PROCEEDINGS

OF THE

CLEVELAND NATURALISTS' FIELD CLUB.

1907-8

VOL. II. PART III.

CONTENTS

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VOL. II. PART III.
Edited by the Rev. J. Cowley Fowler, B.A., F.G.S.

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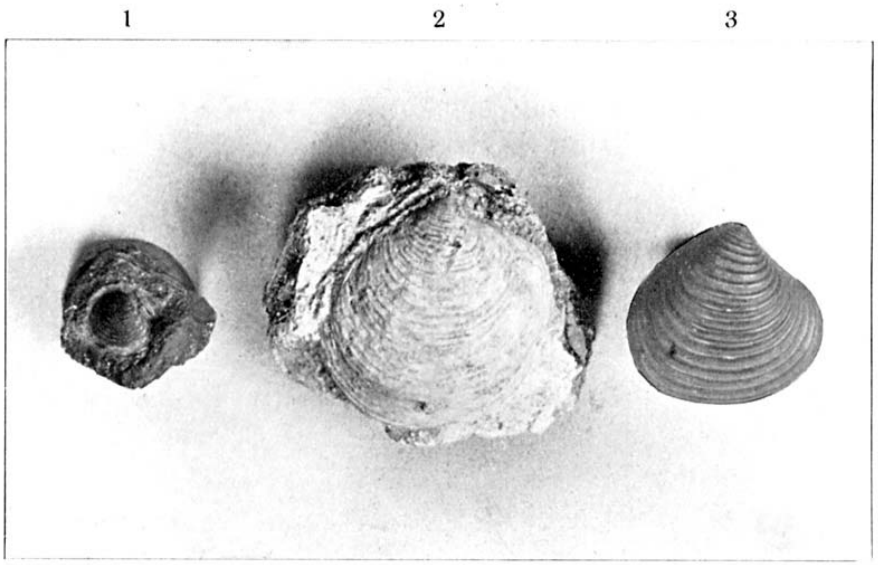
Trigonia lingonensis, MAIN SEAM OF IRONSTONE, MIDDLE LIAS.
ESTON MINES.

Trigonia lingonensis. MAIN SEAM OF IRONSTONE. MIDDLE LIAS.
ESTON MINES.



1 *Astarte striato-sulcata,* MIDDLE LIAS, CLEVELAND.
2. *Astarte duboisiana,* CORALLINE OOLITE, PICKERING.
3. *Astarte sulcata,* RECENT, REDCAR.

1.Astarte striato-sulcata. MIDDLE LIAS, CLEVELAND.
2.Astarte duboisiana. CORALLINE OOLITE, PICKERING.
3. Astarte sulcata, RECENT, REDCAR.

THE FAUNA OF CLEVELAND-PAST AND PRESENT

BY FRANK ELGEE

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INTRODUCTION.

The history of the animals of our district, including those inhabiting both sea and land, is a subject, which must be of interest to all the members of a society, having for one of its objects the investigation of the fauna of Cleveland. During the last few decades, the zoology and palaeontology of North Eastern Yorkshire have been zealously studied by numerous enthusiastic observers, many of whom are prominent members of this society. Thanks to their labours, we now possess a tolerably comprehensive idea of the character of the local fauna, its constituent species, and their local distribution though it must be admitted that very much more work remains to be done, before our knowledge of it can be regarded as anything like complete. Nevertheless, an attempt will here be made to survey the zoology and palaeontology of Cleveland as a coherent whole; to consider the distribution of the various animals in space and time; to ascertain the elements of which the fauna is composed, and the natural groups into which it can be divided; and to trace the faunas that have at different periods lived within the district.

As will be gathered from the statistical tables given in this paper, the fauna of Cleveland, both recent and fossil, is a very rich one, nearly four thousand species having been recorded. This richness is primarily due to the great variety of natural habitats the area possesses, each one of which is inhabited by a special suite of animals. For not only is there a varied coast line with sheltered bays, low sandy shores, a tidal estuary, precipitous cliffs and long stretches of intertidal scars; but there is likewise a varied land surface with hills and valleys, woods and moors, swamps and streams. To the residents have also to be added the animals which visit these localities, either as regular immigrants, casual visitors, or as accidental introductions by man. On turning to the rocks of the district we find that they contain a great suite of organic remains, numbering over a thousand species occurring in groups in the different strata, and now all extinct.

Regarding this fauna as a whole we shall deal with it from two standpoints, the statical and the dynamical. The statical aspect treats of the fauna as at present, its species and local distribution, its divisions into natural groups or associations and the likenesses and differeneces of these groups as compared with one and another and to similar and dissimilar groups in this and other countries.

This dynamical aspect of the fauna treats of the history of the animals which have lived within the district and their origins; the lines of past migration and distribution, and the

changes the fauna has undergone in relation to past climate, and past vissicitudes of geography. In other words, it deals with the evolution of the fauna, and the causes, which have contributed to that evolution.

It will be convenient to consider first the present marine fauna, to see what species it is composed and their status on the district coastline. Unfortunately it will not be possible to treat of the divisions of the marine fauna into groups or associations corresponding wirth the different habitats of the different species, since few observations except those of a very general kind have been made on this subject.

We shall, next pass on to the history of the marine animals of the Cleveland coast, and ascertain the period when they entered the district. We shall then discuss the past marine faunas of Cleveland, as revealed by the study of the fossils in the local strata, and the conclusions to be drawn therefrom regarding the past climatic and geographical conditions.

The terrestrial fauna will next be dealt with, which will furnish data for its history during recent geological periods. Finally will come a resume of the marine, the fossil, and the terrestrial faunas as a whole.

2.THE MARINE FAUNA

The annexed table No. 1 gives so far as I have been enabled to ascertain, a census of the species and genera of marine animals, occurring on and off the coast as far south as Whitby. Ther figures there shown cannot otherwise be regarded than as considerably below the actual number inhabiting the coastline; since there are many groups of marine animals which have hardly received any attention from local naturalists. This table does not call for any special comment at our hands, but it will be noticed that it shows the fishes and the mollusca are the most numerous forms of life on our coastline, so far as number of species is concerned.

TABLE I

CENSUS OF THE MARINE FAUNA OF CLEVELAND

CLASS	SPECIES	GENERA
Mammalia	4	2
Reptimes	1	1
Fishes	131	79
Crustacea	44	33
Tunicates	1	1
Cephalopods	4	4
Univalves	59	43
Bivalves	53	33
Polyzoa	31	17
Worms	15	15
Echinoderms	16	11
Medusae	2	2
Hydrozoa	37	18
Actinozoa	9	6
Sponges	2	2
Protozoa	4	4
Total	413	271

This marine fauna can be divided into groups according to the status of the various species, whether these be residents, migrants, irregular visitors, or accidental stragglers, The first of these include most of the familiar fishes molluscs echinoderms, worms, and sea anemones of our shores; and these animals, especially the mollusca, can be further subdivided into groups, corresponding to the geographical regions to which they belong. Generally speaking the molluscan fauna of Great Britain, forms part of the Celtic Province of marine conchologists. This province also includes the coasts of the North Sea, the Baltic, Sweden, and Denmark. Local species characteristic of this geographical region are *Cardium edule, Mya areria, Mytiltus edulis, Pecten maximus, Ostrea edulis* and numerous others.

Intermingled with these Celtic species are others ranging much further northwards, and generally typical of the Boreal and Arctic Provinces. To the first of these provinces, corresponding to the west coast of Norway, Iceland, the Shetland and Faroe Islands, and the north coast of North America, belong such local molluscs as *Aeolis despecta* and *Doto fragilis,* two sea-slugs; *Buccinum undatum, Littorina rudis, Lacuna divaricata, Skenia planorbis, Gibbula cineraria, Modiolaria discors,* and *Solen ensis;* and the species which range into the Arctic Province and there mix with true Arctic shells, include *Chrysodomus antiqua, Sipho islandicus, Nassa incrassata, Acmea testudinalis, Turtonia minuta,* and *Saxicava rugosa.*

Two species found at Redcar may be cited as examples of forms, which extend southwards into the Lusitanian Province; an area embracing the Mediterranean and the coasts of France and Spain, These two species are *Chione gallina* and *Tellina tenuis.*

In a similar manner the other marine organisms of our coast might be classified, but it must be carefully borne in mind that such divisions are not exact. Owing to the absence of barriers to dispersal marine animals often have a very much wider geographical distribution than land animals. Hence some marine shells are genuine cosmopolitans, being found in all seas. The Common Mussel *(Mytilus edulis)* and the Boring Shell (S*axicava rugosa)* are said to belong to this class, and there can be little doubt that their distribution is practically worldwide.

Accidental stragglers to our coast are not infrequent, and the only marine reptile given in the table may be taken as an instance, viz.: the Hawk's Bill Turtle *(Chelone imbricata),* a resident of tropical waters, found dead off Redcar in 1849. Other rare stragglers are the Opah or King Fish *(Lampris luna),* of brilliant colours, a native of thr Atlantic and Pacific Oceans: the Tunny *(Thunnus hymnus),* a warm blooded fish; the Pllchard *(Clupea pilchardus):* and the Basking Shark *(Cetorhinus maxrmus),* the latter being the so-called "grampus" which created such a sensation on Redcar Sands two years ago.

Concerning the history of the marine fauna of Cleveland very little can be said here. We may endeavour to find out, however, the period when the animals first appeared on our coast. Of course, the obvious answer to this problem is after the North Sea was formed, but when this took place the geologist can only assign a relative date. That the North Sea existed in pre-Glacial days is certain and that it contained a fauna even richer than the present one is also certain. For in those well-known formations of Pliocene times-the Crags of Norfolk and Suffolk-are to be found shells precisely similar to those in the present sea together with species now extinct or living elsewhere, and indicating a somewhat warmer climate. In many of the glacial beds of the Cleveland district, fragmentary shells of *Cyprina islandica, Tellina balthica,* and *Dentalium entalis* are of frequent occurence and they also prove the existence of the North Sea in pre-glacial

times from the bed of which they were carried by the great northern ice-sheet, For during the Ice Age it seems fairly well established that the German Ocean was filled with thick glacier-ice, and that consequently the pre-glacial marine fauna was either driven away southwards or became extinct locally: but with the retreat of the ice and the gradual amelioration of the climate the various species would return to repopulate their old haunt.

We have to picture to ourselves this great movement of marine animals, some creeping from rock to rock along the coast, others being carried helplessly by the currents and tide, and yet others actively swimming through the water. At first the northern forms now confined to the Arctic Province would prevail, to be followed by the more temperate types of the Boreal and Celtic Provinces. With the retreat of the ice beyond the point where the North Sea becomes one with the Atlantic, an influx of animals would then ensue from the north, which continues at the present time.

According to the eminent French conchologist, M Paul Fischer*, thc Straits of Dover are somewhat of a barrier to a large number of shells peculiar to the Lusitanian Province, or otherwise they would extend into the North Sea, and this may perhaps explain the rarity of Lusitanian forms on the Cleveland Coast. But if this barrier has been effective with one group of shells, it seems difficult to understand why it should not have been effective with the Celtic and Boreal groups, as they spread northwards after the Ice Age. This may have been so, but in that case the marine fauna must to a great extent have entered the German Ocean from the north, as just described. Movements of marine animals through the Straits of Dover northwards, and from the Atlantic southwards, must have taken place, though perhaps on a smaller scale in the former than in the latter. Again, these distributions would be interrupted by the conversion of the sea floor into dry land, an event, which certainly occurred in post-glacial times. After the subsidence of the land the sea would once more prevail and bring with it its inhabitants.

Thoroughly to trace the history of the marine fauna, we should have to investigate the geographical distribution of every species, and that of the genus to which it belongs. Next we should have to ascertain the distribution of the genus in time, and find out at what geological epoch, and in what country it became most numerous in species. Only after .we had collected this vast body of facts, would we be in a position to discuss the history of our local marine fauna. To do so here is out of the question, but to illustrate this line of research let us take the case of the genus of bivalve shells known as *Astarte,* of which two species have been recorded from the coast, *A. sulcata* and *A. compressa.* The first of these ranges far north to Novaya Zemlia, the White Sea, and North America, and extends southwards to the Canaries and throughout the Mediterranean; the latter also extends far north to Greenland and Novaya Zemlia and according to Gwyn Jeffreys, is extensively distributed throughout the North Atlantic to the North Eastern Coast of America.

Besides these two local species there is another, *A. triangularis,* found locally on all the British Coasts and extending to the Canaries; whilst about twenty other species flourish in the Northern and Arctic Seas of Greenland, Iceland, Norway, Northern Europe, and North America. Thus it will be seen that the genus at the present day is of essentially northern distribution, and associated with cold climates.

Turning- now to the palaeontology of the genus, we find that the three British species are found fossil in the Pliocene deposits of Norfolk and Suffolk, where, however, they occur with nearly twenty other species most of which are extinct. Further back in time the living forms do not go and omitting the Miocene *Astartes* which do not occur in Britain, we meet with the group again in the lower Eocene beds of the south of England, whence

half a dozen species have been recorded. * It is also numerous in the Tertiary deposits of the Continent and North America. In these formations, however, it is associated with animals and plant having a decidedly tropical aspect, indicative of warm climates.

Several species occur in the Cretaceous formations, but not until the Jurassic is reached does the genus attain its maximum dimensions. In this great geological system, the species are perhaps most numerous in the Upper Corallian and Lower Kimmeridgian strata, where they are so abundant that they constitute a definite geological horizon, known to continental geologists as the Astartian. Even in the Upper Oolitic strata of North Eastern Yorkshire they are comparatiyely abundant, over a dozen species having been obtained, and of which the commonest is *Astarte duboisiana* from the Coralline limestone of Pickering and neighbourhood. Altogether nearly 300 species of fossil *Astarte* are known and attain their maximum development in the Secondary

* Bullen Newton, Catalogue of British Eocene and Oligocene Mollusca.

Period, where, however, they are found in deposits, not only indicating a warm climate but actually forming the fossilized remains of coral reefs such as we find at Hackness, East Ayton, and Pickering.

The genus *Astarte,* according to Von Zittel, is first definitely known from the Triassic formation. It then gradually began to increase in numbers, and reached its maximum growth in adaptation to the warm tropical seas of later Jurassic times. After this epoch it slowly but surely begins to decrease, probably not so much owing to the varied, changes of geography and climate which the genus witnessed (though these factors have doubtless played somc part in its diminution but perhaps owing to the competition of more vigorous molluscs and animals. The pressure of these rivals may have caused the present descendents of the semi-tropical Jurassic *Astartes* to become adjusted to the colder seas of the Northern Hemisphere, and that far from regarding these seas as the original home of the genus, we must probably place it, so far as our continent is concerned, in Central Europe in late Jurassic times. The present foms, including our two local species, are the relicts of a once numerous family of semi-tropical shells.

We thus see that the common shells we so carelessly crush with our feet on the sea shore, have a very complex history extending manv millions of years into the past, and of which we can only form a very indefinite idea. What has just been said is applicable to every marine animal on the Cleveland Coast; for some, an imperfect picture of their evolution can be formed, for many others even this imperfect picture is an impossibility, since all or nearly all records of their enormous past have vanished for ever.

3. -PAST MARINE FAUNAS.

What we have just considered concerning the geological history of *Astarte,* naturally leads us to the third division of our subject, the past marine faunas of Cleveland. Although we have learned that the present marine fauna has undergone many vicissitudes in its development, we have yet to see that our district was occupied by many marine faunas, not only altogether different from the present, but also very different from one another. To do this we must go back to that far distant time when Cleveland was under the seas of the Mesozoic or Secondary Epoch. No Quaternary or Tertiary deposits exist in our area, so that the history of the past marine faunas is necessarily very imperfect, and has to be filled in with details drawn from other parts of the country. It is proposed, however, to contrast the fossil animals of the local stratified rocks with those inhabiting the coast to-day, ascertain in what way they differ or agree, and see what

conclusions can be drawn from them regarding the climate of Cleveland when they flourished.

TABLE II.

CENSUS OF THE FAUNA OF THE LIAS.

CLASS	SPECIES	GENERA
Pterosaur	1	1
Crocodilia	7	3
Plesiosauri	9	3
Icthyosauri	7	1
Fishes	20	12
Crustacea	23	9
Insects	2	2
Cephalopods (other than Nautili Ammonites and Belemnites)	4	3
Nautili	7	1
Belemnites	41	1
Ammonites	117	7
Univalves	86	19
Scaphopods	5	1
Bivavles	190	42
Lamp Shells	27	7
Worms	10	3
Echinoderms	20	14
Corals	4	2
Protozoa (Foraminifera)	74	21
Total	654	152

The New Red Sandstone of the Triassic System, which underlies the lowlands of Tees-side, contains no local organic remains of enough importance to be considered here. It may be remarked in passing, however, that these rocks are composed of sand formed under desert conditions, and probably blown by the wind into lakes saturated with salt, now lying at a depth of nearly two thousand feet. Succeeding the Triassic rocks comes the well-known Lias, but the change of geographical condition which first supervened, is indicated by a set of beds termed the Rhaetic (after the Alps of that name where they are characteristically developed), containing a few stunted marine fossils. Of these the most important is the shell known as *Avicula contorta,* remarkable for its wide distribution in various parts of Eastern, Western, and Southern Europe, of course on the same geological horizon. The teeth of Sharks are of frequent occurrence, and are of interest from the fact that their nearest living representative, is the Port Jackson Shark of the Australian Seas.

With the Lower Lias, so picturesquely developed on the scars at Redcar, Saltburn, and Robin Hood's Bay, we are introduced to a rich and varied fauna, the statistics of which can be gathered from Table 2. On comparing the fauna of the Lias with that of the Cleveland coast, we find that the number of species in the former is greater than in the latter. But as we have seen the full number of living species is still far from being known, if these could be enumerated the total would probably be greater than that for the whole of the Lias.

This comparison would be misleading, however, if we do not bear in mind the fragmentary character of the fossil faunas. This imperfection of the geological record is

owing to the circumstance that only animals which secrete hard parts leave any remains in the stratified rocks, such soft bodied organisms as jelly-fish, worms, and sea-slugs, disappear altogether, and many other animals must, though possessing hard parts, decay away before they can become petrified. Joining these consideration with the long period of time during which the Lias was laid down, we may feel sure that animal life was more abundant in those days than it is now, as far as the immediate district is concerned.

The differences of the Liassic Fauna from the present one constitute those palaeontological features so characteristic of the Mesozoic ages. None of the species except perhaps a few Foraminifera are now living, and of these, whole groups have become extinct, the Reptilia, the Ammonites, and Belemnites being the most noteworthy. With regard to the Mollusca other than the Cephalopods it has to be remembed that, including Inferior Oolite forms, thirty-four genera of them are extinct; whilst twenty-three genera presently to be dealt with in detail although still living, are non-existent in the British area. The nearest points of resemblance between the living and the fossil faunas, is in the occurrence of a number of genera still represented on our coast, such as *Mytilus, Pecten, Ostrea, Modiola,* and *Littorina* amongst the Mollusca.

Let us now take a brief survey of the succession of marine faunas whose records are to be found in the Lias and the Inferior Oolite of the district. Beginning with tbe Lower Lias, the most remarkable zoological feature it possesses is the great abundance of what are known as the Arietan Ammonites, characterised by their keeled and radiately ribbed shells. *Arietites Buchlandi* from the rocks on which Redcar Pier stands, is a familiar type. Now, the Rhaetic Beds below the Lias contain no Ammonites at all, yet on ascending through a few feet of strata, we come across them in swarms. What, therefore, is the implication of this fact? Well, probably that the conditions of life during the deposition of the Lias in England, were unfavourable to their existence, and that the Ammonites entered the Cleveland Liassic Sea from elsewhere. The researches of an eminent continental geologist, Van Mojsisovics, have shown that these chambered shells attained their maximum development, not in the Lias, but in the open Triassic Seas of South Europe, Asia, America, and the Arctic Regions; during which epoch over one thousand species belonging to over thirty distinct genera flourished. With the disappearance of the unfavourable conditions existing in our district during Triassic times, the Ammonites invaded the Liassic Seas from the south, west, or east, but probably not from the north, where there is supposed to have been a land surface.

Associated with the Arietan Ammonites are other genera of Molluscs, including the familiar Miller's Thumb *(Gryphea arcuata),* a species of oyster, strictly confined to the Lower Llas, and forming hard scars of limestone at Redcar. Amongst the other bivalve shells of the Lower Lias *Cardinia,* is most noteworthy and characteristic, though now quite extinct. The beautiful univalve, *Pleurotomaria anglica,* is somewhat numerous at Redcar, and belongs to a genus which is abundant in the stratified rocks, but is at the present time almost extinct, a few living examples having been found in the Antilles and Japan.

The nature of the Lower Lias rocks, shale with thin bands of limestone, indicates the conditions of life at that epoch, viz., moderately deep water, clear when the limestone bands were formed, and muddier when the shales were deposited. In the Middle Lias still shallower water existed, as is testified by the ripple marked sandstone of the Sandy Series, with their oyster beds and swarms of *Cardium truncatum.* These littoral conditions were followed by deeper water in which the shaly beds of the Ironstone Series were deposited, a life condition, which prevailed up to the close of the Liassic period.

In the Middle Lias, which includes the Ironstone Series, we are confronted with a rich and varied fauna quite different from that of the Lower Lias. Not only have nearly all the species died out which are characteristic of the inferior beds but also whole genera. The Arietan Ammonites, so numerous in the Redcar Rocks, are replaced by species belonging to new, genera. Of these *Aegoceras capricornus,* and *Amaltheus spinatus,* may be taken as typical examples. The *Cardinias* are reduced to one or two feeble representatives, whilst peculiar genera of bivalve Mollusca become very dominant. viz. *Gresslya, Pleuromya, Goniomya, Arcomya, Ceromya,* and *Pholadomya.* All of them are extinct, except, *Pholadomya,* two or three species of which have been dredged from the bottom of deep parts of the Atlantic.

A famous bivalve of the Ironstone is *Trigonia lingonensi* one of the earliest members of a genus, which attained an extraordinary and beautiful development in later Jurassic times, but is now only represented by a few species in the Australian Seas. This rare shell is practically confined to the Ironstone of Eston and Upleatham Hills, but specimens have been obtained at Boulby and Roseberry Topping. Not only is it of great rarity, but it is seldom found with both valves in opposition. *

The- Brachiopoda, or Lamp Shells, arc not uncommon in the Ironstone Beds though scarce in the North Sea to-day. The familiar *Rhynchonella tetrahedra* is very abundant and frequently occurs in pockets, whilst *Terebratula* is also numerous. Table No.3 shows the fauna of the Ironstone Series of the Middle Lias.

TABLE III

CENSUS OF THE FAUNA OF THE IRONSTONE SERIES OF THE MIDDLE LIAS.

CLASS.	SPECIES.	GENERA.
Reptiles	2	2
Cephalopods	16	3
Univalves	23	10
Bivalves	62	35
Lamp Shells	11	4
Worms	4	2
Echinoderms	3	3
Total	121	59

In the Upper Lias, we meet with another distinct group of fossils. New genera of Ammonites, *Stephanoceras, Phylloceras,* and *Harpoceras* abound together with many unique bivalves, uch as *Inoceramus dubius* from the Jet Rock; *Leda ovum* and *Trigonia literata,* from the Alum Shale. Fishes are comparatively numerous in the jet shales, and

(Mr. T. W. Saunders, of Saltburn, has a beautiful and perfect specimen found by him in Boulby Mines.)

comprise forms *(Leptolepis saltviciensis)* related to the Herring, and others related to the Sturgeon and the Bow-Fin of the United States.

But it is for the Reptiles that the Upper Lias is so celebrated, and the species, which then flourished are now extinct. The most important of them are undoubtedly the Fish Lizards, or Ichthyosauri, of which six species have been obtained from the Upper Lias of Cleveland. The Ichthyosaurus was a huge carnivorous animal, often attaining a length of

twenty feet, and it is worthy of note that these great marine reptiles were of a very fish-like shape and even provided with fins, as some specimens from the Lias of Wurtemberg have shown.

Less numerous in species than the Fish Lizards and probably less ferocious, were the Plesiosaurs, differing from the former in having long flexible necks. Besides these there were several reptiles closely related to the modem Crocodiles, as well as Flying Dragons *(Scaphognathus)*, the remains of which have all been discovered in the Alum Shale.

There is a curious feature connected with the fauna of this stratum, tending to show that even in a limited area like Cleveland, different conditions of life must have prevailed even during the deposition of one bed. At Peak and Whitby, and along the coast generally, the common fossils of the Alum Shale are extremely numerous, but on Carlton Bank they are very scarce, even *Leda ovum,* the typical bivalve of the horizon, being very far from abundant. Evidently the life conditions must have been less favourable in the western, than in the eastern part of our area during Upper Liassic times.

The fauna of the Inferior Oolite (see Table 4) is less rich than that of the Lias, owing to the Estuarine conditions under which it lived. The records are to be found in thin marine strata intercalated between massive grits and sandstones, the chief of them being the Dogger, the Eller Beck Bed, the Millepore Bed, and the Grey Limestone Series. Different suites of animals occur in each of these, and the most striking feature of the Bajocian fauna as a whole, is its richness in bivalves, in this respect even exceeding the Lias.

TABLE IV.
CENSUS OF THE FAUNA OF THE INFERIOR OOLITE.

CLASS.	SPECIES.	GENERA.
Reptiles	3	3
Fishes	3	3
Nautili	2	1
Belemnites	7	1
Ammonites	16	5
Univalves	81	27
Bivalves	216	48
Lamp Shells	26	6
Polyzoa	3	3
Crustacea	7	5
Worms	9	3
Echinoderms	20	14
Corals	7	6
Total	402	125

Before concluding this section, attention must be directed to certain conclusions that may be drawn from the fossils of the Lias and Oolite. The following genera of shells though found fossil in the district, are also found liviing in tropical and semi-tropical seas at the present time.

Nautilus *Anatina*
Pleurotomaria *Cardita*
Nerita *Corbis*
Neritopsis *Cucullaea*
Onustus *Cypricardia*
Phasianella *Cytherea*

Pitonilus	*Macrodon*
Turbo	*Solenomya*
Hinnutes	*Trigonia*
Perna	*Waldheimia*
Plicatula	*Lingula*

They seem to indicate that the climate of Cleveland during the Mesozoic Ages was distinctly warmer than it is today. This inference receives verification from the fossil Cycads of the Oolite, and the famous Coral Reefs of the Tabular Hills.

Again, these tropical genera, have to be set thirty-seven genera of Molluscs still living in British waters, but as these are existent in nearly all seas, they rather help than contradict the general verdict of the local fossils. The abundance too, of a rich Cephalopod fauna, as well as the number of Reptilian types tends to show the favourable conditions for marine life during Liassic times.

Another feature of the Liassic fauna is the extraordinary change of life forms, in comparatively speaking, such it small vertical thickness of rock. Liassic rocks a few hundred feet thick show, not merely change of species, but in some instances change of genera: the differences between the Redcar Rocks, and the Ironstone Series, being both striking and remarkable with the *genera* of the Ammonites, and the *species* of Bivalves. From the pre-glacial Crags of Norfolk and Suffolk, we know that these beds indicate a marine fauna similar to that of today, in fact the same, so far as the species of Mollusca are concerned. The time, however, since the Crags were deposited must be very considerable, perhaps tens of thousands of years. If in the case of the Crags, after the lapse of tens of thousands of years, little if any change even in species has occurred, how long a period of time must have elapsed during the deposition of the Lower and Middle Lias, to permit of such great evolution of form?

This remarkable change in form is best illustrated by the Ammonites, of which nearly 120 species have been described frorn the Yorkshire Lias alone, As is well-known the majority of the species are confined in groups to separate beds or zones, Twelve such zones have been determined in the Lias of Cleveland, each characterised by a special Ammonite or set of Ammonites, Hitherto, no explanation has ever been afforded of these peculiarities of geological distribution, Before any solution can be attempted, the following factors ought to be borne in mind.

Each zone or bed of the Lias was deposited under different conditions of sedimentation, and to these conditions is undoubtedly due, the ordinary palaeontolgical features of the strata. This alone cannot have been sufficient to produce the great generic distinctions of the Ammonites. A more important factor must have cooperated with the changing life conditions, viz. the high organisation of these curious molluscs. They constitute an important section of the highest class of the Mollusca, the Cephalopoda, which with the exception of Insects, must be ranked amongst the most complicated and highly organised Invertebrates. Complexity of organisation is accompanied with greater delicacy, if we may so term it, of physical constitution, which being adjusted to numerous external conditions is singularly liable to be overthrown by changes in environment. Consequently, in the case of the Ammonites, these changes of environment indicated by the varied strata of the Lias, joined with the long period during which the rocks were deposited, may have led to more rapid modifications of form as compared with the other classes of Molluscs.

4.THE TERRESTRIAL FAUNA

TABLE V.
CENSUS OF THE TERRESTRIAL FAUNA OF CLEVELAND.

CLAS s	SPECIES,	GENERA.
Mammals	25	15
Birds	249	175
Reptiles	5	4
Amphibia	5	3
Coleoptera	930	330
Lepidoptera	610	270
Land Snails	73	24
Freshwater Bivalves	9	5
Total	1,906	826

On the annexed table is summarised the chief results of the researches of zoologists on the land fauna of the district, from which may be obtained a fairly comprehensive idea, of the total number of species of all classes of the animal kingdom, to be found in Cleveland or which have visited Cleveland. Although the figure given there, 1900 species, seems a large one, yet it must be far below the actual total. The Mammals, Birds, Reptiles and Mollusca, cannot be very much increased, if at all, but the Insecta with further research will perhaps be more than doubled. For not only are the figures of the Lepidoptera and Coleoptera by no means complete, but the great orders of Hymenoptera, Diptera, Hemiptera, and Orthoptera have as yet few or no records. It will be noticed too, that there are no record of Spiders, Land Crustaceans, Earthworms, and other low forms of animal life, but which if the species could be enumerated would still further swell the total. Taking everything into consideration, it may be roughly estimated, that between four and five thousand species of animals inhabit Cleveland today.
This fauna can be classified according to the status of the various species composing it, viz.
Introductions by Man.
Accidental Stragglers and Visitors.
Irregular Visitors.
Regular Visitors.
Resident Species.
This classification, as we shall see further on, provides a partial solution to the manner in which animals, now resident, may have entered the district. Neglecting, therefore, the various classes of visitors for discussion in the next section, let us devote some attention to the residents, since these offer many suggestive problems for investigation.

Though the highest point of Cleveland, on Urra Moor, is but 1,489 feet, still many interesting facts illustrate the altitudinal range of local animals. Thus, the Mole, the Angles Shades Moth *(Phlogophora rneticulosa)*, and the Black Slug, ascend from sea-level almost to the highest watershed. I have noticed the Mole on grassy moorland slopes, at 1,200 feet, near Ralph Cross, Castleton; the Moth (essentially a lowland species not dependent on ericetal plants for its food, and therefore a straggler to the uplands), on the promenade at Saltburn, and on Kildale Moor (1,000 feet); whlist the slug *(Arion ater)* can often be seen crawling on the peaty soils of the hills. The Mole, however, appears to be absent from the true heather moor, perhaps owing to the general absence of earthworms. The non-occurrence of the earthworm on peaty moors is probably due to

the nature of the soil, but its absence from them must be of no little account in explaining their botanical aspect.

Investigating the vertical range of animals, more especially invertebrates, in Cleveland, distinction must be made between stragglers to the uplands, and residents on the uplands. The higher watershed between the great dales has not yet been explored by zoologists, and will probably yield rare and interesting species throwing light on the zoological evolution of the district. A few cases are on record of essentially moorland insects occurring in the lowlands, where they cannot possibly have bred since their special food plants are wanting. Thus, the Cotton Grass Moth *(Celaena Haworthii)* frequents boggy places on the hills, where *Eriophorum* grows and on which its larvae feed. Nevertheless, specimens have been taken by Mr. T. A. Lofthouse, F.E.S., in his garden at Linthorpe, and Emperor Moths *(Saturnia pavonia)* have also occurred at the electric lights of the ironworks, though the insect is confined to the moors. Facts such as these indicate movements on the part of moths, for purposes that must be wholly conjectural in our present state of knowledge regarding the migration of Lepidoptera.

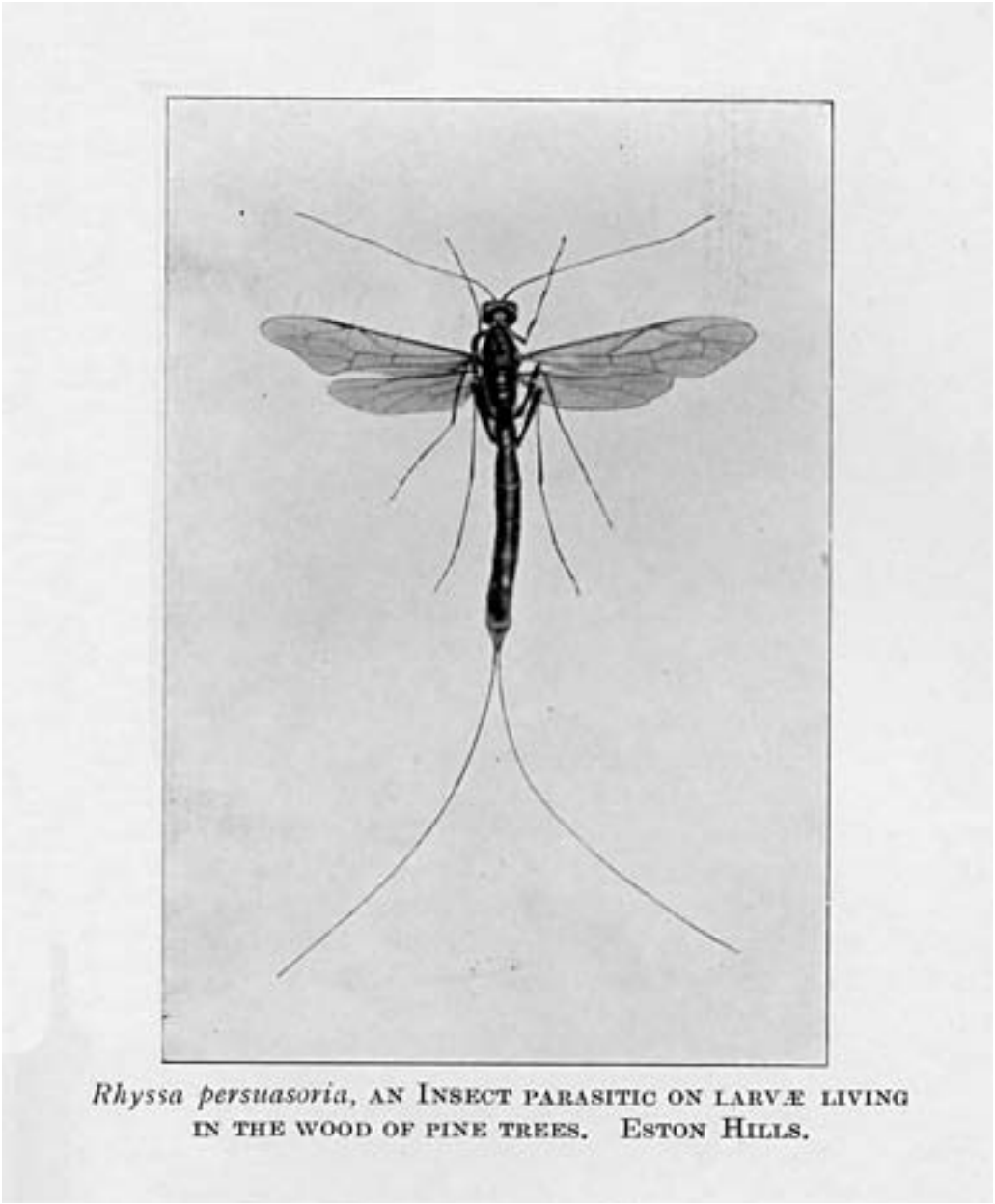
As we shall presently find, numerous animals are peculiar to the moors, but apart from limited or unlimited vertical range, there are indications of a limited longitudinal range of species. I say indications advisedly, for the distribution of many forms is still very imperfectly known, and any conclusions are likely to be rendered nugatory by the discovery of fresh localities. Thus, *Aspilates strigillaria,* a heath-frequenting moth, has not yet been found by local entomologists further westwards than Danby; a fact not explicable on the assumption of the westerly ground being inadequately worked, since the insect fauna of that area is much better known than that of the eastern area. The species, however, occurs further eastwards at Cloughton Newlands. The Solitary Ant *(Mutilla europaea)* seems to be confined to the moors of the seaboard between Robin Hood's Bay and Scarborough.

The richness of the land fauna of Cleveland is due to the variety of natural habitats the district affords. Coast sand dunes, salt marshes, rocky cliffs, wide moors of different types, woods, lanes, fields, hills and valleys, all have different resident faunas adapted to the varied conditions of life in each. We may term these faunal groups, "associations," analagous to the plant associations of the botanist, and it will be of no little interest to contrast the faunal associations of the local sand-dunes, pine woods, and moors with one another.

In the case of the Coatham sand dunes, the first point, which strikes the observer is the great abundance of Mollusca, nearly a dozen species of land snails being more or less numerous. In this respect the dunes are in marked contrast to the moors which posses no molluscan fauna except the Black Slug *(Arion ater).* For this contrast there must be some cause, either in the nature of the vegetation, or the differences of climate and soil. No doubt the moors are unfavourable to molluscan life, but it remains to be shown how the various botanic, climatic, and edaphic conditions act injuriously upon these organisms. In the pinewoods, slugs are fairly numerous but other Molluscs do not seem to be at all common.

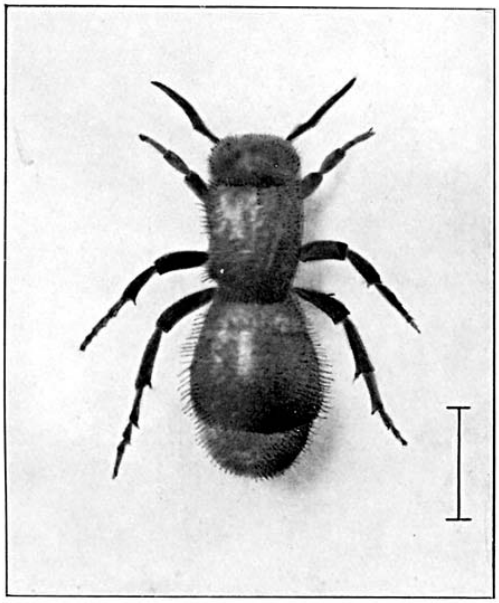
Numerous species of insects are peculiar to each habitat, and this arises from the fact that they are confined to the special plants growing in these localities. On the sand hills several special Lepidoptera are to be met with, *Tapinostola elyrni,* and *Agrotis valligera* among others, as well as peculiar Coleoptera. In pine woods the restricted insect fauna is much more numerous, and to confine our attention to those living on the Scots Pine there are nearly a dozen species of Lepidoptera (such as *Trachea piniperda, Ellopia*

prosapiaria, etc.); numerous Beetles (such as the Pine Weevil, *Hylobius abietis);* and Sawflies (such as *Sirex fuvencus* and *gigas, Lophyrus pini)* together with their parasites. *Rhyssa persuasoria* is the most extraordinary of these parasites on aceount of it laying its eggs in the burrows of the Giant Sawfly, (S. *gigas),* on the larvae of which it feeds. These insects form a most heterogeneous association, all united by the fact of their being ultimately dependent upon the pine tree for their existence.



Rhyssa persuasoria, AN INSECT PARASITIC ON LARVÆ LIVING IN THE WOOD OF PINE TREES. ESTON HILLS.

Rhyssa persuasoria, AN INSECT PARASITIC ON LARVAE LIVING IN THE WOOD OF PINE TREES. ESTON HILLS.



SOLITARY ANT (*Mutilla Europœa*), FEMALE, ENLARGED.
SECOND YORKSHIRE EXAMPLE; FROM MOORS NEAR ROBIN HOOD'S BAY

SOLITARY ANT *(NJutilia Europcea),* FEMALE, ENLARGED.
SECOND YORKSHIRE EXAMPLE; FROM MOORS NEAR ROBIN HOOD'S BAY

The faunal association of the moors is also peculiar, including: among birds, the Grouse, the Merlin, the Ring Ouzel and the Twite: among beetles numerous forms such as *Haltica ericeti,* and the Weevil *(Ceuthorhynchus ericae);* sawflies, hemipterons, and spiders, as well as the Viper amongst Reptiles. The heath frequenting Lepidoptera, besides being restricted to special moorland plants, are also restricted to habitats but little altered by man. For centuries the moors have remained as they are now and moreover unlike birds or mammals, the insects have never been disturbed. We feel, therefore, that any conclusions we may deduce from their distribution, which is better known than that of any other order of insects, will be found to be of permanent value.

The subject of faunal associations has had to be treated somewhat cursorily, not only owing to lack of space but also from the circumstances that very much more zoological work yet remains to be done in Cleveland before exact and accurate comparisons can be made. Interesting results would be bound to appear and would throw light on the local distribution of various animals and their past history.

It may be remarked that the nature of our woods, when the natural origin of these is disputed, may be inferred from the insect fauna. Recently planted woods of coniferous and deciduous trees in different parts of the district never contain the \Vood Ant *(Formica rufa).* This insect, so far as my observations go, is confined to localities on the edge and slope of moorland valleys, and the anthills may often be seen on the open moor far enough away from any wood. The Wood Ant is not a moorland insect, and in one place, Great Hograh Beck in Basedale, its nests are extremely numerous along the sides of that

wooded ravine. All the evidence goes to show that this wood is natural, and that wherever the nests of the Wood Ant occur, even if no trees is now near (as in the lower heathery parts of Basedale), they indicate the prescence of former woodland.

In concluding this section, it is evident that in the same manner as the botanist speaks of ecological botany, so the zoologist can speak of ecological zoology. That is, the ascertainment of the species of animals of any particular habitat, a pine wood, a moor, a salt-marsh, or a sand dune; the conditions under which they live; the features they have in common; the features in which they differ; their relationship to one another; and their distribution over any district. If plants are dependent on soil, climate, altitude, and other factors, animals are also not only dependent on these, but on the plants as well, factors which differ everywhere, not only in different associations but in the same associations occupying different localities. By thus noting in what these faunal groups agree, and in what they disagree, some substantial basis will be found for an adequate discussion of the history of animals which in its turn is largely dependent on the geological changes any area has undergone. To this history we must now turn.

V. -THE HISTORY OF THE TERRESTRIAL FAUNA.

The dynamical aspect of the fauna deals with its evolution, and the history of the succession of faunas, which have lived within the district. It is a branch of zoology beset with peculiar difficulties. The lack of data so apparent when considering the statics of the fauna could easily be obtained by further investigation. Not so with the dynamics of the fauna, the full history of which can never be written because the records have absolutely disappeared. Hence, an interpretation of the land fauna must to a large extent be speculative, for in this enquiry palaeontology helps us but little. From it we learn, however, that the mammalia were once extremely different from what they now are. The remains found in the celebrated cave of Kirkdale proved that a most extraordinary assemblage of mammals formerly lived in North East Yorkshire. It seems probable that the occupants of this hyena den flourished in pre-glacial times, for the mammalia found in the post-glacial peat bogs only include, at any rate in Cleveland, the Red Deer, the Reindeer, the Wild Boar, the Wild Ox, but not such animals as the Hyena, Mammoth, Rhinoceros, or Hippopotamus.

Arguing from analogy, it seems reasonable to infer that the insects of the pre-glacial period must have presented similar features to the mammalia, that is, a strong mixture of African and northern species, but of this we have no palaontological evidence. Nor does there seem to be any trace left in the present insect fauna of the extreme southern species of pre-glacial times. In this respect they agree with the post-glacial mammalia, and it may be inferred from this that the Ice Age must have been the factor in exterminating the southern fauna.

The relation of the Cleveland land fauna to the Ice Age is one of extreme importance, and it is in this relation where I think the special interest of our fauna lies to the student - of zoo-geography. For as Professor Kendall well remarks "The whole argument concerning the history of our fauna depends upon a correct and sound conclusion regarding the facts of glacial geology." Accepting, therefore, the conclusions of the glacialist as thoroughly established, we may remark that the pre-glacial animals would be driven from those parts of our district covered with deposits left by the ancient ice. But a large part of Cleveland was never overridden by glaciers, and the driftless area corresponds roughly to the moorlands and the great dales south of the main Cleveland watershed. If now we turn to Greenland, which contains a comparatively numerous fauna and flora living close to a heavily glaciated land surface, it seems natural to infer that

during the Ice Age the driftless area of Cleveland supported a somewhat similar Arctic fauna and flora.

Merely noticing in passing that most of the moorland plants flourish at the present day in Arctic climates, we shall find that several species of insects now living in Cleveland also live under the glacial conditions of Greenland, and probably with various Arctic plants have existed on the driftless region throughout the Ice Age. Of these insects, I have so far been able to discover eight, four beetles and four moths as follows :-

MOTHS
Agrotis occulta v. implicata. In Scotland and in Greenland. Absent from Shetland. (Spiiler.)
Plusia interragationis. In Greenland (Rink.)
Cheimatobia brumata. In Greenland. (Rink)
Eupithecia nanata v. gelidata. A dark form from the Shetlands, Greenland, and Labrador (Spiller).

Quedius fuligidus. As far north as Discovery Bay, and extends ovcr Greenland and the whole of North America and Europe as far south as the Atlantic lslands (Fowler).
Creophilus maxillosus. . Common throughout the kingdom. Greenland (Fowler).
Otiorrhynchus rnaurus. Local. Greenland and Iceland (Fowler).
Bradycellus cognatus. Local; on heaths and mountains in high districts but occasionally found in lowlands. Greenland (Fowler).

The present enquiry reveals very clearly the extraordinary adaptability of certain species of insects, the same kind often ranging from a warm to an Arctic climate. As I have elsewhere pointed out the approach of the Ice Age would .be gradual, and joining this fact with the great adaptability of insects we may infer that numerous other species survived the Ice .Age on the driftless area of Cleveland.

The course of events, therefore, in the Quaternary history of our fauna seems to have heen a pre-glacial fauna similar to the present but containing more species; then the Ice Age with extinction of most forms except those that survived on the driftless area; and finally a re-advance of the temperate and southern forms with commingling of northern species after the retreat of the ice. Hence the fauna of Cleveland must consist of diverse elements, viz.
1-Pre-glacial survivals.
2-Northern forms, coming with the Ice Age.
3. Temperate and southern forms, coming into the district after the Ice Age.

Generally speaking, the land fauna of Cleveland belongs to that typical of England-the " Continental or Germanic " type-with a faint mixture of Arctic forms on the hIlls: and a still fainter Gallic facies represented by *Mutzlla europaea.*

Palaeantology being of little assistance in solving the history of the local fauna, we have to fall back on temporary explanations indicative of the various parts of the world whence our local animals have come. For all species except residents this is comparatively easy, since we can readily trace them back to their homes. Various insects and shells are introduced by man from the different countries of the Continent and the singular point about some of these introduced species, is the fact of their very rarely, if ever, becoming residents in the district. Thus, the Timberman Beetle *(Astynomus aedilis)* occurs commonly at Middlesbrough in imported timber and has even been taken in the

neighbourhood yet despite the very favourable plantations of fir and pine this insect has not become established.

Colonies of the Kentish Snail *(Helix cantiana)* introduced in railway ballast flourish for some time and then die out.

Tuming next to the migratory and visiting birds of Cleveland, these animals coming to us from distant countries only need a change in their life conditions here, to make them permanent residents. Doubtless in the past, changes have taken place and converted a visiting species into a resident species.

It is generally accepted by naturalists, that all species of animals have arisen by descent with modification from proximate or remoter ancestors. The species of a genus, however, are not uniformly distributed. In some localities they are more numerous than in others, and if the species have been derived from some common ancestor, it is clear that where they are most thickly clustered the evolution of forms will there have been most active. Gradually the various individuals advancing further and further from a centre of distribution give rise to less numerous forms, and by tracing back our native species to their original centre we can readily comprehend how they have dispersed from different countries.

The gradual approach of the Ice Age brought with it a great number of Arctic animals and plants, some still surviving in parts of our district. We may take as an example the genus *Lagopus,* to which the Grouse belongs, and which includes the Ptarmigan, the Willow Grouse, and other species. The Grouse is a species considered to be peculiar to Britain, though closely related to the Scandinavian Willow Grouse. Belonging to a genus of strictly northern and even Arctic range it follows from the theory of centres of distribution that it came from the north. Its history seems to have been the dispersal southwards by the Ice Age of a bird extremely like, if not identical with the Willow Grouse, its gradual adaptation to the post-glacial climate of Great Britain, and consequent loss of white plumage in winter owing to the less abundant snowfall. In other words the Red Grouse is simply a southern form of the Willow Grouse, evolved during the complex movements of animals during the glacial and post-glacial periods.

Several other northern animals came with the Grouse including the Little Yellow Underwing Moth *(Anarta myrtilli),* and various beetles. But the competition of southern forms has driven most of the true arctics from Cleveland, and it is now chiefly on the higher mountains of our island that they are to be found.

If the Ice Age drove out most of the pre-glacial species, it would seem likely that these northern animals constitute the oldest element of our fauna, but indications are not wanting, that some forms may have survived from Pliocene times.

The beautiful Emperor Moth so abundant on our moors belongs to the genus *Saturnia,* which has its headquarters in Asia. Hence, on the theory, Asia is to be regarded as the home of the Emperor Moths, which have gradually spread westwards across the Old World. The present distribution of the Emperor Moth supports this contention, as it occurs all over Europe, except in the Islands of Sardinia and Corsica, and extends far into Palearctic Asia.

Various other animals inhabiting the district can similarly be traced back to centre of origin. An American element is to he found in the Pearl Mussel *(Unio margaritifer);* an Asiatic element in the Nightjar and the Death's Head Moth; a South-Eastern European

element represented by the Tiger Beetle, and the *Clausilia* amongst the Mollusca; and a central European element in the beautiful Thorn Moths*

Although this theorv undoubtedly accounts for the distribution of many species; of animals, it by no means accounts for all. Species may have arisen in centres that are now lost, because the species there have died out; and, where a genus is now most highly developed, this has not always been the case, as palaeontology shows. For instance, in the first section of this paper we saw that the genus A*starte,* though now so abundant in northern seas, was in Jurassic ages most numerous in the warm seas of Central Europe

.

Where fossil evidence is lacking, as in the majority of insects, speculations as to their original homes must at the best be hazardous. One of the beetles mentioned as living in Greenland belongs to the genus *Creophilus,* which attains its maximum development in New Zealand where there are six species, a seventh occurs in South America, and the eighth, C. *maxillosus,* is the European form. According to thc theory of centres of distribution New Zealand should be regarded as the place of origin of these insects, but it is quite clear that the species of this group originated at a time when the present distribution of land and water was quite different, and that the home of the genus may have been in lands now beneath the sea. That the species of a genus originated in a centre cannot he disputed, but it would be erroneous to suppose the present distribution of the species indicates this centre.

VI -CONCLUSION

Having reached the end our survey of the zoology of Cleveland, past and present, it only remains to sum up the chief conclusions we have drawn from it, and to take a comprehensive view of the evolution of the fauna as a whole. We saw that the earliest fauna of the district is a marine one, and dates back to the late Triassic Period. This fauna has in its turn succeeded by the numerous faunas of the Lias and

For further details see Scharff's" European Animals, their Geological History, etc,"* and *"History oj European Fauna."*

Inferior Oolite, all distinct from one another, all now totally extinct, all very different from the present inhabitants of the local coast line, and indicative of a warmer climate. Not in this district, but in Eastern Yorkshire, we can further trace the evolution of marine animals to the close of the Cretaceous Period. Age after age, fauna succeeded fauna, until just before the Glacial Period, the North Sea contained a suite of animals very similar to those now living there. With the advent of the Ice Age the pre-glacial animals were slowly driven from the sea, and replaced by Arctic species, until even these were driven out by the advent of the great northern ice-sheet.

After a longer or shorter period of refrigeration, the climate gradually began to ameliorate, the ice-sheets retreated northwards, and were followed by the marine species characteristic of the Arctic province. These in their turn were succeeded by the temperate species with a few southern forms, until the present status of the marine fauna was reached. This succession of events was probably interrupted by the conversion of the seafloor into land, and minor fluctuations of climate.

The land-fauna can only be traced back to late Tertiary times. What it may have been before then we have no local evidence to show, but from data found in other parts of

Britain, it may in the future be possible to fill in the Tertiary history of our animals. In Pliocene times the mammalia were of African, northern, and temperate types, features probably characteristic of all the other land animals of the district. The approach of the Ice Age brought with it numerous Arctic species, many of which survived that period on the driftless area. In post-glacial times, the temperate and southern animals belonging to our fauna once more entered the district, unaccompanied, however, by any African or extreme southern species. These gradually ousted the true Arctic species, occupied all those habitats for which they are adapted, and in so doing formed faunal associations very distinct from one another. We also saw that many of our residents originated in various parts of the world, the Arctic regions, Europe, Asia, and America, long before the Ice Age, the Glacial Period being merely an incident in their complex evolution.

Finally, it may be observed that since the whole of Britain was severely glaciated, the return of the land-fauna must have taken place from the Continent, across lands now covered by the North Sea and the English Channel. Doubtless the fluctuations of climate in post-glacial times affected the terrestnal animals to a greater or lesser degree, but a consideration of these changes must be left for a future occasion.

Of course, in a short paper like this, only a very imperfect outline can be given of such an extensive subject. Many interesting aspects of the fauna have had to be omitted and others just briefly touched upon. We have, however been enabled to perceive clearly the largeness and variety of the fauna of Cleveland, and the interesting problems it presents. Above all, we have learned that it is far from being fixed, and that like all other existences it conforms to the great law of evolution.

JURASSIC PLANTS FROM THE CLEVELAND HILLS

BY REV. GEORGE J. LANE, F.G.S.

Paleobotanical records afford striking evidence on the study of plant evolution.

The Permo-carboniferous vegetation reveals a comparatively homogeneous flora of wide geographical distribution, consisting largely of Lycopods, Calamites and Vascular Cryptogams.

That the "Cycads," the abundance of which is one of the most conspicuous features of the " Mesozoic Flora," existed in Paleozoic Ages, there is no conclusive proof. Only limited evidence can be supplied of the occurrence of genera, which can be confidently placed in any of the existing families of the Conifers.

At the close of the Wealden period a second evolutionary wave occurred in the world vegetation, as shown by the decrease of the Cycads and the emergence of Angiosperms.

The testimony of the Yorkshire rocks contributes much to our knowledge of the vegetation of the Lower Oolitic period. Since the days of Young, Bird, and Phillips, Yorkshire has been classical ground for Bajocian plants.

The comparative absence of records from the Cleveland Hills is, however, a regrettable fact. Our area if persistently worked will, I am fully persuaded from my own personal experience, yield valuable contributions to our knowledge of Bajocian vegetation. To the late Rev. J. Hawell we are deeply indebted for his researches in this particular, but much

remains to be done. Our knowledge at present is very circumscribed. Coming into this district in 1904 and recognising

Zamites sp. Ref. *Buchianus*
INFERIOR OOLITE SANDSTONE, CARLTON BANK,

this department of study as attractive and offering scope for investigation I essayed the task. After laborious journeys, meeting with non-success, I was rewarded with some valuable finds in 1906. Some of these were entirely new records for our district and were given by me to the Middlesbrough Museum. Among the fossil plants were:-
1. *Equisetites columnaris.* It consisted of the crushed part of a stem, near the apex where the leaf sheaths are close.
2. *Otozamites graphicus.*
3. *Baiera Lindleyana.*
4. *Zamites species.* This is a remarkably fine specimen deposited in light brown sandstone (se illustration).

With the valuable aid of Mr. Elgee, Asistant Curator of the Dorman Memorial Museum, we determined three of these plants correctly, but the plants were subsequently forwarded to Mr. Seward, who confirmed our determinations.

Zamites species has not been recorded previously from the Bajocian in Yorkshire. It bears a striking resemblance to a species named *Z. Buchianus* discovered among the Wealden Flora, and suggests that the character of the vegetation of the world from the

Upper Triassic period to the Wealden to have been remarkably uniform and constant in its main features.

Otozamites graphicus, and *Baiera lindleyana* are new records for the North - West Cleveland area.

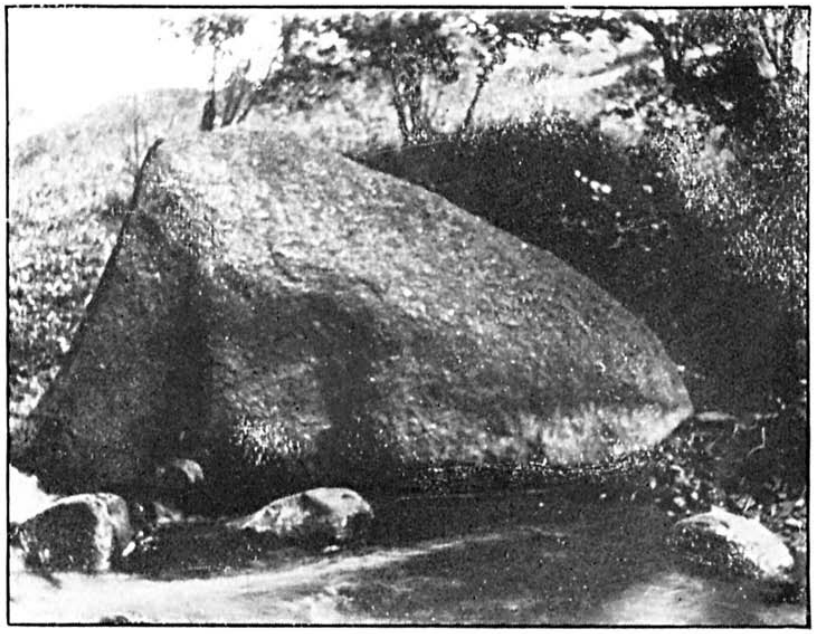
Thc geological horizon from which these plants were derived is the Inferior Oolite of Estuarine origin. This sandstone bed in the neighbourhood of Carlton Bank is full of plant remains, and some short time age a fossilised tree a few yards in length was seen and awakened much interest. This sandstone attains a greater thickness in this locality and contains less shale than further east and was probably deposited in the estuary of a river flowing from West to east in early Oolitic times.

A LARGE GLACIAL BOULDER AT WHORLTON

BY THE REV. J.C. FOWLER, B.A., F.G.S.

I have recently had a photograph taken of an immense boulder which lies in the beck about three-quarters of a mile from the village of Swainby, up Scugdale. The block accompanying this paper is from the photograph, which shows the erratic in situ. It is of Shap Granite, sub-angular like the majority of erratics showing what rough usage it has had-long continued-so as to wear down all the angles even of such hard stone. It lies in the moraine of the great glacierr which pressed up Scugdale and overcame the local one coming down the valley, and these valleys probably all contained local glaciers, and here it has been at rest for some 50,000 years; which appears to be a fair estimate of the time since the Glacial Period according to our present knowledge, the tendency of thc present time, however, being to lower that estimate somewhat.

The boulder is very large, the dimensions being as follows: Round the stone at the water level it is 23 feet. From the water level at the left (looking at the photograph) over the back down to the water level on the right it is17ft. 2in. In the foreground, from the water level over the highest point to the water on the other side it is 10ft. We do not know the shape under ground or how far it rests out of sight.



LARGE BOULDER OF SHAP GRANITE, SWAINBY.

The distance from Shap on the Pennine Chain in Westmoreland in a straight line is sixty miles or more and this boulder must have been brought with countless others down the direction of the Tees Valley. There are boulders of Shap Granite and Basalt (chiefly) scattered over the North and East Ridings of Yorkshire in particular. One very large boulder may be seen in a street in Darlington; another one as big at Seamer Junction near Scarborough in the stationmaster's garden (both Shap Granite). I have noticed two rather large boulders of Basalt at Barnby, near Market Weighton, and on the Yorkshire Coast they may always be found of all sizes up to large blocks; there is a fine erratic preserved in the churchyard at Grosmont, brought from High Burroughs farm in 1892-345ft. above sea level, it is of Shap Granite and probably contains about one cubic yard.

We have many other erratics in this parish but of the glacial boulders I have seen, the one here illustrated is amongst the largest and of great interest. I have a large collection of drift stones, which I have picked up from time to time, and about which I may have something to say in the future.

AN INTERESTING GEOLOGICAL DISCOVERY

BY THE REV. J.C. FOWLER, B.A., F.G.S.

An addition has recently been made to the old churchyard at Whorlton of half an acre, on a slope, at the West side facing the village of Swainby. In the process of digging the drains, eight of which were made, draining into a main drain at the bottom, a uniform depth of 6ft. of drift clay was found full of boulders, except at the N.E corner where the shale was met with in a confused mass nearer to the surface.

In the third cutting from the road near the top, the drainers found a tree stump at the depth of 6ft. from the surface, the stump was about 2ft. high and the roots were in the shale below; the drainers broke off the stump and left the roots in the shale and the stump is now in my possession.

The tree was evidently about 15 or 16 inches diameter at the bottom, and the stump is in a rotten condition, some of the wood is stilll hard and black and appears to be oak, but of this I can say nothing positive: the interesting thing about it is that it was found as it grew, overwhelmed by glacial drift 6ft. deep. These shales are Lower Lias.

Before the glacial period the physical geography of this country was in the main as we see it now, the chief features not being greatly altered. It is quite certain, however, that the outline of the Cleveland Hills extended much further north than at present, a large part being worn away by glacial action, especially that of the melting ice streams. It would appear that this tree grew at the close of the glacial period when vast quantities of Lias had been removed and this particular spot worn down to the Lower Lias shales. The drift full of boulders of all sizes up to stones as much as one can lift was deposited under torrential conditions, and the tree was evidently overwhelmed.

Most of the stones are of local rocks but specimens of limestones, including Dent Marble (so-called), Shap Granite, Basalts, and other travellers are common in one place quite a number of Dogger boulders occurred.

This is the first time that I have met with any announcement of a tree having been actually found as it grew in one of the mild inter-glacial seasons, if there were any, or at the end of the Ice Age before the mantle of drift was distributed by torrential waters.

A COUNTER, TEMP. EDWARD III

BY THE REV. J.C. FOWLER, B.A., F.G.S.

The coin of which we give illustrations was found some years ago in the inner moat of Whorlton Castle, it was dug up and came into my possession at the time. I have now had a couple of blocks made so as to reproduce it for our Proceedings. It is in very fine preservation-not a current coin of the realm, but a Counter used by the King's Chamberlains for counting the expenses of his privy purse. I showed it to the officials of the coin department at the British Museum; the late Sir John Evans happened to be present, and he was most interested in the coin, which he greatly admired; it was made after the coins of France of the period. As a matter of course, a duplicate coin was produced, but it was as thick as a florin, and my coin is quite thin like Elizabethan coins. On the “Obverse" the coin has a shield in the centre charged with three keys-indicating the chamberlain's office, on a bend surrounded with crowns and lions; and round the whole EDWARDUS REX REGNAT, crowns also being interspersed between the words.

On the “Reverse" there is an arrangement of "Fleurs-de-lys " at the four extremities of a cross with equal arms in a kind of square with four more " Fleurs-de-lys " in the angle, and round the whole the words GARDE ROBE REGIS, the words being separated by crowns as on the " Obverse." "Garde-robe" meaning wardrobe or private apartments of the king.

Coins are still used as counters by old fashioned people at whist, and Shakespeare's "As you like it," ii, 7., says " what for a *counter,* would I do but good? "

COUNTER, TEMP EDWARD III

OBVERSE.

REVERSE

Tally-sticks may still be seen hanging from the sides of huxters’ carts in Brittany.

It would be interesting if we could find out how this particular counter came to be at Whorlton Castle. There is no evidence to show that Edward III was ever here. Graves informs us that Nicholas de Meinill “was summoned to Parliament among the Barons, from the 9th to the 16th Edward III," so that Whorlton was not unknown to the King by name and representation. Then again in those days monarchs travelled about a good deal over their domains and frequented the castles of their Barons and sometimes paid royal visits to monasteries, and many a time an Abbott or a Prior has been delighted to see the back of some royal or dignified person who has honoured him with a visit, and depleted his larder to the no small hurt of the monastry.

However, the coin has survived so far, as a link with the past, and may have fallen out of the doublet of one of the royal retainers who might have been sent to the castle on some royal errand. This coin carries us much further back than the date of the gatehouse of the

present castle, viz., Richard III. An interesting article on the expenditure of Edward III may be found in the first volume of "The Antiquary," by Sir James H. Ramsay, Bart.

Since writing the above, during a search in the Public Record Office, I discovered in "The Patent Rolls" and " Calendar of Close Rolls," that Edward II or his Chancellor with his seal was at Whorlton on August 6th and September 4th, 1323, where several letters were dated. Letters were also dated from Darlington, Northallerton, Thirsk and Stokesley, but I did not find any mention of a visit from Edward III**.**

CLEVELAND LEPIDOPTERA IN 1906

BY T. ASHTON LOFTHOUSE, F.E.S.

*Denotes species recorded in Proceedings for first time.

The weather in the spring and early summer was cold and inclement as has been usual in the district for the past few years. "Sallows" in the spring were early and soon over and nothing of any note was taken off. The summer was somewhat finer on the whole but insects were mostly late; towards the end of August and in early September a few days of fine hot summer weather occurred and insects were specially noticeable at this time, the heather bloom which was very late was more than usually attractive while at the same period "sugaring" absolutely failed. Many interesting species occurred on the heather bloom, among them being *Noctua dahlii* and *Triphosa dubitata* insects both new to the local list, other insects that occurred were *Orthosia suspecta* (a belated worn specimen, only the second recorded for Cleveland); *Cloantha solidaginis* in numbers; *Noctua glareosa,* very plentiful and very variable, some specially fine rosy specimens being noticeable: *Polia chi, Thera firmata, Cidaria populata, immanata* and *testata. Larentia caesiata,* and many other common species. "Sugaring' , as an attraction proved of very little use this year with one or two exceptions, one warm evening in September it attracted seven specimens of *Epunda lutulenta,* one *Anchocelis lunosa* and other common species.

NOCTUAE, Cymatophora ftavicornis. A notable feature of the season was the finding of this insect in abundance, and very variable, in March among Birch on Eston Hills by Mr. J. W. Harrison.

Acronycta leporina. Larvae taken off Alder at Castleton.
Acronycta menyanthidis. Taken at Danby on June 4th.
Celaena haworthii. A specimen of this insect taken at sugar in garden at Linthorpe on September 3rd, a rather unusual locality for this species.
*__Noctua depuncta__. Taken at sugar at Kildale in August.
*__Noctua dahlii__ Taken at Heather bloom and sugar at Kildale.
Triphaena fimbria. Imagoes taken at Thornaby by Mr. Proud. Larvae also taken near Middlesbrough by Mr. Harrison.
Orthosia suspecta. Single worn specimen at Heather bloom at end of August.
Dianthrecia cucubali. Took number of Larvae off Silene seeds in garden at Linthorpe also off Silene flos-cuculi seeds at Kildale.
GEOMETRAE. Epione apiciaria. Fairly plentiful about Sallow bushes at Kildale in August.
Eugonia alniaria. Noticed at Kildale in September.
Oporabia filigrammaria. Kildale.
*__Thera firmata__. Common on Heather bloom at Kildale.

*__Triphosa dubitata__. Taken at Heather bloom Kildale.
__PYRALIDES. *Scoparia crataegella__. At sugar Kildale.
__PHYCIDAE. *Homaeosoma nimbella__. Middlesbrough.
__TORTRICES. *Tortrix unifasciana__. Redcar.
__Tortrix costana__. Bred from Mandale Bottoms.
*__Peronea caledoniana__. Battersby and Kildale Moors.
* __Argyrotoza conwayana__. Beaten out of Wild Rose at Great Ayton in June.
*__Ptycholoma lecheana__. Guisborough.
*__Hedya lariciana__. Kildale, only two previous Yorkshire records for this species.
__Hedya neglectana__. Middlesbrough.
*__Sciaphila subjectana__. Bred from Wild parsley, Mandale Bottoms, and taken at Redcar.
*__Sciaphila hybridana__. Redcar.
*__Phoxopteryx myrtillana__. Eston and Grcat Ayton on Heath.
*__Paedisca corticana__. Taken from firs, Guisborough.
*__Predisca sordidana__. Among Alders. Great Ayton.
*__Ephippiphora pflugiana__. Kildale.
*__Pamplusia mercuriana__. Battersby.
*__Retinia pinivorana__. Kildale.
*__Stigmonota internana__. Fairly common about Gorse at Eston, also occurs at Ayton and Kildale.
*__Stigmonota regiana__. Bred from Larval taken under bark on Sycamore trees at Ayton and Guisbrough.
*__Catoptria cana__. Kildale.
*__Trycheris aurana__. Kildale.
*__Euprecilia atricapitana__. Redcar.
*__Xanthosetia zoegana__. Redcar and Marske.
__TINEAE. Lemnatophila phryganella__. Off Oak, Kildale.
*__Epigraphia steinkellneriana__. Saltburn.
*__Scardia cloacella__. Middlesbrough and Kildale.
*__Tinea semifulvella__. Great Ayton and Tollesby.
*__Incurvaria muscalella__. Flying plentiful in sun along hedges at Linthorpe in May. Kildale in June.
*__Harpipteryx xylostella__. Bred from Honeysuckle, Middlesbrough and Guisbrough.
*__Depressaria costosa__. Marske and Kildale.
*__Depressaria alstraemeriana__. Saltburn.
*__Depressaria angelicella__. Kildale.
*__Gelechia ericetella__. On heath Kildale and Swainby.
*__Gelechia dodecella__. Kildale.
*__Anacampsis ligulella__. Kildale.
*__Ceratophora rufescens__. Redcar.
*__Argyresthia spiniella__. Among Mountain Ash at Great Ayton and. Guisbrough.
*__Ornix anglicella__. Swainby.
*__Coleophora fabriciella__. Great Ayton, only one previous record in the Yorkshire list.
*__Coleophora albicosta__. Among Gorse at Eston in June, also at Kildale and Stokesley.
*__Coleophora laripennella__. Redcar.
*__Elachista rufocinerea__. Saltburn.

1907

For the most part of the spring and summer of this year the weather was cold, showery and sunless, June was exceptionally wet, there being over 3in. rainfall registered at Middlesbrough. The result of this was that insects were scarce and what occurred were

mostly exceptionally late; as evidence of the lateness of the season the dates on which the following species were noticed will give some idea:
Melanthia bicolorata, three specimens on October 5th; *Xylophasia monoglypha* at sugar on October 22nd and 25th; and two specimens of *Cosmia trapesina* on October 12th.
" Sallow" bloom in early April attracted a large number of the commoner *T. ceniocampidae* and also a few *Trachea piniperda,* and one or two specimens of *Triphosa dubitata.* " Sugaring" proved a complete failure.

NOCTUAE. Mamestra abjecta. One on sugar at Redcar in July, also several **M. albicolon**.
Celaena haworthii. A few dashing about on moor at Danby (very worn) on September 28th.
*__Cucullia verbasci.__ Larvae on Mullein in garden at Linthorpe.

GEOMETRAE. Selenia lunaria. Two or three specimens at Great Ayton in May.
*__Boarmia gemmaria__. Common in gardens all over district, comes freely to light. Some of the specimens quite dark.
Hybernia leucophearia var. marmorea. Took very nice specimens of this variety at Guisbrough in March.
*__Eupithecia innotata__. Specimen taken on banks at Redcar at end of June.

PYRALIDES. *Ebulea sambucalis. At Valerian flower in garden, also common at light.

PTEROPHORIDAE. Amblyptilia acanthodactyla. Danby at end of September.

TORTRICES. *Penthina dimidiana. Redcar.
*__Spilonota trimaculana__. Bred Middlesbrough district.
*__Capua favillaceana__. Among bracken near Great Ayton.
__*Stigmonota orobana.__ Staithes.
*__Dichrorampha plumbagana__. Redcar and Staithes.
*__Pyrodes rheediella__. Kildale.
*__Euprecilia angustana__. Staithes, Kildale and Glaisdale.

TINEA. *Tinea fuscipunctella. Linthorpe, Middlesbrough
*__Lampronia rubiella__. Eston.
*__Nemophora swammerdammella__. Great Ayton.
Adela ruflmitrella. Swept off grass plentiful near Ayton.
* __Adela viridella__. Kildale.
*__Swammerdammia cresiella__ and __var griseocapitella.__ Kildale.
*__Plutella porrectella__, On Valerian flower at Linthorpe.
*__Bryotropha politella__. Staithes.
*__Nannodia stipella var nreviferella__. Redcar.
*__Parasia metzneriella__. Sandsend.
*__Chelaria hubnerella__. Kildale.
*__Gracilaria alchimiella__. Great Ayton.
*__Gracilaria tringipennella__. Kildale.
*__Gracilaria syringella__. Common about Privet in garden in June.
*__Coleophora alcyonipennella__. Bred Saltburn.
*__Coleophora laricella__. Common among Larch at Great Ayton.
*__Coleophora fuscedinella__. Bred from Birch and Alder, Ayton and Middlesbrough.
*__Chauliodus chaerophyllellus__. Great Ayton.
*__Chrysoclysta aurifrintella__. Redcar.
*__Elachista cinereopunctella__. Kildale.

*__Tischeria complanella__. Great Ayton.
*__Lithocolletis faginella__. Kildale.
*__Lithocolletis corylifoliella__. Redcar.
*__Cemiostoma laburnella__. Common at Eston and Middlesbrough.

REPORT ON THE COLEOPTERA OBSERVED IN CLEVELAND.

BY M. LAWSON THOMPSON, F.E.S.

The following report on Beetles occurring in the Cleveland District consists chiefly of records made in the early part of last century by the late Rev. G. T. Rudd, M.A., and L. Rudd. Many of them may be found published in Stephens' "Manual of British Coleoptera (1839)." G. T. Rudd was Vicar of Sockburn and resided for a number of years at Worsall Hall, near Yarm. He died in London on March 4th, 1847, at the age of 52. He appears to have been a regular correspondent of Stephens, as may be seen by a reference both to the "Manual" and the "Illustrations of British Entomology" (Coleoptera) (1828).

The remaining notes refer to my own earlier observations, and those of my friend, the Rev. W. C. Hey, M.A., of West Ayton, near Scarborough, who has visited Redcar and Coatham marshes in former years.

COLEOPTERA.

Cychrus rostratus, L. At Saltburn; and in Arncliffe Woods, Glaisdale.
Carabus nitens, L. On Eston Nab (G. T. Rudd).
Carabus arvensis, F. On Stanghow Moor near Saltburn (May, 1893).
Notiophilus aquaticus, L. On Easby Moor.
Notiophilus palustris, Duft. On Stanghow Moor.
Nebria livida, F. Redcar (G. T. Rudd).
Elaphrus cupreus, Duft. Marton (L. Rudd); Saltburn.
Miscodera arctica. Payk. On Stanghow Moor under a stone. One specimen in July, 1891.
Acupalpus meridianus, L. Banks of the Tees (L. Rudd).
Bradycellus placidus, Gyl!. Banks of the Tees (L. Rudd).
Bradycellus distinctus, Dej. Saltburn, on the sea banks. One specimen in May, 1892.
Bradycellus harpalinus, Dej. On the sea banks at Saltburn.
Bradycellus collaris, Payk. On the moor at Kildale (August, 1903).
Dichirotrichus pubescens, Payk. Banks of the Tees. Common (G. T. Rudd).
Harpalus rubripes, Duft. Banks of the Tees (L. Rudd).
Pterostichus picimanus, Duft. Banks of the Tees (L. Rudd).
Amara aulica, Panz., **A. convexiuscula**, Marsh, and **A. tibialis**, Payk. Banks of the Tees (L. Rudd).
Calathus flavipes, Faure. Banks of the Tees (L. Rudd).
Calathus micropterus, Duft. In a plantation below Stanghow Moor; also at Glaisdale.
Calathus piceus, Marsh. At Kildale.
Anchomenus fuliginosus, Panz. In Arncliffe Wood, Glaisdale. Common.
Bembidium minimum, F. At Eston (W. Hey).
Bembidium affine, Steph. Marton (G. T. Rudd).
Bembidium anglicanum, Sharp, (Andreae, F.) and **B. paludosum**, Panz. Banks of the Tees (G. T. Rudd).
Trechus rubens, F. Saltburn, on the sea banks. One specimen in July, 1892.
Cymindis vaporariorum, L. Shores of the Tees. Six specimens in April, 1828 (L. Rudd).
Brychius elevatus, Panz. In the stream at Saltburn.
Haliplus obliquus, F. Marton (L. Rudd); Coatham Marshes (W. C. Hey).
Haliplus fulvus, F. Marton (L. Rudd).

Haliplus variegatus, Stm. Marton, rare (G. T. Rudd).
Haliplus rufficollis, Dc G. Redcar (W. C. Hey); Arncliffe Wood, Glaisdale.
Hyphydrus ovatus, L. Marton. Common the males in the proportion of five to one (L. Rudd).
Coelambus inrequalis, F. Maron, scarce (L. Rudd); Coatham Marshes.
Coelambus impressopunctatus, Sehal. (**picipes**, *F.)* Coatham Marshes. A single specimen :Mareb, 1887 (W. C. Hey).
Deronectus latus, Stcph. Marton Lodge (L. Rudd).
Deronectus depressus, F. Marton, common (L. Rudd); Coatham Marshes (W. C. Hey)..
Hydroporus pictus F.. Coatham Marshes (W. C.Hey); Marton (L. Rudd).
Hydroporus lineatus, L. Marton Lodge (L. Rudd).
Hydroporus incognitus, Sharp., **H. memnonius** Nic and **H. nigrita**, F. Common in Arncliffe Wood, Glaisdale.
Agabus nebulosus, Forst. Marton, not common (L. Rudd).
Agabus melanarius,. Aube (**tarsatus**, Zett). In a pool in Arncliffe Wood, Glaisdale. One specimen in September, 1894. A very rare insect.
Agabus bipustulatus, L. Coatham Marshes (W. C. Hey); Arncliffe Wood, Glaisdale.
Copelatus agilis, F.. Marton, 1828, in pools on the hills near Marton Lodge, but very scarce (L. Rudd).
Dytiscus punctulatus, F. Marton, 1829; not of very frequent occurrence (L. Rudd).
Acilius sulcatus, L. Coatham Marshes (W. C. Hey).
Gyrinus minutus, .F. Marton (L. Rudd).
Gyrinus urinator, Ill. Marton (G. T. Rudd).
Helophorus aquaticus, L., and **H. brevipalpis**, Bedel. At Redcar (W. C. Hey).
Helophorus dorsalis, Marsh. Marton Lodge: uncommon (L. Rudd).
Cyclonotum orbiculare, F. On the margin of a pond at Saltburn.
Sphreridium bipustulatum, F. At Redcar (W C. Hey).
Cercyon littoralis, Gyll., **C. unipunctatus**, L.; and **C. quisquilius**, L. At Redcar (W. C. Hey).
Cercyon haemorrhous, Gyll. On the margin of a pond at Saltburn.
Cryptopleurum atomarium, OL. Estan (W. Hey).
Aleochara fuscipes, F., **A. lanuginosa**, Grav., **A. nitida**, Grav., also var. bilineata, Gyk., and **A. morion**, Grav. All these species are found at Redcar. (W. C. Hey)
Callicerus obscurus, Grav. Stockton-an-Tees (G. T. Rudel).
Homalota vestita, Grav. Eston (W. Hey).
Homalota pilicornis, Th. In Saltburn Wood, under the bark of a rotting fir stump. One specimen early in October, 1893.
Homalota trinotata , Ier. Common in vegetable refuse at Saltburn.
Homalota serdida , Er. At Redcar (W. C. Hey).
Tachyusa constricta , Er. Yarm (G. T. Rudd).
Autalia rivularis , Grav. Common in vegetable refuse at Saltburn.
Encephalus complicans , West. Marton Lodge (G. T. Rudd).
Oligota inflate , Man. Common in vegetable refuse at Saltburn.
Myllrena kiraatzi , Shp., and **M. brevicornis**, Mat. By the streams in Grinkle Wood (1907).
Tachyporus hypnorum, F. At Redcar (W. C. Hey),
Tachinus proximus , Kr. In decaying fungi in a plantation just below Stanghow Moor. Two specimens in September, 1905.
Tachinus elongates , Gyll. Near Marton, very rare (L. Rudd).
Mycetoporus lepidus , Grav. On Stanghow Moor, near Saltburn.
Mycetoporus clavicornis , Steph., var., **forticornis**, Fauv. On the sandhills at Saltburn in September, 1907.
Quedius mesomelinus , Marsh, var. , **fageti**, Th. In Saltburn Wood.

Quedius mesomelinus , Marsh, and **Q. tristis**, Grav. At Redcar (W. C. Hey).
Ocypus olens , Mull., and **O. brunnipes**, F. At Redear (W. C. Hey).
Philonthus intermedius , Bois. In vegetable refuse at Saltburn. (July, 1907)
Philonthus reneus , Rossi, **P. politus**, F., **P. marginatus**, F., **P. sordidus**, Gr., **P. cruentatus**, Grnel., **P. varians**, Pk .. and **P. trossulus**, Nord. All these specimens are found at Redcar (W. C. Hey).
Philonthus debilis , Orav-. In a dead bird on the coast at Saltburn (1906).
Cafius fucicola , Curt. Redcar in profusion (G. T. Rudd, vide Steph., Ill., 1833).
Cafius xantholoma , Grav. Common at Redcar (W. C. Hey).
Xantholinus punctulatus , Pk. Redcar (W. C. Hey). Common at Saltburn.
Leptacinus batychrus , Gyll. Marton (G. T. Rudd).
Leptacinus linearis, Grav. In vegetable refuse at Saltburn.
Lathrobium brunnipes, F. Marton (G. T. Rudd).
Evaesthetus scaber, Grav. Marton (G. T. Rudd).
Stenus guttula , Mull. Marton (G. T. Rudd); Redcar (W. C. Hey).
Stenus providus , Er., var., **rogeri**, Kr. On Hutton Moor near Guisbrough.
Stenus crassus , Steph. At Saltburn (1892).
Stenus argus , Grav. Saltburn, at the roots of grass on the sea banks (1893).
Stenus subreneus , Er. Saltburn, on the sea banks (1892).
Stenu, rerosus , Er. In Arncliffe Wood, Glaisdale, on herbage (1894).
Bledius tricornis , Herbst. Redcar (G. T. Rudd, 1828, vide Ent-. August, 1878).
Bledius bicornis , Germ. Banks of the Tees (G. T. Rudd).
Bledius arenarius, Payk. Common along the shores of Tees (G. T. Rudd).
Platystethus arenarius , Faure. At Kildale.
Platystethus arenarius , Faure., and **P. cornutus**, Gyll. At Redcar (G. T. Rudd and W. C. Hey).
Homalium riparium , Thems. In decaying fish in Saltburn Wood (1894).
Phlreocharis subtilissima , Man. At Yarm (G. T. Rudd).
Silpha nigrita, Cr. Marton Lodge (G. T. Rudd).
Choleva morio , F. Saltburn, in a dead bird (May, 1892).
Choleva nigrita, Er. At Saltburn.
Euconnus denticornis , Mull. Marton Lodge (G. T. Rudd).
Eumicrus tarsatus, Mull. In vegetable refuse at Saltburn (July, 1907).
Euplectus sanguineus , Den. In vegetable refuse at Saltburn (July, 1907).
Trichopteryx grandicollis , Man. In vegetable refuse at Saltburn (July, 1907).
Hippodamia lb. Punctata , L. At Saltburn. One specimen in February, 1893.
Saprinus reneus , F. Shores of the Tees (W. C. Hey); also at Redcar.
Epurrea prusilla , Ill. In Kilton Wood, near Saltburn.
Soronia punctatissima , Ill. In Saltburn Wood. One specimen in August, 1894.
Corticaria umbilicata , Beck. Saltburn, on the sea banks (July, 1893).
Corticaria elongate , Gyll. At Kildale.
Melanophthalma fuscula, Mum. At Kildale.
Silvanus surinamensis , L. Common in a granary at Thornaby-on- Tees.
Cryptophagus distinguendus , Stm. Saltburn Wood, In decaying fungi (September, 1902).
Atomaria ruficornis , Marsh; One specimen at Saltburn in 1897.
Ephistemus gyrinoides, Marsh. Common in vegetable refuse at Saltburn**.**
Typhrea fumata , L. At Kildale.
Aspidiphorus orbiculatus , Gyll. At Marton (G. T. Rudd).
Heterocerus laevigatus, Panz. Marton (G. T. Rudd),
Aphodius scybalarius, F., **A. sordidus**, F. and **A. tristis**, Panz. On the Redcar Sandhills (W. C. Hey).
Elater balteatus, L. At Eston, 1907 (G. B. Walsh).

Limonius cyiindricus, Payk. Banks of the Tees near Yarm (G. T. Rudd).
Helodes minuta, L**.** At Kildale**.**
Cyphon pallidulus , Bob. Common on Stanghow Moor (July, 1907).
Toxotus meridianus , L. At Saltburn.
Donacia discolour , Panz. (**comari**, Suffr.). On Stanghow Moor in July, 1907.
Labidostomis tridentate , L. Roseberry Topping (G. T. Rudd, Steph., Man., p 307).
Lamprosoma concolor , Stm. In Saltburn Wood (June, 1907)).
Chrysomela marginata , L. Roseberry Topping (G. T. Rudd).
Phredon cochlearire , F. On the margin of a pond at Saltburn**.**
Lochmrea suturaiis , Th. Common on Stangow Moor near Saltburn, also Castleton and Kildale Moors.
Galerucella tenella , L. Common in a bog at Kildale.
Longitarsus suturellus, Duft., var., **fuscicollis**, Steph. Taken at Saltburn and Kildale.
Longitarsus jacobaex , Wat., and **L. gracilis**, Kuts. Common on Ragwort at Kildale.
Haltica ericeti , At Common on Stanghow Moor; Kildale Moor.
Aphthona nonstriata , Gceze. Common at Seamer, near Stokesley (June, 1907).
Cassida nobilis , L. Marton Lodge, very rare (L. Rudd).
Cassida flaveola, Thumb. At Kildale in September, 1907.
Melandrya caraboides, L. Near Middlesbrough.
Salpingus reratus , Muls. On Stanghow Moor, and at Saltburn (July, 1907).
Notoxus monoceros , L. Redcar, in profusion (G. T. Rudd, 1828).
Apion cruentatum , Walt. At Kildale in September, 1907 ..
Trachyphlceus alternans , Gyll. On the sea banks at Saltburn (July, 1907).
Ceuthorhynchus contractus , Marsh, and **C. quadridens** Pam;. Common at Redcar.

CLEVELAND NATURALISTS' FIELD CLUB

SECRETARY'S REPORT FOR 1906-7

In presenting to the Members of the Cleveland Naturalists' Field Club my NINTH ANNUAL REPORT, I have pleasure in stating that the season, generally speaking, has been a successful one, both Summer and Winter Meetings being on the whole fairly well attended; the attendance at the winter meetings being above the average. The membership is practically the same as last year, and there is, I consider, room for improvement in this respect.

SUMMER MEETINGS. Eight meetings were arranged for the Summer months (exclusive of Yorkshire Naturalists' Union Meetings,) and with one exception (Kirkleatham) the weather conditions prevailing were favourable. The meetings were held at the following places: "Saltburn Gill," "Slapestones" " Kirkleatham " (owing to unfavourable weather only seven members attended this meeting), "Stanley Grove, Ayton," "Mulgrave Woods," "Westerdale, via Basedale," "Raisdale," and "Saltscar, Redcar." The attendance was quite up to the average.

In nearly every case localities were visited that had not recently been investigated by the Society. We were specially favoured by permission from various owners given to our members to visit their estates; in no case was the Club met with a refusal.

I am pleased to acknowledge the great assistance I had from members and others in making arrangements and acting as guides at our meetings during the past year. The meetings were by this means more than usually interesting.

The following assisted in making the arrangements and acted as guides to some of our meetings :-Rev. J. Cowley Fowler, B.A., F.G.S., Messrs. T. J. Cozens, H. Frankland, H. T. Hallimond, S. H. Harries and J. W. R. Punch.

On the occasion of the Westerdale Meeting Mr. and Mrs. C. Hood kindly entertained the party to tea.

A special meeting was held to investigate the Marine Fauna on Saltscar Rocks, Redcar, in September, when the President (Mr. H. Simpson) made the arrangements and acted as guide. The meeting was a successful one in every way. At the conclusion the President hospitably entertained the party to luncheon at Redcar.

Permission was granted to visit estates belonging to the Marquis of Normanby, The Earl of Zetland, Messrs W. H. A. Wharton, Newcomen and Lowther. Your thanks are also due to Mr. Wynne Finch, for permission to visit his property at " Stanley Grove," and also for placing a workman at our disposal to assist in the " hunt" for "iron pan."

A Yorkshire Naturalists' Union Meeting was held at Guisborough in August, and was in every way successful. Mr. J. J. Burton as local secretary for the meeting, and others of our members assisted in the arrangements. About fifteen of our members attended the meeting.

WINTER MEETINGS. Since the last Annual Meeting Eight Winter Meetings have been held; this series being one of the most successful we have had. With one exception (the Y.N.U. Lecture by Mr. Bayford) the whole of the papers have been given or the arrangements made by our own members.

The attendance, with one or two exceptions, was good, the Saturday evening meetings especially being well attended. The papers read were as follows: "A Chat about Beetles," by Mr. E. G. Bayford, this being a Y.N .U. Lecture; "Smuggling days at Marsh," by the Rev. F. Grant James. A most interesting and amusing paper; "Among wild plants in Teesdale," by Mr. J. T. Cozens, with lantern illustrations. "Colour," by Mr. Geo. B. Walsh. B.Sc. iIlustrated by experiments and sketches; "The Origin of the Cleveland. Moors," by Mr. Frank Elgee, illustrated by maps, sketches, and specimens. Mr. Elgee has had this paper printed. "History of Middlesbrough," by T. A. Lofthouse, illustrated by plans, sketches and photographs. .

Two microscope and exhibition meetings were held, our President kindly arranged these, and provided some of the interesting exhibits. Many of our members lent, microscopes and slides. Exhibits were made by Messrs. M. L. Thompson, Whiteley, Dodson, Frank Elgee, Saunders, Lane, Harrison and Lofthouse.

The meetings with two exceptions have been held in the rooms of the Cleveland Literary and Philosophical Society, and the Club are again indebted to them for placing rooms at our disposal.

Two of the meetings were held in the Dorman Museum kindly placed at the disposal of the Club.

By permission of the Lit. and Phil. and by invitation of the Lecturer, members had the privilege of attending a Lecture on the " Isles of Greece," delivered bv Mr. W. H. Thomas.

Our thanks are due to Mr. F. W. Pearson for kindly working the lantern at two of the above meetings.

We have several microscopists connected with the Society, and probably others will join if a short series of demonstrations or lecturettes on practical microscopy could be arranged for during the winter months, certain members being responsible for the subject on each evening. I should be glad if the microscopy sectional committee would take the matter up. I do not think there is any question as to its ultimate success, and it, no doubt, would stimulate work in branches of the local Fauna and Flora that have hitherto been neglected.

MEMBERSHIP. The membership now stands at 105. The following new members have been elected since the last Annual Meeting, Messrs. Arthur Appleyard, T. Brayshay, H. F. Dodson, William Hudson, J. W. H. Harrison, B.Sc., T. W. Saunder, and Geo. B. Walsh, B.Sc.

PROCEEDINGS. At present the Society's income only allows of the Proceedings being published once in two years. If our membership could be materially increased or a larger sale ensured for our Proceedings we might be able to publish proceedings annually instead of bi-annually. There is a good deal of material available at present and I do not anticipate that there would be any difficulty in obtaining suitable local matter of interest to enable us to publish annually, besides local papers that have been read at our Winter Meetings that are suitable for publication. We have the promise of a valuable geological section through the Cleveland Ironstone district with notes thereon, by Mr. F. W. Allison. Paper such as these we should be in a position to publish at once to ensure the matter not being published out of the district.

There are a large number of back Proceedings (which include many valuable local papers) in the hands of the Society, the full set of Vol. I**,** in parts, may be obtained at 5s., this is :13 per cent less than the published price. We shall be glad if members who have not complete sets would complete, and also if they would induce any interested in local records to purchase them.

LIBRARY. The following works have been added to the small library during the past year. Hull Society's Proceedings Vol. III**,** part 4; Y.N.U. Transactions, parts 31 and 33; Baker's North Yorkshire; Yorkshire Geological Society's Transactions for 1906, The Naturalist for 1906, and Report -of the Bradford Natural History Society.

SECRETARY'S REPORT FOR 1907-8

In presenting to the Society my Tenth Annual Report I have pleasure in stating that the season generally speaking, has been quite as successful as any previous season in the Club'S existence. The Summer Meetings arranged were held with one exception, more than the usual number of Winter Meetings were held and the papers presented were equal to, if not in advance of, what we have had in previous sessions. During the past year another part of our proceedings was published, and the Membership shows a slight increase over last year.

SUMMER MEETINGS-The programme arranged for the Summer months provided for eight meetings (exclusive of Y.N.U. Meetings) and with one exception (Boosbeck-Aysdale Gate which was abandoned owing to very unfavourable weather) the meetings were all held; the weather conditions at the Seamer and Harlsey meetings were,

however, anything but favourable, and prevented any satisfactory investigation being made.

Meetings were held at Great Ayton, when Easby and Kildale were visited; Stokesley to Seamer; Hart when the sea banks between Hart and Blackhall were investigated and the rich characteristic limestone flora noticed; Staithes to Runswick; Marske to Saltburn along the banks, where many interesting plants were noticed; Egton Bridge, and Harlsey.

I have again to acknowledge with thanks valuable assistance I have received in making arrangements for many of the meetings from members and friends, which have made the meetings much more enjoyable and profitable.

At the Stokesley-Seamer meeting Messrs. Cozens and Elgee acted as guides, and Mr. Frank Elgee contributed to the circular for the meeting an interesting resume of objects of interest to be observed. Mr. John Gardner, F.E.S., of Hartlepool, acted as guide to the Hart Meeting, and Mr. T. W. Saunders at the Staithes-Runswick Meeting. Mr. Simpson piloted the party at the Marske to Saltburn Meeting and thanks are also due to Mr. and Mrs. Monk who kindly provided tea for the party on arrival at Saltburn. Mr. Frank Elgee provided notes on the geological features to be noticed at the Egton meeting and also attended the meeting and acted as guide. At the Harlsey meeting the Rev. C. V. Collier, M.A., F.S.A., gave the party a short description of the various objects of interest in Harlsey Church, and also pointed out various objects of archaeological interest in the immediate neighbourhood. The Rev. and Mrs. Collier kindly entertained the members to tea.

Permission was granted to visit estates belonging to J. J. Emmerson, Esq., R. B. Turton, Esq., W. H. A. Wharton, Esq., Sir B. Samuelson & Co., Ld., and Joseph Constantine, Esq., and the thanks of the Club are due to them for the privileges kindly granted.

The only Y.N.U. Meeting held in the district was at Robin Hoods Bay at Whitsuntide. It proved very interesting to those who spent the week end in the district, but to some others who essayed to visit it on the Whit Monday it will be remembered more for the rapid railway journey than anything else, members leaving Middlesbrough at 9-30, arriving at Robin Hood's Bay at 5-30, returning again at about 8-30 and arriving in Middlesbrough between one and two o' clock next morning, surely an event to be remembered.

WINTER MEETINGS-Since the last Annual Meeting 15 Winter Meetings have been held, this being the longest series ever held in a season since the Club was formed; with three exceptions the papers have been given by members of the Club, and have been more than usually interesting.

The attendance at the meetings on the whole has been fairly satisfactory, especially at the Saturday meetings.

The first meeting was a MICROSCOPIC AND EXHIBITION MEETING, at which Mr. Simpson undertook the arrangements, and he had the assistance of Mr. Stephens and others of our members, many of whom lent Microscopes. Natural History objects were exhibited by Messrs. Lawson Thompson, Frank Elgee, and T. A. Lofthouse.

At the following meetings papers were read and demonstrations given by Mr. G. B. Walsh, B.Sc., on the "Atomic Theory," and "Flame"; Mr. J. Percy Hodges on " Diatoms," with microscopic demonstrations; Mr. Frank Elgee on "Shells," and the "Marine Fauna

and Terrestrial Fauna" past and present, of Cleveland (2 lectures), illustrated by diagrams, specimens, etc.; "Microscope mounting" demonstration, by Mr. Bertram Cockburn, of Redcar, "Bats, their structure and senses," illustrated by lantern slides, a Y.N.U. Lecture by Mr. Arthur Whitaker, of Barnsley; "The Royal Arms," illustrated by lantern slides, by the Rev. C. V. Collier, M.A., F.S.A., Vice-President of our Society; "Nature's Marvels," by Mr. T. J. Cozens, B.Sc., F.C.S. ; "Some Notes, chiefly Geological, respecting the origin of Natural Scenery," (illustrated by lantern slides), by the President, Mr. J. J. Burton; "The Ancient Citadels and Temples of Greece," by Mr. W. H. Thomas; "The Beauties of the Insect World as revealed by the Microscope," by Mr. Henry Hall, illustrated by lantern slides, by arrangement with the Manchester Microscopical Society, and "Seaweeds as Food," illustrated by lantern slides, by Mr. H. Simpson, Vice-President.

The meetings with three exceptions have been held in the rooms of the Cleveland Literary and Philosophical Society, and the Club are again indebted to them for placing rooms at our disposal. Three of the meetings were held in the Dorman Museum kindly placed at the disposal of the Club by the authorities.

Our thanks are again due to Mr. F. W. Pearson for kindly working the lantern at our meetings.

The Club's thanks are due to our members for so kindly coming forward and giving papers at our meetings during the Winter Season, two or three offers of papers we have not been able to avail ourselves of, but these will, no doubt, be taken advantage of for next Session.

MEMBERSHIP.-The Membership now stands at 109. The following new members have been elected since the last Annual Meeting -Miss Appleyard, Mr. Jos. Constantine, Dr. W. J. Fordham, Messrs. Geo. Knight, Harold A. Scruton, B.Sc., Herbert and Fred Outhwaite and Mr. and Mrs. Benham.

During the year the Society lost two members by death, the Rev. F. Grant James, Vicar of Marske and a Vice-President of the Club at the time. Many members of the Club will remember with pleasure the two occasions on which he gave most interesting papers to the Club on the "Ancient Worthies of Marske," and on "Smuggling Days at Marske," both papers that would be well worth printing in our Proceedings, if it is possible to obtain the manuscript. He would have liked to have taken a more active part in the Club's work, but was prevented owing to his time being very much taken up with his Parish Work. By his decease the Club lost a most valuable member. A vote of condolence was passed with his widow at the meeting held at Ayton in May, and a letter of acknowledgment and thanks was received from Mrs. Grant James.

Mr. Jno. Garbutt, of Loftus, the other member who passed away early this year was a member who generally attended the meetings in the Loftus district, and was always willing to assist in making arrangements and act as guide to our members when in his locality. Only a few days before his death I received a bird skin (a Bramble Finch) from him that he wanted identifying.

PROCEEDINGS. During the past year Proceedings for the year 1905-6 (Vol. II**,** part 2) have been published and issued to members. The number is well up to the average both as regards size, illustration, and value of the papers contributed.

Blocks for illustrating the Rev. J. Hawell's paper in it were kindly lent by Mr. J. W. Brotton, of Battersby. The Club is indebted to the Rev. J. Cowley Fowler, Mr. H. Simpson and others for seeing the above through the printer's hands.

Papers should have been got together for another part of the Proceedings before this but I have been much too busy to attend to it. In my opinion any quantity of suitable material could be got together for printing, amongst it being the local records and references contained in many papers delivered to the Society's Meetings at various times, namely the Rev. Grant James' " Marske Worthies," and "Smugging Days at Marske," and other local notes collected by him, "Cleveland, its Geology and Scenery," by Mr. J. S. Calvert: “Origin of the Cleveland Moors," and "Cleveland Fauna, Past and Present," by Mr. Frank Elgee; "Historic Middlesbrough." by the late R. Lofthouse; Mr. Burton " Notes on origin of Natural Scenery" (local part); "Seaweeds" by Mr. Simpson; "Insect Notes, Coleoptera, Lepidoptera, &;."

I regret to say that our Proceedings seem to have a very small sale, and that they do not seem to be made widely known by our members.

LIBRARY. -The following works have been added to the Society's small Library during the past year, Hull Society's Proceedings for 1907; The Naturalist for 1906; and the Yorkshire Geological Society's 'Transactions’ for 1907.

GENERALLY. -Our meetings have been frequently reported in the local press, and our thanks for this are due to the Editor of the "North Eastern Gazette," the "Northern Echo," and the "North Star." Our thanks are also due to the N.E.R. for kindly granting members special privileges for travelling at reduced fares and also for specially stopping trains at non-stop stations for two of our Meetings.
My thanks are due to members for kind assistance in making arrangements for meetings, and the Club's thanks are especially due to those who have given papers and acted as guides at our meetings. I personally am very much indebted to the great assistance rendered me by Mr. Frank Elgee as Assistant Secretary, and also to Mr. H. Simpson who has seen to the reporting of many of the meetings, and has also assisted me very much in connection with meetings where Microscopes were required.

In concluding my final report it will probably interest members to know that the Club since formed as the Cleveland Naturalists' Field Club has been in existence 27 years, and of this period I have now been Secretary for the past 10 years. When formed the Society had 72 members; when I took up the position of Secretary it had about 65, now the membership is 109, and with a more active Secretary I am quite sure this number should be considerably increased. During the past years the number of Winter Meetings has increased year by year, and in the past season 15 Winter Meetings have been held, this being a record for the Club. During the time I have been Secretary 1 Volume (consisting of 5 parts) of the Proceedings has been completed and 2 parts of Volume II published.

CONDITIONS AND ADVANTAGES OF MEMBERSHIP.
MEMBERSHIP. -The Terms of Membership are the subscription of an annual sum of not less than 5s. Members receive the Proceedings, copies of all Circulars for Summer and Winter Meetings, Associate Card of Membership of the Yorkshire Naturalists Union, have access to the Society's small Library, and also the privilege granted by the N.E.R. for travelling at reduced rates at excursions.
WINTER MEETINGS. -A Series of Meetings are held during the Winter monlhs, particulars of which are sent out in the Autumn. The Secretary will be glad to hear from Members willing to give papers.

THE LIBRARY, which consists of works on Science, Natural History and Archaeology, is placed (on loan) in a case in the Dorman Museum, and is accessible to Members on application to the Hon. Librarian, Mr Baker Hudson. Donations of works on the above subjects, especially those relating to Cleveland, are at all times acceptable.
HAWELL BEQUEST. -Under the will of the late Rev. J. Hawell, M.A., F.G.S., Members have the special use of the Library of geological, conchological, and other works, as well as access to the large and valuable collections of Mollusca and Fossils bequeathed by him for the benefit of the Cleveland Naturalist's Field Club and the Dorman Museum. These may be inspected at any time by Members at the Museum, on application lo the Curator or his assistant.

Any persons interested in the work of our Society are invited to become Members, even if they are not able to be active Members. Their support would be valuable and would also show that the work of the Society was not altogether unappreciated.