tracheae opening in a very distinct transverse impression near the centre of the abdomen	Anyphaenidae
	Tube tracheae opening just in front of the spinners, the aperture being small and inconspicuous	15
15.	Labium rather long. Eyes distinctly heterogeneous	Clubionidae
	Labium very short, almost semi-circular. Eyes almost homogeneous	Sparassidae
16.	Spinners short and arranged in a compact group	17
	Spinners of superior pair long, consisting of more than one joint	22
17.	Genital aperture placed some considerable distance behind the openings of the laminal tracheae	18
	Genital aperture placed between the openings of the laminal tracheae	19
18	Legs without spines	Pachygnathidae
	Legs with spines	Tetragnathidae

19.	Tibiae, metatarsi and tarsi of legs I and II with a row of long strong spines upon their undersides	Mimetidae
	Legs I and II without such spines.. ..	20
20.	Tarsi IV with a double row of short curved spines upon their undersides. Remaining joints of legs usually without spines. Tibia of male palpus without apophysis..	Theridiidae
	Tarsi without spines. Legs almost invariably furnished with spines which, however, are sometimes very minute and confined to tibia IV. In this latter case the tibia of the male palpus is almost always furnished with an apophysis	21
21.	Height of clypeus greater than length of ocular area (except *Tapinopa* and *Tapinocyba*). Falces without basal protuberances ..	Linyphiidae
	Height of clypeus not greater than length of ocular area. Falces often with basal prominence	Argiopidae
22.	Tube tracheae opening in two apertures close behind the laminal tracheae	Argyronetidae
	Tube tracheae opening in a single aperture just in front of the spinners	23
23.	Spinners normally arranged in a group ..	Agelenidae
	Spinners arranged in a transverse row beneath the extremity of the abdomen, the long spinners, corresponding to the superior ones of the Agelenidae, at the end of the row	Hahnidae
24.	Eyes in four unequal rows. Legs furnished with numerous very long spines ..	Oxyopidae
	Eyes in three rows of 4, 2, 2, four in the front row	25
25.	Eyes of first row very large. Tarsal claws 2 ..	Salticidae
	Eyes of first row small. Tarsal claws 3 ..	26
26.	Second row of eyes much shorter than the third. Clypeus high. Tibia of male palpus with an apophysis	Pisauridae
	Second row of eyes not much shorter than the third. Clypeus moderate. Tibia of male palpus without an apophysis	Lycosidae

Note.—*Pholcomma gibbum*, a very minute Theridiid, has the eyes arranged as in Pholcidae. The caput of the male in some cases is elevated and the position of the eyes modified in consequence. Such species may be referred to the family Linyphiidae or more rarely to the family Theridiidae.

III.—PRACTICAL WORK.

Collection of specimens. The apparatus required for the capture of the Araneae is of a most unassuming and inexpensive type. An old umbrella should be obtained, and when the district to be visited does not offer facilities for cutting hedge-stakes a stout walking-stick must also be provided. A wide-mouthed, securely corked bottle of methylated spirit will be required, a few dry specimen tubes, a pair of tweezers, a note book, a newspaper and some strong tool which can be employed either for digging or for removing loose bark from tree-trunks. Every likely and unlikely situation should be systematically examined, and it must be remembered that many species will often be discovered under most unexpected conditions. Brick-bats, stones and boards which have lain undisturbed for some time should be carefully inverted and examined, also the holes in decayed tree trunks. Trees, bushes and tall herbage should be beaten or shaken above the umbrella, and grass and low growing plants pulled up and disintegrated over the newspaper. It is most important to recollect that the spiders thus obtained should be handled as little as possible. The neatest method is to hustle the specimen into a dry tube held in the left hand by means of the fingers of the right hand and thence transfer to the spirit bottle. Extremely minute species may be picked up by a wetted finger. The jumping spiders are, without doubt, the most difficult to capture, for beside the fact of their rapid and erratic movements, their bodies are often ornamented with easily-detached scales upon whose presence much of the value and beauty of a specimen depends.

Examination of Specimens. The method of examination of spirit preserved spiders is of great importance, and I therefore append a few hints.

A compound microscope must be regarded as a necessity, but a simple and inexpensive stand will meet all requirements. With regard to objectives a 2-inch, 1-inch and $\frac{1}{2}$-inch will be found amply sufficient for all ordinary work. A rather low-power eyepiece should be selected, and a good stand-condenser will be necessary. Armed with this very modest array of optical accessories we may proceed to examine a specimen with a view to determining its identity. A small china saucer should be procured—the top of a pomade pot is all that can be desired—

and partially filled with clean methylated spirit. In this the specimen should be placed and examined whilst entirely submerged. When working by artificial light the bulls-eye condenser will be necessary to obtain satisfactory illumination. A preliminary examination should be made with the lowest power, the higher magnifications being only necessary for viewing such points of structure as the palpal organs, epigynal plates, tarsal claws, etc. Beginners would be well advised to attempt the identification of none but adult specimens.

Preservation. Spiders are best preserved in methylated spirit, which should be slightly diluted by the addition of from five to ten per cent. of distilled water. Much of the spirit now supplied will turn cloudy on the addition of a small percentage of water; but the clearness of the mixture may be restored by the addition of more spirit. Other liquids have been tried wit' more or less success, but to me they all appear vastly inferior to methylated spirit. Rum, however, will be found a most useful preservative for such specimens as are intended for dissection. Specimens may be stored either in corked tubes or in stoppered bottles. The former method has the disadvantage that in the event of being left for some time unreplenished the spirit is liable to evaporate and the specimens are thus irrecoverably destroyed. With stoppered bottles one of two methods may be adopted. If space and purse permit, a separate bottle may be kept for each species; but, in the event of one or both of these items being somewhat limited, resource may be had to another system. Glass tubes are taken and arranged round the inside of a large stoppered bottle and are kept in position by a central plug of cotton wool. Sufficient spirit is then poured in to submerge and fill the tubes. The specimens are placed in the tubes together with a label written with lead pencil or Indian ink, and each tube is plugged with a small pad of cotton wool. When a specimen is required for examination, the containing tube may be removed by means of a large pair of forceps, and the spider then emptied into the china saucer before mentioned.

Recording Observations. Careful notes should be made of all habits observed, of local captures, of dates of appearance in adult state, of snares formed and of other matters of importance or interest. The greatest care however, should be exercised in order to render such data of absolute accuracy, for an erroneous statement, like a snowball on a hill, is not only more easily started than stopped but is very liable to increase in volume as it travels. If doubtful occurrences are noted they should be liberally embellished with marks of interrogation.

LITERATURE.

A few remarks upon modern araneological literature may be of use, although in a work of this kind anything like a complete bibliography would necessitate the expenditure of an unjustifiable amount of space. The student should have access, if possible, to the following works, all of which are in the English language.

1861. John Blackwall. *A History of the Spiders of Great Britain and Ireland* (Ray Society). The descriptions are fairly useful and there are coloured illustrations of 273 species.

1879-82. Rev. Octavius Pickard-Cambridge. *The Spiders of Dorset* (Dorset Field Club). The descriptions are as a rule very complete and lucid. The illustrations are, unfortunately, very few in number.

Published at intervals by the same author numerous papers in *Proceedings of Dorset Field Club*; by Frederick O. Pickard-Cambridge many valuable contributions to *Annals and Magazine of Natural History*, etc., by Rev. John E. Hull and Dr. G. H. Carpenter several papers upon North of England and Irish spiders respectively.

1899-1902. *An Introduction to British Spiders* by the present author, published in *Science Gossip*. A synonymic list with many illustrations. The descriptions, owing to limitation of space, are extremely short and in many cases inadequate for purposes of identification.

1900. Rev. Octavius Pickard-Cambridge. *A List of British and Irish Spiders*. Copies of this valuable list may be obtained from Mr. Pickard-Cambridge, price 3s.

(To be continued).

GEOLOGICAL NOTES ON THE NEW RAILWAY BETWEEN ILFORD AND WOODFORD, ESSEX.

By T. V. HOLMES, F.G.S., *F. Anthrop. Inst., Vice-President E.F.C.*

This new railway leaves the Great Eastern Main-line between Ilford and Seven Kings Stations. Thence its course for more than three miles is nearly due north, a little east of Ley Street and Barking Side and across Fairlop Plain. But before reaching Manor Road, which connects Woodford Bridge and Chigwell Row, it makes a westerly turn, and crossing the Hainault and Chigwell roads a little south of their junction near Chigwell, passes between the farmhouses known as Newbarns and Luxborough, and bending southward joins the Loughton, Epping and Ongar branch about midway between the stations of Woodford and Buckhurst Hill.

The sections visible along its course were either between its Ilford end and the Cran Brook, on the northern side of Ley Street, or from a few yards south of the Manor road to a few yards west of Chigwell Road. Between the Cran Brook and the cutting which begins south of Manor Road the line is on an embankment. West of the Chigwell Road the surface of the ground rapidly slopes down to the level of the marshes of the Roding, which are crossed by the new line on an embankment. There is a short slight cutting close to the junction with the Loughton branch.

Looking northward from the Ilford end of the new line, a glance shows that thence to Ley Street the cutting is in old Thames river deposits, the height of the flat surface above ordnance datum rising gently northwards. It is about 40 ft. at Cauliflower Lane (*a*) the most southerly road crossed; a little more than 50 ft. at Ward's Lane (*b*); while at Hatch Lane (*c*), close to but south of Ley Street, it is from 68 to 70 ft., where the line crosses. The beds in the cutting between these lanes consist of gravel, or gravel and sand at the bottom, capped by a variable thickness of loam. No peaty beds were seen. But at one spot, a little north of Ward's Lane, some calcareous concretionary lumps appeared towards the bottom of the loam. They were, in all probability, the remains of a bed of shell marl. The surface loam thickened considerably between Cauliflower Lane and Ward's Lane, but its thickness was constantly varying. London-clay was visible for a horizontal distance of about 10 yards, at the bottom of the cutting, about 80 to 90 yards north of Ward's Lane. The cutting from Cauliflower Lane to Hatch Lane is 10 or 11 feet in depth.

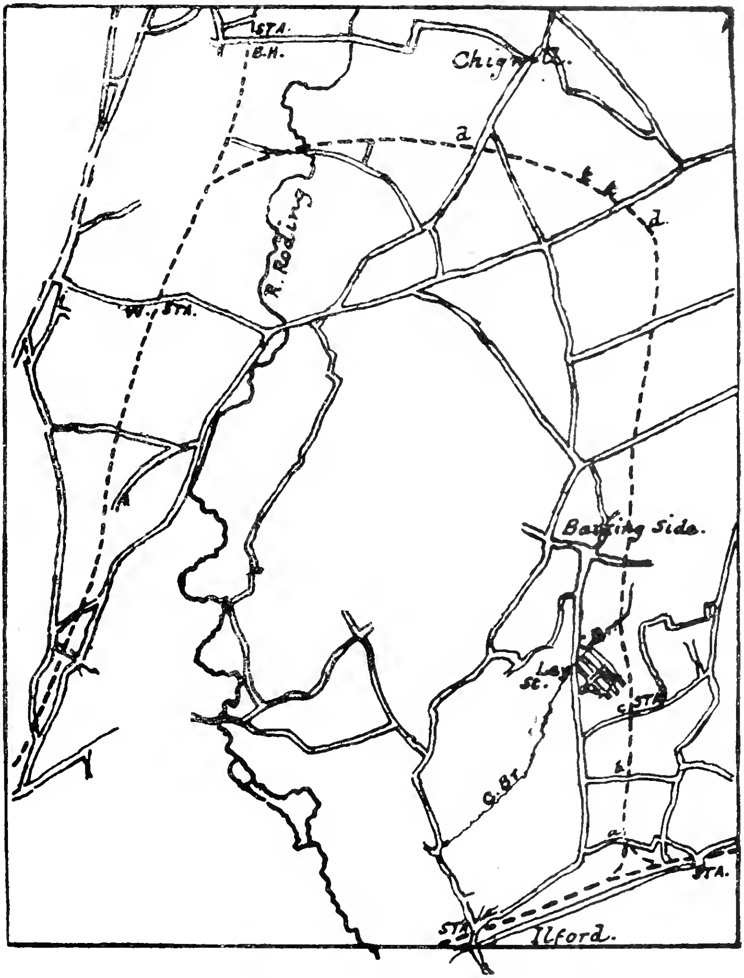


FIG. I Sketch-map of Railway between Ilford and Woodford.

Railways - - - STA = Station. B.H. = Buckhurst Hill. a = Cauliflower Lane. b = Ward's Lane. c = Hatch Lane. C.Br. = Cran Brook d - - d = Extent of Cutting. t - - t = Tunnel. Scale, 1 inch to the mile.

About 100 yards south of Hatch Lane there were some curious pipe-like hollows in the surface loam on the western side of the cutting, the origin of which seems at first sight not easy to explain. It appears to me that in this matter we shall obtain light from the appearances presented where the artificial bank bounding the channel of the present Thames has excluded a certain portion of the alluvial flat. In the excluded portion we see river deposits exposed to influences to which they were everywhere subject before man embanked the stream. In the surface loam are many irregular hollows, begun as broad surface cracks and deepened by rain. Similar hollows in old deposits would become liable in times of flood to be more or less filled with water bringing with it fine gravel and sand. Probably the hollows shown in Fig. 2 also owe something to the influence of

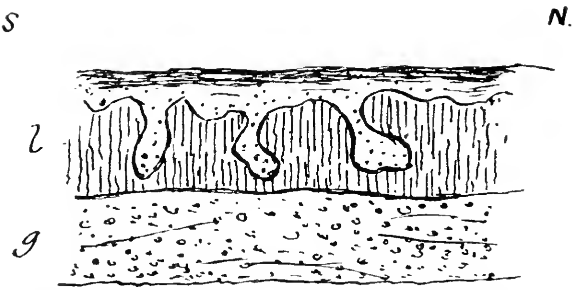


FIG. 2. Pipe-like hollows in the loam S. of Hatch Lane.
l - loam. g - gravel.
Height of section about, 11ft. Breadth 22ft.

ice. The kind and amount, however, of the ice-action they suggest is not that of the Glacial era during the deposition of the Essex Boulder clay, but rather that of a severe winter of the present day, such as occurred in 1894-5. Then we saw the Thames covered with blocks of ice which floated up with the tide and became stranded here and there during the ebb. Masses of this kind floating in the more ancient Thames would not, as now, be confined to its channel, but would often be deposited, during exceptionally high tides, over the adjacent alluvial flats. In some cases they would bear with them a certain amount of sand, gravel or animal remains. And they would be extremely likely, through the very variable amount of pressure on the surface loam, caused by their irregularities regards size and distribution, to alter the shapes of the sand-filled hollows from their originally simple forms to the apparently abnormal outlines they present in those figured here.

Where the railway crosses Hatch Lane, a slight ridge north of the lane marks the presence of the southern boundary of a slightly higher and older terrace of old Thames deposits than the beds seen nearer Ilford. Hence on the slope of this ridge we find the London-clay at, or close to, the surface, its presence being slightly obscured by the washing down the slope of the gravel capping the ridge. The cutting north of Hatch Lane, and east of the compact collection of houses known as Ley Street, showed the rise of the London-clay towards the southern boundary of this ridge. A few yards north of the bridge which crosses the line near the School, on the northern side of the Ley Street Station, the London-clay sinks to the

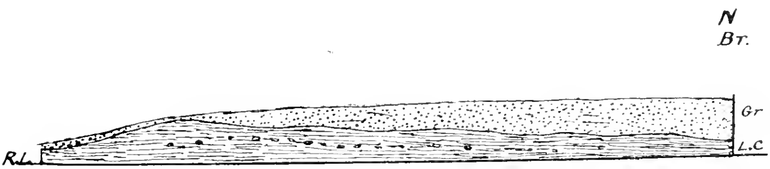


FIG. 3 Section from Hatch Lane, at Ley Street R. Station, to the Bridge over the Railway near the School, Ley Street.
Gr., Gravel. L.C., London clay. Br., Bridge.
Length of Section about 430 yards. Height, at bridge, 20ft

level of the line. The ridge, north of this bridge, gradually decreases in height towards the Cran Brook. At the northern end of Ley Street Station the height of the surface appears to be about 85 feet above ordnance datum.

As this Ley Street terrace is cut in London-clay, its boundary is not clearly traceable for any distance. But its general course near Ley Street appears to be nearly due east and west, keeping a little south of the farmhouse called Great Newbury, east of the railway, and crossing Horns Road westward, close to but north of its junction with Hatch Lane. The Ley Street terrace, being older than those southward, has been longer subject to denuding agencies than they have been. Therefore, while the general level attained by the old river deposits north of the Cran Brook shows them to belong either to the Ley

Street terrace or to an older one, the slight valleys worn in the gravelly plain to the underlying London-clay tend much to obscure its nature and real elevation, when viewed from a point between Ley Street Station and the Cran Brook.

Beyond the Cran Brook northward, there are, as already mentioned, no cuttings for a distance of more than two miles. The next begins in a field on the more southerly side of Manor Road, between Grange Hill and Frog Hall, where the line begins to turn westward. North of Grange Hill Farm there is a tunnel about 270 yards long, westward of which is an open cutting as far as Newbarns Lane, west of the road between Chigwell and Woodford Bridge. Beyond the spot at which the line crosses Newbarns Lane are the marshes of the Chigwell Brook and the Roding which are traversed by means of an embankment. And the slight cutting close to the junction with the Loughton line is too shallow to afford anything of geological interest.

Between Manor Road and Newbarns Lane the cuttings and tunnel are in London-clay. But here and there west of the tunnel there are many pebbles on the surface of the clay, especially near the spot at which the Hainault Road crosses the line. The new railway here touches the northern boundary of a patch of gravel which is shown on the map of the Geological Survey (1. N.W. drift edition) as existing mainly south of the line and between the Hainault and Chigwell Roads. It is coloured as old river gravel, and is about a mile north-west of the gravel of Fairlop Plain and fifty or sixty feet higher in level. It would, therefore, appear to be of more ancient date than that of Ley Street and Fairlop Plain, and of less antiquity than the glacial gravel north of Chigwell. The railway cutting, however, does not afford any good sections in this gravel; that which appears here and there towards its top having been apparently washed down from the land south of the line.

East of the new line, in a field south of Manor Road at its junction with Vicarage Lane, appear, in old English letters, the words "Cing well (site of)." This is, I suppose, the well alluded to by Mr. Whitaker (*Geol. Lond.*, etc., vol. I., p. 504) when speaking of the sandy beds in the London-clay which sometimes give rise to small springs, frequently medicinal—"I have heard that a spring on the south of Chigwell Row was much appreciated in the neighbourhood."

EOLITHIC IMPLEMENTS FROM THE PLATEAU GRAVEL AROUND WALDERSLADE, KENT.

By J. P. JOHNSON.

[*Read March 8th, 1902*].

My attention was first drawn to the occurrence on the higher ground around Walderslade (which is a delightful little place nestling in a hollow in the North Downs near Chatham) of flint implements belonging to the earliest, or Eolithic, period of the Stone Age, when engaged in surveying there during the latter part of last year, 1901. They were always associated with characteristic plateau gravel *dèbris* in the shape of pebbles of chert, pieces of ironstone and the peculiarly stained flints. But most of them came from one or two spots near the escarpment where, judging from the abundance of these last in the surface soil, there must still be some patches of this early drift left *in situ*.

It is my intention in this paper to figure and describe some of the more interesting of these implements, but in order that they may be more readily understood it will be necessary to include a few remarks on Eolithic implements in general.

In 1889 Sir Joseph Prestwich gave an account of some very primitive flint implements which had been discovered by Benjamin Harrison around the village of Ash on the chalk plateau known as the North Downs. From their peculiar red-brown colour he connected them with an old gravel of which only a few patches now remain on the highest portions of the plateau, the main mass having been removed by denudation. Since then pits have been sunk in the neighbourhood and the contemporaniety of the implements with the plateau gravel has been established beyond doubt. This gravel is the oldest deposit[1] which has yielded relics of prehistoric man, and the rudely trimmed pieces of flint which it contains constitute the very earliest attempt of prehistoric man to make a piece of stone suitable for use as an implement.

1. The chipping on certain flints from deposits of greater age have from time to time been brought forward as evidence of their use by man or a man-like animal, but they are hardly convincing. A concise review of the question will be found in Mr. E. T. Newton's address to the Geologists' Association in 1897, with whose impartial conclusions one is disposed to agree. On the other hand it is only fair to add that Mr. A. Rutot (*Bulletin de la Société d' Anthropologie de Bruxelles, vol. xiv.*, 1901) accepts the artifical nature of the chipped flints from the Miocene strata of Thenay, Puy-Courny and Otta, and from the Pliocene deposits of Saint-Prest. The Plateau Gravel is probably of late Pliocene age.

Indeed the plateau gravel may even contain traces of man dating back to a time before he had learnt to fashion flint implements for himself. For no doubt he employed flints of suitable size and shape in breaking open bones for the sake of their marrow, and in analogous ways, long before he became acquainted with the art of modifying them for purposes to which they were not naturally adapted. Indeed it was no doubt through such use that he first became acquainted with the peculiar properties of fracture possessed by flint, the knowledge of which was to play so important a part in his future career. Though flints battered and splintered in this way are seldom

FIG. 1. Scraper. (Actual size.)

distinguishable from those that have been much knocked about by natural agencies, such for instance as the action of a torrent, yet now and then the handiwork of man can be recognised in them. And possibly some of the battered flints from the plateau gravel, the fractured surfaces of which, from their very much worn and abraded condition, would seem to be older than the deposit itself, bear traces of use which date back to a time anterior to that at which he discovered the way to work flint.

Even the recognisable implements are of so primitive a character that their artificial origin was for long, and indeed is still, disputed by a great number of anthropologists. But while no doubt much of the work of Eolithic man is indistinguishable from that of natural agencies, much on the other hand is very different and often bears a striking resemblance to that on the more makeshift of the tools of later periods. And one must remember that the similarity of many of these implements to the products of nature is only what one might expect since they are man's first attempts, especially when one takes into consideration the fact that most of these tools at least were of a temporary nature, being made when occasion demanded, and thrown away immediately after use.

One of the greatest obstacles to the general acceptance of these chipped flints as the work of man has been the difficulty of assigning any definite use to them, but in this connection one must remember that the purposes for which many of the indisputable implements of later periods were intended are also quite inexplicable.

Probably one of the first uses to which a flint was put, was the scraping of the adherent flesh from the inside of a newly removed skin. For this purpose the piece of flint employed must have a regular edge, but as this condition is rarely met with in nature, it was usually necessary to remove the irregular portions by chipping. It is to this class that the majority of the Eolithic implements belong. The "scraper," indeed, is one of the commonest of prehistoric implements and is still to be counted among the domestic appliances of certain savage races.

A good example of a scraper is shewn in fig. 1. It is a tabular piece of flint with the edge trimmed or bevelled by chipping. The dotted parts of the drawing represent the original crust of the flint, and the lined portions, the fractured surfaces: of the latter only the small chippings shewn in the side views are artificial. The chipping is of the same deep red-brown and opaque colour as the rest of the outside of the flint.

Another type of scraper is represented by fig. 2. The working in this case is translucent and, although much stained, is therefore fresh in appearance when compared with the body of the flint. The knob at the end was probably used as a handle. The fashioning of a scraper from a knobbed piece of flint is peculiar to Eolithic man.

A frequently occurring modification of the scraper is an instrument corresponding to the modern spokeshave. In this the modified edge instead of being either convex or straight, is concave. The concavity may range in shape and size from a small semicircle—such as was probably employed for scraping pieces of wood or bone into the form of pins—to comparatively large and slight curves—such as would be used for scraping any rounded surface.

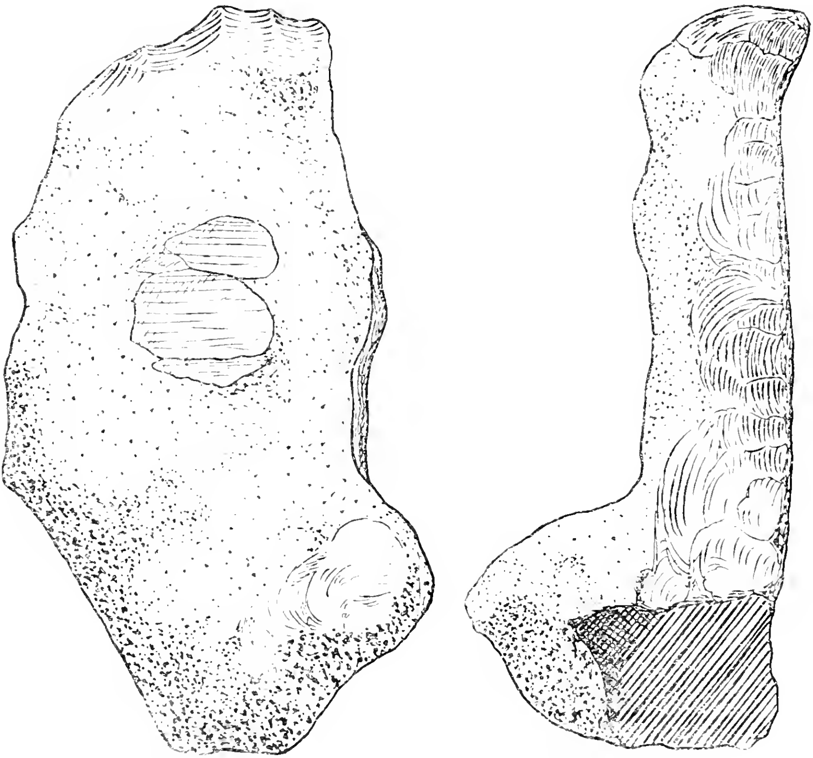


FIG. 2 Scraper with knob of flint left as handle (Actual size.)

The double form of concave-edged scraper shewn in fig. 3, is very characteristic of this period.

Figure 4, represents a neat little spokeshave in my collection. One might at first be inclined to think that the use of so large a piece of flint in manufacturing so small an implement was a

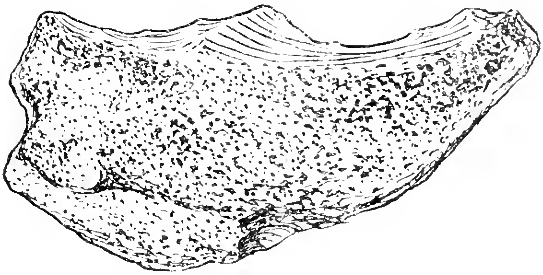


FIG. 3. Double concave-edged Scraper (Actual size.)

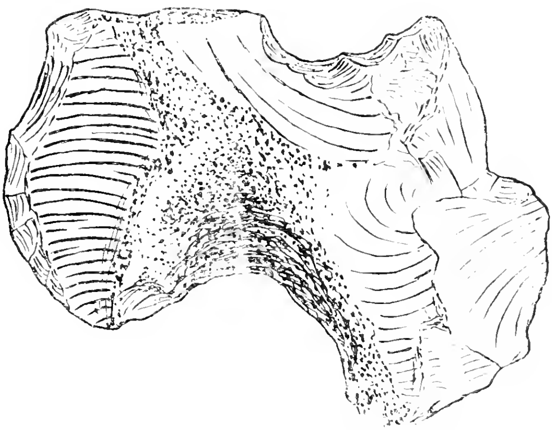


FIG 4 Spokeshave (Actual size.)

waste of material, but I find that the shape of the flint is particularly well adapted for grasping in the hand, and that the maker would seem to have taken this into consideration in selecting the position for the hollow.

The only other really abundant implement is the borer, which, as its name implies, is a pointed tool[2] used for making holes in soft substances such as wood. In some the points are short while in others they are long and tapering. Fig. 5 is a good example.

The massive pointed implement represented by fig. 6 is noteworthy. I can say little more of this than that there are many ways in which such an implement could be employed.

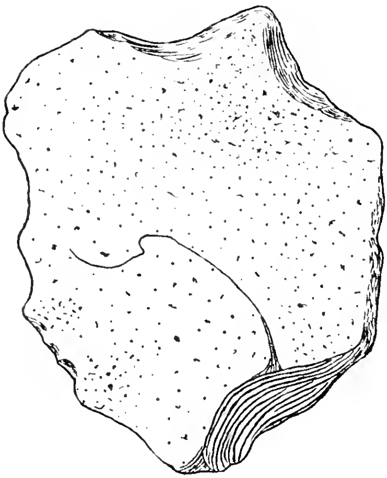


FIG 5. Borer. (Actual size.)

The working, being of an opaque yellow colour, is much lighter than the rest of the flint. As in the other specimens figured in this paper the reverse side is a more or less plane surface.

The implements found in the plateau gravel range over a very long period of time. This is shewn by the association of unworn with much rolled specimens, and by the occurrence of the most crude forms side by side with comparatively well-finished examples.

2. The bluntly pointed implements though resembling Borers are probably double Spokeshaves. Rutot (l.c.) says "les poinçons, qui ne sont peutêtre que de simples grattoirs à deux encoches, la point étant sans usage,"

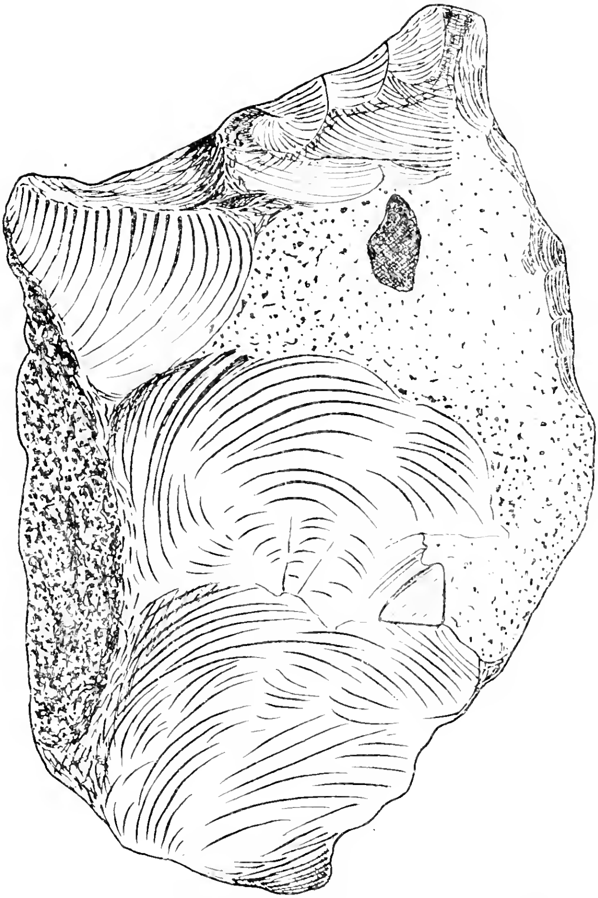


FIG. 6. Massive Pointed Implement. (Actual size.)

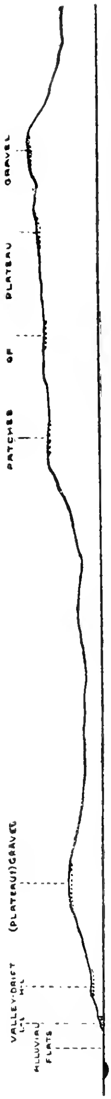


FIG. 7. Vertically exaggerated Section from Ash to Swanscombe, shewing the relation of the different implement-bearing deposits of the Thames Basin. (The correlation of the patch of gravel overlooking the high-level valley-drift at Swanscombe, with the plateau gravel, though probably correct, is not yet certain, owing to the absence of any sections in it.)

What the makers of these implements were like is quite unknown as no human bones nor indeed any contemporaneous organic remains have ever been found in the plateau gravel. Nothing of that sort could be preserved from such antiquity in so porous a deposit. Our knowledge of the animals with which these people were associated and hence of the approximate conditions under which they lived is little better, though a slight clue is afforded by the occurrence in a drift at Dewlish of Eolithic implements together with the bones of an extinct species of elephant—the *Elephas meridionalis* of Nesti—which did not survive into the succeeding Palæolithic period.

The relation of the plateau gravel to the other implement-bearing deposits of the Thames Basin is well shewn by the accompanying section (fig. 7), and may be briefly tabulated thus :—

Pliocene ..	Plateau Gravel ..	Eolithic.
Pleistocene	High-level Valley Drft Low-level Valley Drift	Palaeolithic.
Holocene ..	Alluvial Flats ..	Neolithic —Historic.

Implements of Eolithic type have been found at several localities in Britain outside the Thames Basin[1] the most noteworthy being Dewlish and Alderbury. They also occur on the adjacent mainland of Europe[2] and in South Africa.

For the use of those who would like to go more deeply into the interesting problems connected with Eolithic man, I have appended a list of the more important papers that I have been able to consult in the preparation of this account. In this connection

1. As new records I may mention that I have obtained Eolithic Implements from among Plateau Gravel *débris* overlooking the railway-station in the Chipstead Valley and from the heights above Dover, both localities being on the North Downs.

2. The implements from the Plateau Gravel roughly correspond to the "Reutelian" and

I have received much help from my friend Kennard, who has kindly lent to me his extensive collection of pamphlets dealing with this subject, and I take this opportunity to express my thanks to him.

BIBLIOGRAPHY.

1. Sir Joseph Prestwich, "On the Occurrence of Palæolithic Flint Implements in the neighbourhood of Ightham."
Quart. Journ. Geol. Soc. xlv. (1889).
2. Sir Joseph Prestwich, "On the Drift Stages of the Valley of the Darent."
Quart. Journ. Geol. Soc. xlvii (1891).
3. Sir Joseph Prestwich, "Primitive Characters of Flint Implements from the Chalk Plateau."
Journ. Anthrop. Institute, xxi (1894)
4. W. J. Lewis-Abbott, "Plateau Man in Kent."
Natural Science, iv. (1894).
5. T. Rupert Jones, "On the Geology of the Plateau Implements."
Natural Science, v. (1894)
6. A. M. Bell, "Remarks on Flint Implements from the Chalk Plateau."
Journ. Anthrop. Institute xxiii. (1894)
7. Sir Joseph Prestwich, *Controverted Questions of Geology*: London (1895).
8. W. Cunnington, "Authenticity of Plateau Man."
Natural Science, xi. (1897).
9. A. S. Kennard, "Authenticity of Plateau Man."
Natural Science, xii. (1898).
10. R. Ashington Bullen, "Authenticity of Plateau Implements."
Natural Science, xii. (1898).
11. W. J. Lewis-Abbott, "Authenticity of Plateau Implements."
Natural Science, xii. (1898)
12. W. Cunnington, "Palæolithic Implements from the Plateau Gravel."
Quart. Jour. Geol. Soc. (1898).
13. A. M. Bell, "The Tale of the Flint."
Longman's Magazine (1898).
14. Benjamin Harrison, "Eolithic Implements."
Trans. S.E. Union Scientific Societies (1899).
15. G. Leith, "On Caves, Shell-mounds and Stone Implements of South Africa."
Journ. Anthrop. Institute, xxviii. (1899).
16. R. Ashington Bullen, "Eolithic Implements."
Trans. Victoria Institute (1900).

"Mesvinian" of Rutot, who however considers that the latter stage only is represented. Nevertheless owing to the fact that the implements from the Plateau Gravel are not all of the same age but range over a long period of time, quite as primitive forms as the Reutelian are met side by side with the better finished types (Mesvinian) such as are figured in this paper.

Rutot is certainly under a misapprehension when he thinks he finds contemporaneous Reutelian implements at the base of the brickearth (low-level valley drift) at Erith, although he offers a very ingenious explanation. He however overlooks the occurrence in the immediate neighbourhood of an indisputably older deposit (the high-level valley drift) which contains Palaeolithic Implements and which of course is itself newer than the Plateau Gravel.

17. A. Rutot. "Note sur la Découverte d' importants Gisements de Silex taillès dans les collines de la Flandre Occidentale."
Bull. Soc. d'Anthropologie de Bruxelles, xviii. (1900).

18. R. D. Darbishire, "Implements from the Chalk Plateau."
Proc. Manchester Literary and Philosophical Soc. xlvi. (1901).

19. *Annual Report of Wellington College Natural Science Society* (1901).

20. A. Rutot, "Sur une Preuve de l'existence de l'Homme sur la Crête de l'Artois avant la Fin du Pliocène."
Bull. Soc. Belge de Geologie (1901).

21. F. J. Bennett, "Antiquity of Man."
Chatham and Rochester Observer (1901).

22. A. Rutot, "Sur la distribution des Industries Palæolithiques dans les Couches Quarternaires de la Belgique"
Comptes-Rendus du Congrès International d'Anthropologie et d'Archéologie préhistoriques XIIe Session. Paris (1900).

23. E. R. Harrison, "Eolithic Flint Implements."
South Eastern Naturalist (1902).

24. A. Rutot, "Défense des Eolithes."
Bull. Soc. d'Anthropologie de Bruxelles. xx. (1902)

NOTE.

At the reading of the above paper at the meeting on March 8th, 1902, Mr. A. S Kennard made some remarks which are embodied in the following note, to which the author has replied. These observations will most conveniently be given here :—

"It is of the utmost importance that the attention of Essex geologists should be called to these Eolithic implements since without a doubt they will be found in the county if proper search is made. Examples which may be of this age have been found in the Thames gravels at Grays and Ilford but what is wanted is to find these implements in the higher and older gravels. Whether it is right to assign such names as 'borers,' 'spokeshaves,' 'scrapers,' &c., to these implements may well be questioned. We know nothing of the customs of these primitive folk and our only knowledge of the existence of these primitive folk is derived from these flints. It is unsafe even to compare them with existing savages since all or nearly all of these have reached a higher scale in development than that which the Eolithic folk had attained. Even with the later Palæolithic implements we know next to nothing of their probable uses and this remark applies to many Neolithic tools also. The only ground on which the use of such names can be defended is the necessity of using terms which will be understood by all students of anthropology, hence their employment should refer to shape only and not to probable use.

"These primitive implements are known from Belgium, France, Egypt and South Africa, but it does not follow that they are all of the same age. Each district must be worked in detail before we can speak definitely

A S. KENNARD."

"I heartily endorse my friend Kennard's remarks as to the necessity of employing caution in interpreting the uses of these primitive implements. I do not however believe that the possibility of discovering their purpose is quite so hopeless as he seems to think If we can trace the evolution of any of these implements from the earliest to the latest periods of the Stone Age we may yet do so, and such an evolution is, in my opinion, clearly observable in the spokeshave—scraper group, the latter implement even having been observed in use among modern savages. Now if we could connect the scraper of the Eskimo and that of the Eolithic folk with an intermediate series of intermediate age, would we not be justified in assuming that the use was the same? It is certainly unlikely that any radical change would take place in the use of a particular type of implement.

"However it has not been my intention to dogmatise in my explanation of the uses of these implements, but rather to suggest. It is necessary in a general and introductory paper of this description to give an idea of the most probable way in which they would have been used, and that is all that I have done.

J. P. JOHNSON."

WALTON AND FRINTON, ESSEX, IN 1902.

REPORT OF THE EXCURSION OF THE CLUB, 7th JUNE, 1902.

By W. H. DALTON, F.G.S., *Hon. Memb., E.F.C.*

The cliff-section of Walton-Naze has been often described, the richly-fossiliferous sands of the Red Crag having constituted it one of the "happy hunting grounds" of the collector for more than half a century. Though but a few feet thick, it has been so assiduously searched that a very large proportion of the fauna of the Crag period has been found represented here. This is partly due to the way in which the shells are protected from the solvent action of percolating water by a thick bed of clay, capped in its turn with several feet of gravel, and partly to its slight coherence in comparison with that of the subjacent London-clay. This may sound paradoxical, in view of the direct object of the excursion, the study of the progressive degradation of the London-clay itself. But it is merely a question of relative coherence—loose sand above stiff clay—and the result is the formation of a sort of shelf of the clay, from which rises a second and steeper cliff, 15 or 20 yards inland of that which descends to the beach. The shelf is much modified by slipping, and by the erosion of channels for the escape of springs from the interior, and is at some points a fairly steep slope. It is often masked by a mass of Crag sand, forming a talus of gentle gradient, on which the collector can lie prone, and fill his boxes at leisure, regardless of comment from Philistines occupying the cliff-top or the beach. The several beds extend inland, and outcrop successively on the western slope of the Naze peninsula, as shown on the Geological Survey map.

The effect of denudation on the various beds are characteristic for each. The porous and fairly coherent gravel on the top offers a vertical face. Never being saturated by the most prolonged rainfall, it remains in place till dislodged pebble by pebble, as the supporting grains of sand are removed by direct lateral lashing of rain or spray. The water it receives on its level surface sinks in, and escapes westward over the edge of the underlying clay into the Crag below. This clay, originally assigned to the Chillesford clay, which in Suffolk is interbedded with the Crag, is probably representative of the Post-Glacial freshwater bed of Clacton cliff, a correlation now published for the first time, and based partly on its lithological character and that of the superincumbent gravel, and partly on the presence, about midway in its thickness, of a seam of peaty matter and fossil wood, as at Clacton. This seam was of limited extent, and has now disappeared with the recession of the cliff, but fortunately some of the wood is preserved in the Club's collection at Stratford. This Post-Glacial clay or loam offers a nearly vertical face, being sufficiently sandy to absorb and discharge rainfall without becoming pasty or slipping. The Crag below it has a steep face for a foot or two, merging into the talus. Its basement bed of water-worn bones, teeth and pebbles, derived from the denudation in the Crag period of the London clay and of some deposits of intermediate age, is seldom visible, but a shark's tooth badly damaged, and a large piece of bone, were among the finds of the day. The London clay, rising to some 30 feet from the beach, has generally a steep face, but here and there springs oozing from the Crag have caused heavy slips, breaching the bank, and furnishing the waves with broken and semifluid material, incapable of resisting their transporting power.

Notwithstanding the evident recession of the brow of the upper cliff, there is no perceptible difference between the high-water line of the old and the new Ordnance maps. This may be partly due to inaccuracy in the survey of 1838, or the operations for protection of the coast, although somewhat inadequate, may have retarded the waste, as far as is perceptible on the small-scale map, one inch to the mile. The difference indeed are chiefly in the opposite direction, that of increase of the land. Considerable areas are shown in the new map as enclosed from tidal access in the interesting area of Hamford or Hanford Water, west and northwest of the Naze. Some of these have since been regained by the sea, either through accident or neglect. But outside, and apart from human action, deposition has been proceeding, and the new map shows a projecting spit of sand (the Pye Sand), nearly a mile in length beyond the low-water line of 1838. This, coupled with the fact, informally mentioned by Mr. Mothersole at the excursion meeting, of the presence of quantities of Crag shells on the beach in that direction, far beyond the outcrop on the Naze, points to a northerly shore-current thereabouts, as a backward eddy from the general southward tendency, so fully evidenced at the groins and breakwaters along the Naze and towards Frinton. These are banked up to the top with sand on the north side, whilst to the south of each the bare London-clay forms a black slippery surface, full of water-holes.

Seawater, apart from its motive force, tends to preserve the London-clay, by excluding atmospheric air, and maintaining a state of saturation. It is the alternation of drought and wet that breaks up the fairly-solid clay, converting its abundant iron-pyrites into oxide of iron and free sulphuric acid, the latter in its turn attacking the carbonate of lime generally present. Both the ferric oxide and the sulphate of lime occupy greater bulk than in their previous combinations, apart from that of the carbonic acid gas set free by the later re-action. Some change possibly takes place also in the elements of the clay itself, for it passes from a rather tough mass, but one which will break into fragments, to a plastic dough, which can only be torn or squeezed apart. Perhaps in the absence of sufficient carbonate of lime, the sulphuric acid attacks the alumina of the clay, or the change may be purely molecular. At any rate, the modification proceeds inwards from every crevice, and each expansion produces further fissuring, until the mass, even at an early stage of the process, is traversed in every direction by cracks with slimy surfaces. A little excess of rain, and these surfaces are forced apart by water making its way in by capillary attraction. Under such conditions, the whole becomes practically a viscous fluid, and cliffs or railway-cuttings are subject to perpetual slipping in greater or less degree. Every hillside of similar material is perennially on the down-grade from the same cause, and even gentle slopes have a like movement in minor measure. Expansion by moisture will be vertical only in absolutely level ground, where no cause exists for divergence to any side. If ever so slight a deviation from the vertical is possible, the expansion will be fractionally towards that side. Subsequent contraction will be truly vertical, unless a lower position is possible by a further lateral movement. On a cliff the action is more perceptible, because more rapid, and the prompt removal by the sea of whatever reaches the beach has induced the popular belief that the sea is the primary agent of destruction. Neptune has been blamed for what is mainly the action of Jupiter Pluvius. That Neptune assists in the spoliation cannot be denied, but he is accessory after the fact, the receiver of the proceeds.

In the later section of the day's operations, the *modus operandi* of these confederate powers was clearly demonstrated. The cliff-top between Walton and Frinton is practically a plateau, from which a covering sheet of gravel, probably of Post-Glacial date as at Clacton, has been but lately denuded, small patches of pebbles and sand being of frequent occurrence. The margin is indented into much the same form as that to which a child reduces a slice of bread-and-butter, a series of irregular, more or less circular scallops, with projecting points. At these salient angles, often very acute, the fall is nearly vertical; in the intervening recesses, a steep slope of a few yards generally reaches a ledge still covered with the original turf of the summit, and often fairly horizontal, but breaking into columns by intersecting cracks, as it passes by infinitesimal slips down the treacherous slope. Lower down a chaos of angular lumps of all sizes leads to the beach, interspersed with flows of viscid mud where surface waters seek exit through the obstructing masses. In every case the determining cause of the recess is seen to be one of the patches of residuary gravel already mentioned, its presence implying a slight hollow on the surface of the clay, and a collecting ground for the rainfall of the immediate vicinity. Near the edge, in every recess, new cracks show the initiation of a further loss. Where a continuous esplanade has been constructed, it will require to be cleared from time to time, until the cliff reaches the angle of the slope compatible with permanent stability. But at the end of such artificial protection, Nature resumes her sway, eats into the undefended face, gets behind the masonry or concrete, and destroys it length by length. The only effectual system under the conditions is that of closely-set groins rising above springtide level, to accumulate sand and check the removal of slipped or solid clay. How far this may be regarded as a matter of imperial rather than of local interest and duty is a political question unsuited for discussion in these pages.

NOTES RELATING TO COAST EROSION IN ESSEX AND SUFFOLK.

EXTRACTED FROM THE REPORTS OF THE COMMITTEE OF THE BRITISH ASSOCIATION.

The Committee on Coast Erosion was appointed in 1881 at York. A preliminary Report was issued in 1884 and detailed reports appeared in 1885, 1886 and 1888. The final Report with summary of the evidence was issued in 1895. As these reports are somewhat scattered it may be well to summarise those relating to our coast, as an addendum to Mr. Dalton's remarks above. The somewhat crude diction arises from the notes being concise answers to a set of very definite questions.

In the second Report (*Brit. Ass. Rep.* 1886) Mr. John Bateman, of Brightlingsea, gave some evidence concerning the Estuary of the Colne, in which he stated the nature of the coast to be a fringe of flat salt-marshes overflowed at high tides. They form small cliffs of about 5 feet, and then soft mud reaches to low-water mark. There is no shingle. The coast-line is N.E. to S.W. and the prevailing wind is S.W. The E. wind is most important in raising high waves. The set of the tidal currents is the same as the mouth of the Thames. The coast is being worn back by the sea almost without exception from the mouth of the Thames northwards, and eastwards certainly at Mersea, Brightlingsea, St. Osyth, and Clacton. The cliffs only commence at Clacton. Questioned as to the rate of erosion he stated that the area of one salt-marsh of about 10 acres had diminished by nearly one-third in 20 years. The Tithe Commutation Map of Brightlingsea (1822?) shows "West Marsh Point" to have been something like 100 yards seawards of its present position. Land is being gained from the sea, and something like 700 acres of Brightlingsea were enclosed from the salt-marshes, 1700-1800. No record has been preserved of exact dates, but a map of 1780 shows much now enclosed to have been then subject to occasional overflow. There are also curious isolated 'hills' of shingle and clay on some of the enclosed marshes, evidently washed together by sea action. 'Dunes' of blown sand fringe the coast of St. Osyth for $2\frac{1}{2}$ miles, infringing perhaps 50 to 150 yards on the marshes; their height is 12 to 15 feet. He did not think that they were increasing and they are prevented from spreading landways by a long salt-water 'crick,' locally so-called, which runs close behind them inland.

In the same Report, Mr. Peter S. Bruff, M Inst. C.E., gave evidence relating to the Suffolk and Essex coasts, from the river Deben to near the river Colne. He described the nature of the coast as varying—cliff, flat 'denes' and embanked marshes. The Cliffs are London Clay, sometimes capped with crag, gravel or sand; their greatest height above H.W M. being 68 feet, and least 6 feet; an average of 37 feet. The coast-line lies N.E. to S.W. and the prevailing wind is S E. to S.W. In raising high waves the most important wind is the N.E. to S.W.; in piling up shingle the most important wind varies locally from E. to W. (N. to W. at Walton). and in travelling of shingle the N.E. to E. is most efficient. The set of the tidal currents is N.E. to S.W. The range of tide in vertical feet at springs is 11 ft. 6 in., and at neaps, 8 feet. The width of spring tide between high and low water is from the Deben to the Orwell 25 yards. at Walton-on-Naze 230 yards, and at Clacton 150 yards. From the Deben to the Orwell the area covered by the tide consists of sand and shingle with occasional layers of cement stone at the foot of the beach. From the Orwell to the Colne there is a clay flat at foot of the beach uncovered at low water. The shingle is about 30 to 40 yards broad at Felixstowe and Clacton. With respect to the tide mark it is sometimes evenly distributed, and sometimes in patches with sand between, and it travels from N.E. to S W. A small proportion of the pebbles are as large as hens' eggs, the majority much less. A ridge of shingle is formed by the spring and neap tides, the height above the respective tide marks varying according to the state of the wind. The average height would be about 2 feet above the tide marks Where not protected by groynes the shingle is diminishing, by natural causes. The groynes of timber-piles and planks are 30 or 40 yards long, generally at right angles to the shore line, at varying distances apart, and of very diverse heights; there are some stone ones at Walton-on-Naze. Between the Deben and the Orwell, they arrest the shingle very effectually, and prevent the loss of foreshore and land. At Walton the same is true in a less degree A considerable quantity of shingle has been taken from the beach at Clacton at about high-water mark, for road-making and for concrete for building. It is said that some 40 or 50 years ago cement stone was dredged and otherwise removed in front of Felixstowe, which removal had an injurious effect upon the coast, but the practice has long been discontinued The coast is being worn back by the sea at Felixstowe, between the 'Lodge Point' and Martello Tower P., and also at Walton and Frinton. At Felixstowe the greatest loss was where there was 'flat ('Benthill') at the foot of cliffs. At Walton and Frinton there are London Clay cliffs 40 to 68 feet above high water. At places as much as 100 feet is lost by erosion in 10 years, but a fair average would be about half that amount. The loss at Felixstowe is practically stopped by the groynes on the beach For data, the Tithe-maps of the parishes in question may be compared with the $\frac{1}{2500}$ Ordnance Survey Maps of 1874. At Walton and Frinton the loss is practically confined to areas bare of shingle. The existence in the cliffs of potholes of sand and gravel containing water is also a cause of subsidence; the water breaking out on the base, carrying the sand with it, loosens large masses of the upper part of the cliff. The loss of land at Walton and Frinton has gone on from time immemorial:[1] but it has been noticed that since the construction of the Harwich Harbour Conservative Board's Works at Landguard Point there has been a greater scarcity of shingle on the beach at Walton and Frinton. Part of Landguard Common and the land at the mouth of the Deben is formed of 'blown sand' (locally called 'Benthills') covering the top of a shingle beach, their height being from 3 to 10 feet above high water-mark. The Benthill at Landguard Point is increasing in consequence of the Conservancy Board's jetty. The sand is not blown over the land, this being prevented by the 'bent grass' or 'marram.' With his report Mr. Bruff presented tracings showing the Harwich Harbour Conservancy Board's Works at the entrance to the harbour, and the scouring away to Landguard Point to the S.W., and accumulation of beach to the N.E. of the same. And he referred to the various reports presented to and published by the authority of Parliament.

In the same report Mr. W. Teasdell, C.E., stated that at Gorleston Suffolk, the cliff had gone back from 200 to 300 feet within the last 40 years, within the last 6 years, 60 feet; the cliffs are sand 80 to 90 feet high.

At the British Association meeting for 1895 (*B.A. Rep.* p 678) our member, Mr. John Spiller, F.C.S., furnished some details on "Recent Coast Erosion at Southwold and Covehithe," Suffolk. The report was published in full in the Supplement to the *East Anglian Daily Times*, Sept. 13th, 1895, but the following abstract will be sufficient for the present purpose:—

"Owing to the prevalence of northerly winds, culminating in a moderate gale on May 16th (1895) the tide rose to an unusual height all along the East Coast, and attacked the soft sandy cliffs between Dunwich and Covehithe, creating a new cove at the northern extremity of Southwold, and sweeping away the roadway at the back of the beach to the extent of half an acre at this particular spot. The Cliffs at Eastern Bavents and Covehithe likewise suffered considerably, and this loss being reported to Mr. W. Whitaker induced that gentleman to lend his maps with certain measurements noted thereon for the purpose of exact comparison. Thus provided, the author walked over the ground and took fresh measurements at the several points along the route, which resulted in the determination of the amount of cliff-waste since 1882 and 1889, and this, stated briefly, was as follows;—

1 At a Local Government Board enquiry with regard to the Frinton Council's application for leave to borrow £1,760 for sea defences and cliff preservation, held on October 31st, 1902, it was stated that the encroachment of the sea at Frinton during the last 50 years had been very severe. Sixty yards of cliff had been lost since 1874. This was at the rate of about 10 feet per annum. Near the eastern extremity of the parish there was an old stone groyne where a large bed of sand had accumulated, and damage done to the cliffs there had been checked to a large extent.

	feet.
Easton Bavents, loss in 6 years	20
Easton High Cliff, ,, 13 ,, ...	22
Covehithe Cliff, ,, 6 ,, ...	84

The accuracy of these observations was checked by Mr. Horace B Woodward, and other indications observed conjointly proved that the general loss at Covehithe amounted to about 50 yards since the present Ordnance map was constructed The lines of high and low water mark had manifestly altered, so that a fresh survey was necessary

A discussion on Coast Erosion took place at the Conference of Delegates of the Corresponding Societies during the Bristol meeting of the British Association in 1898. The labours of the Coast Erosion Committee were then at an end. A chief result of this discussion was an application to the Admiralty, which has since secured the co-operation of the Coast Guard in noting the changes on our coast. One speaker, Mr. W. H. Wheeler, who had paid much attention to the subject, then remarked that the retention of a considerable mass of shingle in front of a place would furnish a better protection than a sea-wall. As to the cause of the travelling of shingle along the shore in a definite direction, Mr. Wheeler, in a paper read to Section C. at the same meeting, said "that the travel of shingle is not coincident either with the prevailing or predominant winds, but on a tidal coast the predominant drift is invariably in the same direction as that of the flood tide." (*Report* 1898 p. 884.) North of the estuary of the Thames the shingle travels from the north southward; south of the estuary it travels from the south northward.

It should be added that the Reports above alluded to contain a Bibliography of the subject up to the year 1895.

ADDITIONAL NOTES ON THE SECTIONS SHOWN AT THE NEW RESERVOIRS IN THE VALLEY OF THE LEA, NEAR WALTHAMSTOW.

EVIDENCE OF THE PUDDLE-TRENCHES.

By T. V. HOLMES, F.G.S., F. Anthrop. Inst., *Vice-President, E.F.C*

While the sections afforded by the excavations for the new reservoirs have been of the highest interest in their display of the various changes in the details of the river deposits, they have given very little information as to the varying depths at which the London-clay was reached beneath the river deposits.[1] It is true that here and there at the bottom of the excavations the top of the London-clay was either visible, or the presence of fragments of septaria nodules in the gravel suggested the nearness of the clay. But, as we shall see, the general impression derived from visits to the reservoir excavations, as to the depth of the London-clay, needs correction from the additional evidence obtained during the construction of the puddle-trenches in the centre of the boundary banks.

I am greatly indebted to Messrs. Sharrock and Spencer, the engineers representing Messrs. Pearson, the contractors, for information as to the strata met with in the puddle-trenches, of which they have preserved a most careful account. But I do not propose here to touch upon the details of the river-deposits, or even to note minutely the varying depths at which the London-clay, was found in the puddle-trenches, my object being simply to give the distribution of the depths which are within normal limits and of those which are beyond them.

In the first place, it seems desirable for the sake of comparison, to note at what depths the London-clay has been touched beneath the river deposits of the Lea Valley outside the new reservoirs but within a short distance of them. On consulting Mr. Whitaker's Geological Survey Memoir on *The Geology of London and of Part of the Thames Valley* (vol. 2) we learn that at Waltham Abbey the East London Water Company in their well close to Waltham Lock, found 18 ft. of river deposits above the London-clay, at Walthamstow Marsh 17½ ft., at Chingford Mill 10 ft., and at Longwater Pumping Station, Tottenham, 20 ft. at one spot and 16 ft. 100 yards away. And the records of borings and sinkings through the somewhat older river deposits of Tottenham and Edmonton nowhere show them to be more than 21 ft. thick. But as they are few and scattered over a large area, they do not necessarily preclude the existence of spots between them which might give a different result.

Dr. Henry Woodward, F.R.S., in his paper on "The Ancient Fauna of Essex" (*Trans. Essex Field Club, vol. iii.*, pp. 1-29, 1882-3) gives an account of the sections exposed during the construction of the reservoirs of the East London Water

1 T. V. Holmes "Geological Notes on the New Reservoirs in the valley of the Lea, near Walthamstow," *ante* pp. 1-16.

Company at Walthamstow in 1868-69, south of those now being made. The sections in the river deposits of Walthamstow Marshes, closely resembled, as might be expected, those within the newer and more northerly reservoirs. And Dr. Woodward adds, that while the depth of the general floor within the reservoirs nowhere exceeded 10 feet, "the trenches made for the 'puddled walls' in the centre of the artificial embankments went down to a depth of 20 to 24 ft."

The details preserved by Messrs. Sharrock and Spencer show a very much greater amount of variation as to the depth of the London-clay beneath the river deposits in the new reservoirs, than has been met with elsewhere in the district. At the neighbouring spots already mentioned the depth varied from 10 to 24 ft. In the more northerly of the new reservoirs, the "Banbury Reservoir," the London-clay was generally reached in the puddle-trench on its eastern border (near the edge of the marsh) at depths of from eight to nine feet. At other parts of the reservoir boundary the depth was greater, the variations being, however, very gradual, and the greatest depth reached being 26 ft. at the most westerly point of the reservoir, a few yards due east of the rifle butts. In the boundary bank of the southern, or Lockwood, reservoir the variations were much greater and more sudden. Starting from its southern end, I was informed that a few yards west of the old channel of the Lea,[2] London-clay was found at a depth of 13 ft., and at 25 ft. at a similar distance east of it. Proceeding in a northerly direction along the western side, as far as Stonebridge Lock, the greatest depth was 23 ft. and was met with close to the Lock. Along the eastern side London-clay was deepest at a point about due west of the northern end of "Low Maynard Reservoir," being there 36 ft. below the surface. The average on the eastern side was from 20 to 25 ft., or very nearly the same as that of the western side from Stonebridge Lock southward. But on the western side, from Stonebridge Lock to the north-western end of the reservoir, the London-clay gradually becomes deeper, and was found to be, at the north-western corner, 57 ft. below the surface of the marsh. Then, 60 or 70 yards east of that point, in the northern boundary, the clay was only 15 ft. below.

2 See Map, ESSEX NATURALIST, vol. xii., p. 2 (1901).

Thus it appears that the average depth from the surface of the London-clay, in the puddle-trenches of the new reservoirs, is about 18 ft., and that its normal variations are from 9 to 10 ft. on the one hand to about 25 ft. on the other. And this result coincides with that obtainable either from Dr. Woodward's remarks on the puddle-trenches of the more southern reservoirs, or from the sinkings and borings given in Mr. Whitaker's *Memoir*. Thus, while in the boundary of the Banbury reservoir the London-clay cannot be considered to be at an abnormal depth anywhere, in the "Lockwood Reservoir" it appears to be abnormally deep at its north-western corner, where it is 57 ft., and on its eastern side, close to the northern end of the "Low Maynard Reservoir," where it is 36 ft. below the surface. And a line drawn across the reservoir through these two spots would doubtless mark the position of the narrow subterranean hollow in the London-clay which may, or may not, attain its greatest depth at the north-western corner. A continuation of this line northward would bring it to a point a little westward of the most westerly point in the northern reservoir where, as we have seen, the London-clay was deeper than at any other spot in its boundary bank.

I am informed that where the thickness of the beds above the London-clay was greatest, in this depression, the material composing them consisted of gravel, sand and silt, much resembling that of the river deposits elsewhere. And the direction of the narrow line of depression seems to be nearly due north and south, or very slightly west of south and east of north. But whether the somewhat unusual depth of 26 feet, at which the London-clay was found at the western end of the Banbury reservoir, indicates the nearness of a more noteworthy depression beneath the Rifle Butts, we have no evidence to determine.

The paper "On a Deep Channel of Drift in the Valley of the Cam, Essex," by Mr. W. Whitaker,[3] appears to me to describe some drift-filled hollows which are all akin to that beneath Lockwood reservoir, while one example has a specially strong resemblance to it. Mr. Whitaker gives details of wells at Quendon and Rickling, Newport and Wendon, which all show a very great and wholly unexpected thickness of the Glacial-gravel and sand, which underlies the Boulder-clay,

3 *Q. J. Geol. Soc.*, vol. lxvi., p. 333 (1890). ESSEX NATURALIST, vol. iii., p. 140 (1889).

resting in hollows on the Chalk. In one case at Newport, a boring for a well for the Grammar School was begun in the Glacial-gravel and sand. Instead, however, of the slight thickness expected, "the boring tool, after passing to a depth of 340 feet, chiefly through loamy beds, did not succeed in reaching the chalk, and the work was abandoned. The drift, therefore, must here go down to a depth of about 140 feet below the level of the sea, how much deeper we know not."

But the drift-filled channel which most perfectly resembled that at "Lockwood Reservoir" is the one described by Mr. Whitaker at Littlebury, a little more than a mile north-west of Saffron Walden. There the valley of the Cam is cut in the Chalk, and the Glacial Drift is to all appearance confined to the high ground east and west of the river valley, which ranges north and south. At the bottom of the valley are some River Gravel and Alluvium, the village of Littlebury standing mainly on the gravel, which is west of the stream. In five wells the depth to the Chalk varied from 3 to 6 feet only. In two other wells it was 15 feet from the surface; while a third well ended in sand at a depth of 22 feet. These wells are scattered through the village. But near the centre of the village, and only a few yards more easterly than the wells mentioned, a boring 218 feet deep did not touch the Chalk, the whole of the material pierced through being Drift. The length of this channel is doubtful, but its direction is evidently that of the river valley, where the surface is occupied by river-deposits, just as in the case of the channel beneath the Lockwood reservoir.

As regards the nature of this deep channel in the Chalk, Mr. Whitaker reviews the various explanations that suggest themselves. These are, he says, "disturbance, sinking in of the Chalk, and erosion." He dismisses, as extremely unlikely, the idea of a fault, or that the gravel has filled in a hollow caused by the local dissolution of the Chalk by chemical action, though he admits that it may have deepened a hollow formed in some other way, and decides that erosion of some kind must have been the agent. And that the channel must have been cut before the deposition of the Boulder clay on the higher ground on each side of the river valley, in either Pre-Glacial or early Glacial times.

It appears to me that in the channel under the "Lockwood Reservoir" we have, in all probability, one of the same kind, and one also the result of erosion in either Pre-Glacial or early Glacial times. In this case in the valley of the Lea there is quite as strong a probability against the agency of a fault as in that at Littlebury; while local chemical dissolution, which formed a possible cause on the Cam, either of making or deepening the channel, is out of the question with the London-clay of the Lea.

I have already remarked that at Littlebury glacial deposits are seen only on the high ground east and west of the river valley, Boulder-clay alone having been noted there. But at Newport, also on the Cam, and about three miles southward, the Glacial sand and gravel is found in the sides of the valley between the river-deposit at the bottom and the Boulder-clay above. In the valley of the Stort this is the case everywhere from its source to its junction with the Lea at Hoddesdon. From Hoddesdon southward the Glacial Drift, whether gravel or Boulder-clay, or both, is seen only on the high ground at some distance from the river. But both on the eastern and western sides of the Lea it has been noted as far south as Hendon, Finchley and Muswell Hill in Middlesex, and Woodford and Romford in Essex.[4] So that there can scarcely be any doubt as to the Post-Glacial age of the valleys of the Cam about Littlebury and the Lea at Tottenham and Walthamstow. Of course I use the word Post-Glacial in its only legitimate sense as meaning of later date than the Chalky Boulder-clay of Essex and Middlesex.

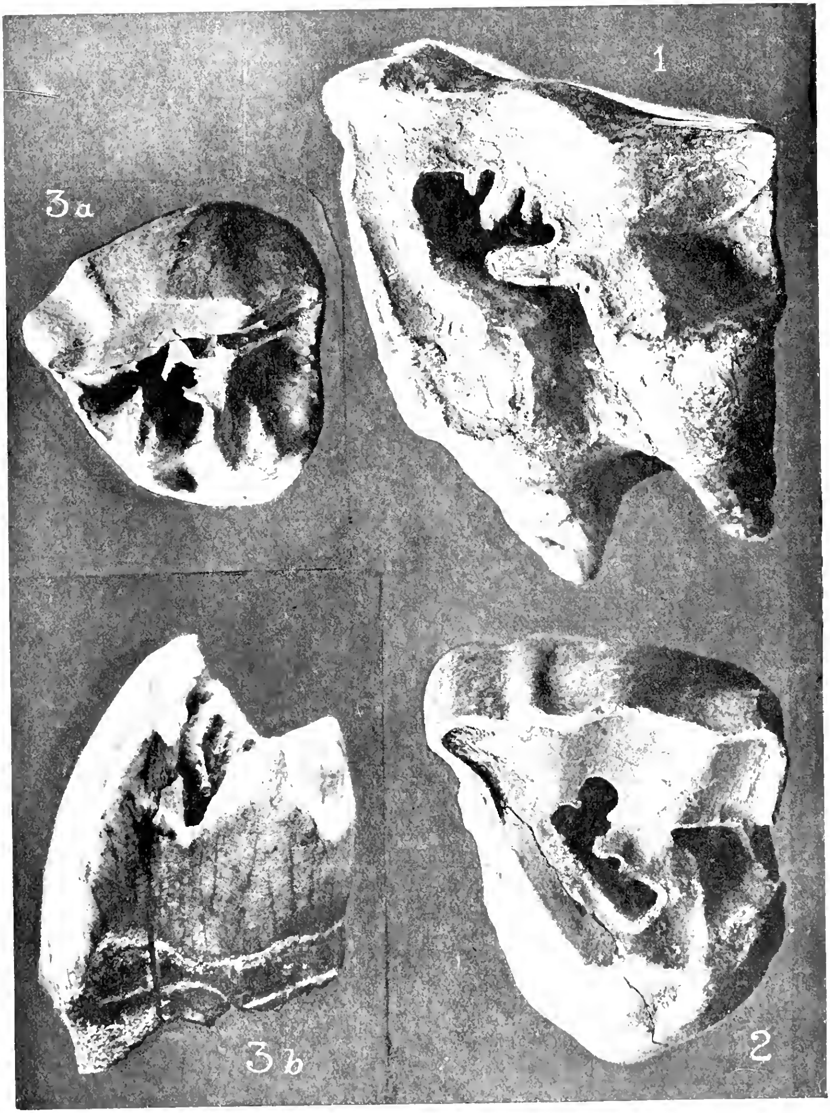
In the north of England, as Topley remarked in the discussion on Mr. Whitaker's paper, many examples are known of the Pre-Glacial and Post-Glacial valleys of rivers and the relations between them. In illustration he stated that in Northumberland the Blyth was in Pre-Glacial times a tributary of the Wansbeck, and a deep Pre-Glacial valley, which was filled with Glacial Drift, occurred between the present valleys. Many other cases might be mentioned in which the Pre-Glacial drainage system, having been in its general features like that of Post-Glacial times, the river valleys in the two periods have here and there coincided. In this part of the south-east of England the Glacial deposits have covered the Pre-Glacial

4 *Q. J. Geol. Soc.*, vol. lxviii., p. 365 (1892); *Q. J. G. S.*, vol. l., p. 443 (1894). Also ESSEX NATURALIST, vol. vii. (1893).

plateaux and at the same time filled up more or less completely the Pre-Glacial valleys. In the Boulder-clay at Hornchurch near Romford, about 100 feet below its usual level, thereabouts, yet covered by some of the oldest gravel of the present Thames there is a certain approximation to coincidence, in the valleys of the two periods. Where Post-Glacial drainage has taken a new course, the position of an old Pre-Glacial valley may remain unsuspected but for a well boring, as at Newport Grammar School. Where there is a local coincidence between the Pre-Glacial and

Post-Glacial valleys, there we may find a fragment of a Pre-Glacial channel filled with material of Glacial age beneath river-deposits of later date, as at Littlebury and the Lockwood Reservoir. But of course both channels alike suggest that during their formation the whole country stood at a much higher level above the sea than it now does. For in each case the bottom of the channel is below the present level of the sea.

The photograph is one taken by Mr. F. Meeson during the visit of the Geologists' Association in April, 1901. The spectator is looking southward, and the view gives the section across two



TEETH OF RHINOCEROS, FROM ILFORD, ESSEX.

old channels in the "Lockwood Reservoir," the more northerly of which is shown in Fig. 5, p. 8, ESSEX NATURALIST, vol. xii. In spite of its small scale, the photograph illustrates the disappearance of the peat bed close to the old channels and its replacement there by sand and gravel. The section has now disappeared.

ON SOME TEETH OF RHINOCEROS FROM ILFORD, ESSEX.

WITH REMARKS ON THE DISTRIBUTION OF RHINOCEROS IN THE THAMES VALLEY DEPOSITS.

By MARTIN A. C. HINTON.

[*With Plate X.*]

During the course of the last six years I have had occasion to examine many of the vertebrate remains which have been obtained from the Pleistocene deposits of Ilford, Essex. These specimens include among them a large series of the molar teeth of *Rhinoceros*, referable for the most part to the species named *R. hemitœchus*, Falconer (=*R. leptorhinus*, Owen). Some of these teeth appear to me to be of such interest and importance as to merit being described and placed on record, and they form the subject of this communication.

The first specimens to be described are three upper molars in my own collection which were obtained from the Cauliflower Brickyard in 1897. One of these is a penultimate premolar of the left side; it is somewhat damaged, the external lamina of the outer wall being lost. The posterior valley is just isolated into a reniformly triangular fossette. The transverse valley is just on the verge of isolation, but whether this had been actually accomplished or not cannot be ascertained as the inner wall of the tooth is somewhat mutilated. The crochet is strongly bifid, projecting a little more than halfway across the valley. The outer wall gives off *three* combing plates all more or less parallel with the crochet and one only of which has been touched by wear. Remains of a thick coat of cement are seen on this specimen.

The next specimen (fig. 1, plate x.) is a finely preserved second true molar of the left upper jaw. In this the posterior valley is still intact. The crochet is emitted at a right angle from the anterior wall of the hind barrel and is closely approximated to the hind wall of the front colline, which it does not quite touch. From the middle of the outer wall no fewer than *four* combing plates project, the penultimate of which, counting from the crochet, is large and massive. The form of the crochet is more or less rectangular and the combing plates are disposed in the same general direction with it. There is a very thick coat of cement on the lower portion of the crown. The dimensions of this tooth are:—

Greatest antero-posterior length of external wall	..	2·38 inches
Antero-transverse width (at base of crown)	..	2·5 ,,
Postero-transverse width (at base of crown)	..	2·14 ,,

The third specimen is a last true molar of the left upper jaw and is, unfortunately, badly damaged. Notwithstanding this mutilation, however, it is of considerable interest. The crochet is given off at a comparately open angle and bends flexuously as it juts into the transverse valley ending off very near the anterior barrel in a sharp edge. The outer wall gives off *three* combing plates which all trend more or less in the same general direction as the crochet though they converge somewhat towards it. The valley is still further complicated above the crochet by a process which projects into it from the anterior barrel evidently resembling in this respect the tooth from Grays Thurrock described by Dr. Falconer (*Palæontological Memoirs*, vol. ii., p. 336). On various portions of the crown remains of a thick coat of cement may be seen.

From the great complication of the transverse valley in each of these three teeth, from their relative states of wear and from the similarity of their appearance, I consider them as belonging to one individual. From the form of the crochet in the premolar and the second true molar, the direction of the combing plates, and from the circumstance of the thick coat of cement which is seen on all of them I have referred these teeth to the *R. hemitoechus*, Falconer. They are cited here because of the extreme complication of the transverse valley of which they afford a fine illustration and which is characteristic of many of the teeth of this species from Ilford.

The specimen described next was submitted to me for identification by Mr. G. White who obtained it with others from one of the pits on the Uphall Estate, the sections and fossil contents of which have lately been described in the admirable papers by himself and Mr. J. P. Johnson which have appeared in the ESSEX NATURALIST. It is a detached fourth premolar of the left upper jaw. The transverse valley is completely isolated through wear and into it, from the posterior barrel, is projected a strongly developed bifid crochet. The outer wall gives off two very small combing plates, one of which is parallel to and just above the bifid crochet. The other is given off in a line with the anterior external angle of the tooth, converging towards the first and the crochet at a right angle. The posterior valley is not yet isolated, and the cap of enamel which arises from its inner wall, and which passes over the hind barrel and so into the inner wall of the tooth is still in great measure intact (fig. 2). There is a well marked basal bourrelet passing right round the anterior barrel. This starts from near the grinding surface a little inwards from the anterior angle; from this point it gradually sinks until the inner extremity of the anterior barrel is reached, from whence it rapidly rises up again ending off at the inner and forward rim of the enamel cap before spoken of. The dimensions of this tooth are :—

Antero-posterior length measured along outer surface at base ..	1·7 inches
,, ,, ,, inner ,, ..	1·25 ,,
Antero-transverse width at base	2·47 ,,
Postero- ,, ,, ,, ...	2·2 ,,
Height of crown at junction of anterior and posterior barrels ..	1·4 ,,
,, ,, anterior outer angle	1·88 ,,

I have referred this specimen to *R. leptorhinus*, Cuvier, *pro parte* (=*R. megarhinus*, De Christol). The point to which I wish to direct special attention is the remarkable state of wear and the figure will give a much better idea of the characters described here than any mere verbal description. In all known species of *Rhinoceros*, either fossil or recent, the small posterior valley is the first to be isolated into a fossette by the detrition of the tooth. This arises from the fact that while the entrance to the posterior valley is comparatively shallow, not cutting deeply into the body of the tooth, being from this cause soon obliterated, the entrance to the transverse valley forms a much deeper cleft separating the barrels and consequently remaining for a proportionally longer period intact. But in this specimen it is the transverse valley which has been isolated first, the posterior valley having its entrance still intact though cutting into the tooth no deeper than usual. This malformation appears to me to be of great interest, the only other instance of which I am aware occurring in a fourth premolar of the upper jaw which Dr. Falconer referred to *R. etruscus* and which is figured in the *Palæontological Memoirs*, vol. ii., Pl. xxv., fig. 6. This latter specimen is from one of the Italian Pliocene deposits and is now preserved in the museum at Pisa.

The next specimen to be noticed was also obtained by Mr. G. White from one of the Uphall sections. This is a slightly worn penultimate molar of the left upper jaw. The crochet is thin and wedge shaped and is projected well across the transverse valley. The external wall gives off a large combing plate converging at a right angle towards the crochet, while just above the latter from the anterior barrel projects another little combing process. The large combing plate is placed nearly diagonally to the anterior outer angle of the tooth. The barrels have their apices compressed and somewhat twisted, making the entrance to the transverse valley appear very wide. There is a small prominent tubercle in the entrance of the latter between the barrels. The dimensions of this tooth are:—

Antero-posterior length (external) of crown	..	3·0 inches
Antero-transverse width, at base ..	..	2·5 ,,
Postero-transverse width, at base ..	..	1·9 ,,

This specimen is very characteristic of the *R. leptorhinus* Cuvier, *pro parte*, to which species I have referred it.

In the collection of Dr. Frank Corner, F.G.S., there is a fine first upper true molar of the left side obtained by him from the Cauliflower Brickyard. This has the crochet thin and wedge shaped, and given off at a somewhat acute angle. A small combing plate is projected from the external lamina in a line with the antero-external angle. The posterior valley of the tooth is still intact. The anterior colline is large and shows the apical contortion characteristic of the species to which I have referred it. There is a well marked emarginate bourrelet passing round the base of the front colline. The posterior barrel or colline is broken, but shows apical contortion in section. The enamel is smooth, with a rather thick coat of cement upon the lower part of the sides of the crown. The dimensions of this tooth taken at the base of the crown are:—

Antero-posterior length (externally)	..	2·49 inches
Antero-transverse width ..	..	2·66 ,,
Postero-transvere width ..	..	2·05 ,,

This tooth I have referred to *R. leptorhinus*, Cuvier, *pro parte*, of which it is very typical. It is the only example of this species that I am acquainted with from the Cauliflower Brick-yard.

The last specimen I have to notice is in the collection of Mr. J. P. Johnson who obtained it with others from the Uphall section (Figs. 3 and 3a). This is a fine and slightly worn ante-penultimate premolar of the left upper jaw. Its large size would seem to indicate the *p.m.* 3 rather than the *p.m.* 2, but that it is the latter is perfectly clear from the sub-triangular form of the crown, the form of the anterior colline, and the absence of a pressure scar in front. The latter character proves that there was no first premolar in this individual. The anterior colline is seen to form a completely isolated conical cusp exactly as in the specimen figured by De Christol in his memoir in the *Ann. des Sciences Nat. Zool.*, ser. 2^{me}, vol. iv., pl. 3, fig. 12. The apex of this cusp is worn off, a small elliptical disk of wear being the result. Figures 3 and 3a will give a much better idea of this specimen than any description. It is referred to the *R. leptorhinus*, Cuvier, *pro parte*, of which species it is very characteristic. Subjoined are the dimensions of this specimen together with some corresponding ones given by Falconer of this species and by Dawkins of the homologous tooth in *R. hemitocchus*, Falconer.

P.m 2 *R. leptorhinus*, Cuvier *pro parte* (*R. megarhinus*, De Christol).

	Ilford	Falconer *op. cit.*
Antero-posterior length ..	1·6 in.	1·55 in., 1·45 in., 1·95 in., 1·55 in.
Greatest-transverse width..	1·76 ,,	1·70 in., 1·60 in., 1·70 in., 1·60 in

P.m. 2 *R. hemitoechus*, Falconer (*R. leptorhinus*, Owen), Dawkins, (*Q.J.G.S.*, vol. xxiii., p. 213).

Antero-posterior length ..	1·15 inches ..	1·15 inches
Greatest-transverse width ..	1·40 ,, ..	1·28 ,,

The distribution of the species of *Rhinoceros* in the Middle-Terrace deposits of the Thames Valley below London is of considerable interest. At Ilford *R. hemioetchus* is by far the commonest form; remains of *R. leptorhinus* occur in fewer numbers but still fairly abundantly, while *R. antiquitatis* is of very rare occurrence. At Grays Thurrock *R. leptorhinus* ranks first in abundance, *R. hemitoechus* being the rarer; and *R. antiquitatis* not known from this locality. At Crayford and Erith on the other hand the commonest remains are those of *R. antiquitatis*, the other two species occurring but very rarely. In this connection it is of interest to note that in the case of Ilford the remains of the prevalent species of *Rhinoceros* exhibit a tendency to vary towards the prevalent species occurring at Grays Thurrock in the greater complication of the transverse valley of the molars by combing plates—a character much more common in *R. leptorhinus* (the Grays form) than in *R. hemitoechus*. A precisely analogous instance is presented in the relationship between the Elephant remains found in the deposits of the two localities. At Ilford *Elephas primigenius* is the common form, while at Grays Thurrock this position is held by *E. antiquus*. But many of the molars from Ilford of the Mammoth depart from the typical form of that species and by having plates of thicker enamel, more or less complicated by crimping, they approach in appearance what is seen in *E. antiquus*.

In the present state of our knowledge, no conclusions can be with safety drawn from these facts of distribution. They, in common with many other ascertained facts of Pleistocene Geology and Palæontology, indicate important portions of the history of the Thames Valley, but these portions we cannot read until we have been able to appreciate many factors which as yet are but little understood.

In conclusion I have to express my best thanks to the gentlemen mentioned in this paper for the loan of their specimens and my warmest gratitude to Mr. F. W. Reader for his kindness in preparing the admirable figures in the accompanying plate.

THE TWO FORMS OF THE SEA-ASTER (ASTER TRIPOLIUM).

By PERCY CLARK, B.A.

As I now write (September 6th, 1901) the Essex Saltmarshes, bordering the sea, which are overflowed by the water at springtides, present a beautiful appearance. The tall upstanding masses of the Sea-Aster growing there in wild and unchecked profusion, are all in flower, and their small golden heads massed together in thousands shed a glow of soft yellow colour over the Saltings. But a few paces inland where the same plant grows on the side of dried up ditches or on low banks, they possess a ray (absent in the former) of delicate lavender florets surrounding a yellow centre, which clothes them in an entirely different aspect.

Has any one remarked on this peculiarity before? I do not find it noted in my hand-book. I closely examined the marine plants and found in many cases a few poorly developed lavender ray-florets growing unevenly here and there, but the majority had none at all, and the few that produced them looked as if they were half ashamed of owning such shabby productions. Yet just over the sea wall, where the tide could not penetrate, the lavender or purple rays were in full bloom, and conspicuous by their strong and healthy condition. Is it a case of degeneration? Can it be that the sea-aster thriving on the soft luscious mud of the saltings, has found such a luxuriant habitat that it troubles no longer to produce the beautifully tinted ray-florets which erst were probably intended to attract the helpful bee or other winged insect?

In the present crowded state of the plants, would the wind be a sufficient carrier of pollen? They certainly show a very marked variation in accordance with habitat. It has at first sight the look of a clear case of either evolution or devolution, and I should be glad of an opinion, if I can elicit such, in the pages of the ESSEX NATURALIST.

[The two forms of the Sea-Aster are, of course, well-known, the rayles or generally nearly rayless, one being separated as var. *discoideus*, but I have been unable to find that anyone has before connected the forms with a difference in habitat. When I received Mr. Clark's interesting notes last year, it was too late to test the suspicion that possibly there was a young and an older form of the flower, and that the latter had shed the ray-florets. I therefore, with Mr. Clark's approval, kept the note back Whilst on the Essex Coast this August and September I paid attention to the asters, and I can certainly confirm Mr. Clark's observations. I observed very many thousand plants growing on the mud bordering the estuaries and creeks, and in the vast majority the purple "rays" were absent in all stages—the imperfectly rayed plants noticed were only a very small percentage of the wholly rayless form. At the same times, the asters growing on the higher tideless lands in St. Osyth parish and elsewhere, were conspicuously attired with beautiful purple, or whitish purple, rays. Diptera and Hymenoptera frequent both forms—but in my experience are in far greater profusion on the "rayed" asters.—W. COLE.]

MUSEUM NOTES No. IV.

VIII.—ADDITIONAL OBJECTS FROM THE ROMANO-BRITISH SETTLEMENT AT CHIGWELL, ESSEX.

Very many of our readers are acquainted with the interesting series of objects so admirably arranged and exhibited by Mr. I. Chalkley Gould in the Epping Forest Museum, and with the little "Handbook" which he prepared in explanation thereof.[1] At the Meeting of the Club on January 25th, 1902, Mr. Gould showed some specimens which had recently been discovered at the site, and made some remarks on the same, which are embodied in the following notes. Most of the objects have been added to the series in the Museum:—

"I exhibit a few coins and some fragments of 'Samian' and other pottery from the Chigwell Settlement. Though mostly in poor condition the coins are of value to us, being approximately indicative of the period of occupation of the site; at the same time it must not be forgotten that Roman coins circulated for ages after the death of the rulers whose superscription they bore.

"Most of the coins hitherto found at Chigwell have suffered so much decay as to render identification impossible, but those shown exhibit sufficiently distinguishing impressions, while a few are in very good condition.

"They consist of the following specimens:—

NERVA (Silver). Bust facing to right.[3]
(*A D.* 96-98) *Inscription.* IMP. NERVA CAES AUG PM TR P COS ii COS iii PP
Reverse. Two hands joined. CONCORDIA EXERCITUUM

HADRIAN (Brass). Bust facing to right
(*A.D.* 117-138) *Inscription.* Gone.
Reverse. Two figures and an altar. Almost undecipherable.

1 *Notes on the Romano-British Settlement at Chigwell, Essex, &c.* Essex Field Club *Museum Handbooks, No* 2, 1895. Price 3½d. post free.

2 In his book *Le Tombeau de Childeric I.* L'abbe Cochet relates that Roman coins circulated in some country districts of France (even down to 1853) where such pieces were known as *sous à La Vierge.* They appear frequently to have found their way into the church offertories, enabling clergy and sacristans to make respectable collections of such coins!

3 This coin is kindly lent by Mr. W. Daniels of Chigwell, the others belong to the writer. —I. C. G.

ANTONINUS (Brass). Bust facing to right.
(*A.D.* 138-161) *Inscription.* Gone.
Reverse. Figure holding a sceptre in one hand, a cap in the other. S.C. COS IIII. This coin was issued in A.D. 154.

ANTONINUS (Brass). Bust facing to right. Head is in good condition.
Inscription. Gone. Should read IMP. CAES. T. AEL HADR ANTONINUS AUG PIUS PP.
Reverse. Figure of Concord looking to left holding two military ensigns TR. POT XXII. COS IIII SC

ANTONINUS (Silver). Bust of Antonine facing to right. ANTONINUS AUG PIUS PP TR P COS III.
&
AURELIUS *Reverse.* Bust of M. Aurelius facing to right.
(*A.D.* 161-180) AURELIUS CAESAR AUG P II F COS (Antonine made Aurelius his consort in ruling the Empire).

LUCILLA (Brass). Bust facing to right. LUCILLA AUGUSTA.
(*m A.D.* 164) *Reverse.* Female figure seated, a young boy on her knees, young girl before her and another boy behind. FECUNDITAS S.C. (Lucilla was married to Lucius Verus A.D. 164).

CARACALLA (Brass). Bust facing to right.
(*A.D.* 211-217) *Inscription.* Gone, and reverse totally destroyed.

CONSTANTINE (Brass). Armoured head facing to left.
(*A.D.* 306-337) *Inscription.* Gone.
Reverse. Wolf suckling the twins. This coin was issued A.D. 327 to 330. A broken, mutilated specimen.

"The pottery is selected from a bushel or two of potsherds recently excavated in digging brickearth—the pieces are of little importance in themselves but are of interest to us from the position of the discovery, being a little further N. and N.W. than the site of former finds, showing the still greater extent of the village. Those who are familiar with the plan in the handbook, descriptive of my collection on view in the Forest Museum, will remember that a considerable area is shaded to indicate the pottery-yielding ground; the recent discoveries would somewhat extend that shading, in the directions mentioned.

"Another point of interest must be noted. Most of the more or less perfect vases and urns in the Forest Museum came from the more southern portion of the area (formerly excavated for gravel). Those were usually associated with undoubted evidence of cremation; we were then upon the cemetery or burial ground of the settlement, but the more recent finds, resulting from excavations further north, are not so associated but are found in pockets (or small pot-holes) or scattered broadcast without surroundings of black earth or burnt material.

"We have in fact passed from the habitations of the dead to the land of the living who occupied this unknown, unnamed settlement in the Roding Valley."

I. CHALKLEY GOULD.

THE LIBRARY TABLE.

The Elements of Agricultural Geology: A Scientific aid to Practical Farming *By Primrose McConnell, B.Sc., F.G.S., Tenant Farmer, Ongar Park, Essex.—(Crosby, Lockwood and Co. 21s. nett)* 1902

This valuable work is divided into fourteen chapters. One to iv. are mainly occupied with the origin and formation of soils, their mineralogy and physiography. Chapter v deals with drainage and water-supply; vi., vii., viii., ix. and x are concerned with formations and farming, and the evolution of live stock occupies chapters xi., xii., xiii and xiv

Many who casually turn over the pages of this book and note the vast area from which Mr. McConnell's examples and illustrations are derived, may be inclined to suppose it too deficient in local interest to be noticed in the ESSEX NATURALIST. But a glance at the preface will reveal the fact that the author for the last twenty years has been farming on the London Clay in Essex, and that he dates from "Ongar Park Hall," Ongar. It is therefore obvious, that no persons are so likely to find his researches specially interesting as residents in that county And in the remarks to follow it seems best to keep in the main, to matters of local interest, referring those interested in the broader aspects of the subject to Mr. McConnell's book.

Our author (p. 31) complains of the apathy of the Government as to the interests of agriculture shown in the case of the Geological Survey and its neglect for so many years of the superficial deposits. But the public opinion of the country sixty or seventy years ago was felt to be very unlikely to consent to grants of money for scientific purposes unless they could be justified by the strongest economical reasons. Accordingly the most weighty argument put forward for the establishment of a Geological Survey, and, in its earlier years, for its continuance, was the statement that a knowledge of the geological structure of the country would at once check the making of useless borings and sinkings and show where they might be made with success. In this way immense sums of money would be saved to the country, while the cost of the Survey would be comparatively trifling. Hence the Survey work began in the mining districts of the north and west, and was carried on with the utmost possible speed, so that its use purely as a business matter, might be obvious to the most unscientific of politicians. This necessarily involved the neglect of superficial beds of every kind. For, on a coal field, for example, the outcrops of the rocks of Carboniferous age, with the lines of fault crossing them, are the fundamentally important things to be noted on the geological map. To show, in addition, the superficial beds, would often be but to obscure the most valuable information, as well as to retard the progress of the Survey. And similar reasoning would apply more or less to formations directly underlying or overlying the Carboniferous series. The special needs of the miner may be shown by the following illustration. In pre-geological days there was a popular view in the Northumberland and Durham, and in the Yorkshire and Derbyshire coalfields that there was "no coal under the limestone." This was true of the Carboniferous Limestone on the west, but utterly untrue of the Magnesian Limestone eastward. Other examples might be given, but the supreme importance, in mining, of a knowledge of the geological structure of a district hardly needs further illustration.

On the other hand, a knowledge of the geological structure of a country has not the same importance to the farmer. Let us, for example, again take two limestones, each of which occupies a considerable proportion of the surface of Englaud, the Carboniferous Limestone and the Chalk. We learn from Mr. McConnell that the grass growing on the bare Carboniferous (or Mountain) Limestone is exceptionally sweet and nutritious, fattening sheep in a few months. The grass growing on the bare Chalk is also excellent for sheep, as we all know from the reputation of the South Down breed. But it would be obvious to any farmer that in each case the sheep fed on grass growing on bare limestone, and he would need no knowledge of the geological structure of the respective districts or the comparative ages of the limestones.

But though, regarding England as a whole, the claims of the miners for geological information are manifestly greater and more fundamental than those of the agriculturists, the counties of Norfolk, Suffolk and Essex have unquestionably been under a special disadvantage in the postponement of drift maps till the claims of the miners were satisfied. This becomes obvious when drift maps and non-drift maps are compared with each other. A drift map of Kent, when compared with a non-drift map, seems but to possess some additional details. Drift maps of Norfolk, Suffolk and Essex, compared with non-drift maps of those counties, look like maps of districts of utterly different geological composition.

As regards the formations of Essex and their farming qualities, nothing is said by Mr. McConnell of Chalk in connection with that county, though its capabilities as seen elsewhere are noted. Chalk, however, occupies but a very small proportion of the surface of Essex, being found only in the north-west corner and between Purfleet and East Tilbury. And the lowest Tertiary beds, the Thanet Sand and the Woolwich Series, occupy but very narrow strips of country adjacent to those where the Chalk is seen. The next, in ascending order, the Oldhaven Beds, cover but an insignificant area in Essex; but we learn that at Hassenbrook Farm, near Stanford-le-Hope, a small, thin patch of this formation occurs, largely composed of rolled flint pebbles in sand; and that it is the best strawberry land in the district. The London Clay, which comes next, forms a very large proportion of the surface in southern and eastern Essex. As regards its character as a soil, it is described as being specially suitable for grass, and as once (when wheat was dear) having been valuable for growing wheat, clover and beans. Mr. McConnell, however, thus gives his own experience of it :—

"The greater part of the author's farm is situated on this clay, so that he has learned from sorrowful experience what the nature of the soil is. Tiptree Hall—farmed by the late Mr. Mechi—is also on this soil and is now a fruit farm."

We are also informed that "the general contour of the land is a low uneven, gentle undulating surface, the highest land not much over 400 ft over sea level, though some few hills in Essex reach 600 ft."

The present writer has never been able, aided by the new ordnance maps, to detect any hills in Essex having a height of 500 ft. The highest ground appears to be on the Chalk of the north-west corner

Of the Lower Bagshot sands and gravels we learn that, though sometimes too sandy or gravelly for fertility, yet while they have not the "body" of the London Clay, they are more easily and satisfactorily worked. They cover but a small area in Essex compared with the London Clay, on which they lie as isolated patches at Brentwood, Rayleigh, Laindon Hills and elsewhere.

The Pliocene "Crag" of Eastern Essex is still more insignificant as a maker of soil. It is the highest bed shown on a non-drift map except the alluvium of the river marshes.

By far the most important of the drift beds is the Chalky Boulder Clay, which probably occupies at least as much of the surface of Essex as all the other beds combined, and a still larger proportion of that of Suffolk. Mr. McConnell states that it covers about 3,000 square miles in the Eastern Counties. He has about 50 acres of it on his own farm, capping the undulations of the London Clay, and finds that "it is the only arable land he has that is fit for cultivation, the rest being London Clay." The Chalky Boulder Clay appears to make good wheat land. He adds that "in the course of ages a large part of the lime has been dissolved out of the surface layer." This point makes the detection of Boulder Clay so doubtful when only shallow sections are exposed. But it is satisfactory to learn that "there is still sufficient left to supply the soil for plant needs; while the existence of marl pits shows that much of this marly clay was dug and spread on the surface in the olden times; in fact, if the subsoil is dug into almost anywhere, beds and streaks of bluish-white marl are found in abundance."

It is interesting to learn that the sand and gravel of the Glacial Period, which underlies the Chalky Boulder Clay, has generally a large admixture of earthy matter in it, and forms a good loamy soil which compares favourably with that of either the London Clay or the Boulder Clay, both in the neighbourhood of Ongar and that of Chelmsford.

On the other hand, the patches of gravel coloured red on the drift maps, which appear at High Beach, Laindon Hill, Rayleigh, and elsewhere in southern Essex, and are considered to be of pre-Glacial age, are barren gravels, "given over to gravel-pits and the growth of birch or copsewood." Similarly barren are the Post-Glacial gravel patches, coloured orange.

As regards old river deposits, our author speaks highly of the loam or brickearth in the neighbourhood of Southend and Rochford.

In the chapters on "The Evolution of Live-stock" some curious facts about sheep are mentioned. At a place in Derbyshire a "fault" separated a limestone area from one in which silicious grit formed the surface. The sheep were all of one breed. But while those which fed on the lime-stone were healthier and made better mutton, those which fed on the sandstone had superior wool. Bakewell, it appears, classed wool soils thus: -Clay, the best; sand next; lastly lime. But we are also reminded of "the effect of clay formations—as the Oxford Clay—in developing such diseases as liver-fluke and foot-rot."

It seems to me, however, worth suggesting that possibly much of the ill-health of sheep on clay may be due to bad water supply.

But it is impossible, in the space available in the ESSEX NATURALIST, to discuss adequately a book which covers so large a field as this, and is the result of so many years' hard work, both in the library and on the farm. It is a pleasure to be able to congratulate the author on the success of his labours, and to recommend his book to all who are interested in Agricultural Geology.

T. V. H

The Giant Beaver (*Trogontherium*) **in the Thames Valley.**—In the *Geological Magazine* for September (1902) there is a short paper by Mr. E. T. Newton, F.R.S., F.G.S., on "The Giant Beaver (*Trogontherium*) from the Thames Valley." Mr. Newton remarks that English specimens of *Trogontherium* have been chiefly obtained from the 'Cromer Forest Bed,' "that rich and remarkable series of beds occupying a position in time, between the Crags and the Glacial deposits of East Anglia." A few specimens have, however, been found in the Norwich and Weybourn Crags. Now a lower incisor tooth of *Trogontherium cuvieri* has been met with in a bed of gravel (at 78 feet O.D.) an old Thames Valley deposit, near Greenhithe, Kent, together with remains of *Elephas antiquus*. *E, primigenius*, *Rhinoceros*, *leptorhinus*, *Bos primigenius*, etc., and many Palæolithic implements. The implements have been figured and described by Mr W M. Newton in *Man* for June, 1901.—T. V. H.

The Matrix of the Suffolk Chalky Boulder-clay.—A paper on this subject, by the Rev. Edwin Hill, M.A., F.G.S., appears in the *Quarterly Journal, Geological Soc.* (vol. lxviii., pp. 179-182. It need hardly be remarked that the Suffolk Boulder Clay is also that of Norfolk and Essex, though it covers a larger proportion of Suffolk than of the counties due north and south Indeed, some of the specimens examined were from the neighbourhood of Bishop Stortford, and one from Finchley in Middlesex, others came from Boston, Lincolnshire, though most were from Suffolk Mr. Hill remarks that the materials of the matrix do not appear to have come from the east, but from the west or north-west, and that they were drawn from a limited belt lying on one side of the basin which the Boulder Clay occupies.—T. V. H.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31st, 1901.

[*Read and adopted at the 22nd Annual Meeting on March 22nd, 1902.*]

But a few paragraphs will suffice for a record of the Club's year. The work, both in connection with the Society itself and the Museums, has been mainly of a routine nature, although the Council venture to submit that the scientific credit of the Club has suffered no diminution.

FINANCIAL.—The following is Mr. Howard's report:—"The financial position of the Club is on the whole sound, and, as will be seen from the Statement of Account, the adverse balance is diminished to £5 5s. 6d., but this result has only been obtained by the most strenuous economy. There is an urgent need for an increased roll of members to provide the funds so desirable for the Club's work.

There is also still a great need of funds to enable the Curator to bring the museums up to the right standard of completeness The case of the Forest Museum is specially urgent, and at the Essex Museum there are no funds available to purchase the specimens required to complete the collections and do other most important work."

MEMBERSHIP ROLL.—The Club has, unfortunately, lost several members by death and removal from the County, and this has tended to reduce the roll, in spite of election of many new Members. As far as can be estimated at present, there are 264 Ordinary Members, Exempt Members 4 and Honorary Members 16, making a total of 284, four less than at the date of the last Annual Report.

MEETINGS.—Eleven meetings were held within the year, the November meeting having been transferred to 1902 in consequence of the usual date being that of an important scientific fixture in London. In addition to the papers read we have had the benefit of several important lectures and addresses by scientific men, and the Council wish to record the cordial thanks of the Club to the following gentlemen:—to Prof. G B. Howes, F.R.S., who gave an address at the meeting on Feb. 23rd on "Recent Work on Molluscan Morphology"; to Mr. E. Sanger Shepherd who on March 30th gave a most interesting and well-illustrated lecture on his process for producing photographs in natural colours, to Mr. E. M. Holmes, F.L.S., to Prof. J. B. Farmer, F.R.S., and Prof. H. Marshall Ward for assistance at the meeting for inspection of the Forest on May 18th. On this occasion we had anticipated the benefit of the two verderers, Sir T Fowell Buxton and Mr. E. N. Buxton, but the alarming accident to the former just before the meeting prevented this It was with great relief that all present heard that no serious consequences ensued.

We have again to thank the Countess of Warwick for kind hospitality at Bigods on the occasion of the visit of the Club on June 6th, and also Mr. and Mrs. Henessy for their courtesy at this meeting. At the meeting on Canvey Island on June 15th we had the great benefit of the leaderships of Dr. Murie and Prof. Boulger On June 29th the Club was the recipient of much kindness and hospitality at the hands of Mr. and Mrs. Sharrock at the Reservoir works at Tottenham and Walthamstow—the arrangements made by Mr. Sharrock for the comfort of the Members were most thorough and welcome. At the Annual Cryptogamic Meeting on October 12th we again secured the ever welcome assistance of Dr. M. C. Cooke and Mr. G. Massee and Prof. Marshall Ward gave an inspiring address on the "Scientific Study of Fungi." At the Ordinary Meeting in October, Prof. Meldola gave a lecture on "Mimetic Insects," which was admirably illustrated by a very fine series of lantern slides, many of them produced by the Sanger-Shepherd process of photography in colour, the specimens from which they were taken having been arranged by Prof. E. B. Poulton, of the Hope Museum, Oxford.

The papers read at the meetings have been, or will be, published in our journal.

Although a matter hardly officially connected with our Field Meetings, the Council cannot refrain from recording the very kind invitation for the meeting at Bigods on July 24th given to the members of the Club by the Countess of Warwick, which was highly appreciated by those who accepted the invitation.

The Council also wish again to record their high appreciation of the valuable facilities for holding meetings in the Institute granted by the Technical Instruction Committee of the Borough of West Ham. And the kindness of the Principal, Mr. Briscoe, has been most marked during the year, enabling our meetings to be carried with a facility and success not to be equalled in the history of the Club.

Essex Naturalist.—Three parts of the journal were published during the year, comprising 234 pages, with six full-page plates and numerous other illustrations. The Council has to thank Mr. F. W. Reader for several valuable blocks, for much care taken in copying drawings for re-production and generally in assisting the editor in preparing matter for the press; also Mr. H. A. Cole for drawing of the Dug-out Boat discovered in the Alluvium of the Lea Valley.

The somewhat irregular appearance of the Essex Naturalist is still a source of great regret to the editor, but he hopes to remedy this soon, as the pressure of other work in connection with the two museums is lessened. But the *amount* of matter issued is evidently almost the maximum which the present financial resources of the Club will permit. There appears to be no falling off in the number of papers of real scientific and local interest sent in, and if it were in our power to print them many others would doubtless be submitted. The editor would also like to have a few illustrations in colour occasionally and to make the records of local scientific events occurring within our districts more systematic and complete. But this is impossible, from the cause hinted at above. We can only have faith and await the "Good time coming." At present the hope seems bound up with an increase of membership. One hundred more members would enable us to nearly double the present issue of the Naturalist and to mould it more into the form of a quarterly journal of Natural History in a wide sense of these words.

Essex Museum of Natural History.—The history of affairs at the Museum was brought up to the end of 1900 in the last report, and a full account of the opening of the Museum to the public on October 18th, 1901,

ESSEX FIELD CLUB.

Treasurer's Statement of Receipts and Expenditure for the Year 1901.

GENERAL RECEIPT AND EXPENDITURE ACCOUNT.

Receipts.	£ s. d.
To Subscriptions, arrears	13 16 0
,, ,, 1901	137 4 0
,, ,, 1902	2 0 6
,, Life-Compounders for *Essex Naturalist* ...	9 0
,, Balance of Library Account...	1 15 0
,, ,, from Life Composition	1 3 10
,, Deficit	5 5 6
	£161 13 10

Expenditure.	s. d.	£ s. d.
By Balance (Deficiency from 1900) ...	7 0	
Less in Secretaries' hands .	5 8	
		1 4
,, Printing and Illustrating *Essex Naturalist* ...		47 17 4
,, Printing (Circulars, &c.) and Stationery		14 7 6
,, Postage of *Essex Naturalist*, Circulars, Correspondence, etc.		17 8 6
,, General and Incidental Expenses . .		8 1 6
,, Library Expenses		4 13 5
,, Lecturers' Fees		4 4 0
,, Amount transferred to Essex Museum (West Ham) Maintenance Fund		50 0 0
,, To Life Composition Account		10 0 0
,, Loss on Field Meetings, as *per* Hon. Secretary's Statement		5 0 3
		£161 13 10

ESSEX MUSEUM (WEST HAM) MAINTENANCE FUND.

Receipts.	£ s. d.	£ s. d.
To Balance at Bank	68 4 1	
,, ,, in Secretary's hands	6 14 10	
		74 18 11
,, West Ham Corporation		100 0 0
,, Transferred from General Account		50 0 0
,, Sale of Handbooks		2 3 1
Due to Curator—£45 17s. 6d.		£227 2 0

Expenditure.	£ s. d.	£ s. d.
By Curator's Stipend and Railway Fares		111 15 0
,, Printing Handbooks		11 17 0
,, Removal of Specimens		1 0 0
,, Fire Insurance		1 16 0
,, Sundries		8 1 4
,, Curator's Disbursements		10 6 3
,, Balance at Bank	74 17 7	
,, ,, in Curator's hands...	7 8 10	
		82 6
Due to Curator—£40		£227 2 0

ESSEX MUSEUM (WEST HAM) EQUIPMENT FUND.

Receipts.	£ s. d.
To Balance at Bank	65 4 9
,, Deficiency	13 6
	£65 18 3

Expenditure.	£ s. d.
By Printing	3 1 6
,, Cases	17 0 0
,, Specimens, etc.	45 16 9
	£65 18 3

EPPING FOREST MUSEUM CAPITAL AND MAINTENANCE FUND.

Receipts.	£ s. d.	Expenditure.	£ s. d.	£ s. d.
To Balance ...	5 9 1	By Printing...		3 18 0
,, Subscriptions	6 10 0	,, Fittings for Museum		69 15 0
,, Donations	102 2 6	,, for Secretary		3 3 10
		,, Balance at Bank ...	35 8 7	
		,, ,, in hands of Secretary	1 16 2	
				37 4 9
	£114 1 7			£114 1 7

SPECIAL MEMOIRS AND PUBLICATIONS ACCOUNT.

Receipts.	£ s. d.	Expenditure.	£ s. d.
To Sale of Publications	2 17 5	By Balance (Deficiency from 1900)	15 6 8
Balance (Deficiency)	12 9 3		
	£15 6 8		£15 6 8

SUMMARY OF BALANCES, JANUARY 1st, 1902.

	£ s. d.		£ s. d.
To Epping Forest Museum	37 4 9	By Cash at Bank	132 1 7
.. Essex Museum Maintenance	82 6 5	,, ,, in Treasurer's hands	3 10 6
.. Life Composition	115 0 6	,, ,, in Secretaries' hands...	3 8 1
		,, Investments	89 12 6
		,, Deficit Museum equipment	13 6
		,, General Fund	5 5 9
	£234 11 8		£234 11 8

Having examined the above Accounts with the books, vouchers, and Banker's pass-book, we find the same correct.

18th March, 1902.

WALTER CROUCH, }
JOHN D. COOPER, } *Hon. Auditors*

has since been printed in the ESSEX NATURALIST. The work during the year 1900 was necessarily mainly confined to improving the arrangement and increasing or renewing the specimens in several departments.

The removal of the three centre cases from Chingford to the main Museum has enabled the curator to improve the collection of mammals and at the same time allow of more space being given to the birds. The Corporation Committee largely aided in the reconstruction of these cases, and they also kindly gave orders for the making in the workshops of the Institute of 13 square wall-cases for the reception of some of the smaller animals and for botanical collections. Ten of these cases are at present temporarly filled with selections from the Essex collection of Seaweeds. The authorities of the Institute also allowed the curator to place four large cases containing the general collection of fossils in the gallery. Mr. H. E. Smedley, F.L.S., lent his series of wax models of British Fungi, made by himself, and the collection was for some time a very beautiful and attractive exhibit in the gallery. On the removal of Mr. Smedley's collection our member, Mr. J. Avery, kindly lent a large selection from his collection of engraved views of Essex, and this has been arranged round the gallery, the Institute constructing the frames to contain the pictures.

The principal additions to the Museum during the year were the acquisition by purchase of the Cryptogamic collection of the late Mr. E. G. Varenne, of Kelvedon; a considerable number of specimens of plants from our late member, Mr. Sewell; a large number of Lepidoptera from our late member, Mr. F. Coles; archæological specimens from Mr. F. W. Reader and his brother, Mr. T. W. Reader; Palæolithic implements from Somaliland from Mr. Seton-Karr, together with other specimens of stone implements; and of a beautifully set-up specimen of the Kite, formerly belonging to the late Mr. Henry Doubleday, by Mr. J. E. Harting.

The arrangement of the specimens in hand will necessarily take a long time. The curator has had the benefit of the assistance of Mr. H. Whitehead who had been appointed by the Technical Instruction Committee, but Mr. Whitehead's time being largely occupied in other ways, the progress has been slow. The work of the curator is also hampered by want of space, and still more seriously by want of sufficient funds to obtain the necessary cabinets, cases and appliances, and the special specimens and preparations urgently required. Meanwhile he can only once more appeal to the members of the Club, and to those interested in the museum "idea" for assistance both financial and scientific. There are thousands of species still required, and we are in need of systematic collecting in most groups. Essex is a very rich county, but specimens must be gathered with skill and care to be available for museum purposes.

EPPING FOREST MUSEUM.—As reported at the last Annual Meeting, the re-arrangement of the collections, and additions thereto, has now been taken in hand. A Committee has been appointed, under the chairmanship of the Rev. A. F. Russell, and a public subscription started to obtain the funds necessary to carry out the scheme proposed by the curator. A considerable sum has been subscribed, but more money is still needed. The work of reconstruction has been carried on slowly through the year, and the major portion of the cases are now nearly ready. The curator had hoped to complete the work by May or June next, but this is hardly possible now, unless the Museum Fund is considerably increased. The museum is vastly improved by the additional space and new fittings, and the Council venture to think that when completed it will be a most useful and popular addition to the attraction of the Forest, and a valuable supplement to our main museum. A full report will be submitted by the Museum Committee when the work is more nearly completed.

The only considerable addition is the series of specimens from the Lea Valley Excavations at the new Reservoir Works at Tottenham and Walthamstow. The Council has to thank in this connection Col. Bryan, Mr. Sharrock, Mr. Marsh and Mr Traill, for their kindness and assistance afforded during the visits to the works, and the care with which the various relics were preserved and forwarded to the Museum.

The Council have also to thank Mr Chalkley Gould for his continued assistance in arranging the series of specimens from the Romano-British Settlement at Chigwell.

Conference of "East Anglican" Natural History Societies.—The Second Conference was by invitation of the Club held at Dunmow on June 6th, but only two representatives of the Norfolk and Norwich Society attended and none from Ipswich Members of the Essex Field Club attended in numbers. A very pleasant conversation took place, introduced by Mr. W Cole in some remarks on the advisability of initiating a scheme for systematic collecting, more especially of marine forms. But under the circumstances no action could be taken. It is now suggested that the Third Conference should be held during the ensuing summer at Ipswich, and that town being central for the "East Anglian" district it is hoped that a goodly company will attend the meeting, and some practical work may be begun.

In connection with conferences the Council have to thank Mr. F. W. Rudler, F.G.S., for acting as the Club's representative at the British Association Meeting at Glasgow. Mr Rudler, as Chairman of the Conference, put forward some valuable advice, which will be found summarised in the report which he has sent in for publication in our journal.

Presidency.—The Council has great pleasure in recommending the re-election of Prof. Meldola as President of the Club for the ensuing Club year.

Honorary Members.—The Club has recently lost by death three very eminent Hon Members. In view of this and with the desire of strengthening the scientific position of the Club, the Council recommend that the following gentlemen be elected at the Annual Meeting as Honorary Members of the Club. All these gentlemen have expressed themselves very favourable to the work the Club is trying to do, and several of them have already done yeoman's service in our interests :—

List of Eminent Scientific Men suggested for election at the Annual Meeting, 1902, as Honorary Members of the Club.

W. H Dalton, Esq., F G.S (*late of the Geological Survey.*)

Prof. J. B. Farmer, M.A., F.R.S., *Professor of Botany, Royal Coll of Science.*

Prof. G. B. Howes, LL.D., F.R.S., F.L.S., *Professor of Zoology, Royal College of Science.*

Prof. E. Ray Lankester, M.A., LL.D., F.R.S., F.L.S., &c., *Director of the British Museum of Natural History.*

C. H. Read, Esq., F.S.A., *Keeper of the British and Mediæval Antiquities British Museum.*

Sir W. T. Thiselton-Dyer, K.C.M.G., LL.D., F.R.S., F.L.S., &c., *Director of the Roydl Gardens, Kew.*

Prof. H. Marshall Ward, D.Sc., F.R.S., F.L.S., *Professor of Botany, University of Cambridge.*

H. B. Woodward, Esq., F.R.S., F.G.S., *Geological Museum, Jermyn Street.*

[N.B.—All the above gentlemen were elected at the Annual Meeting on March 22nd, 1902.]

THE ESSEX FIELD CLUB.

THE 208th ORDINARY MEETING.

SATURDAY, JANUARY 25TH, 1902.

The 208th Ordinary Meeting was held at half-past six o'clock in the Physical Lecture Theatre of the Municipal Technical Institute, Stratford, the President, Prof. R. Meldola, F.R.S., in the chair.

Mr. Frank Woolnough, *Curator of the Museum, Ipswich*, was elected a member of the Club.

At the commencement of the proceedings, Mr. Cole said that the members would lament the death of Lord Rookwood, one of the Life Members of the Club, and a gentleman who had earned the esteem and gratitude of all interested in the county of Essex. Before he became a peer, as Sir Henry Selwin-Ibbetson he was largely concerned in the rescue of Epping Forest, and he piloted the Epping Forest Act through Parliament. Later, he aided the Club in defeating encroachments on the Forest by railway and tramway companies. In many movements made for the benefit of the county, Lord Rookwood took a leading part, and his loss would be long regretted. He died in London January 15th, 1902 in the 77th year of his age. Mr. Cole concluded by moving that he should be empowered to send a letter of condolence in the name of the Club to Lady Rookwood on the death of her distinguished husband.

This was seconded by the President, who cordially supported the tribute of esteem put forward, and the resolution was carried unanimously.

Mr. T. V. Holmes, F.G.S. exhibited a drawing of an old wooden water-pipe, found in making excavations in Wigmore Street, London, and made some remarks on these disused methods of conveying water. He thought that ancient contrivances of the kind were worth recording, inasmuch as they were so soon wholly forgotten.

Mr Holmes afterwards embodied his observations on ancient wooden water-pipes in a paper which will be printed in the ESSEX NATURALIST

Mr J Chalkley Gould exhibited some pottery and coins from the Romano-British Settlement at Chigwell, Essex, which he had obtained in continuation of the series of relics from that spot already exhibited in the Epping Forest Museum. Mr Gould made some remarks on these specimens which are given in the "Museum Note" in the present part (*ante* pp. 238-40.)

The President said that they were all much indebted to Mr. Gould for the persistence and success with which he was watching the excavations at Chigwell. He also expressed his satisfaction at finding Mr. Gould inclined to deposit all the specimens in the Club's Museum at Chingford. It so commonly happened that relics of the kind got dispersed in private hands, and the evidence which they might afford was practically lost All such objects should be carefully preserved, registered, and brought, as it were, to a focus in some local Museum.

The President exhibited and presented two or three fashioned flakes from Sherringham, Norfolk. He had found and kept these, not for any intrinsic value, but he was unaware whether worked flints had hitherto been found at Sherringham, and therefore it would be well to preserve these

The Secretary said that Mr. Seton-Karr had recently sent to him a set of Stone Implements of Palæolithic type, found by himself in Somaliland, Eastern Africa, with a request that the Club should select six specimens for the Museum and distribute the remainder among various English and Continental Museums named by Mr. Karr. The Secretary exhibited the whole set of 38 implements. Mr. Seton-Karr had described his specimens in *Journ. Anth. Inst.*, vol. xxv. (1896) p. 172, pl. xix.-xxi. *Brit. Assoc. Rep.*, 1895, p. 824 And Sir John Evans had more recently (*Proc. Royal Society*, vol. lx. (1896) p. 19) called attention to this subject (see also Evans' *Ancient Stone Implements*, 2nd Ed (1897) p. 653) Sir John remarked on the identity of form of the implements with those found in the Pleistocene deposits of North-western Europe and elsewhere.

Mr. Cole also exhibited a collection of various stone implements previously presented to the Museum by Mr Seton-Karr.

Mr. F. W. Reader made some extended remarks on these specimens which will be embodied in a "Museum Note" in a future part of the E. N., and moved that a vote of thanks be sent to Mr. Seton-Karr for those welcome contributions, which had so greatly enriched the Club's collections

Mr. Charles H. Read, F.S.A., remarked that these implements certainly very closely resembled the Palæolithic types found in Britain and on the Continent, but he urged caution in assuming that they were actually of Palæolithic age. So far as he knew, there was absolutely no *geological* evidence at present forthcoming upon which to base accurate conclusions as to the age of these implements.

The vote of thanks to Mr. Seton-Karr was carried unanimously

Mr. George Massee, F.L.S., communicated a note on the occurrence in Epping Forest of *Amanita citrina*, a species new to Britain. And he also sent for the Museum an original coloured drawing of the species (Mr Massee's note appeared in the last part, *ante* p. 129.)

Mr. W. Cole said that the remarkable point about Mr. Massee's discovery was, that this conspicuous fungus should have escaped the notice of all the acute botanists who had for 21 years attended the Annual Fungus Forays of the Club. It was possible that the recent extensive thinnings in the Forest had somewhat altered the character of the soil, and that the resulting conditions had proved more favourable for the *Amanita* than those previously obtaining.

The President, in proposing a vote of thanks to Mr. Massee, alluded to the hypothesis of the deferred germination of the buried seeds of plants, as being possibly analogous to the case of the Hymenomycete.

The vote of thanks was carried unanimously.

Mr Charles H. Read, F.S.A. (Keeper of the Department of British and Mediæval Antiquities, British Museum) then gave a most interesting and instructive Address on the subject of Local Archæological Investigation He urged the importance of such a society as the Essex Field Club making a careful examination of the numerous prehistoric sites in the county. But in conducting such explorations great caution was necessary. An earthwork should be explored only by persons acquainted with the right methods of working and the varied knowledge of the geologist, antiquary and ethnologist was often necessary to conduct the enquiry on right lines and to correctly interpret the results obtained. He advised the making of an archæological survey of the county, plotted down on a large scale map, as being one piece of work well within the power of a local society. On it all barrows, mounds and other indications of prehistoric occupation should be carefully marked down. Then should these sites be threatened by the interference of the owners of land or other persons, the opportunity should be taken by the Club, to make explorations carefully and scientifically, so as to prevent the misfortune which they had so often to lament of the destruction of prehistoric monuments with no record of evidence from which their nature or period could be inferred.

The lecturer alluded to the very interesting "Red Hills" of the Essex Estuary lands, from which the series of specimens in the Museum had been obtained by Mr. Cole. He thought that these remains should be investigated, and suggested that the Society of Antiquaries might possibly make a grant to the Club towards the expenses of exploration.

Mr. Read referred to the great want of exact knowledge of the sequence of the "Bronze Age" and the importance of gathering all the evidence possible before it was too late to do so. Although he recognised the great value of local Museums, he deprecated the establishment of a large number, because he feared the interest in them would thereby be lessened by the diffusion of objects which were best studied and appreciated when gathered together in large collections. He also pointed out that it was not conducive to the promotion of archæological knowledge to keep in local Museums objects of extreme rarity which had no relation whatever to other exhibits. It was much better to send these to the National Museums, where perhaps such an object would find a place among the larger series of antiquties, and even fill a gap in a world-wide collection.

The President, in proposing that the thanks of the Club should be given to Mr. Read for his valuable and suggestive address, pointed out that historical records, of the nature of local traditions, very often clung with great persistence to ancient remains and, however erroneous, were never dispelled till the shovel and pick had been brought to bear upon them He referred to the Club's explorations of the Epping Forest earthworks as examples of exploration by scientific method which had been instigated by the late Genl Pitt Rivers Prof. Meldola further expressed satisfaction that the Society of Antiquaries was carrying on the work of the Archæological Survey, although he feared that Essex had not much to show so far in this direction. With reference to the occurrence of palæolithic remains in their county he reminded the meeting that they had been fortunate at the outset of their career in having had among them such a keen observer as their hon. member Mr. Worthington Smith, some of whose earliest contributions to the subject had been published by the Essex Field Club. The President also expressed his great interest in Mr. Read's suggestions with reference to the registration and preservation of the prehistoric remains of the county and he referred to the similar proposals brought by him in 1883 before the Club and the Conference of Delegates of Corresponding Societies at the Southport meeting of the British Association (see *Trans. Essex Field Club*, vol. iv., p. 116) Coming as these suggestions now did from an archæologist of such distinction as Mr. Read, he hoped they would bear practical fruit and that the Club would continue the work of scientific exploration of the ancient remains of the county which they had already commenced under such favourable auspices. There yet remained an immense amount of work to be done in this field, and he expressed the hope that the systematic investigation of the mysterious " Red Hills " to which Mr. Read had alluded would be taken in hand before long.

Mr. T. V. Holmes thought that they might well be congratulated on Mr Read's valuable address. In illustration of the damage done in former years to ancient earthworks by persons ignorant of the interest attached to them he might mention that Mr. W. Cole and he visited Pictsbury Ramparts, near Colchester, a few days after the occurrence of the Essex Earthquake. The camp appeared on the map of the Geological Survey (48, S.W.) as a complete oval But they found about three quarters completely removed, and only about one fourth (which was within the boundaries of a wood) preserved. The destruction had been done simply as an agricultural improvement, though on meeting the farmer occupying the land, and talking with him about it, they learned that the removal had been a costly piece of work, and scarcely a profitable one. It was described as a pretty spot, the ramparts having once stood about 30 feet high, where, at the time of our visit there was a perfect level. In Greenwich Park, there still remained many low tumuli on the top of the hill between the Observatory buildings and the gate at the top of Crooms Hill. In the year 1844, we learn from *Hasted's History of Kent* (Part I. *Hundred of Blackheath with additions by Streatfield and Larking*, edited by H H. Drake, London, 1886), that the reservoir a few yards south of these barrows was made. Many barrows were destroyed to obtain material for the banks bounding the reservoir before orders were given to stop the destruction, and oblige the constructors of the reservoir to obtain their gravel a few yards farther away. We also learn that these barrows were opened in the year 1784 by permission of the Surveyor of the Royal Domains and some glass beads, braids of human hair, and patches of woollen cloth found in them, But it also appears that about 70 years before the date of this exploration.

"one Hearne, a park-keeper, had opened these barrows, and no doubt removed many valuable relics" The appearance of some of the more prominent barrows still remaining shows that "exploration" implied simply digging into them from the top.

Mr. J. Chalkley Gould said however much we may deplore the destruction of Pictsbury Ramparts, to which Mr. T. V. Holmes has just referred, we must remember that vandalism was perpetrated by some (probably needy farmer anxious to make the utmost of his land, but what shall be said of the British Government which a few years ago destroyed the greater part of the interesting earthwork at Shoeburyness—a work which is of so great interest not because of its size, but for its definite mention in the Saxon Chronicle? We hope that the present War Office authorities are careful of the fragment which remains.

With regard to the settlement of the Saxons in our county, which appears to have been accomplished so much later than similar settlements elsewhere, Kent and Suffolk for instance, it would be work worthy of the Essex Field Club by investigation of any sort to throw light on this subject and the reason for the later occupation.

Mr. Read's address was so full of matter that one could talk long of the points it suggests, but he would only refer to the remarks upon the multiplication of museums. There is no doubt that their undue increase would weaken the character of all and to establish too many will be a serious mistake

Mr. A. S Kennard pointed out the difficulties under which the archæological student laboured, arising from the indifference of the general public. He noted that two most important discoveries in connection with the "Bronze Age" had been made in Essex, one being the largest bronze sword yet found in this country, and the other a magnificent hoard of bronze spear heads of an extremely raw type He urged the importance of describing all objects of interest as soon as it was possible. He pointed out how utterly untrustworthy with the statements often made by the labourers and warned the members against a well-known forger of flint implements at present living in Essex

The discussion was continued by Mr. Reader, Mr. Briscoe, who advocated the establishment of a photographic survey of Essex by the Club in connection with the Museum, and by Mr. W. Cole and others.

A very cordial vote of thanks was passed to Mr. Read, who replied on some points alluded to by the speakers.

Mr. W H. Dalton, F.G.S., exhibited and presented to the Museum some specimens of brackish water Mollusca from Fowlness, Essex, which had been collected during the past summer by Mr. Llewellyn Owen.

THE 209th ORDINARY MEETING.

Saturday, February 22nd, 1902.

The 209th Ordinary Meeting was held in the Technical Institute, Stratford, at 6.30 p.m , the President, Prof. R. Meldola, F.R.S in the chair.

Mr. F. W Green was elected a member.

The Secretary read a letter from Lady Rookwood, thanking the Club for the vote and letter of condolence upon the death of her husband, Lord Rookwood, passed at the last meeting.

The first business was the announcement of retirements from the Council, and the nomination of new members of Council and Officers for election at the Annual Meeting on March 22nd.

The nominations were duly made, and the list of Councillors and Officers is given in the report of the Annual Meeting, *post* p. 260.

The Secretary announced that the Council were desirous of recommending that the Club should elect several eminent scientific men as Honorary Members at the Annual Meeting. But it had been found that to do this alterations would be necessary in Rule II, and Rule XII.

Mr. Cole therefore gave notice that at the next meeting he would move such necessary alterations (see *post*, Meeting on March 8th).

Mr. F. W. Elliott exhibited a portion of a quern, which had been found in a garden at Buckhurst Hill, but there was no direct evidence of its true place of origin.

Mr. Chalkley Gould said that the quern was of the kind frequently found in Essex.

The Secretary exhibited two books recently presented to the Club, viz. the new edition of the *Handbook of British Birds* by the author, Mr. J. E. Harting, F.L.S. and Connold's *British Vegetable Galls* presented by Miss Read. He also said that he had arranged for the exchange of publications and information with the Fisheries Board for Scotland and the Northumberland Fisheries Station.

He also exhibited four beautiful specimens of the Bearded Tit or "Reed Pheasant" as it was called in Essex, where it was once common in the marshes below Barking Creek, (*Panurus biarmicus*). These specimens were from Rickling Fen, Norfolk, and were presented by Mr. J. E. Harting. And he announced that Mr. Harting had given to the Club his collection of Land and Fresh-water Shells, the collection being that used in the preparation of Mr. Harting's little book, *Rambles in search of Shells*; most of the beautiful original drawing for the illustrations in that work were made from the specimens in the collection.

A vote of thanks was passed to Mr. Harting for his interesting gift, the President remarking that this was only one of Mr. Harting's many kindnesses to the Museum.

Mr. John Avery read a paper on "George Edwards, the Stratford Naturalist," and exhibited a very fine engraved portrait of Edwards. (Mr. Avery's paper will appear in the ESSEX NATURALIST).

The President said that they were much indebted to Mr. Avery for placing on record another Essex worthy, who must have been a man of very considerable talent to have gained the Copley Medal of the Royal Society.

Mr. Walter Crouch also made some remarks upon the paper.

A lecture was then given by Prof. E. B. Poulton, M.A., F.R.S., Hope Professor of Zoology, University of Oxford, entitled "Protective Resemblance, Warning Colours and Mimicry: Some new illustrations of well-known Principles." The lecture was illustrated by a very extensive and beautiful series of lantern-slides, many of them being coloured, and some were striking examples of the new three-colour process of photography.

It is impossible to give in a short space, and without illustrative figures, a report which would do justice to Prof. Poulton's admirable exposition of a difficult subject. His remarks and examples extended over almost the whole range of the theories of Mimicry of Bates and Müller among butterflies, Protective Resemblance among caterpillars and other insects, and Agressive and Protective Resemblance amongst crustaceans, reptiles, &c. Many striking instances of "Warning Colours" were shown, and the speaker especially dwelt on the expansion of the theory of common warning colours of Muller brought about by the recent observations of Messrs. Marshall and Shelford. Prof. Poulton also described the remarkable discovery of the American artist, Mr. Thayer, which is illustrated in the models of birds in the British Museum and in the Hope Museum, showing that the light colour of the under sides of many birds and animals serves to practically render them invisible when illuminated from above, as in nature. The lecturer suggested that these models should be reproduced in the Club's Museum.

The President, in proposing a vote of thanks to Prof. Poulton for his admirable lecture, said that they were particularly indebted to that gentleman for having taken the trouble to come up from Oxford for the purpose of addressing the Club, this being the third occasion on which the Hope Professor had given them the pleasure of hearing from him the results of his continued investigations in that field of biology which he had cultivated with such distinction. The lecturer had referred in the course of his remarks to his own (the president's) contributions to this subject, but he thought that the best contribution he had ever made was the discovery of Prof. Poulton himself. Referring to the different subjects dealt with by the lecturer he emphasized the point so well brought out by the magnificent illustrations shown, viz., that it would appear as though natural selection had been at work with an eye to artistic effect, picking out every detail of colour, pattern, structure and attitude that could be made use of in adapting the animals to their environment. It was impossible to say whether a species harmonised with its surroundings unless it were seen under natural conditions, and large and apparently conspicuous animals, such as zebras and giraffes, had been shown to be really well adapted for concealment when among their natural surroundings. He (Prof. Meldola) went on to say that he was glad of the present opportunity of being able to make a public recantation of a view which he had many years ago first broached at a meeting of the Essex Field Club. He referred to the light or white colours of the *undersides* of birds and animals. At the time when this subject was being discussed by the Club (see *Proc. E. F. C.*, vol. I., p. vi., and discussion in *Nature*, vol. 31, p. 505 and 32, p. 172) he had not realised that such an arrangement of colours could possibly have the enormous effect in affording concealment that had now been shown to be the case by the American artist, whose models of ducks in the Natural History Museum at South Kensington and in the Hope Museum at Oxford, of which Prof. Poulton had shown them photographs, were well worth looking at. He thought that their own Museum ought to possess such models, which were not very difficult to make.

In ignorance of the optical effect producible by this arrangement of colour he had in 1880 and since, in common with other naturalists, attempted to explain the white colours of the undersides of birds, &c., as being of purely physical origin. That explanation he now unreservedly withdrew in favour of protection by concealment.

With reference to the work on colour adaptability in individuals, as shown by the illustrations of caterpillars, he thought that the lecturer had been too modest in concealing his own share in this most important work. Although he (the President) had by observation arrived at the conclusion that such adaptability existed and had claimed natural selection as an efficient cause of the phenomenon, it was only the experimental investigations of Prof Poulton, carried on with such consummate skill and patience, that had placed these deductions on a solid basis of irrefutable facts. As an example of concealment by adventitious means he reminded them that they in Essex had the well-known case of the larva of the Essex Emerald Moth (*Geometra smaragdaria*; see ESSEX NATURALIST, vol I., p. 120).

The President also expressed concurrence with the strictures which the lecturer had imposed upon the conclusions drawn from the experiments of those who, like Plateau, had actually tasted insects having warning colours and because they could find no unpleasant taste had inferred that the whole theory of distastefulness was erroneous. It was impossible to institute a comparison between the senses of taste and smell of man and of insect-eating birds and animals Distastefulness might be associated with quite other characters than those of taste or smell as interpreted by our senses. Cantharidin, for example, a product of the blister-beetle, would be an extremely unpleasant thing for a bird or animal to get into its mouth although possessed of no distinctive smell as far as we know. An insect producing this compound as an active defensive principle might derive the full advantage of having warning colours without any nauseous smell or taste at all The danger would only be realised after the insect had been taken into the mouth by its enemy. Hence the value in such cases of danger signals.

The President went on to say that the development of the Müllerian theory of mimicry in the hands of Prof Poulton was a source of immense gratification to him since he (the speaker) as the lecturer had told them, had been very largely responsible for the adoption and promulgation of that theory in its initial form in this country. It was the late Charles Darwin who had first sent him in 1879 the publication, *Kosmos*, containing Fritz Müller's modest little paper, accompanied by one of his characteristic postcards asking him to see if there was anything in it. On looking through the paper he came at once to the conclusion that there was a very great deal in it —how much, they had perhaps been able to realize from the Hope Professor's remarks that evening Although he was himself a firm believer in the application of Darwinian principles to the cases comprised under the general term "Müllerian Mimicry," he thought it desirable to point out, by way of answer to those who had from the beginning opposed the new ideas with the charge of being too theoretical, that quite apart from the question of the truth of the theory, its utility under the influence of Prof Poulton had now been demonstrated beyond cavil. Inspired by the new idea the lecturer had set observers and collectors systematically at work in various parts of the world and some of the results had been submitted to the Club on the present occasion. In the way of results no theory had been more prolific, and the great mass of material accumulated by the zeal of Prof. Poulton and embodied in the collections in the Hope Museum was standing evidence that the departure made in 1879 had been most prolific as a source of substantial facts. He concluded by moving a most cordial vote of thanks to the lecturer.

Some remarks were made by Mr. Elliott and Mr Cole, and the vote of thanks was passed by acclamation.

Prof. Poulton replied on some points mentioned by the speakers.

It was announced that a supplemental meeting would be held on March 18th to clear the slate of some papers in hand, and that at the Annual Meeting on March 22nd the President would deliver an Address dealing with the scientific work of the Club during the 21 years from its foundation.

THE 210th ORDINARY MEETING.

SATURDAY, MARCH 8TH, 1902.

The 210th Ordinary Meeting was held in the Technical Institute, Stratford, at 6.30 o'clock, the President, Prof. R. Meldola, F.R.S., in the chair.

In accordance with notice given at the last meeting, and in the printed circular calling the present meeting, Mr. W. Cole moved :—

> "*In Rule II the word 'twenty' be struck out, and the words 'twenty-five' substituted.*
>
> "*In Rule XII the words limiting the number of Honorary Members to be elected in any one year, to five, to be held in abeyance so far as regards the present year,* 1902."

Mr. F. W. Reader seconded the motion.

These resolutions were put by the President to the meeting, and carried unanimously.

It was announced that to fill one of the vacant seats on the Council the name of Mr Champion B Russell had been sent in to the Secretary, and consequently Mr Russell's name went forward for election at the Annual Meeting.

Mr. Avery exhibited a series of Essex Copper "Tokens" of dates towards the end of the 18th century. The tokens were in a beautiful state of preservation. Mr. Avery described the tokens and made some remarks upon them.

Prof. Meldola laid upon the table a plan of the section of a well at Easton Lodge, recently made. The details were in Mr. Whitaker's hands for incorporation in another batch of Essex Well-Sections now being prepared for publication in the ESSEX NATURALIST.

Mr. W Cole exhibited a shell of the Swan Mussel (*Anodonta cygnea*) from Mr. Harting's collection, taken with many others from an Otter's haunt, showing that the end of the shell had been bitten off by the otter, and the molluscan animal abstracted. This went to show that the otter lived to some extent upon mollusca.

Mr Chalkley Gould exhibited on behalf of Mr. B G Cole, a counterfeit Spanish dollar found a few years ago in Epping Forest, which had been presented to the Forest Museum by Mr. Percy Gearing. Mr. Gould remarked that during the reign of George III the excessive scarcity of silver money led the British Government to attempt to remedy the deficiency by buying Spanish dollars, counter-marking them (on the bust of the Spanish ruler) with the Hall-mark of King George, and issuing them as British coin. As a natural consequence counterfeiting on a large scale ensued, and after two attempts so to utilize the dollars, the Government abandoned the plan ; the entire Spanish impression was obliterated under a powerful press, and the silver was used to coin the well-known Bank of England dollar. The exhibited example of the forged dollar, with the counter-mark of 1797, was found with many others in Epping Forest, near the "Wake Arms," at a spot selected, doubtless, by some counterfeiter who was prevented from recovering the hoard It is heavily plated with silver upon a copper body, The coin is "Carolus III [of Spain] Dei Gratia, 1773" About 40 years ago a considerable number were found at or near the same spot.

Mr. Frank P Smith gave a most interesting *viva voce* account of the preliminary portion of his projected series of papers on "The Spiders of Epping Forest." The lecture was illustrated by about 50 lantern slides, many of photographs taken in the open from actual specimens, affording instances of "Aggressive Resemblance" and other facts in the life-histories of spiders. Mr. Smith also explained his methods of collecting and studying spiders, and the precautions necessary in securing photographs.

The President proposed a cordial vote of thanks to Mr Smith for his admirable lecture, and for the series of papers of which it was the forerunner He also made some remarks on points in the lecture, more particularly on the instances brought forward of "Aggressive Mimicry" among spiders

The vote of thanks was passed by acclamation and Mr. Smith replied

The report of the Club's Delegate at the British Association meeting at Glasgow, Mr F. W. Rudler, F.G.S., was taken as read. Mr Rudler was cordially thanked for his report and for his services as Delegate. The Report was printed in the last part of the ESSEX NATURALIST, *ante* pp. 140-145.

A paper on Eolithic Implements from the Plateau Gravel around Walderslade, by Mr. J. P. Johnson was "read" in abstract (in Mr. Johnson's absence through illness) by Mr. A S Kennard The paper was illustrated by specimens and by a few lantern slides. It will appear in the ESSEX NATURALIST.

Mr. A. S. Kennard also exhibited and presented to the Club, some Eolithic stones from the country near Rochester.

Both Mr. Kennard and the President commented on the value of these implements as affording evidence of the existence of man at the time the Plateau gravels were deposited. Mr. Paulson also joined in the discussion. Votes of thanks to Mr. Johnson and Mr. Kennard were passed.

THE TWO HUNDRED AND ELEVENTH ORDINARY MEETING.

SATURDAY, MARCH 22ND, 1902.

Previous to the Annual Meeting an Ordinary Meeting was held, the President in the chair, for the purpose of proposing some candidates for membership, &c.

Mr. Reader exhibited and explained some models of the mode of hafting Flint Implements which he had had prepared for the Museum, and also exhibited two burnishers from Clerkenwell, to show that the use of Stone Implements still obtained in some trades. A description of these models will form the subject of a future "Museum Note."

He also exhibited photographs of a prehistoric mine in Chili, and a model of the mode of hafting blocks of limestone in that mine so as to be serviceable as hammers

Remarks were made by Professor Boulger and Mr. D. Howard on the chemical composition of prehistoric bronze implements.

Thanks were voted to Mr. Reader for his interesting exhibitions. THE ANNUAL MEETING followed.

THE TWENTY-SECOND ANNUAL GENERAL MEETING.

SATURDAY, MARCH 22ND, 1902

The 22nd Annual Meeting was then held, Prof. Meldola, F.R.S., President, in the chair.

The minutes of the Annual Meeting, held on March 30th 1901, and printed in the ESSEX NATURALIST, vol. xii, pp. 48-49, were read and confirmed

The Treasurer, Mr. David Howard, F.C.S., read the summary of the Treasurer's statement of Account for 1901 which had been duly signed by the Auditors, Messrs Walter Crouch and J. D. Cooper This statement was received and adopted by the meeting.

The Secretary read the Annual Report of the Council for the year 1901 This was received and adopted.

At the Meeting on February 22nd last, the following members retired from the Council by the Rules:—Messrs. J. Avery, L. Cranmer-Byng, A. J Furbank, G. E Vaughan, and the Rev. R. E. Bartlett; Messrs Avery and Vaughan submitting themselves for re-election. There are also two vacancies remaining over from former years.

At the same meeting the following were duly proposed; Mr. J Avery, Mr. Percy Clark, B.A., Mr Primrose McConnell, B.Sc., F.G.S., Mr Hugh H. Mason, F.R.C.S., L.S.A., C.C., Mr. G. E. Vaughan, and Mr. C. B. Russell, M.A., J.P., C.C., has since been nominated.

As Officers the following were nominated:—

President—Prof R. Meldola, F.R.S., F.C.S., F.E.S.; *Treasurer*—Mr. David Howard, J.P., F.C.S.; *Hon Secretaries*—Mr. W. Cole, F.L.S., F.E.S., and Mr. B. G. Cole; *Librarians*—vacant; *Auditors*—Mr. Walter Crouch, F.Z.S. and Mr. J. D. Cooper.

No other Members having been proposed for any office, the above gentlemen stood elected as Members of the Council and Officers for the year 1902, and were so declared by the Chairman.

The President said that the Council had resolved to recommend eight gentlemen for election as HONORARY MEMBERS of the Club. The resolution passed at the last meeting would permit of the selection of these gentlemen at the present meeting. All had consented to become Members, and he thought that the list would show that it was representative of the different departments of science coming within the scope of the Club's studies. The President then read out the list, which is printed in the Annual Report of the Council.

The election of these gentlemen as Honorary Members was proposed by Mr. E. A. Fitch, and seconded by Mr. G. E. Vaughan, and carried unanimously.

The President nominated as Vice-Presidents during his year of office the following.—E. N. Buxton, J.P., Walter Crouch, F.Z.S., I. Chalkley Gould, and J. C. Shenstone. F.L.S.

Mr. W. Whitaker, F.R.S. proposed that votes of thanks should be given to the officers for their services during the past year. This was carried unanimously.

Mr. David Howard returned thanks for the officers collectively.

The President then delivered his ANNUAL ADDRESS which was entitled "The Coming of Age of the Essex Field Club, a record of Local Scientific Work, 1880-1901." This paper was printed in the last part, *ante* pp., 79-16.

Mr. John Spiller, F.C.S. as an "Original Member" of the Club, had much pleasure in proposing a cordial vote of thanks to the President for his services during the year and for the admirable Address he had delivered, and that the Address be printed in the ESSEX NATURALIST.

Rev. W. C. Howell warmly seconded the vote of thanks.

Mr. David Howard in putting the vote to the meeting proposed that 250 separate copies of the President's Address should be printed off and, circulated as extensively as possible, for the purpose of calling attention to the work of the Club, in the hope of thereby recruiting the roll of membership.

The vote of thanks was carried by acclamation, and Mr. Howard's proposal regarding the extra copies of the Address was agreed to also

The President suitably responded, and expressed his pleasure at seeing so many old members of the Club in the room to support him in his endeavour to place the 21 years' work of the Club clearly before the county.

The Hon. Secretary presented an account of the "Tea Fund," showing that the receipts had been £4 13s. 6d. and the expenditure £4 18s. 5d.

SPRING WOODLAND AND MEADOW RAMBLE.

SATURDAY, MAY 3RD, 1902.

One of the usual Spring Rambles was arranged for the above afternoon to visit the very interesting woods in the Ongar Park district.

Unfortunately the weather was extremely unsettled, and a severe storm in London prevented many members attending, including three of the

"Conductors." But in spite of these adverse conditions more than 50 members and visitors attended, and Mr. Primrose McConnell, B.Sc., F.G.S., and Mr. I. Chalkley Gould efficiently acted as leaders.

The party assembled at North Weald Station about 10 minutes to 3, and Mr. McConnell at once led the way to the Ongar Park Woods, where the keeper was in attendance.

Ongar Park Woods are portions of the old Forest of Essex, considerably changed by long years of planting and management as game woods. They formed part of the "Purlieus" of the Forest, for the history of which Fisher's *Forest of Essex*, pp., 159-170 should be consulted. Very considerable information respecting the natural history of these woods will be found in the reports of previous visits, in our *Journal of Proceedings*, vol. ii, pp. xliii.-xlvi. ("From Epping to Theydon Garnon") and *Ibid*, vol. iv., pp. civ.-cviii. In the latter report, some editorial remarks on the Purlieus will be found (p. cvii., foot-note). The late Mr. English there gave many details of the entomology of the woodlands, and Prof. Boulger of the botany.

On the present occasion, Mr. McConnell called a halt at the "Eight Wents" and remarked that it was almost exactly 18 years since the Club had visited Ongar Park Woods. The place where they were standing at the moment was the meeting point of eight "Wents" or "Wonts," rides which radiate in straight lines outward like the spokes of a wheel. The Ordnance Map showed that these were at mathematically exact distances from one another; one of the rides, however, had within the last thirty years been allowed to grow up and become obliterated, in the interests of game preservation The centre point had at one time been occupied by a spruce fir tree—long gone however. The height above sea level of this centre point was 340 ft., so that it was thus the third or fourth highest point in Essex.

Ongar Park Wood was a remnant of the ancient Forest of Essex, and was continuous with Epping Forest, though now for many generations it had been private property The district of Ongar Park was one of the seven "Purlieus" of the Forest of Waltham (which included what is now Epping Forest) and the name was common to several of the present day farms and woods of the neighbourhood—such as the speaker's own farm, Ongar Park Hall, also Ongar Park Lodge, Ongar Park Grove, etc.

The prevailing timber tree of the Wood was hornbeam, but many other species were quite common, and some specimens of the Wild Cherry (*Prunus cerasus*) and of the American locust-tree (*Robinia pseudacacia*) were to be found.

The late Mr. English had collected some specimens of rare moths—such as the "Camberwell Beauty" and the "Great Emerald," in these rides in bygone years.

The geological formation of the ground over which they had come was largely Glacial Drift on the top of the London Clay, with small patches of the Chalky Boulder Clay of East Anglia. The surface soils were thus composed of the corresponding gravelly, marly, and clayey material; the two first being the basis of most of the arable fields in the neighbourhood, while the clay is mostly in permanent grass land. The heathy portion they had crossed was given on the Geological Survey map as "Pebble Gravel"

As the party were to have tea at Toot Hill it was interesting to note the origin of the name of this little country hamlet "Toot" or "Taith" was the name of a Norse Goddess, and the word was quite commonly applied to places, as for instance at Tooting, Tooter's Hill, Tottenham, and so on, and it indicated where there had been village settlements in the times of the Vikings.

Unfortunately the rain began soon after Mr. McConnell's address and all investigations in the woods was stopped The party was obliged to press forward over the field-paths to Toot Hill. By the way, Mr. Chalkley Gould pointed out that the trenches were still quite distinct which had enclosed the rectangular piece of ground where are now the cottages and gardens of Toot Hill. The site commands a good view round three sides and across the Roding valley.

The party reached the "Green Man" in a sharp shower. But an excellent tea soon comforted everybody Then an Ordinary Meeting, the 212th, was held for the election of new members, Mr. J Chalkley Gould, *Vice-President*, in the chair.

The following were elected members of the Club:—

Messrs. Edward Chichester, M.B. (London), Francis Dent (Hon. Sec. Essex Bird Society), James Dietrichsen, (Mrs.) Dietrichsen, (Miss) Blanche Hewett, B.Sc., Ernest C. Horrell, F L.S. (Staff Instructor in Biology, Essex County Council) John F. Rogers, Frank Sulley, William White, F.E.S., and Edward Wilshaw.

After the meeting, the rain having ceased, the ramble was continued by very pleasant meadow-paths, and through an old disused lane, which was stated to have been an ancient pack-horse road leading to the church. In the lane and meadows the cowslip was extremely abundant, and many other interesting plants were noticed. And then the antique wooden church of St. Andrew's was reached, and carefully examined under the guidance of Mr. Chalkley Gould The Club visited Greensted Church on the first Field Meeting held (March 29th 1880) when the late Captain Budworth acted as guide (see *Journal of Proceedings*, vol. i., p. viii.) and in the report details of the construction of the Church will be found It is one of the oldest Churches in the world, and the nave is probably the only example of a Saxon wooden Church which has come down to us.

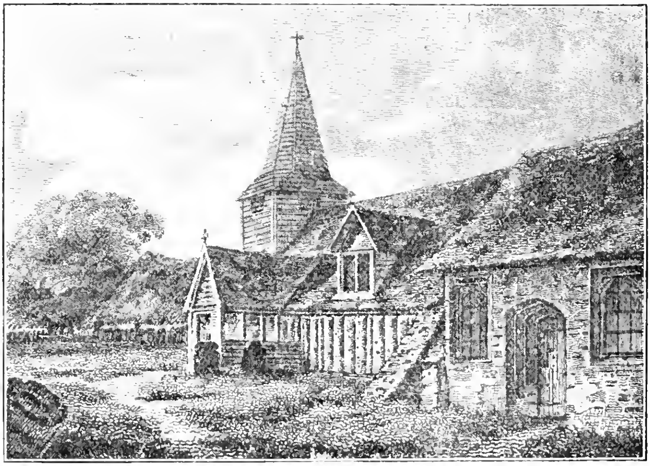
In the dusk of the evening the company seated themselves in the ancient building whilst Mr. Gould gave a eloquent lay sermon on the partly legendary life of Edmund, the saintly king of East Anglia, a story which from its local and quaint interest may be summarised here:—

"England in the middle of the 9th century was still split up into petty kingdoms, or sub-kingdoms, under the house of Wessex, that known as East Anglia including the present counties of Norfolk, Suffolk and part of Cambridgeshire. Of this kingdom, Edmund, a boy of 14 years, became ruler in 855 and 856[1] and the decade which followed shewed him to be pious and studious, though not the less a sportsman and a warrior

1 It is recorded that the northern portion of East Anglia recognized his kingship in 855, the southern part not until the following year.

"In the years succeeding the date of his coronation, East Anglia could boast of peace and prosperity beyond that of the other Saxon kingdoms, but the shadow of the terrible Northmen's raven soon caused gloom throughout the land, and in 865 the shores of England were invaded by 20,000 pagan Danes. I may not occupy your time with the story of the next five or six years but pass to the sad year A.D. 870, when East Anglia's dauntless Christian king vainly fought the pagan host. Chronicles of the mediæval monks tell how boldly the king, then 29 years old, bore himself before his conquerors and persecutors.

"The final scene was enacted on a gloomy November day in the Forest of Eglesdune (now represented by Hoxne, near Eye in Suffolk). Here the pagan savages bound the king to an oak tree, scourged his body and made him a target for their iron-tipped arrows, finally cutting off his head.



Greensted Church, near Ongar.
(From a Print dated 1800. Block lent by Mr. A. Lockyer.)

"The story goes on to tell that when the Danish host had gone thundering on to further pillage, the body was sought for by Christian Saxons, that they found it in an open clearing, but discovered not the head till in the depths of the forest they heard a voice as of the king cry "here! here! here!" And there they saw a strange sight—a great grey wolf crouching down with its paws expanded and between them the head of the monarch! Peacefully giving up possession, the wolf retired and the mourning Saxons gave the remains burial near the forest.

"There the body rested for 33 years, till in A.D. 903 it was translated to Beodricsworth, the place afterwards known as St. Edmund's Burh, now Bury St. Edmund's, where it remained peacefully for over 100 years.

"Many stories of miracles connected with St. Edmund's body are to be read in the chronicles and numerous were the people who flocked to and enriched the shrine and monastery, but in A.D. 1010 the hordes of Turchil the Dane landed near Ipswich to pillage the fair Saxon country-side, and then dreading lest the priceless relics should fall a prey to the invaders, a monk conveyed them to London (sundry miracles helping him on the way).

"Peace came to England, and in 1013 the third translation took place, though Alphum, Bishop of London, hotly fought to retain the holy bones in the city. The body of the king was conveyed in solemn procession to Bury St. Edmund's and here our local interest begins, for the monks travelled by an ancient way (now mostly dwindled into bridle-roads and footpaths) which led from the Roding valley here, and hence to Clare and Bury. Here, where St Edmund's remains rested for some days, pious hands are said to have erected this rude wooden Church; but personally I think it probable the building was here already, for Greensted was an old-time village on the king's highway when the road through Ongar did not exist and Ongar was but a little settlement on a cross road. As such it remained till Eustace of Boulogne held it under the Conqueror, and Richard de Luci made it his home in the days of Henry II.

"That however, is another story. Our interest is in the timber nave of this little church, associated as it is with the romantic journey of the remains of Edmund; and long may its timber walls stand a lasting memorial of East Anglia's king, martyr and saint."

The evening was still stormy as the party traversed more pretty meadow paths to the little station at Blake Hall

---

VISIT TO WALTON-ON-NAZE AND FRINTON, ESSEX.

SATURDAY, JUNE 7TH, 1902.

The stormy and unsettled state of the weather during the previous few weeks had rendered it undesirable to hold any meetings, especially on the coast. But on this day a visit was made to the picturesquely situated towns of Walton and Frinton in order to view the fast diminishing exposures of the celebrated Red Crag formation, and to study the rapid denuding action of the weather and sea on the soft cliffs of this part of the coast. As the programme said "it would be a startling object-lesson in geology."

The Club has visited Walton on two previous occasions; first on September 14th, 1889 (ESSEX NAT. iii., 230-32) when the late Dr. Taylor was the demonstrator, and again on June 7th, 1890 (E. N. iv., 129-32) under the guidance of Mr. Whitaker and Mr. Holmes. In the reports of these meetings much information on the topography and geology will be found. The literature on the geology of the neighbourhood up to the end of 1888 is catalogued in the "List of Works on the Geology of Essex," pp. 61-86 of vol. iii. of the ESSEX NATURALIST. The maps are Geol. Sur. Map 48 S.E. with adjoining part of 48 N.E. and 48 S E. with accompanying memoirs to these sheet by Whitaker and Dalton And in 1890 Mr W. H Dalton wrote for the Essex Field Club "A brief sketch of the Crag Formation of East Anglia. An outline of the Nature, Position etc., of the Beds which have furnished the Collection of Crag Fossils in the Essex Museum of Natural History," a valuable little pamphlet, giving the latest aspect of the subject.[2]

On the present occasion, Mr W H Dalton F G S., and Mr T. V. Holmes, F.G S. were the "Conductors," and we had also the benefit of the company of Mr. J E. Greenhill who had been staying at Walton for some little time. Unfortunately the stormy weather much restricted the party, which assembled at about 1 o'clock at the "Royal Albion" Hotel for luncheon Afterwards a walk along the foreshore was taken to inspect the sections of the London Clay and the Crag, but very soon the rain came down and observations had to be taken under the shelter of umbrellas Mr. Dalton, was, however, able to demonstrate most points of interest, and a few fossils were collected, although the wet and "greasy" state of the cliffs rendered climbing somewhat unpleasant and at times unsafe The geological and topographical observations made are embodied in Mr Dalton's special report in the present part of the ESSEX NATURALIST (see pages 217-21). As the afternoon wore on even the euthusiasts were compelled to beat a retreat to the inn, and to ward off the damp with a cup of warm tea

Afterwards an ORDINARY MEETING (the 213th) was held, the President Prof. R Meldola, in the chair

The following were elected members of the Club:—Mr W H Ault, Rev. Henry E Bird, Rev. Father Clements, Mr H. W. Lewer, Mrs Lewer, Mr. H T Malby (F. Roy, Photo. S) and Mr Elliott Sparks.

Mr. Picton exhibited a Neolithic Celt found by one of his pupils on the beach at Clacton Although Palæolithic Implements have been found at Clacton, there appear to be no records of Neolith Celts in that neighbourhood A figure of this implement will be given later in our journal

Mr. Henry Mothersole exhibited a Neolithic Implement from the gravel-pit in "Admiral's Park" Chelmsford, whence Mr. H. Corder obtained the fine spear-head many years ago which was recorded and figured in the "Transactions" of the Club (*Trans E F C*, vol. ii., p 29, pl. ii.) Mr Mothersole's implement, with other Neoliths from the neighbourhood of Chelmsford, will be figured in a future part.

Mr Mothersole also exhibited and presented to the Museum, a few flint flakes and "scrapers" gathered that morning on the shore at Walton, from the spot near which Dr. Laver and Mr Spalding had found so many implements (see ESSEX NATURALIST, vol ii., 187)

A short discussion took place on the subject of the erosion of the East Anglian coast, and Mr Holmes read some notes from the British Association Report on Coast Erosion which he had extracted for the purposes of the meeting These are embodied in the notes on Coast Erosion in another part of the present issue (see pp 221-24)

Towards the evening the ramble was continued along the cliff to the pretty modern village of Frinton Mr Dalton had no difficulty in strikingly demonstrating his remarks Frinton has suffered in an extraordinary degree from coast erosion the site of the old Frinton Hall lying half-a-mile out at sea, and

2 Essex Field Club Museum Handbooks. No. 4. Price 2½d. post free.

it is quite evident that the heroic attempts now being made by the authorities to arrest the decay of the land will be abortive.

Time did not allow of an inspection of St. Mary's Church, almost the smallest in England; the chancel, blown down in the great storm of 1703, was restored in 1879. On the way to the station, the Marconi Company's "wireless" telegraphic stations now erected at Frinton was seen with interest. A few members of the party remained down at Walton for the Sunday

---

THE OAK GALLS AND GALL INSECTS (CYNIPIDÆ) OF EPPING FOREST.

By E. J. LEWIS, F.L.S., F.E.S.

[*Read January 26th, 1901.*]

The study of Galls and Gall-Insects has never attracted the amount of attention that so interesting a subject deserves, although it affords a wide field for inquiry both to the entomologist and the botanist.[1] Galls occur on a great number of plants, and are caused by a variety of creatures, not only insects but also by mites and worms. Among the worms we find such species as *Tylenchus tritici* (Bastian) which belongs to the family Anguillulidae, or Eel-worms, forming galls known as "Ear-cockles," or Wheat Eel-worm Galls. The family Eriophyidæ (Phytoptidae) contains many species of gall-forming mites, those red formations so often seen in great numbers on the leaves of the maple and sycamore being examples. The swollen buds so prevalent on the black currant bushes are due to the presence of a species of mite, *Eriophyes ribis* (Nalepa), belonging to this family, thousands of individuals being present in each bud, and now doing such an enormous amount of damage that non-infested bushes are becoming the exception. An allied form, *E. avellanae*, is commonly met with on the hazel, causing the buds to swell in the same way. Other species (*E. taxi* (Murray) and *E. rudis* (*typicus*) (Cam.)) affect the buds of the yew and birch, respectively, in a similar manner.

Gall-makers are included in several different orders of the Insecta. For instance, the turnip gall weevil (*Ceutorhynchus sulcicollis*), which produces swellings on the turnip and on the

1 Readers will find much information not only with regard to the galls of our county, but also on the general subject, in Mr. E. A. Fitch's paper on "The Galls of Essex," *Transactions Essex Field Club*, vol. II., pp. 98-156. In this paper wood-cuts are given of many of the oak-galls formed by the Cynipina, as well as those on other plants made by Coleoptera, Diptera, Hymenoptera, &c. Mr. Fitch also gave abundant bibliographical references. ED.

stalks of the cabbage, belongs to the order Coleoptera (beetles). In the order Diptera (true flies) gall-making species are found chiefly, but not entirely, in the family Cecidomyidae, an example being the hairy nail-gall, *Hormomyia piligera*, found on the upper sides of the leaves of the beech. In the order Hemiptera we have the family Aphidae including such species as *Chermes abietis*, which causes the common but remarkable cone-like gall on the Norway spruce, and *Schizoneura ulmi* which forms a gall on the elm. The order Hymenoptera includes the family Tenthredinidae (sawflies) some of which form well known galls on the leaves of various willows. To this order also belong the Cynipidae, which produce galls on the rose and other plants, but chiefly upon the oak. There are many other gall-makers besides those which I have enumerated, but in the following record I am dealing only with those Cynipids which form galls upon the oak.

Cause of the formation of Oak-Galls.

A gall is a peculiar growth of the tissue of a plant due to irritation set up by some internal animal agency. This irritation acts upon the cambium layer of the plant in which the gall-maker lays its egg. The abnormal formation is not due to any poison injected by the insect at the time of oviposition, but the egg must be laid in the cambium ring, or growing meristamatic tissue of the plant, in order to form a gall. Morbid growth results either from irritation caused by the swelling of the egg after oviposition and the subsequent hatching of the larva, or more commonly by the latter alone, in which case the gall does not commence to form until the larvae have emerged. Growth of a gall only occurs while the juices of the plant are active, no growth taking place in the winter.

The gall-makers themselves are usually small and insignificant looking insects, but the galls which they form differ greatly both in size, shape, colour and texture. The position in which they appear on the tree also varies as they may arise from the buds, leaves, stems, or roots. In the centre of each gall there is a hollow cavity in which the larva feeds and grows, subsisting on the juices of the surrounding tissue; here it pupates, the perfect insect subsequently boring its way out through the side of the gall, the hole thus formed being in many cases exceedingly small compared with the size of the insect. The hole forming the means of exit for some small parasite may often be mistaken for that of the gall-maker.

Parthenogenesis and Alternation of Generations.

Alternation of generations is an exceedingly interesting feature occurring in the life history of those Cynipidae forming galls on the oak. There are two generations a year, the first, consisting of females only, is known as the Agamic generation, the second, which includes both males and females, as the Sexual generation.

The two generations give rise to galls which may differ entirely both in shape, size and situation.

Those galls which mature in the spring give rise to insects comprising females only, which proceed to lay fertile eggs without having any connection with a male. This is known as Parthenogenesis or reproduction without male agency, the generation of flies being Agamic. After these have oviposited in the spring, galls arise which mature in the summer, and the insects emerging from them comprise both males and females (sexual generation); the latter, after copulation, lay eggs which in turn eventually cause galls to form which are exactly similar to those from which the agamic generation emerged in the spring. The reason for this alternation of generations is not known, and it would take too long to discuss the various theories on the subject, but it seems to be intimately connected with the extrusion of the polar bodies during the germination of the egg, previous to the formation of the embryo. In the eggs of the sexual generation two polar bodies are extended, while in the eggs laid by the agamic generation only one polar body is extruded.

In all lower forms of life we find the occurrence of parthenogenesis more common than in the higher forms. As regards the Cynipidae there are a few species forming galls on the oak which have only one generation a year, this generation being agamic. It is probable that these and other agamic generations at one time possessed males, as we find cases among the Cynipidae forming galls on other plants where a few males are still present.

For instance, in the case of *Rhodites rosae*, which forms the common "Bedeguar" or Pincushion-gall on the rose, the males are almost extinct, though a few are still found; consequently reproduction has become parthenogenetic, owing to a gradual loss of males, there being only one generation a year. It is probable that the process has been equally slow in other forms, but is so far advanced that only females are known. In *Rhodites rosae* we may conclude that males will soon be quite as extinct as they at present are in the agamic forms of oak gall-makers. Again, the receptaculum seminis is present both in the agamic and sexual generations, though atrophied in the former. Unless this can be explained by its being inherited in the agamic generation from the sexual, but being functionless has gradually become atrophied from want of use and may eventually disappear, it seems to point to the fact that males were present at some remote period. Before copulation can take place the ovipositor of the female must be extruded. Copulation takes place soon after the insects leave the galls, and the females sit with the ovipositor extruded awaiting fecundation. But this extrusion is carried out by the females of the agamic generations also, though they have no males to fecundate them and reproduce parthenogenetically. Does not this apparently prove that these agamic generations at one time had males, or could this act come under the head of inherited instincts?

Some galls, especially bark galls such as *Andricus radicis*, require two years in which to complete their generation cycle. The rudiment of the gall is formed in the first year and further development is arrested till the following spring, when the gall formation is renewed with a fresh period of vegetative activity. Maturity is reached in the autumn, the flies emerging in the spring of the next year. These lay eggs in the buds, which give rise to the sexual generation (*A. trilineatus Htg.*) which in turn oviposit to form the *A. radicis* gall. Galls formed by the brood appearing in the spring take a much shorter time to reach maturity than those formed by the sexual generation.

Insects of the agamic generation appear in early spring often in very cold weather, some forms, such as *Biorhiza terminalis*, frequently ovipositing during the winter, when the snow is on the ground and the temperature at freezing point; consequently it is a good thing for them to be able to lay their eggs at once, without previous connection with a male. The sexual generation on the other hand appears in the summer when the weather is warm, live longer, and so have more time to spare for the process of continuing their species.

Gall variation.

As before mentioned galls of different generations of the same species often occur on different parts of the oak besides varying in shape and colour, etc. Galls of the agamic generation, *Dryophanta folii*, the common Cherry-galls of the oak, occur on the back of the leaf while the corresponding galls of the sexual generation, *D. taschenbergi*, usually arise from adventitious buds situated on the trunk of the tree. The former when mature are large, round, yellowish galls, often with a red cheek, the latter are very small velvety galls, purplish in colour, hardly noticeable against the bark.

The great difference between the galls as they occur on the oak, and the similarity existing between the insects which form them, is very marked. The larvae are fleshy, legless grubs, usually white or yellowish in colour. The perfect insect is, as a rule, brown or black, and it is almost impossible to find sufficient variation to differentiate between the species in some cases. Those agamic forms having only one generation a year, such as *Andricus quadrilineatus* and *A. seminationis*, are practically identical, and yet the galls are very different. This may be accounted for by the fact that the larva is surrounded by the gall tissue throughout its whole life, and is never exposed to the light, so cannot be acted upon in any way by external influences, and consequently varies but little. The perfect insects live only a short time and die as soon as the eggs are laid. The galls on the other hand serve to protect the larvae from parasites, and are, therefore, greatly modified by external conditions.

Inquilines and Parasites.

The number of parasites and inquilines preying on the gall-makers and living in their galls is enormous. They are of three kinds :—

Inquilines or "guest-flies" which live in the thickening of the gall substance, doing no harm to the hosts.

Inquilines which do not directly prey upon the host but starve it out and take up the extra room thus obtained for their own benefit (including certain Synergidæ in the galls of *Cynips kollari*.)

Direct parasites preying on the larvae, such as Chalcididae, Ichneumonidae, and Braconidae.

There are also insects of various orders which feed upon the substance of the larger galls such as *Biorhiza terminalis*. They are known as "commensals."

On account of the number of parasites, inquilines, etc., found in oak galls, it is important to differentiate between them and the true gall-makers:—

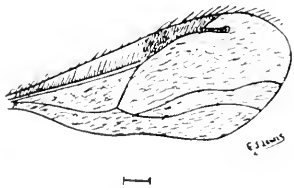


Fig. 1 Wing of a Chalcid.

Characters of the Chalcididae. Wings without a system of cells, having a single nervure proceeding from the base near the costa to which it afterwards passes after giving off a short vein more or less terminally thickened (Fig. 1.) The angles of the pronotum do not extend back to the point of insertion of the tront wings. Antennae elbowed, with seven to thirteen joints.

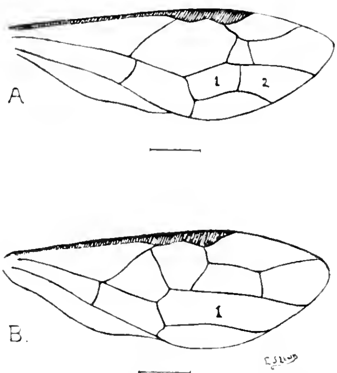


Fig. 2 *A*. Wing of an Ichneumonid.
B Wing of a Brachonid

Characters of the Ichneumonidae. Wings with a system of cells well developed. The space in the front wing dividing the posterior cell from the cubital cells, is separated into two portions by a transverse veinlet (Fig. 2 *A* Antennae many jointed. Abdomen attached to the lower part of the medium segment, *Characters of the Braconidae.* Wings with a moderate number of cells. The anal or second posterior cell is separated from the cubital cells by a large space having no cross nervure. (Fig. 2 *B.*) Antennae not elbowed, nearly always more than fifteen jointed. Abdomen with little mobility between the segments, the suture between second and third usually absent

Characters of the Cynipidae. Wings with few cells and having no stigma. Pronotum fixed to the mesonotum, the angles extending back to the points of insertion of the front wings. (Fig. 3 *A.*) Antennae straight, composed of twelve to fifteen joints.

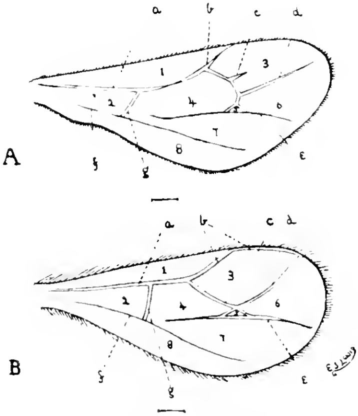


Fig. 3. *A.* Typical *Cynips* Wing. *B.* Typical *Synergus* Wing.

Nervures.	*a.* *b.*	Sub-costal	*e.* Cubital		
			f. Median		
	c. *d.*	Radial	*g.* Transverse basal		
Cellules.	1	Humeral	4		
	2	Median	5	Areolet	Cubitals
	3	Radial	6		
			7	Discoidal	
			8	Posterior	

Besides the true gall-makers there are other genera of the Cynipina which live as Inquilines in various Cynip galls. Such genera are :—

(1.) *Synergus*: This is represented in nearly all oak galls.

(2.) *Ceroptres*: Occurring chiefly in *Andricus trilineatus* galls.

(3.) *Sapholytus*: In galls on *Quercus cerris.*

The Synergidae have the radial cellule of the wings closed, but in the Cynipidae the subcostal vein is not continued along the front margin. In this way they can be easily distinguished. (See Fig. 3.)

Parasites attacking gall-making insects belonging to the Cynipina are chiefly members of the family Chalcididae. These are small blue or green-metallic coloured Hymenoptera preying upon both larvae and pupae, the same species being often found in different galls.

Ichneumonid and Braconid forms, parasitic on the Cynipid oak gall-makers, are not numerous.

Parasites often prey upon the larvae of Inquilines. Certain Cynipidae are parasites upon other insects, such as Aphidae, and are sometimes found in the galls of members of their own family.

Parasites reproduce themselves sexually. Agamic forms, are, however, found among Inquilines, the genus *Ceroptres* furnishing examples of both kinds.

Protection against Parasites.

Various devices for the protection of the larvae against these intruders are consequently necessary, and it is on this account to a large extent that galls present such a variety of form and structure. Hairs may be produced in abundance on a gall, as in the case of *Andricus ramuli*, where it is covered with a dense white matted growth, or a few stiff hairs may be present (*Neuroterus tricolor*). In *Andricus fecundatrix*, the gall is completely imbedded in an abnormal growth of scale leaves, giving it the appearance of a hop. A covering consisting of the phloem or bast cells of the peripheral layer protects *Andricus corticis* galls. In the case of *Andricus sieboldii*, the gall secretes a sweet sticky substance, of which ants are very fond, and these latter insects often protect the galls with a hood of earth. A hard woody growth near the centre of the gall serves as an extra means of protection to the larva in the case of *Cynips kollari*. In other cases the larva may be enclosed in a separate cocoon within the gall (*Andricus curvator* and *A. inflator*). The substance of the gall may be very bitter and obnoxious to birds which peck at it to get at the larva within (*Cynips kollari*). Other galls are highly coloured as a warning to birds (*Biorhiza terminalis*). The most interesting form of protection is that of "Protective Resemblance" where galls take the likeness of buds so accurately that even when specially searching for the galls one is liable to pass them over without notice (*Andricus albopunctata*). Parasites often distort galls either by stunting them or causing them to swell. I have often found *Andricus fecundatrix* galls rendered polythalamous by a number of contained Synergid larvae. Some galls, such as *Andricus collaris*, which naturally fall to the ground during late autumn, will remain on the tree when attacked by parasites.

The common oak Marble-gall (*Cynips kollari*) may often be seen of smaller size and darker colour than is normally the case. On cutting through one of these galls it will be noticed that instead of there being one cell only in the centre of the gall, there is a ring of cells present. These have been formed by Synergid larvae and they will be found to have filled up and eliminated the cell of the original gall-maker.

Cynips kollari galls often have knobs or excrescences upon their surface which are caused by inquiline larvae living in the gall substance. *Biorhiza terminalis* galls (the common "Oak Apple") are particularly liable to parasitic infestation and are inhabited by a great number of insects. As many as seventy-five species have been collected from these galls, besides Acarina and Araneida.

Although some changes in the appearance of a gall, such as those mentioned with regard to *Cynips kollari*, are due to parasitic infestation, they are for the most part probably caused by some substance secreted in the salivary glands of the larva, which acts upon the surrounding tissue, on the juices of which the larva feeds. This would account for the remarkable variety in form, etc., shown by the spangle-galls of the genus *Neuroterus*, since the method and time of ovipositing are in each case apparently the same.

Oviposition and growth of the Gall.

The piercing apparatus of a gall-fly is, as one would expect to find it, of somewhat exceptional construction, the act of oviposition being of extreme importance with these insects. The ovipositor and its attachments take up practically the whole of the interior of the abdomen when in repose.

The plates mentioned below are paired and the whole apparatus is worked by five muscles.

It is made up of :—An anterior plate, a posterior plate and a triangular plate.

The anterior plate (Fig. 4, *d*) is attached to the lower end of the triangular plate (*c*) and the base of the posterior plate (*e*).

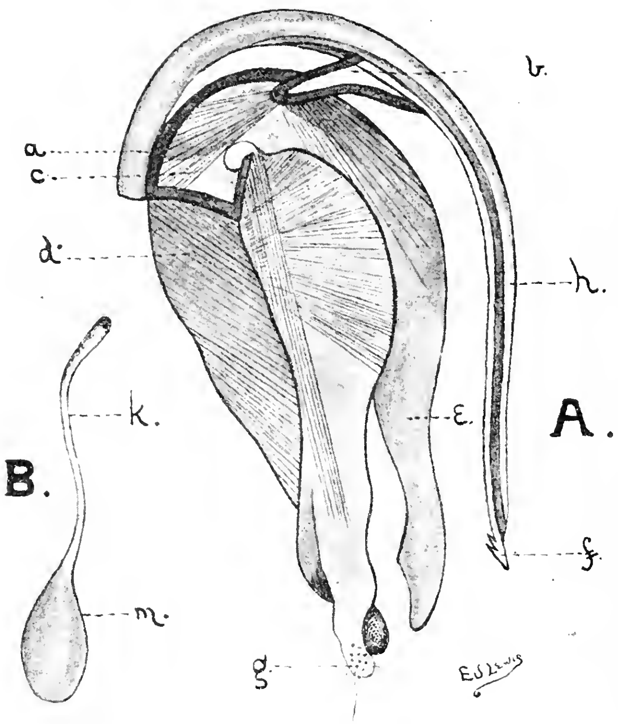


Fig. 4. *A.* Ovipositor of a Gall-insect *Dryophanta* (× 30)
B. Egg of a Gall-insect

a. Apical } attachment of support
b. Basal }
c. Triangular plate
d. Anterior plate
e. Posterior plate.
f. Spiculæ
g. Anal papilla
h. Sheath
k. Egg stalk
m. Egg body

It is narrowed toward the apex at which is situated the papilla (*g*).

The posterior plate (*e*) is also narrowed towards the apex and broad at the base.

The sheath (*h*) is made up of two pieces which together form a groove in which the two spiculæ, or boring apparatus proper, can move.

These spiculæ (*f*) are attached to the triangular plate and are usually toothed at the apex.

The five muscles which are attached to the plates act on the posterior plate by contraction and expansion, giving the spiculae a backward and forward movement.

The egg itself consists of a round egg body (Fig. 4, *m*) which eventually contains the embryo, and a long stalk-like process (*k*) which is useful in two ways. During the process of oviposition the egg body is not sent down inside the ovipositor, but the egg-stalk is clasped and carried down by the two spiculae, the main portion of the egg remaining outside, as the groove inside the sheath is not large enough to admit it.

In the case of such galls as *Biorhiza terminalis*, when the egg is laid in the bud, a passage is first formed by the insect down to the cambium layer. The egg, when it reaches the extremity of the ovipositor, is not detached from the spiculae, but the egg body is placed at the mouth of the groove formed in the bud from which the ovipositor is partially withdrawn and pushed down until it reaches the cambium layer. The ovipositor is furnished with a number of tactile hairs whereby the insect is kept informed, as it were, of the progress of the egg to its proper destination.

Besides acting as a means of attachment to the spiculae by which the latter can seize the egg, the egg tube is also used as a respiratory organ whereby oxygen can be admitted to the embryo developing in the interior of the embedded egg body For this purpose it is left lying in the canal formed by the insect previously to the deposition of the egg. One insect may lay from six hundred to seven hundred eggs, and oviposition may extend over a period of three or four days. As before mentioned the egg must be laid in the cambium layer, which envelopes the whole of the plant and represents the growing zone. Eggs laid in winter buds are particularly liable to failure, as the cambium ring is only represented by a thin layer at the base of the bud; consequently in many cases no gall is formed because the eggs have not been placed exactly in this growing zone. The cell growth after the emergence of the larva is sometimes very rapid, in some cases it commences before the larva is quite free from the egg. In the case of *Trigonaspis renum* a period of months elapses after the egg has been laid before gall formation commences. The probable cause of the differences in size and form, etc., existing between various galls has already been referred to, but besides having some property in their saliva which acts on the surrounding tissue, the different ways in which the larvae feed may also have some important bearing on the case.

The general characteristics of the Family Cynipidae.

Antennae twelve to fifteen jointed, never elbowed.

Legs have the trochanters biarticulate.

Wings without a stigma. One radial cellule. One to three cubital cellules. Submarginal nervure absent.

Prothorax reaching at the sides to the insertion of the wings.

Abdomen pedunculated and compressed.

No cocoon spun by the larvae, which are apodal.

Eggs stalked.

The Cynipidae are divided into five Sub-Families:—

(1.) The Ibalina, containing a single genus *Ibalia* including one species, which is parasitic on *Sirex*.

(2.) Allotrina, containing two genera, *Phaenoglyphis* and *Allotria*, parasitic on Aphides or on the parasites of Aphides.

(3.) Encoelina, containing genera which include species parasitic on larvae of various insects, especially Diptera, such as *Musca*, *Eristalis*, *Tachina*, etc.

(4.) Figitina. This sub-family is divided into three sections, Anacharides, Onychides and Figitides. The Onychides are chiefly parasitic on Beetle and *Syrphus* larvae, while the Figitides comprises genera (such as *Figites*) which contain species parasitic chiefly upon Diptera, mostly dung-flies of the family Sarcophagidae.

I have mentioned the above sub-families of the Cynipidae merely to show how very generally parasitic the members of the family are, though they are of little or no importance to us in our present paper.

The fifth sub-family of the Cynipidae, namely the Cynipina, contains the gall-making insects and the Inquilines living in their galls, and includes all the oak-gall making species.

The following are the chief characters of the sub-family, Cynipina :—

Wings with the areolet opposite to, or not much beyond, the base of the radial cellule, which is usually elongate. The three cubital cellules are as a rule complete. The cubitus arises from the middle of the transverse basal nervure.

Legs with two spurs on the hind tibiae, no processes on the hind tarsi.

Scutellum punctured, wrinkled or alutaceous.

Hypopygium acute or ending in a hairy projecting point.

Basal Segments of the abdomen not subequal or subsessile; the second abdominal segment much longer than the others, not unusually half the length of the abdomen.

Ovipositor spiral or semi-spiral

The *Egg* has already been described and figured.

The *Larva* is apodal. Thirteen jointed, fleshy, and white to yellowish in colour. Larval life varies much in duration in different species, from about a month to as much as three years.

The *Pupa*, like the larva, is yellowish white in colour and is never enclosed in a cocoon.

The Perfect Insect. (Chief general characters given above.)

(1.) Mouth parts. *Labium* fleshy, truncated or with a curved top. Mandibles short, broad and toothed. Inner lobe of the *maxillae* obsolete. Outer lobe broad and fleshy.

Labial palp 2-3 jointed.

Maxillary palp 4-5 jointed.

(2.) *Antennae.* These differ in the males and females, being longer and thinner in the former.

(3.) *Wings.* Not always present. Seldom longer and sometimes shorter than the body. Hairs may be present on the surface and round the margin. When present the wings are four in number and membranous.

(4.) *Thorax.* This is well developed. The pro-thorax laterally reaches the tegulæ, the pleural region being specially prominent. In front the pro-thorax is but slightly developed, bearing, however, a keel which is often incised presenting two tubercle-like bodies The parapsidal furrows are often absent from the meso-thorax, when present they may be complete or incomplete.

The *scutellum* may be shining or opaque and varies much, having either one or two basal foveae. It usually overhangs the meta-thorax and median segment.

The *meta-thorax* is very small, though the pleural and sternal regions and the meta-notal stigma are quite distinct.

(5.) The *median segment*, though in reality the first abdominal segment, forms in the Cynipina and other Hymenoptera, a fourth thoracic segment It is, as it were, separated from the abdomen by the petiole, and is often confounded with the meta-thorax. In reality the petiole is the second abdominal segment The stigma of the median segment may be larger, foveate or reticulate.

(6.) *Legs*. Of moderate size *Trochanters* bi-articulate. There are either one or two spurs on the fore tibiae, and on the hind tibiae there are two unequal spurs The *Meta-tarsus* is long and the tarsi are four-jointed.

Claws may be simple or cleft

Patella seldom conspicuous

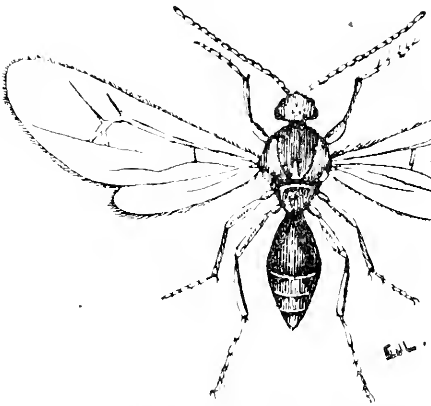


Fig 5. *Andricus ollans* (Htg.) Perfect insect, magnified. An example of the Sub-Family Cynipina

(7.) The *Abdomen* varies much in form. It may be slender or thick, long or ovate Sometimes it appears to be nearly sessile, which is due to the shape of the patiole

According to Cameron there are seven abdominal segments, which differ in length, especially the second and third, a point much used in classification. The apical ventral segment may be ploughshare shaped The number of segments in the abdomen differs with different authors according to whether they consider the medium segments or the petiole to be the first abdominal segment In reality the median segment is If this latter view is taken the abdomen consists of eight instead of seven segments, the varying segments being the third and fourth There are only six visible segments on the ventral region of the female, and five in the male.

The *Ovipositor*, which has been previously described, has its origin close to the base of the abdomen

These gall-makers are usually small insignificant looking insects, their colour varying as a rule from black to brown. This, however, is not always the case, as in some species, such as *Biorhiza terminalis*, the general colour is a light yellowish red, while the abdomens of the *Trigonaspis crustalis* gall-flies are a bright red. As a rule the abdomen is glabrous and shining, but in the genus *Cynips* it is pubescent.

The colour in males and females scarcely differs at all. They are very sluggish insects and when disturbed feign death, tucking their legs and wings close to the body and falling to the ground.[2] Many parasitic species frequent flowers, but gall-makers are only known to take water. It is often difficult to distinguish between the species and sometimes it is impossible except from the galls.

Genera of the Sub-Family Cynipina, which occur as Inquilines in Oak Galls:—

Genus *Synergus* (The chief characteristics and habits have already been given). The third and fourth true abdominal segments are amalgamated, the suture being rarely visible. The antennae of the male are 15 jointed and in the female 14 joints are present; the male also has the third antennal joint curved and sometimes enlarged. The parapsidal furrows are complete. There are two-parallel keels on the medium segment. Claws cleft. One of the chief differences between these insects and the oak gall-makers is the closure of the radial cellule in the former.

They may be separated into two divisions (1) Those ovipositing in autumnal galls, leaving them early in the spring and (2) those depositing eggs in spring galls, leaving them in July. The former include the following species:—*Synergus melanopus*, *rheinhardi*, *tscheki*, *tristis*, *vulgaris*, *incrassatus*, *nervosus*, *pallicornis* and *thaumacera*. The latter division contains *Synergus albipes*, *faciates*, and, according to Mayr, *thaumacera*, which latter he says has been bred from the galls of *Biorhiza renum*.

2 "Feigning death" is an expression commonly applied to this habit in insects and other creatures, but surely it is an incorrect one. Does an insect, when it dies, fold up its limbs in this way, and why should a living one feign death at all?—the fresh morsel whether alive or apparently dead would probably be equally welcomed by a Tit or Creeper in search of breakfast. Is not the habit rather a very effective form of concealment (as we think Prof. Poulton has somewhere hinted) enabling the insect to escape notice by its close resemblance in this attitude to the soil or to some inanimate object? Anyone who has collected by beating branches of trees over an open umbrella or tray well knows how difficult it is to see insects when they are in this folded-up attitude, amid the mass of green and dried buds, leaves and twigs, which are shaken down. And who could detect such an insect as the common beetle, *Byrrhus pilula* lying in this concealment attitude on the rough and rutty soil of a footpath, or many weevils when they fall from bushes or low plants on to the surface of a field or bank. The habit seems to be well worthy of detailed study, and should be taken up by some entomologist in search of a subject of research.—ED.

It is exceeding difficult to differentiate between the species of this genus, as the different individuals vary to such an extent among themselves that it is almost impossible to separate them in many cases, the specific characters rarely remaining constant. For this reason I have not here described the different species, but an excellent account of this genus has been given by Mr. Cameron.[3]

With regard to the galls to be hereafter described, the inquilines inhabiting them are also given in each case.

Two other genera include insects found as inquilines in oak galls, namely, *Ceroptres* (Hartig) and *Sapholytus* (Foerster). In the former, one species, *Ceroptres arator*, is mentioned by Cameron as present in galls of *Andricus noduli* from Clydesdale, and it is also said to have been reared from *Cynips kollari* galls. The genus *Sapholytus* contains only one British species, *S. connatus* (Htg.) also bred from *Andricus noduli* galls. The characters of these two genera have been given by Mr. Cameron in his work already referred to.

It very often happens that after taking great trouble to breed Cynipidae from a number of different galls one only succeeds in rearing a large proportion of inquilines and parasites. This is very naturally the cause of much disappointment, especially when one is just commencing to collect. Synergidae are very easily mistaken for the gall makers, which they greatly resemble, though as a rule one soon finds plenty of opportunity for ascertaining their exact appearance. True parasites are easily distinguished.

Collecting Galls.

To any one commencing a study of Oak galls who requires to obtain specimens for a collection or for breeding purposes, a great deal of time might be saved, in the case of some species, by first looking through a collection such as that at South Kensington and thus obtaining some of the idea of the exact appearance of the galls before going out to search for them.[4] There are many species which are by no means easy to find even when you *are* aware of their exact appearance; such galls as

3 Peter Cameron's *Monograph of British Phytophagous Hymenoptera*, vol. iv. London Ray Society, 1882-92.

4 It is anticipated that by the Spring of 1903 a typical collection of galls and gall-insects, with drawings and other illustrations, will be placed in the Club's Epping Forest Museum in Queen Elizabeth's Lodge, Chingford, Essex.—Ed.

Andricus albopunctata, *A. malpighii*, *A. collaris* and *A. seminationis* are easily passed over. On the other hand, some galls, such as *Neuroterus baccarum* and *N. tricolor*, being very difficult to preserve, look so different in a collection compared with those growing on the tree that previous examination of specimens in a collection may be quite misleading to the beginner. When searching for galls the casual examination of a branch is not sufficient; a minute examination of buds, leaves, or cuttings, may often result in the finding of several galls even when previous search has failed to reveal their presence. So far as my experience goes, galls are usually scarce in damp woods, and I have frequently found that both species and specimens are more numerous in drier and more exposed situations. One is often able to obtain better results in a short time from searching hedges in a country lane than by spending hours in searching trees in a wood.

Experimental Breeding.

In order to ascertain the life-history of the various species of gall insects, and to investigate the gall formations in the different generations, it is necessary that very close and accurate observations should be made. The act of oviposition is a very important item in this respect. In all cases it is best, and in many instances essential, that in experimental breeding the natural surroundings should be maintained, in order to obtain satisfactory results. For those insects which lay their eggs in the buds, the latter should be well developed; while for those which oviposit on the leaves there should always be tender shoots ready for use. In order to effect this a number of young oak saplings (about 4 or 5 years old) should be obtained. They should then be planted in large pots and placed in some sheltered position where they can obtain the necessary amount of air and light and where they may be subjected to the ordinary temperatures. At the same time the insects must not be allowed to escape or get mixed up in any way. For this purpose I have found the most satisfactory method to be one on the same principle as that made use of, I think, by Dr. Adler. A square box frame-work fitted with a glass top and having the sides covered with gauze to give ready access to the air is placed over each oak sapling. In some cases, in order to facilitate observation, I had gauze on three sides only, the fourth side being fitted with glass. In this way the insects are not allowed to escape and the necessary investigations can be carried on without difficulty. As the oak does not usually bear fruit until it is about twenty years old (though it depends to a large extent upon soil and climate), this method is obviously useless in the cases of those species which produces galls on the catkins. For these the only way is to experiment upon the full grown tree by covering in certain branches with gauzs. When the act of oviposition is witnessed the bud or leaf should be marked by tying just beneath it round the branch, a piece of cotton or wool. It is necessary with those galls which fall to the ground to mature (such as *Neuroterus lenticularis*) that the natural temperature and amount of moisture should be maintained. As before mentioned, in order to prevent any mistakes, it is desirable that very careful and accurate observations should be made. It is always best when possible that a series of different experiments with the same species should be carried on at the same time. Where one experiment fails another may be successful, and time. saved. Even then many disappointments are sure to occurs The result of one apparently successful experiment in breeding should not be taken as proof, but to allow for possible error the observation should be repeated the following year. There is a great deal yet to be found out with regard to alternation of generations among these remarkable insects, and in the case of such species as *Andricus solitarius* the life-history has yet to be worked out.

Preservation of Galls.

With regard to the preservation of galls for a collection. There are many kinds which are very difficult to preserve as they lose their colour and shrink; and this especially applies in the case of such galls as *Andricus radicis* which contain a great amount of moisture, causing the gall to shrivel and wrinkle after evaporation. I have tried the quick drying method with only partial success, and in many instances by gradual drying and by not exposing the galls to any very high temperature I have caused them to keep their shape and colour fairly well; but such galls as *Neuroterus tricolor* and *N. baccarum* soon lose both. If kept in spirit the proper form is retained but the colour as a rule gradually vanishes. I find that the best thing to do is to make coloured drawings of the galls when fresh, so that a fair idea of their natural appearance may be had, after the galls themselves have lost their proper shape and colour.

Another method of exhibition, which has been made use of at the British Museum, is the preparation of coloured wax models of the galls and of the plants upon which they grow As regards oak galls, such as *Trigonaspis crustalis*, both generations are shown in the same case, *Trigonaspis renum* appearing on the leaves and *T. crustalis* from the adventitious buds on the trunk. There is often a tendency to depict "good specimens" by exaggerating the size and number of the galls, and this should be guarded against as giving a wrong impression to anyone who is just starting to collect, who is not always quite certain what to look for. [I have found that a solution of formalin (about 5 per cent. of the 40 per cent. commercial formalin) preserves the *form* of most galls, but any colour dependent upon chlorophyll or its derivatives disappears in the course of time. We are now trying in the museum a method of bleaching with sodium hypochlorite, which discharges *all colour* and produces a semi-transparency, displaying form and structure excellently well, the specimens being "put up" in 90 per cent· alcohol. Of course, as Mr. Lewis says, such preparations should be placed alongside drawings giving the natural colours of the galls.—W. Cole.]

Classification.

Since the discovery by Dr. Adler of the alternating agami and sexal generations among the oak gall-makers, the nomenclature has undergone, a change. The method adopted by Mr Cameron is the truly scientific one, but these alternating generations present such variations that the generic names used by Dr. Adler,[5] which serve to differentiate more clearly between the agamic and sexual forms, are still adhered to in many cases. I have, therefore, inserted a list showing the differences between the nomenclature of these two authors.

In the case of the three forms, *Andricus fecundatrix*, *Andricus malpighii* and *Dryophanta divisa*, I have found galls of the agamic generation only, and have been unable to find specimens of the corresponding sexual generations, *Andricus pilosus*, *A. nudus* and *Dryophanta verucosus* respectively, so that in this list these latter have been printed in italics. I have inserted them partly because in giving an account of the generation cycle they must necessarily

5 *Alternating Generations. A Biological Study of the Oak Galls and Gall Flies.* By Hermann Adler, M.D., Schleswig. Translated and Edited by Charles R. Straton. F.R.C.S., F.E.S. Oxford 1894.

be mentioned, and partly on account of the fact that as I have found the agamic generation in Epping Forest it is highly probable that the sexual generation is to be found there also, and a description will, therefore, be of use in distinguishing these galls.

In the following account I have kept the generic name of the agamic generation for the sexual generation also. In this respect I have followed Cameron, but in the case of the specific names I have, with a few exceptions, retained those used by Dr. Adler.

(To be continued.)

NOTES—ORIGINAL AND SELECTED.

Destructive Storm in Essex.—In connection with the detailed and exhaustive report given by Mr William Cole in the ESSEX NATURALIST (vol. x, 112-129) of the great storm of June 24th, 1897, which wrought such havoc in certain but happily restricted districts in Essex, it will be of interest to recall the account given by Mr. Jacob George Strutt, the artist in the *Magazine of Natural History* for 1833 (pp. 103-107) of a similar storm which occurred in Thorndon Park, near Brentwood, on the 12th of October, 1831. The main part of the narrative there reprinted was taken from a Chelmsford paper, and it was accompanied by a woodcut of a scene from the midst of the havoc drawn upon wood by Mr. Strutt, which is here reproduced. I quote some paragraphs from the narrative: "On the evening of Wednesday, the 12th inst. (October, 1831), a destructive hurricane ravaged a considerable portion of the park of Thorndon Hall, the seat of Lord Petre, near Brentwood. The blast came on about eight o'clock, and in less than four minutes the work of havoc was complete. It appears that the wind came from the south-west, and entered the park near the Lion's Lodge, where it threw down a small portion of the paling. It then traversed the park in a varying sweep of about 150 yards' breadth. It is difficult to form any idea of the manner in which it took its course, as it has made many singular selections of spots and single trees. The line of desolation is not an uninterrupted one; in many places, a large breadth of trees has escaped unhurt, while others, apparently sheltered by them, have been shivered or torn up by the roots. In some groups of three or four trees, one of the least exposed has shared in the ruin, while its more exposed neighbours have not lost a leaf. On entering the park at the Lion's Lodge, on the west or Warley side, the eye is immediately attracted to the right hand by several oaks, 60 feet long, which have been torn up by the roots and to which are adhering masses of earth, 14 feet in length, and from three to four feet in thickness . . . The stems of many trees are off within a few feet of the earth, some at the height of two or three feet, others at a greater height; and one elm has been severed at about 20 feet from the ground, 15 feet of the stump having half its body torn away

In one place, about 100 yards from this spot, the destruction has been tremendous. In a circle of nearly 40 yards diameter, whole trunks, huge limbs and branches, with immense masses of earth, lie on the ground in wild confusion, mingled in such a manner that it is impossible to count the number of trees destroyed. It appears as if a battery of heavy artillery had been directed against a great mass of timber which had crowded that part of the park." The narrator gives numerous details of havoc in various parts of the grounds, which attest the extraordinary force and capricious character of the storm, and remarked that the "blast has not taken a direct and lofty course, sweeping all before it, and we can form no other idea of it, than that it moved with infinite velocity, undulating like the rushing of a mighty sea; sometimes passing over the spires of the gigantic oaks and elms, and then

Effects of Storm in Thorndon Park, October 12th, 1841

striking the earth, rebounding and insinuating itself beneath some trees, and levelling others by its force operating near the earth" . . . "We understand that (the storm) did some little injury at the distance of a mile to the east of the park. It was also severely felt at Upminster, in the west, before it commenced its ravages on Lord Petre's demesne. We have endeavoured to compute the extent of mischief done in the park, but find it impossible, from the confused state in which the shattered and fallen timber at present lies; but we believe there cannot be less than 300 trees torn up, or so much shattered as to render it necessary that their remains should be felled. As to the partially injured timber, it is too extensive to be enumerated. This park, during the war, furnished some of the finest naval timber that could be procured in the kingdom, and it still presents a large number of equally valuable trees . . . It is a little singular that the noise occasioned by the destruction was heard in the mansion, but was supposed to be thunder, and the real cause was not ascertained till next morning The hurricane was immediately succeeded by a tremendous fall of rain." This graphic description of the Thorndon Park Storm recalls in many particulars our Essex experience particularly in the isolated character of its destructive effects —WILFRED MARK WEBB, F L.S., Odstock, Hanwell

The Soils and Sub-soils of Norfolk A paper with the above title, by Mr H B Woodward, F R.S , F G.S , of the Geological Survey, was read before the Norfolk and Norwich Naturalists' Society on March 25th, 1902, and is published in Vol. VII of their *Transactions*, pp. 401-414 As the counties of Norfolk, Suffolk and Essex have a specially strong resemblance to each other in geological structure, it seems desirable to draw the attention of the Essex Field Club to Mr. Woodward's remarks He gives an account of the various essays and maps on the soils of Norfolk, from the *Rural Economy of Norfolk*, by William Marshall, published in 1787, to the work of Nathaniel Kent (1796), Arthur Young (1804), R.N Bacon (1844), Joshua Trimmer (1847), Searles V. Wood, junior and Mr F. W. Harmer somewhat later, and lastly that of the Geological Survey The distribution of the various soils and subsoils of Norfolk is then noted. Mr Woodward adds that while there is a general correspondence between the subsoils and soils, " yet there is an infinite variety in the soils such as cannot be fully indicated on a geological map, and can only be inferred from a knowledge of the subsoils." He inclines therefore to think that :—" A detailed sub-soil map on a scale of 6 inches to a mile, carefully and judiciously surveyed, should serve as a basis for special investigations of soils. On it the general characters of soils should be indicated, and where there is much landslipped material or considerable downwashes of the sub-soils these should be marked Sometimes downwashes of gravel from the uplands are of sufficient importance to have shallow gravel-pits opened in them, or buildings may be erected on them—and yet in ordinary geological maps, which profess to show the Drifts, this debris from higher grounds, or 'run of the hill' has been omitted when it is of sufficient importance to influence the surface features. This is, undoubtedly, a defect."

Of course on maps 6 in to the mile much can be indicated useful to the agriculturist, the builder and others, which could not be shown on maps of smaller scale; much also which would be felt to add obscurity rather than information to a map one-inch to the mile. Readers of the ESSEX NATURALIST may be interested in learning that the Geological Survey of Essex on the six-inch scale is now begun.—T. V. H.

[*Several Reports and Notes are held over until the next volume.*]

End of Volume XII.

An interesting record of the Club's work for 21 years is given by Prof. Meldola in his pamphlet "The Coming of Age of the Essex Field Club" (price 1s., *post free*).

ORDINARY (SCIENTIFIC) MEETINGS are held at frequent intervals for the reading of papers and the exhibition of specimens, etc., and FIELD MEETINGS are arranged during the summer months, and held in various parts of the County under the guidance of experienced Naturalists, Geologists and Archæologists.

Considerable efforts have been made to catalogue the FAUNA and FLORA of the County, and it is wished to extend this work as funds and opportunities will permit, particularly in the direction of a systematic Exploration of MARINE and ESTUARINE forms of life by DREDGING. etc., and their preparation and preservation in the Essex Museum, for future reference and study.

Although bearing a county title, *the Club offers exceptional advantages to Metropolitan residents.* Many parts of Essex are but little known, although of the greatest interest to the naturalist, geologist and antiquary, and the Museums and Libraries at Stratford (at which place a large proportion of the "Winter Meetings" are held) and Chingford, bring the Club into close touch with London naturalists.

Very considerable material has been accumulated towards a LOCAL and EDUCATIONAL MUSEUM, which is established in a handsome building at Stratford (by the generosity of Mr. Passmore Edwards, and in conjunction with the Corporation of West Ham) to form a home for County collections and specimens, where they may be consulted by all interested in Essex. A BRANCH MUSEUM to illustrate the Natural History and Archæology of EPPING FOREST has been established (under the sanction of the Corporation of London) in QUEEN ELIZABETH'S LODGE, CHINGFORD, which has proved very attractive to thousands of visitors to the Forest. Greatly increased space for the Museum is now accorded at the Lodge, the Corporation of London having spent about £1,200 in the restoration and adaptation of the building. In consequence the Museum is in process of re-arrangement, which will be completed, it is hoped, in the summer of 1903.

The Club already possesses a good nucleus of a Local and Scientific LIBRARY, which has been obtained by donations, exchanges and purchase.

The *Minimum* SUBSCRIPTION is Fifteen Shillings per annum, payable upon election, and afterwards on the 1st January in each year. The usual entrance fee is at present in abeyance. The LIFE COMPOSITION is £10 10s. in one payment. *Members can purchase the publications of the Club at a Discount of 25 per cent. from the published prices.*

Copies of the RULES, FORMS OF PROPOSAL FOR MEMBERSHIP, together with specimen copies of the ESSEX NATURALIST, and other information, will be gladly sent on application to the *Hon. Secretaries*, Messrs. W. and B. G. COLE, Buckhurst Hill, Essex.

N.B.—All communications of a financial nature, SUBSCRIPTIONS, DONATIONS to the MUSEUM and LIBRARY FUND, etc., should be sent to the *Treasurer*, DAVID HOWARD, Esq., Devon House, Buckhurst Hill, Essex; communications relating to the LIBRARY, and Donations of Books and Pamphlets, and SPECIMENS FOR THE MUSEUM should be sent to the Head-quarters, Essex Museum, Romford Road, Stratford, Essex.