

The business of the Annual Meeting having been completed, the Meeting resolved itself into an Ordinary one.

The newly-elected President, H. M. ORMEROD, F.G.S., took the chair, thanked the members for his election, and promised to fulfil the position to the best of his ability.

NEW MEMBERS.

The following gentlemen were unanimously elected ordinary members of the Society, viz. :—

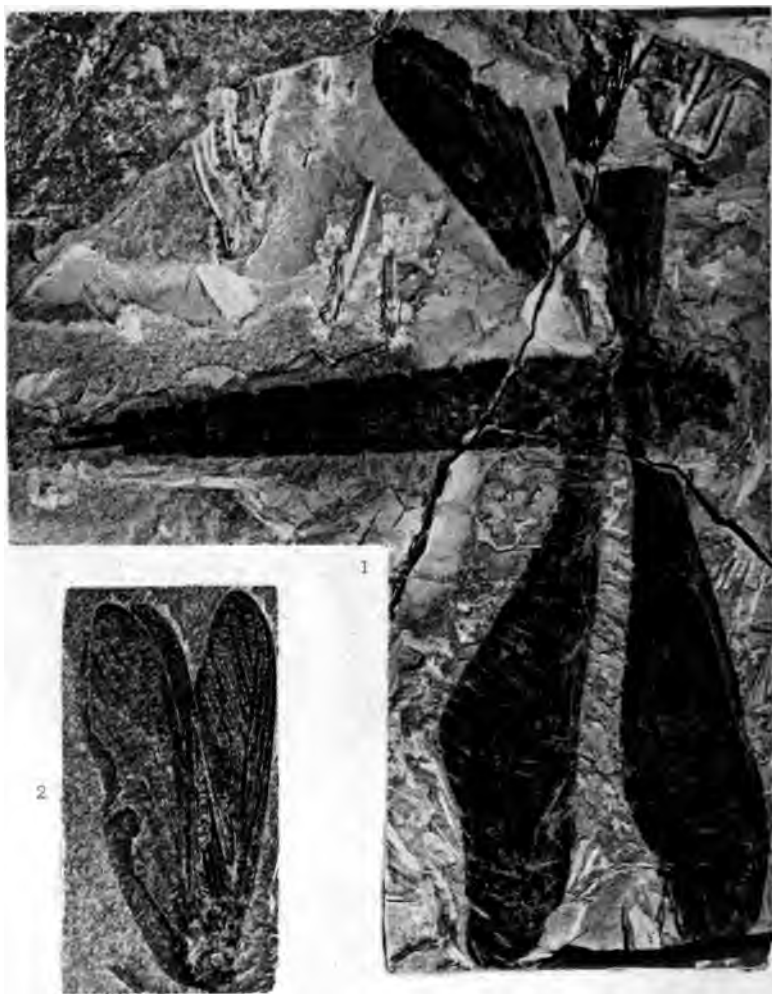
JOHN TURTON, jun., one of H.M.'s Inspectors of Mines,
Bolton.

CRISPIN DUGDALE, Clough Fold, Rossendale.

THE PALÆOZOIC INSECT FAUNA.

Mr. MARK STIRRUP presented a translation which he had made of a communication received from M. Charles Brongniart, of Paris: "On the Fossil Insects of the Primary Group of Rocks: a rapid Survey of the Entomological Fauna of the Palæozoic Systems." In introducing the subject, Mr. Stirrup said that M. Brongniart was some few years ago elected an honorary and corresponding member of the Society, and although he might be unknown personally, he was, no doubt, known to most of the members as the inheritor of a distinguished name in the annals of science. This paper was received from him in the month of July, during the recess. It was upon a subject in which, for some years, the author had taken a deep interest. It was only in recent years that the presence of the remains of insects in the palæozoic rocks had been revealed. In 1867 Mr. Scudder

an American author, described some insects in the Devonian rocks of New Brunswick. That, he (Mr. Stirrup) believed, was the first intimation we had of insects having been found in these primary rocks. Up to the year 1882, 110 specimens only had been found in the whole of the coal strata of the world. These were confined to Germany, America, and France. The first specimens in France were found at Saint Etienne, and the majority of them were comprised in the group Blattidæ, which was represented in our fauna by the familiar cockroach, or black beetle, the remainder, numbering 100 or more insects, belonged to various other orders. The number of species found, had been of recent years continually increasing, principally from the rocks of the United States and of France. Many would ask, Why there has been found such a large number, for instance, in France, and none in our own country? The reason, he believed, was that at Commentry, in France, where such a large number had been discovered, several of the pits were worked in the open daylight—in surface workings; the men were thus able to see readily the fossil impressions in the shale; and, what was, perhaps, more fortunate, there happened to be at the mines at Commentry an engineer, M. Fayol, who took a special interest in looking after these insect remains. In England, no doubt, it would be more difficult to examine the shales of our coal pits, which were often in long galleries under ground. Possibly, however, if insect remains were looked for on the waste heaps lying on the surface, searchers might be rewarded by finding some of those impressions which had been found so plentifully in France. He would also draw attention to the fact, mentioned by the author, that many of the insects described, differed very little from those existing at the present day. It was worthy of notice that, whilst creatures belonging to the higher orders of



1 - WOODWARDIA NIGRA 2 - CALONEURA BANSONII

imal life, such as reptiles, fishes, &c., of which examples
 d been found in the coal measures, the species then
 presented were now entirely extinct, while we are able
 group with living forms, many of the insects which lived
 the carboniferous period. Mr. Stirrup then read M.
 ongniard's communication, which was as follows:—

THE FOSSIL INSECTS OF THE PRIMARY GROUP OF
 ROCKS: A RAPID SURVEY OF THE ENTOMOLOGICAL
 FAUNA OF THE PALÆOZOIC SYSTEMS.

By Mr. CHARLES BRONGNIART, of Paris,

Lecturer and Corresponding Member of the Manchester Geological Society.

(Translated by Mark Stirrup, F.G.S., Hon. Sec.)

(Received July 17th, 1885.)

The fossil insects of palæozoic times are not yet well
 known, in consequence of the small number of specimens
 which have been discovered in the different carboniferous
 deposits of the globe.

Moreover, these specimens are usually imperfect, and
 authors generally have had at their disposal only fragments
 of wings, the soft parts of the body having probably rotted
 away, leaving no traces upon the schistose rocks.

The rarity and the bad state of preservation of the speci-
 mens are the principal causes of so few naturalists taking
 the study of the fossil hexapods.

The important discoveries, however, made since 1878, in
 the mines of Commentry (Allier)—thanks to the devotion
 of the enlightened director of these mines, Mr. Henry
 de la Roche—have resulted in giving us more exact notions of
 the entomological fauna of the epoch of the coal deposit.

Whilst in Europe and North America there have been

described only about 120 examples, at Commeny, since 1878, 1300 have been met with, of which the greater part is admirably preserved. While up to the time of these discoveries no idea of the form of the body of these coal insects could be given, I am now in a position to make known the external anatomical details of the bodies of these witnesses of bygone ages.

The wings of insects furnish valuable information to aid in their determination, but one must not always rely solely on their form and venation, for it would often risk the commission of grave errors.

It is necessary, as much as possible, to take into account the characters of the body. Many authors, having had at their command only wings, or fragments of wings, have sometimes been deceived in their determinations. Moreover, it has been too long thought possible that the divisions created to classify living insects could be made to include the insects of the old formations.

It is curious to find how little the insects have changed, to see these creatures, which are reckoned among the most ancient, undergoing modifications of only a secondary order, in coming down to the present time.

Nevertheless, there is more homogeneity among the primary hexapods than this group presents to-day, but there is nothing in that which need astonish us.

The insects which are found in the palæozoic schists belong to types represented at the present day by the Orthoptera, the Neuroptera and the Hemiptera.

Some authors have reported the discovery of Coleoptera; but these so-called Coleoptera are but in reality fossil fruits or Arachnida.

I have, myself, referred to Coleoptera, the perforations found in some fossil woods; but if that were so, the Coleop-

classification from the indications mentioned previously. In fact, it would be compulsory to sunder from one another the Neuroptera (Planipennes and Trichoptera) from the Orthoptera pseudo-Neuroptera, insects, in reality very closely allied. For analogous reasons, one is obliged to abandon the division into Mandibulata and Haustellata groups.

In 1863, Packard proposed to create two series among the insects: the METABOLA and the HETEROMETABOLA. In this latter group he ranges the Coleoptera, Orthoptera, Neuroptera, and the Hemiptera, and bringing into the first group the Hymenoptera, Diptera, and the Lepidoptera.

Samuel H. Scudder had the same idea in this respect as Packard; he created the names of Sternoptena (Metabola of Packard) and of Gastroptena (Heterometabola of Packard.)

But the terms employed by Packard, seemed to him better fitted for general use, and he has adopted them.

Packard and Scudder starting from the principle that the more an Arthropod has the three regions of the body (head, thorax, and abdomen) clearly distinct the one from the other, the more it is raised in organisation, it is among the Hexapoda that this character is most prominent. The Myriopoda, on the contrary, being the most degraded in consequence of the great number of segments of which the body is composed. The higher Crustacea and the Arachnida are intermediate examples, for the head and the thorax are united, and form the Cephalothorax. Among insects the component parts of the thorax are more or less united together among themselves, and those will be the types, whose thoracic segments are the most united, and consequently, whose organs of flight are the most nearly connected, that will be considered as the most perfect.

The METABOLA are precisely the hexapoda which present this perfection in the highest degree. They form unquestionably a more homogeneous section than the HETERO-

METABOLA, and are, moreover, of more recent appearance on the surface of the globe.

Let us then state shortly the principal characters of these two great groups of insects, such as Packard and Scudder have described them :—

METABOLA.

Body clearly divided into three very distinct parts (head thorax, abdomen), the three segments of the thorax closely united together.

Component pieces of the mouth arranged, as a whole or in part, for suction.

Mandibles rarely opposed one to the other.

Anterior wings membranaceous and much larger than the posterior, which are sometimes rudimentary.

Larva generally soft, not resembling the adult.

Pupa always inactive.

Complete metamorphosis

Lepidoptera — Diptera — Hymenoptera.

It will be remarked that I have omitted to mention the Coleoptera, which Scudder places among the Heterometabola; but, in my opinion, the Coleoptera form an intermediate group, or are, at least, among the Heterometabola, in course of progression towards the Metabola.

HETEROMETABOLA.

Body divided into three parts; the three segments of the thorax are very distinct.

Mouth arranged generally for grinding, rarely for sucking.

Mandibles opposed one to the other.

Anterior wings more or less coriaceous, with very numerous and strong nervures, generally longer and straighter than the posterior wings, or equal to them.

Larva most frequently resembling the adult.

Pupa active or inactive.

Metamorphosis most frequently incomplete.

Hemiptera — Neuroptera — Orthoptera

In the primary systems the presence of Coleoptera is, as I have said, very problematical, and the orders, whose existence has been proved, all belong to the great section of the Heterometabola. The classification of Packard and of Scudder is therefore that which agrees the best with the data of palæontology, of embryology, and of morphology.

We proceed now to pass in review the Heterometabola found in the Palæozoic formations, showing the relationships which they offer to the present fauna.

SILURIAN SYSTEM.

An insect has been found this year in the sandstone of Jurques (Calvados) analogous to the May Hill sandstone belonging to the Middle Silurian. Some days previously M. Lindström announced the discovery of a scorpion (*Palæophoneus nuncius*) in the Upper Silurian of the island of Gothland. Almost at the same time a second scorpion was discovered in Scotland in similar deposits.* The impression on the Jurques sandstone consists of a wing whose neuration recalls that of certain Orthoptera of the families of the Acrididæ, Locustidæ, and especially of the Blattidæ.

That which is very remarkable, and which distinguishes this impression from all the wings of living or fossil Blattæ, is the length of the anal nervure and the small width of the axillary field. Pending new discoveries which shall enlighten us concerning the zoological affinities of this fossil, we have placed it in the family of the Blattidæ, under the name of *Palæoblattina Douvillei*.

* M. Brongniart writes to me under date 4th August, 1885, as follows:—
“Mr. Scudder has just written to me saying that a Scorpion has recently been found in the United States, in Silurian rocks, analogous to those of Gothland and Scotland, where the two first examples were found.”—M. S.

DEVONIAN SYSTEM.

Several remains of wings have been found in the Devonian schists of New Brunswick; they have been studied with care by Mr. Scudder, who has referred them to the Neuroptera or to the Orthoptera pseudo-Neuroptera.

The estimate of the affinities of these insects is very difficult, and Mr. Hagen has blamed Mr. Scudder for being mistaken in his determinations. Without wishing to impair the importance of the excellent work of Mr. Scudder, we consider that this naturalist has been a little too hasty in his conclusions, and that his determinations are at least a little risky, having regard to the bad state of preservation of his material. Nevertheless, Mr. Hagen has, in our opinion, wandered much further from the truth than Mr. Scudder.

1. *Gerephemera simplex*.

Scudder, who had created the family of the ATOCINA for this fossil imprint, has brought it into my group of the PROTOPHASMIDA.

Is it right or wrong? It seems impossible to say, for it appears to me difficult to form a correct opinion from so small a fragment. This wing must have belonged to a large insect; it was about 6 centimètres long. The wing was rather elongated, and the nervures were united by a rather loose reticulation.

2. *Platephemera antiqua*.

It is with reason that Scudder had placed this wing in the family of the *Ephemeridæ*; Hagen is mistaken in wishing to refer it to an *Odonata*. This wing reminds one much of that of the *Palingenia virgo*; but the fossil is seven times larger than the latter.

3. *Lithentomum Hartii*.

The remains of wing thus called by Scudder is considered by that author as belonging to a neuropterous insect of the

group of the *Sialina*. He creates for it the family of the *Cronicosialina*.

So much trouble appears to me useless, the specimen not being, in my opinion, sufficiently well preserved, to permit the appraising of the characters of this fossil.

4. *Homothetus fossilis*.

The wing that Scudder describes under this name presents characters common to the Neuroptera and the Orthoptera. He creates the family of the HOMOTHETIDÆ for it.

I have been able to compare the figure given by Scudder with some insects from Commeny, and am convinced that this type is near to the *Ephemeridæ* (genus *Ephemera* and *Potamanthus*).

5. *Dyscritus vetustus*.

In spite of the smallness of the fragment represented, it ought, in my opinion, to be classed in the same family (*Ephemeridæ* or *Homothetidæ*).

6. *Xenoneura antiquorum*.

The imprint which the author describes is curious, because it presents at the base of the wing some stricæ, which have induced a belief in an apparatus of stridulation.

Scudder having regard to the absence of reticulation between the widely separated nervures, thinks that this insect forms a special and extinct family in the order of the Neuroptera.

I am much of the opinion of Scudder with respect to all these Devonian imprints; but I believe that in the present state of our knowledge it is impossible to be quite certain; we must wait further discoveries. Nevertheless, if Mr. Scudder's opinions are to be accepted, one must believe that the Neuroptera, the Neurorthoptera, and Orthoptera pseudo-Neuroptera were already in existence during the Devonian epoch.

CARBONIFEROUS SYSTEM.

It is in this system that we begin to find a pretty large variety of insects, and, thanks to the fine discoveries made at Commentry, we are able to establish a little order in this very interesting subject of the Palæozoic Hexapoda.

The number of works published on these insects is already considerable, and we owe much to Messrs. Germar, Goldenberg, Geinitz, Sterzel, Van Beneden, Dana, Lacoe, Woodward, Andree, Goss, and, above all, to Scudder, for having studied with patience and perseverance the materials that they have had in their hands.

But, seeing the number, relatively small, of the remains that they have made known, it has been very difficult for them to give a comprehensive view of the entomological fauna of these ancient times.

This task has been for me an easier one, seeing that I have had at my disposal a series of fine and numerous specimens.

I am therefore about to sketch a sort of *PRODROMUS OF A FAUNA OF THE HEXAPODA OF THE COAL EPOCH.*

1. *Orthoptera.*

Claus places the Thysanura among the Orthoptera; they are generally considered as being primordial types of insects. No author has described them as occurring in the system with which we are now engaged. Nevertheless they existed as early as the carboniferous period, for 45 specimens have been found at Commentry.

It is difficult to see the number of the joints of the legs, of the palpi and of the antennæ; but these organs can be discerned upon several specimens.

The body is cylindrical, becoming thinner at the posterior part, and terminated by a many articulated filament as long as the body.

The antennæ and the legs are thick and short, the head

appears pretty large. The pro-thorax is very narrow, and the meso-thorax and the meta-thorax are co-equal and much longer than the pro-thorax.

The segments of the abdomen are ten in number and equal in size, the last only is a little longer.

It appears to me that upon one of the specimens, some abdominal plates are seen, as have been observed on the *Machilis*.

The whole of the body (antennæ, legs, thorax, abdomen) is covered with very numerous and very short hairs. The body with the abdominal filament varies in length between 15 and 22 millimètres.

This insect resembles the *Lepisma* and the *Machilis*. It differs from them in several characters, but the principal difference consists in the presence of a single abdominal filament in the fossil species. I shall designate this ancestor of the living Thysanura by the name of *Dasyleptus Lucasi*, dedicating it to Mr. H. Lucas, of the Museum of Paris.

Among the Orthoptera a great number of Blattæ or o PALÆOBLATTARIÆ (Scudder) have been described, and Mr. Scudder has classed them in several groups. He has made a special study of them, therefore I shall not speak of them here.

Goldenberg has named *Fulgorina Klieveri* a wing which must have belonged to a large Blattida; we shall designate it by the name of *Megablattina Klieveri*.

Another family of Orthoptera was pretty well represented, which I shall call PALÆACRIDIODEA. A first group contains many genera; the *Oedischia* (mihi), of which the third pair of legs resembles those of living locusts. The *Sthenaropoda*, near allies of the *Oedischia*, but whose legs are thicker and shorter, and less fitted for leaping.

The genus *Protogryllacris* (mihi), represented by an insect called *Corydalis*, then *Gryllacris*, and afterwards *Lithosiakis*

Brongniarti by Scudder. The name of *Lithosialis* ought to be changed in order to show that this insect did not resemble the *Sialis*.

A fourth genus, *Paolia* (Scudder), including many species, should come in this first group.

The second group contains three genera :

The *Sthenarocera* (mihi), insects with strong and long antennæ, body short and thick, long legs, and long and narrow wings, recalling somewhat those of the *Pachytylus*.

These insects do not measure less than 11 centimètres from the anterior part of the head to the extremity of the wings, when the latter are folded upon the back.

The *Caloneura* (mihi) (Plate, fig. 2) are near akin to the foregoing ; but the legs and the antennæ are more slender, the wings are shorter and not so narrow ; the nervures are admirably surrounded by coloured bands.

The *Macrophlebium Hollebeni* of Goldenberg goes into this family for the present.

All these insects may be regarded as the ancestral type of the Orthoptera (Saltatoria) jumpers of the present day.

I shall form the order of the NEURORTHOPTERA, which will include two sub-orders—that of *Neurorthoptera* properly so called, and that of *Palæodictyoptera* (Goldenberg).

The first sub-order will comprise—

1. The family of the *Protophasmida* (mihi), represented by the genera *Protophasma* (mihi) *Lithophasma*, which I create for a wing figured by Goldenberg under the name of *Gryllacris Lithantraca*, and which afterwards Scudder had placed in the genus *Lithosialis*; lastly, the genus *Titanophasma* (mihi), of which the body only is known to us, a gigantic body measuring 28 centimètres in length ; also the genus *Archegogryllus* (*A. priscus*. Scudder).

2. The family of the *Sthenaropterida*, which includes the *Meganeura Monyi*, a wing measuring 33 centimètres in

length—I had named it *Dictyoneura Monyi*; the *Archæoptilus ingens* (Scudder), and *A. Lucasi* (mihi), wings which must have attained 25 to 30 centimètres in length.

Then the *Megathentomum pustulatum* of Goldenberg will take its place in this family; two insects that Goldenberg had named *Acridites formosus* and *A. carbonatus* will also come into the genus *Megathentomum*.

In this first sub-order of the Neurorthoptera I have placed some insects of large size, whose wings have strong nervures united by a rather loose reticulation, insects which have some likeness to our living Phasmians by the form of the body, but which are much removed from them by the neuration. We must consider the Phasmians as much modified descendants of these ancient types.

The second sub-order has been created by Goldenberg, and has been adopted by other authors. This savant, nevertheless, had elevated it to the rank of an order. It contains a series of insects of rather large size, which seem to have completely disappeared from our present fauna.

The first family, that of the *Stenodictyopterida* is composed of insects which have a thick and short, but broad body, strong legs of moderate length.

But that which rightly characterises them, and makes of them a sufficiently homogeneous group is the reticulation of the wings. The latter are elongate, rather narrow, traversed by rather straight nervures united by a very regular network of great fineness, reminding one a little of the network of the wings of our living Odonates.

This family contains six genera.

1. The genus *Eugereon* of Goldenberg. (*Eugereon Boeckingii*, Gold., *Eugereon Heeri*, mihi) is characterised by a short and thick but broad body; the head is small, the prothorax is scarcely broader than the head, whilst the mesothorax and the metathorax are much broader and longer. The legs are

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short and thick, and seem to be spined. As to those special organs which Goldenberg has described near the mouth of the insect, I have not been able to find them on my specimens which are notwithstanding very well preserved. On the other hand, the abdomen bears at its extremity two recurved appendices.

2. The genus *Scudderia* (mihi) is proposed for an insect whose neuration is different from that of the *Eugereon*, and which is of larger size, the wing measuring nine centimètres in length.

3. I shall name *Megaptilus Blanchardi* that large wing that I previously had supposed must have belonged to the *Titanophasma Fayoli*. Its neuration recalls that of the *Eugereon* and of the *Scudderia*. It must have measured 18 to 20 centimètres in length and five centimètres in breadth. Therefore it has been borne by an insect of respectable size.

4. The *Haplophlebium Barnesii* and *H. longipennis* of Scudder will take their place here.

5. Then will come the *Goldenbergia* (Scudder) and the *Dictyoneura* (Goldenberg).

I place in the genus *Goldenbergia* the following species:—

<i>Termes Heeri</i>	Goldenberg.
<i>Termes affinis</i>	id.
<i>Termes laxus</i>	id.
<i>Termes contusa</i>	Scudder.
<i>Termes longitudinalis</i>	id.
<i>Termitidium amissum</i>	Goldenberg.
<i>Dictyoneura Decheni</i>	id.
„ <i>Humboldtiana</i>	id.
„ <i>anthracophila</i>	id.
„ <i>elegans</i>	id.
„ <i>elongata</i>	id.
„ <i>Smitzii</i>	id.
„ <i>obsoleta</i>	id.
„ <i>sinuosa</i>	Scudder.

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<i>Dictyoneura Decheni</i>	id.
„ <i>Humboldtiana</i>	id.
„ <i>anthracophila</i>	id.
„ <i>elegans</i>	id.
„ <i>elongata</i>	id.
„ <i>Smitzii</i>	id.
„ <i>obsoleta</i>	id.
„ <i>sinuosa</i>	Scudder.

The genus *Dictyoneura*, Goldenberg will comprehend the *D. Goldenbergi* (mihi), *D. Wbelluloides* Gold., *D. jucunda* (Scudder).

The body is short and thick, the head is big, the thorax has the three segments nearly equal and much raised, nevertheless the prothorax is narrower. The abdomen measures 45 millimètres in length, and is terminated by two long multiarticulated filaments, and by two recurved hooks; moreover, some foliaceous appendices are observed, borne by the antepenultimate ring. The legs are short, strong, angular, and spined. The wings are not very wide (25 m.m.), and have a very distinctive neuration. The reticulation recalls that of the preceding genera; the wings were traversed by coloured bands.

The second family, that of the HADROBRACHYPODA (mihi), comprises two genera, the *Miamia* (Scudder) (*M. Bronsoni*) and the *Leptoneura* (mihi), *L. Oustaleti*, *L. delicatula*, *L. robusta*, *L. elongata* (mihi).

All these insects have a very distinctive *facies*. They have a little of the appearance of the living *Termes*, but, nevertheless, they cannot be ranged in the same group. It would not appear to me exaggerated to say that it is an ancestral type of the *Termes*.

The head is pretty broad, armed with strong mandibles, the antennæ are short, the legs are short and squat, the wings are elongated, a little sickle-shaped, and traversed by fine nervures.

Some wings are still tinted by a rather clear brown pigment.

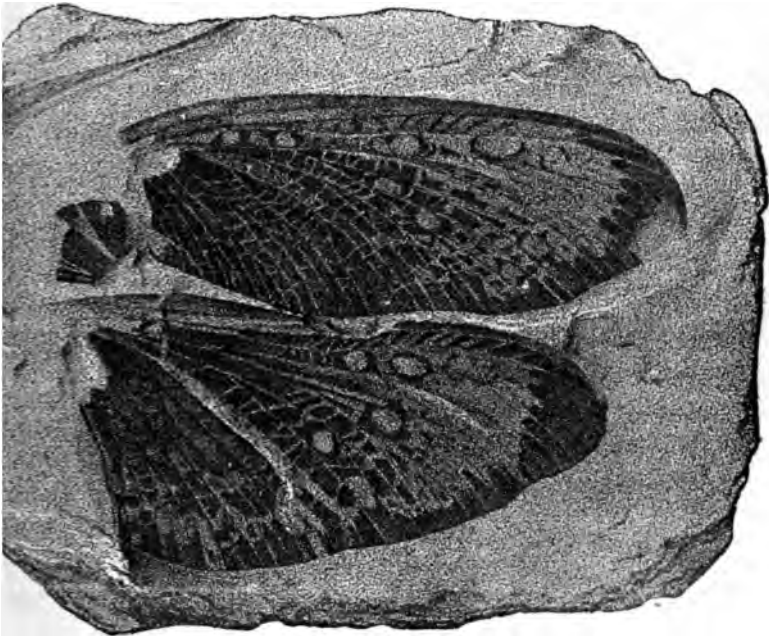
The third family of these Palæodictyoptera includes some insects absolutely new; I shall designate the family by the name of PLATYPTERIDA.

The wings are broad, generally rounded at their extremity, resembling, morphologically speaking, the wings of the

PROTOPHASMIDA, but differing from them completely by the neuration; the nervures, in fact, are rather separated one from the other, and the wings are coloured by pigments often forming very elegant outlines. The body is less stubbed than that of the preceding insects, and the abdomen is terminated, in one of the types, by two filaments.

This family will comprise four genera.

1. The *Lamproptilia*; (*L. Grand' Euryi*) *L. priscotinecta*, *L. elegans* (mihi).
2. The *Zeilleria*; *Z. fusca*, *Z. formosa*, *Z. carbonaria* (mihi).
3. The *Spilaptera*; *S. Packardi*, *S. venusta*, *S. libelluloides* (mihi).
4. *Acridites priscus* (Andree).



Insect from Coal Mines of Commentry. *Lamproptilia Grand' Euryi* (Natural Size.)

Afterwards comes a series of insects which may be included in the order of the *Pseudo-Neuroptera*; six families may, in the present state of our knowledge, take their place in this order.

1. The family of the MEGASECOPTERIDA (mihi), (in which I have established eight generic sections) is characterised by insects with a body more or less robust, with a head generally small, with legs of middle size, with an abdomen terminated by two long appendices, which appear to be multi-articulated and hairy, with wings nearly similar to one another, rather elongated and narrowed at their base, showing nervures much separated one from another, and joined again by large nervures, which gives them a very special *facies*.

The abdomen sometimes presents lateral plates which must have served for respiration.

The genera *Protocapnia* (mihi), *Brodia* (*Br. priscotineta*), Scudder, *Trichaptum* (mihi), *Campyloptera* (mihi), will be classed in this group.

The wings of these insects are generally coloured rather irregularly-disposed spots.

The genus *Sphecoptera* (mihi) comprises insects with slender wings, very lengthily pedunculated, very narrow and of deep tint, ornamented with little circles deprived of colour, and rather irregularly arranged.

It is here that I believe it possible to place the *Breyer Borinensis*, described by Mr. Preudhomme de Borre.

The genus *Woodwardia* (mihi) is a very interesting one; includes three specific types—*W. modesta*, *W. nigra* (Platfig. 1), and *W. longicauda*. These two last are remarkably preserved; the head is rather small, very distinct from the thoracic rings. The prothorax is shorter than the two other order to denote some remarkable specimens that I have received from Commeny.

Rhipidoptera elegans (mihi).

Afterwards comes a series of insects which may be included in the order of the *Pseudo-Neuroptera*; six families, in the present state of our knowledge, take their place in this order.

1. The family of the MEGASECOPTERIDA (mihi), (in which I have established eight generic sections) is characterised by insects with a body more or less robust, with a head generally small, with legs of middle size, with an abdomen terminated by two long appendices, which appear to be multi-articulate and hairy, with wings nearly similar to one another, rather elongated and narrowed at their base, showing nervures more separated one from another, and joined again by lateral nervures, which gives them a very special *facies*.

The abdomen sometimes presents lateral plates which must have served for respiration.

The genera *Protocapnia* (mihi), *Brodia* (*Br. priscotini* Scudder, *Trichaptum* (mihi), *Campyloptera* (mihi), will be classed in this group.

The wings of these insects are generally coloured with rather irregularly-disposed spots.

The genus *Sphecopectera* (mihi) comprises insects with slender wings, very lengthily pedunculated, very narrow and of deep tint, ornamented with little circles deprived of colour, and rather irregularly arranged.

It is here that I believe it possible to place the *Brey Borinensis*, described by Mr. Preudhomme de Borre.

The genus *Woodwardia* (mihi) is a very interesting one which includes three specific types—*W. modesta*, *W. nigra* (Pl. fig. 1), and *W. longicauda*. These two last are remarkably well preserved; the head is rather small, very distinct from the thoracic rings. The prothorax is shorter than the two other orders to denote some remarkable specimens that I have received from Comentry.

Rhipidoptera elegans (mihi).

rings. The abdomen, composed of ten rings, is slightly cylindrical, narrower at its extremity, and terminated by two long filaments. The wings are triangular, and, as they are very elongated, they present an obtuse angle nearly in the middle of the wing. The wings are of a deep colour, and present here and there little rounded spots of a brighter shade.

The body of *W. nigra* is 8 centimètres in length, without counting the filaments, which are from 10 to 12 centimètres long. The spread of the fully-extended wings (envergure) is at least 16 centimètres.

It is here that I proceed to place the genus *Corydaloides* (*mihi*), *C. Scudderi* (Plate, fig. 3), *C. gracilis*, created for some insects of the smallest size, but whose body measures 4 to 5 centimètres in length; the spread of the fully-extended wings is about one décimètre; the body is more stubbed than that of the *Woodwardia*, it is also less cylindrical. The neuration is analagous to that of the preceding genus; the nervures and nervules are nevertheless more abundant, and the wings are not coloured.

But this genus presents a very curious particularity upon which it is well to insist.

Firstly, I will call to your minds in a few words that insects breathe by the aid of tracheæ, whose distribution in the body is variable. Among perfect insects these tracheæ open on the outside by orifices which are called *stigmata*; these generally breathe the ordinary atmospheric air.

A great number of larvæ, especially those of the Neuroptera and of the Orthoptera, are aquatic, and the organs of respiration are modified. The tracheæ, in place of ending suddenly and presenting openings or *stigmata*, ramify endlessly. Sometimes the extremities of the tracheæ are free, at other times they are united in some kind of foliaceous organs. The insect then breathes the air contained in a state

of dissolution in the water, either by the aid of branchial tufts, or by the means of branchial plates.

Among the larvæ of the Ephemera the seven first rings of the abdomen show on each side a foliaceous organ, in which the tracheæ are seen to ramify. The oscillations of these appendices maintain a continuous current around the larvæ; these organs are only obliterated at the time of passage to the state of the sub-imago.

In 1848 Newport made known a pseudo-Neuroptera of the family of the Perlida, the *Pteronarcys regalis*, which presents in the adult state, on the under part of the abdominal rings, some branchial tufts protected by a sort of pocket, and besides which it is provided with stigmata. This insect is amphibious, it can breathe the ordinary atmospheric air and the air which is contained in dissolution in the water.

The *Corydaloides* (mihi) offer in the adult state an analogous disposition of the organs of respiration. Each one of the abdominal rings presents a plate on each side, where one can see very well, even with the naked eye, the branching out of the tracheæ. I have, besides, been able to verify the presence of stigmata. I possess ten examples of imprints of this kind.

It is then permissible to suppose that these insects were amphibious like the *Pteronarcys*.

Like the latter, it presents at the extremity of the abdomen two multiarticulated filaments.

I shall place by the side of these *Megasecopterida* an ancestral type of the Libellulæ; the creation of the PROTODONATA family, and of the genus *Protagrion* seems to me necessary.

Until now a single wing only has been found at Comentry. It measures 10 centimètres in length and two centimètres in breadth.

Its form, its neuration, and its reticulations remind one

h of the living Odonata. There are, nevertheless, some or notable differences.

the third family, that of the HOMOTHETIDA of Scudder,ains some insects of more modest size, more slender; more sessile wings, and with finer neuration. The ules are also more numerous than with the ASECOPTERIDA.

in this family will be classed the *Hemeristia occidentalis* (Scudder) the *Pachytylopsis Persenairei* (Preudhomme de Selve) the *Chrestotes* (*C. lapidea*, Scudder); *C. Danae*, L.; (Synon, *Miamia Danae*, Scud.); *C. Lugauensis* (Zel); the *Omalia macroptera* (Cœmans and Van Beneden); three new genera from Commeny (genera *Oustaletia*, *Myptilus*, *Diaphanoptera*.)

the three last families of this group include some ancestors of the Ephemerida, Perlida, and of the Ascalaphus. PROTEPHEMERINA (genus *Homaloneura* (mihi) near to living *Potamanthus*.) The PROTOPERLIDA (genera, *Promphipnoa* (mihi); *Protokollaria* (mihi); *Pictetia* (mihi); *Operla* (mihi).) The PROTOMYRMELEONIDA (genus *Pro-laphus* (mihi).)

the order of the HEMIPTERA is represented during theozoic epoch.

Up to the present time there have only been met with types which we have been able to class in the group of the *Homoptera*, these are the ancestors of our Fulgoridæ of our living Cicadellæ.

Edenberg has named *Fulgorina Ebersi* and *Fulgorina hensis*, some insects very near to our Fulgora.

In this same genus I shall place some insects from Commeny, *F. Goldendergi* (mihi), *F. ovalis* (mihi), and *F. minor* (mihi).

The creation of several generic sections is necessary in

Dictyocicada antiqua (mihi).

Protociccus parvulus and *P. fuscus* (mihi).

Protociccius Fayoli, *P. antiquus* (mihi).

Mr. Scudder names *Phthanocoris occidentalis* a wing that he considers as belonging to a Hemiptera Heteroptera.

I do not share his opinion, and I find a great analogy in the neuration between this wing and those of the *Pæocera olivacea* (Blanchard) which belong to the Homoptera.

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This paper may be considered as a list, as a general view of the fauna of the primary Hexapoda.

New discoveries will perhaps compel naturalists to multiply genera, but I believe that the general sections already designated will be able to be kept; for all that I have stated is based upon the numerous discoveries made at Commentry during the last eight years.

These discoveries have enabled me to rectify many mistakes made for want of precise data, and for want of fine specimens.

This paper is far from being perfect, but it appears to me necessary, if it only permits of a glance at the riches which have been supplied to me by the mines of Commentry.

Plates are in preparation, and I hope soon to be able to show the figures representing all these curious fossils.

At the moment of going to press I am in receipt of a new memoir from Mr. Scudder, which establishes some new families and genera among the primary hexapods.

In my opinion Mr. Scudder is mistaken in many cases, but we are agreed upon many points. The new genera which he creates demand a close examination, which I reserve for another occasion; but it is curious to note how few types Mr. Scudder has found in America similar to those which have been described in Europe.

The PRESIDENT said: We are all, I am sure, indebted to M. Brongniart for his communication, and to Mr. Stirrup for introducing it. We all know that insects have long ago been found in the Lias, especially in Gloucestershire; but, now, recent discoveries take us back to the Devonian. Are these insect remains, may I ask, found in the shales or in the coal itself?

Mr. STIRRUP, in reply, said that he believed from the information given to him by M. Brongniart that these remains are found in the shales, such as occur in the roofs of our coal mines, where so much of the *débris* of fossil vegetation was found. They are not in any special deposit.

The PRESIDENT: They would appear to be found among the impressions of leaves, on which naturally they would feed.

Mr. DICKINSON: I have great pleasure in moving that a vote of thanks be given to M. Brongniart for his paper, and to Mr. Stirrup for his translation of it. At the same time, it is difficult, and, I think, would be premature, to accept the statements as they have been made. If we assume, as I think the paper states, that all these insects whose remains are found were amphibious, at least at one period of their lives, a great difficulty would be got over. So far as my own experience goes, I have never yet met with a single fossil but what was of some species which, at one period or other of its life, had a water *habitat*. Some few years ago a paper was brought before us, in which it was stated that a fossil spider had been discovered. I replied, rejecting the statement at the time; and I believe that, since then, this so-called spider has proved to be a small lobster. I have seen some of the illustrations that have been handed round; and, clearly to my mind, one at least, represents some creature allied to the lobster; and in all of them there is nothing which may not as

allel rods, are jointed, and occasionally divide near the extremities: some are covered with very fine scales, but bear no affinity to the nervures of the wings of insects. The two things are entirely different. I understand from Mr. Ward, of Longton, that such insects are found in the fine shale, and not in the coal; and I have very little doubt, from the nature of the skeletons that are shown in the figures, and from the nervures of the wings, that they are those of insects, but how far aquatic I am not prepared to say. I have seen fossils from Oldham showing insect borings; which leave no doubt in my mind that insects did exist in the carboniferous age.

The PRESIDENT: Are those borings any considerable size?

Mr. WILD: They are only about the sixteenth of an inch in diameter. They are found in a woody sort of nest. They are both longitudinal and transverse in the section, and also pass across from the outside through the bark into the wood.

Mr. WATTS: It would, I am sure, enhance the value of the paper if, when it is printed in the Transactions, some of the photographs which are here shown were published along with it. I do not wonder greatly at the amphibious character of some of the insects described by M. Brongniart, inasmuch as many of our insects at the present day begin life in the water; and it may be that during the carboniferous period, or earlier, more insects began life in the water, and continued to live in it for a longer period than they do now.

The PRESIDENT: It would certainly add to the value of the paper if a selection of these photographs could appear.

Mr. DICKINSON: I think such a paper ought not to be published without giving the reader the means of forming a judgment for himself, the so-called beetles may be little crabs.

Mr. STIRRUP, in replying upon the discussion, said : Mr. Dickinson is so heterodox in his palæontological views, one hardly knows how to answer him. No one, I think, could possibly mistake those objects presented to you in the photographs for anything else but insects, or the wings of insects. The lines and markings show the neuration of undoubted wings, and the position and number of these nervures furnish the distinctive marks of certain insect groups. I do not think that all these insects were aquatic. They belong to numerous orders, some of whose representatives began life in the water, others were amphibious, as shown by M. Brongniart. The Blattidæ occur in warm and humid situations such as we might expect in those forest lands of the coal measure epoch, but their modern representatives certainly are not aquatic. Speaking to the general subject, there cannot be a doubt that insects occurred in profusion in the coal measures. That is the idea should carry away with us, and I would ask gentlemen connected with coal mines to keep a sharp look-out for fossils of this character. Some of our members will hope, have the gratification of bringing such fossils before us, and thereby enable us to dispel the doubts that Dickinson has expressed.

J. C. Branner
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