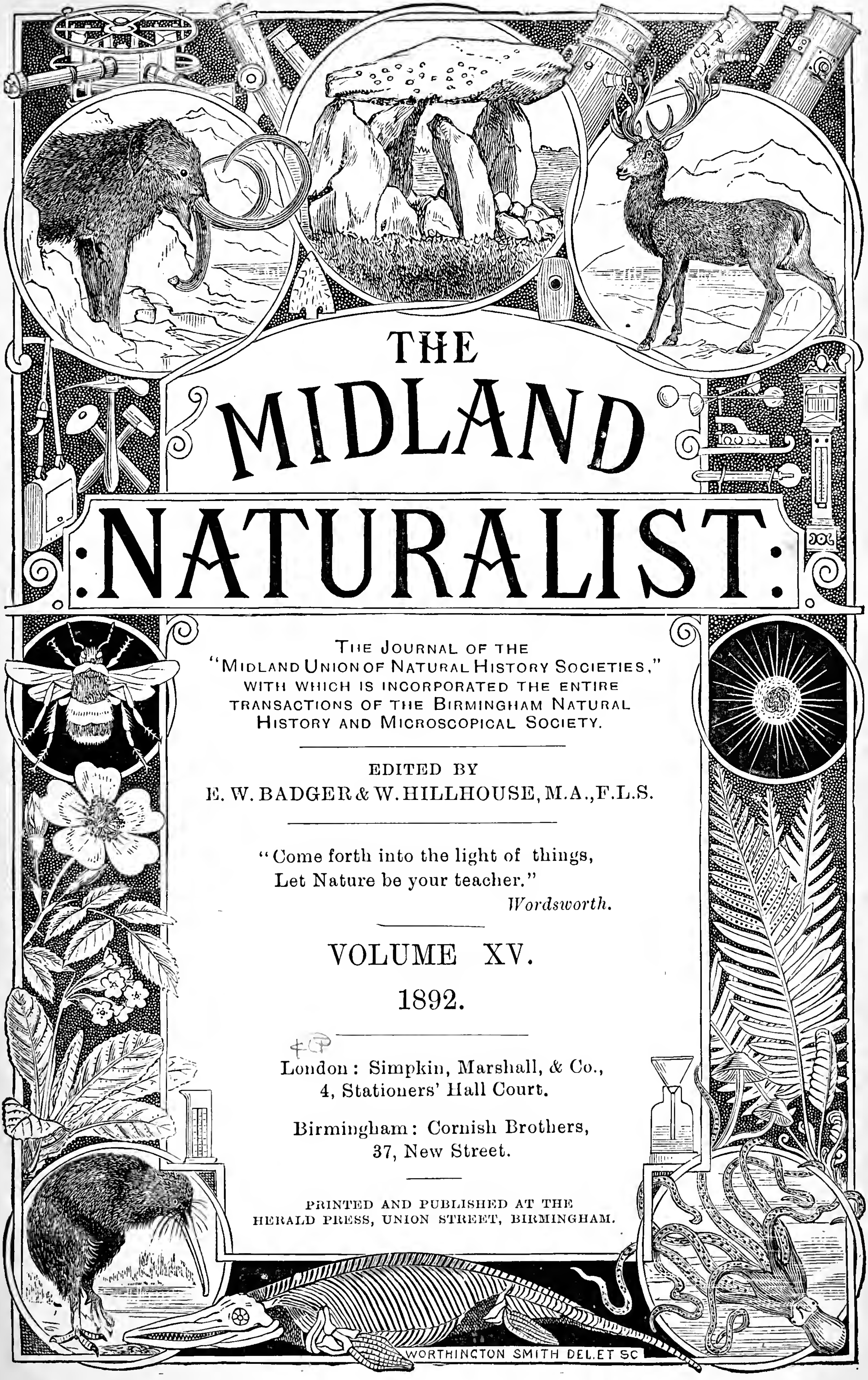

THE MIDLAND NATURALIST:

THE JOURNAL OF THE "MIDLAND UNION OF NATURAL HISTORY SOCIETIES," WITH WHICH IS INCORPORATED THE ENTIRE TRANSACTIONS OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

EDITED BY
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"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

VOLUME XV.

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PREFACE.

The conclusion of another year of the existence of the "Midland Naturalist" provides its editors with a welcome opportunity for expressing their grateful thanks to the many friends and contributors of whose work its pages are a partial record. Some of their names will be found in a list upon another page; but the regular, continuous, and unostentatious work of the secretaries of those societies of whose meetings periodical reports are received, merits equal praise, and, in some respects, even a greater meed of thanks.

As an exponent of the more quiet and homely side of the scientific work of the Midlands, the Editors believe that Volume XV. will be found in no way to suffer in a comparison with its predecessors. While it is altogether impossible but that in a serial of this kind some of the papers published from time to time—and those, perhaps, from the standpoint of the future the more important—shall not be of an eminently readable kind, yet they believe that in the general interest of its contents this volume will vie with any which have gone before. It will be their endeavour in the future to maintain the high character which their periodical has borne in the past.

With so much to be grateful for, it seems ungracious to utter a word of complaint; nor would the Editors make such repeated reference to the scanty length of the subscription list, but that their own efforts to improve the "Midland Naturalist" are necessarily dependent upon the financial support received. It cannot be too clearly understood that, although all the work of writers and editors is voluntary and unpaid, for years the maintenance of the periodical has been a financial charge upon the goodwill of its printers. An increase in its size, which for a long while the Editors have been desirous of bringing about, is thus impossible, and illustrations which they are anxious to more freely introduce are financially out of the question. What the New Year may have in store for them they cannot say; like Mr. Micawber they anxiously await the good times, which they hope may soon "turn up."

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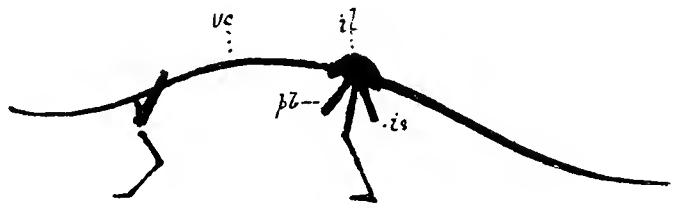

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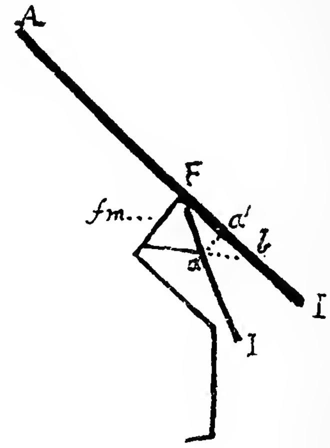

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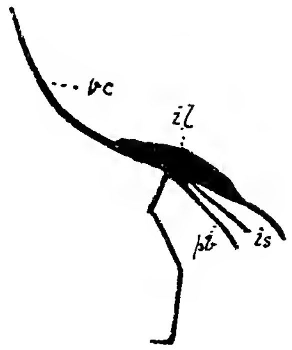

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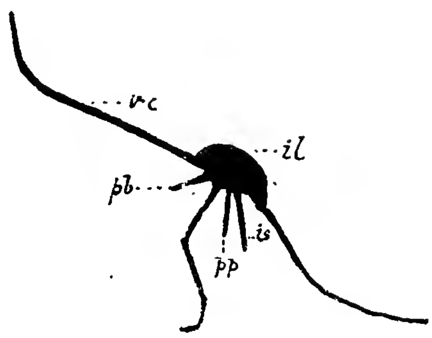

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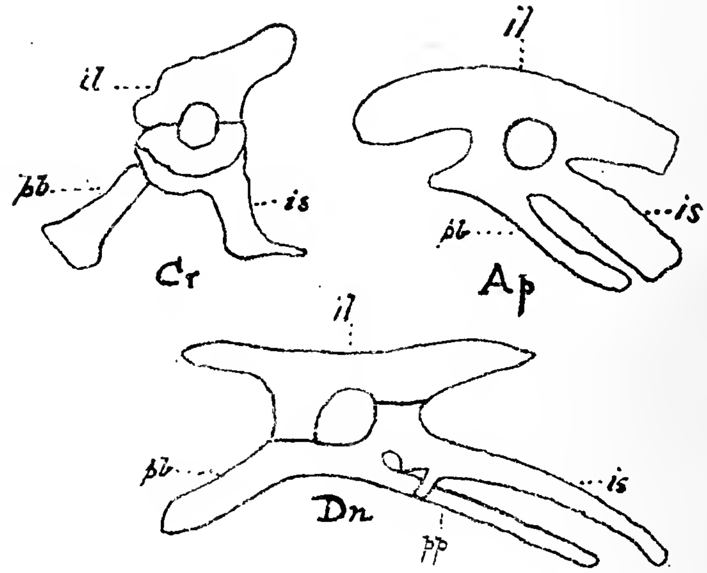

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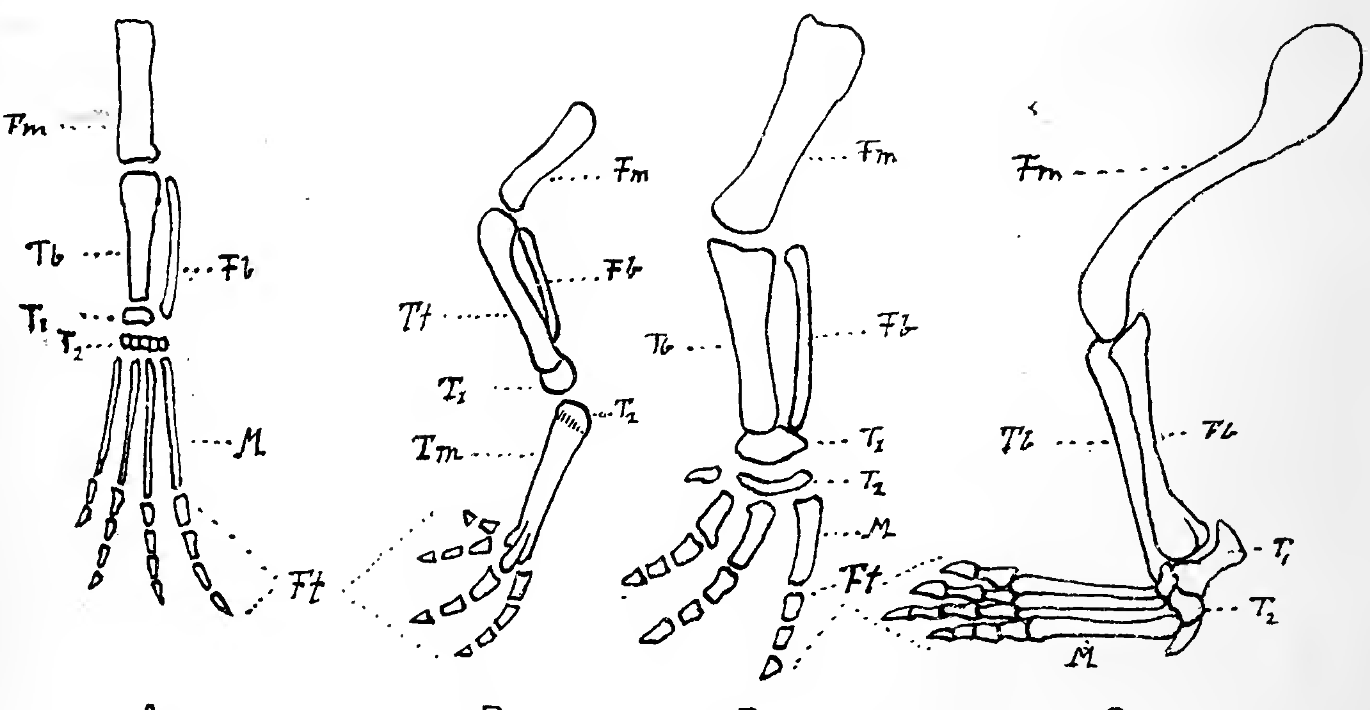

Fig 6.

L.M. et A.B.B del^s. Herald Press Litho.

DRAGONS OF THE PRIME.

THE MIDLAND NATURALIST.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

"DRAGONS OF THE PRIME."*

BY A. BERNARD BADGER, B.A.

(Concluded from Vol. XIV., page 223.)

So much for the sea-loving Ichthyosaur and Plesiosaur; now we will consider another series of reptiles which lived on the *land*—the Dinosaurs. These reptiles are remarkable in two ways: (1) Amongst them we find some of the very largest animals which have ever lived on the earth; and (2), although undoubtedly reptiles, yet some in many respects are very like birds. Now, in order to understand and appreciate the great interest of these reptiles, we must compare the structure of an ordinary reptile, say a crocodile, with that of a bird.

The differences between the two creatures are many, but the one that strikes us most is that, while the crocodile (Plate I, Fig. 1), walks on all fours and has its body placed hori-

Description of Figures in Plate 1.

In Figs. 1, 2, 3, 5—*il.*, ilium; *is.*, ischium; *pb.*, pubis; *vc.*, vertebral column; *pp.*, post-pubis.

Fig. 1.—Diagram of the skeleton in the most reptilian Dinosaurs (*e.g.*, *Ceteosaurus*), which is practically the same as in the crocodile.

Fig. 2.—Diagram of the skeleton of birds.

Fig. 3.—Diagram showing the mechanical advantage of the avian over the reptilian pelvis in maintaining a semi-erect attitude: AFI′, vertebral column; FI, position of ischium in reptiles; and FI′, position of the same in birds; *fm.*, femur.

Fig. 4.—Diagram of skeleton in Dinosaurs.

Fig. 5.—The pelvis of Crocodile (Cr.), Apteryx (Ap.), and Dinosaur (Dn.).

Fig. 6.—Diagram of bones of the hind limb in embryo bird (A.), adult bird (B.), Dinosaur (D.), and Crocodile (C.). *Fm.*, femur; *Tb.*, tibia; *Fb.*, fibula; T_1 T_2, the two rows of tarsal bones; *Tt.*, tibio-tarsus; *M.*, metatarsals; *Tm.*, tarso-metatarsus; *Ft.*, foot.

* The substance of a lecture delivered at the late Summer Meeting in Oxford of the University Extension Students.

zontally, the bird (Fig. 2) has the body almost upright and walks on the hind legs only, using the front limbs for flight.

Owing to its horizontal position, the weight of the crocodile's body is equally distributed over the four limbs, the centre of gravity falls within the space between the four feet, and the body is in a position of stable equilibrium. Its weight tends to bring it down to the ground, but the body is kept suspended by muscles which fasten the trunk to the front and hind limbs. These muscles are not attached directly to the vertebral column, but to two bony girdles, those from the fore-limbs being attached to the shoulder-girdle, and those from the hind-limbs to the pelvis. The two girdles are themselves attached to the vertebral column, but owing to the general equilibrium of the body there is no great strain upon them and the limbs as points of support, and, consequently, no need for a very firm attachment of them to the vertebral column.

If we examine the pelvic girdle (Fig. 5 Cr.), with which we are chiefly concerned, we find that in the crocodile, as in all vertebrates, it is made up of two parts, one on each side, and each composed of three separate bones, which are joined together at one point, and there form a socket for the head of the thigh bone of the leg. One of the bones of the pelvis—the *ilium*—projects backwards and upwards, and is attached to the vertebral column, thus forming the connection between that structure and the pelvis. The other two project downwards; one, the *pubis*, also projecting forwards, and the other, the *ischium*, projecting backwards. The muscles which suspend the hinder part of the trunk to the limb pass from the ilium to the femur.

Now, in the bird (Fig. 2), the body is semi-erect, and is supported on the two hinder legs instead of on all four, by being balanced about a horizontal axis which passes through the upper ends of the thigh bones and the sockets of the pelvis. The weight of the body, however, is greater in front than behind, so that the body tends to swing about its axis downwards and forwards; in fact, if left to itself, the body would fall forwards, so that the head and neck would come to rest on the ground. This, however, is prevented by the arrangement of the bones and muscles of the pelvis, which is quite different from that in the crocodiles. The centre of gravity, then, being in front of the axis of rotation, the front part of the body tends to fall down, the hinder part to rise up, just as in the case of a pair of scales if one pan is heavier than the other. The muscles are attached, on the one hand, to the hind legs, and, on the other, to the pelvic bones; they, by their action, pull the hinder part of the vertebral column downwards from a more oblique to a less oblique position with regard to a vertical line passing through the axis of rotation, and, consequently, raise the fore part of the vertebral column and of the body. The whole weight, therefore, of the fore part of the body is supported by these muscles, and the strain on the pelvis is very great, so that it would be torn away from the vertebral column were it not firmly attached to the same. This firm attachment of the pelvis to the vertebral column is effected as follows: the ilium extends forwards as well as backwards, and for its whole length, which, proportionally, is much greater than in the crocodile, is actually ossified into one piece with the vertebral column. Moreover, the ischium, which in the crocodile is only loosely attached to one end of the ilium, in most birds is turned backwards parallel to the backward extension of the latter, and united into one piece with it. So, too, the pubis, instead of extending forwards as in the crocodile, runs backwards also parallel to the ischium. The ischium, the ilium, and the hinder part of the vertebral column, then are *all* united together and form a single piece of bone. By this backward position of the ischium, and union with the bones just mentioned, two objects are gained :—

(1.)—The ischium becomes firmly fixed, so as to afford a rigid surface for the attachment of the muscles which pass from it to the bones of the hind legs and keep the body semi-erect, and (2) a mechanical advantage is given to those muscles over that which they would possess were the ischium less oblique.

For if the ischium (Fig. 3) is in the position FI, and a muscle is attached from the femur to it at *a*, then the available power at right angles to the body, which is the effective force in balancing the latter, will act at a distance F*a'* from the fulcrum F; if the ischium be in the position FI' and the muscle be attached at *b*, so that the distance F*b* is equal to the distance F*a*, then the distance from the fulcrum is greater, and, the force being the same as before, the movement obtained is greater—in other words, the muscle has greater power. The same holds for the muscles attached to the tibia.

Another difference between the bird and the crocodile is that while the former walks on its *toes*, the latter walks on the *soles* of its feet.

Now, the Dinosaurs are especially interesting, because some of them are like typical reptiles, and walk on all four legs; in others, the front limbs are so much shorter than the hind limbs as to be useless for walking, and there is every indication that the body instead of being horizontal like that of most reptiles was semi-erect like that of birds, and that the Dinosaurs walked or hopped on their hind legs as birds do. Among the Dinosaurs, then, we find all stages from the ordinary reptilian mode of progression and position of the body up to those characteristic of birds. Some of these stages I now propose to trace.

The most reptilian of the Dinosaurs (Fig. 1) progressed on all fours as the crocodile does, but differed from the latter in the fact that the front limbs were slightly shorter than the hinder. These Dinosaurs, however, moved with the body horizontal, and in accordance with this position the pubis and ischium are placed as in the crocodile, for the muscles attached to them and to the hind limbs have no great work to perform in keeping the body suspended. These particular Dinosaurs, too, were plantigrade, as the crocodile is, *i.e.*, they walked on the soles of their feet. Like the crocodile, too, they had five fingers and five toes. Again, the bones of the *limbs* were solid, but in some of the most enormous of these creatures the pre-caudal vertebræ, which are very large, have cavities in the bone filled with air: owing to their size, these vertebræ would have been very heavy had the bone of which they are composed been solid throughout; as it is, their weight is considerably reduced.

The proportions of some of these Dinosaurs may be judged from the size of the bones which are preserved in the Oxford University Museum; they belong to *Ceteosaurus*, "the lizard," that is, "as big as a whale." The vertebræ of this creature are 9in. across, and are as big as those of a fossil elephant 14ft. high.

The other bones of *Ceteosaurus* correspond closely in size to similar bones in the fossil elephant which I have mentioned:—

	Ceteosaurus.	Elephant.
Humerus	51in.	53in.
Radius	38	39

From these similarities of dimensions, it might seem at first sight as if the reptile were as high as the elephant, but, since the legs of an elephant are almost straight, whilst those of a lizard are bent, it is more probable that *Ceteosaurus* was about ten feet in height; its head was seven or eight feet long; its total length fifty feet.

This huge lizard was a marsh-loving animal, and dwelt by the sides of rivers, in a land thickly covered with ferns, cycads, and coniferous trees, and from the nature of his teeth we can tell that he was a plant-eater, and lived on the vegetation of the country.

But if *Ceteosaurus* was big, his near relative, *Atlantosaurus*, was huge enough to make three of him. *Atlantosaurus* was 100ft. long, and 40ft. high, yet a harmless creature withal, which would only take flesh-food if an animal happened to get entangled amidst the bushes of the forest which he was engaged in masticating.

Some of the Dinosaurs, then, closely resembled ordinary reptiles in their mode of walking on all fours; others, however, as I said, touched the ground with the front limbs only seldom, or not at all, walking on the hind limbs with the body semi-erect, and partially supported by the tail, as in the kangaroos. Such an animal was *Iguanodon*. The evidence for the idea that these Dinosaurs used their hind limbs alone for progression is as follows:—

(1).—Foot-prints have been found which correspond to the toes of the hind feet; they always exist in single pairs, as do those of birds, and no prints are found in connection with them which would correspond to the front feet.

(2).—Their front limbs are both much shorter than the hind limbs, far too short to touch the ground, and keep the body horizontal. And also are very weak, while the hind limbs are stout and strong.

These reptiles, then, have given up the horizontal position of the body and the mode of progression usual to their order, and have taken to that characteristic of birds; with the assumption of this semi-erect position, and of this movement confined to the hind-limbs, modifications in the arrangement of the bones of the latter and of the pelvis appear very like that in birds.

Just as in birds, the body of these Dinosaurs (Fig. 4) is balanced on a horizontal axis passing through the upper ends of the thigh bones and the sockets of the pelvis, and also, just as in birds, the fore-part of the body is the heavier, and is prevented from falling forward by a similar arrangement of bones and muscles. This is seen on comparing the pelvis of the Dinosaurs with that of a bird, say of one of the group of Ostrich-like birds—the Apteryx. (Fig. 5.)

In the Dinosaur the ilium (Fig. 5 Dn., *il.*) projects forward as well as backwards, thus offering greater surface for attachment to the vertebral column. Here, then, is a bird-like feature added to the typical reptilian structure. Then the ischium is directed very far backwards and is very long; it lies nearer to the ilium than does the ischium in the crocodile, and in this respect, therefore, resembles the bird more than the reptile, although, indeed, it is not actually united to the ilium as is the case in most birds, though not in Apteryx. In Apteryx, too, the pubis lies parallel to the ischium ; in the crocodile it projects forwards. In the Dinosaur, these two conditions are combined, for it has both a bone projecting in front like the pubis of the crocodile (Fig. 5 Cr., *pb.*) and also a second bone—the post-pubis (*pp.*) projecting behind parallel to the ischium, like the pubis of birds.

It was thought at one time that the pubis of birds corresponded to the backwardly projecting part of the pubis of Dinosaurs, and the pubis of reptiles to the forwardly projecting part. It seems certain, however, now, that such is not the case. The backward projecting pubis of birds really corresponds to the forward projecting part of the Dinosaur's pubis. In the evolution of the birds, the pubis has become swung backwards from the forward to its present position, a movement which actually takes place in the development of the individual. The bone, however, in the Dinosaurs which looks like the pubis of birds is a secondary structure which has been developed in relation to the semi-upright position of the body, for the better balancing of the latter and for the attachment of muscles which keep the body from falling forward.

All the semi-erect Dinosaurs have this bird-like arrangement of the bones of the pelvis ; but some of the less specialised forms show their connection with the reptiles by possessing the typically reptilian number of five toes on the hind feet, and also in the fact that the animal walks on the soles of its feet like the crocodile and not on the toes as birds do. Other Dinosaurs, however, resemble birds not only in the structure of the pelvis, but also in that of the hind limbs; at the same time there are interesting differences between the two groups.

(1).—The hind-limb (Fig. 6, B., D.), both in birds and in the most bird-like Dinosaurs, is divided into four regions, of which the uppermost (thighbone, or *femur*, *Fm.*) is similar in both. In the Dinosaurs the third region is much shorter than in the birds.

(2.)—In birds the second of these regions is composed of two bones : one, the *tibio-tarsus* is strong and stout; the other, the *fibula*, is very thin, and does not reach to the lower end of the former. In the Dinosaurs the two bones are almost equally strong, and though of the two the fibula is the weaker, yet it is just as long as the tibio-tarsus.

(3.)—In birds the third section of the limb, or *metatarsus*, is composed of a single bone, the upper end of which works directly on the lower end of the *tibio-tarsus.* In the Dinosaurs, however, the third section of the limb, which obviously corresponds to the third section of the bird's limb, is made up not of one, *but of three separate bones, while between them and the second section of the limb are two rows of small bones which apparently are not present at all in the bird.*

(4).—In each animal there are four toes, three larger, and one smaller; each animal, too, walks on the toes, and not on the soles of the feet.

If, now, we compare the Dinosaur limb with that of a crocodile, we shall find that really they are very similar. The difference between them lies in the position of the bones which form the sole of the foot. In the crocodile these are four in number and lie flat on the ground; in the Dinosaur they are raised from the ground and are *three* only.

The Dinosaur's limb, then, seems to resemble the typical reptilian limb more than the bird's; it resembles the bird's limb in being divided into four parts, and in being digitigrade; it differs from the bird in the fact that there are three bones in the third part instead of one; and that two rows of small bones lie between the second and third parts, which are not present in the bird. The Dinosaur limb, in fact, differs from the bird's in just those points in which it resembles the typical reptilian limb.

If, now, we compare the structure of the limb in an embryo bird (Fig. 6, A.) while it is still inside the egg with that of a Dinosaur (Fig. 6, B.), we find a very close resemblance between the two. For instance, in the chick, we find that the whole limb is divided into four main parts as in the adult, but the fibula instead of being shorter than the tibia is just as long, as is the case in the Dinosaur.

Then, again, the third section of the limb is made up not of a single bone, as in the adult, but of several separate bones, as in the Dinosaur. The resemblance to the limb of the latter is completed by the presence between the second and third parts of the limb of two rows of bones. (Fig. 6, T_1, T_2.)

In these bird-like Dinosaurs, then, the hind limbs have quite the structure of the embryo bird; hence, we can say either that the Dinosaur has the limb of an embryo bird, or the embryo bird has the limb of the adult and specialised reptile.

The apparent great difference between the structure of the limb in the embryo and that in the adult bird is due to the coalescence of various parts; thus the four separate meta-tarsals of the third part of the limb (Fig. 6, A*M.*) join together to form a single bone (Fig. 6 B *Tm.*), and also at their upper ends join with the lower of the two rows of little tarsal or ankle bones. (T_2.) On the other hand, the upper row of tarsals (T_2) joins with the lower end of the tibia to give rise to a single bone. (*Tt.*)

Starting, then, with the limb of the crocodile as typical of that of the reptiles, we find forms among the Dinosaurs leading to the condition of the limb in the embryo bird, and so to that in the adult, which, is itself so different from that in reptiles. The hind-limb, then, of Dinosaurs is intermediate in structure between that of the typical reptiles and that of birds.

In another respect, too, these bird-like Dinosaurs differ from typical reptiles and resemble birds, namely, in the structure of the limb-bones; these contain air spaces, just as do the limb-bones of birds, and for the same purpose, also, to make them lighter.

The highest forms of the Dinosaurs, then, were animals which were very like birds in many ways, but they differ in some important particulars. Thus:—

(1).—As far as we know they had no feathers, and could not fly.

(2).—The structure of the fore-limbs was unlike that of modern birds: in the latter, the bones which correspond to those of the palm of the hand are coalesced into one; in the Dinosaurs, these bones are separate.

(3).—Again, modern birds have no teeth in their jaws; in the Dinosaurs, the jaws carry many sharp teeth.

The two last-mentioned differences between Dinosaurs and modern birds are bridged over by the structure of the celebrated fossil bird *Archæopteryx*; in it the palm bones or carpals are not united together, but are separate as in the former, and corresponding to them are three well developed fingers, each of which bears a claw.

Then, again, *Archæopteryx* has teeth in its jaws like those of Dinosaurs, and, in addition, its tail is very long, like that of a lizard, instead of being short as in birds.

Archæopteryx, then, was a very reptilian bird and certainly bridges over the space between the Dinosaurs and the modern birds. The resemblances between it and the former naturally lead us to suppose that we have before us, in the Dinosaurs, animals which represent stages in the evolution of birds from reptiles; we can trace, as it seems, the reptile gradually giving up the old way of walking on all its four limbs, and instead, rising into a semi-erect attitude, and stalking along on its hind limbs; we see the bones becoming lighter, and it seems as if only feathers were needed to change the most bird-like Dinosaur into a form like *Archæopteryx*.

But though there is so small a difference between the most bird-like reptile and the most reptile-like bird, yet the most bird-like reptile that we know of—the Dinosaur, *Compsognathus*—is certainly not the ancestor of *Archæopteryx* and flying birds, for instead of being older than *Archæopteryx*, it is its contemporary. If, as seems very probable, some of the Dinosaurs were the ancestors of birds, it must have been those forms which lived in the Triassic times, long before the age of *Archæopteryx*. These earlier Dinosaurs, though not so like birds as some of the later forms, yet resemble *Archæopteryx* in this, that they had biconcave vertebræ. No doubt they gave rise to forms in which the bird-like characters of the limbs were more developed; then, from these forms arose two lines of animals, one of which developed feathers and became birds, while in the other no feathers appeared, and they remained only bird-*like* reptiles to the end of their days, representing, more or less closely, some of the various stages in the evolution of birds.

Such, then, are some of the chief points of interest in the structure of the Dinosaurs. Very curious must have been the appearance they presented as they stalked or hopped about the land on their strong hind legs, using their long tails to help them, as do the kangaroos.

Some of these two-legged reptiles were covered with great plates of bone, each bearing a spine a foot or two in length. If creatures of such a size required such armour, it could only have been in defence against the attacks of their carnivorous relatives, such as *Megalosaurus*. While *Ceteosaurus* wandered about the low marshy swamps of the Oxfordshire Sea, *Megalosaurus* preferred the land, and must have been the terror of all animals less huge and ferocious than himself. This Dinosaur was 20ft. high; his jaws were armed with teeth two inches in length, curved backwards, and along their inner, concave edges notched like saws, so that they both held firmly the prey which he seized, and were very effective cutting instruments, as the jaws moved up and down; fingers and toes ended in great claws: with the former he grasped and tore to pieces any creature that came his way. While the land was his usual habitat, yet on occasion he waded in the shallow rivers or seas, and, perhaps, even swam about in the water by means of his powerful tail. There he might have been seen, now devouring the hugh ammonites and cuttles, now engaged in dreadful combat with the long-necked *Plesiosaurus*. And, there we will leave him and other "dragons of the prime."

NOTES AT THE BRITISH ASSOCIATION, CARDIFF, 1891.*

BY C. J. WATSON.

It is the custom of the British Association to invite local scientific societies to send each a delegate to their meetings, in order that they may there, in conference, make suggestions to its council, and afterwards convey to their respective societies instructions on points concerning which their co-operation is required. This society, however, does not send a representative, because it does not publish reports of its proceedings, which is made a condition of its recognition by the Association. It has occurred to me that, even without this official sanction, one of the duties of representatives, and that not an unimportant one, might be discharged by any or all of our members who might attend its meetings. I mean that they should take notes of any new or interesting scientific fact brought under their notice, and on their return freely communicate the same to those of their fellow members who, from want of leisure or other causes, are unable to go to the meetings. Unfortunately this idea did not occur to me until I received the usual modest request from our secretary for a paper. The consequence has been, that I did not put down my notes at the time in writing, and, as a natural result, many of the observations that I wish I could recall, both for my own sake as well as for yours, have faded away from my memory beyond the possibility of recall. And here I would remark that there is no surer way of giving precision to our understanding of a subject, and of fixing it in one's memory, than to undertake the responsibility of imparting it to others. It is in this lies the great value to our members of the delivery of papers at intervals to their fellow members. If you only realised this as you ough t, you would come forward in such numbers that the official life of our secretary would, instead of being one of constant worry and anxiety, be pervaded with an endless glow of satisfaction and happiness.

Without further remarks I will proceed with the subject of my paper, but if my notes should appear to you fragmentary and disjointed, I trust that you will attribute it to the cause which I have named, and which I will endeavour to prevent from operating on a future occasion. The meeting place for this year was the rapidly

*Read before the Birmingham and Midland Institute Scientific Society, November 4th, 1891.

growing town of Cardiff. At the beginning of the century this town had only a population of 1,000, and in 1840 10,000, whilst at the present time it numbers no less than 132,000 inhabitants. This unprecedented increase is entirely owing to its position as the natural outlet for exporting the coal raised in the S. Wales coalfield; and, in fact, I see that, for tonnage of export, it is this year the first port in the kingdom. At Barry, which is included in the port of Cardiff, the increase of population has equalled that of some of the American frontier towns of which one occasionally hears; for whereas three years ago, when its dock was constructed, its population was under 300, it now exceeds 16,000.

Cardiff is situated at the mouth of the two rivers, the Taff and the Rhymney, and it was on the banks of these that the coal and iron brought down by canal was formerly shipped. When, however, railways began to bring down these productions in larger quantities something more was needed, and the father of the present Marquis of Bute undertook the construction of an artificial dock, which has proved the forerunner of the splendid series now to be seen there. The docks at Cardiff, including those at Barry and Penarth, have a water area of over 250 acres; but what struck me most was the extensive network of railways connected with them, and the highly ingenious arrangements for the rapid discharge of coal into the ships. At the Bute Docks the railways run at the quay level, but when the trucks approach the ship-side they are raised up on a hydraulic lift, and also tilted up by the same agency. At Barry, on the contrary, the trucks are brought along elevated railways, and run by gravitation on to the platforms overhanging the ships, where they also are discharged by hydraulic power. This arrangement permits of the shoot platforms being able to travel a short distance along the edge of the quay, thus enabling loading to go on simultaneously at several hatchways in the same vessel. In fact, it is not uncommon for a vessel to enter with the one tide, be loaded, and go out again with the next, a celerity which does not give unqualified satisfaction to the sailors, as curtailing their time ashore. Hydraulic power is extensively used at this dock for the various motions required. Six large accumulators are kept charged with a pressure of 600lbs. to the inch, and, to supply it to the travelling cranes, telescoping tubes are used. The dock gates are opened by direct-acting rams, supported on gimbals, and the ponderous iron bridges over the entrances are moved by the same agency.

As usual, a number of factories were thrown open to the inspection of visitors. One of the most interesting of those which I visited was that of the Cardiff Artificial Ice and Cold Stores, which is said to be the most complete in the kingdom. The method used is that of compressing ammonia gas to a liquid and then allowing it to expand. The cold thus produced is absorbed by a solution of $Ca\ Cl_2$, which is then circulated through the freezing tanks and cold rooms. In compressing the NH_3 water is used to absorb the heat given out, and it is remarkable that in this warm water a variety of uncommon forms of microscopic life occur. The cold rooms, which are kept at a temperature of 19°F., are cased with charcoal packing and can only be entered from the top of the building, this arrangement being adopted to prevent the warmth of the atmosphere from getting in. They are lit by electric incandescent lamps, and there is an arrangement so that, by shutting the doors from the outside, the current is broken. The hydraulic lifts are of a very complete character, for as many as 1,700 carcases have been placed in the stores in one hour. It gives one rather an uncanny feeling to go into these cold and feebly lighted rooms and see immense piles of shrunken limbs, covered with hoar frost. One's thoughts involuntarily turn to the mummies in the Egyptian catacombs. Amongst other things there was a quantity of game belonging to the Marquis of Bute, which was kept there frozen until required for his table.

A number of factories are situated on the ground which has been reclaimed from the Bristol Channel. One of these is that of the Tin Stamping and Enamelling Co., which covers an area of $3\frac{1}{2}$ acres. The process must be seen to be understood, but I may mention that large tinplate bowls are here stamped out at one operation, and, moreover, three at once in the one die. It is obvious that the metal must be of exceedingly good quality. The manufacture of enamelled vessels for domestic uses has recently attained a large development, in consequence of improvements which have rendered the glaze much more durable. I was told that for these articles steel was preferred by the makers, on account of its being actually cheaper than iron. I saw, also, that the whole of the works were lit up by the incandescent electric light, a pretty good proof that it can be had as cheap as gas. From thence I went to see a newspaper printed. I had seen the same processes at Newcastle two years ago, but, as newspaper offices are not usually open to the public, it may be worth while to give an outline of the method. The paper is not printed directly from the type, but from stereotype, which has the advantage of lessening the wear of the type and of allowing the multiplication of presses. It also renders practical the immense advantage of adapting what was a flat form of type to the cylindrical rollers of the continuous printing press. The method adopted is to press the type upon a series of damp layers of paper and wadding, and which is dried by steam in about ten minutes whilst still in contact with the type. The pasteboard matrix is then bent around a half cylinder and the stereo metal poured in. In about a minute the cast is taken out, trimmed, and then placed on the printing cylinders. A roll of paper, weighing about 5cwt., has been previously placed on the machine, and, with a roar that makes you think that demons have broken loose instead of a beneficent genius, the machinery is set in motion. It is impossible, whilst the apparatus is at work, to trace all its actions, but enough is seen to excite the highest admiration and wonder. The continuous web of paper, as it is printed, is cut up, folded, counted, and deposited in fifties, at a rate which makes one think of flakes in a snow storm. I have never seen, to my mind, a more impressive sight than that of a modern newspaper printing machine in full activity.

The public museum at Cardiff contains a miscellaneous collection of curiosities, but its Natural History department is at least better than any of which we can boast in Birmingham. It contains a very fine set of models, constructed in glass, of invertebrate animals, many of them on an enlarged scale.

In consequence of the continuously bad weather, I did not get far away from the town. A visit to Llandaff Cathedral, two miles out, was interesting, as it is considered the finest in Wales. In the fields below was growing abundantly *Saponaria officinalis*, which is usually considered to be an escape, but which was here certainly growing quite wild.

A visit to Penarth headland, the same distance away, was very interesting from a geological point of view. The section is 100ft. in height, and displays at the base Triassic marls, with large nodular masses of gypsum. This is followed by 70ft. of Rhaetic or Penarth beds, and these are capped by Lias. The whole series is perfectly conformable, and the colour changes so gradually from the red of the Triassic to the grey of the Lias that the observer cannot, at first sight, distinguish where the one leaves off and the other begins. The cliff is continually showering down small particles of rock, and though I did not see any large blocks come down, yet they evidently do so at times, and this induces caution in approaching too near.

I now come to what is supposed to be the more immediate business of the Association, that is, its indoor meetings. The proceedings were commenced, as you have probably seen, by an address by Dr. Huggins, its president. His subject was the branch of astronomy to which his labours have chiefly been devoted, namely, the spectroscopic examination of the stars. I am saved, however, the necessity of reporting it to you, by the fact that Sir R. Ball, in his recent address to the Midland Institute, dwelt upon precisely those points which struck me in Dr. Huggins' address. It is the custom at the meetings of the Association to decorate the reception room with banners appropriate to each of its past meetings. You will see among the photos a copy of the one prepared by Dr. Huggins this year. At the top of it there is a stripe which, on the banner, was worked with the colours of the spectrum, and beneath is the glorious constellation of Orion and the Dogstar.

The first general lecture to the members was given by Prof. Miall, on "Certain Difficulties in the Life of Aquatic Insects." The lecture was admirably illustrated. I was particularly struck by the way in which troughs containing living insects were shown right way up on the screen. This was done by sending the light obliquely downwards through the object, and then reflecting it up again on to the screen, by means of a totally reflecting prism. The most interesting point of the lecture, to me, was the influence of the surface tension of water. By this expression is meant that the molecules forming the surface of a liquid in contact with air have different properties to those in the body of it, and that they act as though there were upon it an elastic film which resists the passage of the body into or out of the liquid, according to whether the body repels or attracts the liquid. By this I do not mean that there is any foreign substance forming a scum over the liquid; in fact, any greasy or other impurity will always lessen the surface tension of water. It is unnecessary for me to shew you that light bodies will rest on water, though specifically heavier, provided that they do not become wetted. Thus a polished steel needle will float on water in a sort of trough formed under it, and there are several insects which may be seen on almost any calm sheet of water skating about with the utmost facility. This appears to be due to the quantity of hair on their legs, and Professor Miall gave the following illustration: If you press a sheet of paper down on a sharp point it will be penetrated, but if you imagine an exceedingly great number of points, there will be required a corresponding expenditure of power. In the corresponding case of a wetted body trying to emerge from a liquid, it is perhaps not so well realized that the same resistance is experienced as in the case of the body resting on its surface. Now, to apply this to the study of aquatic insects, let us take the case of the common gnat. The larvæ of this insect are commonly to be found in large numbers in rain-water tubs in the country. When undisturbed, they may be seen generally hanging head downwards at the surface of the water. Now the reason of this is that the animal is an air breather, and it obtains its supply by a tube from near its tail, whilst its head is busy below gathering its food out of the water. If alarmed, however, it dives with a few vigorous jerks below the surface, it having, as will be seen, a higher specific gravity than that of water. When it has regained confidence a greater expenditure of power is required to bring it to the surface, but the moment that its breathing tube has penetrated into the air its efforts cease, and it hangs serenely from the little cup which has formed itself at the extremity of that tube. Now, how does the little animal succeed in pushing this tube against the resistance of this surface tension? Simply by converting the end of the tube, for the time being, into a point. There are three triangular plates surrounding the end of the tube, which, when folded together, form an acute pyramid, which penetrates the surface and then instantaneously opens out, so as to form the cup before spoken of. In the course of time the larva changes to a pupa, and now the conditions are altered. No food is taken by the pupa, but air is still required; whilst to facilitate the emergence of the perfect winged insect when the final transformation takes place, its specific gravity becomes less, so that, when at rest, it floats at the surface of the water. Moreover, as the perfect insect requires to emerge at the thickest part of the pupa, it is necessary that this portion of it shall float the highest, and hence two breathing tubes are developed from the back of the thorax. Now the animal is, of course, subject at times to the attacks of enemies from above, but with its decreased specific gravity it would be almost impossible for it to loose the surface film without some special contrivance, and this, according to a recent observer, appears to consist of a pencil of hairs, which draw a film of water over the end of each tube.

A further application of the principle of surface tension is seen in the case of water snails. According to Professor Miall, it is only with those without shells, the others being specifically lighter than water; but I have noticed it occurring with both kinds. If these animals be kept in an aquarium, they will frequently be seen gliding along in an inverted position under the surface of the water with as much ease as flies walk on a ceiling. When the animal is heavier than water, a cup is formed by its foot in the surface film, and, by the extreme mobility of that organ, the animal alternately advances the cup, and then swings its body along underneath it; and at the same time feeding on the surface conferva. If the snail be forcibly submerged it at once drops to the bottom, and can only rise again by the aid of some friendly plant. Professor Miall speaks of the rigidity of the surface as the means of progression, but, for my part, I do not think that a snail could practise this mode of locomotion, unless it were of different specific gravity to water; since the surface of liquids does not, so far as I can see, possess different properties to the body of the fluid, unless it be distorted from a true plane.

At one of the sectional meetings Professor Miall subsequently gave a paper on a subject intimately related to the foregoing, namely, "Aquatic Leaves." Plants growing in water have leaves of two kinds—submerged or floating. The first derive their CO_2 from the water, and are commonly much divided; whilst the latter breathe direct from the atmosphere by means of stomata on their upper surface, in a manner similar to those of terrestrial plants. Both kinds of leaves may well be studied on the water ranunculus, Now, as even the floating leaves are produced from below, they have to penetrate the surface film; and even afterwards have to provide for being able to free their surfaces from water deposited on them by rain or agitations of the surface of the pond or stream in which they live. The first end is attained by the young leaf coming up closely curled up, and as sharply pointed as if it had to penetrate solid earth. The second condition presents more difficulties, and Professor Miall's paper was more suggestive than explanatory. It appears to me that the end is most generally attained by the leaf being coated by some water-repelling varnish, and having a convex surface, so that the water drains off all round. Professor Miall, however, objects that the supposed varnish does not act when the leaf is dead. In the case of our water-lilies, the margin of the leaf is turned up so as to form a sharp edge, which cuts the surface of the water if the leaf should happen to be submerged, and channels are provided to drain the leaf to the point where the petiole joins the blade. In a species of water-lily which I photographed last week at the Botanical Gardens, the edge of the leaf is corrugated, and a cleft divides the otherwise circular leaf down to the petiole. Professor Miall also stated that many floating leaves are much divided, apparently to facilitate the drainage, and that some are clothed with hairs, in order to repel water from their surfaces. Altogether, I think the subject is well worth the attention of botanical students.

The second lecture was delivered by Professor Rücker, and was a splendid example of an experimental lecture. His subject was that of "Electric Stress." By this is meant the action of electrified bodies upon interposed non-conducting substances. Faraday long ago showed that a non-conductor does not play a merely passive part, when placed between two conducting bodies, one of which is electrified; but I never saw the action made so evident as it was in Professor Rücker's lecture. If the two terminals from an electrical machine be placed in a shallow glass vessel containing ether, and sulphide of antimony be sprinkled in, when the machine is worked the powder will arrange itself between the poles in a manner similar to the behaviour of iron filings between two magnetic poles, with this difference that the particles tend to gather around the + pole. To shew the action upon the dielectric, carbonic disulphide is used with polarized light. In its normal condition CS_2 transmits polarized light without change; but, if it be between two differently electrified plates, the beam of light, if its plane of polarization were inclined to the plane of the plates, becomes partially depolarized. If it be then passed between another pair of electrified plates, at right angles to the first, the action is reversed, unless the one pair have charges of the same kind. In fact, the liquid under the influence of electricity behaves just like a plate under mechanical pressure: we have accomplished the, at first sight, impossible task of squeezing a liquid in one direction and not in another. A variety of experiments were shewn amplifying this principle. If the action was sufficiently intense, colour was shewn to be produced. This when analysed by the prism exhibited a spectrum with a dark band in it, which moved along it, according to the amount of electric stress. Even after the band had moved off the visible spectrum at the red end, it was shewn to be present in the ultra-red region by means of Mr. Boys's radio-micrometer.

There were two conversaziones given by the local committee. Exhibits of scientific objects were not very numerous, but I note the following. There was a lantern exhibition of views from Languedoc in S. France, which shewed scenes strikingly resembling the cañons of Colorado. The district is so remote from the ordinary run of tourists that it has remained comparatively unknown. There was also an exhibit by Professor Copeland of a model to shew a possible way of accounting for the bright radiating streaks seen on the moon at the full. This was effected by placing an immense number of glass beads in the required directions on the surface of a plaster globe, and it certainly produced the required effect. Professor Copeland at one of the sectional meetings argued in favour of this being the true cause of the phenomenon, but his auditors did not seem to see their way clear to imagining the presence of anything resembling glass spheres on the moon's surface.

A short lecture was also given on the subject of "Finger-tips as a Means of Personal Identification." It has long been known that the ridges on the ends of the human fingers present very beautiful and curious patterns. It was also known that they differ in different individuals, but it has been only recently that Mr. F. Galton has succeeded in deducing and classifying them so as to afford a practical means for the identification of individuals. It is said that the markings do not change materially with age or occupation, and that it has been found particularly useful in the case of Eastern nations, in which the individuals, at least to the European eye, very much resemble each other. A paper on this subject by Mr. Galton will be found in the "Nineteenth Century," for August last, and a more preliminary one in "Nature," June 28th, 1888.

At the sectional rooms there were two exhibitions which should be of interest to our photographic friends. The one was by a committee appointed to collect and register photographs of geological interest in the United Kingdom, and the other by a similar committee for obtaining photographs of meteorological phenomena. The latter contained some fine examples of clouds taken through yellow glass, and also of flashes of lightning, &c. The two committees would be very glad to receive specimens from any observer, and I may say that, as yet, scarcely any geological photographs have been received from the neighbourhood of Birmingham.

There is another lesson which I learnt at the British Association that I should like, though with considerable diffidence, to bring under the notice of this Society. It was constantly remarked in the Cardiff newspapers that the speakers at the sections did their part indifferently, and, so far as I saw of the proceedings, I could not deny the justice of the charge. It was said that the speakers talked to the black-board, or their apparatus, or even to their bottom waistcoat button, and but rarely to their audience. Now I am sorry to say that the majority of the frequenters of the meetings of this Society do not shine as debaters, and here I must say that no one can be more conscious of his own defects than I am of my own shortcomings, so that I trust you will pardon my calling attention to this matter. I might, however, plead in my excuse that until recently I had no possibilities of learning better, but now that instruction in the valuable art of elocution is given in this building I would strongly urge our members to take advantage of it. It is of very little use to devote a lot of time to acquiring knowledge unless one is able to give it out again to others; and to do this most effectively one must be able to address a number of persons at the same time. Perhaps at some future time mechanical power may be called in to do for the voice what the printing press has done for the hand, but waiting the advent of that invention we must make the best use of our natural powers. I would especially urge it upon our younger members, for they may rely upon it that with increasing years it becomes more difficult to acquire what ought to be simply a matter of habit. There seems to be an impression that the study of elocution is only needed for those who wish to take part in dramatic performances. Now that is quite a mistake. It is true that in the exposition of, say, the Binomial Theorem there is not much room for the graces of expression; but, at all events, we all wish to be audible when speaking, and unfortunately most untrained speakers do not succeed in even that fundamental quality, and I would therefore again press it upon all scientific students to acquire at least the rudiments of that very useful art.

In bringing these notes before the Society I am well aware that none of them may be absolutely new. The diffusion of news at the present day is so rapid that a diligent reader may have seen all of them in the journals reporting the meeting, or even in still earlier literature. I can only say that they have been new or interesting to me, so that I may, I think, hope that they have not been entirely devoid of value to at least some of our members present.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from Vol. XIV., page 286.)

* **Nepeta Cataria.** 13, about Kidderminster; 50, near Stourport, Witley, and Worcester. Tab. 22. Severn, Malvern, Lickey.

* **N. Glechoma.** Tab. 14. In all the districts.

* **Melittis Melissophyllum.** 131, woods near Halesowen, Scott. *See "Mid. Nat.," Vol. XI., p. 19. A doubtful record.* Tab. 22. Lickey, extinct.

* **Lamium amplexicaule.** Tab. 22. In all the districts.

* **L. incisum.** 50, near Earl's Court, St. John's, Worcester. Tab. 22. Severn. Very uncommon.

* **L. purpureum.** Tab. 22. In all the districts.

* **L. album.** Tab. 22. In all the districts.

* **L. maculatum.** 94, found by the late Dr. Streeten at Defford Common some years ago. Tab. 22. Severn. Extinct. *Not native.*

* **L. Galeobdolon.** Tab. 22. In all the districts.

* **Leonurus Cardiaca,** xxx. Near Bewdley, Jorden; 13, Iverley, Scott. Tab. 22. Severn. *Not native.*

* **Galeopsis Ladanum, G. Tetrahit.** Tab. 22. In all the districts.

G. versicolor. 50, Hurcott, near Kidderminster, 1847; 104, Broadway Hill; 126, Romsley Hill. Tab. 22. Avon, Severn, Lickey. *First record.*

* **Stachys Betonica, S. sylvatica, S. palustris, S. arvensis.** Tab. 22. In all the districts.

* **Ballota nigra.** Tab. 22. In all the districts.

* **Marrubium vulgare.** 13, Mitton, near Stourport; 50, roadside at Grimley; 93, Cracombe and Coldknap Hills; 131, near Lye Waste, Scott. Tab. 22. Severn, Malvern, Lickey. *Malvern is omitted from the text, and Avon from the table.*

* **Teucrium Scorodonia.** Tab. 22. In all the districts.

* **Ajuga reptans.** Tab. 22. In all the districts.

* **Cynoglossum officinale.** Tab. 20. In all the districts.

* **C. montanum.** 36, Nash. 95, Purton, *fide* Rufford. Tab. 20. Avon, Severn, Malvern. *The Malvern localities are omitted from the text. Madresfield, 1884. Towndrow !*

* **Borago officinalis.** Tab. 20. In all the districts. *Not native.*

* **Anchusa sempervirens.** 119, near Moseley Hall. Tab. 20. Severn, Malvern, Lickey. *Not native.*

* **Lycopsis arvensis.** Tab. 20. In all the districts.

* **Symphytum officinale.** Tab. 20. In all the districts.

* **Echium vulgare.** 13, about Kidderminster and Stourport; 119, Dudley Castle. Tab. 20. In all the districts.

* **Pulmonaria officinalis.** 86, Tame Valley. Tab. 20. Severn, Malvern, Lickey. *Not native.*

* **Lithospermum officinale.** Tab. 20. In all the districts.

* **L. arvense.** Tab. 20. Avon, Severn, Malvern.

* **Myosotis palustris, cæspitosa, arvensis.** Tab. 20. In all the districts.

M. repens. Tab. 20. Severn, Malvern. *First record.*

* **M. sylvatica.** 6, Bewdley; 72, Malvern; 101, Bredon and Broadway; 124, Lickey D. Tab. 20. In all the districts.

* **M. collina.** 13, Habberley Valley. Tab. 20. Severn, Malvern, Lickey.

* **M. versicolor.** 13, Severn D.; 65, Malvern, Tab. 20. Severn, Malvern, Lickey. *Must be in Avon also.*

* **Pinguicula vulgaris.** 66, Malvern Hills; 96, formerly at Feckenham. Tab. 23. Avon, Malvern, Lickey. *Extinct, except at Malvern.*

* **Utricularia vulgaris.** 35, near Chaceley; 61, same locality. Tab. 23. Malvern.

* **Hottonia palustris.** 35, 61, near Chaceley. Tab. 23. Severn, Malvern.

* **Primula vulgaris** and var. **caulescens.** Tab. 23. In all the districts.

* **P. veris.** Tab. 23. In all the districts.

* **Lysimachia vulgaris.** 34, Longdon Marsh; 51, Severn side, near Kempsey; 90, Avon. Tab. 23. In all the districts.

* **L. Nummularia, L. nemorum.** Tab. 23. In all the districts.

* **Anagallis arvensis.** Tab. 23. In all the districts.

* **A. cærulea.** 51, Tibberton; 67, Silurian hills of Malvern; 97, 101, Avon D. Tab. 23. Avon, Severn, Malvern.

* **A. tenella.** 66, Malvern Hills; 96, formerly at Feckenham; 119, formerly at Moseley. Tab. 23. In all the districts; extinct in Avon.

* **Centunculus minimus.** 68, 73, near Brand Lodge, Malvern (*Hereford*); 119, formerly at Moseley.

* **Glaux maritima.** 36, Droitwich Canal. Tab. 23. Severn.

* **Samolus Valerandi.** 38, 51, Battenhall, Defford; 91, between Cracombe Hill and Evesham. Tab. 23. Avon, Severn.

* **Plantago Coronopus.** 115, Lickey. Tab. 23. In all the districts.

*† **P. maritima,** Tab. 23. Severn, extinct. *An error? See "Mid. Nat.," Vol. XI., p. 20; Vol. XIII., p. 164.*

* **P. lanceolata, media, major.** Tab. 23. In all the districts.

*‡ **Littorella lacustris.** 60, 131, Scott, Pensnett Reservoir. *In Stafford.*

‡ **Amaranthus Blitum.** 6, near Bewdley. Tab. 23. Severn. *Not native.*

* **Chenopodium polyspermum.** 51. Tab. 23. Severn, Malvern, Lickey.

* **Ch. urbicum.** 51, near Worcester. Tab. 23. Severn, Malvern.

* **Ch. album.** In all the districts.

Ch. ficifolium, xlvii. Tab. 24. Severn. *First record.*

Ch. murale. 51, near Worcester. Tab. 24. Severn. Also in Add. and Corr.

* **Ch. hybridum.** 95, near Evesham in 1850, Mr. T. Westcombe. Tab. 24. Avon.

* **Ch. rubrum.** 51, near Worcester. Tab. 24. Avon, Severn, Malvern.

* **Ch. Bonus-Henricus.** 51, Worcester, Tibberton. Tab. 24. In all the districts.

Ch. Botrys, xxx. Hagley Hall Gardens. *Not native.* Irvine's "Handbook," 1858. *Omitted from notice of this work in "Mid. Nat.," Vol. XIII., p. 257.*

Beta maritima, xxx. 21, railway embankment, Shrub Hill, Worcester; plentiful for two years, "Phytologist." Tab. 24. Severn. Extinct.

* **Atriplex angustifolia.** 51. Tab. 24. In all the districts.

* **A. erecta.** 51, near Worcester. Tab. 24. Severn.

A. deltoidea. 51, near Worcester.

* var. **microsperma**, 51, near Worcester.

* **A. hastata** (**patula**). 51, aggregate of erecta and angustifolia.

* **A. Babingtonii.** 33, Salden. Tab. 24. Avon.

A. hortensis. *Not native.* With Beta maritima, above Severn. *Not in table.*

* **Rumex maritimus.** 36, 38, 61, Longdon Marsh and other places. Tab. 24. In all the districts.

* **R. palustris.** 51, southern part of Severn valley. Tab. 24. Malvern, Lickey.

* **R. conglomeratus.** Tab. 24. In all the districts.

†* **R. nemorosus** = var. **sanguineus.** 51. "The green var. viridis only met with, according to my own observation." Yet, Tab. 24. Severn, Malvern. Very uncommon. *Mr. R. F. Towndrow, Malvern.*

* var. **viridis.** Tab. 24. In all the districts.

* **R. pulcher.** 51, Dodderhill Churchyard, Droitwich; 68, Longdon; 96, Pershore Churchyard. Tab. 24. Avon, Severn, Malvern.

* **R. obtusifolius, R. crispus.** Tab. 24. In all the districts.

* **R. pratensis.** 14, 51, Wannerton Downs; 68, Longdon; 86, Malvern, D. Tab. 24. Avon, Severn, Malvern.

* **R. Hydrolapathum.** 51, Severn banks, Longdon, &c.; 91, Avon. Tab. 24. In all the districts.

* **R. Acetosa, Acetosella.** Tab. 24. In all the districts.

* **Polygonum Bistorta.** 6, Bewdley; 72, 86, Malvern D.; 115, 126, Lickey D. Tab. 24. Severn, Malvern, Lickey.

* **P. amphibium.** 90, River Avon. Tab. 24. In all the districts.

* **P. lapathifolium, P. Persicaria, P. Hydropiper.** Tab. 24. In all the districts.

* **P. nodosum** (**laxum**). Tab. 24. Malvern. Form of P. lapathifolium.

* **P. mite.** 51, near Worcester. Tab. 24. Severn.

* **P. minus.** 65, 69, 72, Malvern. Tab. 24. Malvern.

* **P. aviculare.** Tab. 24. In all the districts. No vars. stated.

P. Roberti (*Raii*). 37, near St. Peter's, Droitwich. Tab. 24. Severn. *First record.*

* **P. Convolvulus.** In all the districts.

*† **Fagopyrum esculentum.** Tab. 24. Avon, Severn, Lickey. *Not native.*

* **Daphne Mezereum.** 84, Little Shelsley. See also Add. and Corr. Tab. 25. Avon, extinct; Malvern.

* **D. Laureola.** 72, Malvern. Tab. 25. In all the districts.

* **Aristolochia Clematitis**, xxx. On the site of old gardens in Worcester and Chaddesley Corbet. Tab. 25. *Not native.*

Buxus sempervirens, xxx. 101, Bredon Hill; planted. Tab. 25. *Not native.*

(To be continued.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—BIOLOGICAL MEETING. December 8th. Mr. R. W. Chase in the chair and about 150 members and friends present. Mr. J. B. Stone, J.P., F.I.S., gave a very interesting account of his recent tour round the world, which he illustrated by a large collection of Natural History specimens. At the conclusion of the meeting a vote of thanks to Mr. Stone was carried with acclamation.—MICROSCOPICAL SECTION. December 1st. Mr. C. Pumphrey (President), in the chair. Mr. W. H. Wilkinson exhibited a peculiar growth in timber, leaving a cast in the heart wood. The specimen came from Wellington, Salop. Also a lichen, *Cladonia digitata* var. *macilenta*, in fruit, from Sutton Park, where it is rare. Mr. G. Lavender exhibited a growing fern, *Anemedictyon phyllitidis*. Mr. W. Morley exhibited Vol. I. of the Minutes of the Birmingham Naturalists' Association, the ancestor of the present society. Mr. J. Edmonds read some notes on Diatoms, and exhibited under the microscope an extensive series of specimens. Mr. G. Lavender also exhibited an equally large series, and Mr. W. P. Marshall exhibited one of Muller's Typen Platten of 100 specimens, using his one-twenty-fifth inch objective. A keen discussion followed, and Mr. Bishop (a visitor) drew attention to the markings on the diatom frustules and the recent researches and photographs of these algæ by the Royal Microscopical Society.—EXTRA MEETING. December 16th. Mr. C. Pumphrey in the chair. Mr. Clark gave a demonstration on the mounting and preparing of specimens. After a few introductory remarks he mounted a few specimens dry, fully demonstrating each step, and followed with balsam. Finally aquatic larva and entomostraca were mounted. The specimens were then put under the microscope and examined. Mr. Neville also exhibited a large series of his own preparations in balsam.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—November 23rd. Mr. Wiltshire gave a lantern exhibition of photographic views; they comprised a series of pictures of London views, rural scenery, churches, and a large number illustrative of the scenery of North Devonshire, those of the Lynmouth and Lynton districts being much admired.—November 30th. SPECIAL—CONCHOLOGY. Mr. J. Madison exhibited specimens of each British species of Clausilia and Pupa and photographs of the same, and called attention to the advantages of photographing these small objects, sufficiently magnified to show their distinctive features; Mr. Linton, variously marked shells of *Patella vulgaris*; Mr. Hawkes, nummulites, sharks' teeth, and jaws of porpoise; Mr. S. White, shells collected in the Cheltenham district, including hibernating specimens of *Helix pomatia*; Mr. J. W. Neville, odontophore of *Haliotis tuberculata*.—December 7th. Mr. J. Moore showed specimens of *Limnæa peregra* var. *sinistrorsa;* Mr. J. W. Neville, a series of shells of Conus from Ceylon; Mr. J. Collins, a collection of the rarer plants from co. Cork, including specimens of *Orchis pyramidalis*, *Habenaria viridis*, *Cochlearia danica*, *Hymenophyllum tunbridgense*, *Allium triquetrum*, *Polypodium vulgare* var. *hibernicum*, &c. Mr. H. Hawkes said some of the plants shown had a home in Ireland when that country was joined to Portugal, and were amongst the oldest plants on British soil. Under the microscope Mr. Collins showed flea of hedgehog, *Pulex erinacei*.—December 14th. ANNUAL EXHIBITION. The President, Professor Hillhouse, M.A., F.L.S., exhibited a large number of botanical specimens, chiefly illustrating abnormal development; Mr. H. Hawkes, a series of diagrams of microscopic fungi, and ideal landscapes of geological epochs, also a large collection of specimens illustrating the common objects of the sea shore; Mr. J. Madison, fossil shells, land, freshwater, and marine, from the Eocene of the Barton beds and Isle of Wight; Mr. Corbett, a collection of minerals; Mr. Linton, land and marine shells, the latter from Tenby; Mr. Lilley, collections of shells from the Christchurch and Towyn districts; Mr. W. Tylar, lanternscopes and photographs; Mr. J. Collins, a collection of ferns; Mr. C. P. Neville, cases of Indian butterflies; Mr. J. W. Neville, a series of entomological preparations for the microscope, illustrating the orders Lepidoptera, Coleoptera, and Hemiptera; Mr. P. T. Deakin, cases of freshwater shells of the genera Unio and Anodonta, and Maltese marine shells; Mr. W. J. Parker, nests of Weaver Bird; Mr. Cardwell, stuffed birds. A number of living objects and interesting preparations were shown under the microscopes. During the evening, the President gave a hearty welcome to the numerous visitors present, and commended the study of nature for those who wished to utilise to the utmost the gift of sight.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—November 16, 1891. The President, Mr. W. G. Blatch in the chair. The Rev. C. F. Thornewill showed a specimen of *Sphinx convolvuli*, taken on September 30th, at Burton-on-Trent. Mr. G. T. Baker showed *Callimorpha hera*, from Jersey and the Continent, also *Nemeophila plantaginis* var. *hospiton*, from various localities. Mr. P. W. Abbott showed *Nonagria geminipuncta* and *Toxocampa pastinum*, a series of each from the Isle of Wight. Mr. R. C. Bradley showed a series of the genus *Calliphora*, including *grœnlandica*, *azurea*, *cognata*, &c. The Rev. C. F. Thornewill said that he had found in a cellar at Stretton, near Ashley, forty or fifty specimens of *Gonoptera libatrix*, also specimens of *Triphosa dubitata*. The Rev. E. J. Nurse read a paper on "Wicken Fen and its Moths," mainly dealing with a holiday spent there this year, but including much information gathered during some years' residence there.—December 7th, 1891. Mr. R. C. Bradley in the chair. Mr. R. C. Bradley showed a box of Lepidoptera taken during the year at Sutton. Mr. C. J. Wainwright showed *Asteroscopus sphinx* (*cassinea*), from Hanbury Park, and *Calyminia affinis*, from Arley. Mr. E. C. Tye showed a boxful of captures made this year, including *Chœrocampa porcellus*, from Sutton, *Lithosia mesomella* from Wyre Forest, *Noctua glareosa*, from Sutton, &c. Mr. P. W. Abbott showed a boxful of this year's captures, including *Phibalapteryx lignata*, Sutton, *Noctua dahlii*, Sutton, &c. Mr. G. T. Baker showed four boxes full of Scotch insects, collected at various times in the Shetlands and Hebrides, at Rannoch and Forres, by the Messrs. Salvage.

ON SPECIMENS FROM THE PERMIAN BRECCIA OF LEICESTERSHIRE COLLECTED BY W. S. GRESLEY, ESQ., F.G.S.*

BY PROFESSOR T. G. BONNEY, D.SC., LL.D., F.R.S., V.P.G.S.

For some years prior to 1889 Mr. W. S. Gresley, F.G.S., had been engaged in collecting specimens from the Permian breccia, in the neighbourhood of the Leicestershire coal-field, with the intention of writing a paper on the subject, in addition to that already published in the "Midland Naturalist."†

From time to time he had consulted me on the microscopic structure of his specimens, and in 1889, on leaving England for America, he presented to me his whole collection, with nearly seventy microscopic slides and his manuscript notes, expressing the hope that I should be able to make use of the results of his labours. Continued pressure of other work has prevented me until recently from discharging the trust which he committed to me.‡

I have now re-examined all the specimens, and compared them with the notes made by Mr. Gresley or copied by him from memoranda which I had previously forwarded. It would have been unfortunate if the results of his long-continued work had been wholly lost, for Mr. Gresley's collection was to a considerable extent made, not from surface exposures of the breccias, but from pit and well sinkings, cuttings, or other localities which are not permanently accessible. It is, however, to be regretted that the completion of the paper has fallen into the hands of one who, like myself, has but a very slight knowledge of the district. The specimens have been roughly grouped according to their petrographical characters, and those of igneous origin have been described first.||

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* Read before the Birmingham Natural History and Microscopical Society, November 17th, 1891.

† "On the Occurrence of Fossiliferous Hæmatite, &c.," "Midland Naturalist," Birmingham, 1886, Vol. IX., p. 1.

‡ That it is now accomplished is largely due to the aid of a former student at University College, Miss C. A. Raisin, B.Sc., who relieved me of all trouble in arranging the specimens and notes, in looking up references, in checking the microscopic descriptions, and whose kind help as assistant and amanuensis I gratefully acknowledge.

|| The reader of these notes must not forget to consult Mr. Horace T. Brown's admirable paper on the "Permian Rocks of the Leicestershire Coalfield" ("Quart. Journ. Geol. Soc.," Vol. XLV., p. 1), to which this may be regarded as a supplement.

I.—Syenite.

(10, 38.*) There are two fragments of rock which bear macroscopically considerable resemblance to the "southern syenites" of Charnwood, appearing fairly coarse compounds of reddish, whitish, and dark green minerals. Both have externally a corroded aspect, one, a rather pyramidal fragment, about $2\frac{1}{2}$in. long by $1\frac{1}{2}$in. each way at the broader end, seems quite unrounded, and the other fragment is probably from an angular mass. Microscopic examination shows some quartz; felspar, hornblende with alteration products, and more or less decomposed ilmenite, set in a micrographic matrix of quartz and felspar. Allowing for the greater decomposition, these rocks correspond with the syenites of Markfield, &c., to the description of which I refer for details.†

II.—Felstone, &c.

The next group of rocks consists for the most part of fragments of felstone, varying from very compact to minutely granular. In form they exhibit gradations from angular to subangular. (35.) The first shows scarcely any rounding, and bears macroscopically and microscopically considerable resemblance to the purple porphyritic dacites which occur as fragments in the volcanic agglomerates of Charnwood, and it is not very unlike the uncrushed Sharpley rock. Parts of the slide, however, exhibit a subspherulitic character, and there are traces of fluidal structure; perhaps, also, of slight mechanical disturbance. (53.) The second is an angular fragment of a pale reddish rock, slightly spotted with green. Under the microscope, quartz and felspar crystals, of rather fragmental aspect, are seen to be somewhat thickly set in a devitrified matrix. The structure may be partly due to flow, but strain shadows in the quartz and other appearances suggest a possibility of mechanical disturbance. This specimen also presents some resemblance to certain rocks in the northern part of Charnwood. (62.) The next specimen apparently is broken from a more rounded mass, and is of a purplish tint, with lighter and darker specks. Under the microscope it proves to be an altered dacite, and bears much resemblance, in the condition both of the quartz and felspar and of the ground mass, to specimens which I have described from High Sharpley. The rock has been affected by sub-

* The numbers are those on Mr. Gresley's specimens.

† "Quart. Journ. Geol. Soc.," Vol. XLVII. (1891), p. 101. T. G. Bonney. "Note on a Contact-structure in the Syenite of Bradgate Park;" and "Quart. Journ. Geol. Soc.," Vol. XXXIV. (1878), p. 215, E. Hill and T. G. Bonney, "The Pre-Carboniferous Rocks of Charnwood Forest."

sequent pressure. (67.) The next is from a subangular fragment of a compact purplish, somewhat slaty-looking rock, in which felspar crystals are so irregularly scattered as to suggest a fragmental origin, but under the microscope, the rock closely resembles some of the compact purple rhyolites which occur as fragments in the agglomerates of Charnwood, and to these, on the whole, I am disposed to refer it. (47.) The next is an angular fragment with rounded edges, the matrix of which corresponds very well with that of the compact purple rhyolitic rocks of the Charnwood breccia, but it has two or three irregular vesicles filled with a pinite-like mineral,* a structure which, so far as I know, they do not exhibit. (26.) A brecciated rock infiltrated with quartz. It is difficult to speak with certainty, but, on the whole, I incline to the view that the rock is a rhyolite, which has been rather decomposed, brecciated, and permeated by silica. The cracks are filled with regular grains of crystalline quartz, and contain some irregular patches of a dull green, chloritic mineral. These veins also present a rather brecciated aspect, as if the rock had been again disturbed after infiltration. (9.) An angular fragment of quartz-porphyrite of a warm, light red colour, somewhat speckled. Under the microscope, the ground mass, which is much stained with ferrite, appears to be wholly crypto-crystalline. In it are scattered a fair number of (*a*) crystals of rather decomposed felspar, many (perhaps all) of which are plagioclase; (*b*) numerous granules of quartz, occasionally showing some of the crystal angles, usually clear, but sometimes with enclosures of the ground mass; (*c*) an altered ferro-magnesian mica, now of a dull greenish colour, with the iron oxide partly separated; (*d*) a few larger grains of iron oxide; (*e*) some small crystals of apatite. (29.) A fragment which appears to be a fine-grained felstone, with small crystals of felspar and hornblende and grains of quartz scattered about in a rather compact matrix. The rock does not, as far as I know, exist at Charnwood, but might possibly be related to the "syenites" of that region. (19.) A decomposed and devitrified igneous rock, with some crystals of felspar, past further recognition, and (?) altered biotite; also, some altered iron oxide and perhaps a little quartz. The rock probably has been once a sanidine-trachyte or an andesite. It does not remind me strongly of any Charnwood specimens, being more micaceous than is usual in the uncrushed rocks of that district. (31.) A rather speckled, greenish-grey rock, becoming paler in weathering; it appears

Cf. "Quart. Journ. Geol. Soc.," Vol. XLII. (1886), p. 187, G. A. J. Cole, "On the Alteration of Coarsely Spherulitic Rocks."

to contain small grains of decomposed felspar and hornblende in a compact matrix. Probably a porphyrite. Certainly not from the Charnwood series. (64.) A fairly angular fragment from Overseal, which does not appear as if it had travelled far. Examined microscopically, the ground mass is seen to consist of decomposed felspar, apparently plagioclastic, a moderate amount of viridite, probably replacing augite, sometimes exhibiting an ophitic arrangement, and interstitial black and deep brown matter, which I think indicates the former existence of a basic glass. The rock is microporphyritic, the felspars being probably, at any rate in part, plagioclase; and it appears to have been rather vesicular, the cavities being now occupied by a chloritic mineral with a ringed or banded arrangement. Also there are several grains of a pinite-like mineral, more or less speckled with opacite, and with a rich brown dust. In several of them the exterior has a corroded aspect, as if the mineral had consolidated at an early period and had subsequently been attacked by the magma, but one or two have a prismatic form, with an occasional imperfect transverse cleavage. A basalt, though not one of the most basic.

III.—Volcanic Grits and Agglomerates; and Argillites. Probably from the Charnwood Series.

(74.) An angular fragment, about 4in. × 2in. × 2in., with edges slightly rounded, consisting of a piece of green argillite with an adherent volcanic matrix, the latter a good deal decomposed. This may be from one of the Charnwood breccias, which contain large argillite fragments. (20.) A subangular somewhat rounded specimen of a fairly coarse grit, consisting of fragments of lava, some of which are distinctly andesitic in character, plagioclase microliths abounding. This rock and the one following are very probably from the Charnwood series. (30.) A fairly angular specimen of a coarse volcanic breccia composed of greenish-grey and darker fragments. (72, 108, 135.) Three specimens, two from Overseal, of fine-grained, greenish, speckled volcanic grit, one angular, the others somewhat rounded, one of them being striated; all bear much resemblance to rocks of the Charnwood series. (21.) An angular piece of a dull-coloured volcanic grit. Some of the fragments in it have indications of a slight fluidal structure. Epidote and secondary hornblende have formed, and there is a considerable amount of micro-mineralogical change. It contains the curious mineral described by me in 1891.* The specimen bears most resemblance to rocks

* "Quart. Journ. Geol. Soc.," Vol. XLVII. (1891), p. 88. E. Hill and T. G. Bonney, "On the North-west Region of Charnwood Forest."

at the N.W. end of Charnwood, and has probably come from that series. (50.) A hard breccia of volcanic fragments, which under the microscope are seen generally to be rather angular; they appear often to be stained by subsequent infiltration of iron oxide, so that in the case of the more compact it is difficult to say whether they are a decomposed volcanic glass or a mudstone; but undoubtedly three or four varieties of igneous—almost certainly volcanic—rocks are present. In one, a porphyrite (?), larger crystals, about ·03in. diameter are present, together with a dull green, feebly refracting mineral, of which there are two or three larger patches in the slide; this, probably, replaces a pyroxenic constituent. In this fragment one or two of the larger crystals are curious. They resemble felspar in form, and partly in appearance, but seem to consist mainly of a polysynthetic quartz. There is also a fragment in the slide which may have a similar origin. It is possible that some of the materials in this breccia may have come from the Charnwood series, but the resemblance is not striking. (45.) A fragment, in part angular, in part somewhat rounded, of a rock which consists of compact green and of rather gritty light-red bands, with a faint cleavage. Under the microscope, the coarser band is seen to contain a large number of felspar crystals, whole and in fragments, the matrix and the remainder of the slide consisting of fine-grained material, occasionally ferrite-stained, probably volcanic dust. This is most probably from the Charnwood series. (93.) A fragment, with corners somewhat rounded, of a banded, fine-grained volcanic grit. Of the likeness of this rock to one of the Charnwood series I cannot speak quite so confidently. (5.) A rock containing a large number of felspar fragments, more or less decomposed, together with some irregular patches of a green colour, set in a dark, earthy-looking, sometimes greenish or brownish paste, the material being arranged in bands of coarser and finer. Granules of black iron oxide are present. The green patches probably consist of a kind of viridite or palagonite, replacing a glassy basic material; now and then a rather decomposed felspar crystal can be detected in it. Probably they represent fragments of a rather basic lava. This rock possibly may be from Charnwood, but the resemblance to those known to occur in that district is not striking. (104.) A specimen, with rounded edges, from Stanton, of a banded ashy grit, somewhat like Nos. 5 and 45. (63.) A flattish fragment, with edges and angles somewhat rounded, consisting of a hard, greenish argillite or imperfect slate (striated). Most probably from the Charnwood series. (84.) A fragment, with slightly worn edges, of a somewhat banded argillite of greyish-green colour, having a faint cleavage. Also from Charnwood. (85.) A flake of faintly banded flinty argillite, probably with some minute quartz grains. (86.) A triangular, thick, flake-like piece of a rock, intermediate in character between 84 and 85, and belonging to the same series. (88.) A fairly angular fragment of a very similar rock; also from Charnwood. (129.) From Linton and Coton Park Colliery. A somewhat cuboidal mass, roughly about 4in. across, the faces being defined by joint or bedding planes, the angles and corners somewhat rounded. A fairly well banded argillite, probably from the Charnwood series. (4, 17, 22, 65, 79, 80, 81, 83, 133.) Nine fragments which bear a close resemblance to the argillites of Charnwood. The specimens are all more or less angular, one at least being partly bounded by surfaces apparently due to joints or cleavage. The angles and in some cases the sides are somewhat rounded, although almost unworn edges of fracture still occur in one irregular fragment from the tunnel, Wooden Box. An imperfect cleavage can be traced in several of the specimens, sometimes causing them to flake off. Four of the specimens are a pale-greenish tint, weathering lighter or with red staining; the others are of a dark, dull-greenish or slate colour. All are argillite, two or three having a very flinty character; in one a lamination is developed on the weathered surface, and on another, from Overseal, are striations. Microscopic examination affords little additional detail; in one slide chlorite can be identified, and in another a transparent mineral, probably felspar. All these rocks may be taken as almost certainly derived from the Charnwood series, some having a close relation to such flinty argillites as those of Grace Dieu and Whittle Hill. The six specimens which follow belong most probably to the same group. (32.) One, however, is stained a deep claret colour, so that it is impossible to be certain about its relations. (61.) Another is a pale greenish-grey, very compact, possibly with a slight cleavage. (82.) Another, from Woodville, a greenish, subangular fragment of a very fine grained (? quartzose) argillite. (77.) One polygonal fragment occurs of a more definitely compact, greenish-grey argillite. The form is an elongated rhomboid, the faces being determined by the cleavage planes. The rock bears some resemblance to the honestones of Whittle Hill. (138.) A fragment from Overseal of rather hard, slightly micaceous, purplish slate, possibly connected with such a series as that of the Brande (striated). (78.) A very fine grained quartzose rock of a dull green colour. It might represent the cleaved condition of a rock similar to 105. (89, 90.) Two flattish, more or less oblong fragments, with rounded edges and corners, of a fine-grained, quartzo-felspathic rock or quartzose grit. These two specimens may possibly be connected with the Charnwood series. (68.) A red, rather jasper-like rock, with some traces apparently of a rude cleavage. There has been considerable micro-mineralogical change, and so much infiltration of red iron oxide, that it is very difficult to come to any conclusion. It might have been either an argillite or a volcanic glass, or possibly an altered specimen of one of the clay ironstones (see 36 and 73).

IV.—SEDIMENTARY ROCKS OF UNCERTAIN DERIVATION.

(54, 55.) Two fragments from Overseal, so far as can be seen, rather rectangular; both of a pale reddish, somewhat green-spotted volcanic grit, but exhibiting some microscopic differences. The one (54) consists of broken quartz and felspar and of lapilli, which are all rather compact in structure but various; some of them are blackened with opacite; one appears to have been more scoriaceous, the cavities being now filled with viridite. A few of the included fragments are rounded, the rest rather angular. The structure of several reminds me of the volcanic series in the north-western part of Charnwood Forest. The second specimen (55) has very little clastic quartz and felspar, consisting mainly of lapilli generally rather rounded, of which there are many varieties, one a very typical andesite; several of them more or less blackened with opacite. The former specimen bears rather more resemblance to a Charnwood rock than the latter, but it is not impossible both may have come from that series. (56.) A fragment from Overseal, of a similar rock, containing a flattish pebble quite an inch long. The angular shape of this specimen, with well-defined joint faces, indicates that it cannot have travelled far. It exhibits under the microscope a considerable amount of subangular quartz and of lapilli, probably water-worn. The latter have the same general character as those in the preceding specimens (54 and 55); some are of a very compact devitrified glass, some contain quartz grains, one exhibits "globules" of a greenish tint in a lighter matrix (with ferrite-staining occasional in both), perhaps connected with either a perlitic or incipient spherulitic structure. The connection with the Charnwood series is not striking. (103.) A subangular fragment, from Overseal, of a reddish grit, containing rounded grains, both of lavas as in previous specimens, and of quartz, some compound; these in one or two cases suggest a derivation from quartzite, others possibly come from veins. (16.) A somewhat worn angular piece of a dull quartzose rhyolitic rock. Under the microscope it is seen to consist of (*a*) quartz in subangular grains. These are often cracked, resemble the quartz from a rhyolitic rock, and appear, in one or two instances to contain enclosures of devitrified ground mass. Some of them show the polygonal markings noted in No. 1; (*b*) rather more rounded fragments of rhyolitic rock and scoria, exhibiting many minor varieties of structure. They are devitrified and generally ferrite-stained. Many of them may have come from Charnwood, but some exhibit structures which I have not noticed in the rocks of that region. There is also a fair-sized grain of quartzite. Its quartz grains are pretty clean, and the secondary quartz is sometimes in optical continuity with an original grain. (24.) This is composed chiefly of subangular to rounded grains of quartz, of a compact Indian-red, volcanic rock, and of a pale greenish-grey minute grit or mudstone. The green grit fragments are more angular, while the red felstone are more rounded. Some of the quartz grains with more or less polygonal cracks, and with enclosures of the ground mass (?), remind me of those in the Peldar Tor rocks. I doubt if the volcanic materials came from Charnwood; they present a different aspect and show no signs of crushing. As a whole they seem a little more basic in character. There is much palagonite in the slide, especially in the above-named grit. (1.) A piece with larger fragments contains indubitable scoriæ, well-rounded, almost certainly water-worn, with other rounded fragments of volcanic rock in various stages; some are deep iron-red, some much stained with a green chloritic mineral, some almost black; they probably exhibit varieties of rock with a silica percentage from about 50 to rather over 60. One fragment resembles a rather impure quartzite, and another, which is subangular, consists of quartz with cracks forming a kind of honeycomb pattern. These prove to be mostly lines of minute cavities, but some appear to be true cracks. (42.) Apparently a similar rock, with rather small fragments and less of the green-grey constituent. A coarse grit rather than a breccia. (2.) A subangular piece of breccia. The fragments, which are imbedded in a gritty matrix, consist of grey-green, fine-grained grit, with occasionally a few larger grains, probably of a red felstone, both resembling those already described (*cf.* 24, &c.). (118, 119, 117.) Two similar specimens from Overseal, somewhat rounder, and a third from Stanton, only differing in being rather finer grained. (18.) A fine-grained variety of the uncleaved volcanic grits of the Permian breccia. The constituents include fairly well rolled pieces of various volcanic rocks, often showing a fluidal or scoriaceous character, probably derived by denudation from cones, the materials of which were of an andesitic type. Also some rather angular quartz grains occur with the polygonal markings already mentioned, with a few grains of magnetite, and fragments of a grit. The last is composed of angular bits of quartz, felspar more or less decomposed, perhaps also decomposed volcanic glass, and grains of a greenish chloritic mineral and iron oxides, all cemented by a brownish-green paste. The green mineral is probably due to the decomposition of basaltic or andesitic detritus. Part of the specimen is simply a fine-grained grit, but I suspect that materials of volcanic origin varying from moderately basic to somewhat acid enter directly or indirectly rather largely into the composition of this rock. It does not occur at Charnwood, and the fragments in it do not remind me strongly of any rocks in that region. (34.) A grit with many well-rounded grains both of quartz and of more than one variety of a fairly acid igneous rock. (12.) A subangular fragment of hard dull-red quartzite, composed of (*a*) quartz grains, subangular to well-rounded; these look rather dirty from the presence of minute cavities, some apparently empty, but many with fluid enclosing small bubbles, which do not exceed about one-sixth of the volume, and are commonly less. A few grains show a compound structure, and one, larger than the rest, seems to be a quartz schist; (*b*) a few fragments of devitrified rhyolite (sometimes larger than the quartz, and rather angular), certain of which are not unlike the rhyolitic rocks of Charnwood. One, however, shows a distinct perlitic structure, which I have never seen in any Charnwood specimen. Three larger fragments of igneous rock are enclosed; one contains many variously-shaped patches of chlorite, and is considerably altered; perhaps it is a rather basic, ashy rock; another probably is a fine-grained ash of a more acid type, and a third—smaller—is an ashy argillite. Each grain of quartz has an external coating of hæmatite, and the interstices are filled with crystalline quartz (not in optical continuity with the grains), in which little tufted crystallites of hæmatite often occur. (11.) A piece of a subangular fragment of a light-coloured, speckled volcanic grit. Under the microscope it is seen to consist of some fragments of decomposed felspar, probably orthoclase, two or three of quartz, and the remainder fragments of devitrified volcanic rock; a few of these are darkened with opacite or ferrite. Of the rest, some contain felspar microliths, others appear to have been glassy dacites or rhyolites. Viridite and ferrite have formed in the dusty matrix. The rock reminds me slightly of some of the volcanic series of the Wrekin. (39.) A well-rounded ovoid pebble of grit about 3½in. long. This was obtained from the Coton Park and Linton Colliery. It consists of quartz in angular, subangular, and even rounded grains, with angular and subangular fragments of various lavas, generally resembling those already described. Some grains of hæmatite occur and one or two flakes of light-coloured mica. One of the quartz fragments contains minute enclosures arranged in a sort of honeycomb pattern. (120.) An angular piece of a grit from Stanton, containing a considerable number of rather irregular and unworn fragments of volcanic rock interspersed in a ferrite-stained matrix. The fragments are rather variable, sometimes containing well-marked felspar microliths, sometimes small vesicles, but probably they belong to the andesite group. (3.) A rock interbanded with coarser and finer materials; the finer consisting chiefly of small pieces of felspar in a dusty, ferrite-stained matrix, the coarser of similar fragments with a considerable number of bits of volcanic rock, some vesicular, some compact—in shape resembling the fragments in the specimen last described, and probably akin in species. (58.) One rock seems to consist of rather more basic material. It is fine-grained, greenish to purplish, with a thin, compact, greyish band. Under the microscope this finer-grained layer appears to be composed of a light brown, somewhat dusty-looking material, interspersed among tiny flakes of a greenish (? chloritic) mineral. In the coarser bands, the matrix has the same character, but is full of rounded grains (from about ·006in. to ·015in. diameter) of a rather darker brown and a dull green colour. Neither variety has much depolarising effect; both exhibit more or less of an aggregate structure, and probably are related to palagonite; especially the greenish form, and result from the decomposition of basic volcanic glasses. A few grains of quartz of rather irregular outline are present in the slide. The rock is probably a Palæozoic grit. (94.) From Measham, a very hard darkish-green, minutely-grained grit, containing apparently felspar and mica, besides quartz. (37.) A hard, fine-grained, greenish-grey, felspathic grit with crystals of iron oxide, not improbably pseudomorphs after pyrite. Under the microscope it is seen to consist of small, rather angular fragments of quartz, earthy grains (doubtless decomposed felspar), a greenish mineral slightly dichroic, probably chlorite or altered biotite, a colourless mica, limonite and perhaps hæmatite, with a grain of tourmaline.* Probably a Palæozoic rock. (60.) An excessively fine-grained, slightly felspathic quartzite, probably related to 48. The laminæ appear to have been contorted by subsequent disturbance. (102.) A rounded pebble from a cutting at Woodville, near Boothorpe, of a

* Two large boulders from the Coton Park and Linton Colliery (41, 40) are described later.

quartzo-felspathic grit bearing some resemblance to 95, but more decomposed, and looking as if it was truly Permian. (105.) A rather angular fragment from Overseal, of a quartz felspar grit similar to the two following specimens. (48.) A rock consisting of small, moderately-angular grains of quartz and felspar, often decomposed, including a little microcline. Two or three grains of tourmaline, and perhaps one of zircon, are present in the slide, with a flake or two of mica. No lava fragments can be recognised with certainty. (69.) Rather subangular in form—a hard, fine-grained quartz-grit with some felspar. I think this rock, like the last, occurs also in the Trias. (101.) A long, irregular-shaped, but slightly rounded fragment from Overseal, of a rather felspathic quartzite. A similar rock occurs in the Trias. (100.) From Overseal, a very fine-grained quartzite, pierced with tubes of irregular form (? annelid). This rock is something like, but much finer-grained than, the well-known quartzite of N. W. Scotland. (87.) A subangular fragment of a fine-grained quartzose rock, rather like the last, but without distinct tubes. (66.) From Boothorpe, a fine-grained quartzite. It reminds me of some of that in the Bunter, though the outside has a very different appearance, being dimpled, the result, I suppose, of weathering. Some other specimens are apparently fragments from veins or similar formations—one (25), is a nodule of chalcedony, which encloses a few fragments, in two cases apparently felspar, in the others possibly a volcanic rock silicified, or a slate, suggesting that the mineral was deposited within such a rock; two (127, 128), are quartz with more or less hæmatite; others are a jasper-like material, including one from Stanton.

(To be continued.)

NATURAL HISTORY JOTTINGS IN NATAL.*

BY ARTHUR HUNT.

There are few branches of Natural History, if any, that can offer such a diversity in form, colour, or habits as that presented by "Insect Life;" and to a lover of that branch there is, here (Natal), every opportunity for studying the many curious and interesting sights that one comes across, be it in that particular branch or amongst animals, birds, or flowers. A man must be a mere "collector" who can pass by a lovely bird or noble tree and say "It is not in my line."

* Read before the Birmingham Natural History and Microscopical Society, February 10th, 1891.

To me the chief difficulty is to find time to study, be it ever so superficially, the countless wonderful sights of Nature with which we are surrounded here. We have no all but impenetrable forests such as Stanley had to cut through, but the beauty of our "bush" in its virgin state is hard to describe. Along our coast we have no trees of any great height, but from the fig trees with their massive gnarled trunks and wide spreading branches that almost shut out the daylight from above, and add so much to the stillness that seems to pervade the woods—a stillness that is only broken by the harsh cry of some bird, or by a rustle in the grass or undergrowth—to the lovely fresh green of the "Flat-crown Acacia," there is every shade of green. These fig trees, with their small, deep green leaves, form a background that serves to show up in contrast the pale green of this delicate leaved "flat-crown," with its burden of sweet-scented flowers and its network of leaves interposed like a mantle of lace of an indescribable pattern between you and the sunlight above.

Of course, there are many other kinds of trees and shrubs, but what gives to the whole a wild and tropical appearance are the creepers that twine around the tree trunks and branches, and from there trail down in festoons of greenery, or long bare prickly stems that hang like snakes from tree to tree. Amongst the trees grow bushes ablaze with flowers and bright with berries, whose colour tempts but whose taste repels, and around these again spring up the weeds and grasses as though to complete the confusion. Through all this tangled mass there are numerous Kafir tracks that seem to meander about as though they would lead you nowhere, and yet are really the short cuts so much favoured by the Kafirs, by whom they are made as they walk in single file from place to place. These very twists and turns are made but to avoid some thorny bush or fallen tree; and although one may manage to strike a straighter line, it will, in all probability, end in more scratches to the hands and rents in the clothes than the lessened distance has been worth.

From time to time an open space will be found where, although the low bushes are pretty numerous, there are no large trees, and it is in these spots that the swarm of insect life becomes almost bewildering. I can never forget my first day with the net in the bush, and after collecting here it would seem very tame work to be at home again in England, and go out day after day only to be able to boast of having *seen* a "new one."

I went out just beyond the town and commenced business with the intention of catching all I saw, but came away with the firm belief that I had seen more than I could ever catch.

While chasing one, another species would fly across my path, and, while still undecided as to which to catch, two or three others came darting past, and I sat down in despair, and it was only by fixing my eye on a certain one and taking no notice of the rest that I caught any at all. Of course all that is over now, and I can tell most of them by their flight alone. Compared with other countries, Natal, or rather South Africa, is poorly represented, having only about three hundred and eighty species of butterflies or moths, and of these nearly two-thirds are found in Natal, which is the richest country in South Africa in insect life. I have now one hundred and sixty-five species, and so have plenty more to catch yet, especially as my only opportunities are Saturday afternoons and a few occasional holidays, and it is during these outings that I have come across the different things that I think will be of interest to you.

On my arrival, I received many warnings with regard to snakes, and at first I scarely made a step but I feared I should be treading on one; but now I just blunder along and find that when let alone they let you alone. There is no doubt we have plenty of them, and I have come across some, but they have never given me any trouble.

One day, whilst wandering up the dry bed of a small stream, over which the bright coloured crab spiders had strung their webs, and hung suspended from them in mid air, I entered a small cave-like recess in the bank, made, I believe, by the Kafirs when extracting clay, and busied myself in bottling some large, sleepy moths, very like your "Old Lady;" and, on coming out again, I saw a small, black "imāmbā," as they are called here, about three feet long, coming gliding towards me. Taking my stick from my butterfly net, I soon quieted it, and would have taken its skin but the body writhed and twisted about so much, and my knife was so blunt, that I was compelled to leave it.

I have had them get up from close to my feet, but have never been attacked by one, In poking in holes in the trees, in searching for beetles, I am always careful, as in these places I have found the cast-off skins of snakes; and apart from these, are the centipedes, four and five inches in length, that would give one a nasty nip. I was up a "flat-crown" tree one day, after some large hairy caterpillars, and having disturbed a nest of large ants, and found them showing a liking for me that was not returned, I was coming down; when, while forcing my way through a tangled mass of creepers that grew around the branch on which I was, I saw a bright green snake staring me in the face. Thinking the snake had more right to the tree than I had, I kept my eyes fixed on it, and slid down to the ground with a bump. From there I was unable to reach it with a stick, so had to content myself with throwing an empty bottle at it, and making it glide away into the thick of the bush. On almost any of the larger trees may be seen dozens of bright red millipedes, about two inches long, that curl up and fall to the ground when touched; and quite as numerous are the large shiny black ones, of which I have had specimens quite six inches long. Basking in the sun, on the trunk of a tree, the blue-headed lizards will often be seen; but they, like many more things, are far more beautiful in life, for when dead they lose nearly all the lovely blue colour of the head and neck that makes them so conspicuous as they dart round the branches in endeavouring to keep out of sight.

We have several kinds of lizards, from a wee little thing —about two or three inches long, that runs about on the walls and fences in pursuit of unwary flies—to what is called the iguana, one of which I have seen five feet long from the nose to the tip of the tail. They are not iguanas, but monitors, as they have no crest on the back or tail, and no teeth on the palate, and, as far as I know, there are no iguanas here. I had a live one brought to me some time ago, and after killing it, and working for five hours scraping to get the flesh away from the skin, I stuffed it; and it now hangs over my bed. While out in the bush one morning, a young companion shot at one with his catapult, and happened to strike it in the eye and stun it; and when we tried to kill it with sticks, it whisked its tail about like a whip lash, and it was only after I had broken its skull and my net stick too, that it at last succumbed. It is said that they will give a nasty bite, and I can quite believe it, as they have a row of fine sharp teeth in each jaw.

In walking through the bush paths, or along the bed of a stream, it is no uncommon thing to feel something across your face like a fine string, and it was quite a surprise to me to find that it was only a spider's web, for although I have read of their webs being strong enough to support the weight of an umbrella, I had hardly believed it; but I can assure you that some of the webs—I do not mean a single thread, but a tangled mass of web—are quite strong enough to do so. A more unpleasant thing, when walking beneath the trees, is to hear a buzzing round your ears and feel a sharp pricking, and look up to see that you have shaken a branch on which hangs a wasp's nest, and on which the wasps were sitting motionless until you disturbed them. I have often noticed them resting on their nests, apparently doing nothing, but as my observations have been rather cursory, it may be that I have misjudged them. The nests of these wasps are wonderfully made. They consist of a group of hexagonal cells, made of a vegetable fibre, suspended by a foot-stalk of the same material from the branch of a bush or tree. I think these nests are the work of a single wasp, or pair of wasps, and if it is so, I can only account for there being so many—about a dozen—sitting on one nest, by supposing that they have just emerged from their pupa state, and are drying their wings before flying off to commence life for themselves.

Some wasps make their cells of mud, and place them, sometimes singly, sometimes in groups of three and four, in most out-of-the-way places. I have found them stuck between the heads of two rivets on a locomotive boiler that had been left for some time unused. These cells are not hexagonal, but generally cylindrical with rounded ends, something like a diminutive sausage. In the bottom of each cell is placed a goodly stock of spiders for the nourishment of the larva on its coming out from the egg; and these spiders are quite fresh, and are, I believe, not really dead.

I have seen one of the mason wasps dragging a spider along which was almost as large as itself. In Figuier's "Insect World" it is stated that insects, when on the wing, can only support about their own weight; but I think this can hardly be correct, or else there are many exceptions. Our wasps manage to get insects heavier than themselves carried into places, where they can only get by flying. I once put a humble bee, that I had stunned, on the board in front of a beehive, and in a few minutes I was greatly surprised to see a bee get astride of it, and fly with it right out of sight, thus exhibiting a strength of wing capable of supporting quite twice its weight. I then placed another there, but the bees chased me and left the humble bee, so I did not continue the experiment. There is one wasp that makes a long string of cells on a dead twig or grass stem, and these cells are made of cow manure, and are about six or seven in number. Each cell contains a few spiders and an egg laid by the wasp, which has a yellow, black-tipped body, and a waist that looks too weak to bear it.

I one day watched a sand wasp burrowing in the sand, and was astonished at the rapidity with which it tunnelled out the ground. Commencing to scratch with its fore feet, it dug a hole in the slanting face of the bank, getting rid of the stuff it dug out by plunging it out like a rabbit in its burrow. Very soon the sand began to accumulate behind it to such an extent as to nearly block the hole; when, with a backward movement, it shovelled it further away from the entrance by means of its body, which it used like a spade. Each time that it came out to clear the way it gave a buzz that seemed to express either satisfaction at the progress it was making with its labour, or anger at the sand hindering its movements.

I suppose that when finished it would lay its egg at the bottom of the hole, after having laid in a stock of food for its young in the shape of spiders, grasshoppers, or other insects. I opened several of these nests, but they were all empty, so cannot say with what they would be stocked.

(*To be continued.*)

NOTES FROM A WINTER JOURNAL, 1890-1.

BY O. V. APLIN,
MEMBER OF THE BRITISH ORNITHOLOGISTS' UNION, AUTHOR OF "THE BIRDS OF OXFORDSHIRE."

The following notes relating to Oxfordshire during the great frost of the past winter, extracted from my journal, may perhaps be interesting to the readers of the "Midland Naturalist." On account of the remarkably dry autumn and winter (the rainfall in North Oxon in 1890 was only about eighteen instead of the average twenty-five inches) and the consequent absence of floods, save for a week at the end of January and the first few days of February, the wild fowl season was a poor one in point of numbers. But in point of interesting species procured or observed in the county, the past winter will yield to few. Unless anything to the contrary appears in the text, the notes must be understood to refer to this parish (Bloxham).

October 18th.—Redwings arrived at Bodicote.

19th.—Fieldfares arrived. Half a dozen Lesser Redpolls feeding in an alder at Bodicote. Great store of alder seed, also larch-cones, hips, haws, holly, and other berries. Sloes, like the garden plum crop, have failed. Song Thrushes hard on the yew berries now. Very cold; north wind, still.

23rd.—Adult male Common Scoter shot on Broughton Moat this morning. Barred Woodpecker in orchard.

28th.—Excessively sharp frost last night, and froze all day in shade. Many Fieldfares.

30th.—Extraordinary change in trees and hedges this last two days. Leaves have come off in showers. Ash quite bare now and hedges brown. Beech is copper and gold, and elms even turning. Rooks carrying off walnuts from the big trees.

November 2nd.—Mild.

3rd.—Grey Wagtail on roadside near Wickham, close to ditch, which in an ordinary season would be running or half full at this season, as it carries off drainage from Crouch Hill and fields about there; now dry. On the 11th it was a little running stream, in which state no doubt the wagtail expected to find it.

15th.—Large flocks of Fieldfares; very numerous now.

25th.—Sharp frost, morning; N.N.E.—N.E. Considerable sprinkling of snow on ground and a very little in day. Turned cold yesterday, and to-day the long frost virtually commenced.

27th.—Report from Oxford of "unusual numbers of Redpolls lately," W. W. F. Bitterly cold; little snow.

28th.—Two or three inches of snow on the ground. Said to be the coldest day by 4° in any November for fifty years. I may here briefly mention that streams were frozen next day. A lull in the frost began on the 30th, but the first few days of December were cold. Drying easterly winds on 6th and 7th, snow on 8th. Then very cold; and on 19th heavy snow, six inches on ground, which thereafter continued snow-covered until a few days before the final break up of the frost on 24th January. Thermometer not over 25° all day.

29th.—Very sharp frost. Fieldfares, Redwings, and Starlings very tame. Robins and a Pied Wagtail fed within a couple of yards of us, where some men were moving mud thrown out of the Swere. A party of five Siskins feeding in alders at Bloxham. A flock of Redpolls in alders at Bodicote Mill. A great flock of Skylarks on clover lea; the field was covered with their tracks and little places where they had scratched. An examination of the crops of some of them showed that they were *not* eating the clover plants. A pack of five-and-twenty Partridges in this field very conspicuous on the snow. One Snipe in the Swere. A Dunlin shot from a party of five in a wet ditch in "The Marshes," at Banbury.

30th.—Some Redpolls and a charm of seven Goldfinches in the alders here.

December 7th.—A snipe close to the railway station. Some Redpolls in the alders near the "Pest House." One was shot somewhere near here about the first of the month. In October I ventured to predict that, on account of the abundant crop of alder seed, these birds would be more plentiful than usual. Two Grey Wagtails in the village brook.

11th.—A Red-throated Diver picked up alive close to Banbury this morning.

13th.—A Snipe in the brook close to the village.

14th.—Very hard frost. Thermometer stood at 20° under a verandah between nine and ten a.m. Still harder at night. A Snipe and a "Jack" in warm spring near South Newington. Thick rime.

18th.—Examined a Water Rail shot in "The Banks" ditch, Barford, a few days before. This ditch has its origin in a spring, and after emerging from a covered drain flows with rather a sluggish current through several fields. The soil through which it flows is rather boggy, and the sides of the ditch are rush-grown. Although widening out here and there, it is generally from two to four feet wide, until after passing through three fields it becomes considerably wider, and is very much grown up with rushes. This stream (above the wide grown-up portion) did not freeze all the winter. Indeed, during nearly the whole of its course through three fields there was not a bit of ice on it, even at the banks. In the clear moonlight of some of the sharpest nights it used to look like a black streak winding through the snowy fields. The Swere itself was frozen hard, even in places where it flowed fast enough to "talk," the ice forming a roof over the current. It is almost needless to say that this ditch yielded a few Snipe all the winter.

Kingfishers are now suffering greatly. In the first week of the month sixteen were sent to one taxidermist in Oxford. Received news that a White-fronted Goose was shot at North Aston about the 15th. Some weeks afterwards I saw this bird; it was killed with another from a gaggle of about twenty. Also received news of a Golden Eye Duck shot at Handborough about the same date (but from the description I am inclined to think this was a Scaup), and of some Wild Geese seen in the Cherwell Valley, near Cropredy.

19th.—Very heavy fall of snow, six inches on ground, and drifted a little. Hard frost at night. Had news of three Wild Geese killed in the Cherwell Valley at Twyford Mill, near Adderbury, this week. They were unfortunately plucked and eaten before I could see them, but from the description I had of them I have no doubt they were Bean Geese (*Anser segetum*). The fortunate sportsman told me afterwards that about the same time he saw gaggles of thirty-seven, seven, and three in the same locality. Five Bramblings, with about fifty other small birds, were netted round some ricks here.

20th.—Extremely sharp. A female Blackcap Warbler was shot while feeding on the berries of the cotoneaster. Great, Blue, Marsh, and Cole Tits come to the suet I have hung up, also Robins, but only one Sparrow has succeeded in settling on it. A Jack Snipe flushed and killed from the Swere, which is frozen over in most parts; a good deal of ice on the bottom in shallow, quick places. Heard the Isis is frozen from Oxford to Iffley, and bears skaters above the city. The *Oxford Times* of to-day contains report by Mr. S. Sargent of a Golden Eye Duck (probably the one I heard of) shot on the 10th on the Evenlode, near Handborough Mill, and of four Wild Geese seen by him feeding on the bank. Also of a fine male Scoter shot between Iffley and Folly Bridge, on the 12th, by Mr. Thomas Dolly, jun.

21st.—Sunday.—Extremely sharp. Walking out for a few minutes in the afternoon, I went down to the brook to see the Grey Wagtails. The snow being very deep, I made hardly any noise, and so surprised a Snipe on a shallow "scour" in midstream; thinking itself unseen, it squatted down, with the tip of its beak just touching and rippling the water. I kept quite still for a few minutes, when he slowly raised his head but did not move, and I backed quietly out of sight. Very hard frost at night.

22nd.—Foggy. For a still day, perhaps the coldest I ever knew. Thermometer this morning registered 30° of frost at Bloxham ($2\frac{1}{2}$ feet from the ground), and 32° at Broughton; and at Bloxham at midday it only stood at 15°. Icicles collected on the hair and dress of those who were out of doors. Froze in my bed room last night and again during the day. Eleven Kingfishers received by a stuffer in Banbury just lately. A Jack Snipe, shot this morning, was in good condition.

23rd.—Froze in bed room again last night; and this with very thick old walls, a large fire burning until midnight in the room below, and another occupied bed room above.

24th—Examined a male Pied Woodpecker, shot at Bodicote early this month. A beautiful scene at night. The moon, thinly veiled with light, slowly passing clouds, shed a soft light on the white ground and the evergreens heavily laden with snow.

25th.—Six Wild Geese seen near Nell Bridge, Adderbury. The Sorbrook, at Bodicote, has borne skaters for some days.

26th.—Canal like a road for miles. Cherwell, between Banbury and Nell Bridge, only open on the "scours" about Franklin's Knob and just below Sutton Mill. A few Fieldfares and half-a-dozen Larks on brook bank at Weir Lock were the only ones seen in a long walk. I afterwards heard they had entirely left a favourite farm in Bloxham parish; this I heard on January 8th.

28th.—Redwings and Missel Thrush coming to holly tree close to house at Bodicote.

29th.—Cold. N.E. wind blowing fresh and very unpleasant.

30th.—Bitterly cold wind, E., strong, and most painful. Froze very hard all day. I hear the shade temperature has not been above 32° for twenty days. The most painfully cold day, as far as one's feelings go, since 18th January, 1881.

31st.—Very cold east wind, but not so strong. Snow at times, dry and drifting.

(To be continued.)

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 22.)

* **Euphorbia Helioscopia. E. amygdaloides, E. Peplus, E. exigua.** Tab. 25. In all the districts.

* **E. platyphylla.** 95, S. Littleton; Pershore, Purton. Tab. 25. Avon. *Extinct?*

* **E. Lathyris,** xxx. 21, 22, old garden, in Crow's Nest Wood. Tab. 25. Severn, Malvern. *Not native.*

* **Mercurialis perennis.** Tab. 25. In all the districts.

* **Ceratophyllum demersum.** 52, Spetchley. Tab. 25. Avon, Severn, Malvern.

* **C. submersum.** 52, Northwick Pool. Add. and Corr. Tab. 25. In all the districts.

* **Parietaria officinalis.** Tab. 25. In all the districts.

* **Urtica urens, U. dioica.** Tab. 25. In all the districts.

* **Humulus Lupulus.** 50. Tab. 25. In all the districts.

* **Ulmus campestris** (including suberosa). 52, planted. Tab. 25. In all the districts, var. glabra. Tab. 25. Severn, Lickey.

U. carpinifolia, xxx. 52. Is a synonym for var. glabra. *Not in table.*

* **U. montana.** 52, Severn; 70, Malvern. Tab. 25. In all the districts.

* **Salix pentandra.** 98, Alderminster; 123, Frankley. Probably planted. Tab. 25. Avon, Severn, Lickey.

* **S. fragilis.** 29, Severn D. Tab. 25. In all the districts.

* **S. Russelliana.** 29, Severn D. Tab. 25. Avon, Severn, Malvern.

* **S. alba.** 29, Severn D. Tab. 25. In all the districts.

var. cærulea. 29, Severn D. Tab. 25. In all the districts.

* var. vitellina. 29, Severn D. Tab. 25. In all the districts.

* **S. undulata.** Tab. 25. Avon district. *Not in text. Not localised.*

* **S. triandra.** 29, Severn D. Tab. 25. Avon, Severn, Malvern.

* var. amygdalina. 29, Severn D. Tab. 25. Avon, Severn, Malvern.

S. Hoffmanniana. Tab. 26. Severn. *Not in text. Not localised.*

* **S. purpurea.** *Not in text.* United with S. Helix in Tab. 26.

var. **Lambertiana.** 95, Badsey, Purton. *Not in Table.*

* **S. Helix.** 29, Severn D. Tab. 26. United with S. purpurea. Avon, Severn, Malvern.

* **S. rubra and Forbyana.** *Not in text. Not localised.* Tab. p. 26.

* **S. viminalis.** Tab. 26. In all the districts.

* **S. Smithiana.** 29, Severn D. Tab. 26. In all the districts.

* **S. acuminata.** 135, Lickey. *Not localised.* Tab. 26. Malvern. *Not localised.*

* **S. cinerea and var. aquatica.** Tab. 26. In all the districts

* **S. aurita.** Tab. 26. Avon, Malvern. *Lickey district, W. M. !*

* **S. Caprea.** Tab. 26. In all the districts.

* **Populus alba, P. canescens, P. tremula, P. nigra.** Tab. 26. In all the districts.

* **Betula alba.** 4, 17, 70, 113.

B. glutinosa. Not noted in text, but united with B. alba in Tab. 26 as in all the districts.

* **Alnus glutinosa.** Tab. 26. In all the districts.

* **Fagus sylvatica.** Tab. 26. In all the districts. Planted.

* **Castanea vulgaris.** Tab. 26. Severn, Malvern, Lickey. *Not native.*

* **Quercus Robur.** 53, Severn D.

* **Q. intermedia.** 4, Wyre Forest. 53, Severn D. Tab. 26. Severn, Malvern.

* **Q. sessiliflora.** 53, Severn D. Tab. 26. Severn, Malvern.

* **Corylus Avellana.** Tab. 26. In all the districts.

* **Carpinus Betulus.** Tab. 26. Severn, Malvern, Lickey. Planted. Entirely absent from Worcestershire as a native tree. Text, p. 71.

* **Taxus baccata.** 4, 14, 53, Severn D. 70, 81, 86, Malvern D. 122, 128, Wychbury Wood. Tab. 26. In all the districts.

Pinus sylvestris, Abies excelsa, Larix europæa. Tab. 26. In all the districts. Planted.

* **Juniperus communis.** 6, Wyre Forest. 53, Bush Hill, Powick. 68, Silurian Hills, West Malvern. 93, Cracombe and Coldknap Hills. Tab. 26. Avon, Severn (extinct), Malvern.

* **Typha latifolia.** 56, Severn D. Tab. 29. In all the districts.

* **T. angustifolia.** 14, 56, Severn D. Tab. 29. In all the districts.

* **Sparganium ramosum.** 56, Severn D. Tab. 29. In all the districts.

* **S. simplex.** 56, Severn D. Tab. 29. In all the districts.

* **S. minimum.** 56, Pool at Cotheridge. Tab. 29. Severn.

* **Acorus Calamus.** 91, Avon at Pershore. Nash. Tab. 29. Avon, Malvern, Lickey.

Arum maculatum. Tab. 29. In all the districts.

* **Lemna trisulca, minor.** 56, Severn D. Tab. 29. In all the districts.

L. polyrrhiza. 56, Severn D. Tab. 29. Severn, Malvern, Lickey.

L. gibba. 56, Severn D.; 65, Malvern Chase. Tab. 29. Avon, Severn, Malvern. Must occur in Lickey.

* **Potamogeton natans.** Tab. 29. In all the districts.

* **P. oblongus** *(polygonifolius).* 14, Hart Common; 56, Severn D. Tab. 29. Severn.

P. plantagineus. *Not in text.* Nevertheless in Tab. 29, in Severn D.

P. rufescens. 56, Severn D. Tab. 29. Severn, Lickey. Unlocalised.

P. heterophyllus. 1, Malvern? *doubtful.* Tab. 29. Malvern? Lickey. The latter unlocalised.

* **P. lucens.** 56, Severn at Evesham. Tab. 30. Avon, Severn, Lickey.

P. prælongus. 135, Malvern D. Not in Tab. *Unlocalised. Not in "Bot. Malvern Hills." Must be an error.*

* **P. perfoliatus, P. crispus.** 56, Severn D. Tab. 30. In all the districts.

P. zosteræfolius. 56, Blakedown and Churchill Pools. *First discovered by Mr. Westcombe.* Table 30. Severn. *First record.*

P. gramineus. 56, Severn D. 92, Brooks tributary to the Avon at Evesham. Tab. 30. In all the districts. Unlocalised. *I refer this to P. obtusifolius, M. and K. See "Mid. Nat.," Sept., 1889, Vol. XI., p. 203. Malvern.*

* **P. compressus.** 56, "Ditches near Abbot's Moreton." Purton. Tab., p. 30. *It is doubtful what modern species is intended here.* See Purton, "Mid. Flora," Vol. III., p. 16. "Mid. Nat.," Oct. 1887, Vol. X., p. 256.

* **P. pusillus.** 56, Severn D. Unlocalised. Tab. 30. Severn.

* **P. pectinatus.** 56, Severn D. Tab. 30. In all the districts.

P. flabellatus. 92, In the Avon at Evesham. Tab. 30. In none of the districts. *In the Stour below Kidderminster. W. M. !*

P. densus, ix., lxi. Avon D. 92, Defford Common. 101, Bredon Hill. Tab. 30. Avon.

* **Zannichellia palustris.** 56, Severn D. 64, Malvern Chase. 96, Feckenham Bog, *fide* Purton. Tab. 30. Avon, Severn, Malvern. *Omitted from Lickey district, but generally occurs there.*

* **Alisma Plantago.** Tab. 29. In all the districts.

* **A. ranunculoides.** 96, Feckenham Bog, *fide* Purton. Extinct. Tab. 29. Avon.

Actinocarpus Damasonium. 85. Has been found at a pool side near Tenbury. This plant being most attached to the south-eastern counties of England, scepticism might attach to a mere report by a young botanist; but having an authentic specimen no doubt whatever can exist on the subject. *This is a very curious sentence. Mr. Lees does not state that the plant was gathered by the young botanist, nor give his name, nor state in words that the plant was in his (Mr. Lees's) possession. I have never seen the specimen, nor received from the late Mr. Lees any information from which the locality could be identified. It has never been found a second time; credit must, nevertheless, be given to the statement.* Tab. 29. Severn, Malvern, and Teme. *The duplication of the district must surely be erroneous.*

* **Sagittaria sagittifolia.** 14, 56, Severn D.; 91, Avon D.; 115, 123, Lickey D. Tab. 29. Severn, Avon, Lickey.

* **Butomus umbellatus.** 14, 34, 56, Severn D.; 91, Avon D.; 123, Lickey D. Tab. 29. In all the districts.

* **Triglochin palustre.** 6, 56, Severn D.; 65, Malvern D.; 101, Avon D.; 115, 119, Lickey D. Tab. 29. In all the districts.

* **Hydrocharis Morsus-ranæ.** 53, 61, Severn D. Tab. 27. Severn, Malvern.

* **Anacharis Alsinastrum** (*Elodea canadensis*). 25, 26, Severn D.; 92, Avon. Tab. 27. Avon, Severn, Lickey.

* **Orchis Morio**. 53, Severn D.; 82, Malvern; 105, 106, Lickey. Tab. 27. In all the districts.

* **O. mascula**. 53, Severn D.; 72, Malvern; 106, Lickey. Tab. 27. In all the districts.

* **O. ustulata**. 68, Malvern D. Tab. 27. Severn, Malvern.

* **O. maculata**. 53, Severn. Tab. 27. In all the districts.

* **O. latifolia**. 53, Severn D.; 131, Cradley Park, Scott. Tab. 27. In all the districts.

O. incarnata. xlix. Very similar to the last. *In many places in the Severn district!* Tab. 27. Severn. *First record.*

* **O. pyramidalis**. 53, Severn D.; 68, 82, Malvern; 93, 101, Avon. Avon, Severn, Malvern.

* **Gymnadenia conopsea**. 6, 54, Severn D.; 68, 82, Malvern; 97, Avon. Tab. 27. In all the districts.

†* **G. albida**. Tab. 27. Lickey. (*Scott, an error.*)

* **Habenaria viridis**. 6, 54, Severn D.; 82, 83, Malvern D.; 97, Avon D. Tab. 27. In all the districts.

* **H. bifolia**. 54, Woodbury Hill; 68, 82, Malvern D., 123, pastures in Upper Stour valleys.

* **H. chlorantha**. 54, Severn D.; 72, Malvern D. Tab. 27. Avon, Severn, Malvern.

* **Ophrys apifera**. 54, Severn D.; 68, Silurian Hills, W. Malvern; 82, Eastham; Abberley; 89, Ridge Hill, Martley; 93, Cracombe and Coldknap Hills. (*Feckenham, W. M.!*) Tab. 27. In all the districts. *Not localised in the Lickey. Tardebigg Reservoir. Mr. Humphreys!*

(*To be continued.*)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION. January 5th. Mr. C. Pumphrey, president, in the chair. Mr. T. V. Hodgson exhibited a series of spiders and their allies, and read a few notes descriptive of the specimen exhibits and the relationships of the different groups. Messrs. Edmonds and Carpenter brought additional specimens. The specimens exhibited were Anatomical 5, Acaridea 4, Pycnogonidea 3, Phalangidea 1, Araneidea 5. It was proposed by Mr. Udall, and seconded by Mr. Levick, and unanimously resolved to form a sub-section for Practical Microscopy. Mr. Hodgson was re-elected secretary of the Microscopical Section for the ensuing year.—GEOLOGICAL SECTION. January 19th. Mr. T. H. Waller in the chair. Mr. C. Pumphrey gave an address on the "Giant's Causeway," illustrated by lantern. Mr. T. H. Waller was re-elected president of the Geological Section, and Mr. J. Udall hon. secretary.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—December 21st. The Rev. W. H. Painter presented to the library a copy of his book, "A Contribution to the Flora of Derbyshire," for which a vote of thanks was passed. Mr. J. Collins showed a series of slides under the microscope, illustrating the adulteration of fabrics; Mr. Linton, palate of *Limax maximus*.—December 28th. A reunion of past and present members. The meeting was largely attended, and during the evening a lime-light exhibition of photographs of castles, abbeys, forest trees, and other pictures was given by Mr. S. Delicate, assisted by Mr. W. Tylar and other members.—January 4th. The committee reported that the new lantern, with lime-light apparatus, was complete, and gave every satisfaction, and was now at the service of the members. Mr. J. W. Neville exhibited trilobites, graptolites, and other fossils from the lower Silurian and Cambrian formations of Wales; Mr. G. H. Corbett, lignite from Brook Point; Mr. J. Moore, *Epeira diadema* and *E. quadrata*, with their nests; Mr. J. Collins, a collection of mosses, made in the Highlands of Scotland and North Wales, by Mr. Cash, of Manchester. Under the microscope: Mr. J. W. Neville, tracheal tubes in nervures of the wing of *Sirex gigas*.—January 11th. Mr. Linton exhibited a number of shells of *Helix aspersa*, showing the manner in which they had been repaired by the mollusc. The subject for the evening was Practical Microscopy. Mr. H. Hawkes gave a demonstration in finishing microscope slides. The ground-colour used was made of flake white, as supplied in tubes for oil painting, mixed with copal varnish. Various designs were then made on the white with crimson and blue, prepared in the same manner. The slides mounted in Canada balsam had first to be ringed with spirit varnish to prevent the running in. Mr. Hawkes also showed a cabinet constructed to hold all the requirements for mounting and finishing slides.—January 18th. Mr. W. Tylar gave the first of two lime-light exhibitions of photographs, taken during a recent tour on the Continent. The series mainly comprised pictures of Swiss scenery, many of them being taken off the track of ordinary tourists. The pictures were of a most interesting description, and called forth the applause of an appreciative audience.

BIRMINGHAM ENTOMOLOGICAL SOCIETY. — December 21st, 1891. Rev. C. F. Thornewill, vice-president, in the chair. Mr. P. W. Abbott showed *Agrotis obelisca*, taken by Mr. A. J. Hodges in the Isle of Wight; also a specimen of *Noctua c nigrum*, with which species, Mr. Hodges says, *obelisca* is often confounded on the sugar. Mr. R. C. Bradley showed *Pyrellia lasiophthalmia* from Sutton. Mr. Abbott read a paper on "A holiday collecting in the Isle of Wight." He worked specially for *Agrotis lunigera* with considerable success, but such was the danger of collecting on the cliffs, where alone they are to be taken, that he advised others to leave it alone. He took many other good things, the methods of capture of which he described; and the paper was illustrated by two drawers of the specimens taken. —January 11th, 1892. Mr. W. G. Blatch, president, in the chair. Mr. R. C. Bradley showed some diptera which had been shown at a former meeting as *Pteropœcilia lamed*, with the note that they had been confirmed as that species by Mr. Verrall. They had since, at his request, been again submitted to Mr. Verrall, and he names them as *Toxoneura muliebris*, and remarks that *P. lamed* is not yet recorded as British satisfactorily. A letter was read from Mr. C. J. Fryer recording *Stenamma Westwoodi*, from Warwick. Mr. C. J. Wainwright read a paper on "A holiday spent in North Cornwall last year," in which he described the results of a fortnight's collecting on the north coast, during which he took *Plusia orichalcea* and many good diptera. The paper was illustrated by photographs and the collections made.

Plate 2.

Fig II.

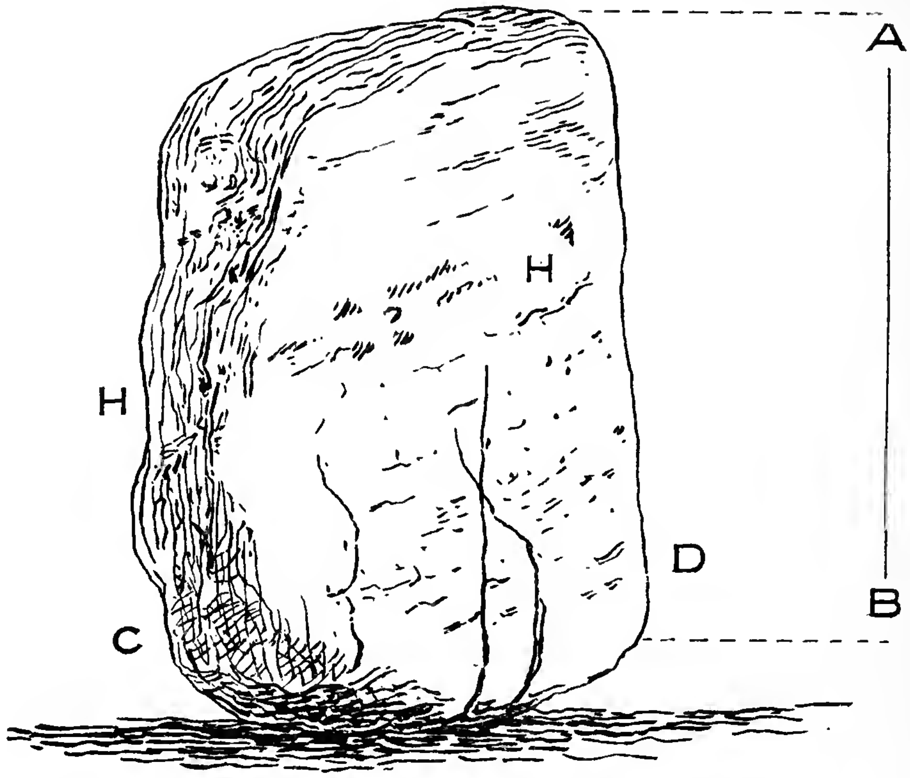
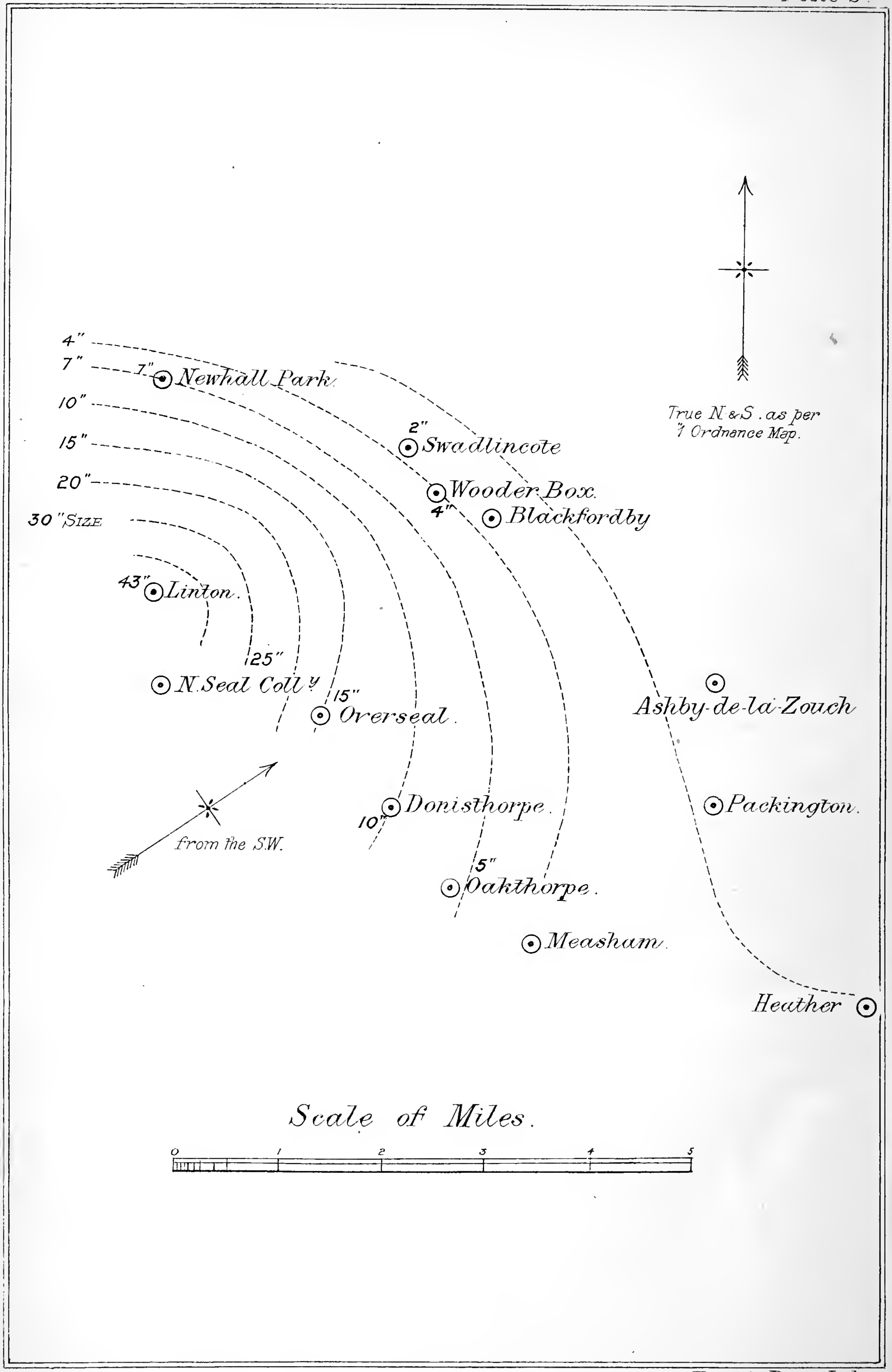


Fig I.

Herald Press Litho.



Herald Press Litho.

ON SPECIMENS FROM THE PERMIAN BRECCIA OF LEICESTERSHIRE COLLECTED BY W. S. GRESLEY, ESQ., F.G.S.

BY PROFESSOR T. G. BONNEY, D.SC., LL.D., F.R.S., V.P.G.S.

(*Concluded from page 35.*)

V.—ROCKS PROBABLY OF CARBONIFEROUS AGE.—SANDSTONES, MUDSTONES, &c.

(49.) An angular fragment, slightly rounded at the edges, of a hard, fine-grained, somewhat micaceous sandstone. (? Carboniferous.) (71.) An angular fragment of a fine-grained, quartzose, sedimentary rock, with irregular rusty spots, the origin of which is difficult to determine. This might be Carboniferous. (91, 92, 97, 98, 99, 132, 136.) Seven specimens of sandstone, often somewhat micaceous, weathering brownish or reddish; five collected from Woodville, Overseal, or Measham; one a very close, compact grit or quartzite, with bedding apparently much contorted. Four specimens are striated or indented. One of them is a fine-grained grit of dull reddish colour; and another is a large, flattish, rounded pebble, 7in. × 6in. × 2½in., of a fine-grained, hard quartzose sandstone, with specks of felspar. (75, 76.) Two pieces of hard clay, much slickensided and polished. From Linton Colliery, and from brickyard N.W. of Woodville. Certainly Carboniferous. (44.) Some kind of argillite. It has a slightly brecciated look in parts. (? Iron-stained rock from the Carboniferous.) (96.) From Overseal—a fairly angular fragment of rather hard siliceous mudstone, somewhat iron-stained, with plant remains. Certainly Carboniferous. (51.) Probably a hard mudstone, with holes, which were occupied by crystals of pyrite, now rotted away. (52.) This specimen appears to

DESCRIPTION OF FIGURES.

PLATE 2.—Sketches (drawn by Mr. Gresley) of boulders from the Permian breccia at Coton Park Colliery.

Fig. I.—A boulder of grit or sandstone, with five or six striations, about 10 inches long, on the flattest surface.

Fig. II.—A boulder of similar materials, with many white fragments, (? felspar) about the line C D. Hæmatite spots (? pebbles), blotches, and streaky patches about the horizon H. The face of the boulder from A to B, and half round the mass, is well smoothed, but not polished.

PLATE 3.—Plan (drawn by Mr. Gresley) to indicate the distribution of the largest fragments in the Permian breccia, and the direction from which they have probably come.

be a fine-grained mudstone, with curious greenish spots; most probably a variety of clay-ironstone, showing a certain amount of concretionary action. (7, 36, 73, 126, &c.) Clay ironstones occur with cone-in-cone structure; this, in three or four instances, is very well developed, in others it seems to be more slightly marked. One is from Overseal, others from Donisthorpe and Stanton. (8, 27, &c.) Many specimens are, more or less, impregnated with iron oxide. One consists of quartz grains, in a few cases rounded, but usually rather angular, cemented with hæmatite, which seems sometimes to have acted corrosively on the quartz. In another, rather angular fragments of quartz (a little of which is compound) and of felspar are similarly cemented. (6, 13, 14, 15, 134, 137, &c.) A large number of rocks are "burnishers" (including one from Packington and one from Overseal); these, or similar specimens, have been already described by Mr. Gresley.* The fossiliferous specimens are, in many cases, hæmatite nodules or rock impregnated with hæmatite. (33.) A quartz grit, with specks of (?) felspar, cemented by red iron oxide, contains a small cylindrical cast, like an organism. (70, 116.) In other ferruginous specimens are obscure remains of plants. (140, 141.) Two, consisting of hæmatite, one very earthy, contain apparently stigmarian rootlets. (142.) One hæmatite pebble includes a structure which Mr. Gresley has suggested may be a worm-cast or tube. Others contain leaf impressions (143), one, in a hæmatite pebble, being a good specimen of Neuropteris gigantea. (50, &c.) In six specimens pinnules of Neuropteris, with other vegetable remains, are more or less clearly indicated. (144.) One hæmatite fragment contains apparently, besides pinnules of Neuropteris, leaves of a (?) sigillarian plant; this, if I rightly understand the label, comes from the same block as (145), which is a very fine-grained, reddish sandstone, from Overseal, with probably infiltration bands of secondary origin. It contains traces of organisms, possibly plant stems, around which some hæmatite seems concentrated. (146.) Another fine-grained sandstone, from a well at Gosty Lees, Overseal, exhibits traces of Stigmaria. (147.) One red sandstone, or conglomerate, a specimen of the breccia from Oakthorpe, includes, apparently, a crinoid stem. (148.) In a fragment of cherty limestone, from Overseal, is a specimen of a lamellibranch (? *Nucula luciniformis*), with a second, ill-preserved bivalve and some other

* "Midland Naturalist," Birmingham, 1886, Vol. IX., p. 1. W. S. Gresley, "On the Occurrence of Fossiliferous Hæmatite Nodules in the Permian Breccias in Leicestershire."

markings. (59.) An exceedingly fine-grained quartzose grit, or, possibly, a chert, with the impression of a crinoid stem, and one or two other organisms—doubtless Carboniferous. (46.) A piece of chert, consisting of a number of small silicified organisms, cemented together by cryptocrystalline quartz. Among the organisms can be distinguished a few small crinoid stems, and one or two chambered foraminifera. Fragments of shell can be recognised, with probability, but the majority, both from their smallness and from the effects of replacement, can be only conjecturally identified, and I cannot speak more positively in regard to sponge spicules. But that this is a piece of Carboniferous chert, I have no doubt.

VI.—Large Boulders from Coton Park Colliery.

At a depth of about 510 feet, in a trial shaft sunk beneath the village of Linton, near Burton-on-Trent, two large boulders, with some of smaller size, were found in the year 1887, in a mass of Permian breccia lying on denuded coal measures. In the same deposit a fossil shell was found, which, however, has unfortunately been lost. The dip of the Permian at this place was to the west, about 1 in 4. One of the boulders was 3ft. 9in. × 3ft. 10in. × 2ft. 3in., weighing about a ton, much weatherworn in places; parts of the exterior were blotched and stained with red and purple, and on the flattest surface were five or six striæ about 10 inches long. Here and there the matrix of the breccia adhered. This contained bits of hard red hæmatite ("burnishing stones"). A little of the matrix also adhered to the other boulder, which measured 3ft. 3in. × 2ft. 9in. × 2ft. Part of its surface was well smoothed but not polished, and was marked with striæ, some about 3 inches long. (Plate 2, Figs. I. and II.)

The larger boulder (40) consists of a hard quartzo-felspathic grit, with a few flakes of mica. It might be a sandstone from the Carboniferous series, possibly from the Millstone Grit. It is a conglomerate, containing small pebbles (nature uncertain) in a reddish felspathic matrix. Under the microscope we find quartz grains in a rather iron-stained felspathic base, often converted into a microlithic micaceous mineral. Other fragments may be decomposed lava, some look more like a fine grained schist or phyllite. There are a few flakes of a colourless mica and one of brown mica. The second specimen (41) is a sandstone or felspathic grit, bearing, under the microscope, a close likeness to the last. Some bits of fine grained phyllite seem certainly present; two or three fragments of felspar, one resembling microcline, can be recognised, with probably one or two rhyolitic fragments, also a little calcite or some allied carbonate. If I understand rightly, this specimen represents the second of the above-named boulders, but the accompanying note is not free from ambiguity. It is, however, certainly from "a large boulder in this find."

VII.—Specimens doubtfully Permian.

Five specimens remain to be described. Of these one is spheroidal, three are very well rounded, and the fifth appears to be a very old fragment of a fairly rounded mass. I have kept them together, since the external appearance differs from that of most of the Permian fragments, and resembles that of the Bunter pebbles. As the two deposits in some parts of Leicestershire come very close together, it seems possible to me that in certain cases a pebble from the upper deposit might get into the lower. (28.) A rounded pebble of a rock, the matrix of which looks like an andesite with quartz, felspar, altered biotite, and a fragment of a rather different lava, but almost all the grains have a curiously fragmental look and several of the quartz grains are compound, containing also plates of the mica, and in one case part of a felspar crystal; in another example a small grain of felspar seems completely included, and the compound quartz has a clotted look as in gneisses. Mica, both white and brown, is also associated with grains of felspar. A few grains of (?) tourmaline occur, also apatite crystals. Can an igneous rock have broken through a gneiss and filled itself with small fragments? Such a thing does happen. (23.) The slide is more quartzose than I should have expected. It shows grains mainly quartz, some iron oxide, probably some zircon, seemingly rolled, with a few rolled grains of tourmaline and (?) epidote. A similar rock is found as boulders in the coal at Dukinfield. The last two minerals occur in various old quartzites which I have described.* (43.) This seems to be a fine-grained dark quartzite. Under the microscope it consists of rather angular small quartz grains, a brownish mineral, probably decomposed felspar, and a bluish or greenish dichroic mineral (a secondary product both after the latter and as needles in a quartz vein), which I think is pretty certainly tourmaline, I found a pebble of the same rock in the Staffordshire Bunter, near Rugeley. (57.) A well-rolled pebble, which may have come from a long distance. It is a clastic rock; the fragments are subangular; a few probably

* See a paper by J. Radcliffe, "Quart. Journ. Geol. Soc.," Vol. XLIII., p. 599.

of volcanic origin, but much of the quartz shows a compound structure and resembles that from veins. Some, however, may have come from a gneiss or schist. Some bits of the felspar resemble that of a granitoid rock more than that of a lava. One fragment is composed of brown and white mica and quartz granules (the least abundant). Brown mica predominates, the flakes being about ·002in. to ·003in. long. Those of white mica sometimes attain to double this size, and are rather apt to be aggregated. As I am not able to assert that any constituent in its present condition is of clastic origin, I think the fragment is from a true schist. One or two gneissoid fragments contain a grain of zircon, one possibly some zoisite. Tiny but well developed crystals of brown mica are not rare in some of the fragments. I believe that this rock is largely composed of the debris of very ancient rocks. (95.) From Measham, a small round pebble about $\frac{3}{4}$in. long, of the peculiar quartz-felspar grit which I have described from the Trias.* To this formation I think the pebble more probably belongs.

VIII.—DISTRIBUTION OF THE ROCK FRAGMENTS; AND CHARACTER OF THE MATRIX.

The distribution of the fragments does not suggest any special inferences. All the different classes of rocks which I have described are represented among the specimens from localities in the neighbourhood of Overseal. (129.) Among those from the place itself we find various rocks; the basalt (64), one or two specimens of Charnwood type, a dark slaty rock (138), specimens of the rhyolitic conglomerate, such as (119), the quartzose grit (103), a felspathic quartzite (101), and fine-grained quartzite (100), also a sandstone (132), and other rocks probably Carboniferous. From Coton Park, in addition to the two large boulders of grit or sandstone (40, 41) and the quartzo-rhyolitic pebble (39), come a slickensided clay (75) and a sandstone, probably Carboniferous, also the banded argillite of Charnwood origin. From Woodville or its neighbourhood come a pebble, probably from Charnwood (82), a Carboniferous sandstone (97), with a hard Carboniferous clay (76), and a pebble of quartzo-felspathic grit (102), of uncertain age. From Wooden Box, a flinty argillite from Charnwood (81). From Oakthorpe, a breccia with a crinoid stem (147). From Mea-

* Address to the Geological Section of the British Association, Birmingham, 1886, p. 612, T. G. Bonney. "Geol. Mag.," Decade 2, Vol. VII. (1880), p. 405, "Note on the Pebbles in the Bunter Beds of Staffordshire," T. G. Bonney.

sham, a pebble apparently Palæozoic (94), and a Carboniferous sandstone (98); and from Boothorpe a fine-grained quartzite (66). From Stanton, a Charnwood ash (104), a rather fine-grained rhyolitic breccia (117), a volcanic grit (120), and a cone-in-cone specimen. From Packington, a burnisher; from Donisthorpe, a cone-in-cone rock. The matrix from which the above fragments have been derived is itself a breccia, consisting of small angular to rounded pieces of various rocks imbedded in a gritty material more or less earthy. It is either of a dull red colour or more or less blotched with this tint. The specimens are enumerated after the order in Mr. Gresley's diagram. (Plate 3.) (125.) The rock from Linton Colliery is more than usually argillaceous, and of a dull purplish-red colour, every part of it being much stained and glazed with iron oxide (perhaps tinted with manganese oxide). On the other hand, the matrix at the Coton Park Colliery is a loose, friable grit, made up of small and well-rounded fragments of quartz and various rocks. (114.) The mass of the Overseal breccia seems to consist rather largely of tiny pieces of a green slaty rock, not unlike some of the more flinty slates of Charnwood. A larger fragment of purple slate is present in the specimen. (109, 124.) The Stanton breccia also seems to consist to a great extent of minute bits of other rocks, greenish-grey and tints of red; little chips of slate can be distinguished among the former. (122, 123.) The Oakthorpe rock is a warm red colour, rather sandy in aspect, but not very rich in quartz, with but little of the green material. The larger fragments are subangular to rounded. (115.) A small specimen from Wooden Box does not show much of the real matrix. It seems to be a speckled, reddish and greenish-grey grit, in an earthy ground mass, with but little quartz. (110.) From Woodville, the specimen contains pebbles of green or purple argillite, and of a quartz-grit in a gritty matrix, stained in places brown or purple. (113.) The small fragments of green slate noted above appear to be also abundant at Swadlincote. The grains, which consist of quartz, are not numerous; they are mostly of a dull reddish material, all in a hard earthy cement. The larger fragments are generally rather angular. Mr. Gresley observes that the colour of the rock at Woodville and at Swadlincote is markedly greenish in contrast to the very red tint at Overseal, Stanton, &c. (121) Near Midway, on the Swadlincote and Woodville Junction Railway, the green, slaty constituent seems to be almost wanting. The hard, earthy cement is present in greater quantity. The larger fragments seem generally fairly rounded, and a good many of them are vein quartz. (111, 112.) The matrix at Blackfordby is of a yellowish colour, blotched with red, and among its finer materials green fragments are fairly numerous, but a chloritic or epidotic rock, which occurs in larger pebbles, seems to be at least as common as the above-mentioned slate. These specimens seem to call for only one general remark—that a larger proportion of "paste" (decomposed felspar or felspathic rock) and a smaller of quartz grains are present here than is usual in the Triassic sandstones. They have, however, some general resemblance to the basement breccia of the Keuper, if it be accurately represented by a large specimen in University College, collected, I believe, in the Kidderminster district by Prof. Morris. They have a rough similarity, especially in the dull red colour, to some of the Permian breccias of Worcestershire, while a specimen from Rowthorne, county Derby, is greyer, more quartzose and Triassic-looking.

These breccias afford evidence which has an important bearing on the past physical geography of this part of the Midlands. The rock fragments are very various, and include specimens of Charnwood and other præ-Palæozoic or old Palæozoic rocks, besides representatives of the Carboniferous Limestone, of the Millstone Grit (probably), and of the Coal Measures; the last in considerable abundance. The country, then, for a considerable distance around must have been affected not only by great post-Carboniferous movements,* but also by great post-Carboniferous denudation, sufficient at any rate to make a section through the members of the latter system, and probably to expose in places that ancient floor, which has been described by previous authors. Portions of it, of course, may not have been covered by the Carboniferous rocks. We must also remember that in Leicestershire the Millstone Grit is not thick, and the Carboniferous Limestone in many places is thinning, in some absent. It does not seem probable that any great and strong river rolled its sands over this area. The materials suggest the mingling of fragments of many kinds brought together from different quarters. The comparative rarity of well-rounded fragments seems also irreconcileable with the deposit of a large river or the action of ocean waves.† According to a diagram con-

*Mr. Gresley, in a manuscript note, states that in his opinion a very long time must have elapsed between the deposition of the Coal Measures and the formation of the Permian breccia, because the fragments of the former in the latter are very much the same in their lithological condition as are similar rocks in the existing Coal Measures.

†According to another note of Mr. Gresley's, the Permian breccia does not usually exhibit stratification—"a confused mass of fragments are huddled together in an unstratified matrix."

structed by Mr. Gresley, a copy of which is annexed (Plate 3), the materials probably came from the S.W., for the largest fragments are found near Linton, and they diminish in size from that place in directions ranging from N. by E. to S.E. He also notes that the breccia appears to be thickest at Linton, thinnest at Swadlincote.

IX.—Striated Fragments.

One question is suggested by some of these specimens, which, having regard to what has been already written on the physical geography of the Permian, is of exceptional interest. How were these comparatively large fragments transported, and how, seeing that some must have travelled for a considerable distance (for their variety justifies that inference) have they escaped rolling ? Was ice the agent ? As I believe that Mr. Gresley is disposed to answer this question in the affirmative, and as striations have already been attributed to ice action in the Permian rocks of west-central England,* I have examined the striated specimens as carefully as possible, with the following results:—(132.) A flattish, rounded pebble, about 7in. × 6in. × $2\frac{1}{2}$in, of hard quartzose sandstone, which has two or three deep broad scores, the longest about $1\frac{1}{4}$in., on one of the flatter surfaces. While they might indicate ice action, I incline, from their general appearance and the presence of one or two depressions near the narrower edges, to attribute them to the action of other rock fragments. (91.) A rather triangular piece of sandstone which has, near the crest of its more curved surface, five rather short and broad grooves of different length. These also seem more likely to be formed as suggested above. (92.) Another flattish piece of sandstone which has grooves on both sides ; most of these also are rather broad, two of them making an acute angle. On the whole, I attribute these to the same cause as the previous examples. (63.) Striations on this rock are in two directions, roughly at right angles. Some of the narrower at first sight are very like glacial striations, but one of them bends at the end like a hook, which is peculiar. Also the sides of the fragment, though less than one inch broad, are striated to some extent.

* "Quart. Journ. Geol. Soc.," Vol. XI., 1855, pp. 198-205, "On the Occurrence of Angular, Subangular, Polished, and Striated Fragments and Boulders in the Permian Breccia of Shropshire, Worcestershire, &c." By A. C. Ramsay. (I have examined the specimens in the Museum at Jermyn Street, the markings on which appear to be more like those produced by friction from earth-movements than ice-striations.)

(133.) A rather rhomboidal fragment, with rounded edges, of a greenish argillite, exhibiting well-marked scratches upon two adjacent faces and upon one end, the longest being over 2in. There are, at least, four upon the end face, which measures quite 2in. each way, the sides being 5in. long. This position is not easily explained on the hypothesis of ice action, and, on the whole, the marks remind me more of those made by other stones. (134.) A burnisher. Such striæ as there are do not seem to me due to the action of ice. (137.) A specimen with hæmatite, on which, possibly, are faint, but very obscure, traces of plant remains; the striations might conceivably be slickensides, but certainly are not ice marks. (135.) A fine-grained felspathic grit. I see no signs of glaciation, but some pressure marks. (136.) A fine-grained grit, of dull reddish colour, which has two or three parallel striæ on one flat face, smoother and flatter at bottom than is usual with ice marks; that is, they are more like the rut of a wheel than the furrow of a plough. (138.) A fragment of rather hard, slightly micaceous, purplish slate, which has two flat faces, both striated—very like ice striæ, but a little smooth at the bottom.

While it is difficult to deny that certain of these markings may be striæ which have been produced in some way or other by the action of ice, I am more than doubtful of others, and am not convinced that this explanation is necessary for any. The striæ, however, could not in any case be relied upon to prove the existence of glaciers, for they could have been equally well produced by coast ice.* At the same time, the very angular character of many of the fragments, their size, and the great diversity which they exhibit, might fairly be brought forward in support of the hypothesis that ice had been one of the agents of transport; for instance, it is difficult to understand by what other means such boulders as those at Coton Park could have been brought to their present position. It must, then, be admitted that, even if we are unconvinced by the striæ, the general evidence of the breccias of this Leicestershire district seems favourable to the idea that a rather low temperature prevailed in Permian times.

* This, I find from a manuscript note, is Mr. Gresley's opinion. He attributes the breccia to "a wasting away by frost, &c., of pre-existing rocks, the debris being accumulated on floe-ice, which broke up from time to time, drifted out into tranquil water, and dropped the fragments to the bottom."

NOTES FROM A WINTER JOURNAL, 1890-1.

BY O. V. APLIN,
MEMBER OF THE BRITISH ORNITHOLOGISTS' UNION, AUTHOR OF "THE BIRDS OF OXFORDSHIRE."

(*Concluded from page 43.*)

1891.—January 1st.—Giving a little, and thermometer said to be above 32° in shade for first time for twenty-five days. Examined the following birds, procured in the last days of the old year :—Sclavonian Grebe, from Hook Norton; Pomatorhine Skua, immature dress, caught alive at Finmere; Hooded Crow, Byfield; Woodcock, a little bright red bird, picked up nearly dead close to Banbury; Kestrel, female. The birdstuffer who showed me these had received a few Bramblings or "Mountain Finches."

2nd.—The same taxidermist received two Green Woodpeckers which had been picked up dead, and, like those found in the winter of 1880-1 (especially in January, 1881), had their long tongues stretched out to their full length.

3rd.—A Missel Thrush found, too weak to fly.

4th.—Thawed a little; and some sleety rain, which froze as it fell, and made roads and paths a sheet of ice. Bitter frost at night. Men have skated from Oxford to Reading.

5th.—Country now covered with hard crust of frozen snow, for the snow has only wasted a little. Redwing caught in a garden at Bodicote, too weak to fly; they and Blackbirds have finished hollyberries. A Little Grebe found alive on snow under window of a house at Bodicote this morning, a long way from any stream; it was in very poor condition. Heard that (in my absence) twenty-four Wild Geese had been seen about the parish between here and Barford; on the 26th they were seen on young wheat; next day they flew over my informant quite low down; and on the 31st they were round a load of pea straw standing in a field, running about, said the man who saw them, like Turkeys. Snow shower in the evening.

6th.—A Coot shot yesterday morning on one of the open scours on the Cherwell near Franklin's Knob (opposite Bodicote), where they are never seen in ordinary seasons; it was in very poor condition.

7th.—News of the following birds :—Peregrine Falcon (young female), killed at Waterperry on the 26th December; a Bittern, procured about the same date, near Bletchington, (N.B.—A good many Bitterns were recorded, from different parts of the country, in the *Field* about this time); Pink-footed Goose (*Anser brachyrhynchus*), shot at Water Eaton, on the 6th inst.; an adult female Peregrine Falcon at Bagley Wood, and "Kingfishers innumerable" in the neighbourhood of Oxford, about this date. Also three or four Golden Eye Ducks at Oxford. I afterwards examined the Falcons and Goose.

8th.—I hear all the Larks have disappeared from this parish. On one favourite farm there is not one to be seen. Examined at a Banbury birdstuffer's a Grey Crow, killed close to that town, and a female Pied Woodpecker, from Boddington (Northants), this week. The fields are now covered with frozen snow, about two or three inches deep, and are in the worst possible condition for the birds. Rooks feed on the roads, and one came recently into an enclosed garden at Bodicote. Kingfishers will probably be exterminated, and the Thrush, family too, except Blackbirds in the gardens. News of a Barred Woodpecker seen at North Aston on the 6th inst.

9th.—Very hard frost last night, and froze hard to-day. Although there were many Tree Sparrows in an adjoining Orchard last autumn, I never see any with the other birds which flock to my crumbs.

10th.—Exceptionally severe frost all day, still air and sunny. Thick ice on moustache. Found a little band of Wood Pigeons harrying field of swedes partly uncovered. These must have been migrants, as there have been none about lately. While waiting under a hedge to get a shot I found the gun barrels *painfully* cold. One Snipe in the warm ditch. Swere frozen save in the most rapid places. Snow "squeaked" loudly as one walked on it, a sure sign of intense frost; that in the open parts of the fields is caked hard, and it is possible to walk on it without sinking in. The crust is about one inch thick, over perhaps two or three inches of soft snow. On the top is some fine, dusty, recently fallen snow—just a sprinkling. In this the tracks of birds and animals are fairly lithographed, if one may use the expression. Every toe in the Rabbits, every joint in a Partridge, Crow, or Moorhen's footmark can be seen. I found also the track of Heron and Water Rail along the warm ditch, the hair-like tracks of the small birds under the hedges, and the footprints of the Long-tailed Field Mouse. Saw a covey of eleven Partridges, also four Red-legged Partridges, and wondered how they kept alive. About a score of Carrion Crows roosting in a place always haunted by a few, but where I never saw so many before. These must be migrants, though a few have wintered here. Saw a Kestrel; only two Fieldfares seen.

11th.—Very sharp all day. Froze in my bed room last night and in day. Hung out some fresh suet for the birds. A Starling came but could not settle on it, but a pair of Nuthatches found it out, and stayed a long time, much to the disgust of my Robin.

12th.—Froze again in my room last night. Mr. Darbey writes—" The poor Kingfishers seem now to be all killed, for I have not had one in for several days; and I hear from people who frequent the water side, that now they do not see one where a few weeks ago dozens could be seen; this is very sad." He had received nine Herons, and Mr. Wyatt had two or three about this time. A Brown Owl, shot, was quite fat for an owl. Thaw set in early, and was maintained.

13th.—Thaw maintained, but glass very high and rising. A sheep was roasted on the Thames, at Abingdon, yesterday. The ice on the upper river at Oxford is twelve inches thick, and that on the canal at Banbury fourteen inches.

14th.—Thawing last night; but this morning a wind frost (N.N.W.) set in, and as the day wore on the cold increased.

15th.—Hard wind frost (N.N.W.). Mr. Wyatt received an adult Razorbill from Wroxton. This is, of course, a very unusual chance wanderer from the coast. Snowstorm in the afternoon.

16th.—Cold and bright.

17th.—A sharp snowstorm put half an inch of fresh snow on ground in afternoon; intensely cold afterwards. Flushed Heron and Snipe from the warm ditch. Hardly a bird to be seen in fields now. None of the Thrush tribe; no Pigeons; nothing but Rooks and Jackdaws, and perhaps a few Yellow-hammers, or a Bullfinch here and there. The Grey Wagtails forsook our frozen streams weeks ago. Half-a-dozen Goldfinches feeding in the alders here. Fields like iron now, and the grass fields in many places are covered with patches and lumps of ice, where the partially thawed snow froze. It is not very easy to walk over them now.

18th.—Intense frost. Froze in bed room last night and in day. Bright sunny day; air so still and dry that it was quite pleasant strolling about in the sun before noon. This afternoon while sitting with a friend I heard, to my great astonishment, the spring note of the Great Tit. We had been watching the bird searching the trunk of a walnut tree just before. The thermometer (about three feet from the ground in a sheltered place) when we consulted it stood at 28°. Many Tits come to my food, but my one poor Thrush has apparently succumbed.

19th.—Again a most intense frost last night and this morning. Froze in bed room. News from Mr. Darbey that he has a Wild Swan, shot about the 10th. I afterwards identified this as a Whooper (*Cygnus musicus*). It was killed in the Thames valley near Lechlade or higher. My brother's cowman informed him that there was ice one inch thick in the drinking trough of the spring in his cattle yard. This water has only been frozen once before this winter, viz., on the night of the 10th.

20th.—Severe frost last night, for it froze in my room, but at breakfast time the wind was S.W., and felt warm. Rain in afternoon, and heavy at night, but by midnight sky was clear and it was freezing.

21st.—Wind W. Hard wind-frost and roads very bad. The ground is so hard that none of the rain-water and snow-melt has been able to sink in. On the pools formed in the fields there is half an inch of ice; rather large floods in the valley frozen over. A Barred Woodpecker, male, brought to me.

22nd.—Sharp frost again. Ice on the rain-pools bears boys. Sprinkle of snow at night. Warmer later. An Otter, caught on outside of ice on the Cherwell, near Banbury, brought into that town.

23rd.—Warm. Wind S.W. Rain in afternoon. Robin sang, morning and evening, for the first time since the frost began at the end of November. Barn Owl calling near house last night. We have had a pair of Crows here all the winter; I heard them calling early this morning. News of the fifteen Wild Swans seen in the flooded valley below North Aston.

24th.—Rain in afternoon. Frost at night. Great floods in the valley. No water has been able to sink into the frozen ground, so all the snow-melt and rain has run down into the valley at once; also ice blocks the river. Ice in canal bent up in the middle like a span roof, with a crack down the middle and water over the sides. Saw two Kestrels. Half-a dozen Wild Ducks near the Weir Lock. Many Rooks and Starlings along the flood edges. Three or four Fieldfares near Adderbury. News from Mr. W. W Fowler, at Oxford, that he sees a few Bramblings with Chaffinches in rickyards. Bullfinches rather common here.

25th.—Coal Tit, with spring note "*if-he*." Starlings singing.

26th.—Warm, some wet.

27th.—Ditto. Partridge, with spring call.

28th.—Warm, some wet. Lark singing, a few seem to have come back the last day or two. Hedge Sparrow and Wren have sung a little, but I have heard neither Song Thrush nor Missel Thrush yet.

30th.—Bright and sunny. Went to see the Wild Swans in the valley under North Aston. Saw five, all adult birds. They are Whoopers (*C. musicus*). Sixteen Mallard and Duck on the flood. At night heard the call notes of Teal and Widgeon.

31st.—News of thirty Wild Duck seen on the floods below Broughton.

February 1st.—Flock of Fieldfares and some Redwings in meadows at Broughton. These have returned since the frost. Some Larks on the fallows. Several Robins, and one Song Thursh (the first since the frost) singing.

2nd.—News of three Gulls seen flying over Bodicote on 31st.

6th.—Mr. Darbey, of Oxford, told me that Bramblings had been common, and he had had a good many.

7th.—Examined a specimen of the Fork-tailed Petrel found dead at Chadlington early in December.

8th.—Missel Thrush and Linnet singing. Good flock of Fieldfare.

10th.—Hardly any Chaffinches to be seen. Report in local paper of a Kittiwake Gull shot in Swalcliffe Park on the 3rd. Ring Dove cooing.

14th.—Party of six Pied Wagtails on the mud at Clattercote. Yellow - hammer singing. In a long walk noticed the remarkable scarcity of Chaffinches.

15th.—Walked to Somerton to examine a curious bird which came down the river, dead, to North Aston Mill earlier in the month. It had been thrown away, but from a sight of some feathers, and a sketch, made out that it was an adult Red-throated Diver. Saw a Grey Wagtail in pool in front of Mill. Hardly any Thrushes about. Saw a pair of Kestrels at Clifton, and (in the evening) a Short-eared Owl in the meadows near there. Also a large Hawk sitting on one of the long lines of post and rail fence crossing "Best-moor." The air was clear, but we had no glasses, and the bird was a long way off. It looked grey, and was probably a male Hen Harrier. Two Chaffinches in song. With this spring-like observation I will close these notes, merely remarking that several Chaffinches were to be heard next day, and that it appeared that a few had returned to us.

THIRTY-THIRD ANNUAL REPORT

OF THE

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY,

PRESENTED BY THE COUNCIL TO THE ANNUAL MEETING, FEBRUARY 2ND, 1892.

The Council have the pleasure of reporting that the Society continues in a prosperous condition; the number of members has been almost fully maintained by the addition of new members, to replace those lost by decease and resignation, and the funds show a satisfactory balance in hand,

The Annual Conversazione of the Society was held on December 15th, in the Physics Laboratory of Mason College, a room very conveniently situated, and well suited for the purpose, having the great advantage of the electric light, for the use of which, and for great facilities in the arrangements, the Society is specially indebted to Dr. Poynting. The attendance at the Conversazione was exceptionally large, and the exhibition was of unusual interest. The Society was indebted to Dr. Lapworth for a selection of Fossil Crinoids, &c.; to Professor Hillhouse for a Botanical exhibit; to Mr. J. B. Stone for an extremely valuable and interesting selection from the natural history specimens, photographs, and curiosities collected in his recent visit to Japan, Ceylon, &c.; and to Mr. R. W. Chase for a complete collection of British hawks and owls, a collection of fifty nests of different birds in each of which the cuckoo had laid an egg, and a collection of American snakes. Mr. F. W, North, of Rowley Regis, lent a very valuable collection of diamonds in the matrix from the Kimberley mines of South Africa; and a special interest was added to the exhibit by a fine series of photographs, illustrating the various processes employed at those mines, which were kindly lent by Mr. Charles Cochrane, of Stourbridge. Mr. Spicer exhibited a fine collection of birds, animals, and skins; Mr. Hunt a collection of insects, &c., from Natal, which was of great merit; and Miss Gingell a series of beautifully-executed coloured drawings of plants, fungi, &c. A case of sponges from Mr. Allport; a marine aquarium, with sea anemones, by Mr. Blakemore; a collection of corals by Mr. Carpenter; and Mr. Tye's fine collection of Stalk-eyed Crustacea, were specially interesting. Photography was well represented by Mr. A. W. Wills, in his Burmese pictures; by Mr. Gray, of Belfast, in his Irish views; and by Mr. Watson, Mr. Iliff, and Mr. Brasier in lantern slides and stereoscopic pictures; the microscopic exhibit was also remarkably good and interesting. The handsome floral decorations of the room were kindly contributed by Mr. Spinks, of Hewitt and Co.

An excursion was made to Apley Park and Badger Dingle on Saturday, June 20th, which was attended by thirty-two members and friends, and proved very pleasant and enjoyable, the only fault being that the time was too short for all that had to be seen. The party went by train to Shifnal, first visiting the old church, and then driving to Badger and walking through the charming Dingle; they then drove to Apley and walked along the elevated terrace, admiring the fine trees and the beautiful view; driving back to tea at Shifnal, and then to the return train at Albrighton.

The Saturday Afternoon Excursions have been renewed, and eight of them were carried out in the summer and autumn with very successful results; and these excursions are proposed to be continued in the present year.

The Treasurer's annual financial statement shows a very satisfactory position of the Society's funds; the receipts of the Society for the past year were £156 19s. 6d., and the expenditure £145 19s. 8d., showing a surplus of £10 19s. 10d., and leaving a balance in the treasurer's hands of £25 11s. 9d.

The total number of members for the year is 200, of whom 7 are life members, 140 ordinary (guinea) members, 12 family (half-guinea) members, 8 lady (half-guinea) members, 5 honorary vice-presidents, 21 corresponding members, and 7 associates.

The Council refer with special regret to the loss by death of Dr. Deane, a past president of the Society, who was highly esteemed both for his scientific attainments and his personal qualifications

The fourteenth annual meeting and conversazione of the Midland Union of Natural History Societies was held at Dudley on October 13th and 14th, the President and Mr. W. R. Hughes represented the Society at the meeting. A new secretary, Dr. T. Stacey Wilson, was appointed, and it is hoped the Union may become of more effective service to the associated societies. Excursions were made to the Castle and Wren's Nest Limestone Caverns, and the very interesting Open Coal Working at Clay Croft.

MICROSCOPICAL SECTION.—President, Mr. C. Pumphrey; Secretary, Mr. T. V. Hodgson.—There have been eleven meetings held, with an average attendance of sixteen. Only two papers have been read at the meetings :—

March 4th.—"Worms," by Mr. T. V. HODGSON.

June 2.—"The Mouth-parts of Insects," by Mr. J. F. GOODE.

Both of these papers were well illustrated by diagrams and specimens under the microscope.

In the absence of papers dealing with original work, a suggestion was made by the President to arrange exhibitions of specimens in series with descriptive notes, and the following have been carried out with most satisfactory results :—

May 5th.—"Bird Parasites and the Eggs of Insects," by Mr. C. PUMPHREY.

November 3rd.—"The Ovipositors and Stings of Insects," by Mr. A. READING.

December 1st.—"Diatoms," by Mr. J. EDMONDS.

At these and the other meetings of the Section a large number of specimens have been exhibited, which, in the summer, were almost entirely the capture of the Saturday afternoon excursions, which have been revived. Among the principal exhibitors may be mentioned Messrs. C. Pumphrey, W. B. Grove, and Mr. W. H. Wilkinson, botanical specimens; and Messrs. S. P. Bolton and T. V. Hodgson, living specimens of pond life.

On December 16th an extra meeting was held, in consequence of a general desire for some practical microscopy. Mr. Clarke gave a demonstration in the preparing and mounting of specimens, and it is hoped that this meeting will lead to the formation of a sub-section to carry on practical work in this branch.

It may be said that the Section has slightly improved in many points on the previous year, although the work done has been of a distinctly elementary character. It is to be hoped that during the ensuing year members will take up the life history of some local genus or species, and work it out for communication to the Society; such work is urgently needed.

Biological Section.—President, Mr. R. W. Chase; Secretary, Mr. A. H. Martineau.—During the past year this section has held ten meetings, all of which have been well attended, the average attendance being twenty-eight. Papers have been read at five meetings, and at all the others there has been an abundant display of specimens—more especially during the summer months. Among the principal exhibitors were the following:—Messrs. J. E. Bagnall, R. W. Chase, Steele Elliott, W. B. Grove, T. V. Hodgson, W. R. Hughes, G. Lavender, W. P. Marshall, A. H. Martineau, A. J. Parker, C. Pumphrey, J. B. Stone, C. J. Watson, and W. H. Wilkinson. The section is also indebted to Miss Gingell, who has forwarded rare plants and mosses for exhibition. The following is a list of the papers read:—

February 10th.—"Natural History Jottings in Natal," by Mr. Arthur Hunt, communicated by Mr. C. Pumphrey.

March 10th.—"Exhibition of Plants collected in Norway," by Dr. Fraser, with notes by Mr. J. E. Bagnall, A.L.S.

May 12th.—"Short Notes on the Columbidæ occurring in Britain," by Mr. R. W. Chase.

November 10th.—"Visits to the Marine Biological Laboratory at Plymouth," by Mr. W. R. Hughes, F.L.S.

December 8th.—"Notes on a recent Tour Round the World," by Mr. J. B. Stone, J.P., F.L.S.

Geological Section.—President, Mr. T. H. Waller, B.A., B.Sc.; Secretary, Mr. John Udall, F.G.S.—Nine meetings of the Section have been held during the year. They have been well attended, the average number present being twenty-four. The papers read have been of great interest. The thanks of the Section are specially due to Mr. C. T. Parsons for the exhibition of a fine series of opals from Queensland; to Mr. F. W. W. Howell for his paper on Iceland; to Professors Bonney and Hillhouse for Notes on Permian Breccia of Leicestershire; and to the President, Mr. C. Pumphrey, for his frequent and valuable assistance with the oxyhydrogen lantern. The following papers have been read:—

February 17th.—"Norwegian Scenery," by Mr. C. J. WATSON.
May 17th.—"South Iceland," by Mr. F. W. W. HOWELL.
April 21st.—"A Week in North Wales," by Mr. T. H. WALLER.
June 16th.—"The Collecting Ground for the Proposed New Water Supply of Birmingham," by Mr. W. P. MARSHALL.
October 20th.—"Notes on the Severn Bore," by Mr. W. R. HUGHES.
November 17th.—"On Specimens of Permian Breccia of Leicestershire, collected by Mr. W. S. Gresley, F.G.S.; described by Professor J. G. Bonney, D.Sc., F.R.S.;" communicated through Professor HILLHOUSE.
January 19th.—"The Giant's Causeway," by Mr. CHARLES PUMPHREY.

SOCIOLOGICAL SECTION.—President, Mr. W. R. Hughes, F.L.S.; Secretary, Miss Lilie A. Goyne. — Twenty-four meetings have been held, of which nine were ordinary and fifteen supplementary. At the ordinary meetings the following papers have been read, in addition to those in the previously published list (See "Midland Naturalist," 1891, p. 273):—

October 27th.—"A Great American Thinker," Mr. H. H. SPEARS.
November 24th.—"The Philosophy of Tennyson," Mr. F. HILL.
December 22nd.—"Lord Herbert of Cherbury," Mr. P. H. LEVI.

At the supplementary meetings the second and third parts of Mr. Herbert Spencer's "Principles of Sociology" have been studied; the following expositions having been read, in addition to those in previous list:—

October 14th.—"The Family," Mr. HERBERT STONE, F.L.S.
November 5th.—"The Status of Women," Miss MARY DALTON.
November 12th.—"The Status of Children," Miss MOSELEY.
December 10th.—"Domestic Retrospect and Prospect," Mr. W. R. HUGHES, F.L.S.

The average attendance at the meetings has been fifteen, including one large meeting with an attendance of 100. The section regrets the loss of two members during last year, Mr. E. Hill and Mr. A. J. Hill, of Leamington, who are unable to attend the meetings. On the other hand, there has been a decided improvement in the attendance at the Tuesday meetings, and it is hoped that the papers to be read next session, covering as they do a wider area of philosophical, sociological, and literary interest, may further stimulate the attendance on these evenings.

The Section has received very valuable assistance from Miss Mary Dalton, who has attained distinction at the Midland Institute, and regrets that on account of her removal to London her services will be no longer available.

The Library.—The Librarian (Mr. W. B. Grove) reports that the Library is in the same condition as at the last Report. A slightly greater use has been made of it than during the previous year, the issues being:—Botany, 13; Zoology, 18; Ornithology, 15; Entomology, 8; Microscopy, 15; Geology, 4; Miscellaneous, 24; total, 87. Number of persons borrowing books, 20; but besides this, considerable use has been made of the books on the Tuesday evenings.

During the year a most important donation has been made to the Library by Mr. A. W. Wills, who has presented his large collection of Memoirs and Essays, by various British and Continental authors, upon Fresh-water Algæ, many of them scarce and illustrated by numerous valuable engravings.

Since it is now possible to devote some small sum of money to the increase of the Library, it would be advisable that the principles on which the increase is to be made—the kind of books to be bought, and in what proportion—should be definitely settled by the Council. It is hoped that the new Catalogue will soon be in the members' hands.

General Property.—The Curators (Messrs. G. M. Iliff and Herbert Miller) report that the property of the Society is in fairly good condition, with the exception that the adapter of the 1in. objective from Dr. Hind's cabinet is missing.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(*Continued from page 47.*)

* **Ophrys muscifera.** 82. The Rev. Edward Whitehead, "*fide* Sir J. E. Smith: 'English Flora.'" "*See also Purton, Vol. X., p. 256.*" Tab. 27. Malvern.

* **Spiranthes autumnalis.** 6, near Bewdley; 54, Cruckbarrow; 82, Tedstone. (*Query in Hereford?*) Tab. 27. Severn, Malvern; *Malvern Link, Mr. Towndrow!* Field near *Tardebigg Reservoir, Mr. Humphreys!*

* **S. æstivalis.** 5, 19, 59. Margin of the great bog in Wyre Forest. Mr. G. Jorden, 1854. Tab. 27. Severn. Found once only.

* **Listera ovata.** Tab. 27. In all the districts.

* **Neottia Nidus-avis.** 6, 18, 54, Severn D. 68, 72, 82, Malvern D. 128, Ham Dingle. Tab. 27. Severn, Malvern, Lickey.

* **Epipactis latifolia.** 6, 14, 54, Severn D. 68, Silurian Hills at West Malvern. 82, near Tedstone. 101, Broadway. 115, Lickey. 128, Ham Dingle, near Pedmore. Tab. 27. In all the districts.

Next to E. latifolia three other species or sub-species have been noted in English floras, viz. :—

E. media, Fries.

E. purpurata, Sir J. E. Smith.

E. violacea. Boreau and Durand-Desquenay.

These plants are very difficult to distinguish, and it seems certain that there are only two of them. Mr. Lees unites media with purpurata.

* **E. purpurata**, Smith, or **E. media**, Fries. 19, 54, Nunnery Wood, Wor., Mr. Thomas Baxter, 1849. 68, Silurian Hills of Malvern. Tab. 27. In all the districts. *I think it probable that E. purpurata should be divided between media and violacea. Mr. Baxter's original specimens from Nunnery Wood were named E. purpurata by Professor Babington. That name has now dropped out of the Manual, eighth edition, p. 350, but Professor Babington has since assured me* that the plant belongs to E. violacea. *On the other hand, Mr. Hanbury*, in the eighth edition of the London Catalogue, admits only E. latifolia, E. media, and *E. purpurata. For E. media see "Mid. Nat.,"* Vol. XIII., p. 258.

* **E. palustris.** 5, 6, 59, Wyre Forest. 82, near Tedstone. *Query if in Worcestershire in this locality.* Tab. 27. Severn, Malvern.

* **Cephalanthera grandiflora.** 14, Knight's Walks, Wolverley, Stokes, 1787. Lea Castle Woods, Scott. *Extinct.* 19, Copse by the side of Lower Lane, Tewkesbury, W. Cheshire. (*Query whether in Worcestershire in this locality.*) Tab. 27. Severn. Extinct.

* **C. ensifolia.** 5, 6, Wyre Forest ; 19, 54, Witley Park, plantation near entrance lodge. Tab. 27. Severn.

‡ **Epipogum aphyllum.** 83, 84, gathered by Mrs. Anderton Smith at Tedstone (*Herefordshire*) in 1854. Once found only. Tab. 27. Malvern D. Figure —, p. 148.

* **Iris Pseudacorus.** 29, Severn ; 91, Avon. Tab. 27. In all the districts.

* **I. fœtidissima.** 38, 56, 61, Severn D.; 101, Bredon. Tab. 27. Avon, Severn, Malvern.

* **Crocus vernus,** xxv., xxxi. 22, meadow, by Battenhall Lane. *Not native.* Tab. 28. Severn.

C. sativus, xxv., xxxi. *Not native.* Tab. 28. Malvern. *First record.*

* **Narcissus Pseudo-Narcissus.** 55, Severn ; 67, Silurian Hills, West Malvern ; 89, Pensax ; 120, meadows about King's Norton and Northfield. Tab. 28. In all the districts.

* **N. biflorus.** 55, Severn D.; 86, Malvern D. Tab. 28. Severn, Malvern. With., 4th Edit., "Mid. Nat.," Vol. XI., 59. Scott, "Mid. Nat.," Vol. XI., 21. *Not native.*

*‡ **N. poeticus,** xxxi. Tab. 28. Severn.

‡ **N. lobularis.** Tab. 28. Malvern.

*‡ **N. incomparabilis**, xxxi. Not in Table. *All suspicious or extinct.*

* **Galanthus nivalis.** 15, Astley Wood; 67, base of Herefordshire Beacon, near Wintal Farm, Cradley (*Hereford*). Tab. 28. Severn, Malvern.

* **Tamus communis.** 53, Severn D. Tab. 27. In all the districts.

* **Paris quadrifolia.** 14, Habberley Valley; 53, woods near Worcester; 72, woods of Malvern district; 123, woods in Stour Valley, above Halesowen. Tab. 26. In all the districts.

† **Asparagus officinalis**, lix., xxxi. Rough walls at Great Malvern. Tab. 28. Malvern. *Not native.* (*First record.*)

* **Convallaria majalis.** 6, Wyre Forest; 18, Shrawley Wood; 55, Birchin Grove, Henwick. Tab. 28. Severn, Malvern.

Polygonatum multiflorum, xxxi. Near Clifton-on-Teme, in one spot. Tab. 28.

* **Tulipa sylvestris.** 6, near Bewdley; 15, formerly at a bank near Astley Church; 24, Pitchcroft Ham, Worcester. Tab. Severn, Malvern.

Lilium pyrenaicum, viii. Wyre Forest. Tab. 28. Severn. *Not native.*

* **Ornithogalum umbellatum**, xxxi. Near Kempsey Grove and Broad Heath, &c.; 6, near Bewdley; 24, 55, Pitchcroft Ham, Worcester; 67, Bromsberrow (*Gloucester*). Tab. 28. Severn, Malvern.

* **O. pyrenaicum**, xxxi. Near Cotheridge Court, on old authority. Tab. 28. Doubtful.

* **O. nutans**, xxxi. Bromsberrow (*Gloucester*); 6, 14, near Bewdley; 67, 74, Bromsberrow (*Gloucester*). Tab. 28. Severn, Malvern.

* **Gagea lutea.** 67, 74, gathered by the late Dr. Cradock at the bottom of Purlieu Lane, Malvern in 1855. *In the presence of the writer!* Tab. 28. Malvern.

* **Allium vineale.** 6, near Bewdley; 55, meadows of the Vale of Severn; 92, abundantly in fields near the Trench Woods. Tab. 28. Avon, Severn, Malvern.

* **A. oleraceum.** 6, near Bewdley; 55, Ketch Marl Bank, Cruckbarrow Hill; 93, Cracombe and Coldknap Hills. Tab. 28. Avon, Severn, Malvern.

* **A. ursinum.** In all the districts.

* **Endymion nutans.** In all the districts.

* **Colchicum autumnale.** In all the districts.

* **Narthecium ossifragum.** 6, Leigh Head, Rock Parish, in a wood, Jorden. *I never heard of the plant in this locality, and never heard Jorden mention it.—W. M.* 114, bog on Rednall Hill, Lower Lickey. Lost by drainage about 1856. 119, formerly in the bog on Moseley Wake Green. Tab. 28. Severn, Lickey.

* **Juncus effusus, conglomeratus, glaucus, acutiflorus, lamprocarpus, supinus.** Tab. 29. In all the districts.

* **J. obtusiflorus.** 69, 73, Welland Marshes. Tab. 29. Avon, Malvern.

* **J. squarrosus.** 14, Hartlebury and Pedmore Commons. 55, Broadheath; 114, Lickey; 119, formerly at Moseley Bog. Tab. 29. In all the districts.

* J. compressus. 55, Severn D. Tab. 29. Severn, Malvern.

J. Gerardi. 33, Saldon ; 55, Severn D. Tab. 29. Avon, Severn. *First record.*

* J. bufonius. Tab. 29. In all the districts.

* Luzula sylvatica. Tab. 29. In all the districts.

* L. Fosteri. 55, Perry Wood, and near Birchin Grove; 68, Silurian eminences of the Malvern Hills. Tab 29, Severn, Malvern.

* L. pilosa, L. multiflora, L. campestris. Tab. 29. In all the districts.

* Schœnus nigricans. 96, formerly at Feckenham, Purton. Extinct. Tab. 30. Avon, Lickey. *The Lickey District must refer to Moseley Bog, but Schœnus nigricans did not occur there. See list on p. 119 and "Mid. Nat.," Vol. XI., p. 307.*

* Cladium Mariscus. 96, Feckenham, Purton. Extinct. Tab. 30. Avon.

* Rhynchospora alba. 11, 14, 60, Hartlebury Common ; 119, formerly at Moseley. Extinct. Tab. 30. Severn, Lickey.

* Eleocharis palustris. Tab. 30. In all the districts.

* E. multicaulis. 65. Malvern Chase. Tab. 30. Malvern. See "Mid. Nat." Vol. XII., p. 204.

* E. acicularis. 69, Welland Common; 115, Lickey. Tab. 30. Avon, Malvern, Lickey.

* Scirpus maritimus. 34, 61, Longdon Marsh ; 91, Badsey ; 92, Defford. Tab. 30. Avon, Severn, Malvern.

* S. sylvaticus. 14, 29, 56, Severn D.

†* S. carinatus. 57, Chickhill Pool, Enville (*Stafford*), Purton, *doubtful.* See "Mid. Nat.," Vol. X., p. 256. Tab. 30. Severn, Malvern.

* S. lacustris. Tab. 30. In all the districts.

* S. Tabernæmontani. 57, Northwick. *In several places in the Severn district; must be often overlooked, W. M. !* Tab. 30. Severn.

* S. cæspitosus. 115, Lickey. Tab. 30. Malvern, Lickey.

* S. pauciflorus. 131, Scott. Reservoirs. This locality probably not in Worcester. *See "Mid. Nat.," Vol. XI., p. 40.* Tab. 30. Severn, Malvern, Lickey. *The Severn and Malvern localities are Wyre Forest and Castle Morton Common.*

* S. fluitans. 14, Hartlebury Common ; 57, Severn D. ; 65, Malvern Chase. Tab. 30. In all the districts.

* S. setaceus. 57, Monk's Wood ; 65, Malvern Chase ; 131, Pedmore Common, Scott. Tab. 30. In all the districts.

* S. Holoschœnus. 96, found at Throckmorton, near Fladbury, by Dr. Sheffield, Provost of Worcester College, Oxford. Tab. p. 30. *See "Mid. Nat.," Vol. X., p. 173.*

* Blysmus compressus. 65, 66, Malvern ; 101, 104, Bredon and Broadway. Tab. 30. Avon, Malvern.

* Eriophorum vaginatum. 119, formerly at Moseley Bog. Tab. 30. Lickey. Extinct.

* E. angustifolium. 14, 57, Severn D. ; 91, Pershore ; 115, Lickey ; 119, formerly at Moseley. Tab. 30. In all the districts.

(To be continued.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY. BIOLOGICAL SECTION. Feb. 9. Mr. R. W. Chase in the chair, and forty-seven members and friends present. Professor Bridge and A. H. Martineau were elected President and Secretary of this section, respectively. Mr. T. V. Hodgson exhibited a fine specimen of a beautiful South African bird (*Corythaix musophaga*). Mr. T. V. Hodgson then read a paper on "Fins, Wings, and Hands," which he illustrated with a fine series of diagrams, and photographs, by the aid of the lantern. A hearty vote of thanks to Mr. Hodgson terminated the meeting. GEOLOGICAL SECTION. Feb. 16. Mr. T. H. Waller, B.A., B.Sc., in the chair. Mr. F. N. W. Howell read his paper on "Orœfa and its first ascent." The paper was copiously illustrated by photographs, shown by Mr. C. Pumphrey's lantern. The Biological Theatre was filled by a large and enthusiastic audience. On the motion of the chairman a hearty vote of thanks was accorded to Mr. Howell.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—Jan. 25th.—Mr. P. T. Deakin gave an account of a visit he made to a gravel pit near Gloucester, where some arrow heads and other flint implements had recently been found. Mr. H. Hawkes exhibited a number of Alpine plants, native and foreign, and gave an account of their distribution; also specimens of *Spiranthes autumnalis* and *Neottia æstivalis*, the latter a very rare plant, having only one habitat in this country; Mr. Linton, shells of *Helix cicatricosa* from China; under the microscope, Mr. J. Collins, *Melobesia lejolisii*, a minute alga.—Feb. 1st. Mr. G. H. Corbett showed specimens of *Synocladia virgulacea* and *Acanthocladia anceps*, fossil polyzoa from magnesian limestone, Durham; Mr. J. Madison, specimens of *Helix elegans* from near Dover, a helix new to Britain, also foreign specimens of the same. The President, Professor Hillhouse, M.A., F.L.S., delivered the first of two lectures on "The Geographical Distribution of Plants." The lecturer said the subject was a very large one, and he could only point out a few of the causes that had brought about their distribution. He should speak of the subject under two headings: the facts of geographical distribution, and the attempts to explain the same. All who have travelled much or little must have seen that plants differ in every area; no two places have a vegetation exactly alike. Vegetation was seen at its greatest luxuriance in the tropics, and was characterised by some special differences such as we find in the palms, bananas, tree ferns, and epiphytic orchids. The speaker then traced the features of the vegetation as we approached more northerly latitudes, where conifers largely increased in numbers. From these we came to Alpine plants and shrubs, and still further north to mosses and lichens that reached to the barrier of perpetual snow. One of the facts of geographical distribution is that plants have a tendency to aggregate into limited areas. Mosses and saxifrages were instances in point. The conditions of desert life in plants were spoken of as conditions of extreme heat and cold, the dryness of the area accounting for the latter. A number of well-known plants were referred to. The maiden-hair fern was spread over nearly three-quarters of the globe, *Clematis Vitalba* had a very compact area, Ragged Robin, the northern range of the Eastern hemisphere. The common maple was confined by the line of the Mediterranean Sea, and one remarkable plant, an orchid (*Disa grandiflora*), was confined solely to a mountain at the Cape of Good Hope; this was a good instance of restricted distribution. Now let them consider how botanists explain these facts. Plants can only live under certain conditions. If these conditions are changed the life of the plant is changed too. The effects of heat, cold, light, drought, &c., were described. The direction of winds and the nature of soil were important factors. The distribution of seeds by winds, currents, and animals was referred to, and the extirpation of plants by drainage, deforesting, &c. If a plant cannot change its habit it goes out of existence.—Feb. 8th. Mr. H. Hawkes exhibited about fifty species of Erica and described their area of distribution as a somewhat limited one. They were found from Iceland to the Cape of Good Hope, and eastward to the Ural Mountains. Their centre of distribution was said to be the Cape, as all species, except about thirty, were found there. Mr. Hawkes also showed a series of plants from a herbarium made during a tour round the world; Mr. Linton, a series of marine shells from Panama; Mr. Foster, a boomerang from Australia; Mr. J. Collins, mosses from Llandudno.—Feb 15th, Professor Hillhouse, M.A., F.L.S., exhibited a singular fruit with recurved horn-like processes and dorsal spines, doubtless to adapt it for transmission by animal agency. A lecture was then given by Mr. A. W. Haines, B.Sc., on "Digestion and the Digestive Organs." The speaker said the magnitude of the subject precluded him from dealing with it generally, he should therefore only speak of digestion in Mammalia. After defining the uses of digestion, the speaker said foods were of four kinds, and we should have to trace them through the alimentary canal until all the nutrition was absorbed. The following processes were then described:—Mastication, the use of saliva, and the structure of the glands that secreted it, the swallowing of food, its passage through the œsophagus into the stomach, the structure of the stomach and pancreas, and the formation of chyle. The chemical changes that take place in the passage of different kinds of food through the organs were dealt with at considerable length. The subject was illustrated by drawings on the black-board, and at its conclusion a hearty vote of thanks was accorded the lecturer.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—February 1st. Annual Meeting, Mr. W. G. Blatch, President, in the chair. The Secretary read the annual report of the Council, which showed the number of members to be about the same as at the last annual meeting; and the Treasurer presented his report, showing a balance in hand of £4 18s. 4d. The following were elected as officers for the ensuing year:—President, Mr. W. G. Blatch, F.E.S.; Vice-president, Mr. G. H. Kenrick, F.E.S.; Treasurer, Mr. R. C. Bradley; Librarian, Mr. A. Johnson; Auditors, Messrs. Herbert Stone, F.L.S., and A. Stone-Wainwright; Hon. Sec., Colbran J. Wainwright. Messrs. G. T. Bethune-Baker, F.L.S., F.E.S., and G. W. Wynn were also elected on the Council. Mr. C. Runge showed cocoons of *Trochilium apiformis*, containing larvæ, which he had dug out of poplars from near the roots, at Arley.—February 8th. Social Meeting. By invitation of the Council the members and a few friends met together at the Grand Hotel, when a pleasant social evening was spent. A number of interesting books and insects were shown and examined, and the pleasure of the evening was much added to by the music which one or two members and friends provided.

DECAY IN NATURE.*

BY CHARLES CALLAWAY, D.SC., M.A.

The primary object of this club is the study of natural history, geology, and archæology. Our field of work is a very wide one. The grass of the fields, the flowers by the way-side, the insects that delight us with their beauty or annoy us by their sting, the gravel under our feet, the running brooks, the hills and vales that give such a charm to our country, are but a part of the wonders that Nature invites us to study. Our mother Nature is indeed a most comprehensive teacher. What we know is but the A, B, C of what we shall know. Behind the laws which science has revealed to man, there are hidden other laws which we are almost driven to believe are grander than any of which the human mind has yet conceived. Nature invites us to enter her school; to the diligent student she gives a rich reward—friendship with herself. She loves them that love her; but it is only to her real lovers that she unveils her beauty; neglect of her she punishes with a terrible penalty—the penalty of ignorance.

But there are some aspects of Nature which seem far from beautiful. The grass withers, the flower fades, the insect flutters its brief day in the sunshine and then perishes; the nightingale delights us with its liquid music for a season, but death soon stops its song; a thousand forms of life, which in the spring are full of joy and vigour, fall sick when the winter comes, and die. Decay is everywhere the end of Nature's works. Even the solid granite cliff that seems impregnable to time, yields at last to his unceasing attacks, crumbles gradually away, and disappears. Mountain ranges, whose summits tower to the clouds, perish as certainly and inevitably as the sand heaps on the sea shore.

> "The hills are shadows, and they flow
> From form to form, and nothing stands;
> They melt like mist; the solid lands,
> Like clouds they shape themselves and go."

In these fine lines, Tennyson, as usual, is true to the facts of science. The sea once flowed where now the peaks of the Himalayas rise 29,000ft. above its present level; but in the lapse of ages those lofty summits will be worn down to mere stumps, and may form submarine banks in a future ocean. In a former epoch of the earth's history, our Salopian region was occupied with clusters of volcanoes, which grew in size, age by age, as the lavas and ashes accumulated around their

* Being the retiring Presidential Address to the Severn Valley Field Club on March 15th, 1892.

craters; then the fire-forces ceased to work, frost and rain set in motion the process of decay, the lofty cones dwindled away, and the waves of the Cambrian Sea swept over their worn foundations. The Cambrian epoch drew to an end; and then volcanic energy broke out afresh, this time most actively in the region which is now North Wales, but extending as far as the borders of Shropshire. Again, groups of lofty cones were formed, which spouted forth their showers of ashes and streams of molten lava. But again, the inexorable forces of decay began to work, and the new mountain systems vanished from the earth. Since that time, Shropshire and the Severn Valley have been free from volcanoes; but again and again has the surface of the land been carved out by atmospheric forces into mountain and valley, and the outlines of the scenery have changed from age to age, as if the "everlasting" hills were but the "baseless fabric of a vision."

The changes to which I have referred are, of course, very slow, reckoning by the units of time with which we measure the epochs of history. When Harry Hotspur, four and a half centuries ago, looked southward from the fatal field of Shrewsbury, his eye ranged over a landscape identical in all its solid features with that which we now behold. A thousand years further back, Britons, Romans, and Angles waded the very streams over which we now pass on bridges, and fought battles under the hills where we moderns wield the geological hammer or collect rare plants. Even to the savage men who occupied this area on its last emergence from the sea, the outlines of the scenery were essentially the same as now. The rivers flowed more sluggishly, and here and there spread out into shallow meres, or soaked through morasses. The channels in which they ran have also since that time here and there grown more serpentine; but the hills that bound their valleys have undergone no material change of shape. In the preceding epoch, during the great submergence of central Britain, our old familiar Wrekin, Caer Caradoc, Longmynd, the Stiper Stones, and the Clees, standing as islands in an archipelago, had assumed substantially their present shape. It is when we carry our thoughts back to epochs compared with which this submergence is an event of yesterday, that we are able to recognise the changeableness of even the most solid and durable elements in our scenery.

Perhaps it will help us to comprehend more clearly the law of decay in Nature, if we reflect upon the rapidity with which monuments and buildings of stone perish when exposed to the weather. Have we a church or hall in England that has survived entire from Saxon times? Even Norman and early English buildings of the most solid construction, which have not been repaired or restored, have usually crumbled into heaps of mouldering stones. Take a special case. Some years ago, the ground surrounding the base of Chester Cathedral was removed to a depth of several feet, and the lower part of the walls was laid bare. The comparison of this part with the portions that had been exposed to the storms and frosts of centuries was most instructive. The carvings which had been freshly exposed were as clear and sharp as when they left the hand of the mediæval mason; but above the line of the old level of the soil, the surface of the stone had peeled and flaked away to such an extent that mouldings were destroyed, angles were rounded off, and the most solid blocks had been considerably reduced in size. Let a building be exposed to such destructive action as this, and we know that sooner or later it will crumble to a shapeless heap. Even in a country like Egypt, where frost is unknown, and rain rarely falls, the process of decay, though slower, is equally sure. The twin colossi of Amenôphis III. are a case in point. Each of these enormous statues, originally nearly seventy feet in height, is carved out of a single block of solid sandstone. When they were completed, they were carried up the river on eight ships. and erected on their foundations at Thebes. The sculptor thus proudly describes the completion of his work:—"They were emplaced in their sublime building; they will last as long as heaven." But thirty centuries of sun and air have been too much even for such solid work as this. The "sublime building" has disappeared, and the figures themselves present but vague resemblances to the human shape. The lofty head-gear has vanished, and the features are almost obliterated.

The destructive effect of the weather is well seen in the decay of tombstones. There are some kinds of stone, such as the purple slate of Bangor, that retain an inscription sharp and clear for a century. But this durability is exceptional. In ordinary sandstone, an eighteenth century inscription is often quite illegible. And it is but rarely that we see a gravestone, dating back to the time of the Stuarts, on which the name and date can be deciphered.

The decay which takes places in hills and mountains is certainly not less than that which is visible in the handiwork of man. The hills of North Shropshire are composed of a sandstone similar to that of which Chester Cathedral is built, and it is safe to assert that they crumble away as rapidly. Their southern escarpment, as seen for example at Grinshill Hill, faces to the south. The beds of which these hills are composed probably extended as far south as the Wrekin, a distance of about ten miles, but in the course of ages this broad band of sandstone has been worn and washed away, leaving the wide and shallow valley of the Tern. Let us assume that the escarpments have been retreating towards the north at the rate of one inch in a century, and that they have travelled only half the distance between the Wrekin and their present position. This would give us over thirty millions of years for the carving out of the valley of the Tern.

Some of our Shropshire hills are composed of more durable material than the sandstone of the northern elevations. The chain of hills running from Lilleshall to Church Stretton, of which the Wrekin and Caer Caradoc are the most conspicuous summits, is mainly formed of volcanic ashes and lavas of some firmness of texture. These rocks decay with comparative slowness; but a little experience with a hammer convinces us that the solidity is more apparent than real. Strike a block of the Wrekin lava a smart blow, and it often shivers up into a multitude of small fragments. This weakness is due to the cracks (joints) which penetrate the rock. Sometimes the cracks run in one direction, so that the rock splits up into slabs; sometimes in two directions, when the fragments may be wedge-like; sometimes in three or more directions, so that the rock breaks up into irregular pieces. What the hammer can do in an instant, water and frost can do quite as effectually, though they work more slowly. In this way, our hard Wrekin lavas and ashes, when exposed to the weather, shiver up at the surface into loose fragments.

The granite of the Ercal, near Wellington, is a singular instance of how a rock which is proverbially hard may become one of the frailest. In this case, the cracks which penetrate the rock are so close together that the granite is sliced up into very small pieces. Under the action of the weather these fall away from each other, and a fine gravel is formed, which is shovelled into carts, and used in the making of garden paths.

One of the most durable of rocks is quartzite. It consists of grains of quartz cemented together by quartz, Being composed of a mineral which is incapable of decay—for quartz cannot be resolved into simpler elements by natural forces—it can only be affected by causes which act upon it mechanically. It is usually penetrated by cracks which are not very close together, and under atmospheric influences it weathers into blocks of some magnitude. Owing to these causes it perishes but slowly. A band of quartzite forms the culminating ridge of the Stiper Stones, the shales below it and the flags above it being more destructible, and being more rapidly removed. Masses of this quartzite, weathering out into huge blocks, give to the ridge of the Stiper Stones its peculiar castellated aspect.

These instances will suffice to show how much we are indebted to the forces that cause decay for the beauty of our Shropshire scenery. Valleys are lines of decay. Mountains are merely masses of stone that have decayed less rapidly. If the materials that made up the original crust of the globe had been imperishable, the surface of the earth would have remained a rocky wilderness for ever, and life would have been impossible. The volcanic rocks which probably formed the surface in the earliest times, were converted by the destructive forces of Nature into the mud and sand that were carried into the bed of the seas, where many of the earlier forms of life found their home. The decay of volcanic rocks would also give origin to soils on which land plants could live. It is the decay of the surface crust, combined with the decay of animal and vegetable matter, that provides the soil on which we all depend for existence. All things, even life itself, end in decay, and decay in its turn gives birth to life.

In pointing out thus briefly some of the functions of decay in the economy of Nature, I must not be understood to imply that decay is always a good thing. There are some things that never decay. The beautiful never decays ; justice, truth, love, are imperishable.

To come near home. Let us hope that the Severn Valley Field Club will never decay. Institutions usually continue to live that are worth living. Inactivity ends in atrophy ; but the effort to do some solid work promotes vigour and growth.

FIGHTING THE DRY ROT.

BY W. B. GROVE, M.A.

The mysterious way in which the dry rot (*Merulius lachrymans*) seizes upon a house, and the enormous damage which it is capable of doing when unchecked, have led, in many cases, to my being consulted about the best means of stamping it out, by those who had the task of fighting against it. A letter just received, narrating the issue of a successful combat, will, perhaps, be useful to those who feel a painful interest in this matter. It is written by a builder who asked me in 1891 for advice, and thus relates the progress of affairs :—

"In May last I called upon you with reference to the fungus in wood floor and joists, &c., of room at Stanley Villa, Moseley Road. Acting upon your advice, the floor was all taken up and burned, and all the holes where the joists were in the walls, burned out; walls at back of joists cemented. We then had new joists and double boards, and a cement skirting in room ; we put in iron gratings for ventilation, and have not ceiled under. We find it a perfect cure, not the least sign of fungus appearing ; were very particular to have all timber burned straightway, would not even keep any for firewood. I have to thank you for your kind advice, and in all cases in future purpose adopting the same principle.

"(Signed) JOHN DAVISON.

"Latimer Street South, Feb. 29th, 1892."

There can be no doubt that the chief secret of success in combating the dry-rot is thoroughness, half measures usually fail. The spores will not germinate except on rotten or rotting wood. I believe that the rotting of the wood is, in the first instance, caused by the action of bacteria which may seize upon any part that happens to be soaked in moisture. When the cells of the wood are thus disintegrated, they afford a suitable nidus for the germination of the spores of dry-rot or other similar saprophytic fungus. When the mycelium, spreading from the spores, has established itself, it may spread on to any substance that is near, and we thus get those beautiful woolly-looking growths, as pure and delicate as the drifted snow, which sometimes hang in masses from the walls and bricked ceilings of wine cellars. But in every such case the starting point has been *rotting wood.*

The use of fresh, dry wood, and careful ventilation, so as to secure a current of dry air, will in all cases effect a cure, if care be taken to remove every particle of the old damp wood, and to purify well, by burning, all corners and holes in which spores or fragments of mycelium may have found a lodgment.

Ventilation, alone, produces rather harm than good, as it blows the spores about and helps the fungus to spread if any fragments are left behind.

In a dry place, however, the spores of *M. lacrymans* are perfectly harmless. I have had many perfect specimens in my rooms for examination, and must, at times, have had the air filled with ripe spores, but in no case has any harm resulted. They cannot germinate without a suitable nidus such as I have described above, and after a time, I believe, they lose the power of doing so, even in otherwise favourable conditions.

NOTE ON THE SEVERN BORE.*

BY W. R. HUGHES, F.L.S.

On Saturday, the 19th of September last, I accepted the invitation of my old friend, Mr. F. J. Cullis, F.G.S., to spend a few hours with him in his house-boat "Nautilus," which was moored at Frampton-on-Severn, on the Gloucester and Berkeley Canal, the principal attraction of my visit being to witness the famous Severn bore.

I left Birmingham by a so-called fast train to Gloucester, purporting to start from New Street at 1.33, but it was half-an-hour late; and thus I had little time to examine the interesting old city, of which, from the number of its religious houses in olden times, it was a common saying. "As sure as God's in Gloucester."

Furthermore, the forecast of that excellent institution the Meteorological Office, "Unsettled," was verified to the letter, and we had to contend with "showers locally"—a not infrequent occurrence during the long-to-be-remembered abnormally wet year of 1891. The little screw-steamer "Wave" was timed to leave the docks at Gloucester at 4 p.m., and in our course down to Frampton—about nine miles distant—we noticed the great quantity of foreign timber stacked on the banks of the canal, and the numerous and commodious granaries through which, Mr. Cullis tells me, most of the imported corn passes after its arrival in England.

My friend is always very eloquent and enthusiastic about this fine canal, which, at its junction with the Severn, he describes (in an interesting paper read some time since to the Mason College Union) as "The Sea Gate of Birmingham;" contending that this important navigation, so boldly designed by Midland men a century ago, is still the most natural water-way between Birmingham and the sea.

We arrive at Frampton soon after five, and are hospitably entertained on board the "Nautilus," a very appropriate name for a floating house, in a district of the Lias, and strongly suggestive of its prototypes, the Ammonites of that formation.

Frampton lies in a very pretty part of the Severn Valley, flanked by the Cotswolds on the east, and by the hills of the Forest of Dean and the distant Welsh mountains on the westward. Its village is quiet and picturesque, with old timbered houses, and has a fine open green nearly a mile in

* Read before the Birmingham Natural History and Microscopical Society, October 20th, 1891.

length by a hundred yards wide, and during our ramble there an old house is pointed out to us as having been the birthplace of the ill-fated "Fair Rosamond."

On our return journey to the "Nautilus," in passing along a lane, about eight o'clock, in the fine, still evening, our attention is suddenly arrested by a peculiar rushing sound, uniformly sustained—a curious compound of the wind sighing among the trees, the noise of the waves on the sea-shore, the rush of a waterfall, but distinct from all these, and having a peculiar music of its own. "Hark!" said my friend, "that is the Severn bore!" The river is half a mile distant, and we listen attentively to the "voice of many waters," the first manifestation to us of what has been termed by that enthusiastic naturalist of the old school, the late Frank Buckland (in an interesting paper in his "Log Book of a Fisherman and Naturalist"), the greatest natural phenomenon in the British Islands.

Before I venture to describe what I subsequently saw of the bore of the Severn, it may not be uninteresting to seek an explanation of its derivation. Frank Buckland, when editor of *Land and Water*, invited the opinions of his correspondents on the subject, and the following are among the most noteworthy which were offered:—

Bore, from "Boreas," the north wind.

Bore, from *Bàrh*, Indian for a flood, the same phenomenon occurring in the Hoogly River. In the south of India it is called *Poor*, a flood.

Bore, from *Barre*, Norman-French, the dash of a wave.

Bore, from Celtic *vawr* and *mor*, the letters *v* and *b* being usually interchangeable.

In the River Trent the same phenomenon is called the *eager*. *Eger*, is German for wild boar, the first *e* being pronounced as *a*.

Higra, *eygre*, and *eagre* are old English words. Bailey has "Higra, the raging of the River Severn below Gloucester."

So much for different views as to the etymology of bore.

The bore occurs best at the extreme high tides about the time of the vernal and autumnal equinoxes; but there is a bore at every spring tide, though it is only occasionally, under favourable circumstances of wind and tide, that it is seen to perfection. Locally it is maintained that in the autumn the night bores, and in the spring the day bores, are "higher, heavier, and make a greater noise."

The explanation of the bore appears extremely simple, as the interpretation of every natural phenomenon is when it is submitted to scientific investigation, and freed from the "survivals" of tradition and superstition.

The great Atlantic wave (accompanying the spring tides), in its progress up the Bristol Channel, encounters an opposition in the nature of the funnel-shaped *cæcum*—to speak biologically—of the River Severn; and, finding no outlet, naturally forces its way up superficially until its energy is dissipated. I was informed that this sometimes did not happen till it had reached Worcester, but that since the Severn has been canalised the bore never passes the Weir near Tewkesbury. From the nature of the environment, a south-west wind produces the greatest bore in the Severn.

It will occur to most of us, "Why do not the Rivers Avon and Wye, which also discharge into the Bristol Channel by means of the Severn, experience the effects of the bore?" The answer may be anticipated; but, to be certain, I consulted my good friend, Professor Lapworth, F.R.S., the master of all things geological. He agreed with me that we may accept Mr. Herbert Spencer's definition of the "direction of motion," in the ninth chapter of "First Principles:"—"Bodies move in the line of least resistance, or greatest traction, or their resultant." The Atlantic wave, the residuum of which is the Severn bore, proceeds in the "line of least resistance," and is not deflected laterally by the Avon or Wye. I was told by a local scientist that at the time of high water at Chepstow—one of the highest tides in the world—the River Wye has a tide five feet higher than the Severn. This wants explanation.

Similar phenomena to the bore of the Severn occur in the Humber, the Dee, the Seine, the Hoogly, and other rivers narrowed by local conditions similar to the Bristol Channel. So much for preliminary. Now for my own experience.

We are up betimes on Sunday morning, the 20th; it is the biggest tide of the series, following a full moon, and high water takes place about ten o'clock in the forenoon. So about seven o'clock we take up our station at a place called "Hock Crib," where the River Severn is a mile wide, and, viewed downwards, appears like an inland lake, several miles in length. In the distance is seen the famous Severn Bridge. Our "coign of vantage" is a Lias cliff about fifty feet high, to reach the greensward on which we pass through pleasant woods; the distance from the point where the "Nautilus" is moored being upwards of a mile. There were already present about twenty people of both sexes, and in various walks in life, from the labourer up to the landowner—a pleasant sign as indicative of a growing interest in natural things. An uncomfortable drizzle from the south-west is the only obstacle to our enjoyment of the early morning. The inland lake previously referred to has sand banks and shallows, the tide being out; and the margin is fringed with marsh plants, among which is to be found *Althæa*, the Marsh Mallow.

We keep our eyes fixed on the downward portion of the river, and have not long to wait in suspense. Presently we *hear*, and soon after *see*, the bore—or rather two bores—the tidal wave having been cut through by the sand bank in the river. The tidal wave is about three feet high, and travels, perhaps, at the rate of five or six miles an hour.* One of the streams is coming from westward, the other from southward. Not longer than half an hour from the time of our first observations—and perhaps half that time from the first appearance of the bore—the two streams, turbid with Severn mud, rushing along with force and velocity, and carrying sea-weed, pieces of wood, and *débris* before them, have united, and to our amazement the whole inland lake is filled up, and where dry places hitherto appeared not a vestige of sand is now visible.

At "Hock Crib" the River Severn narrows and bends round outwards considerably for a distance of several miles. We avoid this curve and make straight across for Framilode, a little village higher up the river. By walking fast and taking short cuts, we are in advance of the bore, which travels round the curve. A hundred yards before we reach the river we are made aware, in the village street, of the presence of the bore of the previous evening. A slimy mud covers the roadway, and we notice that the door-sills of the cottages, and even the gateways to the gardens of the bettermost houses, have been plugged with clay to prevent the encroachment of the tidal wave. The river here is a quarter-of-a-mile wide, and has a straight course of nearly a mile, Framilode being in the upper third, and the view of the Forest Hills is very picturesque. We take up our position on a fixed landing stage a few yards out in the river. An interval of half-an-hour elapses, when we see the bore advancing rapidly, at the same pace as before but with less noise, and at a height of nearly three feet. It carries before it the usual *débris* and wreckage, but this has largely augmented, and we notice two or three great masses of timber, weighing probably several hundredweight, driven along the crest of the wave. A local boatman is of opinion, from previous experience and the prejudice of his race, that a wreck has taken place against the Severn Bridge. After the bore has

* Opinions differ as to the height of the bore, which varies according to circumstances, *six*, and even *nine*, *feet* have been mentioned, with a good south-west wind.

rushed past we continue in our position until the rising tide compels us to quit it, and from a point on shore notice with amazement that the tide has risen nearly twenty feet in half-an-hour. It did not, however, ascend to so high a level as the previous night's tide. Passing the pleasant mansion of the popular magnate of the district, we were so fortunate as to meet one of the Harbour Commissioners, who courteously described the tidal phenomena of the lower portion of the estuary. But, as we turn inland, we are convinced that an understanding of the unique magnificence of the Severn bore is still imperfect. A pleasant natural history ramble with my friend and his two sons along the lanes of the Severn Valley completed an interesting and enjoyable excursion.

NATURAL HISTORY JOTTINGS IN NATAL.

BY ARTHUR HUNT.

(*Concluded from page 40.*)

A far more formidable nest to disturb is that of the "cock-tail" ants. These ants, which have earned their name from their habit of running about with their abdomens elevated like a "Devil's coach-horse," build large round nests in the branches of trees, and they are numerous enough to kill anyone whom they may attack.

Ants are like Scotchmen, to be found everywhere, and no matter where you may look you will find them in myriads. When I first came here I lost many of my specimens through not keeping my boxes well closed, and even now the ants are excavating through the *cement* floor of my room, beneath my cabinet; and, although I have repeatedly filled up their hole with cement, they work a way through again. Kill a cockroach or any other insect, place it down, and in a very short time ants will be swarming on it, carrying away legs and wings with a strength that, in comparison to their size, must be stupendous.

Some chrysalids that I was keeping in a box were not touched, but no sooner had one of the butterflies emerged than these little scavengers seized and killed it, and carried it away piecemeal before its wings had time to expand. I have even had them pin a caterpillar to the ground and eat it alive.

Cannibalism seems very common among insects, and I had a fine opportunity of watching a would-be case some little time back. I noticed what seemed to me a peculiar insect gambolling about on the ground, and on stooping to ascertain what it was, I found a large fly—one of the Asilidæ—straddle-legs across a mole-cricket, which it was endeavouring to drag along. It would manage to get along for a few inches, when it would let go, walk around the cricket as though it were trying to find a better method of working, and then, seizing its prey again, would commence another struggle. The cricket, although not dead, appeared to be stunned, and, as the fly appeared to find it too heavy a load, I killed both captor and captured.

These mole-crickets are common here during the summer, and may often be found buried in the ground in holes excavated by means of their curiously flattened forefeet, so excellently adapted to the purpose.

They have a nasty sickly odour, and are not very prepossessing in appearance. I have never heard them making the usual cricket chirp, but we have some large crickets that make up for what their brothers are backward in; for in the evenings, when the bats come out and fly squeaking round the fig trees, the chorus begins, and is strengthened by the "whistle of a stray tree-frog and the indescribable confusion of countless frogs in the marshy ground close by, contending for the vocal prize in all tones of voice, from the deep-pitched growl of an old grandfather to the asthmatic efforts of the frog who has but lately lost his caudal appendage."

Grasshoppers and cicadas join in with their song, which is a noise like steam escaping from a safety valve, and a very shrill whistle combined, so you may judge that there is no lack of music on a summer's night.

One thing I miss very much is the song of birds, for, although many of them here are very beautiful in colour, they have none of the power of song with which some of their more sombre coloured brothers at home are so richly endowed. They have some peculiar call notes, several of which have a very mournful sound when heard in the stillness of the bush. Our butcher bird makes great havoc amongst the grasshoppers and other insects, and makes use of the sharp pointed leaves of the aloes on which to impale its victims. The tick bird is a great friend to the cattle, for it wanders about on their backs, picking off ticks with its bright red beak and seeming quite at home and undisturbed by any movement that the beast may make.

These ticks are an awful pest, as they swarm on the stems of the grass in thousands, and it is impossible to walk there without getting smothered; and, as they bury their heads in one's flesh and require some little force to get them out, they do not add to one's pleasure in taking a walk. Those that infest cattle swell out when filled with blood until as large as a small marble, but those that are so numerous in the grass are not larger than a pin's head.

I am not sure, but I do not think you have any species of the Mantidæ, or "Hottentot gods," as they are called here. We have several kinds; some of them being both curious and pretty. They exhibit wonderful powers of concealment, and, as they feed on other insects, which they have to catch by stealth, one can understand the necessity for this power, for, although they can fly when full grown, they are not so quick as many of the insects on which they feed. I have seen one eating the body of a white butterfly, which had settled on a flower beneath which its captor was concealed.

It would be a difficult matter to explain how they manage to conceal themselves without giving a detailed description, and even then you would not appreciate the similarity without seeing the insect with its surroundings. The commonest variety is of a light green colour, but the varieties, in both shape and colour, seem almost endless. I once saw one that has peculiar flattened appendages on the sides of the body (*Harpax ocellaria*) clinging to the stem of a small plant, and, as it had its conspicuous elytra with their eye-like markings turned towards the ground, and the under part of its body turned upwards, the white and pink of the legs and flattened edges of the body exactly resembled some small pink flowers. I stooped to examine it, taking it to be the flower of the plant, when a wasp hovered near and was just about to settle, but, with a spring, the flower became an insect, with its powerful notched forelegs ready to seize its prey. The imitation was so good that it had deceived the wasp as well as myself.

Some of these Mantidæ are brown, and, when resting on the withered grass or among the small twigs of a bush, it needs a keen eye to distinguish them. I found one eating an ant-lion one day, which seems to be a case of cannibal eating cannibal. I do not mean the ant-lion larva, but the perfect insect, of which I have caught many, some of them measuring six inches across the wings. They look very much like dragon-flies, but have antennæ, which dragon-flies are short of. I have never found them out in the sunshine, but in shady places, resting in the grass or on the trunks of trees, with their wings folded close to the body, and even then they seem sleepy, and prefer the evening time. The largest specimen that I have seen was brought to me by a man who had caught it while trying to singe its wings in a lamp. In almost any dry sandy places there are dozens of small conical pits, at the bottom of which the larvæ can always be found. Their habits are too well known for me to have much to say about them, but I have seen them put to a use that was very interesting. In our garden, the children have a hive of bees, which was always being disturbed by ants, so they collected a quantity of ant-lion larvæ and put them in the loose sand around the post that supports the hive, and as the ants would have to cross these pits to get to the hive, you may judge they formed a good protection.

We have some lovely dragon-flies, but, as when dead they will not keep the beautiful colour of their bodies, they lose much of their interest. Some of our species seem to frequent the bush far more than the neighbourhood of water, and one kind I have never seen near the water. It has dark greenish-bronze wings with the tips quite transparent, the coloured portion ending so abruptly as to give the wings, when seen at some little distance, the appearance of having been folded and the ends snipped off with a pair of scissors. The body of this species is a lovely gray-blue colour. Another species, with a bright red body and wings like crimson network, can be found near any stream or water-course, hovering over the water or settled on the damp ground or rocks.

In the pools on the marshy ground or "flats," as we call it, one may often see the head of a mud-tortoise just above water level, and the children bait hooks with grasshoppers and catch them. I cannot say that I should care to fish for them, as they have a most sickening smell. An old man came to me one morning with a dead snake in one hand and one of these mud-tortoises under his arm. He had heard that I wanted "animals" of any sort, and so he had brought them for me. I took the tortoise home, bored a hole in the edge of its shell, and fastened it by means of a copper wire to a tree, and then watched it. It commenced to burrow in the soft ground by working with its feet and constantly turning with a circular motion, so that it really got underground by making a spiral.

When wandering down the rocky bed of a stream that in summer would be an unfordable torrent, the curiously woven nests of the golden weaver may be often seen suspended from the reeds and swinging in the breeze, while the birds hang from them, and keep up an incessant chattering while at their work. These nests have the openings underneath, so that the eggs are protected from any marauders.

By turning over the stones on the dry bank side, you will probably find a scorpion with its claws so threateningly expanded as to make one feel that it would be far from a pleasant bedfellow. I would rather have one of them on me than a centipede, for the latter, with its numerous, quickly moving feet, is a most repulsive-looking thing. They are to be found under the dead bark of trees, and I often come across them when hunting for beetles.

In the pea-like pods of one of our trees the pupa of a blue butterfly is found, and, when I opened one to see if it was occupied, a small centipede came running out. On picking another pod and biting the end off it, I was surprised to find it also occupied by another centipede, after which you may be sure I did not bite any more.

Though our butterflies are so numerous, there are but few of the larvæ or pupæ that are known. This may be owing to the fact that there are comparatively few collectors; but, although I am always on the lookout for them, I have as yet only found about eight species, and of these there is, as far as I know, only one that has not been figured or described.

To a lover of beetles there is a fine hunting ground here, for there is such variety in colour, markings, and form. It is a most interesting sight to watch our common manure beetle as it rolls its ball of manure along to some place where the ground is soft enough to enable it to bury it, where it will become food for the larva on its emergence from the egg which is deposited within it. The beetle walks backwards, and pushes the ball with its hind-feet, so that while at work it appears to be standing on its head. I have seen two at work at the same ball, but generally there is only one. Beetles of all sorts and sizes are to be found in dead wood, amongst the grass or dead leaves, or buried in the flowers, and even in the fruit.

I have no doubt you have often heard the faint squeak of the bats in the evening time at home, but their note is very weak when compared with that of the bats we get here. A fruit-eating bat that was brought to me some time ago measured twenty-three inches across the expanded wings, and has an enormous head, in shape very like a dog's; and it has powerful teeth, too. Our small bat can be found at any time, asleep in the folded leaves of the banana plants, which are quite a favourite resort of theirs. As soon as the sun sinks below the horizon, dozens of them may be seen flying from the town in a north-easterly direction. I have often seen them dart from beneath the eaves of the houses, and without any hesitation fly straight for the north-east. On the south and south-west the town is bounded by the bay, and on the east by the ocean, so that it may be they choose this direction as it takes them inland to the woods where they will find their food.

One of our butterflies, also, has a great liking for what little twilight we get, and when darkness is fast coming on, two or three of them may often be seen hovering over the sweet-scented blossoms of the orange trees, and then darting away with lightning speed.

Evening is the favourite time for the mosquitoes, the little pests that worry so many new-comers on their arrival here. It is no uncommon thing to see quite large swellings caused by their bites, but they affect some people far more than others, and I have been one of the lucky ones for whom they have apparently no liking. Their curious boats of eggs will be noticed floating on the water in the tanks, and I have found them in the water jug in my bed room, and in any stagnant water hundreds of their curious larvæ or "wiggle waggles" may be seen squirming about.

Except for a small "whirligig" beetle, a boatman and a water scorpion, I have seen no water insects; but to make up for any loss in insect life, the flowers are plentiful near any stagnant water. On the marsh, where the dark green leaves and rich brown heads of the bulrush wave in the wind, the arum lily grows and blooms as it never does under culture. It is a lovely sight to see hundreds of their snowy, vase-like blossoms bending before the wind as it sweeps along and bears the crane from its feeding ground on the muddy flats to its home among the sedges, near the pools where the purple water lilies bloom and cast their fragrance around.

During the winter months—when the rains cease, and the sun's heat cools down to average English summer temperature—these pools dry up, and become mere clay beds for the impressions of the feet of the oxen, which come to seek for water in vain. With all this trampling, when summer's torrents pour, and each hollow becomes a little lake, the purple water lily throws up its leaves in preparation for putting forth the buds that are soon to burst and open out as one of the loveliest of our flowers. Everything that has been so parched and dry as to impress one with a belief that all life has been burnt out of it, begins to put forth shoots and leaves, and to wear a mantle of bright green that seems to cool and refresh one after the months of yellow faded winter.

For comfort our winter months are all that could be desired; but, for all its scorching days and steaming nights, varied with thunderstorms and falls of rain that last two and three days without cessation, I prefer the summer, as then everything seems to wake up both in the animal and vegetable world.

Then the locusts or "soldiers," with their many-coloured bodies, swarm in the vegetation on every roadside, and exhibit colours that have earned for them the above appropriate name. From the grass you may kick up what seems to be neither insect nor bird, but it flies for some distance, with its bright red wings expanded, and then drops to the ground. It is only a grasshopper; but what a size! Its expanded wings will reach six inches, and its hard upper wings rattle together as it flies with a noise that can be heard for some little distance. When you leave the "flat" and enter the bush again, a large brown butterfly gets up from among the dead leaves, flits slowly along for a few yards, and then drops. Go up to where it settled and I defy you to distinguish it from the ground it is resting on. Rustle the leaves and disturb it, then follow it quickly to where it drops, and unless you really see it settle you will not distinguish it, and even with practice one is often deceived, so excellent is the mimicry.

This butterfly measures about four inches across the wings, and is of rich brown, with yellow eye-like markings on the upper side; but its under side is indescribable. In colour it ranges from ochre-yellow to almost black, and varies in marking from having no marking at all to being speckled and spotted as though with salt and pepper. Now as when settled it closes its wings and keeps them perpendicular, you can see how easy it would be to pass it over as it rests among the dead leaves in the quiet shade of the bush.

Another of our butterflies has a habit quite the reverse of the one just mentioned, as it settles in the glare of the midday sun, on a dry sandy bank or stony spot, and opens and closes its lovely purple-blue wings, with their conspicuous vermilion spots that gleam like gems in the sunlight. To find this butterfly in its sleeping haunts at sundown one would never dream of its being so fond of showing off its beauties in the daylight. On a steep, sloping bank on a river side, in places where the wind and rain had worked out the sand, and left the long wiry roots of the plants and trees hanging down like tangled network, I found the sleeping places of this pretty "fly." In making a sweep with my net while endeavouring to catch one of them, I struck the bank close to a small hollow beneath the roots of an overhanging tree, when out flew a swarm of these very same butterflies. Leaving the place for a short time, I came back and put the mouth of my net over the hole, and so captured the tenants. On counting them, I found that I had caught no less than fourteen, and yet some had escaped. One of our entomologists caught twenty-nine in a similar manner. Wishing to know how they settled when at rest, I wandered along the bank until I came to another hole where they were equally numerous, and you may guess my surprise to find them packed on the top of one another in a jumbled mass as close as they could get. I can give no reason for this peculiar habit, and as far as I know it is unexplained.

Stepping from stone to stone along the bed of this stream, one feels that—although the overhanging trees break the fierce heat of the sun overhead—the heat is still strong enough to make one wish for a bathe in the cool water, that trickles in and out and around the boulders washed out by its own untiring action, and then flows into a deep still pool to flow out again in a rippling stream that falls and breaks from step to step in hundreds of tiny cascades. It would not be very wise to yield to this desire, as, apart from the dead thorny branches that have fallen from above, it is in these pools that the dirty-coloured fresh-water crab is on the lookout for something to nip. To see this pretty little brook, so small that at times it almost loses itself among the stones and rank grass where only its ripple betrays it, one would think it could never be worthy to be called a river; but see it when the summer rains fall, and the water pours down from the hills around like a great moving wall that carries all before it, and covers the very boulders around which it used to meander. Where it would have been easy to step across it, it would now be impossible to ford. All our rivers are alike; and in one place our railway crosses a bridge quite four hundred yards long, beneath which in the winter time runs a stream not a dozen yards across, which in the wet season is a wide rushing river. In a steep gully, worn by the water's years of work, is a fall where the beautiful maiden-hair fern peeps from among the rocks, over which the water bounds, but leaving a passage where one may walk with the steep rocky wall on the one side and the flashing water on the other; and beneath these rocks a large moth finds a resting place during the hours of sunshine. I have caught many of them, but have never succeeded in obtaining a perfect specimen, owing, no doubt, to their being so large and clumsy.

Attracted by the lamplight, several kinds of Hawk-moths come flying into the house at night, and among them is the "Death's-head." Beetles, moths, flies, and "flying ants" come trooping in, and on a damp evening they become quite a nuisance. These "flying ants" are the males and females of the so-called "white ants," of which we have any quantity, as you may find by lifting up any piece of board or plank that has been lying on the ground for a short time, when they are seen hurrying hither and thither in great consternation at being disturbed. They do much damage to houses in some parts of the town, especially in those built on the ridge of hills behind the town proper, where it is all red sand, while in town where we have the white sea sand they are not nearly so numerous. They must have many enemies, or they would soon become so numerous as to be beyond control; and even now people build their houses on brick pillars so as to be able to get beneath them, and so keep a lookout for the little clay tunnels within which the ants work. Birds are very fond of them; and it is a pretty sight to see the swallows dart down from the trees and snap them up almost before they have left the ground.

Another great destroyer of dead wood is the boring beetle. We have several, I may say many, different kinds of these beetles, and nearly all are the long-horned ones—very like the European musk beetle. They are lovely insects, some with bright green elytra and thorax of crimson gold, some all shining emerald-green, and some with light red stripes on a ground colour of pale green, but all with a strong musky smell that gives to them their common name. In splitting up some dead wood I once found no less than five specimens of the species, brightly coloured with green and crimson, and just ready to emerge from the holes in which they were laid, with their legs folded close to their bodies. A short time before they were soft white maggots, but they had now begun to eat their way along, and were driving their tunnels through the wood with a precision equal to a boring machine. In this piece of wood, less than a foot long, there were larvæ, pupæ, and perfect insects, thus giving a far better lesson in their life-history than any book could possibly do. One species, with a body about three-eighths of an inch in length, has horns quite three times as long as its body. I cannot say whether these beetles eat the dead wood, but they have powerful mandibles, which project downwards, and not fowards as in most beetles.

In hollow trees or dark dry holes, I have found the so-called "Scorpion spider" (Phrynus). This is a very good name for them, as they are intermediate between the scorpions and true spiders. Their flattened bodies are about as large as a shilling, and they have eight legs, of which only six are used for walking, the first pair being very long and fine, and more like antennæ than legs; while in front they have a toothed pair of nippers, which make them look so like scorpions.

Whilst walking along, on the lookout for entomological specimens, it is no uncommon thing to be arrested by the vacant stare of a chameleon, that sits with its feet and tail clasping the twig on which it rests, and turns and rolls its eyes in all directions. Their peculiar feet, that look as though they were short of some of their toes, are beautifully adapted to their habits, as with them they can clasp and cling to almost anything. The fore-feet have two toes turned outwards and three inwards, and the hind-feet the reverse. Their slow, sleepy movement when walking, and their power of moving one eye independently of the other, give them an expression that is almost idiotic. They dart out their tongue with a rapidity that does not seem to be in keeping with all their other movements, and were it not for this quickness I fear they would go short of food.

Turn over any dead stick or log of wood, and out troop ants, woodlice, and beetles, or even a lizard or a centipede. Look on the green bushes near the water, and you may find the green tree-frog clinging to a stem with its sucker-like toes. Go where you may, or look where you may, fresh sights crop up, and each one bearing its special interest will tend to intensify the love of, and increase the desire for, a deeper insight into the study that affords such endless delights for those in whom there is the least love of Nature and her marvellous workings.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 70.)

* **E. latifolium.** 5, 6, 59, Wyre Forest; 66, 86, Malvern D. Tab. 30. Severn, Malvern.

*† **E. gracile, l.** Said to have been found at Malvern, on the authority of the Rev. Andrew Bloxam. Tab. 30. Malvern. Extinct. *Must be an error.*

* **Carex dioica.** 115, Lickey. In list, as usually occurring, Purton (*fide* Rufford). Extinct. Tab. 31. *Not in Table, nevertheless, in the three editions of the Botany of the Malvern Hills, 1843, 1852, 1868.*

* **C. pulicaris.** 6, Wyre Forest; 86, probably Sapey Brook; 115, Lickey. Tab. 31. Severn, Malvern, Lickey.

* **C. intermedia.** 35, Longdon Marsh; 57, Severn D. Tab. 31. In all the districts.

* **C. vulpina, C. muricata, C. divulsa.** Tab. 31. In all the districts.

*† **C. teretiuscula.** 14, 131, Scott's History of Stourbridge. Tab. 31. Lickey? An error.

* **C. paniculata.** 14, 57, 60, 131, Severn D.; 119, formerly at Moseley. Tab. 31. Severn, Malvern, Lickey.

* **C. axillaris.** 57, Norton, near Kempsey. Tab. 31. Severn, Malvern.

* **C. remota.** Tab. 31. In all the districts.

* **C. stellulata.** 14, Hartlebury Common; 115, Lickey; 119, formerly at Moseley. Tab. 31. Severn, Malvern, Lickey.

C. elongata. This sedge, although mentioned eight times in the volume, is only localised once, at p. 11. "I have myself collected the rare *Carex elongata* on a bank by a path through the fields between Hartlebury Common and the Severn, but I could only perceive a single tuft of it anywhere about." *First record.* Tab. 31.

* **C. curta.** 11, 14, 57, Hartlebury Common; 60, Sandstone country near Kidderminster. *Unlocalised.* Tab. 31. Severn.

* **C. ovalis.** In all the districts.

* **var. bracteata.** Commons below Malvern Wells.

*† **C. stricta.** 57, marshy spots about the brickgrounds at Northwick. Tab. 31. Severn, Malvern, Lickey. *I believe an error.*

* **C. acuta.** 57, same locality as last. Tab. 31. In all the districts.

* **C. vulgaris (cæspitosa, Sm.).** 57, Northwick; 119, formerly at Moseley. Tab. 31. In all the districts.

* **C. pallescens.** 6, Wyre Forest; 115, Lickey; 124, woods in Romsley and Frankley. Tab. 31. In all the districts.

* **C. panicea.** Tab. 31. In all the districts.

* **C. strigosa.** 14, at or near Hartlebury Common; 29, ravine at Shrawley, &c.; 57, near the Severn; 87, Sapey Brook. Tab. 31. Severn, Malvern, Lickey.

* **C. pendula.** 6, Wyre Forest; 86, Sapey Brook; 124, Romsley and Frankley Woods. Tab. 31. In all the districts.

* **C. præcox.** Tab. 31. In all the districts.

C. digitata. 57, reported from North Wood, Bewdley, by Mr. Jorden. Tab. 31. Severn. *First record.*

C. montana. 57, 59, Wyre Forest. Tab. 31. Severn. *First record.*

* **C. pilulifera.** 11, 14, Hartlebury Common; 115, Lickey; 126, Romsley. Tab. 31. Severn, Malvern, Lickey.

* **C. glauca.** Tab. 31. In all the districts.

* **C. flava, C. Œderi.** Tab. 32. In all the districts. *It is doubtful if typical C. flava occurs in Worcester. C. Œderi, probably, does not. The common form of C. flava throughout the county is var. minor, Townsend.*

* **C. fulva.** 5, 6, Wyre Forest; 57, Severn Valley; 114, wet places about the Clent Hills; 124, Frankley and Romsley Woods. Tab. 32. Severn, Malvern, Lickey.

* **C. distans.** Formerly at Feckenham Bog, Purton. Extinct. 32. Not in Table. *Nevertheless stated in all the editions of the "Botany of Malvern," 1843, 1852, 1868, to grow in Longdon Marsh. See "Mid. Nat.," Vol. XII., p. 209.*

* **C. binervis.** 14, 57, Severn D.; 115, Lickey; 119, formerly at Moseley; 124, Uffmoor and Frankley Woods. Tab. 32, Severn, Malvern, Lickey. *Avon district also. Gathered with Mr. Lees at Craycombe Hill, 20th June, 1854.—W. M.!*

* **C. sylvatica.** In all the districts.

* **C. Pseudo-Cyperus.** 6, 14, 29, 57. Severn D.; 115, 124, Lickey D. Tab. 32. Severn, Malvern, Lickey.

* **C. hirta.** Tab. 32. In all the districts.

* **C. ampullacea.** 11, 14, 57, 60, Severn D.; 115, Lickey. Tab. 32. Severn, Lickey. *Also Malvern. In all the editions of the "Botany of the Malvern Hills."*

* **C. vesicaria.** 14, 57, Severn D.; 119, formerly at Moseley; 131, Scott (*Stafford*). Tab. 32. In all the districts.

* **C. paludosa.** Tab. 32. In all the districts.

* **C. riparia.** Tab. 32. In all the districts.

Setaria viridis. xxxi. 711. Tab. 32. Introduced.

S. glauca. 58. Introduced. Not in Table.

Phalaris canariensis. xxxi. 711, 58. Introduced. Tab. 32. In all the districts.

Ph. arundinacea. 58, 97. Tab. 32. In all the districts.

* **Anthoxanthum odoratum.** Tab. 32. In all the districts.

* **Phleum pratense.** Tab. 32. In all the districts.

* **Alopecurus pratensis, geniculatus, agrestis.** Tab. 32. In all the districts.

* **A. fulvus.** Tab. 32. Severn, Malvern, Lickey. One locality in each. *It is strange that so rare a grass should not be mentioned in the text.*

* **Nardus stricta.** 14, Hartlebury Common; 17, 58, Broadheath; 115, Lickey; 125, Clent Hills. Tab. 32. Severn, Malvern, Lickey.

* **Milium effusum.** Tab. 32. In all the districts.

* **Phragmites communis.** 36, Longdon Marshes; 58, Severn; 91, Avon. Tab. 33. Avon, Severn, Malvern.

* **Calamagrostis Epigejos.** 20, Monk's Wood, Grimley. But Tab. 33. In all the districts.

† **Apera Spica-venti.** Not in text. Tab. 33. Lickey. *But query, in what locality?*

* **Agrostis canina.** Tab. 33. In all the districts. *A. canina is, in my experience, a rare grass, but it may be overlooked.*

* **A. alba.** Tab. 33. In all the districts.

A. vulgaris. Tab. 33. In all the districts. *First record of type.*

* **Gastridium lendigerum.** 34, 38, Tarn Hill, north of Tewkesbury; 61, south part of Severn Valley. Tab. 33. Severn.

* **Holcus lanatus, H. mollis.** Tab. 33. In all the districts.

* **Aira cæspitosa, A. flexuosa, A. caryophyllea, præcox.** Tab. 33. In all the districts.

* **Trisetum flavescens.** Tab. 33. In all the districts.

* **Avena fatua.** Tab. 33. In all the districts.

* **A. pratensis.** 68, Silurian hills west of Malvern; 101, Bredon Hill; 104, Broadway. Tab. 33. Avon, Severn, Malvern.

* **A. pubescens.** 14, Meadows at Park Hall, near Kidderminster; 58, Meadows in Severn Valley. Tab. 33. Avon, Severn, Malvern.

* **A. elatior** (*Arrhenatherum avenaceum*) and var. **bulbosum.** Tab. 33. In all the districts. *First record of var. bulbosum.*

* **Triodia decumbens.** 14, Hartlebury Common; 58, Broad Heath; 101, Bredon Hill. Tab. 33. In all the districts.

* **Kœleria cristata.** 58, Severn D.; 101, Bredon Hill; 131 (Scott). Tab. 33. In all the districts. Extinct in Lickey.

* **Melica uniflora.** Tab. 33. In all the districts.

* **M. nutans.** 6, 59, Wyre Forest. Tab. 33. Severn.

* **Molinia cærulea.** 6, 17, 58, Severn D. 115, 119, Lickey. Tab. 33. Severn, Malvern, Lickey.

* **Poa annua, P. trivialis. P. pratensis.** Tab. 33. In all the districts.

* **P. nemoralis.** 58, Severn D. Tab. 33. Severn, Malvern, Lickey.

* **P. compressa.** 58, Severn D. Tab. 33. Avon, Severn, Malvern.

* **Glyceria aquatica.** Tab. 33. In all the districts.

(*To be continued.*)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—February 5th. A meeting of the sub-section for the study of microscopic mounting. It was resolved to hold meetings on the Friday following each meeting of the Microscopical Section. Mr. T. V. Hodgson was appointed chairman, and Mr. C. J. Watson secretary and treasurer. The subscription towards the special expenses of the sub-section was fixed at one shilling.—BIOLOGICAL SECTION.—March 8th. Professor T. W. Bridge in the chair, and about 210 members and friends present. Mr. R. W. Chase gave a lecture on "British Birds and Bird Life," which he illustrated by a long and beautiful series of lantern pictures, many of which were photographed from specimens in his own collection and others of nests, &c., taken with natural surroundings. At the conclusion of the meeting a hearty vote of thanks was tendered to the lecturer.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—February 22nd. Mr. G. H. Corbett showed a section through the jaws of *Ichthyosaurus communis* from Lower Lias beds, Wilmcote. The section showed the bony structure and teeth *in situ*, one old tooth being displaced by a new one; Mr. Linton, specimen of a coral, *Fungia discus*; Mr. J. Madison, specimens of *Helix nisosa* and

H. undata from Madeira; Mr. J. Collins, a small collection of foreign land and freshwater shells.—February 29th. Mr. G. H. Corbett read a paper on "Geological Rambles." The writer said he should only deal with local geology. After speaking of the wear and tear of rocks and the building up of the debris, and condemning that mode of collecting that appropriated everything regardless of its educational value, he described the neighbouring formations and enumerated the different localities where the beds were best seen. The writer said on a future occasion he should deal with the rocks of a larger area. The paper was illustrated by numerous specimens, photographs, and diagrams.—March 7th. Mr. G. H. Corbett showed the longitudinal and transverse sections of *Favosites Forbesii* and *Plasmopora petaliformis* from the Wenlock limestone; Mr. H. Hawkes, a series of plants from Coleshill Pool and Bog, including *Hypericum elodes* and *Narthecium ossifragum*; Mr. J. Collins, fossil diatoms from Canada; Mr. W. J. Parker, *Synchæta pectinata*; Mr. Warner, a parasite in human liver.—March 14th. Mr. H. Hawkes read a paper "Notes on the Early Life of a Scotch Naturalist." The writer took the early life of Hugh Miller and showed how it was influenced by the wild rock scenery, caves, fossils, insects and flowers of Cromarty. His school was mainly Nature, and his training given him by natural objects. His life up to his seventeenth year was carefully traced, and the influence his observations exerted over him was detailed. The leading trait of his character was indomitable courage; this gradually elevated him in the service of science and enabled him to interpret the hidden language of Nature.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—March 14th. Rev. C. F. Thornewill in the chair. Mr. R. C. Bradley showed several species of Culex taken at Sutton. Mr. G. T. Bethune-Baker showed a boxful of Scopariæ from St. Helena, which differed from ordinary Scopariæ in the possession of deeply serrated antennæ, some of the specimens also being nearly black. Mr. Baker said that even from the mainland of Africa nearest to St. Helena he knew of no Scopariæ with the same characteristics. Mr. G. H. Kenrick read a paper, "Some Considerations on Insects Confined to Small Areas." He touched briefly upon self-evident causes of localisation—mountain chains, &c.; and then entered more fully into the causes of the presence on our coast lines, in the fens, woods, &c., of many species only found in those restricted districts in our country, though found in similar ones on the Continent. He remarked that it was strange to find so many species restricted to so small an area as our fens, for example; and showed that they represent a once very wide extent of country, all fen, extending over the German Sea to and including Holland, and of which our Lincolnshire and Norfolk Fens and those in Holland are all that is left. The insects inhabiting this wide extent of country are now to a considerable extent crowded into the few surviving spots, and hence we get many peculiar species in a small area. He believed the same applied to coast species, our coast line having once formed part of a very much more extended continental coast line; and to wood species, our woods being the remains of former extensive forests, &c. He concluded by pointing out many much more complicated questions of distribution and localisation, of which he could offer only slight explanation, and which, he said, opened out a wide and interesting field of study. A discussion followed, in which the Rev. C. F. Thornewill, Messrs. G. T. Bethune-Baker, R. C. Bradley, and C. J. Wainwright joined.

THE FIRST ASCENT OF THE ÖRÆFA JÖKULL.*

BY FREDK. W. W. HOWELL, F.R.G.S.

At 4 45 on the afternoon of Wednesday, August 12th, 1891, we reached the summit of the Almannaskarth (or All Men's Peaked Pass), that Icelandic Skarf Gap which pierces the mountain ridge ending in the beautiful three-peaked Vestrahorn. As we rounded the corner of the last spur we suddenly exchanged the homely foreground of brown rock for a glorious sweep of sun-lit sea. Right across it, fifty-two miles away, westward ho! rose in virgin beauty the snow-clad ridge of the Oræfa. The coast between was fringed with glaciers from the split-up Heinàbergs to the giant mass of the Breithamerkr. Twenty-four hours later we were struggling with the drainage torrents from these icy masses, and at midnight on that same day the electric-gold of a grand aurora was scintillating over our heads in long quivering bundles as we neared Reynivellir.

On the 14th, when we turned out of Eyolfur's hospitable home, I carefully examined the eastern flanks of our mountain, now just twenty miles away, with a telescope kindly produced by our amiable host. Two broken ribs curve east and south-east and south from under the summit. Somewhere in the neighbourhood of the most southerly of these Mr. Paulson's (the first) attempt was made in 1794 from Kvisker.

Reaching the top of the snow-fields he beheld sundry peaks with "hats" of ice on, and, thinking discretion the better part of valour, returned lest he should be dashed in pieces in the chasms at the feet of the said peaks. Up the sky-line there on the south, Mr. Holland and Mr. Shepherd made their attempt in 1861, till an impassable rock wall did for Mr. Holland what fatigue had already nearly accomplished for Mr. Shepherd. To the north of the summit was the gap in the snow-field, through which had hurtled the snow-laden storm that levelled my leading guide and myself a year ago.

I judged it but a short day's ride to Kvisker, but reckoned without the Breithamerkr. This mighty glacier, twelve miles *wide*, as well as long, found us a dozen hours of work. Its drainage river, the Jökulsá (*the* glacier river, *par*

*From a paper read before the Geological Section of the Birmingham Natural History and Microscopical Society, February 16th, 1892.

excellence), was totally impassable, and so was the great cake of ice from under which it issued, and which I had crossed with comparative ease before. This year, however, the warm sunshine, which made our days so bright, had proved an enemy, in that the lower ice was no longer safe. Hour after hour we worked our way up the glacier, turning and twisting among the myriad black-sand-covered ice cones, or coaxing our ponies up the frozen waves of the Jökull's surface, until we found a place where we could cross the ice ridge of the medial moraine, at a point 800 feet above sea level. It was 3 a.m. on the 15th when we reached Kvisker, and midnight before we arrived at Sandfell, my old head-quarters on the west.

Welcome, indeed, was the Sabbath rest. I rode quietly down to church at Hof, with my old friend the pastor, and as we returned a farmer came with us, who, with the pastor, pointed out a great mass of black rock rearing its snow-capped head above the snow-fields, and announced that that was the "Knappr." In 1341, the plain to our left was rich and productive, forty fertile farms gathered round the little church at Sandfell, and flocks and herds browsed on the level meadow land. Suddenly the dormant volcano woke, the snow-fields liquefied, and farms and flocks were swept into the sea, to help to make the sand banks, 180 feet thick, which now lie where Atlantic waves had rolled before. Sira Magnusson's house and the little church alone remain.

Hekla is better known, on account of its greater accessibility and the frequency of its eruptions, which have occurred on an average once in each generation for the last eight centuries; but here, entrenched behind the triple lines of desert sand and glacier ice, and Jökulsá, a hundred miles from any decent port, lies the true Icelandic mountain king.

Near Hof a curious result of one of the waterfloods may be seen. A vast pile of stones has been swept down, and then whirled into a huge circular embankment enclosing a funnel-shaped basin thirty feet in diameter.

At 2 30 on Monday morning my three friends from Svinafell appeared, Páll Jónsson, Thorlakur Thorlaksson, and Jón Sigurdsson, all eager for another attempt.

At 4 a.m. we left, after the inevitable stirrup-cup of delicious coffee. The barometer stood at 29·8. I had determined this time to keep to the rocks as long as possible, and, therefore, after crossing the grass lands of the parsonage and its little Forget-me-not lined stream, in a north-easterly direction, we turned up the slopes of the Hill Sandfell, from which the place takes its name. For some time we found these slopes covered with stunted vegetation, juniper bushes, and several berried plants of the cranberry and blaeberry type. By 4 30 we were high above the channel of a little stream that has cut its way deeply into a bed of ancient muds. The damp, slimy bank of brown, purple, blue, etc., was far more curious to see than it would have been pleasant to deal with. By 5 o'clock we had risen 850 feet, and the aneroid marked 1,250 feet above sea level, the *actual* elevation being about 1,000. Just now sunlight began to appear, though we did not see old Sol himself until nearly 6 o'clock. At 2,000 feet we attained the summit of the Fell, and began the shoulder connecting it with the backbone of the Oræfa. Vegetation was now represented only by mosses and lichens, except where a few saxifrages or stonecrops reminded one of the gems below. The Fell afforded rough going, for its surface consisted mainly of broken fragments of scoria, red and black, with here and there a little pumice. Sometimes these fragments would crunch under our feet, and sometimes an apparently fragile lump would prove hard enough to withstand the trampling of the party. Higher up we encountered broken and disintegrated plates of a basaltic lava, or quantities of a more vesicular kind in which glistened crystals of felspar.

It does not, however, appear that any streams of lava have descended into the plains, like those which the Skaptar Jökull and others in the west and central regions have produced. As we rose higher, masses of pure black obsidian became much more frequent, while ridges of red screes, bordered with pumice beds, well maintained the reputation of Iceland for striking rock colouring. Far below us, on the right (*i.e.* to the south), was a grand ice-fall on the Hofs glacier. Two ice-streams unite, the more northerly being very finely crevassed. As usual, in such cases, a medial moraine continues the line of the separating ridge. From the gorge, into which it descends, there issues a brawling torrent called the Katá.

By 7 30 we were well in sight of the upper ice-field of this Hofs glacier, and extremely grand it is. Upon the ice of the true glacier rests the snow of last winter. As crevasse after crevasse has formed, the snow has parted together with the ice; and, therefore, the section shows a snow-crest cleanly and sharply cut, however rough the ice beneath may be. And so, in scores, these walls rise one above another.

At 8 o'clock the tongue-like ridge we were following gave place here and there to patches of snow, on some of which snow cones occurred similar in sugar-loaf shape and black coating to the ice cones of the Breithamerkr.

A few minutes later we stopped for a second breakfast (3,600 feet, 8 15). A long line of fleecy clouds hung lazily over the Atlantic, apparently some distance beneath us.

Someone got the meat tin open, Jón filled the kettle at a little stream that issued from a great snow-bank, and soon the steaming chocolate was ready. How fresh and sweet these mountain meals! Soon after 9 we left, and at 10 the last bit of rock was reached. Here we roped. Taking first place myself, I put Páll second; my friend, Mr. T. Coulthard, jun., of Preston, next; while Thorlakur and Jón brought up the rear. And then, after a word of prayer to Him who "giveth snow like wool," in which our guides joined in spirit, if not in word, we moved off. Icelanders possess alpenstocks of a heavy kind, and crampons, and are accustomed to the glaciers at ordinary levels, over which they venture to hills where their sheep may have strayed or where moss may be gathered, but for the work now lying before us it was evident that previous mountain experience would be more valuable than local knowledge.

Of true Iceland moss there appears to be little or none on the Oræfa, though it occurs plentifully further north on the spurs connecting it with the Vatna Jökull. At 10 30, shortly after passing the 4,000ft. level, my friend declared that he found himself unable to maintain the pace, and, as it was absolutely necessary for us to be off the icefields before dark, it was decided that he should return, Jón Sigurdsson accompanying him. Almost immediately our troubles began. As we advanced, crevasse after crevasse, running north and south at right angles to our course, compelled constant deviations, so that an hour's work only gave us 300ft. of elevation.

About 1 o'clock we gave up the attempt to proceed directly towards the Knappr, and struck north-east, making for the top of the ridge which forms the backbone of the mountain. The temperature was rapidly falling, and we found the surface of the snow-field covered with innumerable ice-crystals, all pointing towards the wind, which blew freshly in our faces. The surface was honeycombed by the alternate action of sun and frost, and these crystals were attached to the upper edges of the congealed snow, upon which they had evidently been formed by the freezing of passing mist on to projecting points. They crackled merrily under our feet as we hurried on. Now and then we refreshed ourselves with a bit of kola candy, or a meat lozenge, until I discovered that the best plan of all was to take a bit of the candy together with a lozenge and a crystal or two. The combination was a perfect success, providing as it did an iced drink of a most stimulating and exhilarating nature, with none of the pernicious effects of brandy or any such treacherous alcoholic humbug. In addition, it has the advantage of lasting for some time and keeping the mouth moist.

As we approached the summit of the ridge, which proved to be a table-land of snow, heavy mist banks began to roll up, and fine snow to fall. Two or three miles away to the north, through this snow-mist, there towered up a cross ridge, ending towards the east in a pile of precipitous rock, crowned by a heavy snow-cap. It struck me that this was at least as high as the point on our right, but, led on by the declarations of the natives, we turned south after passing the last crevasse, and faced the Knappr. Access was cut off from the north by a network of crevasses, the flank of which we had just turned; we, therefore, advanced until we could approach it from the east, where a huge bank of snow leads right up to the peak. This bank, however, had split and fallen away bodily from the portion lying upon the rocks, so that a deep wedge-shaped cleft interrupted the otherwise promising slope. Still it was the only possible chance, and we, therefore, commenced its ascent. The edge was so sharp that I had to cut a series of steps. At 2 p.m. we were abruptly stopped by the wedge-shaped cleft already mentioned. Untying the rope, I fixed it under my arms, and made the men let me down the southern side of the snow-slope to see if by any means it would be possible to cross to the foot of the cap. I found, however, that this was out of the question. Both slope and cap rested at the edge on rock of so loose and crumbling a nature as to be utterly untrustworthy, while the perpendicular distance to the snow-fields beneath was sufficient to forbid the taking of any risk. Coming back, I made another attempt on the north side and succeeded better. Here it was possible to jump from the bottom of the slope into the cleft. This we did. I then prepared to ascend the cap, which, although resting also on the broken rock, was frozen so hard as to be practically a solid ice sheet, affording good foothold. I began the ascent with a heavy, short-handled axe, which I had taken mainly for hacking at rock surfaces, expecting the men to follow with the ordinary one. However, they made no move, and soon I heard that phrase of dreadful omen to an Icelandic traveller —"Ekke lingra"—"No further." This was succeeded by a lecture on the "wrongness" of the proceeding, to which I naturally gave little heed while the hard ice gave the ample support it did. I climbed as far as the rope would permit, and then threw it off. After an hour's hard work I reached the top, and the aneroid corroborated my own suspicion that this point was several hundred feet below the height which trigonometrical measurement had assigned to the peak of the Oræfa. It was disappointing, of course, but nevertheless the vantage ground was valuable. A few moments' observation convinced me that I was on the summit of the rock wall, from the southern foot of which Mr. Holland retired—and that the point itself was the most westerly of the two black, snow-capped cones, which look so imposing from Knappavellir.

In finer weather the view over the Atlantic would be glorious, but now it was sadly circumscribed, though the headland of Ingólfshöfthi, where the first permanent colonist landed, certainly showed itself clearly enough. The height proved to be about 5,600ft. It was now 4 o'clock, and no time was to be lost if the true summit were to be gained. At 4 30 I was down, and a few minutes took us off the ridge. Then we sat down for tea, and almost in a moment were chilled through. I ordered the men to drive their alpenstocks into the snow and hang a cow-skin coat over them for a shelter. This, with another to sit on, answered very well, and at 5 o'clock we were off again. Poor fellows, they thought our destination was home, and my decidedly expressed determination to go north in search of the ridge aforementioned evoked a rather mournful sigh from Páll. Still, as soon as he saw I was firm, he trotted off bravely enough.

In an hour we covered two and a half miles of the frozen waste, and in another hour found ourselves half-way up the ice staircase that leads to the summit of the cross ridge. The work here was very fine. So precipitous was the slope that in each crevasse the front lip had fallen so far below the hinder as to offer to our delighted gaze wall after wall of pure virgin ice fringed with with huge and lengthy icicles. Sometimes the passage from one to the other was difficult in the extreme; once, indeed, the legs of my camera had to be called into action as a means of strengthening a snow bridge of doubtful safety.

At 7 30 we reached the dome. Three cheers, a line or two of the National Anthem, and a verse of "Praise God, from whom all blessings flow," discharged our duties to ourselves, the powers that be, and those that act.

A motley crew we must have looked with our cow or oilskin coats strapped tightly round us, and caps tied over our ears, and beards thickly matted with half-frozen snow, as we stood on our lofty perch, 6,400 feet above sea level. Of view there was little or none; now and then the wind tore its way through the snow-cloud that enshrouded us, and gave us glimpses of the vast snow wastes of the Vatna, or the interminable desert of the Skeidarar Sandr, but it was manifest that the sooner we were down the better. In fifteen minutes we left, and in an hour turned our faces westward as we quitted the main ridge.

Thorlakur was in front now, and splendidly both he and Páll hurried along. Thorlakur's sharp eyes were bent upon the track we had made in the ascent, our only guide through the labyrinth of crevasses. The footsteps were fast filling up with new snow, and right glad we were to step on to the rocks once more at 10 30, twelve and a half hours after we had quitted them. We had our share of the usual mishaps of a night descent, though nothing of any moment occurred, and at 1 30 on Tuesday morning we arrived at Sandfell. A hearty welcome from Sira Olavur Magnusson and a good hot supper awaited us.

No better headquarters for a future ascent could be found than Sandfell. Páll will know better now than to steer for the so-called "Knappr," and by avoiding it four hours may be saved. Still it will be well to strike up on to the main ridge, before turning north, so as to escape the tremendous crevasse system which lies above the ice-falls of the Hvannadal. Some of these, which feed the Fall Jökull, advance to the edge of precipices, over which the disjointed masses fall. As we camped in the Hvannadal in 1890, we heard the roar of their descent.

Of the "crater," mentioned by Mr. Paulson, we saw as little as did Mr. Holland, although we must have been much nearer its presumed position. Whether a true crater or not, it is now, doubtless, buried deep under the snow. After a day's rest we rode on through Svinafell, a tiny village two and a half miles north of Sandfell. Here our guides live, and with them we went four miles further toward Skaptafell to see an Icelandic rarity—a little Skogar, or wood, on Hafrafell. The spot is really very pretty. A bright clear stream falls into a limpid pool; on the left are several birches, and a mountain ash or two, twenty to thirty feet in height, and on the right a tiny ravine with a few fern-clad ledges. There are some farms on Skaptafell, and one might well be chosen as a base from which to explore the peaks, passes, and glaciers, of the Jökulfell, and Kristinartindar. This Skaptafell, or Shaft-hill, probably takes its name from one of the rock-pillars forming the core of the mass.

NOTES IN AN OLD HERBAL.

BY G. C. DRUCE, M.A.

Recently a book has been acquired by the Bodleian Library which contains many interesting records of plants growing in and about Oxford. The book is the well-known edition of "Dodoen's Herbal," which was translated by Lyte, and published in the year 1619. The special point of interest is the MS. notes and drawings which it contains. They were evidently made by an Oxonian who must have visited Padua, since several references are made to plants growing there or elsewhere in Italy. The date of these notes is uncertain, and the name of the writer unknown. I suspect them to have been made by Wm. Browne, a Fellow of Magdalen, a well-known botanist, who, with Bobart and Stevens, compiled the catalogue of the Botanic Gardens in 1648. He contributed many plant records to How (author of "Phytologia Britannica"), and to Merrett (author of the "Pinax"). Assuming Browne to have been the writer, these notes of plant occurrences in Oxfordshire would precede many of Sibthorp's records, made in 1794 in "Flora Oxoniensis." Possibly some clue to the writer may be discovered from a detailed list of the Oxford notes, which are as follows. That he belonged to Magdalen may be presumed from his alluding to "our grove" and "our cloisters." Merton has no cloisters; Christ Church and New College have no groves.

Page 4.—*Wormewood Romaine* "grows upon a wall at ye narrow turninge by Hart Hall." *Artemisia Absinthium*, L., is not a native of this county, and only rarely appears in a semi-wild condition.

9.—*Dog's Tongue.*—"*Cynoglossum.* All along ye high waie goinge from St. Giles to Woolvercot, in Oxfordshire." *Cynoglossum officinale* is now destroyed in this locality by building operations.

10.—*Anthyllis.*—"Alsoe upon ye side of a hill halfe a mile beyond ye lower Hinksie hard by Mr. Tudball's house." *Anthyllis Vulneraria*, which is not there now.

17.—*Butter Burre.*—"It growes in a medow goinge to Aristotle's well, and a flight shot from Madlin Bridge in a little close, by ye river side." *Petasites vulgaris*, now destroyed, although frequent enough still higher up the Cherwell Valley.

18.—*Bistort.*—"In our Cloyster yard." This refers to *Polygonum Bistorta*, L., a plant once of great repute as a medicinal agent, and hence frequently planted about monasteries in Britain. It is no longer to be found in the municipality, but occurs in many places in the county.

20.—*Paule's Betony.*—"The Male Veronica. In all such places about Oxford." The description refers to *Veronica officinalis*, not to *V. serpyllifolia*, which is generally called Paule's Betony.

"The Female Veronica growes amongst corn almost everywhere," refers apparently to *Linaria spuria*.

29.—*Penniwurt.*—"This growes on all ye old walls about Oxford." None of them now yield *Cotyledon Umbilicus.*

31.—*Filipendula.*—"It growes in Stoe Wood and by the sides of the corne fields thearto adioyninge." A figure of *Spiræa Filipendula* is attached. The plant still occurs in that locality.

32.—*Thalictron.*—"Thease grow in all our meadowes about Oxford." This refers to the Meadow-rue, *Thalictrum flavum*, L., which is still frequent in damp meadows and by stream sides about Oxford. It was figured in Morison's "Hist. Oxon."

36.—*Milkwurt.*—"Plentifully about Oxford." The Milkwort, *Polygala serpyllacea*, Weihe, still occurs on heathy ground both in Oxon and Berks, probably not so frequently as in the 17th century. *P. vulgaris* is a rarer plant with us. It is found on the chalk hills, however, not rarely.

49.—*Dier's Weed.*—"Everywheare by Oxford." This still occurs plentifully about Oxford, and even on old walls in the city. It is the *Reseda Luteola* of Linnæus.

52.—*Lysimachion.*—"The Yellow and Redde grow plentifully in our Oxford ditches." The Yellow Loosestrife, *Lysimachia vulgaris*, and the Red Loosestrife, *Lythræa Salicaria*, still grow in the localities mentioned.

54.—*Mercurie.*—"The male and ye female grow in all woods about Oxford, especially in Merley Wood." This refers to the monœcious *Mercurialis perennis*, L. Merley Wood is near Wytham, in Berkshire, and the Mercury still abounds there.

55.—*Monywurt.*—"Everywheare about Oxford in great abundance." This is the Creeping Jenny, *Lysimachia Nummularia*, which is still frequent, but never (?) found in fruit.

61.—*Mouse-eare.*—"On ye walls in Oxford." This refers to the yellow-flowered plant, *Hieracium Pilosella*, which still occurs in the municipality.

66.—*Coronopus Ruellii.*—"Growes in all the high waies about Oxford." *Coronopus Ruellii*, the Swine's Cress, is still frequent by roadsides and muddy places.

78.—*Scordium.*—"This grows by Ruely Lock, and by the ditches on the rodeside of Gloster Hall in Oxfordshire." Now, alas! absent. It existed by the river near Godstow up to 1856, but the alterations at the lock extirpated it. Search has unsuccessfully been made for it in the meadows between Radley and Abingdon. Likely places are some of the meadows between Eynsham and Tadpole Bridge.

82.—*Sophia.*—"Upon olde walls about Oxford everywheare." As with Scordium, so, too, with Sophia; but the Flix-weed, *Sisymbrium Sophia*, is one of those sporadic plants which it would not be safe to call extinct. Our walls, it is true, no longer yield it; but its delicate foliage was for a year or two seen on that deposit of rubbish which was such an eyesore to those who entered Port Meadow by its south-eastern side. The plant is, however, a permanent constituent of the flora of Berkshire, about Cothill, Tubney, and Marcham.

91.—*Archangel.*—"Theare is another Lamium which beares a yellow flower, and it growes in Merley Wood." The Yellow Archangel, *Lamium Galeobdolon*, with its bright flowers and nettle-like leaves, still is to be found in the locality mentioned.

95.—*Adder's-tongue.*—"In all ye meadowes about Oxford." This statement scarcely holds true now; but the curious fern, *Ophioglossum vulgatum*, is not uncommon in the fields of Oxon and Berks, although not frequent in our immediate vicinity.

96.—*Lunaria.*—"It growes betweene 2 olde Butts goinge from Oxford to Hedington." The Moonwort, *Botrychium Lunaria*, is almost a thing of the past, but specimens have been seen during the last decade on Shotover. It was evidently not an uncommon plant about Oxford in the 16th and 17th centuries. A capital figure of the plant is drawn on the margin by the above record.

97.—*Burnet.*—"It growes in all our Oxford meades." The Great Burnet, *Poterium Sanguisorba*, still abounds in the meadows above Godstow, and is also found rather generally in the Thames Valley. It is one of the few representatives of a more boreal flora which occurs in the counties of Oxford, and Berks.

100.—*Golden Rod.*—"In Chilsey Woods, 2 miles from Oxford, it growes abundantly." The *Solidago Virgaurea*, or Golden Rod, has a very general distribution in Britain, but it is very rare in Oxfordshire. It occurs in one wood at least on the Chilterns, but it has not been recorded for Shotover. The locality given above refers to the small copse above the Childswell Farm, and was, doubtless, at the time the record was made of considerably larger area. The Golden Rod is still to be found on the Boar's Hill range, and is rather frequent on the Bagshot Sands below Reading.

103.—*Comfrey.*—"About Oxford abundantly." It still holds its own, and its pendant flowers which vary in colour, from white, greenish white, pink, red to dark purple, are an ornamental feature in our brookside vegetation.

120.—*Goat's-beard.*—"It growes plentifully about Oxford." The *Tragopogon pratensis* is still common enough on rail banks by waysides, about Oxford. Its large feathery pappus is a beautiful object.

123.—*Canterbury Bels, 1 and 2.*—"Thease grow in Merley Wood, by Botley." Both *Campanula rotundifolia* and *Campanula Trachelium* still occur there. The latter is by no means uncommon in the woods of both counties. The former (if *Campanula rotundifolia* be meant, which is somewhat doubtful) is more frequent on sandy soil than a denizen of woods. It is the true Scotch Hair-bell.

126.—*Foxeglove.* "It grows plentifully in Chylsey Woods, beyond Hincksey." The *Digitalis purpurea* still occurs there and also on the Horsepath side of Shotover.

127.—*May lilly.*—"It growes in Chilsey Woods." The Lily of the Valley, *Convallaria majalis*, although nearly extirpated, still exists within a moderate walk of Oxford, but it rarely flowers.

129.—*Calves snout.*—"I found it in ye corne going to 'Aristotle's Well.'" The locality now built over. The plant occasionally appears in cornfields, &c., about Caversham, and is an abundant plant in the Kennet Valley. It is the *Antirrhinum Orontium.*

177.—*Calamint.*—"This growes upon Hincksey and Bootley Hills." Not the first record for *Calamintha Acinos* or *C. arvensis*, since there is a note by Turner which probably refers to this plant, which is by no means uncommon in dry, sandy, and gravelly fields.

180.—*Wilde Sage.*—"It growes in Chilsey Woods." *Teucrium Scorodonia*, L., still occurs there. It is a rather rare plant of North Oxon.

181.—*Horminum.*—"Growes on ye olde wall on ye back side of Exeter Colledge Chappell." The *Salvia verbenaca* is probably now not to be found on the city walls, but it is frequent by the rail side between Oxford and Culham.

206.—*White Saxifrage.*—"Growes in Stoe Wood, Oxford," which still yields the beautiful Meadow or White Saxifrage, *S. granulata*, as does Shotover and also the Camp on the White Horse Hill.

214.—*Ashweede.*—"Growes in a lane going from Wolvercot to Godstowe." The *Ægopodium Podagraria*, which is by no means frequent about Oxford.

235.—*Centorie.*—"Small Centorie, with a yellow flower. Groweth on ye side of a hill beyond Hinksey." The beautiful *Chlora perfoliata* is now much rarer about Oxford.

243.—*Elecampane.*—"It growes plentifully on a dry pasture, close upon Botley Hills; alsoe by Mr. Tutball's house, beyond Hincksey." The conspicuous *Inula Helenium* is now absent from these localities. It could scarcely be likely to survive the "cuts and thrusts" of many generations of young Oxfordians. The name of Mr. Tutball may assist in localising the date of the MS. notes.

248.—*Wilde Pellitorie.*—"It growes upon ye side of a ditch hard by the fresh house, and all about those ditches." This refers to a composite plant.

254.—*Helleborastrum.*—"This grows in a pasture close upon Bottley Hills; alsoe at St. Bartlem's, a mile from Oxford, amongst a grove of tres hard by the well." The Fœtid Hellebore, *Helleborus fœtidus*, is probably extirpated from both the localities mentioned. It still exists in the county.

262.—*Pety Spurge Peplos.*—"I found it in Charles Armit's garden." *Euphorbia Peplus*, a frequent plant in garden ground about Oxford.

275.—*Dane wort.*—"It growes on ye side of Botley Hills, hard by the path which leads unto Witome [Witham]." *Sambucus Ebulus*, or Dane's blood, or Dane's wort, has also been recorded from Seacourt, by Thos. Hearn.

294.—*Wilde Spleenwort, Lonchitis aspera.*—"It growes in Chilsey Woods, by ye side of a hill wheare springs fall." *Lomaria Spicant* still exists, but in yearly dwindling numbers.

295.—*Ceterach.*—"This growes upon the old Towne walls by Newe Colledge, ower against ye Gallowes." *Ceterach officinarum* scarcely exists in the city precincts now. It grows on the walls of Blenheim Park.

296.—*Trichomanes.*—"It growes upon ye walls as you goe from the schooles to ye University Librarie, and in a corner of New Colledge garden, on your right hand as you enter in." *Asplenium Trichomanes* has become very rare with us, but still lingers about the college to which the writer of the above record belonged.

299.—*Ros Solis.*—"Growes in a bogg in Chilsy Woods." Extirpated, it is to be feared, from that locality; as also by the enclosure of Shotover, from Oxford; but the Sundew, *Drosera rotundifolia*, is still to be found in Berkshire, within a few miles of the city.

302.—*Ranunculus echinatus.*—"Groweth in ye cornfields hard by St. Barthemasse weir." The Corn Buttercup, *Ranunculus arvensis*, has probably increased since the above record.

305.—*Flamula maior.*—"Growes in the ditches by Gloster Hall." The magnificent Spearwort, *R. Lingua*, has become much rarer.

Difficult as it may be to believe that Oxford is really situate amid drier surroundings in the nineteenth than it was in the sixteenth century, yet the disappearance or the diminution in numbers of several of our marsh plants gives credence to this somewhat paradoxical statement. *R. Lingua* lingers in the upper reaches of the Cherwell and Thames, and also occurs near Abingdon.

308.—"*Herba Paris* growes in Merley Wood," a statement which still holds true.

343.—*Pisa sempervirens.*—" Growes in Merley Wood."

358.—*Mellilot.*—"Growes plentifully all about Oxford," which is true of the present time. With the true Melilot, *M. officinalis*, we also have more rarely, as a casual plant, *M. arvensis*, and our rubbish heaps occasionally yield *M. indica* as well.

361.—*Haresfoot.*—"Hard by Stoe Wood." The fields opposite Stow Wood, and from thence to Headington, still yield in abundance the pretty Haresfoot Clover, *Trifolium arvense*, which is a local plant in the county.

361.—*Wood Sorrel.*—"It growes plentifully in Shotover Wood." *Oxalis Acetosella* still occurs there.

364.—*Stichwurt.*—" It growes in Merley Wood and upon Hincksey Hill by ye hedges." *Stellaria Holostea*, L., is an abundant feature in our septal and woodland vegetation.

386.—*Madder.*—" Wilde Madder growes in copse by Chyllsy Woods." " Flowers are white." Probably *Galium saxatile* is intended.

387.—*Golden Crosswurt.*—" It growes on ye side of Botley Hills in the pastures." *Galium Cruciata* still occurs here.

408.—*Lange de beefe.*—" It grows on ye sides of ye ditches as ye go from Boutley Causeway to Medley." *Helminthia echioides* is still to be found in the vicinity.

416.—*Earth Chesnut.*—" It grows in Merley Wood and Chylsey Wood, and in ye cornefields betweene Shotover and St. Bartholemeios Well." The Pig-nut, *Conopodium denudatum*, still exists as a frequent native plant in our woods.

445.—*Rapistrum.*—"There is another sort called *Rapistrum aquaticum*, very common in our Oxford ditches." This refers to *Nasturtium amphibium*, which is frequent about Christ Church meadow, etc.

448.—*Lesser Water Cress.*—" In all the Oxford meadows."

449.—*Winter Cresses.*—" Upon ye bancks of ditches about Oxford everywheare." *Barbarea vulgaris* is still abundant.

449.—*Thlaspi.*—" One kind grows on Botley Hills." The Pennycress, *Thlaspi arvense*, still occurs in our cornfields.

457.—"*Allium sylvestre* growes on a wall as you goe from Baley Colledge to Kettle Hall, also on Hincksey Hills." The Wild Garlic, *Allium vineale*, is no longer to be found on the walls in Broad Street, and is probably gone from the Berkshire Hills. It still exists on some ruined walls near Oxford. "*Ramsons* growes in Merley Wood, and in Stow Wood." Both localities still yield the white starry flowers of *Allium ursinum.*

458.—*Sauce Alone.*—" It growes in our grove." The plant referred to is *Alliaria officinalis*, or Hedge Garlic.

480.—*Base Broome.*—" It growes plentifully about Oxford." A statement which now no longer holds true respecting *Genista tinctoria.*

A WEEK IN NORTH WALES.*

BY T. H. WALLER, B.A., B.SC.

"A Week in North Wales" does not suggest any startling experiences, and it may be as well to say at the beginning that these notes will contain the record of none. Everyone goes to North Wales, from those who can only get off for two or three days at a time of a general holiday to ladies who tramp four together with "a knapsack," and the fortunate ones who can settle down for a month or two in the summer or autumn, and make themselves thoroughly familiar with some of the beauties around them. The country may also be "done" by coach, that is, a good deal of the prettiest scenery may be glanced at for a few minutes and then passed by without a chance of further view. Incidentally, the coaches are a great boon; we found, being two sober, steady-going, middle-aged men, that knapsacks had an awkward knack of getting very heavy towards the end of a day, and very early on made a special study of the coach routes, so that we might arrange for the conveyance to the destined lodging place of such articles as we should not want while on the tramp. Even thus the accumulation of bits of rock was apt to make itself felt towards the end of the day, and rendered the prospect of starting light again the next morning a distinctly agreeable one.

We started from Rhyl one afternoon late in July, taking the train to Penmaenmawr, and immediately struck up through the village, following the directions of the faithful Baddeley, whom, by-the-way, we found all through our walk to be just that minutely accurate friend in need who is the friend indeed for the pedestrian. The first point at which we aimed was the stone circle behind Penmaenmawr Mountain, and, taking it easy along the eastern side of this latter, we at last emerged on the ridge. Immediately it was evident that one of the objects of our visit could not be attained. The wind was so high that there was no possibility of getting a camera to stand: possibly a heavy stone hung on might have prevented the otherwise certain overthrow, but the chances of getting the apparatus steady, even with this help, appeared very remote. So we took a general look at the weird grey stones; tried, as so many others have tried, and as unsuccessfully as they, to imagine the use of such curious erections; tried to recall the various theories we had read about them and their makers—Sun theories, Grave theories, Serpent

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theories, Druid theories, Amorite theories, and so on, and so on. At any rate, the old time vanished people had chosen a fine though somewhat desolate place for their temple or memorials. As we saw them, with the sun getting near the horizon, shining red on the ruddy crest of the rugged Taly-fan, the ragged clouds chasing swiftly along overhead, the rush of the wind among the grass underfoot, and the green hollow in which Penmaenmawr lay peacefully in the evening light, the impression was one which will not easily be effaced.

From this ridge we soon got on to the high ground from which rises the curious mass which forms the summit of Penmaenmawr itself, and at a little farm cottage just under this, an old woman, who seemed to be the solitary inhabitant, tried, as far as her English would allow, to dissuade us from any attempt to go further up. However, there was an easy path, which soon brought us on to the top, where we found that the wind was so violent that we could not stand upright, but could only crouch down behind the cairn. Attempts to reach the second cairn, at a distance of a few yards, only resulted in ignominious clutchings at the bits of rock for support, so we speedily gave up the idea of doing more than getting down again as soon as possible. When passing round the knob or peak (whichever you like to call it), the roar of the wind among the stones was more like a train in a tunnel than any other noise we could think of, and even where we were the shelter of the stone wall along which our road lay was decidedly comfortable. By this time the evening was getting late, but we just had a look into the great quarry, and got a few specimens of the curious segregation veins which are so striking a feature in the stone. Some years ago I exhibited to the Society and described the curious way in which these latest residues of the cooling mass approximate in composition to granite, both in the higher silica percentage and in the proportion of potash to soda.

The descent from the quarry to the village of Llanfairfechan was performed almost in the dark, and our five hours' blowing about made the quiet and rest and food at the hotel very welcome.

The next day we took train for Aber, and walked up the valley to the falls. As all here very likely know this part thoroughly well, there is no need to describe the beautiful lower part of the valley, which in many places it seems no impertinence to compare with that of the Lyn, at Lynmouth, the wider wooded middle section of the valley, or the falls, beautiful, even though the amount of water is but small. Here we struck up the screes on the east side of the valley, in order to reach the path leading to the upper valley, Cwm-yr-Afongoch (the hollow of the red river).

One of the special points which we had proposed to ourselves to be aimed at in our little expedition was the determining whether certain blocks of a curious porphyritic rock which occur plentifully among the broken rocks at the foot of the falls are derived from the great mass of igneous rock over the edge of which the water comes, or are residues of the washing out of the "marine drift," of which the valleys of the north coast of Wales are full.

The colour on the Ordnance map is stated to mean "massive intrusive felspathic rocks;" it is the same in the case of the enstatite diabase of Penmaenmawr, and the little Dinas Hill behind Llanfairfechan, and the same again as the quartz felsite of Llanberis, and the hornblende porphyry of Mynydd Mawr, of which we speak later on. Various patches of crimson interspersed (the colour denoting "Greenstone") make it evident that the surveyors found a variety of rocks, and were in doubt about the real nature of some of them.

It is quite plain, from the researches of more recent geologists, although the tract of country is by no means thoroughly explored, that within this red patch there is included a considerable complex of rocks, and the opinion seems pretty strong that we have here the remains of one of the great Ordovician volcanoes of North Wales. (See Harker's "Bala Volcanic Series in Carnarvonshire," and Sir A. Geikie's "Anniversary Address to the Geological Society, 1891.")

We were fortunate in obtaining specimens of the granophyre which at the falls forms the edge of the mass, and of the more granitic variety a little further in; and also a curious specimen, which, on being examined microscopically, shows a crack filled with perfectly glassy clear felspar along with quartz, from which it can only be distinguished by exhibiting a biaxial figure in convergent polarised light. The crack has cut across an original felspar crystal of the rock, which has been cemented again by the secondary felspar, the twin structure being preserved in the new material.

The porphyritic rock mentioned above was found *in situ*, overhanging the little river in the ridge running north from Bera Mawr, and is no doubt the greenstone of the Survey map. Harker describes it as apparently a bronzite bearing andesite.

This upper valley of the Aber stream affords some grandly wild scenery; spurs from the hills on either side seem at times to cross it almost completely from side to side, and indeed at one place, for possibly a quarter of a mile, the little river runs in a beautiful little rocky gorge in miniature, with little rapids and frequent falls, the rocky sides covered with birch and ferns and a great variety of mosses and flowering plants.

Through great beds of Staghorn moss we finally get to the slope of the summit of the mass, Foel Frâs, with a height of 3,091 feet, according to the guidebooks. From here we struck S.W., along the southern slope of the slightly depressed ridge connecting this summit with Carnedd Llewellyn. This slope is all deeply covered with peat, which has in many places broken away in patches, sliding a few feet downhill, and making very awkward little obstacles to speedy walking, being in many cases four or five feet deep.

From the top of Carnedd Llewellyn, returning for a short distance by the way we had come, we got down a steep slope of broken stones, with Parsley Fern in abundance between them, into the slightly swampy Cwm Caseg. On the far side of the tiny stream at a place, where the bank was some 10ft. high, an overhanging ledge had been formed, over which water was trickling, keeping, for a space of 20ft. or so in length, the whole of the recessed bank covered with a perfect profusion of water plants, and the vivid green of these, contrasting with the stony and peaty soil around, made a very striking picture.

A somewhat uninteresting walk (make a note of it, and don't try to walk for eleven hours without any food if you can help it) brought us to Bethesda.

The next morning we drove up Nant Francon as far as the foot of Llyn Ogwen, in pretty steady rain, and walked up into Cwm Idwal. The rain spoilt the view, but we could just get a sight of the grand moraine heaps on the west side of the lake, and from the high slopes by the Devil's Kitchen note their arrangement in lines along the lake and transversely in a series of curves convex down the valley.

A huge block, fallen from the crags above, composed of slate with felsite interposed, showed very neatly the different result of the great earth pressures on different textures of rock. The slate was cleaved, while the felsite was thrown into rough folds, in which the original flow directions were indicated by the elongated nodules it contained.

A little further on, at a place where the high ground begins to fall away towards the Pass of Llanberis, we came across the outcrop of one of the sheets of felsite which was quite crowded in parts with curious nodules similar to those just mentioned. The appearances presented by these, both as hand specimens and in thin section, seem to me to differ a good deal from those described by various authors—Professors Bonney and Cole, Miss Raisin, and Mr. Harker—as characteristic of the nodular felsites of North Wales. In most of these the nodules are described as of quartz, or agate, or jasper, none of which occur in the specimens we collected at the locality named. Mr. Harker (Bala Volcanic Series, p. 35) mentions some from near Pwllheli which, when broken open, present no sensible difference from the ordinary rhyolite. He states, however, that on microscopic examination a certain difference is perceived. The porphyritic felspars occur within as well as without the nodules, and the traces of fluidal lines also traverse them, but in addition there is "seen a faintly defined radial structure which can be regarded only as a giant skeleton spherulite." In the specimens which I have examined I can see no trace of this radial structure, and in one, at least, there is a very marked banded structure which does not go beyond the border of the nodule. In one case where I was able to prepare a section showing the junction, the felsite surrounding the mass seems to flow round the nodule as round a solid included in the flow, so that I am in great doubt as to whether there is not, for this particular case, the explanation possible of pebbles of previously formed shaly rocks caught up in the lava flow.

A walk over Snowdon from Penygwryd to Llanberis is not specially noticeable, except to remind geologists of the beautiful mass of columnar dolerite which stands up in the midst of the lower part of the great hollow of Snowdon. just by the little Llyn Teyrn. Standing just in the path of the great ice stream which must have filled this hollow, it is completely rounded and smoothed on the side of it which looks up the valley; the ice has flowed right over the top of it, grinding it all to a perfectly curved outline, as seen from that direction. The face down the valley, on the other hand, is altogether craggy, and shows no sign of the action of ice. The columns are some six or seven feet high and eighteen inches or more thick, they are comparatively roughly shaped, and are more striking seen from a distance than from near at hand.

The wild nook of Cwm Glas is accessible by an easy scramble from the Llanberis road up Snowdon, and is most thoroughly worth a visit. Whether for the desolate grandeur of the cliffs of Crib Goch, for the beautifully perfect evidences of ice action in rounding, grooving, and transporting the rocks, or for the magnificent profusion and luxuriance of the Parsley Fern and Club Moss, one visit will certainly incite to another. If you miss the proper place, it is a pretty steep scramble from the upper valley into the lower which, filled with moraine matter, slopes down to the Pass of Llanberis.

At Llanberis the chief geological interest was the quartz felsite of what is generally considered to be the Archæan ridge, extending for some seven or eight miles in a N.E.-S.W.

direction. This has been, as thin sections show, very much crushed; the quartz shows the uneven extinction between crossed nicols, evidencing a certain amount of distortion, and the felspars have, in several instances, been somewhat broken up. Nevertheless, parts of the mass, noticeable by Cwm-y-glo, near the foot of Llyn Padarn, show the flow structure very beautifully. The conglomerate, which is immediately over the felsite, is made up, in great part, of pebbles derived from it, but there are also fragments of various other felsites and quartzites, and the whole is set in a paste, composed of the fine dust of the same rocks. This conglomerate has also been subjected to the crushing mentioned as having affected the compact rock, and has to some extent taken on a roughly schistose character.

Mr. Harker points out that the most intense cleavage and metamorphism of the Welsh slates is met with just along the S.E. face of this old ridge of hard rock, as if the whole of the country had been squeezed against it.

The walk from Llanberis to Snowdon Ranger by Maes Cwm has no feature of special interest until the head of the valley is reached, when the beautiful diversified country from Nantlle to Rhyd-ddu lies before us, with the magnificent ruddy face of Snowdon rather further round to the left. Just across the lake (Llyn Cwellyn) is the fine mountain mass of Mynydd Mawr, composed of a rock which contains a mineral hitherto only met with in some three other localities, viz., Socotra, Ailsa Crag, and Corsica. This is the form of hornblende, called Riebeckite, containing an unusually large percentage of soda, and distinguished optically by its deep blue colour in certain directions. The changes of colour, as the mineral section is rotated, using the polarizer only, are rivalled only by blue tourmaline; but, where the crystals have a prismatic habit, the deepest blue is assumed in a position at right angles to that which would be the case with tourmaline.

Our time only allowed of a rush to the hill, a hurried collection of a few specimens, and a rush back to the station to catch the train for Rhyd-ddu *en route* for Beddgelert.

The Snowdon Ranger Station presents a considerable contrast to New Street Station. There appeared to be one official, and he, very sensibly, was that day filling up the wide gaps in his duties by haymaking in the field which adjoined the line. The train was late (it was Bank Holiday), and yet it seemed to come too soon, disturbing our quiet rest on the grassy bank of the little station, in full view one way of the quiet lake, and in the other of the grand mass of Snowdon, with his precipices, buttresses, and peaks.

The next morning was not promising in the matter of weather for our projected walk across to Tan-y-Grisiau—in fact, there was quite a considerable rain, but we had to go, even if Cynicht had to be avoided; so off through the Pass of Aberglaslyn, turning off just past the bridge into the old road to Tan-y-bwlch, which is not much more than a cart track. In the marshy bit of country called Bwlch Gwernog there are some very finely-rounded rocks, the best preserved being of a rather coarse-grained ophitic dolerite.

Just where the road comes to the edge of the deep, straight valley of Cwm Croesor we get a view of Cynicht, the mountain which, from the coast near Portmadoc, presents so much the appearance of a miniature Matterhorn, standing up conical, and apparently solitary, to the west of the confused mass of Moelwyn.

It is, however, on a manageable scale, and there is only about ten feet of anything at all awkward to get up. The view from the top must be very fine in favourable weather; we, unfortunately, had only disjointed glimpses. The beautiful Nant Gwynant from Beddgelert to Pen-y-gwryd lies apparently at your feet, the little inn standing out distinctly at the upper end of it. The slope into Cwm Croesor is steep and stony, although it is said to be a practicable way down—but looking north it is plain that Cynicht is not all that it pretends to be—in fact, the face looking towards the south is only the abrupt end of a long and gently sloping ridge.

On the very top there is a curious irregularly shaped mass of rock of a nature quite different from anything *in situ* around it. Cynicht is made of slate, while this rock, 7ft. by 4ft. by 2ft., is of one of the basic igneous rocks much weathered. It would appear to have needed the aid of ice to place it in its present position; and, indeed, looking down from the top there is plentiful evidence of the former abundance of this earth-shaping tool. A low depression in the hills to the west is especially rounded off in all ways which face north.

A steady walk along the ridge of the mountain brought us to the most curiously abrupt termination of it, where it ended as a low ledge about 18in. high against a rugged mass of dolerite, of which there are many beautiful varieties in this desolate region. Some of them are most perfect examples of ophitic structure, and one which we collected shows, in a particularly good manner, the building up of skeleton crystals by octohedra of magnetite.

A rough miners' path at last brought us to the head of Cwm Orthin—a valley that must have been beautiful before the waste of the slate quarries covered so much of its surface;

and what is there in the way of mining waste which is more absolutely and defiantly unpicturesque than slate? It remains so clean and fresh-looking, there seems no chance of friendly moss or lichen covering, at any rate within reasonable time, its staring ugliness. No ferns hide in the interstices as in those of the limestone waste of many of our lead mines, and altogether blast furnace slag heaps seem to me distinctly less obtrusively ugly. However, passing down the valley, we came in sight of what Sir A. Ramsay describes as one of the finest displays of ice action to be seen in Wales. We thought we had seen a good deal during our little walk, but certainly here we had come upon something which eclipsed it all. The grooving and rounding of the hillsides and the perched blocks abound on every hand, and the valley certainly should be visited by anyone interested in glacial matters.

At Tan-y-Grisiau our walk ended, and only those who have had a similar week, with just enough gentle scientific and natural history interest to keep them always on the watch, can understand the pleasure with which we look back to it.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 95.)

* **G. fluitans.** 58, Severn D. Tab. 33. In all the districts.

G. plicata. 58, Severn D. Tab. 33. In all the districts. *First record.*

G. pedicillata. Tab. 34. Avon D. Not in text.

* **Schlerochloa distans.** 33, Saldon; 36, Droitwich Canal. Tab. 34. Avon, Severn.

* **S. rigida.** 58, Severn D.; 125, Clent Hills. Tab. 33. In all the districts.

* **Briza media.** Tab. 34. In all the districts.

* **Catabrosa aquatica.** 14, 58, Severn D. Tab. 34. In all the districts.

* **Cynosurus cristatus.** Tab. 34. In all the districts.

* **Dactylis glomerata.** Tab. 34. In all the districts.

Festuca uniglumis. Tab. 97. Wall at Eckington. Tab. 34, Avon. *First record.*

* **F. bromoides.** 14, 58, Severn D. Tab. 34. Avon, Severn, Malvern.

* **F. Myurus.** 131, Scott. Tab. 34. In all the districts.

* **F. ovina.** 58, Severn D. Tab. 34. In all the districts.

* **F. sylvatica.** 19, Shrawley Wood. Tab. 34. Severn. Extinct.

* **F. gigantea.** Tab. 34. In all the districts.

* **F. elatior.** Tab. 34. In all the districts.

* **F. pratensis** and var. **loliacea.** Tab. 34. In all the districts.

* **Bromus erectus, B. asper, B. sterilis.** Tab. 83. In all the districts.

*† **B. diandrus.** 58. Said to have occurred at Severn Stoke. Tab. 34. Severn. *An error?*

* **Serrafalcus secalinus.** 93, Cracombe and Coldknap Hills; 131, Scott. Tab. 34. Rare in Avon, Severn, Malvern, Doubtful in Lickey.

* **S. racemosus.** Tab. 34. Avon, Severn, Malvern.

* **S. commutatus.** 58, Severn D. Tab. 34. In all the districts.

* **S. mollis.** In all the districts. *First record of the type.*

* **Brachypodium sylvaticum, B. pinnatum.** Tab. 34. In all the districts.

* **Triticum caninum, T. repens.** Tab. 34. In all the districts.

* **T. acutum (laxum).** 38, Droitwich Canal, Tab. 34. Severn,

* **Hordeum sylvaticum** (*Elymus europæus*). 68, 72, woods on western side of Malvern Hills. Tab. 34. Malvern.

* **H. pratense.** 58, Severn D. Tab. 34. In all the districts.

* **H. murinum.** Tab. 34. In all the districts.

* **Lolium perenne.** Tab. 34. In all the districts.

‡ **L. italicum.** Tab. 35. Partially naturalised.

* **L. temulentum.** Tab. 35. Malvern.

* **L. multiflorum,** xxxi. *Not native. Not in Table.*

* **Allosorus crispus.** 75, Worcestershire side of the Herefordshire Beacon. Tab. 35. Malvern.

* **Polypodium vulgare.** Tab. 35. In all the districts.

P. Phegopteris. 88. *Not in Table. Very doubtful.*

* **P. Dryopteris.** 18, Shrawley Wood; 75, Malvern Hills; 123, possibly in Dale's Wood, Romsley. Tab. 35. Severn, Malvern, doubtfully in Lickey. I fear extinct in all its Worcester localities.

P. calcareum. 104, Broadway Hill; chiefly in Gloucester; one locality possibly in Worcester. Tab. 35. Avon. *First record of the true species.*

* **Lastrea Oreopteris.** 30, Wyre Forest: 75, Malvern Hills; 86, 87, Teme Valley; 115, Lickey; 119, formerly at Moseley. Tab. 35. Severn, Malvern, Lickey.

* **L. Filix-mas.** Tab. 35. In all the districts.

* **L. spinulosa.** Tab. 35. In all the districts.

* **L. dilatata.** Tab. 35. In all the districts.

* **Polystichum aculeatum** and var. **lobatum.** Tab. 35. Severn, Malvern, Lickey.

* **P. angulare.** 30, Severn Valley; Malvern. Tab. 35. Severn, Malvern, Lickey. *Now become rare in all its localities.*

* **Cystopteris fragilis.** 87, Teme Valley; 100, Broadway; 101, Bredon Hill; 115, formerly at the Lickey. Tab. 35. Avon, Severn, Lickey.

* **Athyrium Filix-fœmina.** Tab. 35. In all the districts.

var. rhæticum. Tab. 35. Malvern.

* **Asplenium Adiantum-nigrum.** Tab. 35. In all the districts.

* **A. Trichomanes.** Tab. 35. In all the districts.

* **A. Ruta-muraria.** Tab. 35. In all the districts.

* **A. viride.** 87, 88, on Ham Bridge. Tab. 35. Extinct.

* **Scolopendrium vulgare.** 30, Severn D. 81, Teme Valley. Tab. 35. In all the districts.

* **Ceterach officinarum.** 31, two localities in Severn district, just without boundary line. *Sporadic in Severn district, W. M.!* 75, Add. and Corr., Malvern. 95, Badsey; Purton, *fide* Rufford. 123, garden wall at The Leasowes; *formerly in great abundance, now extinct.* Tab. 35.

* **Pteris aquilina.** Tab. 36. In all the districts.

* **Blechnum boreale.** Tab. 35. Severn, Malvern, Lickey.

* **Osmunda regalis.** 9, 14, 30, two localities near Kidderminster; 119, Moseley Common. Now extinct.

* **Botrychium Lunaria.** 6, 9, 14, Warshill and Habberley; 87, Shelsley; 101, Bredon Hill, Nash; 138, Bordesley, near Tardebigg; Add. and Corr., in great abundance at the Upper Lickey, near the Obelisk, June, 1867, W. M.! Tab. 36. In all the districts.

* **Ophioglossum vulgatum.** Tab. 36. In all the districts.

* **Lycopodium clavatum.** 6, Winterdyne, near Bewdley; 10, 14, Hartlebury Common. Tab. 36. Severn, Lickey. *Not localised in Lickey district, Upper Lickey, Rev. H. Boyden, 1885. Walton Hill, Mr. Amphlett. High Wood, Randans, 1885, Mr. Humphreys.*

L. alpinum. 10, 14, Hartlebury Common; once gathered in 1836 by the Rev. Churchill Babington and Mrs. Waller, of Stourport. *In Professor Cardale Babington's Herbarium! Now referred by him to L. complanatum.* Tab. 36. Severn. Extinct. *First record.*

* **L. Selago.** 119, formerly at Moseley. Tab. 36. Lickey. Extinct.

* **L. inundatum.** 11, 14, Hartlebury Common, abundant. Tab. 36. Severn.

* **Equisetum arvense, E. Telmateia, E. sylvaticum, E. limosum, E. palustre.** In all the districts.

* **E. hyemale.** 5, 6, Wyre Forest; 88, Sapey Brook; 119, formerly at Moseley Bog; 123, Frankley; 126, Romsley; Tab. 35. Severn, Malvern, Lickey.

* **Chara flexilis.** 65, Malvern Chase. Tab. 36. Avon, Severn, Malvern.

* **Ch. vulgaris** (*fœtida*). 65, Malvern Chase. Tab. 36. Severn, Malvern.

* **Ch. hispida.** 141. *Not localised.* (*Longdon Marsh.*) Tab. 36. Malvern,

* **Ch. tomentosa.** 96, formerly at Feckenham, Purton. Tab. 36. Avon. Extinct.

Ch. fragilis. 141. *Not localised.* Tab. 36. Malvern. *First record.*

(*To be continued.*)

Scientific Gleanings.

MARINE BIOLOGICAL STATION IN JAMAICA.—It is proposed to establish an observing and experimental station, to be called the "Columbus Marine Biological Station," in Jamaica. This will be the first ever yet made within the Tropics, and the great results which have followed from the efforts of private enterprise in such waters (as of Professor Haeckel in Ceylon, and of Professor Brooks in Kingston Harbour) would lead us to expect a relatively enormous increase in our knowledge of marine biology, when a public institution, properly equipped for the purpose enters upon the work. The scheme is intended to serve as a part of the commemoration of the fourth centenary of the discovery of America.

THE REVIVESCENCE OF ROTIFERS.—Dr. Faggioli, of Genoa, has recently demonstrated the untruth of the always doubtful story that rotifers which had been completely dried could be revived by the application of water. He has shown that a rotifer, once really dried, cannot by any means be restored to life again. But he has also shown how the error of the old experimenters originated. They always dried the animalcules on the sand or mud at the bottom of the water in which they had lived; this sand or mud contained the ova, which are not affected by the drying, and, on the reapplication of moisture, there arose a new generation from the eggs, which they mistook for a survival of the former one.

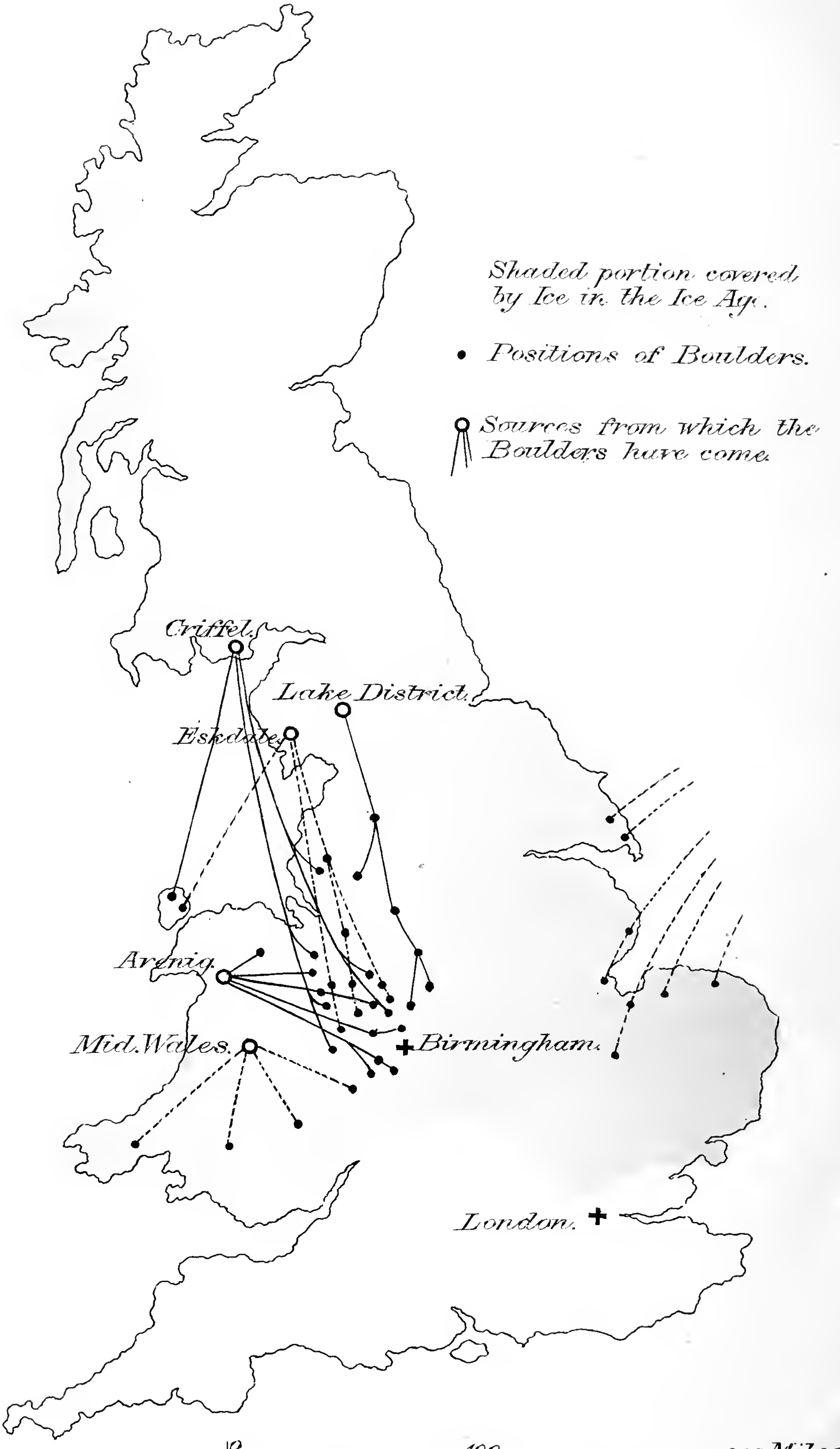
CAN HYDRA LIVE IF TURNED INSIDE OUT?—The oft-quoted assertion of Trembley to this effect has long formed a commonplace of those writers on natural history who retail its marvels for an unscientific public. Some Japanese naturalists have now demonstrated that, though hydra can live for some time in this condition, it is very uncomfortable, and makes every effort to get right side out again. There is no proof that the ectoderm and the endoderm ever interchange their functions, and thus the wonderful part of the story (viz., that the new cavity acted as a stomach and digested food as well as the old one had done) must be regarded as an exploded fable.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION. March 1st. Mr. J. F. Goode in the chair; twenty members present. Mr. C. J. Watson exhibited a fine series of sections of fern petioles, and read a brief but interesting descriptive paper dealing with their structure, and further illustrated his remarks with the aid of the lantern. A keen discussion followed, and a hearty vote of thanks terminated the meeting.—MICROSCOPICAL SECTION. April 5th. Mr. J. F. Goode (President) in the chair. Mr. C. Pumphrey exhibited a fine series of flowers then in full bloom in his garden, amongst which may be mentioned *Daphne Mezereum*, *Primula viscosa*, *Anemone triloba*, purple and white varieties, *Helleborus fœtidus*, &c., &c. Mr. T. V. Hodgson exhibited Baker's small portable microscope. Mr. W. P. Marshall then gave a demonstration on using the compound microscope. Mr. Marshall took the whole of the society's instruments and his own in turn, under which objects were suitably exhibited, and fully explained the management of the light, and the results obtained by the various accessories. A prolonged discussion followed, and a hearty vote of thanks to Mr. Marshall concluded a lengthy and well attended meeting.—BIOLOGICAL SECTION. April 12th. Mr. John F. Goode (President) in the chair. Mr. Steele Elliott exhibited a specimen of the Long-tailed Field Mouse (*Mus sylvaticus*). Mr. W. B. Grove exhibited the root stock of Arrowhead (*Sagittaria sagittifolia*), from the River Cole, near Coleford. Professor T. W. Bridge exhibited skeletons of several species of fishes (Siluridæ), and called attention to the spines with which they were armed. These, he said, served a double purpose both as weapons of offence and defence, and also as organs for the production of sound, the construction of which organs and the mode of producing sound he explained. He also exhibited a beautifully preserved collection of marine invertebrata, which had been received recently from the marine zoological station at Naples, amongst which was a specimen of *Balanoglossus minutus*, one species of a genus representing the oldest and most primitive type of vertebrate structure. A vote of thanks was accorded to Professor Bridge.—MICROSCOPICAL SUB-SECTION. April 15th. Mr. T. V. Hodgson occupied the chair, and Mr. J. Edmonds gave a demonstration in dry mounting. An adjourned meeting was held on April 22nd to put into practice the instruction given.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—March 21st. Mr. W. Tylar read a paper "A Tour on the Continent," Part II., illustrated by lime-light pictures. The views were a series of photographs taken in France, Germany, and Holland. The German pictures were chiefly taken on the Rhine. Some of the instantaneous views of market places, crowded piers, and timber rafts were much appreciated.—March 28th. Special. GEOLOGY. Mr. J. Madison exhibited specimens of trilobite, *Phacops caudatus*, from Sedgley; Mr. Rolan, fossils from Oolite of Cheltenham; Mr. Linton, a collection of Ammonites, from Whitby. Mr. J. W. Neville, a section of Carboniferous Limestone, showing foraminifera *in situ;* Mr. W. J. Parker, *Actinophrys sol*; Mr. H. Hawkes, flea of monkey, and galls of ground ivy with the gall-fly.—April 4th. Mr. H. Hawkes showed specimens of fossil corals and peculiar water-worn stones from Scotland; Mr. Rolan, specimens of *Terebratula biplicata*, from the Cotswold Hills; Mr. J. Collins, the following plants: *Dianthus prolifer*, *Anagallis cœrulea*, and *Bupleurum aristatum*.—April 11th. Mr. J. Madison exhibited specimens of *Planorbis complanatus* and *Limnæa peregra*, both curiously contorted; Mr. G. H. Corbett, *Lima gigantea*, from Lower Lias, Harbury, and other localities. Mr. Matley then read a paper on "The Anodon." The writer said this mollusc could be found plentifully in the pools and canals of the district, and was very available for biological purposes. If one was placed in a small vessel of clear water, the current could be seen passing in and out of the posterior end. When one valve was removed the creature could be examined in detail. The different parts were then described—the branchiæ, ciliated epithelia, and directions of the currents, the circulatory system, digestion, kidneys, liver, and nervous system, the latter being of a very simple type and consisting only of a few ganglia, one of the nerves going to the auditory sac in the foot. The creature was unisexual. The reproductive organs were described, and the ova traced until they emerged from the mantle in a sufficiently advanced state to begin the battle of life. A discussion closed the meeting.

Ice Age.



W. P. Marshall, Del. Herald Press. Lith.

ON THE ICE AGES, PAST AND FUTURE, AND THEIR CAUSES.*

BY W. P. MARSHALL.

There is irresistible evidence of an Ice Age having existed at some former period, in which this country, with the northern portion of Europe and America, was covered by a continuous ice sheet of great thickness. This covered all Scotland and the greater portion of England, and there is distinct evidence that the portion of the country where we are now living was at one time completely buried under a continuous mass of ice. In the accompanying map (Plate 4), for which I am indebted to the kindness of Dr. Lapworth, the shaded part shows the portion of the country proved thus to have been glaciated, extending southwards from Birmingham to half-way between Worcester and Gloucester, to the extremity of South Wales on the west, and nearly as far south as London on the east.

The evidence of this *Ice Age* is of two kinds. First, the presence over a large extent of the country, towards the southern boundary of the shaded area, of great numbers of *boulders*—fragments of rock of various sizes up to several feet in diameter, which are totally distinct from the strata of the locality, and have been identified by careful examination as fragments of the mountains of Wales, Cumberland, and Scotland. These are indicated on the map by lines from five different centres:—

Mid Wales	from	50	miles distance,	grits.
Arenig (Snowdon district)	,,	80	,, ,,	felstones.
Eskdale (Cumberland)	,,	120	,, ,,	granites.
Lake District (Helvellyn)	,,	130	,, ,,	felsites and granites.
Criffel (Dumfries, Scotland)	,,	170	,, ,,	granites.

Boulders are also found on the east coast that are considered to have been conveyed from Norway.

There are no intermediate sources from which these boulders can have been obtained, and there is no other known means of transport for these blocks than conveyance upon a glacier. Fragments of exposed rocks split off by frost action or otherwise and falling upon a glacier, rest upon the surface and are carried forward, slowly but continuously, by the constant gradual flow of the glacier down from the higher

* Read before the Birmingham Natural History and Microscopical Society, May 17th, 1892.

mountain regions to the lower plains; and they are finally left stranded at the foot of the glacier, or dropped higher up when the glacier subsequently retreats on account of the melting of the ice being then at a greater rate than its supply. This process is seen regularly going on at the present day in the glaciers of Switzerland and Norway, in the elevated mountainous regions of those countries where the temperature is low enough, on account of their elevation, to retain ice continuously frozen all the year round.

The second kind of evidence of the Ice Age is the occurrence of extensive longitudinal grooving and striation of the exposed rocky sides of the valleys leading from the northern mountainous parts; which can only be accounted for by the passage of a glacier that filled up the valley carrying imbedded in it numerous fragments of hard rock, that have acted as cutting and grooving tools of enormous power, under the pressure of the superincumbent weight of many hundreds, and in many cases no doubt, thousands of feet thickness of ice in the glacier. This grooving and striation of the rocks is distinctly seen in numerous cases in the valleys of this country; and in Norway it is shown on a gigantic scale, extending to a height of more than 3,000 feet up the valley sides, showing that they were at some former time filled up to that level by glaciers, which ground away the exposed faces of the rocks in their continuous flow.

There is one other country, Greenland, that directly illustrates at the present day the state of things that must have existed in this country at the period of the Ice Age. Greenland is now completely covered with an enormous sheet of ice, which has been ascertained to extend in the middle of the country to a height of 8,000 feet above the sea, and may be considerably higher further north. This ice mass is constantly flowing down to the sea, on both the east and west coasts, in numerous gigantic glaciers, which terminate in abrupt ice cliffs at the sea shore, that are continually breaking off and forming enormous icebergs. These gigantic glaciers are far beyond the Swiss and Norwegian glaciers in size and extent, and in the rate of their motion, and they travel nearly as much in a day as those do in a whole year.

In connection with this subject a special interest attaches to the recent remarkable exploration of Greenland by Dr. Nansen, who succeeded in crossing for the first time the gigantic mass of snow and ice, extending no less than 260 miles in width from sea to sea; and he was thus enabled to study the circumstances similar to those that must have existed in this country at the time of the Ice Age. Greenland is an immense extent of country, nearly 2,000 miles in length from north to south, and 800 miles in width in the northern portion, covered entirely with a continuous ice sheet, excepting only a narrow inhabited fringe on the south-western coast.

The thickness of the ice in the ancient glaciers of the Ice Age is indicated by the height above the floor of the valleys to which the glacier groovings and striations are seen; in Llanberis Pass, for instance, on the flank of Snowdon, these show a thickness of several hundred feet in the glacier that flowed down the pass, and in the Norway Fiords a thickness is shown of more than 1,000 feet.

The fact of the previous existence of an Ice Age has long been established; but all the suggestions made as to the producing cause of the Ice Age were found insufficient to account for so gigantic a phenomenon, until the remarkable investigation of Croll, showing that the cause was not in any changes in the earth itself, such as changes in the ocean currents, by volcanic agency altering the levels of the earth's surface and disturbing the currents; but that the cause was entirely external to the earth, and due to disturbances in the motion of the earth, that were produced by the action of other members of the solar system, and had the effect of altering the position of the earth in relation to the sun, which is the source of all the heat received by the earth. These changes in the motion of the earth are exceedingly slow in their progress, and extend over enormous periods of time.

There are two entirely distinct sets of perturbations in the earth's motion that are combined in bringing about an Ice Age, and their combined effect is exceedingly irregular in amount at different periods; but the total possible disturbance is limited to an amount which, though very large in its effects upon the climate of the earth at the different periods, is in itself only a small fractional disturbance of the earth's standard or normal motion.

One set of the perturbations is caused by the attraction of the sun and moon conjointly; this change is periodic and regular, all the change being passed through in a definite time, and thus the whole change is exactly repeated. The period of this change is as great as 21,000 years; but this period, though so long a time in relation to the inhabitants of the earth, sinks into insignificance when compared with the other set of perturbations, which extend over the enormous periods of a quarter of a million years to more than a million years.

The second set of the perturbations is caused by the attraction of the two planets Jupiter and Venus, and to a slight extent also by the other planets of the solar system. The discovery by Croll of this cause of the Ice Age has been further worked out by Geikie and others, and recently by

Ball, who has contributed a further step in completing the explanation; and this discovery of the *astronomical* cause of the Ice Age is a remarkable triumph of mathematical calculation based upon very careful and accurate observations.

The first named of the two disturbing causes that bring about the Ice Age, namely the action of the *Sun and Moon*; consists in a continued shifting of the *direction of the polar axis* of the earth. This axis is inclined 23° to the vertical, and at the present time it points nearly to the pole star; but each year it points to a spot slightly more eastward, and continues this slow change in direction until in a period of 10,500 years it will have made half a revolution, and will point to a spot as far removed from the zenith on the opposite side to the pole star; and the bright star Lyra will then take its place as the pole star of that future time; while a further period of 10,500 years will bring it back to its present position. The former occurrence of the above event may even have been within the period of human history, for there is some ground for thinking that Lyra was actually the pole star at the time of the building of the oldest Egyptian pyramid, from some astronomical considerations connected with its structure and position.

This gradual and regular change in the direction of the earth's axis has long been known as the *Precession of the Equinoxes*, and is caused by the attraction of the sun and moon (principally the sun) upon the protuberant portion of the earth round the equator; the earth being not truly spherical, but orange-shaped and bulged at the equator to the extent of $\frac{1}{300}$th part of its diameter. In consequence of the inclination of the axis of the earth, this protuberance is thrown out of the direct line of the pull exerted by the sun upon the earth, which causes a tendency to pull it back into that direct line; and if there were nothing to counteract this action the ultimate result would be to bring the axis of the earth gradually more vertical until it became quite vertical, and without any inclination. But the rapid rotation of the earth upon its axis—a speed of 1,000 miles an hour at the equator—causes it to oppose a stubborn resistance to any change in its *inclination*, and the only result of the pull is to cause the *direction* of the axis to shift gradually *sideways*, preserving the same inclination, and gradually rolling completely round, and returning to its original direction. This action is well known in the gyroscope, or in an ordinary spinning-top going to sleep.

The present consequence to us of the inclination of the earth's axis is the difference between winter and summer; in summer the north pole is inclined towards the sun, and our day is consequently longer than our night; and in winter the opposite takes place, and the north pole is inclined from the sun, so that the night is longer than the day. At the half way points, namely the spring and autumn equinoxes, the day and night are of equal length; and, if the axis of the earth were not inclined but vertical, the same would be the case throughout the whole year, and no variation of seasons would take place.

The seasons in the southern hemisphere are the opposite of those in the northern, the summer being there at the time of our winter; and the result of the reversal in the direction of the earth's axis every 10,500 years, would simply reverse these conditions, causing our summer to be at Christmas and our winter to be in the middle of the year, without any change affecting severity of climate or leading to the occurrence of an Ice Age; but there is another cause in action that bears upon this, and the result of the two causes acting combined makes a very important difference.

The earth's annual orbit round the sun is not a concentric circle, but an ellipse that closely resembles an *eccentric* circle, that is a circle in which the sun is out of the centre, so that at one part of the year the earth is nearer to the sun than at the opposite part of the year. Now, it so happens that at the present time the period of our winter occurs when the earth is in that part of its orbit that is nearest to the sun (or at the perihelion); and the result is that our winter is milder than that of the southern hemisphere, which occurs when the earth is farthest from the sun (or at the aphelion). The amount of the eccentricity of the earth's orbit is at the present time very small, and only 1-60th part of the distance of the earth from the sun, so that the reversal of the conditions of winter and summer would only cause our winter to be somewhat colder than at present, and to be similar to the winter of the southern hemisphere at the present time, and would not approach the conditions of an Ice Age.

We now come to the most important of the two causes that bring about an Ice Age—this is, a change in the *amount of the eccentricity* of the earth's orbit, which is constantly going on, but with extreme slowness; and it is calculated that at one period, 200,000 years ago, the eccentricity, instead of being only 1-60th part as at present, was as great as 1-18th part of the earth's distance from the sun; and that the earth was farther from the sun by that amount at one part of its orbit, and as much nearer at the opposite part.

This disturbance in the earth's orbit is caused mainly by the attraction of the two planets, Jupiter and Venus. Venus is the nearest to us of the planets, and nearly as large as the earth ; but Jupiter, although so much farther off, being at fifteen times the distance of Venus, is of the most importance on account of being the largest planet in the solar system, and 340 times the weight of the earth, and the attraction of Jupiter is twice as great as that of Venus. The other planets have all some effect in disturbance of the earth's orbit ; but their effect is a comparatively small amount in the calculation ; Mars, which is intermediate between Jupiter and the earth, being only one-eighth part of the weight of the earth ; and Saturn, the next beyond Jupiter, although 250 times the weight of the earth, is at double the distance of Jupiter, and the force of attraction diminishes in proportion to the square of the distance.

The earth travels round its orbit in a year, and Jupiter takes twelve years to go round, so that the earth passes Jupiter in its course about every thirteen months, and those are the times when Jupiter becomes such a brilliant object in the heavens ; and on each of those occasions the earth gets pulled a little further away from the sun.

Venus travels round in its orbit nearly twice for each revolution of the earth, the time of its revolution being 7½ months ; and in the race round the sun Venus passes the earth about every twenty months, and at those times the earth gets pulled a little nearer towards the sun, excepting when Jupiter happens to be passing at the same time, and then the attraction of Jupiter being twice as great as that of Venus, the result is a pull of the earth away from the sun as the balance of the two forces. Taking the force of attraction of Jupiter as represented by 100 when nearest to us, that of Venus is about 50 when nearest, but only about 1 when at the farthest position on the other side of the orbit, and the attraction of Jupiter is about 40 when at its farthest position. The greatest disturbing effect upon the earth's position in pulling it away from the sun is when Jupiter is at the nearest and Venus at the farthest position, Jupiter being outside the earth's orbit and Venus inside, and the result is a pull outwards amounting to the difference of 100 and 1, or **99**. The greatest effect in the opposite direction, pulling the earth *inwards* towards the sun, is when Jupiter is at the farthest position and Venus at the nearest, and the result is the sum of 40 and 50, or **90**. The pull *outwards*, when both planets are in their nearest positions, is the difference of 100 and 50, or **50** ; and when they are in their farthest positions the pull inwards is the sum of 40 and 1, or **41**.

The changes in the eccentricity of the earth's orbit are the result of the earth being pulled *outwards* at some periods and pulled *inwards* at others, but the combined effect of the two planets in this action becomes an extremely intricate calculation, on account of the great number of possible combinations of their relative positions ; and an enormously long period of years is required for all the possible changes of combination to be rung out. The *average* distance of the earth from the sun throughout each revolution in its orbit is unchangeable, and all the disturbance caused by the interference of the planets is simply a change in the shape of the orbit, making it more or less eccentric and elliptical. The extreme amount of the possible change in the orbit is also strictly limited, because of the overpowering control exercised by the attraction of the sun, which is more than 700 times the weight of all the planets added together ; and he compels them to follow their due courses, although allowing some minor interferences to go on amongst them.

For the production of an Ice Age in our northern hemisphere, a combination has to take place of the two causes that have been mentioned, namely the change in *eccentricity* of the earth's orbit, and the change in *direction* of the earth's axis. The *eccentricity of orbit* has to be so much that the distance of the earth from the sun at the extreme point is materially increased, and the proportion of heat received from the sun at that point is consequently materially diminished ; also the *direction of the axis* of the earth at the time has to be such as to give winter to the northern hemisphere when the earth is at the greatest distance from the sun, the north pole of the earth being directed *outwards* at the time instead of inwards as it is at this present time, when the earth is farthest from the sun.

If the north pole happened to be directed *inwards* at that point of the earth's orbit, it would then be summer in our northern hemisphere, and the result would be simply an exceptionally cool summer, and a corresponding very mild winter ; and this will be the case in the southern hemisphere, whenever an Ice Age occurs in the northern hemisphere.

If the occurrence of an Ice Age depended alone upon the change in direction of the earth's axis, it would occur every 21,000 years ; and this will be still the shortest period possible for the recurrence of an Ice Age, but the requisite conjunction of the second cause, the change in eccentricity of the earth's orbit, prolongs the possible period to nine and a half of these periods, or as long a time as 200,000 years.

The remarkable calculations made by Croll of the changes in the eccentricity of the earth's orbit that must have occurred during the last 200,000 years show that the eccentricity, which is 1-60th part at the present time, was rather less 50,000 years ago, but was as much as 1-21st part 100,000 years ago; it had previously been reduced to 1-30th part, but at the period of 200,000 years ago, the eccentricity had reached the very large amount of 1-18th part. This period corresponds also to one of the periods when the winter in our northern hemisphere occurred at the farthest extremity of the orbit, and the greatest distance from the sun; and it has been calculated by Croll that the result of the two causes combined would be that the average temperature of our mid-winter would be 37° colder than at the present time, and would be sufficient to produce the Ice Age.

It has been shown by Ball that the total amount of heat received by the earth from the sun during each year is divided into two equal portions by the line of the equinoxes, and that only the same total amount of heat is consequently received during the winter portion of the year, as in the summer portion; and that the tendency to an Ice Age depends upon the difference of time of the earth traversing these two portions of its orbit. Not only is the length of orbit greater in the winter portion, but the time of traversing it is increased by the circumstance that the velocity of the earth in its orbit diminishes when its distance from the sun is increased, and the velocity is increased when the distance is diminished; so that the earth is hurried through the warm part and is retarded through the cold part, increasing the length of time of exposure to the extra cold.

At the present time we are so fortunately situated in the northern hemisphere, that the winter period from the autumn to the spring equinox is shorter by seven days than the summer period from spring to autumn equinox; the first period being 179 days and the latter 186 days out of the 365 days making the year. The consequence is that one half of the total year's supply of heat from the sun to the whole earth is spread over only 179 days during our winter portion of the year, while the other half is spread over 186 days during the summer portion, causing the daily supply of heat during our winter to be greater than it would be if the division were equal. In the southern hemisphere this condition is, however, reversed, and there is consequently an increased cold in winter to the same extent.

When the extreme conditions combine together of the greatest eccentricity of the earth's orbit, and the outward inclination of the earth's axis, the difference of length between the two periods of the year can be exaggerated nearly five times and becomes as much as 33 days, or more than a whole month, the winter period being 199 days, and the summer period 166 days ; so that one half of the year's total supply of heat will then in winter be spread over 199 days instead of 179 days as at the present time, resulting in a lower average temperature and a longer period during which this low temperature will continue, conditions causing the existence of an Ice Age.

The conditions required for an Ice Age are a long and excessively cold winter, during the rigours of which snow and ice accumulate to such an extent that the succeeding brief though hot summer is not able to thaw as much water as has been frozen during the winter. Then the ice grows from year to year, and an ice sheet is formed which extends ultimately far beyond the limits within which the polar ice sheets are at the present time formed. In the southern hemisphere, however, the conditions will then be just reversed, and instead of an Ice Age there will be a genial season, with a short mild winter, and a long moderately warm summer ; the winter will be only 166 days long, and the summer 199 days long, and the heat from the sun during that period will be moderated by the circumstance of the earth being during the time at greatest possible distance from the sun.

There appears good reason to believe that the above named causes would be amply sufficient for the occurrence of an Ice Age ; and the conclusion also arises that, as the causes are continuous in action, there will not only be a repetition of the Ice Age at some future time, but that in the past there has been more than one such occurrence ; and in reference to this last point there has been received some definite geological evidence in its confirmation by the discovery of traces of the occurrence of another Ice Age previous to the last one.

In examination of this point Croll has carried back his calculations of the changes in the eccentricity of the earth's orbit for a period of as much as three millions of years, and has found that there were two other periods in that time when an Ice Age must have occurred. The result of his calculations shows that besides the Ice Age of 200,000 years ago, a previous Ice Age nearly a million years ago, for which he has suggested the name of the *Miocene* Ice Age, and another before that at two and a half million years ago, which he calls the *Eocene* Ice Age. In both these the eccentricity of the earth's orbit is calculated to have been still greater than in the most recent Ice Age, and to have amounted to as much as one-thirteenth part of the earth's distance from the sun, and the average mid-winter temperature is calculated to have fallen as much as 44° below that of the present winters. The calculations were also carried forward by Croll for a million years in advance, and he found that near that time there will occur in the southern hemisphere two other Ice Ages within 100,000 years of each other, intermediate in severity between the previous ones; these Ice Ages will apply, however, to the southern hemisphere only, and will not affect the northern hemisphere.

The general results of the investigation into the causes of the Ice Ages are :—

First, that an Ice Age could occur every 21,000 years in this northern hemisphere, if the eccentricity of the earth's orbit were also suitable at the time; and also every 21,000 years in the southern hemisphere, alternately with the Ice Age in the northern hemisphere.

Second, that an Ice Age can only occur when the earth's orbit is changed to near the limit of its extreme eccentricity, and the earth is consequently removed to a farther distance from the sun than usual during the winter season in the northern hemisphere, amounting to an increase of eccentricity to the extreme of 1-13th part; and that the periods of these changes are enormously large, amounting to from half a million to one and a half million years.

Third, that when a Ice Age occurs in one hemisphere there is during the whole of the time a genial climate in the other hemisphere, with a short mild winter and a long moderate summer.

A question that naturally arises is as to the duration of the Ice Ages—the length of time during which each Ice Age may be considered to have lasted—and there is some definite information towards an answer to this question. The time is necessarily limited within one of the 10,000 years periods during which the earth's axis is inclined on the same side, and after which it becomes inclined on the opposite side, and reverses the seasons from the one hemisphere to the other. The Ice Age must come on gradually after the beginning of the 10,000 years period, and gradually pass off towards the end of that period; so that about half the time, say 5,000 years, may probably be taken as the approximate time of the continuance of an Ice Age. This is a period of which we can form some definite idea, as it corresponds with about the length of time that our knowledge of the history of the inhabitants of the earth extends; and we have consequently to think of this country as having been for a similar time without a history, and most of the time buried under a glacier, as Greenland is at the present time.

The gradual coming on of the Ice Age and the advance of the glacial sheet would thus extend over some 2,000 years; that is a longer time than has now elapsed since the beginning of the Christian era, and so slow would be this march that the change during the lifetime of each generation of men would be almost imperceptible, and by the time that the ice sheet completely covered the country, records of the previous state of things existing as at the present day, would be practically lost in the mist of ages. A similarly gradual process would be the subsequent return march of the retreating glacial sheet from the period of the Ice Age to the present state of the country. The gradual driving inwards that is now in progress of the population of the eastern coast of this country from the continued encroachment of the sea upon the coast cliffs must be looked upon by comparison as quite a rapid process.

It may be remarked that the discovery of the *Astronomical* cause for the Ice Age shows that the old astrologers were not altogether wrong in attributing important influences upon mankind to the planets; they only made the mistake of looking for a direct influence upon individuals, instead of a wholesale influence upon large portions of the human race, by causing such a change of climate for a long period of years upon a portion of the earth as would gradually drive out the whole of the inhabitants, compelling them to migrate to a more southern and a warmer country.

THE BOTANY OF BIDDULPH AND THE NEIGHBOURING PARTS OF NORTH STAFFORDSHIRE.

BY THE REV. W. H. PAINTER,

AUTHOR OF A "CONTRIBUTION TO THE FLORA OF DERBYSHIRE."

The Botany of this part of Staffordshire has been but little attended to by Botanists of former generations, owing to the difficulty of access to it, and there being no main road running through it connecting one large town with another. Hence, in the histories of the county, the plants growing in this part of Staffordshire have received but scant notice in the pages devoted to the Natural History of the county.

The district mentioned in the title of this paper, in which I lived for nearly seven years, I have divided for botanical purposes into three parts, and the Roman numerals attached to the description of the plants show in which division they were found by me. When no such numerals occur, and no remark is made upon a plant, it is to be understood that that plant is *common* in all the three districts.

It may not be amiss if, before proceeding further, I give a brief description of this part of Staffordshire.

I.—THE VALLEY OF BIDDULPH.—This valley is bounded on the West by a long hill, Congleton Edge, along the summit of which runs the boundary line between Cheshire and Staffordshire, which terminates at its southern extremity in Mow Cop Hill (1,091ft.). On the East this valley is bounded by hills of various heights, which terminate at Cloud End, in Cheshire (1,190ft.). Northwards, this valley gradually slopes into Cheshire; and, southwards, it is cut off from the other part of Staffordshire by the high ground which forms the watershed between the streams flowing into the Trent and those which flow into the Mersey.

II.—THE VALLEY OF THE TRENT, or, rather, that portion of it in which I have worked, extends from what I believe to be the source of the Trent on Biddulph Moor, and is locally known as *Trent Well*, to a line drawn across the valley near the church of Norton-in-the-Moors. But, inasmuch as the real source of the Trent is a debateable point, I have included in this division that part of the county through which other streams run which are considered by some to be the head-waters of this river. This division has, therefore, for its *western* boundary a line drawn southwards from Mow Cop to Norton, and for its *eastern* boundary the ridge upon which stand the village and church of Brown Edge.

III.—THE RUDYERD BASIN.—This runs parallel with the Biddulph Valley, being bounded on the north by Cheshire, on the west by Lask Edge, on the east by the North Staffordshire Railway, and extends southwards to Leek. I have not been able to examine the whole of this district, owing to its distance from the house in which I lived.

As the character of a flora depends very much upon the geological structure of a district, a brief description of the geology of Biddulph and its neighbourhood will not be out of place here.

The *Biddulph Valley* lies between two ridges of Millstone Grit; the northern portion of it lying upon a great bed of Drift,* in which recent marine shells have been found; whilst the southern and more elevated portion of it consists of the Coal Measures.

The *Trent Valley*.—The sources of the Trent are upon Millstone Grit; and in its descent, this river runs wholly upon the Coal Measures after it has passed through Knypersley Reservoir.

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* Memoirs of the Geological Survey, 81 N.W., and 81 S.W., p. 78.

Rudyerd Basin.—The geology of this district is more diversified than is that of the others. On Biddulph Moor a small patch of Yoredale rocks occurs; at Rushton Spencer the Permian rocks crop out; and at Rudyerd Reservoir a large piece of Alluvial is to be found, but all the high ground is composed of Millstone Grit.

The whole of these districts was, until the Enclosure Acts were passed, a large tract of moorland. The result is, that here and there patches of ground are to be found representing the former state of the land, upon which plants now grow representing a moorland flora.

The altitudes from which I have worked, taken from the Ordnance Survey maps, 6in. scale, are as follows :—

Biddulph Church	515 feet.
Troughstone Hill	1,017 ,,
Biddulph Park	736 ,,
Methodist Chapel, ditto	960 ,,
Wickenstone Rocks	857 ,,
Lask Edge, summit	1,100 ,,
Rushton Dingle	625 ,,

Rudyerd Reservoir I found to be 600ft. above the sea-level by aneroid, and the altitudes which are given in the following pages have been obtained, for the most part, by actual measurement from the above bases.

Thus it will be seen that this part of Staffordshire lies in the mid-agrarian zone of Mr. H. C. Watson, and is characterised by the presence of such plants as *Ulex Gallii*, *Viburnum Lantana*, and *Calystegia Sepium*.

CENSUS OF PLANTS.

Classes of Citizenship.		*Types of Distribution.*	
Natives	340	British	309
Colonists	5	English	32
Denizens	2	Scotch	6
Aliens	14	Highland	1
Casuals	2	Intermediate	3
	363		351

The total number of plants mentioned in the following pages, omitting those which are known to have been planted within the memory of man, is 389; thus there is a discrepancy between the number of plants seen, and those tabulated above; a fact which is partly accounted for by the arrangement of the Rubi in the London Catalogue, Ed. 8, which has been followed as regards the nomenclature and the species enumerated, differing from that of Mr. Watson's "Compendium."

Bibliography.—"The Natural History of the County of Stafford" by the late Mr. Garner, a book of which it is impossible to speak too highly, contains a good list of the plants in this county, in which several plants growing at Biddulph are mentioned. This and my other two districts Mr. Garner was unable to examine thoroughly, as in his botanical days there were no railroads running through them; and his journeys, as he more than once told me, had to be performed either by gig, or by walking. The County Histories which he consulted, and the records in which he incorporated in his book, are as follows:—Shaw's "Antiquities of Staffordshire," 2 vols., 1798-1801; Pitt's "Topographical History of Staffordshire," 1817.

If the botany of the whole county were to be given, of course, all the *old* writers, such as Plot and Ray, and the more *modern* ones, such as Watson ("New Botanists' Guide") and the "Natural History of Tutbury," would have to be referred to. But since I do not find any record referring to this part of Staffordshire, quoted from any other than the two mentioned above, I do not think it necessary to say more upon this point. At the end of the list of plants seen by me will be found another list—that of plants having a higher census number than 100 *not* seen by me, in which those plants are included which, there is every reason to believe, have become extinct.

The specimens of the plants mentioned in this list will be handed to the British Museum.

New county records are marked thus:—N.C.R.

Anemone nemorosa, *L.*

Ranunculus peltatus, *Schrank.* II. Knypersley Pools, &c. III. Rudyerd Reservoir. N.C.R.

R. Lenormandi, *F. Schultz.* II. Knypersley Park.

R. hederaceus, *L.* I. Overton. III. Horton.

R. Flammula, *L.*, **acris**, *L.*, **repens**, *L.*, **bulbosus**, *L.*, **Ficaria**, *L.*

Caltha palustris, *L.*

[**Helleborus viridis**, *L.* Grounds of Knypersley Hall; the remains of former cultivation.] Biddulph Castle, *Garner.* Not to be found.

[**Epimedium alpinum**, *L.*
Nuphar luteum, *Sm.* } Knypersley Hall, with the above.]

Papaver dubium, *Sm.* III. Rudyerd Railway Station; a garden weed.

Chelidonium majus, *L.* II. Near Knypersley Hall.

Corydalis claviculata, *DC.* I. Near Biddulph Mill. III. East side of Rudyerd Reservoir, on gritstone rocks.

Nasturtium officinale, *R. Br.* I. Near Biddulph Forge.

N. palustre, *DC.* II. Knypersley Pools; road to Norton-in-the-Moors. III. Rudyerd Reservoir.

Barbarea vulgaris, *R. Br.*

Cardamine amara, *L.* I. Congleton Edge. II. Knypersley Park. III. Near Rudyerd Reservoir.

C. pratensis, *L.* **C. hirsuta,** *L.*

C. flexuosa, *With.* II. Abundant at Knypersley Pools and in the Park. III. Roadsides, abundant. N.C.R.

[**Cochlearia Armoracia,** *L.* II. Near Knypersley Hall; remains of former cultivation.]

Sisymbrium Thaliana, *Hook.* I. Near Biddulph Grange. III. Near Rudyerd Railway Station.

S. Alliaria, *Scop.*

Brassica Rapa, *L.*, var **silvestris,** *H. C. Watson.* III. Horton.

B. nigra, *Koch.* II. Road from Knypersley to Leek; once seen.

B. Sinapis, *Visiani.* I. Biddulph.

Capsella Bursa-pastoris, *Moench.* Common everywhere.

Viola palustris, *L.* II. Near Knypersley Pools; road from Knypersley to Leek.

V. sylvatica, *Fr.*

V. tricolor, *L.*, and **V. arvensis,** *Murr.* I. Biddulph.

Polygala serpyllacea, *Weihe.* I. Near Biddulph Grange, in field. II. Road from Knypersley to Leek. III. Roadsides, Horton.

Lychnis alba, *Mill.* I. Garden, near Mow Cop.

L. diurna, *Sibth.*, **L. Flos-cuculi,** *L.*

L. Githago, *Lam.* I. In an arable field near Wickenstone Rocks; a casual.

Cerastium glomeratum, *Thuill.* I. Biddulph. III. Rudyerd.

C. triviale, *Link.*

Stellaria media, *Cyr*, **S. Holostea,** *L.*

S. graminea, *L.* II. Lane at Mill Hayes.

S. uliginosa, *Murr.* Common in swampy places.

Arenaria trinervia, *L.* II. Road near Knypersley Mill. III. Near Rudyerd Railway Station.

A. serpyllifolia, *L.* I. Woodside, Biddulph.

Sagina apetala, *L.* III. Wall, near Rudyerd Railway Station.

S. procumbens, *L.*

Spergula arvensis, *L.* I. Cultivated ground, Biddulph. III. Horton.

Claytonia alsinoides, *Sims.* II. Grounds of Knypersley Hall and Greenway Bank; alien.

Montia fontana, *L.* In all three districts.

Var. **rivularis,** *Gmel.* III. Near Harracle's Mill, Horton.

Hypericum quadratum, *Stokes.* I. In the Drive from Biddulph Grange to Knypersley. II. Near Knypersley Pools; and in the Park.

H. humifusum, *L.* I. Biddulph, near railway station. II. Biddulph Moor; Lask Edge.

H. pulchrum, *L.* I. Lane at New Pool.

Malva rotundifolia, *L.* I. Biddulph Hall.

Tilia vulgaris, *Hayne.* I. Biddulph, road to Congleton. II. Near Knypersley Park. III. Near Cliff Hall, Rudyerd. Planted.

Linum catharticum, *L.* Heaths, in all three habitats.

Geranium molle, *L.* I. Near Biddulph.

G. Robertianum, *L.* II. Roadsides. III. Near Rudyerd Railway Station.

Oxalis Acetosella, *L.* In all three districts. A variety with dark pink flowers, in Lion's Paw Wood, II.

Ilex Aquifolium, *L.*

[**Acer Pseudo-platanus,** *L.* Planted.]

Ulex europæus, *L.*

U. Gallii, *Planch.* I. Drive from Biddulph Grange to Knypersley. II. Roadsides; common.

Cytisus scoparius, *Link.* I. Whitemoor, Biddulph. II. Knypersley Park. III. Horton.

Ononis repens, *L.* I. Biddulph, approaching **O. spinosa,** *L.* II. Road from Knypersley to Leek.

Medicago lupulina, *L.* II. Near Knypersley Pools. III. Rushton Spencer, &c.

Trifolium pratense, *L.* I. Biddulph. III. Rushton Spencer, &c.

T. medium, *L.* I. Drive from Biddulph Grange to Knypersley.

T. hybridum, *L.* I. Cultivated ground, Biddulph. N.C.R.

T. repens, *L.*

T. dubium, *Sibth.* I. Drive from Biddulph Grange, &c. II. Near Knypersley Mill.

Lotus corniculatus, *L.*, **L. pilosus,** *Beeke.*

Vicia hirsuta, *Koch.* II. Near Knypersley Hall.

V. sepium, *L.*

Lathyrus pratensis, *L.*, **L. macrorrhizus,** *Wimm.*

Prunus communis, *Huds.* I. Biddulph Common. II. Near Rudyerd Reservoir.

P. Padus, *L.* I. Near Gillow Heath, in abundance.

Spiræa Ulmaria, *L.* I. This plant doubtless grows here, but I have no record of it. II. Knypersley Park. III. Near Rudyerd.

Rubus Idæus, *L.*

R. fissus. *Lindl.* III. Growing upon the side of the railway at Rudyerd Reservoir, where it was first pointed out to me by the Rev. W. H. Purchas. Also in Cliff Wood, and roadside, Rushton Spencer, ascending to 1,000 feet upon Lask Edge. N.C.R.

R. plicatus, *W. and N.* Common in all three districts, ascending to 900 feet.

R. affinis, *W. and N.* N.C.R.

Var. **lentiginosus** [*Lees*]. III. On the east side of Rudyerd Reservoir, *fide* Professor Babington.

Var. **cordifolius**, *W. and N.* III. With the above. Respecting this Rubus, Professor Babington wrote :—"I think that this is the proper cordifolius, and closely allied to affinis ; our ordinary cordifolius is only a form of rhamnifolius." Mr. J. G. Baker also found this variety near Harracle's Mill, but I failed to discover his bush.

R. Lindleianus, *Lees.* I. Near Biddulph Forge, &c. II. Near Knypersley Mill. III. Near Horton Church. N.C.R.

R. leucostachys, *Sm.*

Var. **conspicuus** (*P. J. Müll.*). II. Abundant in this district. III. Near Rushton Spencer. N.C.R.

R. danicus, *Focke.* II. Bemersley, near road to Norton; named by Dr. Focke.

R. pyramidalis, *Kalt.* I. Abundant about Biddulph; ascends to 900 feet at the Bride Stones. II. Lask Edge. III. Near Rudyerd Reservoir. N.C.R.

R. Salteri, *Bab.*

Var. **calvatus**, *Blox.* I. Near Biddulph Hall; "agrees with specimen in my herbm. from Mr. Bloxam," *Dr. Focke*, who, notwithstanding this, calls it *R. villicaulis*. N.C.R.

R. carpinifolius, *W. and N.* I. Near The Hurst, Biddulph. III. Near Rudyerd Reservoir. N.C.R.

R. villicaulis, *Koehl.* II. Mill Hayes Lane. III. Near Rudyerd Hotel. N.C.R.

R. Gelertii, *Fridericksen.* III. Near Rudyerd Hotel, *fide Rev. W. Moyle Rogers.* N.C.R.

R. umbrosus, *Auct.*, **R. Maasii**, *Focke*, Lond. Cat. I. Near Hay Hill Farm, Biddulph; ascending to 800 feet on Lask Edge. N.C.R.

R. Lindebergii, *P. J. Müll.* I. With the preceding, *fide* Rev. W. Moyle Rogers. N.C.H.

R. Sprengelii, *Weihe.* Continental botanists consider the var. R. Borreri (Bell-Salter) only a strong form of this species. N.C.R.

R. melanoxylon, *P. J. Müll.* II. Lask Edge, 900 feet, *fide* Dr. Focke and Professor Babington. Mr. J. E. Bagnall, A.L.S., considers this a weak form of R. Salteri, *Bab.*

R. rosaceus, *W. and N.*

Var. **Hystrix**, *Weihe.* III. Roadside between Lask Edge and Rushton Spencer, *teste Dr. Focke*, but not typical. N.C.R.

R. Radula, *Weihe.* I. Near the Bride Stones, Biddulph Common; near Woodside Colliery, an unusual form, *Dr. Focke;* Lask Edge, 900 feet. N.C.R.

R. Koehleri, *Weihe.*

Var. **pallidus**, *Bab.* In all three districts; very common. N.C.R.

R. distractus, *P. J. Müll.* III. Near Rudyerd Hotel, *fide Dr. Focke.* Nyman, "Conspectus," p. 226, places it under R. Koehleri, *Weihe.* N.C.R.

R. Bellardi, *Weihe.* I. The drive from Biddulph Grange. N.C.R.

R. corylifolius, *Sm.* III. Rushton Spencer. Var. not determined.

Var. **purpureus**, *Bab.* II. Mill Hayes Lane, *Mr. J. E. Bagnall, A.L.S.* N.C.R.

R. cæsius, *L.* I. Between Biddulph and Congleton Edge.

Geum urbanum, *L.* I. Biddulph.

G. rivale, *L.* II. Banks of River Trent and canal feeder below Knypersley Mill.

Fragaria vesca, *L.* I. About Biddulph. III. Rushton Spencer and Horton.

Potentilla Fragariastrum, *Ehrh.* **P. Tormentilla**, *Meek.*

P. procumbens, *Sibth.* I. Spring Coppice, Biddulph. II. Fields, Knypersley. N.C.R.

P. reptans, *L.*

P. Comarum, *Nestl.* II. Between Brindley Ford and Newchapel. III. North end of Rudyerd Reservoir.

Alchemilla vulgaris, *L.*

Poterium officinale, *Hook.* II. New Pool, Knypersley. III. Horton.

Rosa tomentosa, *Sm.*

Var. **subglobosa**, *Sm.* Plentiful.

R. canina, *L.*

Var. **lutetiana** *(Léman).* I. Near Bradbury's Pits, Biddulph. III. Rushton Spencer; near Rudyerd Reservoir. A form approaching R. glauca grows in the lane leading from Rudyerd Village to the railway station.

Var. **sphærica** *(Gren.).* III. In small quantity by the side of the River Churnet, north of Rudyerd Reservoir.

Var. **dumalis** *(Bechst.).* II. Mill Hayes Lane. III. Rushton Spencer. A form approaching R. subcristata near Rudyerd.

Var. **biserrata** *(Mérat).* I. Near Bradbury's Pits, Biddulph; and the drive from Biddulph Grange.

Var. **urbica** *(Léman).* I. Biddulph, in several places. III. Rushton Spencer and Horton Common.

f. **platyphylla**, *(Rau.).* I. The Clough, Biddulph.

Var. **frondosa** *(Steven.).* II. One bush only; south end of Knypersley Pool.

Var. **dumetorum** *(Thuill.).*
Var. **verticillacantha** *(Baker)* } One bush of each in the drive from Biddulph Grange.

Var. **coriifolia** *(Fr.).* In all three districts; moderately common.

R. arvensis, *Huds.* Very common.

Var. **bibracteata** *(Bast.).* I. Near New Pool Farm.

The Roses of Staffordshire do not appear to have received much attention.

Pyrus Aria, *Sm.* I. Congleton Road, Biddulph. III. Near Cliff Hall.

P. Aucuparia, *L.*

P. Malus, *L.*

Var. **acerba**, *DC.* I. Gillow Heath. III. Between Rudyerd and Horton. N.C.R.

Var. **mitis**, *Wallr.* I. Biddulph. II. Knypersley Park. III. Near Horton and Rudyerd Reservoir. N.C.R.

Cratægus Oxyacantha, *L.*
Var. **monogyna** [*Jacq.*]. Common.
Var. **laciniata**, *Wallr.* III. Between Horton and Rudyerd, *teste Mr. J. G. Baker, F.L.S.*

Chrysosplenium oppositifolium, *L.*

C. alternifolium, *L.* II. Crowborough Wood.

Ribes Grossularia, *L.* III. On the railway, Rudyerd.

R. alpinum, *L.* I. Knypersley Hall; planted.

[**Sedum reflexum**, *L.* Biddulph Castle; planted. *Garner.*]

Myriophyllum spicatum, *L.* II. Knypersley Pool.

Callitriche stagnalis, *Scop.* N.C.R.

C. hamulata, *Kuetz.* II. Knypersley Park, *Misses Thompson.* III. River Churnet, north of Rudyerd Reservoir.

Peplis Portula, *L.* II. Knypersley Reservoir; only seen once, in 1887, when the reservoir was almost dry.

Epilobium angustifolium, *L.* II. Near Knypersley Pool.

E. hirsutum, *L.* I. Biddulph. II. Near Black Bull Railway Station.

E. parviflorum, *Schreb.*

E. montanum, *L.*

E. obscurum, *Schreb.* II. Knypersley Park. III. Horton. N.C.R.

Hydrocotyle vulgaris, *L.* I. Near to Biddulph Forge. III. North end of Rudyerd Reservoir.

Conium maculatum, *L.* I. Near Biddulph Hall; a casual.

Apium inundatum, *Reichb.* II. Knypersley Pool. III. Rudyerd Reservoir.

[**Cicuta virosa**, *L.* I. Biddulph Hall; planted.]

(*To be continued.*)

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(*Continued from page 118.*)

Having given a *résumé* of the Botany of Worcestershire, by the late Mr. Edwin Lees, I extract from it the new contributions to the flora of the county. The numerical references are to the pages of the "Midland Naturalist."

Vol. XIV., 1891.

‡ **Anemone Pulsatilla.** 16. (*Gloucester.*)

‡ **A. apennina.** 16. Not native. This was first noted in the second anniversary address to the Malvern Naturalists' Field Club, by the Rev. W. S. Symmonds, 1858. It should have appeared in the "Mid. Nat." Vol. XIII., p. 257.

‡ **Adonis autumnalis.** 16. *Extinct.*

Ranunculus Lenormandi. 16. Lickey district; unlocalised.

‡ Eranthis hyemalis. 17. Not native.

‡ Epimedium alpinum. 17. (*Gloucester.*) Not native.

Papaver Lecoqii. 17.

‡ Glaucium luteum. 17. Not native to the county.

‡ Alyssum calycinum. 17. Not native to the county.

‡ Camelina sativa. 17. Not native.

Thlaspi perfoliatum. 18.

‡ Iberis amara. 18. Not native to Worcestershire.

‡ Isatis tinctoria. 18. (*Gloucester.*)

Sagina ciliata. 19.

‡ Geranium nodosum. 38. Not native.

Medicago denticulata. 40.

Melilotus arvensis. 40.

‡ Trifolium incarnatum. 40. Naturalised.

Vicia gracilis. 40.

‡ Coronilla varia. 41. Not native.

Agrimonia odorata. 41.

Fragaria elatior. 41.

Rubus fissus, Lindl. 91.

R. thyrsoideus, Wimm. 91. (*R. pubescens, W. and N.*)

R. Grabowskii. 91. (*R. montanus, Wirtg.*)

R. calvatus, Bloxam. 91.

‡ R. macrophyllus. 91. (*Hereford.*)

R. mucronatus, Bloxam. 91.

R. Bloxamii, Lees. 92.

‡ R. Menkei. 92. Probably now known as *R. flexuosus.*

R. humifusus, Weihe. 92. (*R. saxicolus, P. J. Müll.*)

R. deltoideus, P. J. Müll. 92. (*R. althæifolius, Host.*)

R. scabrosus, P. J. Müll. 92. (*R. tuberculatus, Bab.*) One of the forms of R. nemorosus according to Mr. Lees.

Rosa cinnamomea. 92.

The following forms of *R. canina*, 111 :—

R. Lutetiana. 111.

R. dumalis. 111.

R. andevagensis or R. verticillacantha. 111.

R. tomentella. 111.

R. Blondæana. 111.

‡ Mespilus germanica. 111. Not native.

Callitriche platycarpa. 111.

‡ Ribes sanguineum. 112. Not native.

‡ Sedum rupestre. 112. Planted.

‡ Sempervivum tectorum. 112. Not native.

‡ S. montanum. 112. Not native.

‡ Astrantia major. 130. Not native.

‡ Eryngium campestre. 130. Not native; but query whether in Worcester or Hereford?

‡ Petroselinum sativum. 130. Not native.

Bupleurum aristatum. 130.

Valerianella carinata. 132.

Carduus Forsteri. 134.

‡ Tragopogon porrifolius. 186. Lickey. Not localised.

‡ Campanula Speculum. 187.

Specularia hybrida. 187.

‡ Polemonium cæruleum. 188. Not native.

Cuscuta Epilinum. 188.

C. Trifolii. 188.

‡ Nicotiana rustica. 188.

Linaria repens. 189.

‡ Mimulus luteus. 189. Not native.

Veronica spicata. 189. Not native to Worcester.

Mentha arvensis var. agrestis. 235.

Calamintha sylvatica. 236. Bromfield. In Herb. Nat. Hist. Soc.

VOL. XV., 1892.

Galeopsis versicolor. 20.

Myosotis repens. 20.

‡ Amaranthus Blitum. 21. Not native.

‡ Chenopodium Botrys. 22. Not native. Omitted in Notice of Irvine's Handbook.

Ch. ficifolium. 21.

Ch. murale. 21.

‡ Beta maritima. 22. Not native to Worcester. Extinct.

‡ Atriplex hortensis. 22, with Beta maritima. Not native. Extinct.

A. deltoidea. 22.

Rumex nemorosus var. sanguineus. 22.

Polygonum Raii. 22.

‡ Buxus sempervirens. 23. Bredon Hill. Planted. Not native.

Salix alba var. cærulea. 44.

S. Hoffmanniana. 44. Not localised.

Betula glutinosa. 45.

‡ Pinus sylvestris. 45. Planted.

‡ Abies excelsa. 45. Planted.

‡ Larix europæa. 45. Planted.

Potamogeton plantagineus. 45.

P. rufescens. 45.

P. heterophyllus. 46.

P. zosteræfolius. 46.

P. obtusifolius. 46.

P. flabellatus. 46.

P. densus. 46.

Actinocarpus Damasonium. 46.

Orchis incarnata. 47.

‡ Epipogium aphyllum. 68. (*Hereford.*)

‡ Crocus sativus. 68. Not native.

‡ Narcissus lobularis. 68. Not native.

Asparagus officinalis. 68.

Polygonatum multiflorum. 69.

‡ Lilium pyrenaicum. 69.

Juncus Gerardi. 70.

Carex elongata. 93.

C. digitata. 93.

C. montana. 93.

‡ Setaria viridis. 94. Not native to Worcester.

‡ S. glauca. 94. Not native.

Apera Spica-venti. 94.

Agrostis vulgaris. 94. First record of type.

Avena elatior var. bulbosus. 95.

Glyceria plicata.

G. pedicillata.

Festuca uniglumis.

Serrafalcus mollis. (Type.)

‡ Lolium italicum. Not native.

Polypodium calcareum.

Lycopodium alpinum.

Chara fragilis.

Mr. Lees's "Botany of Worcestershire" has some drawbacks. It has four separate sets of pages. The pages relating to each botanical district are not headed. There is no index. Many of the species are unlocalised. The species in the text and table do not always tally. It presents us, nevertheless, with one hundred and thirteen additional records, of which forty-three are not native to the county, and others are varieties of which the types have been previously catalogued, or *vice versâ*.

The third edition of the "Botany of the Malvern Hills," bears at the foot of the preface the date July 31st, 1868. I make the following notes upon it :—

Alsine tenuifolia. Not recorded, although it is noted in 1st and 2nd editions.

* **Rosa verticillacantha.** 65.

* **R. andevagensis.** 65.

R. cæsia. 65. First record.

R. coriifolia. 65. *First record.*

* **Sedum dasyphyllum.** 60. *First Malvern record.*

* **Verbascum nigrum.** 60. *First Malvern record.*

The transactions of the Malvern Naturalists' Field Club, in three parts, 1855 to 1870, contain several papers by Mr. Lees, but no additional matter pertinent to the present history.

The third edition of the "Botany of the Malvern Hills" was Mr. Lees's last serious work. He died at Worcester on the 21st October, 1887, at the advanced age of eighty-seven, and was buried on the 28th at Pendock, near Tewkesbury. A notice of his life and works appears in the "Journal of Botany," Vol. XXV. (1887), p. 384. He did more to elucidate the botany of his county than any of his predecessors.

(*To be continued.*)

THE GEOLOGY OF DUDLEY AND THE MIDLANDS.—At the last annual meeting of the Midland Union of Natural History Societies, held at Dudley last year, Professor Lapworth, F.R.S., delivered a most interesting address on the Geology of the district, which he has since revised, and a few copies are now offered for sale (price 6½d. post free), which may be obtained on application to Mr. W. Wickham King, Pedmore House, Stourbridge. No one living is more able to speak with authority about local Geology than Professor Lapworth, and every one interested will, we feel assured, be glad to possess a copy of his most interesting and instructive address.

THE FAUNA AND FLORA OF GLOUCESTERSHIRE (the fauna edited by Mr. C. Witchell, and the flora by Mr. W. B. Strugnell) is announced for speedy publication. We are informed that this work has occupied three years in compilation. It will run to 300 pages, and will contain several illustrations. Mr. Witchell's "Reptilia and Batrachia," and his "Songs of the Birds," are well known and appreciated. In his department of the forthcoming volume he has had the assistance of the principal naturalists of the county. The "Flora" tabulates 1,088 Flowering Plants and Ferns, and there will also be a list of the local Mosses and Hepaticæ by well-known botanists. The volume will be issued to subscribers at 10s. 6d. per copy. The price to non-subscribers will be 12s. 6d. The publisher is Mr. G. H. James, bookseller, Stroud.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION. May 3rd. Mr. J. F. Goode, President, in the chair. Mr. W. B. Grove exhibited, on behalf of Mr. W. H. Wilkinson, *Puccinia Smyrnii* from Shakespeare's Cliff; and on behalf of Mr. Iliff, *Agaricus salignus* from Selly Hill. Mr. Grove also exhibited *Doassansia sagittariæ* from the River Sow, Binley; first time found in county. Mr. C. J. Watson exhibited a species of coccus from an apple tree. Mr. S. P. Bolton exhibited ova of perch. Mr. T. V. Hodgson then gave a brief account of his recent holiday in the Isle of Wight.—MICROSCOPICAL MOUNTING SUB-SECTION. May 6th. Mr. J. F. Goode in the chair. Mr. C. J. Watson gave a demonstration of mounting in glycerine jelly.—BIOLOGICAL SECTION. May 10th. Professor T. W. Bridge in the chair. Mr. W. H. Saunders was elected a member. Mr. W. H. Wilkinson exhibited a small case of butterflies and moths including *Thecla Betulæ*, *Argynnis Aglaia*, *Melitæa Cinxia*, *Polymmatus Adonis*, *Lycæna Medon*, and *Cucullia Scrophulariæ*. Mr. Steele Elliott exhibited a nest and clutch of eggs of woodcock (*Scolopax rusticola*), from Wyre Forest, and also a duck's egg of abnormally dark colour. Mr. W. B. Grove exhibited a rare mountain moss (*Tetraplodon mnioides*) from Ben Nevis. Mr. Grove then read a paper written by Rev. W. Hunt Painter on the "Flora of Criccieth, Carnarvonshire," to illustrate which a large series of dried specimens were shown, many being very rare. A vote of thank to Messrs. Painter and Grove concluded the meeting.—GEOLOGICAL SECTION. May 17th. Mr. J. F. Goode in the chair. The following gentlemen exhibited specimens as under:—Mr. J. F. Goode, a species of Fungia from Suez; Mr. J. C. Stackhouse, the Edelweiss, *Leontopodium alpinum*, gathered by himself in Switzerland; Mr. W. B. Grove, on behalf of Mr. W. H. Wilkinson, *Schizophyllum commune* from Turin, a cosmopolitan fungus found in every country of the globe; Mr. C. Pumphrey, specimens of iron, slags, &c., from the Spring Vale Iron Works, recently visited by the society; Mr. T. V. Hodgson, a tube of Alum Bay sands (nine varieties), collected by himself, April 28th; Mr. C. J. Watson, under the microscope, a preparation of the chalk brought by Mr. Pumphrey from Antrim last season; Mr. Marshall then read his paper on the "Ice Age and its Causes." The paper was well illustrated by a large series of diagrams, and aroused a keen discussion. A vote of thanks, heartily accorded, proposed by Mr. Goode, and seconded by Mr. Pearson, terminated the meeting.

BIRMINGHAM ENTOMOLOGICAL SOCIETY. — May 9th. Mr. G. H. Kenrick vice-president, F.E.S., in the chair. Mr. R. Allday, Stanley Villa, Livingstone Road, Handsworth, was elected a member. Mr. P. W. Abbott showed *Melitæa Athalia* from Abbott's Wood, and south of France; also *Oporina croceago* taken on sallow blossoms at Wyre Forest, and other lepidoptera. Mr. Kenrick remarked that the English Athalia were finer than the French. Mr. G. W. Wynn showed a number of moths taken on the sallows at Marston Green, including *Tæniocampa populeti*, *gracilis*, &c. Mr. R. C. Bradley read a paper on the Tipulidæ, showing six boxes of specimens. He said that there were 170 British species, out of which he had taken 112, also one new to Britain, two formerly considered as doubtfully British, and one or two perhaps new to science.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

The next annual meeting is fixed to be held at Oswestry, on the invitation, and under the auspices of, "The Oswestry and Welshpool Naturalists' Field Club," but the dates are not finally decided upon, but will most probably be Tuesday and Wednesday, August 23rd and 24th. The neighbourhood is an extremely interesting one, and it is to be hoped that there will be a considerable attendance of members.

The following circular has been forwarded for distribution among the members of the societies in the Union, and every effort will be made to ensure a most enjoyable meeting. It is to be hoped that many short papers recording original and interesting observations — biological, geological, or archæological (as suggested in the secretaries' circular) will be forthcoming at the annual meeting.

COPY OF CIRCULAR.

By the kind invitation of the Oswestry and Welshpool Naturalists' Field Club, the Annual Meeting of the Midland Union of Natural History Societies for 1892 will be held at Oswestry, on Tuesday and Wednesday, August 23rd and 24th.

In order to increase the interest and utility of the Annual Meeting, it is proposed to afford additional facilities for the interchange of thought between the members of the constituent Societies. For this purpose a portion of the time of the Meeting will be devoted to the reading of a series of short Papers (not exceeding ten minutes apiece) recording any original and interesting observations made by members of the Union during the past twelve months.

Thus, in Botany and Zoology, the Committee suggest that it would be acceptable to have the record of new or rare species from any locality, accompanied, where practicable and desirable, by the specimens themselves, or observations upon the local Flora and Fauna, &c. In Geology, notes upon the discovery of undescribed strata or fossils, the opening up of new sections, or any similar observations, would be of much interest, more especially if illustrated by specimens, photographs, models, &c. In Archæology, there is abundant scope for interesting scientific or historical memoranda and photographic records of the development of architecture in the Midlands.

In this connection it must be remembered that observations which, considered individually, may seem of little value, may, collectively, prove of distinct scientific importance.

Those willing to contribute in this way to the success of the Meeting are requested to notify their intention of doing so, and the subject of their remarks, to one of the Honorary Secretaries not later than August 10th.

T. STACEY WILSON,
Wyddrington,
Edgbaston,
Birmingham.
W. WICKHAM KING,
Pedmore House,
Stourbridge.

June 28, 1892.

THE NATURALIST IN LA PLATA.*

I do not think I can do a greater service to the readers of the "Midland Naturalist" than to draw their attention to Mr. Hudson's new book, "The Naturalist in La Plata," and recommend them to read it as soon as possible. It is, without question, one of the most interesting books on natural history written in modern times. If anyone is indisposed to take my recommendation, let me support my own opinion by that of Mr. A. R. Wallace, who, in a recent number of *Nature*, wrote of the book as follows:—"It is, so far as the present writer knows, altogether unique among books on natural history. It is to be hoped that its success will be proportional to its merits and that it will form the first of a series of volumes by means of which residents in the various extra-European countries will make known to us the habits of the animals which surround them. What renders this work of such exteme value and interest is, that it is not written by a traveller or a mere temporary resident, but by one born in the country, to whom its various tribes of beasts, birds, and insects have been familiar from childhood; who is imbued with love and admiration for every form of life; and who for twenty years has observed carefully and recorded accurately everything of interest in the life-histories of the various species with which he has become acquainted. When we add to this the fact that the writer of this volume is well acquainted with the literature, both old and new, bearing upon his subject; that he groups his facts and observations so as to throw light on obscure problems, and often adduces

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* "The Naturalist in La Plata," by W. H. Hudson, C.M.Z.S. London: Chapman and Hall, Limited. (16s.)

evidence calculated to decide them; and, in addition to all this, that the book is written in an earnest spirit and in a clear and delightful style, it becomes evident that not all who attempt to follow in his steps can hope to equal their forerunner. . . . Never has the present writer derived so much pleasure and instruction from a book on the habits and instincts of animals. He feels sure that it will long continue to be a storehouse of facts and observations of the greatest value to the philosophical naturalist, while to the general reader it will rank as the most interesting and delightful of modern books on natural history."

The charms of the book, in my opinion, consist in its naturalness, it obvious reliability, and the undoubted value of the observations it records. Probably the best way to induce others to think as I do about it will be to give some extracts, and of those chosen I may say they are not selected because they are the best passages in the book, but are fair samples of the entire contents.

The first extract is about the country:—"This district has been colonized by Europeans since the middle of the sixteenth century; but down to within a very few years ago immigration was on too limited a scale to make any very great change; and, speaking only of the pampean country, the conquered territory was a long, thinly-settled strip, purely pastoral, and the Indians, with their primitive mode of warfare, were able to keep back the invaders from the greater portion of their ancestral hunting-grounds. Not twenty years ago a ride of two hundred miles, starting from the capital city, Buenos Ayres, was enough to place one well beyond the furthest south-western frontier outpost. In 1879 the Argentine Government determined to rid the country of the aborigines, or, at all events, to break their hostile and predatory spirit once for all; with the result that the entire area of the grassy pampas, with a great portion of the sterile pampas and Patagonia, has been made available to the emigrant. There is no longer anything to deter the starvelings of the Old World from possessing themselves of this new land of promise, flowing, like Australia, with milk and tallow, if not with honey; any emasculated migrant from a Genoese or Neapolitan slum is now competent to 'fight the wilderness' out there, with his eight-shilling fowling-piece and the implements of his trade. The barbarians no longer exist to frighten his soul with dreadful war-cries; they have moved away to another more remote and shadowy region, called in their own language *Alhuemapú*, and not known to geographers. For the results so long and ardently wished for have swiftly followed on General Roca's military expedition;

and the changes witnessed during the last decade on the pampas exceed in magnitude those which had been previously effected by three centuries of occupation."

The following extract relates to some of the fauna of this little-known and interesting district:—"The mammalia is poor in species, and with the single exception of the well-known vizcacha (*Lagostomus trichodactylus*), there is not one of which it can truly be said that it is in any special way the product of the pampas, or, in other words, that its instincts are better suited to the conditions of the pampas than to those of other districts. As a fact, this large rodent inhabits a vast extent of country, north, west, and south of the true pampas, but nowhere is he so thoroughly on his native heath as on the great grassy plain. There, to some extent, he even makes his own conditions, like the beaver. He lives in a small community of twenty or thirty members, n a village of deep-chambered burrows, all with their pit-ike entrances closely grouped together; and as the village endures for ever, or for an indefinite time, the earth constantly being brought up forms a mound thirty or forty feet in diameter; and this protects the habitation from floods on low or level ground. Again, he is not swift of foot, and all rapacious beasts are his enemies; he also loves to feed on tender succulent herbs and grasses, to seek for which he would have to go far afield among the giant grass, where his watchful foes are lying in wait to seize him; he saves himself from this danger by making a clearing all round his abode, on which a smooth turf is formed; and here the animals feed and have their evening pastimes in comparative security; for when an enemy approaches, he is easily seen; the note of alarm is sounded, and the whole company scuttles away to their refuge. In districts having a different soil and vegetation, as in Patagonia, the vizcacha's curious, unique instincts are of no special advantage, which makes it seem probable that they have been formed on the pampas.

"How marvellous a thing it seems that the two species of mammalians—the beaver and the vizcacha—that most nearly simulate men's intelligent actions in their social organizing instincts, and their habitations, which are made to endure, should belong to an order so low down as the Rodents! And in the case of the latter species, it adds to the marvel when we find that the vizcacha, according to Waterhouse, is the lowest of the order in its marsupial affinities.

"The vizcacha is the most common rodent on the pampas, and the Rodent order is represented by the largest number of species. The finest is the so-called Patagonian hare (*Dolichotis patagonica*), a beautiful animal twice as large as a hare, with ears shorter and more rounded, and legs relatively much longer. The fur is grey and chestnut brown. It is diurnal in its habits, lives in kennels, and is usually met with in pairs, or small flocks. It is better suited to a sterile country like Patagonia than to the grassy humid plain ; nevertheless it was found throughout the whole of the pampas; but in a country where the wisdom of a Sir William Harcourt was never needed to slip the leash, this king of the Rodentia is now nearly extinct.

"A common rodent is the coypú (*Myiopotamus coypú*), a brown animal with bright red incisors ; a rat in shape, and as large as an otter. It is aquatic, lives in holes in the banks, and where there are no banks it makes a platform nest among the rushes. Of an evening they are all out swimming and playing in the water, conversing together in their strange tones, which sound like the moans and cries of wounded and suffering men; and among them the mother-coypú is seen with her progeny, numbering eight or nine, with as many on her back as she can accommodate, while the others swim after her, crying for a ride.

"With reference to this animal, which, as we have seen, is prolific, a strange thing once happened in Buenos Ayres. The coypú was much more abundant fifty years ago than now, and its skin, which has a fine fur under the long coarse hair, was largely exported to Europe. About that time the Dictator Rosas issued a decree which made the killing of a coypú a criminal offence. The result was that the animals increased and multiplied exceedingly, and, abandoning their aquatic habits, they became terrestrial and migratory, and swarmed everywhere in search of food. Suddenly a mysterious malady fell on them, from which they quickly perished, and became almost extinct.

"What a blessed thing it would be for poor rabbit-worried Australia if a similar plague should visit that country, and fall on the right animal! On the other hand, what a calamity if the infection, widespread, incurable, and swift as the wind in its course, should attack the too-numerous sheep! And who knows what mysterious, unheard-of retributions that revengeful deity Nature may not be meditating in her secret heart for the loss of her wild four-footed children slain by settlers, and the spoiling of her ancient beautiful order!"

Here are some interesting particulars about "the puma, or lion, of America." "It does not attack man, and Azara is perfectly correct when he affirms that it never hurts, or threatens to hurt, man or child, even when it finds them sleeping. This, however, is not a full statement of the facts; the puma will not even defend itself against man. How natural, then, to conclude that it is too timid to attack a human being, or to defend itself, but scarcely philosophical; for even the most cowardly carnivores we know—dogs and hyænas, for instance—will readily attack a disabled or sleeping man when pressed by hunger; and when driven to desperation no animal is too small or too feeble to make a show of resistance. In such a case 'even the armadillo defends itself,' as the gaucho proverb says. Besides, the conclusion is in contradiction to many other well-known facts. Putting aside the puma's passivity in the presence of man, it is a bold hunter that invariably prefers large to small game; in desert places killing peccary, tapir, ostrich, deer, huanaco, &c., all powerful, well-armed, or swift animals. Huanaco skeletons seen in Patagonia almost invariably have the neck dislocated, showing that the puma was the executioner. Those only who have hunted the huanaco on the sterile plains and mountains it inhabits know how wary, keen-scented, and fleet of foot it is. I once spent several weeks with a surveying party in a district where pumas were very abundant, and saw not less than half a dozen deer every day, freshly killed in most cases, and all with dislocated necks. Where prey is scarce and difficult to capture, the puma, after satisfying its hunger, invariably conceals the animal is has killed, covering it over carefully with grass and brushwood; these deer, however, had all been left exposed to the caracaras and foxes after a portion of the breast had been eaten, and in many cases the flesh had not been touched, the captor having satisfied itself with sucking the blood. It struck me very forcibly that the puma of the desert pampas is, among mammals, like the peregrine falcon of the same district among birds; for there this wide-ranging raptore only attacks comparatively large birds, and, after fastidiously picking a meal from the flesh of the head and neck, abandons the untouched body to the polybori and other hawks of the more ignoble sort.

"In pastoral districts the puma is very destructive to the larger domestic animals, and has an extraordinary fondness for horse flesh. This was first noticed by Molina, whose 'Natural History of Chili' was written a century and a half ago. In Patagonia I heard on all sides that it was extremely difficult to breed horses, as the colts were mostly killed by the pumas. A native told me that on one occasion, while driving his horses home through the thicket, a puma sprang out of the bushes on to a colt following behind the troop, killing it before his eyes and not more than six yards from his horse's head. In this instance, my informant said, the puma alighted directly on the colt's back, with one fore foot grasping its bosom, while with the other it seized the head, and, giving it a violent wrench, dislocated the neck. The colt fell to the earth as if shot, and he affirmed that it was dead before it touched the ground."

What follows tells us something about fireflies:—"By bringing a raptorial insect and a firefly together, we find that the flashing light of the latter does actually scare away the former, and is, therefore, for the moment a protection as effectual as the camp fire the traveller lights in a district abounding with beasts of prey. Notwithstanding this fact, and assuming that we have here the whole reason of the existence of the light-emitting power, a study of the firefly's habits compels us to believe that the insect would be just as well off without the power as with it. Probably it experiences some pleasure in emitting flashes of light during its evening pastimes, but this could scarcely be considered an advantage in its struggle for existence, and it certainly does not account for the possession of the faculty.

"About the habits of Pyrophorus, the large tropical firefly, which has the seat of its luminosity on the upper surface of the thorax, nothing definite appears to be known; but it has been said that this instinct is altogether nocturnal. The Pyrophorus is only found in the sub-tropical portion of the Argentine country, and I have never met with it. With the widely-separated Cratomorphus, and the tortoise-shaped Aspisoma, which emit the light from the abdomen, I am familiar; one species of Cratomorphus—a long slender insect with yellow wing-cases marked with two parallel black lines—is the "firefly" known to everyone and excessively abundant in the southern countries of La Plata. This insect is strictly diurnal in its habits—as much so, in fact, as diurnal butterflies. They are seen flying about, wooing their mates, and feeding on composite and umbelliferous flowers at all hours of the day, and are as active as wasps during the full glare of noon. Birds do not feed on them owing to the disagreeable odour, resembling that of phosphorus, which they emit, and probably because they are found to be uneatable; but their insect enemies are not so squeamish, and devour them readily, just as they also do the blister-fly, which one would imagine a morsel fitted to disagree with any stomach. One of their enemies is the Monedula wasp; another, a fly of the rapacious Asilidæ family; and this fly is also a wasp in appearance, having a purple body and bright red wings, like a Pepris, and this mimetic resemblance doubtless serves it as a protection against birds. A majority of raptorial insects are, however, nocturnal, and from all these enemies that go about under cover of night, the firefly, as Kirby and Spence rightly conjectured, protects itself, or rather is involuntarily protected, by means of its frequent flashing light. We are thus forced to the conclusion that, while the common house-fly and many other diurnal insects spend a considerable portion of the daylight in purely sportive exercises, the firefly, possessing in its light a protection from nocturnal enemies, puts off its pastimes until the evening; then, when its carnival of two or three hours' duration is over, retires also to rest, putting out its candle, and so exposing itself to the dangers which surround other diurnal species during the hours of darkness. I have spoken of the firefly's pastimes advisedly, for I have really never been able to detect it doing anything in the evening beyond flitting aimlessly about, like house-flies in a room, hovering and revolving in company by the hour, apparently for amusement. Thus, the more closely we look at the facts, the more unsatisfactory does the explanation seem. That the firefly should have become possessed of so elaborate a machinery, producing incidentally such splendid results, merely as a protection against one set of enemies for a portion only of the period during which they are active, is altogether incredible.

"The current theory, which we owe to Belt, is a prettier one. Certain insects (also certain Batrachians, reptiles, &c.), are unpalatable to the rapacious kinds; it is therefore a direct advantage to these unpalatable species to be distinguishable from all the persecuted, and the more conspicuous and well-known they are, the less likely are they to be mistaken by birds, insectivorous mammals, &c., for eatable kinds and caught or injured. Hence we find that many such species have acquired for their protection very brilliant or strongly-contrasted colours—warning colours—which insect-eaters come to know.

"The firefly, a soft-bodied, slow-flying insect, is easily caught and injured, but it is not fit for food, and, therefore, says the theory, lest it should be injured or killed by mistake, it has a fiery spark to warn enemies — birds, bats, and rapacious insects—that it is uneatable.

"The theory of warning colours is an excellent one, but it has been pushed too far. We have seen that one of the most common fireflies is diurnal in habits, or, at any rate, that it performs all the important business of its life by day, when it has neither bright colour nor light to warn its bird enemies; and out of every hundred species of insect-eating birds at least ninety-nine are diurnal. Raptorial insects, as I have said, feed freely on fire-flies, so that the supposed warning is not for them, and it would be hard to believe that the magnificent display made by luminous insects is useful only in preventing accidental injuries to them from a few crepuscular bats and goatsuckers. And to believe even this we should first have to assume that bats and goatsuckers are differently constituted from all other creatures; for in other animals—insects, birds, and mammalians—the appearance of fire by night seems to confuse and frighten, but it certainly cannot be said to *warn*, in the sense in which that word is used when we speak of the brilliant colours of some butterflies, or even of the gestures of some venomous snakes, and of the sounds they emit.

"Thus we can see that, while the old theory of Kirby and Spence had some facts to support it, the one now in vogue is purely fanciful. Until some better suggestion is made, it would, perhaps, be as well to consider the luminous organ as having 'no very close and direct relation to present habits of life.' About their present habits, however, especially their crepuscular habits, there is yet much to learn. One thing I have observed in them has always seemed very strange to me. Occasionally an individual insect is seen shining with a very large and steady light, or with a light which very gradually decreases and increases in power, and at such times it is less active than at others, remaining for long intervals motionless on the leaves, or moving with a very slow flight. In South America a firefly displaying this abnormal splendour is said to be dying, and it is easy to imagine how such a notion originated. The belief is, however, erroneous, for sometimes, on very rare occasions, all the insects in one place are simultaneously affected in the same way, and at such times they mass themselves together in myriads, as if for migration, or for some other great purpose. Mr. Bigg-Wither, in South Brazil, and D'Albertis, in New Guinea, noticed these firefly gatherings; I also once had the rare good fortune to witness a phenomenon of the kind on a very grand scale. Riding on the pampas one dark evening an hour after sunset, and passing from high ground overgrown with giant thistles to a low plain covered with long grass, bordering a stream of water, I found it all ablaze with myriads of fireflies. I noticed that all the insects gave out an exceptionally large, brilliant light, which shone almost steadily. The long grass was thickly studded with them, while they literally swarmed in the air, all moving up the valley with a singularly slow and languid flight. When I galloped down into this river of phosphorescent fire, my horse plunged and snorted with alarm. I succeeded at length in quieting him, and then rode slowly through, compelled to keep my mouth and eyes closed, so thickly did the insects rain on to my face. The air was laden with the sickening phosphorous smell they emit, but when

I had once got free of the broad fiery zone, stretching away on either hand for miles along the moist valley, I stood still and gazed back for some time on a scene the most wonderful and enchanting I have ever witnessed."

I think most of my readers, judging from these extracts alone, will agree with the opinion I express in the first lines of this notice. I have just received a letter from the publishers giving me permission to make these extracts, and they inform me that the book is being reprinted, the first edition having been entirely sold. E. W. B.

NOTES ON THE "FLORA OF WARWICKSHIRE."

BY J. E. BAGNALL, A.L.S.

Since the publication of the "Flora of Warwickshire" in 1891, many notes have come into my possession that may be of interest from more points than one. As stated on page xxix. of the above-mentioned work, the first record of each plant was given so far as that was known to the writer, but all idea of speaking authoritatively on that matter was disclaimed, as it was very probable that earlier records might exist of which the writer had no knowledge. During the past year some of these earlier records have come into my possession, and I think it is only justice to their authors that these should be published. In the following notes many such records are given, and in each case where the date of the record is earlier than that given in the "Flora of Warwickshire," this date immediately follows the locality, so that whenever a date is given in the following notes, that will imply that the authoritative name following that date should be credited with having given the first record of the plant in question.

Thus, in the "Flora" (p. 1), under *Thalictrum flavum, L.*, the first record is given to "Purt., Midland Flora, 1817," but I now find that in 1810 the Countess of Aylesford collected it near Packington, and that a specimen of this plant bearing the date 1810 appears in her herbarium; hence the first record should have been "Aylesford, Herb., 1810." This I know from my valued correspondent, Miss C. E. Palmer, who has in her possession the herbarium of her distinguished relative, the late Dowager Countess of Aylesford, and who has kindly communicated to me many notes from this herbarium, and also further notes of her own made in various parts of Warwickshire, and records from the herbarium of the late Miss Townsend, of Honington Hall.

Another very interesting communication has been sent to me by my esteemed friend, Mr. G. C. Druce, M.A. This is an old note-book of William Baxter's, A.L.S., and on the first page of this is the following inscription:—"List of plants growing wild within three miles of Rugby, observed during a fortnight's visit to that town between the 26th of June and the 14th July, 1831." This consists of eighty-five pages of notes made in that part of Warwickshire immediately surrounding Rugby, and is valuable as giving first records of many of our common plants, these being in each case indicated by the date 1831 following the locality; and also as a record of many plants then common that are now either very rare or absent from the localities there given, railway workings and other improvements having materially altered many of the wilder features of that neighbourhood.

I am also indebted to other botanists for notes from various localities, such as Mr. Bolton King, M.A., Henry Bromwich, Miss Carril Airy, of Solihull, and others whose names are given; together with further notes of my own. My own notes will be found to relate more particularly to the mosses and hepatics, to which plants I have been giving more especial attention during the time that has elapsed since the publication of the "Flora." In the course of the following notes attention will be called to one or two errors or omissions in the "Flora" that escaped my notice when that work was going through the press.

The figures in parentheses indicate the river basins, as (1) Tame, (2) Blythe, (3) Anker, (4) Avon, (5) Leam, (6) Sow, (7) Stour, (8) Alne, (9) Arrow, (10) Cherwell.

Clematis Vitalba, *Linn.*
(4.) Gaydon Copse, *Bolton King.*
(7.) Near Barcheston, *Bolton King.*

Thalictrum flavum, *Linn.*
(2.) Packington, 1810, *Countess of Aylesford.* Moist meadows by the River Cole, below Castle Bromwich, *A. Britten.*
(4.) Near Rugby Mill and Brownsover, *Baxter, MS.*
(8.) Preston Bagot.

Myosurus minimus, *Linn.*
(4.) Hog Brook Farm, near Lighthorne, *Miss Palmer.*

Ranunculus circinatus, *Sibth.*
(4.) Near Brownsover and Rugby Mill, 1831, *Baxter, MS.*

R. pseudo-fluitans, *Bab.*, *b. submersus*, Hiern.
(2.) Stream near Packwood Mill.

R. trichophyllus, *Chaix.*
(4.) Lighthorne, 1851, *Miss Palmer.*
(7.) Ilmington, *Miss Palmer.*

R. heterophyllus, *Web.* ex p.
(4.) Near Hill Morton, 1831, *Baxter, MS.*
(9.) Small pool near Green Hill Farm, Morton Bagot.

R. peltatus, *Schrank.*
(2.) Packington, 1810, *Aylesford.*

R. hederaceus, *Linn.*
(4.) Hill Morton and near Bilton, *Baxter, MS.*

R. sceleratus, *Linn.*
(4.) Near Brownsover, 1831, *Baxter, MS.*
(7.) Ilmington, *Miss Townsend.*

R. Flammula, *Linn.*
(4.) Near Hill Morton, 1831, *Baxter, MS.*

R. auricomus, *Linn.*
(1.) Near Middleton.
(7.) Hams Court, 1844, *Miss Townsend.*

R. parviflorus, *Linn.*
(5.) Cubbington, near Leamington, *Miss Palmer.*

R. arvensis, *Linn.*
(4.) Near Hill Morton, 1831, *Baxter, MS.*

Caltha palustris, *Linn,* var. *b. Guerangerii,* Boreau.
(4.) Near Brownsover, 1831, *Baxter, MS.*
(2.) Marsh, canal side, near Three May Poles, Shirley.

Eranthis hyemalis, *Salisb.*
(2.) Near Knowle, *Miss Carril Airy.* A rare alien.

Berberis vulgaris, *Linn.*
(4.) Gaydon, *Bolton King.*

Nymphæa alba, *Linn.*
(2.) Packington, *Miss Palmer.*
(1.) Langley Pool, near Middleton. Introduced in both localities.

Nuphar luteum, *Sm.*
(4.) Rugby Mill, and near Brownsover, 1831, *Baxter, MS.*

Papaver Rhœas, *Linn.*
(4.) Clifton Road, near Rugby, 1831, *Baxter, MS.*

P. dubium, *Linn.*
(4.) Between Rugby and Sawbridge, 1831, *Baxter, MS.*

Var. *b. Lecoqii* (Lamot).
(4.) Chesterton, *Bromwich.*
(9.) Near Studley Railway Station.

P. Argemone, *Linn.*
(4.) Opposite Mr. Richardson's Farm, near Hill Morton, 1831, *Baxter, MS.*

Chelidonium majus, *Linn.*
(4.) In the lane between Hill Morton and the Engine, 1831, *Baxter, MS.*
(6.) Kenilworth, *Bromwich.*
(2.) Solihull, *Miss C. Airy.*
(8.) Ullenhall.

Fumaria capreolata, *Linn.* Aggregate.
(4.) Rugby, 1831, *Baxter, MS.*

F. officinalis, *Linn.*
(4.) Near Lawford, 1831, *Baxter, MS.*

Nasturtium palustre, *DC.*
(4.) Near Dunchurch, *Baxter, MS.*

N. amphibium, *R. Br.*
(4.) Between Sawbridge and Rugby, *Baxter, MS.*

Barbarea vulgaris, *R. Br.*
(5.) Near Sawbridge, 1831, *Baxter, MS.*

Cardamine pratensis, *Linn.*
(4.) Near Lawford, 1831, *Baxter, MS.*

C. flexuosa, *With.*
(4.) West Leys, near Rugby, *Baxter, MS.*
(1.) A large-leaved variety of this abundant near Langley Mill, Middleton.

Erophila vulgaris, *DC.*
(2.) Packington! 1810, *Aylesford.*

Hesperis matronalis, L.
(4.) Casual. Chesterton, in a larch cover, *Bromwich.*

Sisymbrium Alliaria, *Scop.*
(4.) Hill Morton, 1831, *Baxter, MS.*

Brassica Napus, Linn.
(4.) Clifton Road, near Rugby, *Baxter, MS.*

B. alba, *Bois.*
(2.) Field, near Packwood Church.

Capsella Bursa-pastoris, *Moench.*
(4.) Rugby, 1831, *Baxter, MS.*

(*To be continued.*)

PROPOSAL FOR A NATIONAL PHOTOGRAPHIC RECORD AND SURVEY.—This is the title of a most interesting pamphlet, which is a reprint of a paper read before the Photographic Society of Great Britain on the 10th of May last, by Mr. W. Jerome Harrison, F.G.S. It is published by Messrs. Harrison and Sons, St. Martin's Lane, London. We cordially recommend it to the attention of all who are desirous that there should be a national record and survey. It is full of excellent practical suggestions, and Mr. Harrison offers to supply further information upon any points of detail to societies or individuals who may contemplate commencing survey work upon the lines described in the paper. Mr. Harrison's private address is 52, Claremont Road, Handsworth, Birmingham, and we have no hesitation in saying that no one is more qualified to offer suggestions of practical value; for he not only originated the scheme which is being so satisfactorily carried out in Warwickshire, but has contributed a large number of most excellent photographs.

THE HAPPY FUNGUS-HUNTER.*

BY W. B. GROVE, M.A.

It has been remarked that, during later years, the mycologist has found himself much better provided with text-books to help him in his study than the students of other branches of cryptogamy. In the case of algæ, lichens, and mosses, the number of books recently published which are a real help to the enquirer may be reckoned upon the fingers; not only text-books, but figures, are in these classes few and far between, and the student is compelled often to rely upon fragmentary lists and papers. But in the case of the fungi, this reproach is being rapidly removed, and if present intentions are adequately carried out, the British mycologist will soon have a modern and sufficient library to consult in any department of the study to which he may devote himself. There is only one thing wanted to secure many happy hours in the future to the budding fungus-hunter, and that is that the promised books shall be written, after sufficient study, by men who are really acquainted at first hand with the branches of which they treat.

Complaints are sometimes made by those unacquainted with the complexity of the subject, that no *cheap* work containing figures of fungi has yet been published. That has always been and is still partly true; a few thousands of minute organisms and a thousand or so of larger ones, cannot be illustrated and described in a cheap form until the demand for such a work becomes enormous enough to recoup the expenses of production. Nor would an enormous demand entirely remove the difficulty. Figures of the larger fungi are of little use unless coloured, so difficult of appreciation are the differences which separate the species. It is only by limiting oneself to a specified and compact branch of the subject, that the opposing demands of cheapness and accuracy can be reconciled.

This is what is done in the first of the books here noticed. Dr. M. C. Cooke is an old parliamentary hand at fungus-eating as well as at fungus-hunting; no one knows more of the subject, at any rate in this country, than he. It is now thirty years since he published his "Plain and Easy Account

* (1) British Edible Fungi: How to Distinguish and How to Cook Them, with coloured figures of over forty species, by M. C. Cooke. London: Kegan Paul, Trench, Trübner, and Co. 237 pp.; price, 7s. 6d.
(2) British Fungi: Phycomycetes and Ustilagineæ, by George Massee. London: L. Reeve and Co. 232 pp.; eight plates, with 137 figures. Price, 7s. 6d.

of British Fungi," in 148 pages, with twenty-four coloured plates, in which especial prominence was given to the edible species. The book was unfortunately complicated by an attempt (necessary, perhaps, at that day,) to give elementary instruction also in the use of terms and in the classification of the fungi, as well as by descriptions of the more common poisonous species. Now he returns to the charge, in a volume entitled "British Edible Fungi," with 237 pages and plates containing coloured figures of upwards of forty species. Here, wisely we think, he eschews all reference to the poisonous forms. The would-be fungus-eater cannot learn too soon that he is not concerned at all with the multitudes of kinds whose culinary properties are either unknown, or known to be deleterious. It is his task to learn to recognise, one by one, in the same way as he learns to recognise his cousins and his aunts, the species which the experience of others has approved. This task Dr. Cooke helps him to perform successfully by a series of exceedingly careful descriptions, which the figures greatly assist. The descriptions are very full, and though couched in untechnical language, seem to be such as should convey a correct impression to any person capable of appreciating accurately the values of words.

Besides this, there are a large number of recipes for cooking fungi, "some old and some new, but all practical." Many of these have been tried and approved in previous years at the famous annual dinners of the Woolhope Club, at Hereford, where mycophagy has always been made a feature of the banquet. Dr. Cooke vindicates his right to speak as one that has authority on this subject, by showing that, out of the 200 British species which are fairly available for domestic purposes, he has personally experimented with sixty-eight, and survived to tell the tale.

The book is interspersed with anecdotes of fungus-eating and collecting, and with many a hint intended for the removal of the long-standing fallacies about mushrooms, which are continually cropping up in one's experience. Such fallacies are—that general rules can be given for distinguishing edible from poisonous species, that no fungus growing on or under trees can be wholesome, that any species which will "peel" is safe, that all bright-coloured ones are deadly, as well as that strangest but most persistent fallacy of all—that the fungi which are exposed for sale on the market stalls of this country are all of one species, called the "common mushroom." As a matter of fact, more than half of those which are brought to market during the "mushroom season" at the end of summer, belong to the "horse-mushroom," although, if that name be applied to their stock, the stall-keepers indignantly deny the charge. As to the mushroom ketchup of commerce, only those who have seen it prepared could possibly say what species of fungi (not to mention grubs) do *not* enter into its composition.

Not only those who wish to be taught the joyous art and mystery of fungus-eating will find interest in these pages, but also those who like to learn somewhat about the curiosities of the vegetable world. For Dr. Cooke speaks with that fulness of knowledge which can only come from the personal acquaintance with his subject gained in a long course of out-door study.

The second work here noticed is of a different character, though of the same size and appearance. Its title, "British Fungi," is very misleading, unless it is to be considered as the first of a series of volumes treating in turn of all the fungi of this country. For this volume is confined to the Phycomycetes (*i.e.*, the "Pin-Fungi" or Moulds) and the Ustilagineæ (or "Smuts"). To this is prefixed a "General Introduction," which treats, in a rather unsatisfactory way, of the Morphology, Geographical Distribution, Collection and Preservation, Examination and Classification of Fungi. This seems to strengthen the suspicion that the author intends this volume as the first of a series, although no hint to that effect is given on the title-page. The suspicion is rendered almost certain by the inclusion of the Ustilagineæ, in spite of the fact that a monograph (already reviewed in the "Midland Naturalist," vol. xii., p. 46) has been recently published on that group by an author better qualified to deal with them; to that monograph, indeed, the present work makes no addition worth mentioning, while in many respects it is decidedly inferior. It seems a pity that space should be wasted in going over the same ground uselessly for the second time, while so much fresh ground remains to be broken. It seems a pity, also, that this volume should be disfigured, as too many by English writers on the Fungi are disfigured, by obvious lack of scholarship. No German or French work, at any rate would admit such blunders as we find here: "lactens," "Dityuchus," "Salprolegnia," "P. agremones," &c., while some of the quoted German book-titles also are an illegible and unmeaning jumble.

One turns with a sigh of relief to the section devoted to the Phycomycetes, for here at least is new ground which has not been worked over since the publication of the "Hand-book" in 1871. Had this section been published by itself, in about eighty pages, for a few pence, it would have been a blessing indeed to the working mycologist, for it collects together a number of observations previously scattered in many journals on the neglected group of which it treats. But weighted as it is with so much useless matter, it loses half its value. And even throughout it, one sees traces everywhere of the author's well-known habit of considering the Kew Herbarium as the limits of his universe. All that cannot be grubbed up from the treasures within those walls, is as if it existed not. To take an example: on page 106 one may read—"The genus Piptocephalis has not yet been met with in Britain"—but the pages of the "Journal of Botany" and the "Reports on the Fungi of the East of Scotland" could both tell a different tale. Two species at least are known to exist here, and a little personal research in the proper habitats, by one who has leisure to devote to it, would soon have added to the number.

But the glory of the field naturalist has departed. The biologist or physiologist is the hero of the hour, and looks down with infinite contempt upon the luckless being who is still content to search for species. 'Tis but the swing of the pendulum, the fashion of the day, and like many another fashion, "Made in Germany." Soon will come the inevitable reaction; but it is, to say the least of it, decidedly ungrateful in the "biologist" to pour such vials of wrath upon the poor searchers of the past, who, if they did nothing else, at any rate provided the theorists with the foundations of their airy structures. For out of his own spinnerets, like a spider's silk, the closet-naturalist cannot evolve the species and genera with which he deals. These are the rewards of one who goes down upon his knees and patiently, hour after hour, turns over heaps of rotting twigs and leaves, or who tramps through woods and fields the livelong day, and returns at night to his study with the spoil. The observations of the laboratory are, of course, right and proper in their place; but a world constructed out of them would bear but little resemblance to the glorious vision which the field naturalist sees unfolding constantly before his eyes. *Liberavi animam meam.*

THE "SYNTHETIC PHILOSOPHY."—We extract the following from the *Athenæum* of 11th June:—"Readers of the 'Synthetic Philosophy' will be interested to hear that one of the closing volumes is through the press, and will be issued as soon as arrangements for simultaneous publication in the United States are completed—probably about June 20th. In the preface to 'Justice,' published in June last, Mr. Herbert Spencer expressed the hope that along with Part I., 'The Data of Ethics,' long since published, Parts II. and III., completing the first volume of 'The Principles of Ethics,' might presently be completed. This hope has now been fulfilled." The book was published on Tuesday, 28th June, a handsome octavo of nearly 600 pages, and we hope soon to give a notice of it in the "Midland Naturalist."

THE BOTANY OF BIDDULPH AND THE NEIGHBOURING PARTS OF NORTH STAFFORDSHIRE.

BY THE REV. W. H. PAINTER,
AUTHOR OF A "CONTRIBUTION TO THE FLORA OF DERBYSHIRE."

(Continued from page 139.)

Ægopodium Podagraria, *L.* I. Biddulph. II. Near Knypersley Hall and Schools.

Pimpinella Saxifraga, *L.* III. Rushton Spencer; only seen once.

Conopodium denudatum, *Koch.*

Myrrhis odorata, *Scop.* I. Near the Clough and the Hall Hill Farm, Biddulph. Biddulph, *Garner.* III. Between Horton and Rudyerd.

Anthriscus sylvestris, *Hoffm.* III. Near Cliff Hall.

Angelica sylvestris, *L.*

Heracleum Sphondylium, *L.*

Daucus Carota, *L.* I. The Hay Hill Farm. II. Fields, Knypersley; a casual.

Caucalis Anthriscus, *Huds.*

Hedera Helix, *L.*

Adoxa Moschatellina, *L.* I. Plantation; the drive from Biddulph Grange.

Sambucus nigra, *L.*

Var. **laciniata**, *L.* II. Near Knypersley Hall; cultivated.

Viburnum Opulus, *L.* I. The drive from Biddulph Grange. II. Near Knypersley Pools. III. Near Rudyerd.

Lonicerum Periclymenum, *L.*

L. Xylosteum, *L.* II. Near Knypersley Hall; alien.

Galium saxatile, *L.*

G. palustre, *L.*

Var. **Witheringii** *(Sm.).* Type not seen.

G. Aparine, *L.* I. In small quantity, the railway sidings, Bradbury's Pits. II. Norton-in-the-Moors. III. Rushton Spencer and Rudyerd.

Valeriana dioica, *L.* I. The drive from Biddulph Grange. III. On west side of Rudyerd Reservoir.

V. officinalis, *L.*

Var. **Mikanii** [*Wats.*].

Scabiosa succisa, *L.*

S. arvensis, *L.* III. Rushton Spencer and Rudyerd.

Eupatorium cannabinum, *L.* II. Seen in one spot only in Knypersley Park.

Solidago Virgaurea, *L.* II. Knypersley Park and Lion's Paw Wood.

Bellis perennis, *L.* Common everywhere.

Gnaphalium uliginosum, *L.* II. Knypersley Pools and Bemersley. III. Rudyerd Reservoir.

Pulicaria dysenterica, *Gaertn.* I. The drive from Biddulph Grange. II. Near Rudyerd Reservoir.

Bidens tripartita, *L.* II. Knypersley Reservoir.

Achillea Millefolium, *L.*, and **A. Ptarmica,** *L.*

Chrysanthemum segetum, *L.* I. Hay Hill Farm, Biddulph.

C. Leucanthemum, *L.*

C. Parthenium, *Pers.* III. Near Horton.

Matricaria inodora, *L.*

Tussilago Farfara, *L.*

Petasites vulgaris, *Desf.* I. Several places at Biddulph. II. Brown Edge near River Trent.

Senecio vulgaris, *L.*

S. sylvaticus, *L.* II. Cinder Bank, Childerplay; Knypersley Reservoir.

S. Jacobæa, *L.*

S. aquaticus, *L.* I. Biddulph Moor, 950 feet. II. Knypersley Park.

Arctium minus, *Schk.* I. Several places at Biddulph.

Cnicus lanceolatus, *Hoffm.*, and **C. arvensis,** *Hoffm.*

Centaurea nigra, *L.*

Lapsana communis, *L.*

Crepis virens, *L.*

C. paludosa, *Moench.* II. Banks of River Trent, Lion's Paw Wood. III. Cliff Wood. In small quantity at both places. In Garner's "Natural History of Staffordshire" this plant is recorded as growing "*On the banks of a rivulet, Biddulph; Shaw.*" I have failed to find it on the banks of the brook at Biddulph.

Hieracium Pilosella, *L.*

H. vulgatum, *Fr.* I. Biddulph. II. Knypersley Park. III. Rushton Spencer.

Var. **sciaphilum,** *Uechtr.* I. Tower Hill, Mow Cop.

H. umbellatum, *L.* I. Gutter Lane; the watershed between Biddulph Valley and the Trent Valley, 700 feet; Woodside Colliery.

H. boreale, *Fr.*

Hypochœris radicata. *L.*

Leontodon hirtus, *L.* I. The drive from Biddulph Grange; on sand.

L. autumnalis, *L.*

Taraxacum officinale, *Web.*

Var. **Dens-leonis,** *Desf.*

Var. **palustre,** *DC.* I. Near New Pool Farm. II. Below Knypersley Mill. III. Horton.

Lactuca muralis, *Fresen.* II. Near Knypersley Pools and Kynpersley Tower. III. Rudyerd Reservoir.

Sonchus asper, *Hoff.* II. Near Knypersley Hall. III. Rudyerd.

S. arvensis, *L.* II. New Pool; near Wickenstone Rocks. III. Rushton Spencer.

Jasione montana, *L.* I. The Clough, Biddulph. III. Horton; Rushton Spencer.

Campanula rotundifolia, *L.*

Vaccinium Oxycoccos, *L.* I. In small quantity near Wickenstone Rocks; nearly extinct.

V. Vitis-Idæa, *L.* I. Trough Stones; Wickenstone Rocks. III. Rudyerd.

V. Myrtillus, *L.*

Calluna Erica, *DC.*

Erica Tetralix, *L.* I. Lask Edge; Biddulph Moor. II. Knypersley Park. III. Near Rudyerd Reservoir.

E. cinerea, *L.* II. Knypersley Park. (It may grow in the other two districts, but I have no record.)

(*To be continued.*)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEEETING.—May 31st. The President (Mr. J. F. Goode) in the chair. Mr. J. Bent was elected a member of the Society. Mr. E. E. Rossiter exhibited a shell of *Helix arbustorum* from Halesowen; Mr. T. V. Hodgson a preparation showing the structure of the pineal eye of *Hatteria*; Mr. Bolton, living specimens of pond-life, under the microscopes.—On May 30th, a party of eighteen started for the Society's excursion to Giant's Causeway, Antrim Coast, and Lakes of Killarney.—MICROSCOPICAL SUB-SECTION. June 10th. A gift of mounting material was presented to the Sub-section by Mr. W. E. R. Martin, who has resigned. Mr. Hodgson gave a demonstration in mounting in balsam, dealing with the simpler objects, such as insects and their parts, and explaining their preparation.—BIOLOGICAL SECTION. June 14th. Mr. R. W. Chase in the chair. Mr. J. C. Poole was elected a member of the Society. Mr. T. Clarke exhibited, Rotifers, *Asplanchua periodonta*, and *Notholca longispina*; a diatom, *Asterionella formosa*, from Windermere, and a lichen, *Cladonia digitata* var. *macilenta*, from Buttermere. Mr. W. H. Wilkinson then gave a most interesting account of his recent tour up the Nile, and illustrated his remarks with an abundant series of specimens, zoological, botanical, geological, and representing the native industries. These specimens were selected with considerable skill, and among them may be mentioned a desert lizard of some bulk, a large series of insects and scorpions, the sugar cane, vegetable ivory, fruit, and manufactured articles of the Loofah, date palm, granite from the celebrated quarry, articles of clothing, &c. Also a facsimile of Egyptian Papyrus, Rameses II., a rare and valuable book.—GEOLOGICAL SECTION. June 21st. Mr. T. H. Waller, B.A., B.Sc., in the chair. Mr. J. C. Pool, of Oscott, was proposed by Mr. R. W. Chase, and seconded by Mr. J. C. Slackhouse. Exhibits: Mr. C. J. Watson exhibited Arbutus and Bird's Nest Orchis, from Killarney; Mr. W. R. Hughes, plants from the neighbourhood of Minchinhampton, on the Cotswolds: *Geranium lucidum*, the shining crane's bill; *G. pyrenaicum*, the mountain crane's bill; *Aquilegia vulgaris*, the columbine; *Lithospermum arvense*, corn gromwell; *L. officinale*, common gromwell; *Habenaria chlorantha*, great butterfly orchis; *Monotropa Hypopitys*, the bird's nest; *Epipactis grandiflora*, helleborine; *Paris quadrifolia*, Herb Paris; *Hippuris vulgaris*, mare's tail; *Euphorbia*, with fungus, *Lecythea Euphorbiæ*. Mosses: *Mnium undulatum*, *Hypnum brevirostre*, both in fruit. Mr. Marshall, rock specimens from Giant's Causeway, including weathered basalt (red to grey), zeolites in basalt, and an exceedingly hard chalk; Mr. Pumphrey, *Anemone sulphurea*, *A. alpina*, and *Geum*, in seed; *Potentilla*, white and yellow; *Veronica spicant*? and *Phyteuma*, purple and blue (Swiss); *Aconite*, yellow; *Dianthus atrorubens*, and *Rosa alpina*, *Hyacinthus plumosus* (Swiss), *Adiantum Capillus Veneris* (from Co. Clare, Ireland). Professor Lapworth, LL.D., F.R.S., exhibited and described a collection of Stromatopora (presented to Mason College by H. J. Carter, Esq., F.R.S.). A very hearty vote of thanks to Professor Lapworth was carried with acclamation.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—April 25th. Special Holiday Exhibits. Mr. H. Hawkes showed some of the rarer algæ of the Weymouth district, also some richly covered with parasitic diatoms. Mr. J. W. Neville, a gathering of foraminifera from the same locality. Mr. G. H. Corbett described the geology of Weymouth and Portland, and showed a number of septarian nodules from the Oxford clay, many of them sliced and polished, and also enumerated the leading fossils observable in the Portland quarries. Messrs. Madison and Linton, a collection of shells made during a conchological ramble in Gloucestershire. Under the microscope: Mr. W. J. Parker, a rotifer, *Hydatina senta*; Mr. Hawkes, *Ptilota plumosa* and *Ceramium* with tetraspores.—May 2nd. Mr. H. Hawkes showed a series of photo-micrographs of diatoms by Mr. Ward, of Manchester; Mr. G. H. Corbett, a series of fossils from the Oxford clay of Weymouth, including some rare specimens; Mr. J. Madison, photographs of an exposure in the Oolite beds of Gloucestershire. Under the microscope, Mr. Hawkes showed a rare zoophyte, *Plumularia pennatula*.—May 9th. The President, Professor Hillhouse, M.A., F.L.S., gave the second lecture on "The Geographical Distribution of Plants." The lecturer said three problems would present themselves to those who thought out this subject:—First, every plant required certain conditions under which it could live, and although you might gradually induce some plants to live under different conditions, yet too sudden a change would often prove fatal to them. Second, that plants have certain methods of distribution. Third, the great obstacles plants have to contend with, even when climatic conditions are suitable. The chief obstacles were mountain chains and water; the breadth of the latter was of small importance if the winds and currents favoured them. Islands were of two kinds, some were only fragments of a continent; our own was a case in point. We have absolutely no plants that exclusively belong to us; they are all European plants. Next we have oceanic islands. The Galapagos Archipelago, though situated on the equator, has a climate modified by antarctic currents. The vegetation of these islands is poor; one half of the plants belong to the islands, the other half are American plants. The island of Madeira had been largely altered by man; of all the plants, about one half are European, a large proportion of the others are only varieties of European plants, many of the remainder are endemic species, and a small proportion belong to Africa. This is singular, seeing that Africa is a hundred miles nearer than Europe. Alpine plants are unknown in this island. In the Canary Islands, one third of the plants are peculiar to them. These islands are near to Africa and far from Europe; of the other two-thirds, most are of European genera, a less proportion are European species, and the smallest group is of African origin. No Alpine plants are found in these islands. In the Azores, which are about 750 miles from Europe, one-tenth of the plants are peculiar to the islands, the remainder are European in their affinities, and they have very limited relations with America. Practically speaking, these three groups of islands resemble each other. The island of St. Helena was spoken of as one where man had greatly altered the flora, but, at the commencement of this century, of forty-five plants forty were peculiar to the island. In Kerguelen Land, of eighteen flowering plants two were peculiar and the remainder came from the Cape Horn district. The lecturer then enlarged on these facts, and what they taught. An oceanic island generally had a flora resembling that upon the nearest land. Madeira and other neighbouring islands pointed to the fact of a more intimate land connection between them and Europe, and that in this connection Africa did not share. The difference found in plants in various areas could be accounted for by the law of natural selection through vast ages in which plants had gone on diverging from the original types. A vote of thanks, proposed by Mr. W. Dunn, seconded by Mr. W. J. Parker, brought the meeting to a close.—May 16th. Mr. John Betteridge reported seeing a flock of fieldfares at Westheath, on May 8th, being the latest date upon which he had observed them. Mr. G. H. Corbett showed polished specimens of tabulate and rugose corals from the Wenlock limestone; Mr. H. Hawkes, specimens of *Lathræa squamaria*, calling attention to its peculiar life-history. Under the microscope: Mr. J. W. Neville, a section of cement-stein from Jutland, showing diatoms *in situ*; Mr. W. J. Parker, two rotifers, *Dinocharis detractus* and *Lindia torulosa*. — May 23rd. Mr. J. W. Neville exhibited a series of molluscan palates, and called attention to their chief differences of structure, and the best methods of mounting them; Mr. Hawkes, for Mr. White, *Paris quadrifolia* and other plants from Solihull; Mr. Hawkes, saw of saw-fish, and the following fungi:—*Reticularia umbrina*, *Ustilago receptaculorum*, and the æcidiospore stage of *Puccinia tragopogi*; Mr. J. Madison an abnormal specimen of *Planorbis spirorbis*; Mr. G. H. Corbett, a number of the rarer varieties of quartz, including specimens of agate (natural colour and stained), moss agate, onyx, chalcedony, cornelian, bloodstone, cat's-eye, and opal. Under the microscope, Mr. Hawkes showed bird's head processes on *Bugula avicula* and *Halecium halecinum*, with polyps expanded. Mr. J. Collins showed a microscope of an old type, but giving good definition. Mr. J. Betteridge gave a list of birds of the Umberslade district.—May 30th. Mr. H. Hawkes showed *Montia fontana*, *Nardus stricta*, and other plants from Sutton; Mr. J. Moore, a series of prints from an old book on microscopy; Mr. Mulliss, larva of tiger beetle; Mr. G. H. Corbett, palatal teeth of fish and ichthyodorulite of *Hybodus Keuperi* from Upper Keuper, Shrewley Common; Mr. W. J. Parker, a small crab embedded in a piece of mother-of-pearl; Mr. J. Betteridge, nest and eggs of nightingale (*Philomela luscinia*). Under the microscope, Mr. Hawkes showed spicules from among polycistina; Mr. Parker, spores of *Equisetum arvense*; Mr. J. Collins, *Scenodesmus quadratus*.—June 13th.

Mr. H. Hawkes showed a specimen of *Aquilegia vulgaris* from Bewdley Forest, and cluster cups on Berberis, remarking on its relation to the puccinia or rust of wheat; Mr. White, a series of plants from Buildwas, including *Habenaria chlorantha.* Under the microscope, Mr. Hawkes, *Volvox globator*; Mr. W. J. Parker, *Spirogyra nitida*; Mr. Darlaston, *Batrachospermum moniliforme*; Mr. J. Collins, a freshwater alga, *Tolypothrix coactilis.*

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—June 4th to 7th. A three days' excursion was made to Sherwood Forest. A party of ten made Edwinstowe their head quarters, from which they worked Thoresby Park, and that part of the forest more specially called Sherwood. They were mainly lepidopterists, but were not rewarded by anything new. Many larvæ of *Euperia fulvago* were taken, a few *Notodonta trepida, Eurymene dolobraria,* and many commoner species were found on tree trunks, &c., but nothing of special value. A few dipterists, who were of the party, were rather more fortunate, taking some nice Syrphidæ on the hawthorn bloom, including such species as *Criorhina floccosa, C. berberina,* &c. They also took, commonly on the furze flowers, the fine "Daddy," *Pachyrrhina crocata.* Glorious weather was enjoyed, and, considering that fact, the number of insects met with was disappointingly small.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—A three days' excursion to Leamington and neighbourhood took place on Wednesday, Thursday, and Friday, June 15th, 16th, and 17th. The party, numbering about forty, including Dr. Callaway, F.G.S. (president), the Rev. R. C. Wanstall (hon. sec. and treasurer), Mrs. Wanstall (Condover Vicarage), Mr. and Mrs. Foliott Sandford (Shrewsbury), Rev. T. Auden, F.S.A., Mrs. and Miss M. Auden (Shrewsbury), the Rev. F. W. Kittermaster and Miss Kittermaster (Bayston Hill), Rev. R. Woods and Mrs. Woods (Malinslee), Miss Moser (Oakwood), the Rev. H. and Mrs. Morris (Stoddesdon Rectory, Cleobury Mortimer), and many other members and friends proceeded by train from Shrewsbury to Leamington. Arrangements had been made for the reception of the party at the commodious and comfortable Crown Hotel, Leamington. After an excellent luncheon a start was made for Stratford-on-Avon, *viâ* Warwick Castle, which had been closed for some days to the public owing to the extensive preparations for the Royal Agricultural Society's Show and the arrival of the Prince of Wales, the Duke of York, and other illustrious guests at the Castle. By very special privilege, the hon. secretary obtained an order for the members of the club to visit the park and grounds, and the exterior of the Castle. A lovely drive from Warwick (*viâ* Sherborne) brought the members to Stratford-on-Avon. Some time was spent in the church, where Shakespeare is buried. The ancient and historic school, in which Shakespeare received his early education, was next visited. Much interest was taken in the quaint old Latin school, that was in truth the cradle of the poet's mind. The Head Master, the Rev. R. S. de Laffan, gave a cordial welcome to the members, and much valuable information, which was greatly appreciated. Mr. Laffan pointed out the place where stood the school desk (now in the Museum) which tradition assigns to the young Shakespeare, and then accompanied the party to the Guildhall, where the poet witnessed the first dramatic representation his eyes ever looked upon when a boy of five. Passing into the Armoury, Mr. Laffan gave the visitors a most interesting account of the frescoes of the Royal Arms of England, dating from 1666, and after visiting other scenes associated with the great master-mind, the rev. gentleman most hospitably invited all the members to partake of tea at the school house, an invitation gratefully accepted by the majority of the party. Before leaving, the Rev. T. Auden proposed, and the Rev. R. C. Wanstall seconded, a most cordial vote of thanks to Mr. and Mrs. Laffan for their kindness and hospitality. A hurried visit was then made to "New Place" (site of Shakespeare's home), the almshouses, and Shakespeare's birthplace, the party returning to Leamington for dinner. After tea in the large room, the hon. sec. referred to the obligation he was under to Mr. S. S. Stanley, hon. sec. of the Warwickshire Archæological Society, who had helped him in arranging the comprehensive programme, and rendered such assistance during the day as guide, and then called upon Mr. Stanley to read a paper on "Stratford-on-Avon before the time of Shakespeare." The paper afforded much instruction to the visitors, and on the proposition of the Rev. T. Auden, seconded by Mr. E. Jones, Mr. Stanley was heartily thanked. On Thursday, the party left Leamington for Stoneleigh Abbey, the seat of Lord Leigh, who had most kindly given permission to visit the Abbey, gardens, and deer park. The ancient Norman church of Stoneleigh was next visited—rich in memorials of the Norman period. The vicar (the Rev. J. Thorn, formerly of Whitehall, Broseley) welcomed the club, and from the reading desk gave a short description of the church. On the proposition of the Rev. R. Woods, seconded by Mr. F. Sandford, a cordial vote of thanks was passed to Mr. Thorn. The party next visited Coventry, where the members had luncheon at the Craven Arms Hotel. They were met by Councillor Andrews, vice-president of the local Archæological Society, and Mr. Fretton, F.S.A., who acted as cicerone to the party, and accompanied them to St. Michael's Church, St. Mary's Hall, Trinity Church, St. John's Hospital, and various ancient houses, &c. Before leaving the party, Mr. Andrews received a hearty vote of thanks, proposed by the Rev. F. W. Kittermaster, and seconded by Mr. Hodges. Mr. Andrews expressed the pleasure it gave him to accept the invitation of the hon. sec. to meet the club. The drive home from Coventry was through the park and Baginton, and after dinner in the evening the beautiful gardens at Leamington, which were illuminated with thousands of lanterns, were visited. The first place visited on Friday was Kenilworth Castle, the chief features of interest being pointed out by Mr. Fretton. The party then examined the remains of the Augustinian Monastery, recently unearthed. After luncheon the members drove to Guy's Cliff, and on to the church at Warwick, and Leycester's Hospital. At the Museum they were met by the Rev. P. B. Brodie, F.G.S., who described the most striking features of the collections, calling attention especially to the unique specimens of *Hyperodapedon*, from the Warwickshire Keuper, and to a very fine example of *Ichthyosaurus* from the Lias. Mr. Brodie was the guest of the club to dinner at the Crown Hotel, Leamington; and after dinner, at the desire of the president, he gave the club an interesting address "On the Fossil Insects found in the Lias of Warwickshire." Cordial votes of thanks were passed to Mr. Brodie, and to Messrs. Fretton and Stanley, who had done so much to elucidate the archæology of the localities visited.

THE ORIGIN AND OBJECTS OF COLOURS AND COLORATION IN ANIMALS.*

BY A. BERNARD BADGER, B.A.

Of the many questions relating to the phenomena of animal organization, one of the most interesting asks what object in the economy of nature is served by the colour which, of greater or less brilliance, and arranged in more or less definite patterns, distinguishes the outer surfaces of all animals. As early as 1794 the grandfather of Charles Darwin referred to the subject, and gave a partial answer which agrees with the views now generally held. In his "Zoonomia" he writes: "The colours of many animals seem adapted to their purposes of concealing themselves, either to avoid danger or to spring upon their prey" ("Zoonomia," Vol. I., p. 509).

Since the time of Erasmus Darwin, the matter has been investigated by many observers, including his celebrated grandson, Wallace, Bates, Fritz Müller, Weissmann, Meldola, and Poulton. As the result of their labours it is now very generally believed that the colours of animals may be divided according to their uses into three groups which, in Mr. Poulton's words, are defined as follows:—

(1.) *Apatetic*, or deceptive colours; those which cause an animal to resemble some part of its usual environment, or which cause it to be mistaken for an animal of another species.

Examples of this class are numerous: such are the general green colour of animals which live on plants, as that of many caterpillars, tropical birds, tree-frogs, and tree-snakes; the shades of yellow and brown characteristic of autumnal moths which fly among the dying and withering leaves; the brown colour of the hare, which, as it sits motionless, exactly resembles a lump of brown earth, etc That the brilliant stripes of the zebra and tiger should be an instance of deceptive colouring is certainly at first sight startling; yet so it seems to be, for it is stated by Francis Galton that on a bright moonlight night the colour produced by the black and white stripes of the former exactly resembles the pale tint of the arid ground of the region it inhabits; while the tiger, among tropical vegetation, is almost invisible at even so short a distance as twenty yards, for his black stripes assimilate with the deep shadows, and his tawny stripes with the long pale yellow leaves of his surroundings.

* Animal Coloration: An Account of the Principal Facts and Theories Relating to the Colours and Markings of Animals. By Frank E. Beddard, M.A., F.R.S.E. London: Swan, Sonnenschein, and Co. Price 10s. 6d.

In some animals their apatetic colouring can be changed to harmonise with that of the environment: thus the tree-frog is bright green when among green leaves, dark brown when resting on the earth or among brown leaves; and trout, as well as some other fish, are light coloured when swimming over a gravelly or sandy bottom, dark over a muddy one. This power of "variable resemblance" is possessed also by caterpillars when they are changing into the pupal condition. Mr. Poulton has shown by a series of remarkable investigations that during the last thirty hours of larval life, many caterpillars are greatly influenced by surrounding colours, so that the pupæ which are formed partake of their general character. Thus, he found that caterpillars of the Small Tortoise-shell butterfly, which had spent the last day or so of that stage among dark surroundings, formed dark pupæ, while the pupæ of those "turning" among light surroundings were light. In nature, dark pupæ are found attached to dark surfaces, light pupæ to light surfaces, and obviously this arrangement gives them a better chance of escaping the notice of birds.

In another type of deceptive colouring, the animal resembles not the general surroundings but some special object which is of no interest either to its enemies or to the creatures on which itself preys; in the former case the animal escapes attack, in the latter it is able to approach its prey with greater chance of seizing it. Very familiar examples of the first-mentioned case are the "stick caterpillars" or "loopers," which are the larvæ of those moths called *Geometræ.* They are very common, but are rarely seen, because of their perfect resemblance to the twigs of the plants on which they feed. Other caterpillars resemble moss or bits of lichen. Many butterflies come in this division, as, for instance, our own Red Admiral and Tortoise-shells, which are very brilliant on the upper surface of their wings, but very sombre on the lower; as they rest on plants, the wings are folded so that the lower surface only is seen, which, in that position, looks not at all unlike a withered leaf. In some tropical butterflies of the genus *Kallima* this resemblance is almost perfect, the shape, veining, blotches, and even the holes due to larvæ being closely represented. There are many other examples equally remarkable, such as the Mantis, which closely resembles the flower of an orchid.

The third type of this class of colouring is where one animal resembles, or, as it is said, "mimics" another, thereby obtaining advantages due to the way in which the mimicked form is regarded by other animals. The best known examples are found among tropical butterflies of the families *Pieridæ* ("Whites") and *Heliconidæ*: certain species of the latter are unpalatable and are not, it is said, eaten by birds, while the former are palatable and largely eaten; certain species, however, of the former obtain immunity by the resemblance which they bear to the unpalatable forms of the *Heliconidæ*, which is so close that even experienced naturalists have at first sight been deceived.

(2.) In the second class, the colours are *sematic*; that is, for warning foes or signalling to friends, and are very prominent and striking. First and chiefly, they may warn off enemies because they denote some dangerous or unpleasant property of their owner; this is the case with the skunk, which carries its large, white, bushy tail high up so that all may see it, as an indication of the horribly smelling fluid which it can eject. Other examples are the black and yellow colours of bees, wasps, and hornets; the gaudy colours of unpalatable insects, of poisonous snakes, and of some frogs, toads, &c., the skin of which secretes an acrid, poisonous fluid. In many cases actual experiment has shown that the owners of the bright colours are rejected as food by creatures which feed on other species of sober tints.

Secondly, bright colours may direct the attention of an enemy towards some specially defended part, such as the bundles of poisonous hairs in some caterpillars, or towards some non-vital part, as the "eyes" in the wings of certain butterflies.

Thirdly, prominent colour enables individuals of the same species to recognise and follow each other; such is the white tail in rabbits.

(3.) The third division is that of *epigamic* colours, or those displayed in courtship; they are generally confined to the male. The bright and beautiful colours of many butterflies and birds, often associated in the latter with plumes and variously modified feathers, are examples; the peacock is a good instance.

The external colours of animals, therefore, are, it is generally believed, of use either for concealing or calling attention to their owners, in which case the degree of perfection present is due to the action of natural selection; or, when the colours are present in one sex only, they are of sexual significance, and are the result of selection by the opposite sex.

In the latest contribution to the subject, "Animal Coloration," by Mr. Frank E. Beddard, the author, who is the prosector to the Zoological Society, gives an account, with numerous examples drawn from all sources, of the principal facts and orthodox theories which have been touched upon above, but also brings forward facts new or not generally known, and champions some unorthodox theories as to the origin of colour changes. The book has grown out of materials used by him for the "Davis Lectures," delivered in the Zoological Society's Gardens in 1890, and is "addressed to persons having no special knowledge of zoology." While the book does not claim to contain much that is quite new, yet certain facts and theories are in it, for the first time, brought before the general public out of the obscurity of periodicals, many of which are foreign; an important feature being that the action of other agents than natural selection in modifying colours is taken into account. Most writers on the subject consider colour to be of use to its owner only in one of the ways mentioned above, and to have been developed by natural or sexual selection; Mr. Beddard shows good reason for differing to some extent from these widely received generalisations. He shows that colours may serve other purposes than those mentioned; that what to human eyes seem to be excellent modes of concealment, may not be so to the eyes of lower animals; that cases of resemblance between animals may not be due to mimicry, and that there may be other agents than natural or sexual selection engaged in developing colours. These points must now be dealt with in a little more detail.

In considering the subject, Mr. Beddard points out that we must draw one very important distinction, that between the *colours* and *coloration* of animals: colours, that is the actual tints (blue, red, etc.), found in animals are a normal product of the organisation entirely independent of utility; they are due either to the structure of the surface on which they appear or to the molecular constitution of pigments present in the animal, and are, therefore, optical effects due to purely physical causes, and *per se* are of no use to the animal. On the other hand, the arrangement and distribution of colours, or coloration, may be of great importance to an animal, and may be developed and modified by natural or sexual selection, and probably by other agents. Colour, then, is a purely physical property; it is due, principally, to the presence of pigment, for even where largely caused by structure, pigment is generally present, forming a background, without which the colour is not visible. Pigment, therefore, is largely concerned in the production of colour, and the origin of a given pigment may explain the meaning of coloration.

Consequently a study of the origin and meaning of animal pigments is of the highest importance to a correct understanding of the problems of coloration. At present very little is known about these important factors in the question; they may be divided into four classes:—

(1.) Pigments of direct physiological importance, as for instance tetronerythrin, common in sponges, and hæmoglobin, which are both respiratory in function.

(2.) Pigments which are waste products stored up in the skin; such is the yellow pigment present in the scales of the Brimstone, Clouded Yellow, White, and other butterflies; it is a compound related to uric acid.

(3.) Pigments obtained from other animals, and more or less altered; the green colour of the blood in caterpillars is due to the slightly altered chlorophyll obtained from the plants on which they feed. It is suggested by Mr. Beddard that the frequent resemblance between animals which live together, as that of certain nudibranchs, annelids, and starfish to the corals on which they feed, may simply be due to the presence in the former of unaltered pigment obtained from the latter, so that the aid of natural selection need not be invoked to explain the likeness.

(4.) The pigment, as far as known, is of no use to the animal except in so far as it produces a resemblance to external objects which benefits the owner. In such cases, which are many, investigation is much needed into the nature and origin of the pigment.

Colour, then, depends on the physical constitution of pigment or of the tissues; anything which affects the physical constitution of the body may produce changes of colour. The external agents likely to be concerned are food, heat, cold, dryness, moisture, light, and darkness. There are several well authenticated instances of the effect of food on colour. Thus, the larvæ of the Large Tortoise-shell butterflies when fed on nettles, which are not their usual food, formed imagoes showing a wonderful similarity to those of the Small Tortoiseshell which usually feed on nettles. Again, some pupæ of *Saturnia* brought from Texas to Switzerland developed into normal forms; the caterpillars which they produced were fed on *Juglans regia*, *J. nigrans* being their food plant in Texas; the moths into which they turned were so different from the parent as to be reckoned a distinct species.

As to climate, the effects seem considerable. Thus heat and moisture seem to produce a darkening of coloration, while cold and darkness have the opposite effect. The prevailing colours in tropical countries are yellows, reds, greens, and browns; in temperate and arctic regions they are blacks, greys, yellows, and whites. In some cases the multitudinous factors which make up the environment produce very marked results. Thus in Ceylon the marine as well as the insect fauna is prevalently green, even echinoderms and corals being of that colour. Probably another example of the action of environment is a butterfly in Argentine, which is exceedingly like the European *Vanessa levana*, and even has a variety like that of the latter, but belongs to a different genus. If the two forms occurred in the same region it would be said to be a case of mimicry, but as this is evidently not the case, is it not probable that some resemblances between animals inhabiting the same country may equally be not due to mimicry?

Again, another example of the effect of external conditions on colour is probably shown by the celebrated fauna of various natural caves such as those of Kentucky, where darkness ever reigns. The animals of these caves are numerous and varied; they are all nearly or quite blind, and are all nearly white, a phenomenon due to the absence of pigment. This colourless condition has been supposed to be an argument for the purposefulness of colour where it is present, since it is thought to have disappeared in this case because it is useless. To this conclusion, however, Mr. Beddard objects; for, says he, colour is allowed to be a normal product of organisation and not to owe its origin to natural selection; therefore, even if natural selection ceases to act it ought to be present whether the coloration produced is useful or not, though the latter, indeed, may become irregular. Since, then, colour is absent, though it ought to be present, it looks as though the absence of pigment is due to environmental conditions, a theory supported by Mr. Poulton's observation, that an amphibian, which when brought from the caves of Adelsberg, was colourless, became darker on continued exposure to light.

In the instances just quoted it seems certain that other agents than natural selection have affected the colours and coloration; it is probable, therefore, that in various other cases the coloration has not been developed by natural selection and has not the purpose which is usually ascribed to it. This conclusion is supported by the following among other instances.

In the case of "red snow" and the green of most plants, it is clear that the coloration is not adapted to a particular end, and this seems true, also, in some cases where there is a wonderful individuality, a character which is usually taken to indicate purposefulness : thus the palate of the Orang-outang is black, that of the Chimpanzee, flesh-colour. Such a difference in other cases is sought to be explained by natural selection, but if no such explanation is possible here, is it not probable that many forms of external colour modifications may exist without such explanation ? Then, again, there are the deep sea animals : the abysses of the ocean are profoundly dark, as is shown both by direct experiment and also by the absence of plant-life ; the majority of the animals inhabiting these depths are blind, and yet, as a rule, they are of brilliant coloration, the sea-urchins being dark purples and browns, the crustaceans often of brilliant scarlet, and the fishes commonly black. Now, as it is an enormously long time since the ancestors of these animals migrated from shallow waters into the abysses, according to the commonly received theory, the coloration originally of use ought now, having for so long been useless, to have disappeared. But it has not. Since, then, natural selection has had no effect in this case, need we suppose that agent essential to account for the coloration of shallow water forms ?

We turn now to another consideration urged by Mr. Beddard : in many cases the object of coloration seems evident enough to human ideas, yet we ought to receive the explanation with doubt, just because we are human and cannot view the matter from the point of the animals concerned, and especially should we suspend our judgment if there are any facts opposed to the theory. Thus, the marine animals—known as the pelagic fauna—which live near the surface of the sea, are generally quite transparent, except for the contents of their stomachs, which are often yellowish, and resemble a small piece of sea-weed. These animals, at first sight, seem perfectly protected against enemies, but, asks Mr. Beddard, of what use is their invisibility in the case of a school of whales or a shoal of fish which simply strain the water of such food as it contains without pausing to examine carefully what is there ? Again, the green iguana lying along the branch of a tree would seem to be another perfect example of protective coloration, yet there is a species in Sta. Lucia which, in spite of its colour, is easily caught by dogs, as these animals hunt by smell and not by sight ; against such foes, and they will be many, the most perfect protective coloration would be useless.

Another consideration of primary importance in discussing the object of resemblances among animals is their power of vision ; we judge of the efficiency of disguise in an animal by the effect on our own eyes, but it is a question how far a disguise, which to us, who are so much bigger and have no commissariat interest in the matter, seems perfect, would be beneficial to a smaller animal, whose chances of forming or obtaining a dinner depended on his keenness of eyesight. For instance, among the pelagic fauna mentioned above, there are small fish so pellucid as to be invisible to our eyes except after prolonged watching; as far as human eyes are concerned they are well protected. The outer surface of their bodies, however, is dotted over with minute specks of pigment. Now if these fish were as big as ourselves, the specks would be as big as saucers, and would show us the presence of the creatures, however transparent the rest of their bodies might be: it is fair to conclude that the result would be the same were we as small as the fish.

Again, among insects, it is not at all certain that vision goes beyond perception of colour, of light and shade, and of movement; appreciation of form seems absent. Such being the state of our knowledge, Mr. Beddard seems justified in his suggestion that it is "surely premature to build up theories which often demand a sense of vision in invertebrated animals precisely similar to that possessed by ourselves."

This observation has a considerable bearing on the value of protective colouring combined with modification of form; certainly in many cases that deception is intended seems obvious, but at the same time it is a question how far insects would be affected by it; "there is a tendency," says our author, "to assume their gullibility without bringing forward any proofs." It seems likely that most insects would be indifferent to the appearance of an object, provided that it remained motionless, so that in the case of the tree-frog, it may not be due so much to its colour that it escapes detection by insects as to the fact that it remains motionless.

Various difficulties in the way of the generally received theory of protective colouring are brought forward, of which we will mention one only. Many caterpillars, which feed on grass or low-growing plants among grass, are brown or green, with longitudinal stripes; the latter, it is asserted, have been developed by natural selection, the caterpillars profiting by the resemblance which they are supposed to present to blades of grass. The larvæ of the *Satyridæ* all have these characters, yet they feed by night, when they cannot be seen, and hide by day, when, if ever, the coloration would be useful. There are other striped larvæ to which the resemblance is equally useless, since they feed on the pith of reeds, and are, therefore, hidden from view.

One very interesting idea is suggested by Mr. Beddard: it is generally thought that colours of animals are modified in adaptation to the environment; our author suggests that in some cases animals seek an environment suitable to their coloration, for it is stated that a small black moth (*Phycis carbonariella*) is constantly met with in patches of underwood that have been burnt; its dusky hues approximate to the colour of charred wood. The Snowy Owl, too, appears to select a snowy patch of ground to rest upon, in preference to rocks and stones which are not covered with snow.

(To be continued.)

THE CULTIVATION OF ORCHIDS.*

BY E. A. BEVERS.

INTRODUCTORY.

The title of the paper I have the pleasure of reading to you to-night is "Notes on Orchids, and their Culture," but I wish you to understand that I do not present myself before you as a professor in the art of orchid culture, but rather to tell you what I know to be absolutely correct regarding their treatment, both from personal observation, and practical work amongst them for upwards of twelve years, and also what I have gleaned from other sources. I would wish to add that I have gained a great deal of very useful information from works by the following authors:—Lewis Castle, F. W. Burbridge, James Britten, and W. H. Gower, whose books you will find very interesting. Orchids, although infinitely more abundant in some regions than in others, are found in almost all parts of the world, except upon the verge of the frozen zone and in climates of excessive dryness. In Europe, Asia, and North America they grow everywhere, in groves, marshes, meadows; at the Cape of Good Hope they abound in similar situations; but in the hot damp parts of the West and East Indies, in Madagascar, and in the neighbouring islands, in the damp and humid forests of Brazil, in the mild warm parts of Central America and Western Mexico, in the damp, tropical parts of India, and in the lower mountains of Nepaul, they flourish in the greatest variety and profusion, not only seeking their nourishment from the soil, but clinging to trunks and limbs of trees, to

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* Read before the Oxfordshire Natural History Society, March 17, 1892.

stones and bare rocks, where they vegetate among ferns and other shade-loving plants in countless thousands. The knowledge of orchidaceæ has grown during the last fifty years at a rate quite out of proportion to that of the rest of the vegetable kingdom. Linnæus only knew about a dozen exotic orchids, and stated his opinion that the world, when fully examined, might probably yield as many as a hundred species. Now at least 2,500 are known to English horticulturists, while the number of species in the order is estimated at 6,000.

When orchids were first imported into this country from tropical and subtropical regions, an idea that they all required excessive heat to grow them appears to have been taught and accepted by all horticulturists. To the earlier orchid growers it would appear to have been of but little moment where the plant came from, or under what conditions it grew in its native habitat. They might come from the humid valleys of the Indian Archipelago, the dry regions of South or Western Africa, the mountain chains of Mexico or Peru, or even the snow line of the Andes, but their treatment was the same, and they were placed in the hottest temperature at command; and even now the highest temperature often means the driest, and this was specially so under the old flue system of heating. Under these adverse conditions we can hardly wonder that many of the newly-imported orchids died in a few months after their introduction—now and then, however, they produced a few flowers, often the last effort of expiring nature, and not properly developed; still the delicate colours and fragrance soon began to be spoken of from time to time, as they flowered in the early collections.

Although a larger proportion of the first or early specimens might now be considered but poor plants, still they attracted the attention of nearly every one interested in plants at the time, including the Duke of Devonshire and the celebrated Mrs. Lawrence, after whom many are named, and they have rapidly risen in the estimation of horticulturists and the general public ever since. Those who invest in orchids judiciously, and use a little common sense to grow them, will receive good interest for their trouble, for most of them are not difficult to grow, not more so than the ordinary geranium, and in most cases the plants will increase in size and value, while a real and lasting pleasure will attend the mind capable of contemplating these living wonders, and amply repay any slight outlay on these the most beautiful of all plants. I do not wish to be understood as implying that orchids alone are worthy of culture; on the contrary, I agree that all plants are beautiful, but orchids are superlatively so, and not by any means so difficult to grow as some people imagine. The old idea of excessive heat is still adhered to by many, although we rarely find orchids enjoying vigorous health in such places, while in the comparatively few places where orchids are cultivated in a cool moist atmosphere, they may be found enjoying the most luxuriant health. This is a very important fact, for every orchid grower knows that healthy imported plants are far better to deal with than such debilitated specimens as have been ruined by bad cultivation in a high and dry atmosphere. I contend that it matters but little what the natural temperature of their native habitat may be; if they succeed well with us here in a much cooler one, so much the better. It is a great mistake to use fire heat when it is not required. In the first place it is unnatural, even when modified as much as possible by moisture. Secondly, it is a source of trouble, annoyance, and expense, both to the gardener and his employer, and I am well satisfied that a great number of beautiful orchids will succeed perfectly well without any fire heat at all during an ordinary summer; in fact, I do not use fire heat from the middle of May until the middle of October, and the orchids grow, I may say, like weeds with me—even last year they were without fire during part of May, the whole of June, July, and part of August (and I think you will remember it was rather a cold summer). Again, during the winter months fire may be reduced to a minimum, by carefully using covering material for the houses, such as mats. My houses were covered with mats during the winter of 1891, *i.e.*, the whole of December, January, February, and part of March—they were covered all over with the exception of about two feet at the top to let in a little light; they do not want much light during the winter months, as most of them are resting; but on the other hand, when they are growing, you cannot give them too much light, but you must not allow them to be scorched by the sun. Another great requisite in the culture of orchids, more especially the cool section, is full and free ventilation, not only during the day time, but also through the night, of course taking precautions against cold draughts by tacking coarse tiffany or perforated zinc over the openings—this also prevents cats, snails, and slugs entering. If ventilation is beneficial during the day time, why not during the night? We are frequently told that orchids require houses to themselves, but really a greater or more absurd fallacy could not be taught; one would almost be led to infer from this that orchids were exclusive and occupied some particular portions of the globe to the utter exclusion of all other vegetation. We can grow palms, begonias, ferns, dipladenias, stephanotis, &c., in an ordinary plant stove, but the orchids which have grown side by side with them in their natural habitats must be placed in a structure called an orchid house. It may be taken as a rule that wherever tropical ferns and fine foliage plants succeed there also orchids, or at least many of them, will luxuriate, often with far greater chances of success than when placed in our so-called orchid houses, which, however desirable, are not absolutely essential to their culture.

I do not to-night intend to go into a minute botanical description of an orchid, but will only give you a rough outline of their characteristics.

ROOTS.

The popular designation of "air plants" that was long applied to orchids, and which still survives in the name of the genus aërides, indicates a character distinguishing a large number of species, namely, all those which in a state of nature grow upon trees and other plants, living upon the moisture in the air and having no communication with the earth by means of roots, as in ordinary plants. These were at one time regarded as parasites, but as they do not derive any of their support from the substance of their host, the term was inaccurate, and epiphyte, meaning simply a plant which grows upon another, was applied to orchids and others of like habit. The epiphytes comprise a large proportion of the tropical orchids, which luxuriate in warm, moist climates, and clothe living and dead trees with fresh green leaves and beautiful flowers. Another large group of species, including those of temperate climates, such as we are familiar with in Britain, are termed terrestrial, from their growing in soil like most plants. These two groups naturally differ considerably in their roots, as they have very different functions to perform. In the former or epiphytes the roots are mostly thick and fleshy, often green, like the leaves or stems, but sometimes white or ash coloured, cylindrical or flat, varying in size from about half an inch in diameter to the most slender fibres, and in length from a few inches to two or three feet. The roots of most epiphytal orchids appear to prefer growing in the air to being surrounded by any moisture-holding substance, and in cultivated plants this is especially noticeable, much injury being often done by burying the roots deeply. The roots of such genera as the Moth Orchid (phalænopsis) are very strange, flat, and of an ashy or leaden colour. These cling closely to the wooden blocks or baskets in which the plants are grown, and often present an appearance almost suggestive of diminutive snakes. Terrestrial orchids produce fleshy and fibrous roots that are confined to the soil, and partake more of the nature of ordinary roots. As many of these plants are deciduous, losing their leaves in the autumn, and as many do not produce perennial stems, they obviously need some store of strength for another season; this is provided for by the tubers, which numbers of our British orchids produce.

THE STEMS.

The orchids which possess true stems are chiefly those of the Vanda, Aerides, Saccolabium, and Angræcum type, in which the leaves are produced in a two-ranked (distichous) manner on opposite sides of the stem, and produce their flowers from the axils of the leaves; some of these attain a height of twelve feet or more, and are the giants of the orchid family.

THE PSEUDO-BULBS.

To the swollen base of the stem, which in many orchids assumes an ovoid form a few inches high, and in others becomes cylindrical and stem-like several feet in length, the name pseudo-bulb is given, and though very different in appearance, it is practically a tuber above ground, and appears to serve in a similar way, as a storehouse of nutriment, to be subsequently used by the plant. All growers understand this, and know that unless large and well-ripened pseudo-bulbs are obtained, good flowers cannot be expected, and as the pseudo-bulbs improve year by year, so do the flowers advance and increase. In the Dendrobiums the pseudo-bulbs become quite stemlike, either erect or drooping, cylindrical and several feet long, bearing the flowers at the nodes over the whole length. In most of the others the growth of one season forms the bulb of the following one, producing its flowers from the top or base.

FLOWERS.

We have outside a row of three sepals, then come three petals, two of which usually more or less resemble the sepals in shape and colouring, while the third petal (as we may consider it for practical purposes), which usually differs considerably in size, colour, and form, and is the lowest in the flower, is known as the labellum or lip. This labellum is sometimes prolonged backwards at the base into a tail or spur, which usually contains honey, and in the wonderful *Angræcum sesquipedale* of Madagascar the spur is more than a foot long. So commonly does the nectary of orchids appear to offer temptations to insects, that Darwin ventured to state the probability that some moth, or similar insect, was concerned in its fertilisation, and possessed for the purpose a proboscis of sufficient length to reach the nectar at the lower part of the spur. This was not quite believed at the time, but since then a moth has been found in Brazil with a proboscis over ten inches long. The other remarkable point in the flower of an orchid is the column. In most blossoms the stamens and pistils are separate organs, but in the orchid these are consolidated into a central, waxy, often club-shaped body, which is known by this name. The mimicry in orchids is very peculiar, many of our British orchids possess flowers which are very suggestive of insects, as the fly, bee, and spider, others again resemble animals as the frog, monkey, and lizard orchids. Amongst the exotic orchids the mimicry is still more striking, as in the Dove plant or Holy Ghost flower of the Spaniards, *Peristeria elata*, which viewed in front is much like a dove about to alight. The celebrated butterfly orchid, *Oncidium Papilio*, is very remarkable, and its extraordinary flowers are said to have attracted the Duke of Devonshire's attention so strongly at one of the London Horticultural Society's meetings many years ago, that it induced him to give his attention to orchids, and led to the formation of the noted Chatsworth collection, one of the finest, if not the finest, in the country.

CULTURE.

All those who contemplate commencing orchid growing should begin with the free-growing, profuse-blooming species, and if these succeed and give satisfaction, which they certainly will do if rationally treated, the newer and rarer kinds may be added as opportunities present themselves. The first commencement of nearly every orchid collection is but a series of trials and experiments, and it is always best to experiment with the commoner plants, rather than with the rarer and consequently more valuable species. Many people have a fancy for purchasing newly-imported plants, and this can be done most weeks at the auction rooms of Protheroe and Morris, Cheapside, and Stevens, King Street, Covent Garden. In fact, my collection, which now numbers about 700, is, with few exceptions, from imported pieces. It is as well, however, to inform you that you will have to compete with the various nurserymen or their orchid growers, men who have in the majority of cases an extensive knowledge and well matured experience of the plants they wish to buy. There are always many additional attractions about imported and unbloomed plants, and a keen pleasure in watching their buds slowly expand, perhaps for the first time in Europe; added to this there is always a possibility of obtaining some new or rare species or varieties amongst them. But, as I said before, you want to know what you are about, and be able to judge whether there is any vitality about the plants you purchase. For instance, orchids grow from a small eye or bud at the base of the pseudo-bulb, and you should be able to tell whether these eyes are alive or rotten and useless, otherwise you would buy a bundle of imported orchids, which, although they would remain green for some time, would never grow. I should therefore advise you to buy a small collection of established plants from any nurseryman who makes them a speciality. This is advantageous in several ways. Strong plants can be obtained that will not be so likely to disappoint the amateur cultivator, and the plants having been properly potted will give little trouble the first year.

(To be continued.)

THE BOTANY OF BIDDULPH AND THE NEIGHBOURING PARTS OF NORTH STAFFORDSHIRE.

BY THE REV. W. H. PAINTER,
AUTHOR OF A "CONTRIBUTION TO THE FLORA OF DERBYSHIRE."

(Continued from page 164.)

Primula vulgaris, *Huds.* In Districts I. and II. This plant is rapidly disappearing, through the depredations of the members of the Primrose League; hence I give no habitats.

P. veris, *L.* I. Moody Street, Biddulph. II. Near Knypersley Pools.

Lysimachia vulgaris, *L.* III. On the east bank of Rudyerd Reservoir.

L. nemorum, *L.*

Anagallis arvensis, *L.*

Fraxinus excelsior, *L.*

Erythræa Centaurium, *Pers.* I. On sand; the drive from Biddulph Grange; New Pool.

[**Menyanthes trifoliata,** *L.* I. Biddulph Hall; planted; likewise the next plant—

Symphytum officinale, *L.*

Var. **patens,** *Sibth.*]

Myosotis cæspitosa, *Schultz.* II. Knypersley Pools. III. Rudyerd.

M. palustris, *With.*

Var. **strigulosa,** *Reichb.* III. Rudyerd.

M. repens, *D. Don.* I. Biddulph Moor. III. Roadside, Horton.

M. arvensis, *Hoffm.* I. Biddulph. III. Rushton Spencer and Horton.

M. versicolor, *Reichb.* II. Knypersley Pool. III. Rushton Dingle and Rudyerd Reservoir.

Calystegia sepium, *R. Br.* I. Biddulph.

Solanum Dulcamara, *L.*

Linaria Cymbalaria, *Mill.* I. Wall in Gutter Lane; alien.

L. vulgaris, *L.* Seen only outside these districts on railway bank at Milton.

Scrophularia nodosa, *L.* II. Mill Hayes. III. Rudyerd Reservoir.

Digitalis purpurea, *L.*

Veronica persica, *Poir.* II. Garden weed at Knypersley Hall; and III. at Rudyerd Railway Station.

V. serpyllifolia, *L.* **V. officinalis**, *L.* **V. Chamædrys**, *L.*

V. scutellata, *L.* III. At north end of Rudyerd Reservoir.

V. Beccabunga, *L.*

Euphrasia officinalis, *L.*

Bartsia Odontites, *Huds.* III. Horton.

Pedicularis sylvatica, *L.*

Melampyrum pratense, *L.* Common.

Var. **montanum**, *Johnst.* I. Congleton Edge and Wickenstone Rocks.

Rhinanthus Crista-galli, *L.*

Mentha hirsuta, *L.* I. Various places in Biddulph. II. Knypersley Pools.

M. arvensis, *L.* II. Knypersley Pools. III. Rushton Spencer.

Lycopus europæus, *L.* II. Knypersley Pools.

Nepeta Glechoma, *Benth.*

Scutellaria galericulata, *L.* II. Knypersley Pools. III. Rudyerd Reservoir.

Prunella vulgaris, *L.*

Stachys Betonica, *Benth.* I. The Drive from Biddulph Hall, in small quantity.

S. sylvatica, *L.*

Galeopsis Tetrahit, *L.*

Lamium purpureum, *L.*

L. maculatum, *L.* III. Rushton Spencer; alien.

L. album, *L.*

L. Galeobdolon, *Crantz.* I. By the side of the brook, Biddulph.

Teucrium Scorodonia, *L.*

Ajuga reptans, *L.*

Plantago major, *L.* Common.

Var. **intermedia**, *Gilib.* II. Knypersley Park. III. Rudyerd Reservoir.

P. lanceolata, *L.*

Littorella lacustris, *L.* II. Knypersley Reservoir, in 1887, when it was dry. III. Rudyerd Reservoir ; Mr. Garner's station.

Scleranthus annuus, *L.* I. Biddulph.

Chenopodium album, *L.*

C. Bonus-Henricus, *L.* III. Rudyerd.

Atriplex patula, *L.*

Var. **angustifolia,** *Sm.* II. Near Knypersley Hall, upon cultivated ground.

A. hastata, *L.* II. Cinder Bank, Childerplay.

Polygonum Convolvulus, *L.* II. Fields, Knypersley.

P. aviculare, *L.*

P. Hydropiper, *L.* III. Near Rudyerd.

P. Persicaria, *L.*

P. lapathifolium, *L.* II. Shingle, Knypersley Reservoir.

P. amphibium, *L.* II. Knypersley Pools and Reservoir. III. Rudyerd Reservoir.

P. Bistorta, *L.* II. Brown Lees ; roadside between Knypersley and Lask Edge ; Brown Edge. III. Rushton Spencer.

Rumex sanguineus, *L.*

Var. **viridis,** *Sibth.* II. Knypersley Park.

R. obtusifolius, *L.* **R. crispus,** *L.*

R. Hydrolapathum, *Huds.* II. Knypersley Hall.

R. alpinus, *L.* III. Rudyerd ; alien.

R. Acetosa, *L.* **R. Acetosella,** *L.*

Euphorbia Helioscopia, *L.* II. Fields, Knypersley.

Buxus sempervirens, *L.* I. Biddulph Hall ; planted ; very old shrubs.

Mercurialis perennis, *L.*

Ulmus montana, *Sm.* I. Biddulph.

Urtica dioica, *L.*

[**Myrica Gale,** *L.* I. Biddulph Hall, planted.]

Betula alba, *L.* I. Trough Stones. II. Near Knypersley Pools.

B. glutinosa, *Fr.* III. Road from Lask Edge to Rushton Spencer.

Alnus glutinosa, *L.*

Corylus Avellana, *L.*

Quercus Robur, *L.*

Var. **sessiliflora,** *Salisb.* I. Spring Coppice and other places, Biddulph.

[**Castanea sativa,** *Mill.* II. Knypersley ; planted.]

Fagus sylvatica, *L.* II. In various places ; planted.

Salix pentandra, *L.* II. Lask Edge, 890 feet ; road to Leek from Knypersley, below Knypersley Mill.

S. fragilis, *L.*

Var. **britannica**, *F. Buchanan Whyte.*

[**S. alba**, *L.*, var. **vitellina**, *L.* I. Biddulph Hall ; planted.]

S. undulata, *Ehrh.* II. Near Kynpersley Pools.

S. purpurea, *L.* III. Near north end of Rudyerd Reservoir. I have not been fortunate enough to obtain the catkins of this shrub, and, therefore, have not been able to determine the varietal name.

S. viminalis, *L.* II. Various places. III. Near north end of Rudyerd Reservoir.

S. Smithiana, *With.*

Var. **sericans**, *Tausch.* II. Near Knypersley Pools, *teste Dr. F. Buchanan Whyte.*

S. rugosa, *Leefe.* II. Near Knypersley Pools.

S. cinerea, *L.* **S. aurita**, *L.* **S. caprea**, *L.*

Populus alba, *L.* II. Road ; south end of Knypersley Reservoir.

P. tremula, *L.* I. Biddulph ; New Pool ; Congleton Edge. II. Knypersley ; Leek Road from Knypersley.

Var. **villosa**, *Lange.* III. Rudyerd.

P. nigra, *L.* III. North end of Rudyerd Reservoir.

Empetrum nigrum, *L.* III. Rudyerd ; in very small quantity ; almost extinct.

Taxus baccata, *L.* In various places.

Pinus sylvestris, *L.* I. Spring Coppice. II. Knypersley Park. III. About Rudyerd. Planted in all places.

Elodea canadensis, *Mich.* II. Knypersley Pools. III. Rudyerd Reservoir, &c.

Epipactis latifolia, *Auct.* II. Knypersley Park ; in small quantity.

Orchis mascula, *L.* I. Biddulph ; in small quantity.

O. maculata, *L.*

Habenaria chloroleuca, *Ridley.* I. Drive from Biddulph Grange.

Iris Pseudacorus, *L.* I. Biddulph Mill.

Narcissus Pseudo-narcissus, *L.* I. Biddulph. II. Crowhall Farm.

Scilla nutans, *Sm.*

Juncus bufonius, *L.* **J. squarrosus**, *L.*

J. effusus, *L.* II. Knypersley Park. III. Rudyerd.

J. conglomeratus, *L.* II. Knypersley Park, &c.

J. supinus, *Moench.* I. Congleton Edge. III. Rushton Spencer.

J. lamprocarpus, *Ehrh.*

J. acutiflorus, *Ehrh.* I. The drive from Biddulph Grange. III. Near Harracle's Mill, Rudyerd.

Luzula pilosa, *With.*

L. maxima, *DC.* II. Dingle, near Knypersley Pool.

L. campestris, *DC.*

L. multiflora, *L.* Common.

Var. **congesta**, *Koch.* II. Near Knypersley Hall.

Typha latifolia, *L.* I. Pond near Moor House.

Sparganium ramosum, *Curtis.* I. Biddulph. III. Rudyerd.

Var. **microcarpum**, *Neuman.* III. Near Harracle's Mill, Rudyerd, Mr. C. Bailey, F.L.S.

S. simplex, *Huds.* II. Knypersley Pools.

Lemna minor, *L.* In all three districts ; likewise—

Alisma Plantago, *L.*

Potamogeton natans, *L.* I. Biddulph Common, 900 feet. II. Knypersley Park.

P. rufescens, *Schrad.* I. Pond near Moor House. II. Knypersley Pools. Canal feeder below Knypersley Mill.

P. obtusifolius, *M. and K.* **P. pusillus**, *L.* II. Knypersley Pools.

P. pectinatus, *L.* III. Rudyerd Reservoir.

Eleocharis palustris, *R. Br.* II. Knypersley Pools. III. Rudyerd.

Scirpus cæspitosus, *L.* I. Wickenstone Rocks.

S. setaceus, *L.* I. Drive from Biddulph Grange.

S. sylvaticus, *L.* III. Near Harracle's Mill.

Eriophorum vaginatam, *L.* I. Wickenstone Rocks.

E. angustifolium, *Bott.* I. Wickenstone Rocks. III. Between Lask Edge and Rushton Spencer.

Carex paniculata, *L.* III. Near Harracle's Mill.

C. echinata, *Murr.* I. Biddulph.

C. remota, *L.* II. Near Knypersley Reservoir.

C. curta, *Good.* II. Between Brindley Ford and New Chapel.

C. ovalis, *Good.* I. The drive from Biddulph Grange. II. Knypersley Park.

C. Goodenowii, *J. Gay.* II. Between Brindley Ford and New Chapel. III. Rushton Spencer ; Horton.

C. glauca, *Murr.*

C. pilulifera, *L.* III. Near Rudyerd Reservoir.

C. præcox, *Jacq.* II. New Pool ; near Knypersley Pool ; Brown Edge.

C. panicea, *L.*

C. pendula, *Huds.* I. The Clough, Biddulph.

C. binervis, *Sm.* I. Wood on Congleton Edge.

C. flava, *L.* II. Knypersley Pool.

C. hirta, *L.* I. Wood on Congleton Edge.

C. paludosa, *Good.* III. Near Harracle's Mill.

C. rostrata, *Stokes.* II. Between Brindley Ford and New Chapel.

Phalaris arundinacea, *L.* II. Knypersley Pool. III. Rushton Dingle.

Anthoxanthum odoratum, *L.*

Alopecurus fulvus, *Sm.* II. Knypersley Reservoir, *Mr. J. W. White, F.L.S.*

A. geniculatus, *L.*

Phleum pratense, *L.* I. Biddulph. III. Horton and Rushton Spencer.

Agrostis alba, *L.* I. Woodside.

A. vulgaris, *With.*

Deschampsia cæspitosa, *Beauv.* **D. flexuosa**, *Trin.*

Holcus mollis, *L.* II. Knypersley Park.

H. lanatus, *L.* I. Biddulph. III. Rushton Spencer.

Trisetum flavescens, *Beauv.* I. Once seen at Biddulph.

Arrhenatherum avenaceum, *Beauv.* Common.

Var. **nodosum**, *Reichb.* I. Gillow Heath; Wickenstone Rocks. II. Norton-in-the-Moors.

Sieglingia decumbens, *Bernh.* I. Biddulph; Mow Cop, *Garner.* III. Horton.

[**Phragmites communis**, *L.* I. Biddulph Hall; planted.]

Cynosurus cristatus, *L.* Planted.

Molinia cœrulea, *Moench.* I. Near Mow Cop; Wickenstone Rocks. III. Lask Edge.

Dactylis glomerata, *L.*

Briza media, *L.* II. Near Knypersley Hall.

Poa annua, *L.*

P. pratensis, *L.* I. Congleton Edge. II. Knypersley Reservoir.

P. trivialis, *L.* II. Knypersley. III. Cliff Wood.

Glyceria fluitans, *R. Br.*

G. plicata, *Fr.*

Var. **pedicillata**, *Towns.* III. North end of Rudyerd Reservoir. Type not seen.

Festuca ovina, *L.*

F. rubra, *L.* I. Gutter Lane, Biddulph.

F. elatior, *L.*

Var. **pratensis**, *Auct.* II. Knypersley.

Bromus giganteus, *L.* II. Lion's Paw Wood.

B. mollis, *L.*

Lolium perenne, *L.* Common.

Var. **italicum**, *Beauv.* II. Fields, Knypersley.

Agropyron repens, *Beauv.* II. Knypersley. III. Rushton Spencer.

Nardus stricta, *L.* Moors.

Pteris aquilina, *L.*

Lomaria spicant, *Desv.*

Athyrium Filix-fœmina, *Roth.*

Cystopteris fragilis, *Bernh.* II. Knypersley Park, once seen. III. Rudyerd Reservoir.

Lastræa Oreopteris, *L.*, **L. Filix-mas**, *Presl.*, **L. dilatata**, *Presl.*

Polypodium vulgare, *L.* I. and II. In small quantities.

P. Dryopteris, *Feé.* II. Knypersley Park.

Ophioglossum vulgatum, *L.* I. In a field close to Knypersley Church, &c.

Equisetum maximum, *Lam.* II. A small quantity in one place in Knypersley Park; not mentioned in Garner's "History of Staffordshire."

E. arvense, *L.*, **E. sylvaticum,** *L.*, **E. palustre,** *L.*, **E. limosum,** *Sm.*

Var. **fluviatile,** *L.* II. Knypersley Pools. III. Near Harracle's Mill.

Chara fragilis, *Desv.* II. Knypersley Pool, the *Misses Thompson.*

Plants not seen by me in this part of Staffordshire:—

Erophila vulgaris, *DC.* "On the top of Mow Cop," *Garner.* Not to be found there now.

Raphanus Raphanistrum, *L.*
Silene Cucubalus, *Wibel.*
Geranium dissectum, *L.*
Trifolium procumbens, *L.*
Vicia Cracca, *L.*
Dryas octopetala, *L.* "Mow Cop, on the authority of the late Dr. Davidson. Several gardeners show the plant as obtained there. I have not found it; but the ground is likely and extensive."—*Garner.* Extinct.

Saxifraga granulata, *L.* Mow Cop, *Garner.* Not seen; probably extinct.

Potentilla Anserina, *L.*
Agrimonia Eupatoria, *L.*
Drosera rotundifolia, *Huds.*
Epilobium palustre, *L.*
Sanicula europæa, *L.*
Galium verum, *L.*
Asperula odorata, *L.*
Sherardia arvensis, *L.*
Tanacetum vulgare, *L.*
Vinca minor, *L.* "By rivulet below Biddulph Castle; abundant."—*Garner.* Not to be seen now.
Pedicularis palustris, *L.*
Thymus Serpyllum, *Fr.*
Urtica urens, *L.*
Listera ovata, *R. Br.*
Triglochin palustre, *L.*
Aira caryophyllea, *L.*
A. præcox, *L.*
Bromus sterilis, *L.*
Brachypodium sylvaticum, *R. and S.*
Hordeum murinum, *L.*
Asplenium Adiantum-nigrum, *L.*
A. Trichomanes, *L.*
A. Ruta-muraria, *L.*
Polystichum lobatum, *Presl.*

MIDLAND UNION OF NATURAL HISTORY SOCIETIES' OSWESTRY MEETING,

AUGUST 23RD AND 24TH, 1892.

The arrangements for the next annual meeting are now finally settled, and the dates fixed are Tuesday and Wednesday, August 23rd and 24th. The Union is invited by the Oswestry and Welshpool Naturalists' Field Club; the president is A. T. Jebb, Esq.; the honorary secretaries, Mr. W. Wickham King, Pedmore House, Stourbridge, and Dr. T. Stacey Wilson, Wyddrington, Edgbaston, Birmingham; the hon. local secretary, the Rev. O. M. Feilden, M.A., Frankton Rectory, Oswestry, and the assistant hon. secretary, Mr. Arthur J. Parker, Cobden Buildings, Corporation Street, Birmingham.

Programmes of the proceedings are now being circulated. They contain detailed information of the excellent arrangements made. Copies may be obtained from the secretaries of the various Societies in the Union, and from the officers whose names and addresses are given above. The annual meeting will be held on the first day at the Wynnstay Hotel, Oswestry, and the conversazione in the evening of the same day (by the kind invitation of Colonel and Mrs. Barnes) at the Quinta, near Oswestry. The second day will be devoted to excursions, one for geologists, the other for botanists. Tickets for the conversazione and excursions may be obtained from the Rev. O. M. Feilden, Frankton, Oswestry, and he will arrange for the accommodation of visitors at the Wynnstay Hotel, Oswestry, on being asked to do so.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION.—July 5th. Mr. J. F. Goode (President) in the chair. Mr. T. V. Hodgson exhibited *Euglena viridis*, encysted and otherwise, from Middleton. Mr. S. P. Bolton exhibited *Trichodina parasitica* on *Hydra fusca*. BIOLOGICAL SECTION.—July 12th. Mr. J. F. Goode (President) in the chair. Mr. C. Pumphrey exhibited a fungus (*Stereum purpureum*) which he had taken from an oak window frame at King's Norton, a pane of glass having been cracked by it during growth. Mr. Bolton exhibited Nitella (in fruit) and *Leptodora hyalina* from the canal at Kingswood. Mr. A. H. Martineau exhibited a small case of insects, including stag beetle, *Lucanus Cervus;* two species of wild bees, *Andrena fulva* and *A. cineraria* ; several moths, *Agrotis lunigera*, *Cloantha Solidaginis*, *Selenia lunaria*, *Cilix spinula*, *Timandia amataria*, and *Stilbia anomala* ; also a few species of Ichneumonidæ, parasitic on Lepidoptera. GEOLOGICAL SECTION.—July 19th. Mr. C. Pumphrey in the chair. Mr. C. J Watson exhibited a fine series of photographs taken during the Irish excursion.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—June 20th. Mr. Rolan exhibited specimens of *Sphinx ligustri*, from New Forest, and a collection of insects from Hagley, including *Cynthia cardui*, *Colias edusa*, and *Smerinthus populi* ; Mr. Hawkes, the æcidiospore stage of *Puccinia coronata*, and other microscopic fungi ; Mr. S. White, a specimen of *Silene gallica*, from Sutton Park ; Mr. J. W. Neville, a foreign wasp, *Pelopæus fistularis.* A paper was then read on "Bird Life," by Mr. C. Cardwell. The writer gave a few plain directions for keeping birds in captivity, so that good health and spirits may be preserved. The first part of the paper consisted of directions for the construction of an aviary on the most approved lines, with arrangements for adapting it to the wants of aquatic birds. The latter part dealt with the rearing of nestlings. Some curious observations were recorded showing a high degree of instinct observable in birds, and the ready way we were able to detect their notes of joy, fear, and anger. The latter part gave rise to considerable difference of opinion.—June 27th. Mr. J. Moore exhibited specimens of Death-watch Beetle, also a series of photographs of molluscan palates ; Mr. J. Madison, a deformed specimen of *Unio tumidus ;* Mr. G. H. Corbett, fossils in pebbles from drift beds of Sutton Park ; Mr. J. Collins, the following mosses—*Bartramia fontana*, with male flowers, and *Pottia truncata*, with sporogonium and young archegonium.—July 4th, Mr. J. W. Neville exhibited specimens of glow-worms, *Lampyris noctiluca*, and pointed out the chief distinguishing features of the sexes ; Mr. J. H. Corbett, longitudinal and transverse sections of jaws of Ichthyosaurus ; Mr. J. Collins, a specimen of *Habenaria conopsea*, from Wyre Forest. Under the microscope, Mr. J. W. Neville, the illuminating organ of glow-worm.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—July 11th. Mr. G. H. Kenrick, Vice-President, in the chair. Mr. Wainwright showed for Mr. Wynn a specimen of *Stauropus fagi*, bred from a larva found at Wyre Forest last year ; also a box containing some of Mr. Wynn's captures made in Sherwood Forest during the late visit of the society, including *Hadena contigua*, *Acronycta leporina*, *Agrotis suffusa*, etc. Mr. Kenrick also showed Sherwood captures ; also *Aplecta herbida* from Trench Woods, and a few Scotch insects, including a fine red variety of *Smerinthus populi.* Mr. P. W. Abbott showed a fine variety of *Arctia caia* from a larva reared on coltsfoot, three specimens of *Stauropus fagi* from Wyre Forest, and a nice series of *Melanippe hastata* from the same place. Mr. W. D. Spencer showed a bred specimen of *Acronycta alni* from near Rugby. Mr. C. J. Wainwright showed diptera taken at Sherwood this year, also a few taken in 1889, including *Xiphura atrata*, etc. Mr. A. Johnson showed larvæ of *Anthocharis cardamines* found on pods of the white rocket, which they resemble very closely. Mr. R. C. Bradley showed his Sherwood diptera, and read a few notes upon them. They included two species of *Criorhina*, *floccosa* and *ruficauda*, and *berberina* was also taken by Mr. Wainwright ; also other nice syrphidæ, and a few nice "Daddies," including one perhaps new to the British list.

OXFORDSHIRE NATURAL HISTORY SOCIETY.—At a meeting of the Society on June 9th, in the geological lecture room at the Museum, Prof. A. H. Green taking the chair, Mr. G. Claridge Druce exhibited some interesting specimens of plants found for the first time in Berkshire—an intermediate form of *Geum*, a hybrid between *urbanum* and *rivale*; a Lychnis hybrid between *dioica* and *vespertina*, and *Trifolium subterraneum*. Dr. E. B. Tylor gave a lecture on "Primitive Arithmetic." He began by explaining that all mankind, however low in civilisation, can count by the obvious use of fingers and toes. Thus certain terms used as numerals have come into existence in various barbaric languages, as where the words denoting 5, 10, and 20 respectively, signify "one hand," "two hands," and "a whole man." In languages like our own, where no such meaning can be discerned, the fact of our counting by tens and scores shows that our arithmetic began also by counting on the hands and feet, the primitive decimal apparatus. The next development in calculation is that of substituting small pieces of stick or stones for the fingers, a heap of ten such being expressed by a larger piece, and a hundred by one larger still. A curious discovery has lately been made regarding the form of the Egyptian symbols for one, ten, and a hundred, namely, that they represent pieces of cord of varying length, thus showing that the written sign was simply a copy of the actual objects formerly used as counters. After this, by the simple device of marking parallel columns on a board, it became possible to show by the column, in which a counter was placed, whether it stood for a unit, or for a group of ten, a hundred, &c. Thus arose the *abacus* of the ancient Egyptians and Babylonians, which passed from them into Greek and Roman arithmetic. It was shown how numbers were added, subtracted, &c., by counters on the Roman abacus, and that this instrument, though now unknown to us, is still in large use. The Chinese swan-pan, or calculating dish, with its balls strung on wires, is an evident copy of the classical abacus which found its way into the far East in the Middle Ages, and it still transacts the whole mercantile calculations of Chinese counting-houses. A similar instrument remains in active use in Russia, and on the retreat from Moscow a French officer brought it back to France and introduced it as a teaching instrument, the so-called "boullier" adopted in England, and it became the familiar ball-frame of our infant schools. The lecturer gave some interesting illustrations of the way in which calculations are made on the abacus, and worked some sums on the Chinese "calculating dish" in a method taught him by a Chinese merchant. He then proceeded to prove that the method of our "ciphering" is derived from the abacus or counting board. Figures or characters for numbers, such as the Hebrew or Greek letters in their alphabetical order, had been in use for ages, but the simplest arithmetical rules were extremely cumbrous and confusing, as anyone may see who will perform even a short multiplication with Greek or Roman numerals. When, however, such figures were written down in the columns of the counting-board—and it further occurred to the Hindu arithmeticians to use a dot or *o* as the sign of an empty space—it became possible to transfer the quick and exact method of the counting-board to the written paper, the order in which figures were set down showing their value as units, tens, &c., and the *o* corresponding to a vacant column. It shows well how the method of numeral figures grew out of the old counter-abacus to notice that till the last century a form of abacus calculation remained in use in England as the auditors' method. Examples were given from the famous 17th century arithmetic of Robert Recorde, where the pupil is taught to reckon "on the line" by drawing pictures of the counters on the abacus and working with them, though he was also instructed in reckoning "with the pen," that is to say, in the modern ciphering with numeral figures.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

OSWESTRY MEETING,

August 23rd and 24th, 1892.

The fifteenth annual meeting was held at Oswestry on the days above mentioned, on the invitation of the Oswestry and Welshpool Naturalists' Field Club, under the presidency of A. T. Jebb, Esq., of Ellesmere. The following delegates were present:—Birmingham Natural History and Microscopical Society, J. F. Goode (president), W. H. Wilkinson (secretary); Birmingham Philosophical Society, J. Udall; Birmingham and Midland Institute Scientific Society, C. R. Robinson; Caradoc Field Club, E. S. Cobbold (secretary), W. Phillips; Dudley and Midland Geological and Scientific Society and Field Club, W. W. King; Oswestry and Welshpool Naturalists' Field Club, A. T. Jebb (president), Rev. O. M. Feilden, M.A. (secretary); Oxfordshire Natural History Society, H. M. J. Underhill; Worcestershire Naturalists' Field Club, Horace Pearce (president). The following members of the Executive Committee were present:—The hon. secretaries, W. Wickham King, Pedmore, Stourbridge, and T. Stacey Wilson, M.D., Birmingham; A. J. Parker, assistant hon. secretary, Birmingham; Messrs. R. W. Chase, J. F. Goode, W. B. Grove, M.A., and Horace Pearce, F.L.S. Amongst the other visitors were:—Mrs. R. T. Rea and Mr. C. Rea, Mr. and Miss Rose (Worcester), Miss Jermyn, Mrs. W. H. Wilkinson (Sutton Coldfield), Miss Wilson, Miss A. D. Wilson, Dr. Fraser (Wolverhampton), Messrs. H. Miller, F. Greenway (Birmingham), W. B. Scott, J. F. Bland (Dudley), Henry Johnson (Dudley), G. Lavender (Walsall), W. B. Malins (Walsall), W. Burson, L. J. Reade (Wolverhampton), C. R. Robinson (Birmingham), &c.

The meeting was in all respects most satisfactory, and, with the exception of Tuesday evening, the weather was all that could be desired. After dinner at the Wynnstay Hotel, Oswestry, the Council met at the same place, and transacted the necessary preliminary business, at three o'clock (Tuesday). At four o'clock the Annual Meeting of members took place, the President, A. T. Jebb., Esq., in the chair. He said:—First of all, I should like to assure you how greatly I appreciate the honour of presiding over you on this occasion. Next, as the president of the local society in this neighbourhood, and on their behalf, I desire to welcome the members of the other societies who propose to pitch their camp in our midst, for, I am sorry to say, too brief a time. Lastly, I believe it is expected of me to give you something in the shape of an inaugural address, but this I shall postpone till the Conversazione this evening. The captious critic—a species whose habitat is not strictly defined —informs me that these combined efforts in the pursuit of science are no earthly good. "You see," says he, while he catches me by the button-hole, "the history of great discoveries, and even of gradual progress in knowledge, would show that an advance has been effected, not by the combined action of the many, but by the persevering labour of the few." Let it be granted. But, notwithstanding all that may be said on that side of the question, it is, I think, indisputable that combined gatherings like ours do good work. At all events, they disseminate an interest in science and popularise research. Then, again, they bring able men from various quarters to compare the result of their labours and to criticise their conclusions. To meet with such men, to breathe the same atmosphere with them, to share the same sentiments, to enjoy their conversation, and to gain, I hope, some information from them to guide and gladden us humble workers in the pursuit of truth—these surely are objects which the Union of Natural History Societies tends to promote. I fear I am taking up too much of your time, and will therefore conclude with the expression of my hope that you will derive pleasure from the excursions during this meeting, and that something may be added to our knowledge of the geology and botany of the district. Of one thing I am certain—if we are favoured with fine weather—any of us who may not take special interest in scientific subjects will be sure to receive much pleasure from the scenery through which our excursions will take us. The country around has claims upon every taste; it appeals to every constitution of mind. I know of no district of which it takes so long to tire. It is full of quiet scenery and restful charm, and I defy anybody to find finer studies of colour and character, of wood and water, of hill and dale, of grey rock and mossy crag, than in this Welsh border-land. I trust when you return home you will carry away with you pleasant recollections, not only of the places you have visited, but also of the persons with whom you have come in contact.

Mr. R. W. Chase, Birmingham, proposed a hearty vote of thanks to Mr. Jebb for acting as president.—Mr. W. Wickham King seconded the motion, which was supported by Mr. W. B. Grove.

THE REPORT OF THE COUNCIL

was then read by Mr. W. Wickham King. as follows :—

In presenting their Fifteenth Annual Report, your Council are glad to be able to refer to the continued success of the Union, and to express the hope that there is increasing prosperity in store for it. They desire to lay stress upon the fact that the aim of the Union is to assist and encourage the Societies of which it consists in the pursuit of scientific research, and to facilitate the record of the scientific results which they obtain.

The Midland Union of Natural History Societies is not—and never was intended to be—an organisation capable of *doing* scientific work, except in so far as the publishing of the results of such work or observation, may be so considered. Its function is that of an organiser of work and a recorder of work done—a central organisation by means of which the scientific work of the more active Societies in the Midlands may be rendered more effective, and by means of which they may also be enabled to help, whether by support or by stimulation, their more feeble brethren.

THE WORK OF THE UNION DURING THE ENSUING YEAR.

Your Council and its Executive Committee have devoted much thought to this subject, because they feel that there is much valuable work that the Union might be made the means of accomplishing, and they hope that as a result of their deliberations the machinery of the Union may have been rendered a little more perfect in one or two points.

Owing to the distance which separates the constituent parts of the Union from one another, it is evident that personal intercourse of members with one another cannot play the important part which it does in some Unions, such as the Yorkshire Naturalists' Union. The Midland Union has, consequently, to rely mainly upon its published periodical, the "Midland Naturalist," as the means by which one society may assist another.

It is, therefore, hoped that a determined effort will be made to increase the circulation of the "Midland Naturalist," and also, what is of equal importance, that each scientific society and member in the Union will feel that the success or the reverse of this periodical and of this Union is dependent upon the willingness of its members individually to contribute short papers or notes upon scientific subjects in which they are interested, and which may prove of interest and instruction to many of their fellow members.

Much useful scientific work has been, and can in the future undoubtedly be, done in the Midlands by local scientific societies in their own particular localities. Here their local knowledge, and the fact of their being constantly on the spot, gives them opportunities for scientific observation unattainable by any occasional visitor. Your Council hopes that honorary secretaries and members of our various societies will use their best endeavours to assist the executive of the Union in collecting and publishing the results of such local research, not only for the sake of preserving much valuable scientific knowledge, that would otherwise be lost, but also for the sake of increasing the interest of all our members in such scientific work.

It is evident that unless the honorary secretaries and members of the more active societies are willing to *give* help in various ways, and unless the honorary secretaries and the members of the less active societies are willing to put themselves in the way of receiving that help, the Midland Union, however perfect its organisation, is powerless to perform the work which it is able and willing to do.

Members of the Union are all, more or less, engaged in researches in which they want assistance from each other. For instance, it often happens that some member has an extensive local knowledge of his own district, which would be of immense assistance to other members who are working up the geology, flora, or fauna of some distant district which presents the same general features. Let members assist each other, and so further the great aim of knowing more about our world from a scientific point of view. There is no lack of questions which require investigation. The only difficulty is to get sufficient and willing helpers. The Darwin medal and the proposed Ray medals are offered to encourage members to undertake scientific research, and it is hoped that the medium of inter-communication afforded by the proposed record of scientific facts, will materially help to place the Union in a prominent position in the scientific world of which its members may feel proud.

The short papers which are asked for need not necessarily deal exclusively with original scientific observations—most valuable though these be; there is another most valuable class of papers, viz., short reviews and summaries of papers bearing upon the Midlands, which have appeared in other periodicals. In this way the more leisured of our members can contribute to the scientific needs and increase the scientific enjoyment of those with less leisure. In this, and many ways, it is in the power of the members of this Union to make the Midland Union and its journal an important factor in the advancement of science in England, and your Council commends with confidence this appeal for increased support to all members of the Union.

BRITISH ASSOCIATION.

The following report has been received from the delegate of this Council to the meeting of the Corresponding Societies' Committee of the British Association:—

Your representative upon the Corresponding Societies'

Committee of the British Association reports that he attended the first meeting of the committee, but was accidentally prevented from attending the second.

Amongst the subjects brought forward it was desired that the attention of the Corresponding Societies should be directed to the following:—

Section A. Meteorological Photography.—The committee appointed to deal with this subject will be very glad to receive photographs of noteworthy phenomena, such as effects of snowstorms, wind, floods, &c., and not only so, but they will also be glad to know the names of photographers from whom interesting photographs of any special natural phenomena can be obtained. The future interest and value of such records will be considerable. The secretary of the committee is Mr. A. W. Clayden, 131, Palace Road, Tulse Hill Park, London, S.W.

Section C.—The Geological Photographs Committee desires an increased amount of support for the interesting work it has undertaken. The formation of local committees is very desirable in order to ensure the recording of interesting exposures of strata, &c., more especially when they are likely soon to be obliterated, as is the case in railway or road cuttings, &c. A Local Geological Photographs Committee has been formed in connection with the Birmingham Philosophical Society, and its secretary is Mr. F. W. Martin, F.G.S., 24, Rotton Park Road, Birmingham.

A report was given of some observations upon the amount of débris brought down by streams supplying reservoirs. It was pointed out that most important evidence of the rate of subaerial denudation of the drainage area of such streams might be obtained by the simple expedient of seeing how soon settling tanks of known capacity became filled with the débris they brought down. The presence of these settling tanks would not only yield valuable geological data, but also serve the practical purpose of preventing the filling up of the reservoir.

For the benefit of individuals or societies undertaking the record of glacial boulders, it was pointed out that the Glacialists' Association had drawn up a serviceable "Schedule of Instructions" for those desiring uniformity in their method of record. There was much interesting information with regard to the work of the Committee, but this will be found in the report of the Committee, of which copies can be obtained. The Secretary is Prof. Meldola, F.R.S., London.

THE EXECUTIVE COMMITTEE'S SPECIAL REPORT.

Your Council will submit a report embodying some valuable suggestions made by the Executive Committee, which they have had under their consideration at their meeting this afternoon, and which they trust will meet with your approval and support.

ALTERATIONS IN THE OFFICE-BEARERS OF THE UNION.

Your Council regret having to report that Mr. Lawson Tait is no longer able to give his valued services as Secretary to the Union, and that they have, on behalf of the Union, accepted his resignation, and conveyed a vote of thanks to him for all that he has done for the Union.

They are glad to be able to report that they have obtained the services of Mr. W. Wickham King, (the Secretary of the Dudley and Midland Geological Society and Field Club), as co-Secretary with Dr. T. Stacey Wilson.

They have also decided to appoint an Assistant Secretary, and Mr. Arthur J. Parker, of Birchfield, Birmingham, has kindly consented to undertake this post.

SOCIETIES IN THE UNION.

The Union at the present time includes sixteen societies as against fifteen last year. Of these, two have joined during the year, viz. :—The Cheltenham Natural Science Society, which your Council is glad again to number amongst the supporters of the Union after an interval of several years, and also the Worcestershire Naturalists' Field Club, which they are glad to welcome as a fresh supporter. During the year the Tamworth Natural History and Antiquarian Society has ceased to exist, and must therefore be struck off our roll.

The sixteen societies are as follows :—

The Birmingham Microscopists' and Naturalists' Union.
The Birmingham Natural History and Microscopical Society.
The Birmingham Philosophical Society.
The Birmingham and Midland Institute Scientific Society.
The Birmingham School Natural History Society.
The Caradoc Field Club.
The Cheltenham Natural Science Society.
The Derbyshire Archæological and Natural History Society.
The Dudley and Midland Geological and Scientific Society and Field Club.
The Leicester Literary and Philsophical Society.
The Malvern Field Club.
The Oswestry and Welshpool Naturalists' Field Club.
The Oxfordshire Natural History Society.
The Rugby School Natural History Society.
The Severn Valley Naturalists' Field Club, and
The Worcestershire Naturalists' Field Club.

TREASURER'S REPORT.

The Treasurer's report is satisfactory, for it shows a balance in hand of £21 16s. 1d., the receipts during the year being £17 9s. 5d, and a balance from last year of £12 3s. 5d., less disbursements £7 16s. 9d., of which printing amounts to £7 2s. 9d. The favourable balance is in large measure due to the regrettable fact that the Darwin medal has not been awarded for two or three years.

THE DARWIN MEDAL.

The Darwin medal for this year ought to have been awarded for papers containing original work in the subject of Botany, and published in the "Midland Naturalist" during the last three years. But your Committee regret having to report that no completed paper or papers on Botanical subjects of a character to warrant the bestowal of the medal have appeared in the "Naturalist" during the past three years.

The subject for next year's award is that of Geology.

THE "MIDLAND NATURALIST."

The following is a list of the principal papers published in the "Naturalist" during the past year:—

"Dragons of the Prime," by A. Bernard Badger, B.A.
"Burma and its People," by A. W. Wills.
"History of the County Botany of Worcester," by Wm. Mathews, M.A.
"The Fungi of Warwickshire," by W. B. Grove, M.A., and J. E. Bagnall, A.L.S.
"Notes on Some Ores from the Barrier Ranges, New South Wales," by T. H. Waller, B.A., B.Sc.
"Sir Roderick Murchison as King of Siluria," by J. Rabone.
"The Geology of the Dudley District," by Professor Lapworth, F.R.S.
"Notes at the British Association, Cardiff, 1891," by C. J. Watson.
"On Specimens from the Permian Breccia of Leicestershire, Collected by W. S. Gresley, F.G.S.," by Professor T. G. Bonney, D.Sc., LL.D., F.R.S., V.P.G.S.
"Natural History Jottings in Natal," by Arthur Hunt.
"Notes from a Winter Journal, 1890-91," by O. V. Aplin.
"Decay in Nature," by Charles Callaway, D.Sc., M.A.
"Fighting the Dry Rot," by W. B. Grove, M.A.
"Note on the Severn Bore," by W. R. Hughes, F.L.S.
"The First Ascent of the Öræfa Jökull," by Fredk. W. W. Howell, F.R.G.S.
"Notes in an Old Herbal," by G. C. Druce, M.A.
"A Week in North Wales," by T. H. Waller, B.A., B.Sc.
"On the Ice Ages, Past and Future, and their Causes," by W. P. Marshall.
"The Botany of Biddulph and the Neighbouring Parts of North Staffordshire," by the Rev. W. H. Painter.
"The Naturalist in La Plata," by E. W. Badger, F.R.H.S.
"Notes on the Flora of Warwickshire," by J. E. Bagnall, A.L.S.
"The Happy Fungus Hunter," by W. B. Grove, M.A.
"The Origin and Objects of Colours and Coloration in Animals," by A. Bernard Badger, B.A.
"The Cultivation of Orchids," by E. A. Bevers."

The report was adopted, and a vote of thanks passed to the Council.—On the motion of the Chairman, the Treasurer's report was passed.

Mr. Goode, on behalf of the Birmingham Natural History and Microscopical Society, gave an invitation to the members of the Union to visit Birmingham next year, and the invitation was accepted.

A recommendation of the Committee was adopted that in future the Executive Committee should also consist of such of the secretaries of the Societies in the Union as were willing to act upon it, and Birmingham was appointed as the place of meeting for the Committee.

Mr. W. Wickham King proposed a vote of thanks to the Oswestry and Welshpool Naturalists' Field Club, which Mr. J. F. Goode seconded, and the motion was adopted. —The Rev. O. M. Feilden said they were delighted to have the Union present.—Mr. Chase moved a vote of thanks to the Hon. Secretaries for the efficient manner in which they had worked up the meeting. The motion was seconded, and adopted unanimously, and Mr. Wickham King in responding, said he hoped to receive the support of the members in making the meeting at Birmingham a large success.

Of the Conversazione in the evening, the various addreses delivered thereat, and the excursions on the following day, full reports will be given in our next number.

THE ORIGIN AND OBJECTS OF COLOURS AND COLORATION IN ANIMALS.*

BY A. BERNARD BADGER, B.A.

(Concluded from page 177.)

We now turn to the subject of sematic colouring; the most important instances are those of gaudy coloration, which are generally believed to indicate that the animal bearing the bright colours is unpalatable. Not all gaudily coloured animals, however, are unpalatable, for, as Mr. Beddard points out, experiments by Mr. Poulton show a very complete series of transitions between conspicuously coloured caterpillars that are disregarded by all foes and conspicuously coloured caterpillars that are always eaten with avidity. His own experiments also show that warning coloration by no means always exempts insects from attack, and that dislike is purely relative among insect-eating animals.

* Animal Coloration: An Account of the Principal Facts and Theories Relating to the Colours and Markings of Animals. By Frank E. Beddard, M.A., F.R.S.E. London: Swan, Sonnenschein, and Co. Price 10s. 6d.

Among various other difficulties to the theory, the following may be mentioned. In the first place, there are cases of animals being provided with weapons of offence, which, however, are not advertised by warning colours; for instance, the larva of a North American Swallow-tail butterfly is conspicuously coloured, and possesses "osmateria," that is, glands which secrete an offensively smelling substance; according to the theory they are advertised by the bright colours. In England, the larva of the Swallow-tail has the organs of offence, but is protectively coloured, whereas we should of course expect it to have warning coloration.

In other cases there is bright coloration, which apparently is not of much use; for instance, some poisonous snakes are most brilliantly coloured; the deadly *Elaps* is an often quoted example, with its rings of black and red. Here at first sight is an excellent proof of the theory; on further consideration, however, difficulties crop up, for the enemies of snakes, if few, yet are most formidable, for they seem able to disregard the poison of the latter and attack them without fear. Hence, the bright colours seem to be of no use, if not actually disadvantageous, while protective coloration would appear to be needed, an opinion supported by the very fact that poisonous snakes generally harmonise with their environment.

There is another type of these sematic colours, in which certain parts of the body, not of prime importance to life, are brightly coloured, in order, it is said, to attract the attention of foes to them and so protect other more vital regions; such are the eyes on the wings of butterflies and the bright-coloured under-wings of certain moths having dusky upper wings. This, however, Mr. Beddard points out, cannot be the object of all such markings, for in the "John Dory" there is a pair of curious marks on each side of the body, which lie over such vital organs that a bite there would inflict serious injury on the fish.

In relation to this subject of warning coloration, one of the novelties of the book to general readers will be Dr. Eisig's theory, which was published in his monograph on a group of the annelids, *Die Capitelliden.* Briefly it is as follows:—

(1.) Pigment in the skin has in some cases been actually proved to be excreted matter; it may be so in other cases where there is at present no direct evidence.

(2.) In earlier times when there were no birds (the chief enemies of larvæ) brilliant coloration due to abundant and varied pigment would be the rule.

(3.) This pigment is possibly the cause of distastefulness.

(4.) If so, brilliant colours are the cause and not the result of inedibility.

If the theory is true, then bright colours are still of warning significance, though not produced for that special purpose. Dr. Eisig's conclusion is supported by experiments which have been made with nudibranch molluscs. Among these animals are species protected by coloration, which is, however, brilliant, while the animals themselves are unpalatable.

With regard to the so-called mimicry of unpalatable by palatable forms, Mr. Beddard suggests various difficulties.

The *Danaidæ*, themselves an uneatable race of butterflies and models for mimicry, resemble in South America the uneatable *Heliconidæ*. This resemblance is believed not to be a case of mimicry, but due to the need that types of warning colours may be as few as possible, so that enemies may have as little as possible to learn, and thus are less likely to make mistakes. Now it is well known that some of the *Pieridæ*, or "Whites," closely resemble certain *Heliconidæ*, the explanation, according to the late Mr. H. W. Bates, being, as mentioned above, that the former are palatable, and, therefore, by their resemblance to the latter, obtain the reputation of being unpalatable. But Mr. Beddard suggests that the principle which has just been stated with regard to the *Danaidæ* may be applicable to the mimicking *Pieridæ*, for two genera of that family are provided with organs similar to those of the *Heliconidæ*, which secrete a strongly odorous substance supposed to be the cause of their immunity from attack; and *Leptalis*, one of the mimicking genera, actually gives off an odour disagreeable to human noses.

Again, there are various other forms of lepidoptera which resemble each other as much as in cases of so-called mimicry, yet for no apparent reason. Such is the resemblance between various North American species of the genus *Catocala*, which resemble the "Yellow Underwings" of the genus *Triphæna*. A similar difficulty occurs in the case of animals which resemble each other, but live in countries far apart, such as the New Zealand Cuckoo and American Hawk, which are much alike. The former is quite unlike the hawk of its own country.

In two other cases of difficulty brought forward by Mr. Beddard, we can perhaps see some explanation. The one case is of two beetles, very much alike, which feed on the nettle, one being very rare, the other common, both minute. The author asks whether, supposing the rare form is palatable and the common one unpalatable, any benefit is gained, as surely protection is obtained by the minute size. Then, again, there is a most remarkable resemblance between an amphipod crustacean and a medusa. According to the author, it is doubtful how far this wonderful departure from the usual appearance of the class to which the former belongs is of use to it, for he thinks that the chief enemies of such small pelagic creatures—whales and fish—would, when in schools and shoals respectively, gobble up what came first, without stopping to inquire too minutely what was there. In both of these instances, Mr. Beddard's restrictions apply to those enemies which are much larger than the creatures concerned: in the case of the beetles, the mimicry would apparently be superfluous; in that of a medusa and amphipod, useless. But would not enemies more on a par in size with the beetles and amphipods be affected by the resemblances? Thirdly, there is a very remarkable instance of apparently perfect mimicry quoted from Professor Semper. That naturalist found in the Balearic Islands an annelid of the genus *Myxicola*, which, although really of very different structure, yet externally exactly resembles the polypes of the coral *Cladocera cæspitosa*, among which it is often found embedded. On further investigation, the Professor found that the annelid also lived among sponges, rocks, sand, etc., objects, in fact, to which it had not the least resemblance. Hence, he came to the conclusion that the resemblance of the worm to the coral is purely accidental. Mr. Beddard seems to agree with this, but again, we ask, is it not likely that the worm does obtain benefit from its resemblance to the coral, for enemies will suspect it of being able to eject stinging-cells, and that whether it is embedded in a mass of corals, sponges, or sand?

An often quoted case of resemblance, which presents difficulties to our author, is the apparent mimicry of Humble Bees and Wasps by certain flies of the genus *Volucella*; the resemblance is very striking, and is generally explained as enabling the flies to enter the hives, where they lay their eggs. Now bees are known to be so jealous as to prevent even members of their own kind, belonging to other hives, from entering their dwellings. Is it likely, then, that they are deceived by the flies? Here, again, the question of insect-vision crops up. But the *Volucellæ* certainly do lay their eggs in the hives, not only of bees, but also of wasps, which are said both to be much more intelligent than their relatives and also to feed on flies. Mr. Beddard throws out a suggestion that wasps and bees may, like ants, have a fancy for keeping pets, a theory which would explain the matter.

Cases of so-called mimicry are commonest by far among insects; they are uncommon among birds and reptiles, and rare among mammals. Why this is so, it is difficult to see, since one would suppose the device as useful among the higher as the lower animals.

In the author's opinion, some cases of mimicry are so striking that they can be explained only on the generally received theory, with the proviso that the initial resemblance, which must have been considerable, must be set down to other causes, such as the influence of like external conditions; but other instances of mimicry, which are to be appreciated only by insects, must in our present knowledge of insect-vision be removed from the category. In the following words he sums up his opinions on the matter:—"Seeing, then, that resemblances may occur between animals which either cannot be, or are probably not, advantageous to either, it is at least necessary to wait for more convincing proofs before it can be more than provisionally assumed that natural selection is responsible for these resemblances in other cases where they appear to us to be useful."

We come now to the last section of the work, that which deals with Sexual Coloration; and here the most novel part is the account of Mr. Stolzmann's views, which are as follows:—It appears from various observations that among birds the males are more numerous than the females. Now this preponderance is not advantageous to the species, for the bachelor males are not only useless, since they are unmated, but they also persecute with their attentions the mated females while sitting on their eggs, and at the same time lessen the food supplies. Now natural selection is concerned not so much with the well-being of the individual as with that of the race, and, consequently, anything tending to lessen the undue proportion of the less useful sex, and so advantage the race, will be seized on by that potent agent in evolution. Hence the gaudy colours, crests, spurs, and pugnacious habits of the males: the gaudy colours attract the notice of enemies, while the plumes impede flight, causing their owners to fall an easier prey; the pugnacious habits cause fighting among the males with their spurs, which often ends in fatal results. Thus the numbers of the males are reduced, and the evil results indicated above are minimised. Also, according to Mr. Stolzmann, the love-dances and songs of birds are a distraction to protect the female from the too constant attentions of the males.

This is certainly a startling explanation. Mr. Beddard thinks it impossible to believe either in it or any other theory which ignores the deep-seated differences between the sexes, and he insists on the well-known fact that the secondary sexual characters of animals are dependent upon the germ glands themselves. This is shown, among other instances, by a chaffinch, in which the left side of the body had the coloration of a hen bird, the right that of a cock, the colours being sharply marked off from each other in the middle line: the bird was a hermaphrodite, having a well-developed ovary on the left and a male gland on the right side of the body. According to our author, "there is a fundamental difference between males and females, based upon the actual difference of sex, which generally finds an expression in outward unlikeness. These superficial differences may also be partly due to the different mode of life led by the two sexes. We meet with them in animals which cannot be moved by any choice or æsthetic preference; but it is also true that they are most highly developed in the higher animals, where such choice is at least conceivable; the mammal, however, forms a very important exception to this statement. Butterflies and birds show the most marked sexual dimorphism in colour; and it is precisely in these two groups that there is the greatest opportunity for colour development, owing to the structure of their feathers and scales respectively. Colour differences become necessarily exaggerated in these animals, through mere multiplication of details. Nevertheless, it is quite possible that sexual selection may have played a subordinate part in the production of sexual coloration, and we may also allow some force to Stolzmann's suggestions."

It will readily be gathered from the account which we have given that Mr. Beddard's book is most suggestive, and a distinct addition to the literature of colours and coloration in animals. It is full of facts and ideas bearing on the subject, a few only of which we have been able to mention. These facts—some well, others little, known—are discussed by the author from all points of view. It is clear that he does not believe in the efficacy of the usually received theories to explain many of the cases which he adduces; but his criticisms, while to the point, are always temperate, his general treatment of the subject being characterised as much by its fairness as its acumen. We feel sure that the book will prove of great interest to general and scientific readers alike.

One improvement should be made in a future edition—a fuller index ought to be given; the existing one, while satisfactory as far as the names of the animals mentioned in the book are concerned, is utterly inadequate in regard to subjects, which are only referred to in the table of contents. It would be a very great convenience, and add undoubtedly to the value of the book, were all the references to such important subjects as "vision," "pigment," and a score of others, collected in the index.

The letter-press is beautifully printed; the illustrations, of which there are thirty-six woodcuts in the text and four coloured plates, are all good and above the average. In fine, "Animal Coloration" is a book which, while indispensable to the library of the biologist, may yet not inappropriately find a place in his drawing-room.

THE CULTIVATION OF ORCHIDS.

BY E. A. BEVERS.

(Continued from page 183.)

CULTURAL MATERIALS.

These consist of peat, sphagnum moss, charcoal, and potsherds. Peat is a well-known substance used extensively for hard-wooded plants, heaths, etc., and for the majority of orchids it is indispensable. It varies greatly in character, depending chiefly upon the nature of the soil where it is obtained, and the roots of which it is composed. In some places it consists mainly of the roots of grasses, and a black soil derived from the decomposition of vegetation, and is then termed bog peat. In others it chiefly comprises wild heath roots and finer grasses, and is found in higher districts; a third kind being mainly formed of fern roots and rhizomes, both the last named containing a varying proportion of light brownish soil from the further decomposition of roots. The third kind is the best for orchids. For these plants it must abound in fibre, and the smaller particles should be shaken out before it is used, when it can be broken up into pieces of various sizes according to the plants for which it is to be employed, but never very small. When ordering peat you should state that it is required for orchids.

SPHAGNUM.

The moss used for orchids consists mainly of *Sphagnum obtusifolium*, but *S. squarrosum*, *S. acutifolium*, and *S. cuspidatum* are abundant in some districts. These are termed bog mosses, and are found in low moist places frequently partly submerged. The sphagnum serves as a retainer of moisture, and by its decay furnishes something for the support of the plant grown in it. When received it should be spread out on a bench, and carefully picked and selected, removing all weeds, leaves, and grasses, or foreign substances, and divided into three qualities. The first should consist of the fresh growing points or shoots, which must be preserved for surfacing; the next in freshness will be set aside for chopping up and mixing with the peat for potting, and the third, comprising all the roughest and most decayed portions, being employed for covering the drainage in the pots before the principal soil is placed.

CHARCOAL

is an important material for mixing with compost for many orchids.

CULTURAL UTENSILS.

Large numbers of orchids are grown in pots and pans, more so perhaps than formerly, when baskets, rafts, and blocks were almost exclusively used. I think they are best grown in pots, as they require less attention with regard to watering.

POTTING.

In all operations connected with orchids it must be remembered that the roots cannot be safely treated like those of many plants, they are much more delicate and readily injured, consequently in potting much care is needed. If the old roots are adhering to the sides of the pots or drainage the pots must be broken, and these or the pieces of crocks, placed in the new pots, disturbing the roots as little as possible. All dead roots must, however, be cut away, and if any of the others appear unhealthy, or if the compost is old or much decayed, they should be washed in tepid water.

Pots should be thoroughly drained, the largest having smaller sized ones inverted in them, and the space round these filled with clean crocks, or crocks can be used alone.

The drainage should be two-thirds the depth of the pot. Large pieces of broken pots are arranged hollow side down, and upon these smaller pieces, and then a layer of sphagnum, then put the plant in position, filling with the compost, which may have been previously mixed—or the peat can be introduced separately, fixing it amongst the roots sufficiently firm to hold the plant steady. The base of the pseudo bulb should always be raised above the rim of the pots, if buried below, the chances are that the eye or bud which springs from the base of the pseudo bulb will decay, and great injury to the plants thus result. They should therefore be raised above the rim of the pots, making an even and rounded surface of peat, covering this with the selected sphagnum previously mentioned. Plants with few or no roots at the time of potting should be firmly secured by means of stakes or wire pegs. The growing point or lead of an orchid should be kept on a level with the surface, the back part of a plant is not of so much importance.

WATERING, SYRINGING, AND RESTING.

Few plants that are not aquatics require so much water as orchids, both about their roots and in the atmosphere, and therefore the supply of moisture is an important operation. Orchids when growing freely can scarcely have too much water, and during the summer they will need attention twice a day, independently of damping the paths and stages or syringing. In the winter and during the resting period the supply must be gradually reduced. In the summer and growing season the material on the shelves and the paths must be kept well moistened.

For supplying the plants and syringing, rain water is the best, and it must always be used about the temperature of the house; this can be managed by storing it in tanks in the house. Hard water should be avoided except for damping purposes, as, though lime is not injurious to some orchids, it disfigures the foliage. The best way to water well established and healthy growing plants is to provide the house with a small tank on wheels if possible, as it can be easily moved about; fill this with rain water and plunge the pots into it, and keep them there until they are thoroughly saturated.

REST.

The best plan to adopt with regard to watering is to carefully observe the habits of the plants themselves; when they show a tendency to stop growing or to rest, water should be gradually withheld; only giving just enough to prevent shrivelling. In a dry atmosphere, flowers as well as bulbs and foliage continually suffer from excessive evaporation, a state of things we should endeavour to avoid as much as possible; therefore a sufficient amount of moisture must be supplied, or the plants will suffer far more than they would from being furnished with too much moisture, although more than will prevent the bulbs and leaves from shrivelling is decidedly injurious to the plants when at rest. When they commence to grow and to produce roots, they should be encouraged by the application of more moisture, both at the roots and in the atmosphere, no matter at what time of the year this may occur. If the moisture has been reduced in consequence of most of the species contained in the house being at rest, and if one or two species that require extra heat, except when at rest, commence to grow, they should be removed to a more humid atmosphere, as for instance a moderately warm greenhouse or intermediate house, where they should be suspended or staged as near to the glass, *i.e.*, light, as possible; for during the dull period of the year they require all the light they can possibly get.

VENTILATING AND SHADING.

In warm moist districts ventilation can be given much more liberally than in cold, exposed, or dry situations, and to these varying circumstances are due the different opinions on the advantages to be derived from free ventilation. Wherever the climate is suitable, and when the weather is favourable, there is no question that the most successful results are obtained by admitting air freely, not only to cool houses but to tropical orchids. In ordinary cases a piece of board eight or nine inches wide, and two feet long, sliding in two grooves outside the house opposite the pipes, is sufficient for ventilation beneath the stages. During the winter, whenever the wind is keen or frost severe, never ventilate, and in very hot dry weather it is better to shade well, employ no fire heat, damp liberally, and ventilate but little. Without artificial heat the temperature may be allowed to rise considerably above the maximum temperature given in the table without danger, if water is abundantly supplied. For this reason the houses may be closed at three or five p.m., according to the season and weather, but a little all-night ventilation in the height of summer will not hurt tropical orchids, and for others it should be the rule at that time of year.

For shading, the ordinary roller blinds are very convenient, as they can be quickly run down or up according to the weather. I prefer the material to be stout tiffany, as it divides the sun's rays and so prevents the plants being scorched, but does not darken the house too much. Artificial shading should only be employed in very bright weather, and in the hottest part of the day, to prevent the temperature rising too high, as too much shade weakens the plants and prevents their growth ripening.

Most plants are subject to insect pests, although it is not often that they do any serious damage, *i.e.*, if ordinary precautions are taken by the cultivator to prevent injury. Thrip is one of the worst, especially if the temperature of the house is excessive and the atmosphere dry.

Red spider sometimes, though rarely, makes it appearance in a dry corner. The yellow fly, green fly, scale of several sorts, and mealy bug attack orchids; while snails, slugs, woodlice, ants, and cockroaches also cause much trouble if allowed to become numerous.

The frequent use of tepid water, and soft soap in very small quantities, or weak tobacco water is the best means of keeping the foliage clean, applying the liquids with a sponge or camel's hair brush, Green fly and thrip may be destroyed by fumigation with tobacco, which should be given very moderately on several alternate nights. But I think the safest plan is to cover the hot water pipes with the tobacco paper, and water that once or twice a day, the steam rising from this will destroy all thrip.

Slugs and snails must be looked after closely, a little bran being a good bait for them. It is most annoying, after waiting and watching for a spike to open its flowers, perhaps for the first time in England, to find one morning that it has been eaten by a slug, and the results of one year's care and growth lost. I generally put some cotton wool round the flower spike, as they cannot pass that. Another very good plan is to invert a pot in a saucer, and on the top of this pot place your orchid, filling the saucer with water; this plan also prevents woodlice from attacking the plants.

Temperature.	*Summer.*			*Winter.*	
Stove	75	65	70	65	60
Int. or Cattleya H....	70	60		60	55
Cool House	60	55		55	50

It is not always possible, nor yet desirable, to follow these figures exactly, as for instance in very hot weather the stove will sometimes run up to 80 deg. or 85, and the cool house cannot be kept below 70, but with care these temperatures do no harm.

The average amount of piping usually recommended for span-roof houses of good size is—warm house, four rows of pipes each side, intermediate house three rows, and cool house two rows. It is always advisable to have rather too much than too little, as is proved in houses of all kinds. The greater the radiating surface the more regular the temperature, and the less injurious it is to the plants in severe weather, when it may be necessary to keep the fires going briskly. I will now say a few words with regard to the structure necessary to grow orchids in. The fanciful idea that peculiarly constructed and expensive houses of various kinds are essential for orchids is a mistake; it was soon found out that much less depended upon the form of the structure than had long been imagined, and that if the requisite heat could be provided the plants would succeed in houses of all kinds, and in all positions. I have frequently noticed attached to villa residences a glass structure called a conservatory, in which plants nearly always either do not thrive at all, or succeed very badly; these structures have been put up by the architect, who in most instances finds this the easiest and best way to fill up an ugly corner. In nine cases out of ten they prove only a source of annoyance and disappointment, because ordinary flowering plants will not grow in them. Should any of you possess such a structure, I say at once grow orchids and ferns; such a house may be turned into a source of real pleasure with a little contrivance, and if it has a north aspect so much the better. It should be provided with the necessary pipes to keep up the temperature, and the stages should be covered with slates, and these again covered with fine pebbly gravel, and this should be kept continually moist by syringing or otherwise; and the plants are either stood upon the material dried or elevated on inverted pots.

(To be continued.)

NOTES ON THE "FLORA OF WARWICKSHIRE."

BY J. E. BAGNALL, A.L.S.

(*Continued from page 157.*)

Senebiera Coronopus, *Poir.*
(4.) Near Brownsover, 1831, *Baxter, MS.*
(9.) Studley, near the river.

Lepidium campestre, *R. Br.*
(4.) Near Brownsover, 1831, *Baxter, MS.*

Thlaspi arvense, *Linn.*
(5.) Ufton, *Bolton King.*

Raphanus Raphanistrum, *Linn.*
(4.) By the side of the footpath, West Leys to Newbold-on-Avon, and in the Clifton Road, near Rugby, 1831, *Baxter, MS.*
(2.) Fields, near Merecote Hall.

Reseda Luteola, *Linn.*
(4.) Near Little Lawford Mill, *Baxter, MS.*
(7.) Foxcote, near Ilmington, *Miss C. E. Townsend.*
(1.) Fields below Wishaw Church.

Viola palustris, *Linn.*
(1.) Shawberry Wood, Shustoke.

V. odorata, *Linn.*
(4.) Lighthorne, *Miss Palmer.*

V. hirta, *Linn.*
(4.) Between Rugby and Hill Morton, 1831, *Baxter, MS.*

V. Reichenbachiana, *Boreau.*
(1.) Baxterley, near Kingsbury.
(2.) Near Warings Green.

V. tricolor, *Linn.*, *b. arvensis*, Murr.
(4.) Near Rugby, 1831, *Baxter, MS.*

Polygala vulgaris, *Linn.*
(4.) Hill Morton, *Baxter, MS.*; Lighthorne, *Miss Palmer.*
(8.) Near Danzey Green.
(2.) Shelly, Solihull.

P. serpyllacea, *Weihe.*
(2.) Packington! 1810, *Aylesford*, recorded as *vulgaris*. Fields near New Park, Middleton.

Silene Cucubalus, *Wibel.*
(1.) Hill near Sutton; Hurst Green, near Wishaw.

Lychnis alba, *Mill.*
(4.) Near Rugby Mill, 1831, *Baxter, MS.*

L. Flos-cuculi, *Linn.*
(2.) Packington, 1810, *Aylesford.*

Githago segetum, *Desf.*
(4.) Dunchurch and Hill Morton, 1831, *Baxter, MS.* Lighthorne, *Miss Palmer.*

Cerastium quaternellum, *Fenzl.*
(4.) Brook side, beyond the Engine, on the way for Hill Morton, *Baxter, MS.*

C. semidecandrum, *Linn.*
(4.) Burton Dassett, *Bolton King.*

C. glomeratum, *Thuill.*
(4.) Hill Morton, 1831, *Baxter, MS.*

C. triviale, *Link.*
(4.) Near Rugby, 1831, *Baxter, MS.*

Stellaria aquatica, *Scop.*
(4.) Lane near Holbrook Grange, and near Rugby Mill! 1831, *Baxter, MS.*
(2.) Bannersley Pool.

S. Holostea, *Linn.*
(4.) Near Rugby, 1831, *Baxter, MS.*

S. graminea, *Linn.*
(4.) Near Rugby, 1831, *Baxter, MS.*

Arenaria trinervia, *Linn.*
(5.) Near Sawbridge, 1831, *Baxter, MS.*

A. serpyllifolia, *Linn.*
(4.) Newbold Lane, 1831, *Baxter, MS.*

Sagina apetala, *Linn.*
(2.) Packington; 1810, *Aylesford.*
(4.) Lighthorne, *Miss Palmer.*

S. procumbens, *Linn.*
(4.) Clifton Road, near Rugby, 1831, *Baxter, MS.*

Spergula arvensis, *Linn.*
(4.) Near Rugby, 1831, *Baxter, MS.* Milverton, *Miss Palmer.*

Var. *b. sativa*, Boenn.
(1.) Blake Street, near Sutton Coldfield.

Hypericum perforatum, *Linn.*
(4.) Near Lawford, 1831, *Baxter, MS.*
(7.) Ilmington, *Miss Townsend.*

H. dubium, *Seers.*
(1.) Lane from Hurley to Kingsbury Railway Station.
(8.) Near Mockley Wood, Tanworth.

H. quadratum, *Stokes (H. quadrangulum,* L.*).*
(4.) Near Brownsover, and between Sawbridge and Rugby, 1831, *Baxter, MS.*

H. humifusum, *Linn.*
(4). Near Hill Morton, *Baxter, MS.*
(8.) Claverdon, *Mrs. Bland.*
(1.) Abundant Ballard's Green, near Arley.

H. pulchrum, *Linn.*
(4.) Near Hill Morton and Dunchurch, *Baxter, MS.*
(8.) Mockley Wood, Tanworth.

H. hirsutum, *Linn.*
(4.) Hill Morton Lane, *Baxter, MS.*

Malva moschata, *Linn.*
(1.) Fields near Wishaw Church.

M. sylvestris, *Linn.*
(4). Near Rugby Mill and Clifton Road, *Baxter, MS.* Lighthorne, *Miss Palmer.*

M. rotundifolia, *Linn.*
(4.) Near Hill Morton, 1831, *Baxter, MS.* Lighthorne, *Miss Palmer.*

Linum catharticum, *Linn.*
(4.) Near Lawford, *Baxter, MS.*

Geranium pratense, *Linn.*
(7.) Ilmington, *Miss Townsend.*

G. dissectum, *Linn.*
(4.) Near Brownsover, 1831, *Baxter, MS.*

G. columbinum, *Linn.*
(5.) Fosseway, near Offchurch Heath.

G. Robertianum, *Linn.*, var. *flore-albo.*
(7.) In a close between Little Wolford and Barton, Warwickshire. MS. note in a copy of "How's Phytologia" in Magdalen College, Oxford, by John Goodyer.—*G. C. Druce.*

Erodium cicutarium, *L'Hérit.*
(2.) Packington, 1810, *Aylesford.*

Oxalis Acetosella, *Linn.*
(2.) Packington, 1810, *Aylesford.*

Impatiens parviflora, *DC.*
(4.) Casual, near Milverton, *H. Bromwich.*

Rhamnus catharticus, *Linn.*
(4.) Newbold-on-Avon; Brownsover, *Baxter, MS.*
(5.) Sawbridge, *Baxter, MS.*
(1.) Lane below Wishaw Church, leading to Dunton House Lane.

R. Frangula, *Linn.*
(2.) Wood in Wheyporridge Lane.

Acer campestre, *Linn.*
(4.) Near Brownsover, *Baxter, MS.*
(1.) Lane to Langley Mill, near Middleton.

Genista tinctoria, *Linn.*
(4.) Alveston Wood, *Miss Palmer.*

Ulex europæus, *Linn.*
(4.) Lighthorne, 1854, *Miss Palmer.*

U. Gallii, *Planch.*
(1.) Hill Hook.
(8.) Near Lapworth.

Cytisus scoparius, *Link.*
(5.) Near Sawbridge, 1831, *Baxter, MS.*

Ononis repens, *Linn.*
(4.) Clifton Road, near Rugby, 1831, *Baxter, MS.*

O. spinosa, *Linn.*
(4.) Long Lawford Lane; Watling Street, near Rugby, 1831, *Baxter, MS.*

Medicago sativa, *Linn.*
(1.) Abundant on railway siding below Water Orton.
(6.) Abundant on railway banks, Trent Valley Line, near Brinklow.

M. maculata, *Sibth.*
(5.) Near Princethorpe, *Rev. J. Caswell.*

Melilotus officinalis, *Lam.*
(7.) Ilmington, *Miss Townsend.*

M. alba, *Desv.*
(4.) Near Milverton, *H. Bromwich.*

Trifolium pratense, *Linn.*, var. *parvifolium*, Bab.
(8.) Footways, lane from Henley-in-Arden to Preston Bagot.

Var. *album, 3 fol. purp., Vul. flore-albo.*
(7.) By Whichford Wood, Warwickshire. MS. note in "How's Phytologia," by J. Goodyer.—*G. C. Druce.*

T. medium, *Linn.*
(1.) Lane to Langley Mill, near Middleton; Arley Wood.
(2.) Shelly, Solihull.

T. hybridum, *Linn.*
(1.) Lane to Langley Mill.
(8.) Near Wawens Moor, Henley-in-Arden.
(2.) Shelly, Solihull.

T. repens, *Linn.*, var. *viviparum.*
(4.) Near Hill Morton, *Baxter, MS.*

T. procumbens, *Linn.*
(4.) Near Rugby and Dunchurch, 1831, *Baxter, MS.* Lighthorne, *Miss Palmer.*

T. filiforme, *Linn.*
(2.) Packington, 1810, *Aylesford.* I believe this to be the true *T. filiforme*, L.
(4.) Near Hill Morton, *Baxter, MS.*
(9.) Near Green Hill Green, Morton Bagot.

Anthyllis Vulneraria, *Linn.*
(7.) Ilmington, *Miss Palmer.*

Lotus corniculatus, *Linn.*
(4.) Near Hill Morton, 1831, *Baxter, MS.* Lighthorne, *Miss Palmer.*

L. pilosus, *Becke* (*L. major*, Scop.).
(5.) By Sawbrook, near Sawbridge, 1831, *Baxter, MS.*

Ornithopus perpusillus, *Linn.*
(1.) Lane from Water Orton to Plant's Brook.

Vicia hirsuta, *Koch.*
(4.) Near Hill Morton, 1831, *Baxter, MS.*

V. tetrasperma, *Moench.*
(4.) Near Hill Morton, 1831, *Baxter, MS.*
(1.) Lane from Hurst Green to Over Green, Wishaw.
(3.) Lane from Mancetter to Hartshill.
(8.) Ullenhall Street.

V. gracilis, *Lois.*
(4.) Lighthorne, 1854, *Miss Palmer.*

V. sepium, *Linn.*
(4.) Near Rugby, 1831, *Baxter, MS.*

(To be continued.)

Reviews.

Characeæ Britannicæ Exsiccatæ. H. et J. Groves. Fasc. 1.

This is the choicest fasciculus of Cryptogamic plants that has yet been issued, and contains a fine series of well authenticated specimens of that difficult group of plants, the Characeæ. The fasciculus consists of thirty carefully selected specimens, artistically arranged on twenty-five sheets of stout demy folio drawing paper, and these sheets being placed within a neatly bound portfolio, are very handy for reference. The long and careful attention given by the authors to this difficult group of plants is a sufficient guarantee for the correct-ness of the nomenclature. Such a series of plants is of the greatest help to the student, serving him better than the most graphic description or the best executed drawing. The following are the species represented:—1-3, *Chara fragilis*, Desv., type and two marked forms; 4-6, *C. fragifera*, Durieu; 7, *C. connivens*, Braun; 8-9, *C. aspera*, Willd.; 10-11, *C. polyacantha*, Braun; 12-13, *C. hispida*, Linn.; 14-17, *C. vulgaris*, Linn.; 18-19, *C. canescens*, Loisel; 20, *Lychnothamnus stelliger*, Braun; 21, *Lamprothamnus alopecuroides*, Braun; 22, *Tolypella intricata*, Leonh.; 23-24, *Nitella tenuissima*, Kuetz; 25, *N. translucens*, Agardh; 26-27, *N. flexilis*, Agardh; 28-29, *N. opaca*, Agardh; 30, *N. capitata*, Agardh. The work will be completed in three fasciculi, at one guinea each, and should form a part of the library of every natural history society in the kingdom. It may be obtained from Messrs. H. and J. Groves, 58, Jeffreys Road, Clapham Rise, S.W.

JAMES E. BAGNALL.

The British Moss Flora. By R. BRAITHWAITE, M.D., F.L.S. Part XIV., Fam. XV., Bryaceæ II. 6s.

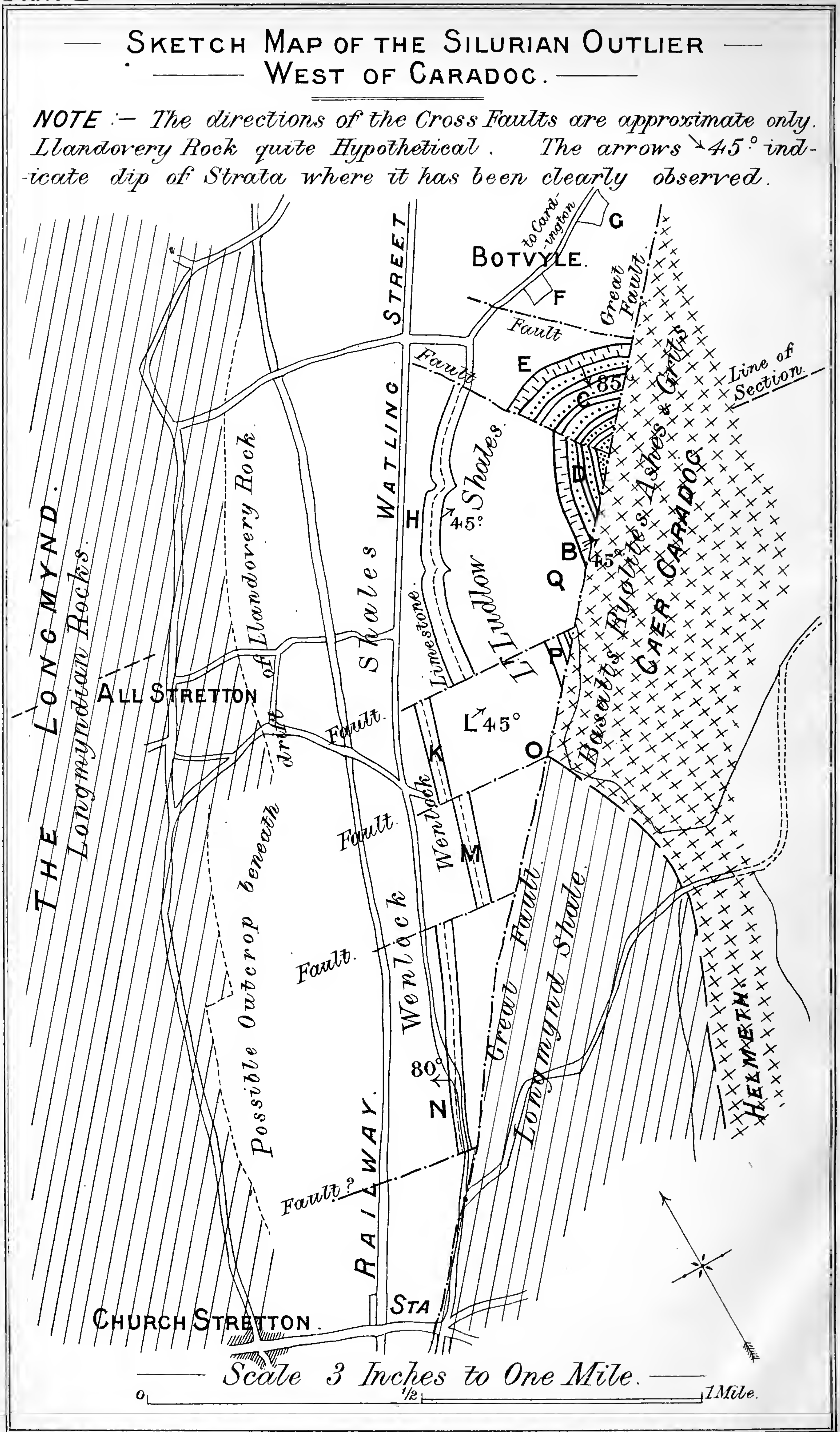
THE unusual delay in the issue of this part has been caused by circumstances greatly to be regretted; first, the serious illness of the author; and, more lately, the death of his artist, whose beautiful reproductions of the author's exquisite delineations have given so great a charm and value to the work. In this part the author continues his monograph of the British Bryaceæ, with the fulness of description and beauty of illustration which have characterised the preceding portions of this work. The part contains forty pages of text, in which forty species and fourteen varieties are fully described, and is illustrated by six plates with beautiful delineations of thirty-three species, many of which are figured for the first time as British species. There are several needful alterations in nomenclature of both genera and species. The generic name *Pohlia*, first applied to one of the species of this group by Hedwig, 1787, replaces the name *Webera*, generally used for the genus; the name Webera was, however, preoccupied by Ehrhart in 1779. Descriptions are given of twelve species of Pohlia, three of which, *P. cucullata*, *P. gracilis*, and *P. commutata* are new to Britain. The rare little moss, better known to British botanists as *Bryum Tozeri*, or *Webera Tozeri*, is here named *Epipterygium Tozeri*. Schimper's genus *Zieria* is replaced by *Plagiobryum*, Lindberg, *Zieria* having been previously adopted by Smith for a genus of Australian Rutaceæ in 1798. This genus contains two characteristic species, *P. Zierii* and *P. demissum*. This is followed by Bryum. *B. julaceum*, of Bry. Brit., is now *B. filiforme*; *Bryum rufum*, of Fergusson, is found to be the beautiul Norwegian species, *B. purpurascens*. *Bryum fallax* and *B. rubens* are new British species; *Bryum atropurpureum*, of Bry. Brit., takes the older name of Dickson, *B. bicolor*; and *B. apiculatum*, of Bry. Brit., is *B. Mildei*, Juratz; *Bryum bimum*, var. *cuspidatum*, of Bry. Brit., is raised to specific rank as *B. affine*. From the foregoing sketch it will be seen that this is a most valuable portion of a truly great work, and all bryologists will sincerely hope that we may soon see the two parts XV. and XVI., which will complete Vol. II. J. E. BAGNALL.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Biological Section. August 9th. Mr. W. P. Marshall in the chair. Mr. T. V. Hodgson gave a brief account of the excursion to Barnt Green on Saturday the 6th inst., and exhibited *Cristatella mucedo* with *Trichodina parasitica* upon it, *Ceratium longicorne*, *Notholca longispina*, *Pedetes saltator*, and *Tubifex rivulorum*. Mr. S. P. Bolton exhibited *Sida crystallina* and some Algæ from the same locality.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—July 11th. Mr. P. T. Deakin exhibited specimens of Sage Brush, from the soda deserts of Utah; Mr. H. Hawkes, *Hydra vulgaris*, stained for the microscope; Mr. J. W. Neville, a peculiar abnormal flower of pansy, that has been continued for several years. Mr. Biddle then read a paper on the "Fertilisation of Flowers," in which the writer described the functions of the stamens and pistil and the structure of the pollen and ovules. The methods of self-fertilisation and cross-fertilisation were described. To the latter, when performed by insect agency, it was stated, we owe the brilliantly coloured flowers, and many of those singular modifications to adapt them to the particular insects that visited them. The advantages of this mode of fertilisation were enumerated. The changes taking place in the ovules after the process of fertilisation was completed were described at some length, the writer saying that from this point the life of the new plant began.—July 18th. Mr. W. J. Parker exhibited male and female specimens of *Dytiscus marginalis*, the former an abnormal insect having no suckers on the front feet; Mr. P. T. Deakin, a collection of Micro-lepidoptera from Sutton Park, giving also a short demonstration of the best method of killing and setting them; Mr. J. Collins, a specimen of *Cardamine impatiens* from Bridgnorth; Mr. S. White, *Epipactis palustris* from Wyre Forest; Mr. G. H. Corbett, polished slabs of Purbeck Marble; under the microscope, Mr. Hawkes, parasite of pig, *Hematopinus suis*. —July 25th. Mr. S. White, a collection of plants from Yardley Wood; Mr. J. Moore, photographs of foraminifera from various localities; Mr. J. Collins, *Draparnaldia glomerata*.—August 8th. Special Holiday Exhibits. Mr. G. H. Corbett showed a collection of fossils from the Wren's Nest, including a number of parts of Trilobites and a series of corals, many of them polished to show their internal structure; Mr. S. White described the botanical features of the country between Dolgelly and Barmouth and showed a collection of plants gathered during the ramble; Mr. Linton, gorse covered with the flowers of *Cuscuta europæa*; under the microscope, Mr. J. W. Neville, section through the leaf bud of *Populus candicans*; Mr. W. J. Parker, *Nitella translucens*.—August 15th. Mr. J. W. Neville showed a number of ironstone nodules containing fossil ferns from the Tipton coalfields and a series of young forms of marine shells; Mr. J. Moore, a series of photomicrographs of molluscan palates, probosces of insects, &c.; Mr. W. J. Parker, a section through flower-bud of tulip.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—August 8th, 1892; Mr. R. C. Bradley in the chair. Mr. G. W. Wynn showed a boxful of moths, taken on sugar during two nights at Wyre Forest, including a nice row of *Aplecta tincta*; also *Cossus ligniperda*, *Cymatophora or*, &c. Mr. C. J. Wainwright showed a nice series of *Xylota sylvarum*, from Wyre Forest; forms of *Amphydasis betularia*, intermediate between the type and *Doubledayaria*, &c. Mr. A. Johnson showed a series of *Chœrocampa elpenor*, *Sphinx ligustri*, &c., and some varieties of *Arctia caia*, from larvæ fed on lettuce.

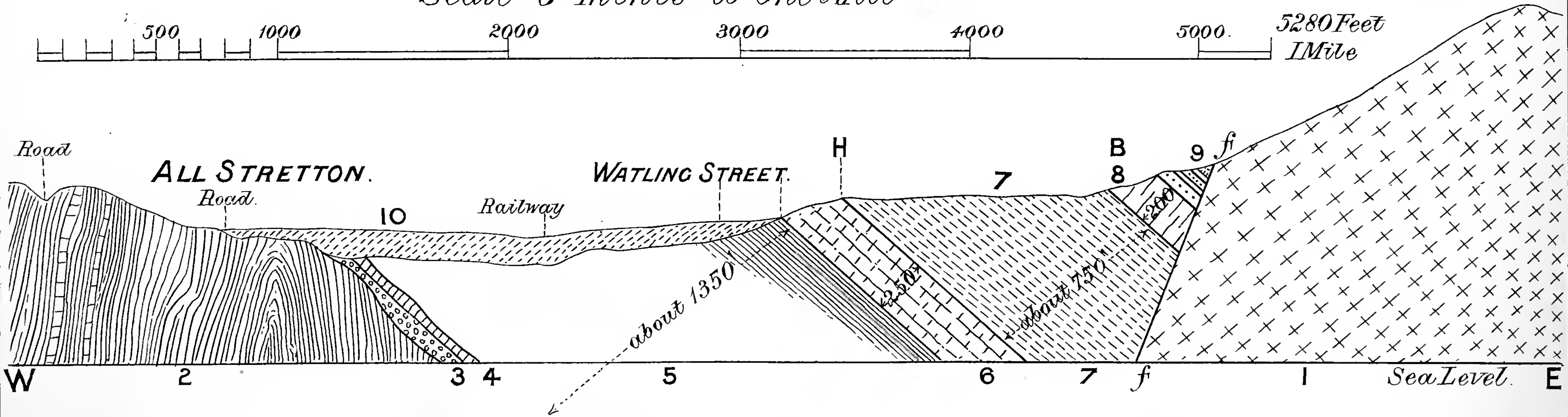


E. S. C. Aug 1892

Herald Press Lith Birm

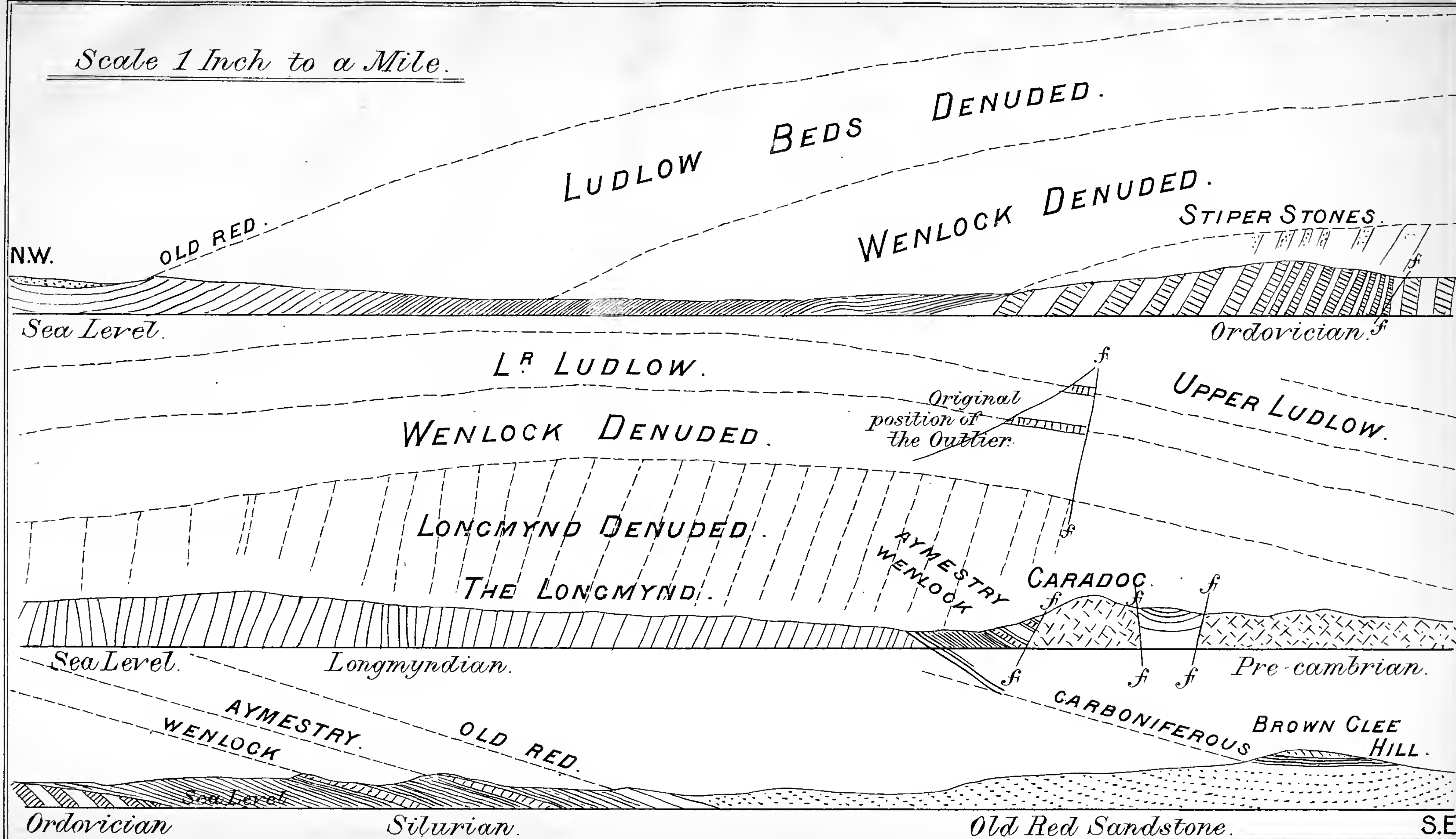
Section across Silurian Outlier West of Caer Caradoc.

Scale 6 Inches to One Mile



1 Basalts, Ryolites, Ashes & Grits. 2 Longmyndian. 3 Possible Llandovery Rocks. 4 Possible Pent-amerus Limestone. 5 Wenlock Shale. 6 Wenlock Limestone. 7 Lower Ludlow Shale. 8 Amestry Lime-stone 9 Upper Ludlow Rock. 10 Drift and Alluvium. f.f. Main Fault.

E.S.C. Aug: 1892. Herald Press Lith.



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Herald Press Lith.

THE SILURIAN OUTLIER WEST OF CAER CARADOC.*

BY E. S. COBBOLD, ASSOC.M.INST.C.E., F.G.S.

The geology of the neighbourhood of Church Stretton is exceedingly complicated, and contains many unsolved problems of great interest, various groups of strata and rocks having been thrown together by great earth movements, so that their relationships to each other, and comparative ages, are exceedingly difficult to make out. The whole of the Caer Caradoc country seems to be cut up by loop faults into a number of detached areas of a more or less lenticular shape, and it is with one of the simpler of these areas that the following remarks are concerned.

An inspection of the geological map of the district will show an elongated area coloured grey, parallel with Caradoc Hill, on its western side, reaching from a little north of the farm called Botvyle to a point near the Church Stretton Railway Station, and streaked in two places with blue lines representing limestone.

On looking at the wide stretch of the same colours to the east in the Wenlock Edge and Ludlow district, one's attention is called to three strongly marked blue lines which run almost continuously from Buildwas and Wenlock on the north to Ludlow and Aymestry on the south. These blue lines mark the outcrops of the three principal Silurian limestones, which form very distinct horizons in the strata of that age, and the question arises which (if any) of these horizons are indicated by the blue lines in the outlier.†

THE THREE LIMESTONES.—These three horizons are known as the Woolhope or Pentamerus limestone occurring almost at the base of the Silurians of Shropshire; the Wenlock limestone near the middle of the series; and the Aymestry limestone occupying the middle of the upper or Ludlow division.

* Read at the Conversazione of the Midland Union of Natural History Societies, held at The Quinta, near Oswestry, August 23rd, 1892.

† Murchison, in the "Silurian System," mentions the outlier as being of Lower Ludlow and Aymestry age, while the Geological Survey Map marks it b_6, indicating the Wenlock rocks.

Vertical Section.—The sequence of the Shropshire Silurian strata, with their approximate thicknesses, as shown on the sections of the geological survey, is as follows:—

Upper Ludlow Rock	about	400 feet.
Aymestry Limestone	,,	100 ,,
Lower Ludlow Shales	,,	650 ,,
Wenlock Limestone	,,	250 ,,
Wenlock Shales	,,	1,400 ,,
Tarrannon Shales	,,	125 ,,
Woolhope Limestone	,,	25 ,,
"Mayhill" Sandstone and Conglomerate	,,	50 ,,
Total ...	,,	3,000 ,,

Absence of Limestones West of the Older Rocks.—The limestones are generally present in the east of the county, but after passing the line of the older ridges of the Longmynd, Stiper Stones, and Shelve districts they are no longer met with; the conditions necessary for the formation of thick beds of limestone were apparently absent from that western area during the Silurian epoch.

Rock Exposures of the Outlier.—In order to keep facts and theory as much apart as possible, I will now proceed to describe the principal exposures of rock in the outlier, which are indicated by various letters on the map (Plate V.); and subsequently will endeavour to point out some of the inferences that may be drawn from them.

In a small wood called Hough's Coppice, about half way between All Stretton and Caer Caradoc, beds of nodular and massive limestone separated by shale may be seen dipping eastwards at an angle of about 45° to 50°. Similar beds are to be found in several positions southwards of this point (at K, M, and N on the map), forming a somewhat detached line of prominences, the last being about an eighth of a mile N.E. from the railway station.

From these beds the following fossils have been identified: Halysites catenularis; Phacops caudatus; Serpulites longissimus; Strophomena trapezoidalis; Leptœna lævigata; Gomphoceras obovatum; there occur also many other corals, but the species have not yet been determined.

About 100 yards eastward of this broken line, and near the middle of its length, in a little clump of Scotch firs (marked L on the map), a small stream exposes some blue, clayey rock (having approximately the same dip, viz., 45° to the east), from which the following fossils have been obtained:—Monograptus colonus; ditto var. basileus; M. Nillsoni; ditto var.; M. Roemeri; ditto var.; Retiolites sp. nov.; Acidaspis coronatus; Phacops caudatus; P.

longicaudatus; Athyris compressa; Belerophon expansus; B. Murchisoni (?); Orthoceras primævum; O. ibex; O. Nicolianum; O. dimidiatum (?) (Stoke Quarry species); Cardiola interrupta; Grammysia sp.; Orthis sp.; Orthonota rigida (?); etc.

Eastwards from Hough's Coppice and close to the fence which divides the uncultivated land of the hill from the fields below (at B on the map), there are two or three exposures of a second limestone not so nodular in character as that before mentioned, showing the same approximate dip (45° east), and characterised by an abundance of Atrypa reticularis; Orthis canaliculata; and Rhynchonella Wilsoni; with O. elegantula, Euomphalus sp., and other forms.

On the survey map a fault is shown running along the general line of this fence, and these rocks are in such a position that they would appear to be abruptly truncated at an acute angle along that line.

A little north of this (at D and C on the map) some very ill-defined exposures of sandy rock are met with, containing numerous casts of fossils, among which have been identified Holopella gregaria; Strophomena rhomboidalis; and Rhynchonella borealis (?).

Northward again, in Botvyle Quarry, a magnificent section is seen of a similar limestone to that at B, and containing a similar abundance of Atrypa reticularis; Rhynchonella Wilsoni; and Orthis canaliculata; as well as R. crebricostata; R. nucula; Strophomena filosa; Chonetes striatella; Murchisonia sp. Here the dip is quite changed, and is at about 85° to the south. These beds may be traced in an easterly direction towards the line of fault, where they appear to end abruptly.

Near Botvyle Farms are two other exposures of shaly material (F and G on the map), where the determination of the dip has not been satisfactorily made out; both contain calcareous nodules and are fossiliferous, but I have not yet explored them sufficiently to give a list of the organic remains. At G (which is close to a pond) the rocks appear to be horizontal, and the purple and green colours are very suggestive of some shales that are to be seen at Minton and Plowden (Tarrannon ?).

Minor exposures of the upper limestone and of the shales of L occur at F, O, and Q on the map.*

* Since writing the above, a further exposure of Lower Ludlow shale has been observed in Caradoc Coppice, near Q, containing an abundance of Phacops caudatus and other forms, a full list of which is to appear in the Caradoc Record of Bare Facts for 1892. This is probably the same as that mentioned by Murchison, op. cit., p. 232.

Inferences.—Such are the observed facts; the direct inferences to be drawn are:—1st. That the upper limestone at B and that in the quarry at E are portions of the same bed. 2nd. That the blue, clayey rock at L is a portion of the lower Ludlow shales. The fossils found here render this practically certain, and its intermediate position between two limestones is confirmatory evidence. 3rd. That the upper limestone at B and E is the representative of the Aymestry limestone, while the lower limestone in Hough's Coppice is a portion of the Wenlock. 4th. That the sandy beds overlying the Aymestry horizon at D and C are of Upper Ludlow age. 5th. That the Great Fault of the survey map forms the eastern boundary of the area.

Summary of Observations and Deductions.—We have, therefore, in this small space, representatives of all the main groups of Silurian strata down to the Wenlock limestone; and from surface indications (change of slope, nature of soil, &c.), we may infer the existence of the Wenlock shales below, and on the west of, Hough's Coppice. At Botvyle Quarry we have Aymestry limestone, tilted at a very high angle so as to be almost at right angles to the other portion at B; and near the farms we have probably Wenlock shale, and possibly Tarrannon shale, but the Wenlock limestone does not at this point appear at the surface. It would be exceedingly interesting to make out whether the basement beds of the Silurian (the Pentamerus limestone and Llandovery conglomerate) are present in this limited area. They are to be seen clinging to the sides of the Longmynd at Plowden and Horderly, and advance up the Church Stretton Valley as far as Little Stretton. They lap all round the south and west side of the Shelve area, and are seen in outlying patches upon those hills; but a most careful search in the fields and streams about All Stretton has failed to bring them to light, and if they are present they are covered up by the drift deposits of clay and gravel, which are to be seen all along the bottom of the valley.

In the map (Plate V.) and section (Plate VI.) I have shown what should be the approximate position of these beds if present at the surface.

The survey map shows the Silurian outlier to be bounded on the west by a second or loop fault along the line of Watling Street, but I have seen no evidence of its existence.

Turning now to the larger question of the piecing together of the rocks, I would call attention to the long white line upon the survey map, which marks the main fault of the valley. The amount of movement that has occurred along this line is stupendous, for the Silurian rocks are brought down so as to be on a level with or below the volcanic rocks of Caradoc, while the evidence of the removal by denudation of vast tracts of Silurian rock (and possibly of old red sandstone) is very striking. In order to realise something of the nature of these phenomena, I have pieced together the survey sections * across the Longmynd and Caradoc area, and have indicated the probable continuation of the Silurian strata after they had been bent upwards into a long dome over the nucleus of the older rocks; I have also made a portion of the section movable, so that the representation of the outlier may be turned back to something like its original position before the fault was formed. When this is done it will be seen that the outlier furnishes strong presumptive proof of the original spread of the Wenlock and Aymestry limestones and shales far to the west of their present position in Wenlock Edge.

Whether these strata were ever quite continuous over the Longmynd and other hills is an open question, but the difference in character between these rocks on the west, where they are of a more sandy nature, and their equivalents on the east, renders it not improbable that the old rocks stood out as islands or a long peninsula in the Silurian sea, and, by shutting off the sandy débris which went to form the Denbighshire grits (of Wenlock or Ludlow age), allowed the calcareous organisms of the Wenlock waters to flourish sufficiently to form the marked beds of limestone on the east.

I should like to take this opportunity of acknowledging the kindness I have received from Professor Lapworth, Dr. Callaway, and Mr. La Touche in identifying fossils; and I am specially indebted to Dr. Lapworth for very many useful hints on field work, and for numberless ideas that I have gathered from him during several very interesting excursions in the neighbourhood.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

OSWESTRY MEETING.

THE CONVERSAZIONE, August 23rd, 1892.

The Conversazione was held at The Quinta, by the kind invitation of Colonel and Mrs. Barnes. The evening was in all respects a most enjoyable one, the objects of interest being as varied as they were numerous. Owing to the

* Plate VII. is a reduced copy of this section, with the original position of the outlier roughly indicated.

stormy weather which prevailed during the evening the gardens, with their magnificent shrubs and flowers, could only be enjoyed from the windows of the house. But as the company left at 10.30 the vivid sheet lightning lit up the grounds and made the great shrubs and trees even more striking than the daylight had done.

A fine collection of rare and valuable curiosities, pictures, engravings, &c., &c., had been gathered together for the Ceiriog Vale Industrial Art and Loan Exhibition on the day previous to the Conversazione, and it was a great privilege for the members of the Union to be able to share in the interest of such a collection, the result of so much labour and thought.

Colonel and Mrs. Barnes had kindly thrown open the whole of their beautiful house to their guests, who wandered from room to room, everywhere finding articles of intense interest. In one room was arranged a very valuable collection of pictures and engravings; in another beautiful specimens of old silver, antique china from various countries, beautiful old lace and embroideries; of the latter one exquisite piece attracted special attention, being worked entirely by men's fingers.

Amongst the old miniatures and autographs exhibited was was one of priceless value—the original letter of William of Orange, written on his landing in England to the nation he came "to save from ruin," and "whose religion, laws, and liberty he intended to preserve." One room was entirely devoted to old MSS. and maps, collected from various sources. Another room contained geological specimens and fossils, collected by Mr. T. James, of Oswestry; also a microscope exhibition, comprising interesting examples of Rotifera, &c.

During the evening the President, Mr. A. T. Jebb, delivered a most interesting address on the "Birds of the Neighbourhood of Oswestry." His careful observations of bird life, and the pains he had taken to find out the derivation of many of the curious names given to birds, added greatly to the enjoyment of his audience. This enjoyment other members of the Union will be enabled to share by the publication of the address in these pages.

The following interesting papers were read later in the evening, and will appear in the "Midland Naturalist":—

"On the Shell-bearing Glacial Deposits of the Gloppa," by Mr. A. C. Nicholson, of Oswestry.

"The Breaking of the Meres," by Mr. W. Phillips, F.L.S., of Shrewsbury.

"On the Silurian Outlier West of Caer Caradoc," by E. Stirling Cobbold, of Church Stretton.

"On Phenology," by Mr. F. A. Bellamy, F.R.Met.Soc., of Oxford.

Not the least interesting or remarkable feature of the evening's pleasure was a series of lantern slides, painted and exhibited by Mr. H. M. J. Underhill, of Oxford. These illustrated in the most beautiful and striking manner the life of our ponds and rivers. Many exquisite specimens were thus shown of the highly organised Rotifera, including several unnamed varieties, and also examples of the Amœba and Vorticella, and other Infusoria. The interest of this beautiful exhibition was greatly increased by the lucid explanation of each slide given by the exhibitor himself.

The varied programme of the evening was brought to a close by a hearty vote of thanks on behalf of the Union to Colonel and Mrs. Barnes for their most kind hospitality in affording to its members such a pleasant and memorable evening.

GEOLOGICAL EXCURSION, August 24th, 1892.

The neighbourhood of Oswestry is an extremely interesting one for the geologist, on account of the great diversity of the strata to be found over a very limited area. Thus, commencing at Tedsmore, six miles S.E. of Oswestry, there is an outlying portion of the Keuper marls and Waterstones, and in the course of nine miles all the intervening strata are represented down to the Carboniferous Limestone. Oswestry itself is on the Permian, and between this and Tedsmore, the three divisions of the Bunter occur, viz., Upper Mottled Sandstone, Bunter Conglomerate (corresponding to the Pebble Beds of Warwickshire, etc.), and the Lower Mottled Sandstone. The study of the various strata is, however, rendered difficult by the depth of the glacial sands and gravels which cover them. To the W.N.W. of Oswestry, in the course of the excursion, the three divisions of the Carboniferous strata, two or three of the Ordovician, and two of the Silurian (or "Salopian") are to be seen. The Old Red Sandstone is missing in the neighbourhood visited (although it occurs four miles north of Chirk). The Carboniferous Limestone is to be seen lying unconformably on the Ordovician Shales, near Oswestry, and on the Wenlock Shale, near Chirk. An unconformity may also be seen at Llansantffraid between the Ordovician (Bala Limestone, etc.) and the Salopian (Llandovery) Shale which underlies the grits.

Shortly after nine a.m. a start was made from the Wynnstay Arms Hotel, Oswestry, by the first detachment of the party, to the number of twenty-five or so, with every promise of a most interesting and enjoyable excursion—a promise which was to be fully realised, for the weather was all that could be desired except for a slight haziness of the distant views in the earlier part of the day, and all the arrangements were satisfactory.

The coal measures over which the route lay at first lie buried by some considerable depth of glacial drift. Some evidence of coal-mining was, however, noticeable on the way to the Bwlch Quarry, and the fact of a thin seam of coal having been met with in the millstone grit when making the Llanforda tunnel for the Liverpool water works was pointed out. The eastern end of this same tunnel and the reservoir and filter-beds belonging to the Liverpool Lake Vyrnwy water supply, were seen from the road. The first halt was made at the Bwlch Quarry, about two miles from Oswestry. In this quarry, which presented a typical exposure of millstone grit, there was a zone of the usual hard, grey rock, several feet thick, in which plant remains, rootlets, etc., might be distinguished, proving it to be a shallow water or shore deposit. Upon this was lying a soft, sandy deposit, which was almost entirely made up of fossil shells of many different species, clearly indicating a deep sea origin for these strata. We have thus to picture a vast change, and periods of great submergence and upheaval following close on one another.

In the sandy, fossiliferous strata, one of the party was fortunate enough to find the tail of a Trilobite, probably Phillipsia, a species which has once or twice before been found about this horizon in the millstone grit. This discovery was of interest as being the last appearance of the Trilobite in Geological time.

At the Gloppa Sand Pit the party was made up to its full strength of forty or more by fresh arrivals, among whom were the president and others from Ellesmere, and Mrs. Barnes and her party from The Quinta.

These sands, which lie at the north end of the Oswestry racecourse, are famous on account of the discovery here by A. C. Nicholson, Esq., and others, of numerous shells in the sands and gravels, characteristic of the Glacial age, although the spot is now close upon 1,300 feet above the sea level. This fact demonstrates clearly to some minds the occurrence during the Glacial Epoch of a great subsidence of the land, whilst to others it has no such import; and these latter would have us believe that this and similar deposits are simply due to the glaciers having pushed up before them during their march overland the sand and gravel from some low-lying sea beach, and thus depositing it, shells and all, on the top of the hills.

At 10 30 a move was made in the direction of the Carboniferous Limestone, and, at a mile distant, Offa's Dyke was clearly seen crossing the line of the road N. and S., and far and near the bold escarpments of Carboniferous Limestone were visible, as it overlies unconformably the softer Ordovician Shale. At the Lawnt, a quarry in the Limestone was visited, and characteristic fossils found in abundance. The scenery from this point as well as other points on the way is very picturesque, and of great interest to the geologist. The hills of the softer Ordovician Shale (Llandeilo) are, many of them, completely rounded by the action of the ice and other agencies, whilst the harder limestone hills, and especially the igneous rocks, have been better able to resist the action of those powerful agencies, and so stand out in bold scarps and outcrops. Abundant evidence is also afforded by the boulders which are found on the sides of the hills, and by the polished and striated stones in the valleys (where preserved in the clays) that glaciers once filled these valleys, travelling more or less N. to S.

From this point to Llanarmon the scenery was very fine, and the drive was rendered most enjoyable by the brilliancy of the sunshine and the clearness of the air. From Llanarmon an easy drive of two or three miles took the party to the granite quarries, where a substantial lunch was provided, Mr. Griffiths (of Chirk) having kindly placed one of his houses at the disposal of the Union for that purpose. After lunch, time did not suffice to do justice to the interesting strata here exposed. The ash beds, which cause the narrowing in of the valley and give rise to the towering and wooded cliffs on either side of the valley, were visited, and some interesting and remarkable spherulitic specimens of the rock were obtained by some of the party. It is hoped that a report upon this rock will appear in a subsequent number of the "Naturalist." Only a hasty visit could be made to the Bala limestone and the fossiliferous shales above and below it; a fair number of fossils were nevertheless obtained. The so-called Hirnant limestone and the Llandovery and Tarannon shales could not be visited at all in the time at the disposal of the geologists.

From Llansantffraid Glyn Ceiriog the route lay through the well-wooded valley of the Ceiriog nearly to Chirk, where the steep wooded hills due to the outcrop of the carboniferous limestone and millstone grit closed in the valley, and formed a striking feature in the landscape. A drive of three miles brought the party back to Gobowen in good time for the Great Western express to the south.

BOTANICAL EXCURSION, AUGUST 24TH, 1892.

The Botanical party, consisting of about sixteen members, led by the Rev. O. M. Feilden, drove in brakes to Ellesmere, calling on the way at Frankton, where they found in the churchyard a fine "fairy ring," caused by the growth of *Marasmius oreades.* The other finds were *Centaurea Scabiosa* and *Gomphidius viscidus.* On arrival at Ellesmere the party walked past Ellesmere mere, across which they had a fine view of the residence of Mr. J. K. Mainwaring, to Blakemere. The name of this lake is sometimes written Blackmere, but it is said that *blake* does not mean *black*, but is an old English word for "yellow." Perhaps some local correspondent can throw light upon this point.

On entering the wood surrounding this, the path led past Kettlemere, a small lake of about $4\frac{1}{2}$ acres, occupying a deep circular depression which probably gave origin to its name. This latter and Ellesmere mere, amongst others, are locally famous for the phenomenon called "the breaking of the meres," which consists in the enormous development, at particular seasons of the year, of some minute species of alga, which cause the water to appear greenish and turbid. Although Blakemere is connected with Kettlemere by a wide artificial ditch, it is said that the former never "breaks," though a gentle current runs from Kettlemere into Blakemere. Ellesmere mere was "breaking" at the time of the visit, the surface near the edge being covered with enormous numbers of spherical bodies, each about as large as a pin's head. These were composed of radiating masses of the threads of a minute yellow-green alga, called *Rivularia* or *Echinella articulata.* In Blakemere there grows *Lobelia Dortmanni*; one of the party, wading in, gathered some of the leaves and withered flower-stalks. Among the other finds were:—*Hypericum elodes, Cicuta virosa, Malva moschata, Linum usitatissimum, Bidens tripartita, Lysimachia vulgaris, Rubus corylifolius, Myrica Gale, Lastrea spinulosa.*

The following Lichens were determined by Mr. Wilkinson, from in or near Oswestry:—

Parmelia caperata, P. physodes, P. perlata, P. olivacea, P. saxatilis, Physcia prunastri, P. parietina, Peltigera canina, P. rufescens, Cladonia pyxidata, C. deformis, C. furcata, Placodium citrinum.

In the wood near Blakemere, Mr. W. B. Grove and the other mycologists of the party gathered the following species of Fungi:—

Agaricus (*Lep.*) *felinus, A.* (*Coll.*) *maculatus, A.* (*Coll.*) *nitellinus, A.* (*Myc.*) *parabolicus, A.* (*Ino.*) *plumosus, A.* (*Ino.*) *geophyllus, Cortinarius rigidus, Russula heterophylla, R. cyanoxantha, R. emetica, R. citrina, R. ochroleuca, R. depallens, Marasmius androsaceus, Lactarius camphoratus, Phallus impudicus, Scleroderma Bovista, Thelephora laciniata. Peziza aurantia,* *Hymenoscypha cyathoidea*, *Helotium herbarum*, *Ramularia calcea*, *Plasmodiophora alni.*

The party then drove to Tedsmore Rectory, where, by the kindness of the Rev. T. M. Bulkeley-Owen and the Hon. Mrs. Bulkeley-Owen, they visited the beautiful gardens, and were afterwards entertained at tea. These gardens are kept in a kind of civilised-wild condition, which adds greatly to their picturesqueness. Amongst the trees a number of fine typical specimens of the curious fungus, *Lactarius exsuccus*, were found, each showing distinctly that faint touch of verdigris at the base of the gills, which seems most easily to distinguish it.

The party then returned to Oswestry in good time to catch the train to the south.

PHENOLOGY, OR THE ANNUAL APPEARANCE OF CERTAIN BIRDS, FLOWERS OF PLANTS, AND INSECTS.*

The word Phenology may possibly be new to many present, many dictionaries may be consulted, but without gaining any information as to its meaning, The origin of the word may probably be from the Greek, φηναι (feni), or φαινομαι, to appear, from which also the word "Phenomenon" is derived; the word Phenology meaning the knowledge or science of appearances; or, to give the full meaning, the observation of first appearance, each year, of certain wild flowers, birds, insects, etc. I shall endeavour to show in this short paper the object and the method of making such observations.

Who does not take some interest in observing, as each spring comes round, the flowering of the violet, cowslip, blue-bell, dog-rose, and other plants; or the return of the swallow, the cuckoo, the swift, or less common birds; or, again, such insects as the cabbage white butterfly, the honey bee, the wasp, etc.?

Everyone is naturally an "observer," but likes to make the observation to suit his or her own sweet will. Yet, how few observers write down their observations, or, if done, how seldom are they available for workers in this particular branch of natural history.

At the best, the notes will most often be made in private pocket-books or on letters. Either the observer may not know of anyone who would want the observations, or naturally would not care to lend such books and letters, or

* Read at the Conversazione of the Midland Union of Natural History Societies, held at The Quinta, near Oswestry, August 23rd, 1892.

would be too busy to copy the observations for another's use. The usual result would, therefore, be just as if the observations had never been made. They would be lost to science. Now, I ask, why should careful and systematic observations of natural history objects be lost? There is no reason, as I think I can show. When one sees a flower out very early or late in the season, or sees certain birds or insects, one says to oneself, "The *weather* has been very favourable for bringing these things about;" or, "The *weather* has been so cloudy or cold, no wonder there is nothing yet to observe;" and so on.

My object in giving this paper is to get such observations made—and I hope I shall persuade some to make them—as will enable one to look at Natural History from a Meteorological aspect. To find out what effect Meteorology—or, to use a more popular phrase, the *weather*—has on certain selected species in the Natural History Kingdom; or, to take a very comprehensive, but opposite view of the subject, what effect Natural History—Botany for instance—has on Meteorology, the weather, or climate: for these three words have really the same meaning.

Any attempt to form a connection between Natural History and Meteorology—in fact, any two or more branches of science—should be fostered. And Natural History Societies and Field Clubs, or rather, the individual members of them, could give immense help towards the former.

The plan I shall presently put before you is not my own, let me tell you, but was made by the Royal Meteorological Society, and it has now been carried on, with one or two revisions, since 1875. The Society now only require observations of thirteen plants, six birds, and five insects, each year. A very light, yet interesting, work, again let me tell you. It *used* to be *hard work*—with other duties—to get an observation of 112 objects every year, this being the number which was formerly required. To aid this scheme, I appeal to observers to make observations—in accordance with the instructions of the Royal Meteorological Society—of the objects here mentioned. The plants have been most carefully selected, being such as can be seen wild in almost every part of the British Isles. They have purposely been chosen, as, besides being common, they are readily known and accessible, the times of flowering occurring between January and September; plants which have already been well observed as useful for forming an average date of flowering; plants which would not be likely to be mistaken for others; also such tall plants, as trees and shrubs.

Having willing observers and the list of plants, &c., one thing is still absolutely necessary, and that is, that all the observations must be made on the systematic plan laid down in the instructions issued by the Society. The observations are of little value, having this idea in the mind, if one observer finds out all the very earliest specimens of the plants and makes notes of those, whilst another will select all the very late places for plants coming into flower. Some may choose shady places, others, very sunny banks, sheltered from all cold winds, or an open, bleak place, for making the observations. The instructions should be fairly followed and all extremes carefully avoided.

The best way is to select two or three moderately open situations for each plant, and then, every year, observe them for the first few flowers, in one or other of the situations chosen. For instance, it would not do to observe a plant in a very cold shady place one year and another year choose a very sunny place for making the observation. This would result in anything but uniformity ; they must be so made that they will be comparable. There is no need to scour the neighbourhood for the very earliest blossom which can be found on either of the typical plants : plants in convenient situations should be chosen.

It is useful, in case of illness or absence, to train one or two persons to make the necessary observations. Any number of observers may send in observations from one locality ; they should, however, all be made independently. The idea is to get the whole country covered by observers, rather than have a few isolated observations.

The following is a complete list of plants, birds, and insects, of which observations are required :—

PLANTS.

1.—Hazel (*Corylus Avellana*).
2.—Coltsfoot (*Tussilago Farfara*).
3.—Wood Anemone (*Anemone nemorosa*).
4.—Blackthorn (*Prunus spinosa*).
5.—Garlic Hedge Mustard (*Sisymbrium Alliaria*).
6.—Horse Chestnut (*Æsculus Hippocastanum*).
7.—Hawthorn (*Cratægus Oxyacantha*).
8.—White Ox-eye (*Chrysanthemum Leucanthemum*).
9.—Dog Rose (*Rosa canina*).
10.—Black Knapweed (*Centaurea nigra*).
11.—Harebell (*Campanula rotundifolia*).
12.—Greater Bindweed (*Convolvulus Sepium*).
13.—Ivy (*Hedera Helix*).

BIRDS.

1.—Song Thrush (*Turdus musicus*).
2.—Swallow (*Hirundo rustica*).
3.—Cuckoo (*Cuculus canorus*).
4.—Nightingale (*Daulias luscinia*).
5.—Flycatcher (*Muscicapa grisola*).
6.—Swallow (last seen).

INSECTS.

1.—Honey Bee (*Apis mellifica*).
2.—Wasp (*Vespa vulgaris*).
3.—Small Cabbage White Butterfly (*Pieris rapæ*).
4.—Orange-tip Butterfly (*Anthocharis cardamines*).
5.—Meadow - brown Butterfly (*Epinephile Janira*).

I hope I have succeeded in rousing many members of Natural History Societies to make the observations required in this useful and interesting subject; and that next year observations will come in so quickly that the success of the scheme will be much enhanced.

I might mention that more than 100 observers sent in observations last year, and that twelve of the Natural History Societies in connection with the British Association are at present represented in this scheme.

Notes of observations may be sent to E. Mawley, Esq., F.R.H.S., Rosebank, Berkhampsted, Herts; to the Royal Meteorological Society, 22, Great George Street, London, S.W.; or I shall be pleased to forward any notes which may be sent to me, and will give any further information.

F. A. Bellamy, F.R.Met.Soc.

4, St. John's Road, Oxford.

THE CULTIVATION OF ORCHIDS.

BY E. A. BEVERS.

(Concluded from page 210.)

If you have only one house I should recommend you to use it as an intermediate house, as in that you can grow a great variety of beautiful orchids. With regard to

PROPAGATING,

few orchids can be quickly increased by any artificial method of propagation. You cannot depend upon it to add much to your stock, as in most cases it takes too long, and it is far better to purchase established plants. But you may like to know something about propagation. In the first place do not commence experimenting with a valuable plant, for orchids are easily injured; the method adopted with many orchids having short pseudo-bulbs of the Cattleya or Odontoglossum types, is to cut between the pseudo-bulbs and through the rhizome, so as to retain some roots on each. The safest plan is to leave these in the pots for some time until it is seen that fresh growths are coming from the divided portions, when they can be potted up. This plan is also adopted when it is desired to produce what are termed back growths to make a better specimen, as the old pseudo-bulbs will often form growths where thus treated, greatly improving the appearance of a plant. If the ordinary methods of propagation are slow, raising orchids from seed is a still slower process, and it cannot be recommended except for those who are interested in obtaining hybrids. It requires much patient waiting, constant attention, and perhaps after years of this care some enemy may devour the plant or from other causes you may lose it. Independently of these difficulties, seed-bearing is exceedingly weakening to orchids; a weak plant may be killed and a strong one so injured that it will take several seasons to recover its usual condition. Then it is difficult to ensure the proper maturing of the seed pods, and even when these develop and ripen satisfactorily, they are occasionally found to contain no seeds, or only imperfect rudimentary bodies that will not germinate. Mr. Veitch, who has probably produced more hybrids than anyone, states that the seed pods take to ripen from four to twelve months, and that considerably longer periods are required to bring the plants from the germinating to the flowering stage, that is, from four to twelve years, and some have taken even longer.

TREATMENT OF NEWLY-IMPORTED ORCHIDS.

The peculiar conditions under which orchids are found wild, the manner in which they are collected, and conveyed long distances in boxes, etc., by mule, boat, and steamer, together with the radical changes they necessarily undergo before they are established with us, render their treatment, when they first arrive, of great importance. Thousands of plants are sold weekly at the auction rooms and elsewhere, which are either immediately killed or weakened by wrong treatment. As a rule, the roots of newly-imported plants are all dead, and few, if any, leaves remain on such as Odontoglossums, Dendrobriums, etc., although the pseudo-bulbs are sound.

In selecting plants from a fresh importation, one or two important points should be remembered; *first*, that the last matured pseudo-bulb is healthy and uninjured, and bears at its base, as I have said before, a sound eye; *secondly*, that the plant has as much foliage as possible; the larger the specimens, the more leads or eyes it should have, and if the pseudo-bulbs are numerous and plump the rhizomes sound and the eyes perfect, nothing more need be desired.

It is always better to begin with strong plants than with scrappy bits, nine-tenths of which will probably come to nothing.

To begin with, the plants should be carefully examined, and all dead roots, pseudo-bulbs, leaves, etc., cut away. A sharp knife should be used, and the operator must be careful or he will cut away eyes or living roots. Too much care cannot be taken over this part of the work. They should then be washed with soapy water. Plants should be placed in pots, which have been two-thirds filled with clean, broken crocks. Stakes may be used to keep the plants upright. In watering, the crocks only should be moistened until new roots are formed, then the plants should be potted, as I have before explained to you, but if you place soil round them, before the new roots appear, you will probably cause the orchid to decay.

Plants which have no pseudo-bulbs require very careful treatment. They should be cleaned and hung, head downwards, in a moist, shaded house, until the leaves are plump and new roots are seen forming. This precaution is necessary for the safety of the central eye or crown, which generally rots if moisture is allowed to lodge in the bases of the leaves.

I have not touched upon the fertilization of orchids, and shall do so only very slightly, as this is of such a very wonderful and complex character that it would take a great deal of time to go into, and in so doing would open up a discussion upon the theory of evolution and survival of the fittest. I will therefore say that if any one is interested in this matter, they cannot do better than study Darwin's "Fertilization of Orchids."

FERTILIZATION.

To effect the fertilization of the flower, and the production of seeds to perpetuate the plant, it is necessary that the pollinia be conveyed to the stigma, and as in the majority of cases these organs are so placed that it cannot be accomplished without foreign aid, we perceive a reason for many elaborate contrivances that compel or induce insects to afford the requisite assistance. It has been observed that in some species self-fertilization is commonly effected owing to the pollen masses partly falling out of the anther case, and hanging in front of the stigma, against which the slightest wind blows them. On the other hand, it would require a great deal of time to describe the very many plans by which the conveyance of pollen masses from one flower to another is provided for, examples of which are found in plenty in our wild orchids. These are fully described by Darwin in his work on the "Fertilization of Orchids."

One extraordinary example I may bring before your notice, it is *Coryanthes macrantha.* In this and others of the genus the lip is formed like a bucket, one portion of which secretes a fluid that falls into the lip and remains there until evaporated, or it sometimes fills the bucket and overflows like a spout. *Coryanthes macrantha* has projections upon the lip, which tempt bees to gnaw them ; and Dr. Cruger has observed that " the bees may be seen in great numbers, disputing with each other for a place on the edge of the flower. Partly by this contest, partly, perhaps, intoxicated by the matter they are indulging in, they tumble into the bucket of fluid; they then crawl along in the water towards the anterior side of the bucket, where there is a passage for them between the opening of this and the column. The first bee, then, which is immersed will have the gland of the pollen mass glued to its back; it passes out of this, and perhaps enters the same or another flower, when the pollen masses are placed directly upon the stigma in coming out as before." After the pollen masses are deposited upon the stigma of an orchid, minute tubes are emitted as in ordinary pollen, these passing down the tissues of the column to the ovary, where they fertilize the ovules. It is strange, however, that in some orchids several days, weeks, or months are required for the tubes to perform this journey, although the distance is much shorter than in numbers of other flowering plants. When fertilization is effected the flowers at once commence fading, and it is curious to see flowers that would perhaps have lasted for several weeks show signs of decay in a few hours after the pollen is placed on the stigma.

The column of an orchid flower is theoretically regarded as composed of four stamens and three pistils, two other stamens being combined with the lip, and thus explaining its occasional three-lobed form. The stamens are considered to be in two rings, the uppermost of the outer ring being that usually fertile, and the upper two of the inner ring are those seen in Cypripedium, while the lower two of the outer ring are those united with the lip; the two outer of the stigmas are united, and the upper one forms the rostellum.

ORCHID FLORA.

Divided into two classes, Epiphytes — Terrestrial. These two classes are distributed into seven orders or tribes:—

1. Malaxeæ—softness or waxy softness.
2. Epidendreæ—something growing upon trees.
3. Vandeæ—Sanskrit for mistletoe or tree orchid.
4. Ophreæ—the eyebrows, referring to ancient fashion of painting eyebrows.
5. Arethuseæ—from name of nymph of Diana, fabled to have been transformed into a fountain.
6. Neotheæ—a bird's nest.
7. Cypripedeæ—Venus's slipper.

MEANING OF NAMES.

The names given to orchids have generally been designed to point out some particular feature of the plant, or were given on account of some economical use, or out of respect to the discoverer, or in compliment to an eminent patron.

Dendrobium—living on a tree; *δενδρον*, tree; *βιος*, life.

Masdevallia—for Don Jose Masdevall.

Cattleya—for William Cattley.

Cattleya Trianæ—Signor Triana, a native of New Granada, and large collector of orchids in that province.

Cattleya Chocoensis—native of province of Choco in the United States of Colombia.

Cattleya Mossiæ—South America, named after Mr. Thomas Moss, an early cultivator, of Liverpool.

Lælia—Roman lady's name, daughter of Caius Lælius, an ancient Roman nobleman.

Lælia Dayeana—Mr. John Day, whose magnificent collection of orchids was at Tottenham; it is now sold.

Phalænopsis—butterfly plant or moth orchid, Indian Archipelago.

Oncidium—tuberculous appearance, from the knobby protuberances in the blossoms.

Calanthe—beautiful flower ; *καλος*, beautiful ; *ἀνθος*, flower.

Aerides—air plant.

Aerides Quinque Vulnerum—the air plant of five wounds, accurately describes the number of petals with their apparently bloody marks.

Odontoglossum—tooth and tongue, so named from a fancied resemblance in the blossom's centre to a tooth and the likeness of the lip underneath to the tongue ; *ὀδους*, tooth, *γλωσσα*, tongue.

Lycaste—a lady's name.

Vanda—sacred mistletoe or tree orchid. The name seems to have come through the Sanskrit, Vanda meaning the parasite growing out of an oak, for the evergreen parasite growing upon and out of other trees rarely appeared upon an oak, and when this occurred a peculiar sacredness was supposed to attach to it. Vandaca, among the Orientals, was an oak.

Cymbidium—boat-shaped ; *κυμβη*, a small boat.

Cypripedium—Venus's slipper ; *κυπρις*, one of the names given to the goddess Venus, because the island of Cyprus was an early and chief worshipper of this deity ; and *ποδειον*, a sock or little shoe.

BOTANICAL NOTES FROM SOUTH BEDS.

VOUCHER SPECIMENS ENCLOSED.

Name.	Date. 1892.		Aspect.	Locality.
Corylus Avellana......	Jan.	21	Open	Hedge.
Helleborus viridis	Feb.	29		
Mercurialis perennis ..	Mar.	19	S.W.	Hedgebank.
Salix caprea	,,	24	Open	
Ranunculus Ficaria ..	April	2	,,	Moist meadow.
Petasites vulgaris	,,	2	,,	Moist meadow.
Anemone nemorosa....	,,	3	,,	Coppice.
Luzula pilosa	,,	3	,,	Coppice.
Nepeta Glechoma	,,	10	S.E.	Bank.
Caltha palustris	,,	10	Open	Moist meadow.
Viola Reichenbachiana	,,	10	,,	Coppice. Few flowers.
V. Riviniana..........	,,	10	,,	Coppice. Plentiful.
Prunus spinosa	,,	17	S.W.	Hill side.
Primula veris	,,	17	,,	Hill side.
Ranunculus auricomus	,,	18	,,	Hedge, in Herts.
Stellaria Holostea	,,	24	S.E.	Hedge, in Herts.
Scilla nutans	,,	24	W.	Coppice, in Herts.
Cratægus monogyna ..	May	5	S.	Very warm position, not general till after the 20th.

Leafing of Oak and Ash.—Observations were made at frequent intervals, in fact almost daily, in portions of the three counties—Beds, Herts, and Middlesex—and it was noticed that Oaks were fairly in leaf during the third week in May, and Ashes not till the fourth.—Jas. Saunders, *Luton*.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(*Continued from page 143.*)

When I commenced my synopsis of the "Botany of Worcestershire," by Mr. Edwin Lees ("Midland Naturalist," Vol. XIV., page 16), I designedly omitted many of the commoner species only recorded in the Table, and a few others also recorded in the Text. I now find it necessary to supply these omissions, and cannot do better than in this place. They are previous records in every case.

Plants omitted in pages 16 to 19:—

* **Clematis Vitalba.** 38, Battenhall and Hallow, and other places near Worcester; 67, Silurian hills at Malvern; 88, on the limestone in the Abberley Hills; 93, Cracombe and Coldknap Hills; 103, Broadway. Tab. 3. In all the districts, except Lickey.

* **Thalictrum flavum.** 29, red marl cliffs of the Severn; 39, on the banks of the Severn, here and there; 119, Moseley. Extinct. Tab. 3. In all the districts.

* **Myosurus minimus.** 39, found in 1836 on Helbury Hill, near Worcester; Porter's Mill, on the Droitwich Canal, Rev. J. H. Thompson; 89, Powick, Mr. T. Westcombe. Tab. 3. Severn, Malvern.

* **Ranunculus fluitans.** 3, in the Severn. Tab. 3. In all the districts except Lickey.

* **R. auricomus.** 122, about Halesowen. Tab. 3. In all the districts.

* **R. hirsutus.** 35, barren fields, near Longdon Marsh; 61, Longdon Marsh. Tab. 3. Malvern district only.

* **R. arvensis.** 122, cornfields on the Upper Stour. Tab. 3. In all the districts.

* **R. parviflorus.** 39, various spots near Worcester; 86, Tenbury neighbourhood. 97, near Evesham. Tab. 3. In all the districts.

* **Berberis vulgaris.** 39, side of Comer Lane, Worcester. "Almost eradicated from county." Tab. 3. Severn, Malvern.

* **Turritis glabra.** 9, 12, 59, on sandy soil about Stourport, Kidderminster, and Wolverley. Tab. 4. Severn, Malvern, Lickey.

* **Cardamine impatiens.** 6, Wyre Forest; 12, Lincomb, about Holly Austin Rocks; 20, Powick; 65, Malvern Hills; 86, near Tenbury; 128, Wychbury Wood. Tab. 4. In all the districts, except Avon.

* **C. amara.** 6, Wyre Forest; 12, Fenny Rough; 20, Rushwick; 119, Moseley; 120, Northfield; 124, Halesowen Abbey. Tab. 4. In all the districts.

* **Sinapis nigra.** 29, banks of the Severn. Tab. 4. Avon, Severn, Malvern.

* **Lepidium Smithii.** 39, Helbury Hill, Worcester; 68, Malvern; Tab. 5. Severn, Malvern.

* **L. sativum.** Not native, xxix. Tab. 5. Severn, Malvern.

* **Viola hirta.** 40, at Whittington, Henwick, &c., not confined to limestone; 67, Silurian hills of Malvern; 93, Cracombe and Coldknap Hill; 98, about Alderminster. Tab. 5. In all the districts. *I have never seen it in the Lickey district.*

The following are recorded for all the districts:—

* **Anemone nemorosa.**	* **Alliaria officinalis.**
* **Ranunculus aquatilis.** Aggregate.	* **Brassica campestris,** var. **Rapa.**
* **R. circinatus.**	* **B. Napus.**
* **R. hederaceus.**	* **Sinapis arvensis.**
* **R. flammula.**	* **Draba verna.**
* **R. Ficaria.**	* **Thlaspi arvense.**
* **R. acris.**	* **Lepidium campestre.**
* **R. repens.**	* **Capsella Bursa-pastoris.**
* **R. bulbosus.**	* **Reseda Luteola.**
* **R. sceleratus.**	* **Viola odorata.**
* **Caltha palustris.**	* **V. sylvatica.** Aggregate.
* **Eranthis hyemalis.**	* **V. tricolor.** Aggregate.
* **Nuphar lutea.**	* **Silene inflata.**
* **Papaver Argemone.**	* **Lychnis Flos-cuculi.**
* **P. Rhœas.**	* **L. vespertina.**
* **P. dubium.**	* **L. diurna.**
* **Chelidonium majus.**	* **L. Githago.**
* **Fumaria officinalis.**	* **Sagina procumbens.**
* **Nasturtium officinale.**	* **Sag. apetala.**
* **N. palustre.**	* **Stellaria media.**
* **N. amphibium.**	* **St. Holostea.**
* **Barbarea vulgaris.**	* **St. graminea.**
* **Cardamine sylvatica.**	* **St. uliginosa.**
* **C. hirsuta.**	* **Cerastium glomeratum.**
* **C. pratensis.**	* **C. triviale.**
* **Sisymbrium officinale.**	* **Acer campestre.**
* **S. Thalianum.**	* **A. Pseudo-platanus.**

In the year 1868 the present writer prepared for a local guide book, entitled "Clentine Rambles" (Mark and Moody, Stourbridge, 1868), a list of the more remarkable flowering plants and ferns to be found in that part of the county of Worcester which lies within a radius of six-and-a-half miles from the summit of Clent Hill.

In 1881 I published a new edition extending the boundary to most of the Lickey district of Mr. Lees, and including the northern part of his Severn Valley district as far as the east bank of the Stour.

The new records are for the most part contained in the edition of 1881. In the interval between the two publications some additional plants have been noted :—

* **Ranunculus Lenormandi.** Pedmore Common. Near the Birches, Hagley, 5th April, 1871, "Journal of Botany," Vol. IX., 1871. *First localised record.*

Early in the seventies, the late Mr. H. C. Watson, well known for his works on the geographical distribution of plants, was engaged on his "Topographical Botany." This consisted of two parts, bearing date respectively 1873 and and 1874. They were printed for private distribution, and 100 copies only were struck off. Each species is enumerated, and below it is a list of the counties in which it is supposed to occur. For instance, we find under the head of Geranium lucidum :—

Devon, S. ! Briggs Cat.
Somerset, S. Coleman Cat.
Surrey !
Berks.
Bedford.
Worcester.
Salop.

Here are a number of records of different degrees of authenticity. On p. 562 are notes on authorities cited, from which we learn that no books are quoted, although a list of the books used is given on p. 571. For Worcester these are :—

Hastings, Ill. (Edwin Lees) (1834).
Lees, Bot. of Malvern, 1868 (1843).
Loudon, Mag. Nat. Hist., 1829-1836.
Purton, Midland Flora, 1817-1821.
Withering, Ed., Var.

A county without an authority is intended to mean that the species has appeared in print, but that it lacks the authority of a personal record. It is not easy to see why a record by Withering or Purton of a well-known common plant should be less worthy of credence than a record of the present day.

In the year 1883 a second edition, "corrected and enlarged," was published, but the author having died in 1881, it was edited by Mr. J. G. Baker and the late Rev. W. W. Newbould.

In 1873 the Botanical Record Club was established for the purpose of completing the County Records of Topographical Botany. No records were admitted but such as were personally vouched by authentic specimens submitted to one of five eminent botanists, called the Referees. The result is that several plants which have been well-known in the county for upwards of fifty years were published as new county records.

The fact is that Mr. Edwin Lees was not a *persona grata* to Mr. H. C. Watson. The latter, with somewhat unnecessary ostentation, ignored Mr. Lees's work, made unpleasant comments upon it, and Mr. Lees was not always sufficiently wise to conceal his annoyance. I shall therefore use the records so far as they suit my purpose, and when old records are called new ones, I shall not hesitate to say so.

The Editor and Recorder was Dr. Frederic Arnold Lees, who, during the publication of the Reports, resided for some time in Kidderminster, and to whom we are indebted for some new records from that part of the county.

The Club issued the following publications :—

First Quinquennial Volume.

Report for 1873.—E. Newman, London, 1874.
,, 1874.—E. Newman, London, 1875.
,, 1875.—T. P. Newman, London, 1876.
,, 1876.—T. P. Newman, London, 1877.
,, 1877.—West, Newman, and Co., London, 1878.
With summary of new County Records.

Second Quinquennial Volume.

Report for 1878.—West, Newman, and Co., London, 1879.
,, 1879.—James Collins and Co., Manchester, 1880.
,, 1880.—James Collins and Co., Manchester, 1882.
,, 1881 and 1882.—James Collins and Co., Manchester, 1883.

Third Quinquennial Volume.

Report for 1883.—James Collins and Co., Manchester, 1884.
,, 1884, 1885, and 1886.—James Collins and Co., Manchester, 1887.

I propose to examine these volumes before proceeding to other sources of information.

Report for 1873 :—

Sinapis monensis, *Huds.* This plant was discovered by John Fraser, Esq., of Wolverhampton, on Sutton Common, near Kidderminster, about a mile from the town, on the Stourport Road. I have specimens from this locality, gathered by the late Rev. J. H. Thompson, labelled Sinapis Cheiranthus, Koch. My own specimens, gathered in 1874 and 1876, are labelled Brassica Cheiranthus, Vill., and bear a marked resemblance to that species gathered at St. Ouen's, Jersey. Sutton Common was ploughed up some time after the date last mentioned, and has been subsequently built upon.

* **Anthriscus vulgaris**, *L.* Roadside bank close to town of Stourbridge on south side, Worcestershire ; on new red sandstone.

This is not a new record. It was noted by Mr. Edwin Lees, "Botany of Malvern Hills," 1st edition, 1843, p. 20 ; 2nd edition, 1852, p. 42 ; "Botany of Worcester," Tab., p. 14. In all the districts. I have a specimen from Bewdley, gathered on the 3rd June, 1857 !

Report for 1874 :—

‡* **Stellaria glauca,** *With.* Bushy marshy place, near Kinver Edge, Stourbridge, Worcestershire, F. A. Lees. S. glauca is very rare in Worcester, but Kinver is in the county of Stafford.

* **Rosa mollissima,** *Willd.* Worcester, F. A. Lees. This may be an addition to the list in Top. Bot. But it was certainly published by Edwin Lees in "Loudon's Magazine of Nat. Hist.," Vol. III., 1830, p. 160. See "Mid. Nat.," Vol. X., p. 284. Also by Rev. Dr. Booker, Dudley Castle Hill, 1825. See "Mid. Nat.," Vol. XI., p. 61.

(To be continued.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION. September 6th. Mr. J. F. Goode (President) in the chair. Mr. J. C. Stackhouse exhibited some specimens of rocks and minerals from the Upper Engadine. Mr. R. W. Chase exhibited a fine series of sponges still attached to the rocks on which they grew. The specimens came from the Mediterranean and some from the West Indies. Mr. W. B. Grove exhibited *Polyporus picipes* from Middleton, a fungus new to this district. Also *Erysiphe montagnei*, growing on the burdock, from the same locality. He also exhibited a specimen in flower of *Desfontanea spinosa*, kindly sent by Rev. Bulkeley-Owen, a shrub which attracted much attention during the recent excursion to Ellesmere of the Midland Union of Natural History Societies. Mr. T. V. Hodgson gave a brief account of the excursion to Middleton, and exhibited *Polyphemus pediculus* from the pool at the Hall, and *Sceuodesmus acutus* from the neighbouring canal. Mr. S. P. Bolton exhibited *Cristatella mucedo, Æcistes crystallinus*, and other rotifers obtained on the same excursion. Mr. Pumphrey briefly described Kingsbury and Middleton Halls. Mr. C. J. Watson exhibited photographs of the Forth Bridge.—BIOLOGICAL SECTION, September 13th. Mr. R. W. Chase in the chair. Mr. T. V. Hodgson exhibited, on behalf of Mr. C. Pumphrey, two fungi from the Cotswolds, *Polyporus sulphureus* and *Agaricus squarrosus.* Mr. S. P. Bolton exhibited, under the microscope, a rare rotifer from Alvechurch. *Lacinularia socialis.* Mr. R. W. Chase exhibited two rose buds of abnormal growth, in which two sets of sepals and petals had formed one above the other.—GEOLOGICAL SECTION. September 20th. Mr. Goode in the chair. Mr. Grove exhibited on behalf of Mr. F. J. Cullis, of Tuffley, Gloucester, the gigantic puff ball, *Lycoperdon Bovista*, 25in. in circumference. This specimen, which was still in fine condition for eating, though it had been gathered in Gloucestershire four days before, and sent by Mr. Cullis through the parcels post, was afterwards served at supper (sliced and fried a delicate brown colour) to ten members of the society and their friends, by whom it was much enjoyed. Mr. Grove exhibited *Lycoperdon pusillum* from Cleobury Mortimer. Mr. Edmonds exhibited a piece of gypsum, found in Kyrwick's Lane, Sparkbrook, in a layer of clay 40yds. below surface. Mr. T. V. Hodgson gave a report of an excursion to Olton Reservoir, and exhibited specimens of Entomostraca, &c., taken during the excursion. Mr. W. P. Marshall exhibited and described a diagram showing relative size, &c., of Jupiter and its newly discovered Satellite.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—August 22nd. Mr. H. Hawkes exhibited a series of skeleton leaves, and gave a few directions for obtaining them; also specimens of *Coleosporum euphrasiæ* and *Mimulus luteus*, from Dolgelly; Mr. S. White, a collection of plants from Wyre Forest, including *Stellaria aquatica, Scutellaria minor*, and *Triglochin palustre*; Mr. J. W. Neville, slides of small plants mounted by a method recently described in the "Microscopical Journal." Mr. W. J. Parker then read a paper on "Insect Instinct." The writer referred to the different theories respecting instinct, and held that it was the result of observation, experience, and invention. Some instances of reflex actions, the result of stimuli, were given. Singular instances of instinct were enumerated, such as the special tasks of insects living in communities, the deposition of eggs by the gad-fly on such parts of a horse as can be reached by the tongue; the egg-boat of gnat; the cuckoo-flies, who labour for a progeny they never see; the difference in the cocoons of insects that remain in them for a few days from those that occupy them until the following year; the ingenuity of the larvæ of the ant-lion in constructing a pit for the capture of its prey. The writer concluded by expressing the opinion that insects were endowed with some power of thinking, and to this was attributable the intelligence so many of them showed.—August 29th. Mr. J. Moore showed a series of photomicrographs of parts of insects; Mr. J. Madison, land shells from the Kenilworth district; Mr. G. H. Corbett, amethystine quartz, from Cornwall; Mr. S. White, plants from Sutton Park, including *Silene gallica (anglica), Melilotus officinalis*, and *M. alba*; Mr. W. J. Parker, a rotifer, *Mastigocerca carinata*.—September 5th. Mr. J. W. Neville exhibited a series of objects illustrating the life history of the hawthorn saw-fly, *Trichiosoma lucorum*; Mr. J. Moore, photographs of animal parasites, &c.; Mr. J. Madison, an unnamed variety of *Paludina vivipara*; Mr. J. Collins, a collection of plants from Cheltenham, including specimens of blue pimpernel, *Anagallis cœrulea*; bee orchis, *Ophrys apifera*; and *Orchis pyramidalis*. Mr. H. Hawkes, snake's-head coralline, *Anguinaria spatulata*.—September 12th. Mr. J. Moore showed specimens of *Colias edusa*, from Sutton Park; Mr. J. Collins, a collection of butterflies from the Severn valley, including specimens of *Argynnis adippe*; Mr. J. Madison, deformed specimens of *Limnæa stagnalis*. Under the microscope, Mr. J. W. Neville, palates of *Zonites alliarius* and *Z. draparnaldi*; Mr. Mulliss, cuticle of oat straw.

BIRMINGHAM ENTOMOLOGICAL SOCIETY. — September 12th. Mr. G. H. Kenrick (Vice-President) in the chair. The following were exhibited:—By Mr. Neville Chamberlain, a box of Lepidoptera, which he had recently collected in Inverness-shire. By Mr. P. W. Abbott, a long series of *Colias Edusa* from Freshwater, Isle of Wight, including half a dozen of the variety Helice, and one specimen intermediate in colour between the var. and type. By Mr. W. Harrison, five local specimens of *C. Edusa*, captured in Trench Woods; also larvæ of *Sphinx ligustri* from the same place. By Mr. R. C. Bradley, *Zygæna trifolii* var. *confluens*, and one specimen of *Emmelesia tæniata*, both from Barmouth. By Mr. G. H. Kenrick, *Plusia bractæa* from Scotland, and *Euperia fulvago* from Cannock Chase and Sherwood Forest. Mr. Colbran J. Wainwright read a paper entitled "Isolation as a Factor in the Evolution of Species," in which he pointed out the great total effect, direct and indirect, which isolation had in assisting divergence of species, and endeavoured to prove that, contrary to the opinion expressed by Mr. A. R. Wallace, it had a very decided though small *direct* effect in causing divergence, an effect sufficient to produce species, though probably no differences of generic importance.

ON THE BIRDS OF THE LAKE DISTRICT ABOUT ELLESMERE AND THE HILL DISTRICT ABOUT LLANSILIN.*

AN ADDRESS DELIVERED AT OSWESTRY

BY ARTHUR T. JEBB, ESQ.,

THE PRESIDENT OF THE MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

My address must necessarily be dry and disjointed; dry because I am neither a ready speaker nor particularly learned about birds, and disjointed because even if I had the tongue of an angel, together with the knowledge of a Yarrell or a Montagu, it would be impossible for me to deal naturally, lucidly, and succinctly with so wide a subject in so short a time. In order to make my discourse less disjointed I will refer, for the most part, to the birds of the lake district about Ellesmere, and to the birds of the hill district about Llansilin; and in order to make my discourse less dry I will introduce a philological element, explaining sometimes the meaning of birds' names, for such information is seldom to be obtained either from bird books or dictionaries.

So far as I can judge, the number of species of birds in our district may be roughly put down at 200; of these 65 are residents, 35 emigrants, and 100 occasional visitors. Some years ago a writer in one of the magazines, while treating of the Shropshire meres, spoke of the osprey as wheeling about over Blakemere until it was brought down by the keeper's gun. That was an imaginative touch. The mere was too near the canal and the high road for an osprey to have anything to say to it. The only osprey I have ever heard of in this part of the world is a fine specimen caught in a trap at Petton in 1858. The word osprey is a corruption of ossifrage (Latin, *ossifraga*), the bone-breaker. Time was when the osprey, or it may have been the white-tailed eagle, was a permanent resident in this neighbourhood, but it was a very long time ago—perhaps as long ago as the days of King Edward the Confessor. High above Whitemere is an elevated point of land crowned by a wood. This place is still called Yarness; that is to say, earn-næs, pure Anglo-Saxon for the eagle's ness, sharp bluff, or headland. Having started with the falcon family, I will push on with the hawks. At Pistyll

* We regret that we cannot give a more complete report of Mr. Jebb's interesting presidential address. For what is here given we are indebted to the *Oswestry Advertiser*.—[EDS. "MID. NAT."]

Rhaiadr, not a great way from Oswestry, the peregrine falcon has sometimes a nest, and would have a nest there often, if it only had peace. But unfortunately the man who kills the poor falcon, supposing he has done something meritorious, if not positively heroic, holds his head higher for a twelvemonth at least. I consider the hobby a rarer bird than the falcon, and I believe I have never seen it alive. Although the kite is a rare bird, solely in consequence of the war of extermination waged against it, I see it from time to time—a year ago I saw it close to my own house. It was a winter's day, with some snow on the ground. Beneath an old hawthorn tree there was no snow. There were a number of redwings feeding on the hips and haws lying on the bare patch under the tree. I was debating in my own mind, while in a sort of ambush not far off, whether I should shoot some of these redwings, for they are good eating. But there was a keener eye upon the birds than mine—an eye far up in the zenith. Suddenly I was aware of a great bird swooping down—a bolt out of the blue. Then off went this huge bird with one of the redwings, whilst others of them were so frightened that they flew about my head and almost between my legs in their fear. There could be no mistake about the kite—his forked tail betrayed him. More than this, the kite is the only hawk that is wont to take his prey on the ground. Associated in my mind with the kite, although a very different bird—a bird of a slow flight and a cowardly disposition—is the buzzard. Of late years at Rhiwlas, near Llansilin, two buzzards have been caught in traps. One of these is now in Ellesmere Museum. I have seen the hen harrier both in Ellesmere and the Llansilin district, but only once in each place. The marsh harrier I have seen several times, but only near Llansilin. The merlin is also a rare hawk, and I have never found its nest. I see the sparrow hawk oftener in winter than in summer, and the kestrel oftener in summer than in winter.

Passing to the names of these birds, the falcon is the hawk with the crooked talons, or. perhaps more probably, with the curved wings. In Latin falx is a sickle, a curved instrument. Hawk, earlier hauek, represents havek or havoc, from the base hab (whence our "have"), to hold or seize. The common phrase "hob nob" comes from *hab* and *nab*, derived respectively from Anglo-Saxon *habban*, to have, and *nabban*, not to have. It means "take it or leave it," *i.e.*, come and talk with me, you may drink or not as you please. This base *hab* is also that from which hobby comes, the letter "y" being an excrescence. So hobby hawk is a tautological expression, signifying the grasping bird that seizes on its prey. Locally, both the kite and the buzzard have the name of the puttock. Shakespeare uses the word. It is a corruption of poot-hawk. A pout or poot stands for a pullet, which is the young of any bird, not merely of a hen. Jamieson, in his Scottish Dictionary, gives a quotation which attributes the "scarstie" of partridges and moor-fowls to the slaughter of their *pouts* and young ones. What hens are to harriers, what sparrows are to sparrow-hawks, pouts or poots are to puttocks. Merlin comes to us through Norman-French from the Latin merula, the name of a bird. Kestrel similarly comes to us from the Latin through Norman-French, but the Latin word is a Latinisation of a Greek word with a diminutive termination. The Greek word, at the bottom of the matter, means a rod or spindle. And the notion, at the bottom of the matter, is vibration.

Leaving the hawk tribe, I will go on to the tribe of ducks. A great northern diver has been obtained at Ellesmere mere, and is now in Lord Hill's collection. There is also a shag there which was got at the same mere. I have a scoter in my collection which was killed at Colemere. For weeks together I have seen a cormorant on Ellesmere mere. I have also seen terns or sea swallows there in the spring. In the winter the commonest ducks about the meres are widgeon, teal, tufted ducks, and pochards. Every now and then a scaup duck appears on the scene. I do not consider this duck to be "very rare," as Mr. Beckwith states.

To turn for a moment to names. The scoter, of course, is the shooter or darter, from the Anglo-Saxon sceotan, the "c" having been softened into "h." From the same root is derived kite, once skite, the initial "s" having been lost. The scyta is the bird that shoots through the air; the scoter is the bird that darts along the water. We speak every day of a skittish horse, and the adjective implies darting about. The older form of widgeon is presumably *wingeon*, from Danish and Swedish *winge*, a wing. The original notion is the bird that flutters its wings and flaps about.

The man who has seen a bittern is a lucky man. When I was quite a boy I saw one myself. Going off very early one morning to fish in Whitemere, I heard a great booming noise in the direction of the water. As I drew near, a brown bird, as big as a heron, got up out of the weeds and flew away. I knew it was a bittern at once, because there was a stuffed bittern in a case at home. The little bittern is not quite so rare as the big bittern; one has been killed at Petton;

another on a moss not far from Colemere. Herons continually frequent the meres. One year there were two nests of these birds at Colemere. There are three heronries still in Shropshire: at Oakley Park, at Attingham, and at Halston, near Oswestry. I am a great admirer of these birds, and I like to think of them frequenting the same waters, in our part of Shropshire, where once their startled ancestors "spread mighty wings to escape the swift rush of the prior's favourite falcon." Their haunts to-day were their haunts a thousand years ago. In the self-same places "these ancient solitary anglers watch and wait."

Always connected in my mind with the heron are the coot and the water hen :—

> "The coot was swimming in the reedy pond,
> Beside the water hen so soon affrighted;
> And in the weedy moat the heron, fond
> Of solitude, alighted.
>
> The moping heron, motionless and stiff,
> That on a stone, as silently and stilly,
> Stood, an apparent sentinel, as if
> To guard the water-lily."

During severe weather in winter, the water hen, usually so shy, becomes comparatively tame, consorting sometimes with barn-door fowl; the coot, on the other hand, continues to be as wary as ever. With reference to the grebes, the great grebe is more in evidence on our meres than the dabchick, which loves to shun observation. The word grebe is Celtic, crib in Welsh being a comb or crest, and cribell, the diminutive, a cock's comb. When the great-crested grebe is swimming along, its neck looks like an upright stick. When it dives it uses only its feet. When on land it cannot walk but shoves its body along, rubbing the breast against the ground, after the fashion of a seal.

Passing to a different class of birds, I would first notice the sedge warbler and the reed warbler. The likeness in their colour, size, and habits is so great that they have often been confounded. Yet there are differences between them which cannot be passed over. In the reed warbler the base of the bill is broader; it has no light stroke over the eye, which in the other is well-defined and conspicuous. Then, again, its song is not so varied as that of the sedge warbler. This latter bird has been called the English mocking bird, for it reproduces in fragments the songs of many species. At one time we may hear it parodying the loud, clear whistle of the blackbird; at another the wholly differing soft, sweet tones of the willow wren. The nest and eggs are also different. While the sedge bird generally places its nest on a tuft of rushes on the ground, or in a bush, very near it, the reed warbler builds among the reeds. The nest is so deep as to conceal the bird when sitting. Although slight in texture, it is firmly interwoven between several reeds drawn together; and thus, suspended like a cradle, waves over the water. If it were not so deep as it is, the eggs would roll out in a wind. The reed warbler keeps always to the water side; sometimes the sedge warbler is to be found away from it. Whenever a nightingale is said to have been heard in Shropshire, I have little doubt it was really the sedge warbler.

Amongst the birds of the water-side we in this country may include the starlings during the closing months of the year, for these birds roost at that time in vast numbers in the reeds at Colemere. I have often gone to Colemere with my children for the purpose of seeing the starlings go to bed. Here they may be seen gradually assembling in their thousands late on some November afternoon, executing their autumn manœuvres in the heavens, "twisting and turning, and wheeling and whirling, with a marvellous combination of suddenness and accuracy," and at last "dropping like stones upon the reeds, on which they cluster as close as they can crowd."

I have omitted to mention the kingfisher. It is not uncommon about Ellesmere, often building, in the spring, near my own house. It is a bird which most affects stagnant pools, while the water-ousel loves best clear mountain streams. There is no greater favourite of mine than the water-ousel or dipper. The plumage of the bird is in perfect keeping with its haunts—dark, with a pure white breast, exactly resembling one of the little balls of foam which loiter among the stones in swift streams. Its song, moreover, seems to be set to the music of rapid waters; and it constantly sings in middle winter, when the stone on which it is sitting is rimmed with ice. The nest of the dipper is very large, formed of moss and water plants, and lined with dry oak leaves. In shape it is like that of a wren. It is usually placed against the bank of a stream, but I have sometimes found it under a bridge, or even at the back of a waterfall, where the water in falling only just cleared the nest as it fell. Two other beautiful birds, building their nests on the banks of Welsh streams, are the delicate sandpiper and the graceful grey wagtail.

If we go up the hills there are red grouse for us in abundance. In some places, as for example a few miles from here (The Quinta) there are a few black grouse. The ring ousels or mountain blackbirds, are only with us during the spring and summer. Curlews, lapwings, and snipe all make their nests on the Llansilin hills; all lay four eggs, and these eggs always have their pointed ends turned inwards, in order, I suppose, to economise space.

To turn to names, curlew is imitative of the cry of the bird like pee-wit. Once, no doubt, it was ke-or-lu, or something of the sort, and when the word was shortened it became less expressive of the whistle. The derivation of lapwing is not so obvious as might be supposed. It has nothing to do with flapwing. In Wycliffe's Bible (Lev. xi. 19) it is spelt leepwynke. In Anglo-Saxon hleápan is to run nimbly rather than to leap or jump; hence hleápere is a messenger. Our verb to "wink" is to move the eye obliquely. So lapwing means the bird which runs sideways. Shakespeare, whose observation nothing escapes, says, "See where Beatrice, like a lapwing, runs." The sidling run of a woman is well known. The derivations of birds' names are often deceptive. Take redstart, for example. A good ornithologist once told me that the name was most expressive, the bird being apt to start aside and show the red of its tail. Start, however, in redstart means tail, Anglo-Saxon *steort*, sometimes a tail of land or promontory, as in Start Point in Devonshire. Redstart, *i.e.*, red-tail, may be compared with red-pole, *i.e.*, red-head. Take coletit for another example. This is not the tit as black as a coal, but the tit with the helmet, *col* in Anglo-Saxon, referring to the black head, divided on the hind part with a white spot. Tit itself may need explanation. In old English "to titter" did not mean to giggle, but to prattle or chatter. We still speak of tittle-tattle. If a human being, a tit is a chatterer or tale-bearer;

> "Tell-tale tit,
> Thy tongue shall be slit,
> And every little dog shall have a little bit;"

if a bird it is a twitterer. The snipe is the bird with the beak or neb, anciently sneb, whence snap and snip, to catch hold of anything with the beak. In old English, neb sometimes stood for the human nose. Speaking of a proud woman, an old writer observed, "How high she holds her neb in air." A snipe was also called a snite in some places; in other words, the bird with the snout.

Just a few words more. Some correspondents of the *Oswestry Advertiser* regard the nut-hatch as rare. This is not my view. While feeding birds with bread in my verandah during the snow last winter, nuthatches kept coming and going so frequently as to convince me that there were many of them. The nuthatch is the only climbing bird that climbs down a tree. Creepers and wood-peckers always begin at the bottom and climb up. From personal observation this spring I have learnt that the female creeper is never fed by the male, at the time of sitting, when on the nest, but at a little distance from the nest. Another bird, supposed to be rarer than it is in this district, is the fern owl or nightjar. It visits the little mosses about Ellesmere every spring for breeding purposes. One such moss lies just below my terrace walk. If anyone were on that walk late in the evening in summer he might perhaps hear on a sudden a strange jarring or churring sound from the upper branches of a spruce fir. If he looked up he would catch a glimpse of a large bird, sitting, not across a branch like other birds, but lengthwise along it; and he would wake up to the fact that from this bird proceeded the singular noise, not unlike the sound of a hay-cutting machine, to which he was listening. The nightjar makes no nest, but lays two beautiful eggs on the ground amidst the fern. Perhaps the rarest bird I have ever met with is the snow bunting. I have seen snow buntings twice on a high hill near Llansilin, once when alone, and once when I was with a keeper, who told me he had seen the birds before, on the Berwyn. These birds never desert the snow. They may indeed be not so rare as is thought; the rare thing is for men who really care for birds, or know anything about them, to be out on Welsh hill tops when covered with snow.

ON HIGH LEVEL GLACIAL GRAVELS OF THE GLOPPA, NEAR OSWESTRY.*

BY A. C. NICHOLSON, F.G.S.

The Gloppa deposit consists largely of sand, gravel, and beds of loam, with numerous boulders of various sizes, some of two or three cwts. in weight. The gravels show the usual eroded surface, and also an abruptly truncated face to the north and north-east, that is, facing the low country, and which face also is the steepest slope. This truncation may be due to subterranean erosion of the neighbouring ground by water, thereby causing slips. The first feature that strikes one in examining this deposit is its total dissimilarity to the drift to the westward and southward, and also to some extent to the easterly drift, both as regards the recent molluscan fauna

* Read at the conversazione of the Midland Union of Natural History Societies, held at The Quinta, near Oswestry, August 23rd, 1892.

which is to be obtained there, and also in respect to the lithological facies of the gravels. The deposit is distinctly glacial, there being numerous striated stones, though the bulk of the stones are waterworn and rounded. We further find here abundantly northern erratics from the granites of Eskdale and Galloway, and probably from other sources, as I have specimens of granites not yet identified which are quite distinct from that of the sources mentioned ;* chalk flints, probably from Antrim ; numerous igneous rocks from the Lake and other districts ; together with stones equivalent to the beds exposed in some of the upper valleys on the easterly side of the Berwyns, but comparatively few local stones, or stones that are near home, except a few representatives of the Bala ash beds, but none of the Bala "greenstone" or diorite beds. This greenstone you will have an opportunity of examining to-morrow. The molluscan fauna is extensive, and comprises almost all the shells characteristic of the glacial gravels. I have collected here—ten species of Arctic and Scandinavian species not now living in British waters ; nine species of Northern type which inhabit Arctic and Scandinavian seas in common with our own ; two species of southern type of British shells, *i.e.*, those which inhabit more southerly waters as well as our own ; forty-four species of general British species ; total, sixty-five species mollusca ; also Balani, two or three species. For the full list see "Quarterly Journal of the Geological Society," February, 1892 (Vol. 48), to which list must be added *Pleurotoma costata*, a shell which I have only found recorded in drift deposits from Selsea, and now "*Tectura virginea*"—found on the occasion of our visit 24th August. An interesting find was that of *Fusus antiquus monstr. contrarium*, which seems to be a rather rare shell, except from deposits near Preston and Wexford. No extinct species—but from similar deposits in the Isle of Man several extinct species—have been found. A fragment of Elephas, probably *primigenius*, was also discovered ; no doubt it was transported there along with the travelled stones, &c. Great interest attaches to the occurrence, *inter alia*, of Lias fossils, in respect to which there has been some controversy, and probably will yet be, as, if these fossils are genuine, which I have not the slightest reason whatever to doubt, and, if they have come from the south-east, they are an important factor in the problem as to whether this deposit owes its origin to having been deposited during the era of the "great submergence," or whether it is

*I have recently found a pebble of the Riebeckite rock, which is most probably derived from Ailsa.

part of the great Anglo-Welsh moraine of the ice-sheet. I will not here express any opinion on the point, save to say that I have not yet been convinced that the facts can all be explained by the morainic and ice-sheet theory. Mr. T. M. Reade, in the "Geological Magazine" for July, 1892, points out this fact, and says: "Nor must we lose sight of the fact that near Macclesfield, and at the Three Rock Pit, near Dublin, shelly sand and gravels have been found at the level of about 1,200ft. above the sea. These places are on the same parallel of latitude, about 190 miles apart. If the transport was by land ice, the ice sheet filling the Irish Sea must have had here a front of not less extension than 200 miles, and a minimum depth of say 2,000ft.; but on this head we have very little to go by. We may very well ask how a snow-field in Scotland, of a less width than the distance between these two places, even assisted by the bordering fields of England and Scotland, should have generated a glacier which not only displaced the water of the Irish Sea, but after spreading out 190 miles still maintained such an enormous depth as to be capable of forcing up sea bottom laterally on either side to the height of 1,200ft., and in the case of the Three Rock Mountain against the contributory glaciers of the Irish Sea. I understand that a reply to Mr. Reade's paper is in contemplation, and we shall await its perusal with interest. These high level glacial gravels are in evidence at various points along the carboniferous ridge to the West of Shropshire and Cheshire, notably at Vrondeg (south of Minera), on the Halkyn Mountain, &c. These have been described by the late Mr. D. Mackintosh, F.G.S., in various papers. The fauna presents a close resemblance to that of the Moel Tryfaen deposit. By the courtesy of Professor Judd, I have examined the shells from there, which are at the Royal College of Science, South Kensington, and the general resemblance in condition and type is very marked, more so than to the Macclesfield shells. The fauna and the included stones correspond closely with those of the Cheshire Lower Boulder Clay. See D. Mackintosh's paper on the coast cliffs of the east side of the Dee estuary. The occurrence of these high level gravels at such distant points as Moeltryfaen, 1,360ft., 45 miles from the mouth of the Dee; Macclesfield, 1,150ft., 50 miles from Dee mouth, 55 from Gloppa; Gloppa, 1,130ft., 40 miles from Dee mouth; and Wicklow, 1,200ft., 100 miles from Tryfaen, and 190 from Macclesfield, adds much interest to the study of these deposits, and whatever explanation is adduced for their formation must account for their deposition at all these different places, as it is evident that they all owe their origin to one and the same cause, and a striking feature is their occurrence at similar heights. It should be pointed out that there is evidence in Shropshire of a south easterly drift, viz., the occurrence of Oolitic fossils at Wellington, Salop, Chalk and Liassic and Oolitic fossils near Wolverhampton and Shifnal. (Vide T. M. Reade's paper on Glacial Geology, "Geological Magazine," July, 1892.) I have on view here six mounted photographs of the Gloppa, three of the sand-pit when in work, the one of which shows the current bedding of the deposit; and the other three are interesting as showing the contour of the esker ridge and mounds.* I have also put together specimens of a few of the more generally characteristic shells (31 species) which may be of interest. The stones of the Gorsedd circle of Wrexham Eisteddfod, 1889, came from Gloppa. Time will not permit of further remarks; however I trust I may have been able to make clear some of the leading features of this deposit.

NOTES ON PLANTS OF RARE OCCURRENCE IN THE SEVERN VALLEY.†

BY CARLETON REA, M.A., B.C.L.

To those members who perchance have not had the opportunity of closely observing the plants growing in the Severn Valley, I venture to offer these few notes concerning the plants of rarer occurrence therein. Commencing at the Mythe Hill near Tewkesbury I found on my last visit with the club the Dyer's Woad (*Isatis tinctoria*); it was growing on the face of the precipitous marl bank that adjoins the Severn. This is, so far as I am aware, the only British station for this plant, though when the aborigines dyed their bodies with its juice it must have been of frequent occurrence, and in later times it was cultivated for its valuable dye, now superseded by indigo. At the coppice near the Mythe Hill Alexanders (*Smyrnium olusatrum*) still flourishes. In the brickfields at Diglis the fine-leaved Water Dropwort (*Œnanthe Phellandrium*) still flourishes, and is rarely met with elsewhere throughout the county. At Kepax Ferry the Meadow Rue (*Thalictrum flavum*) is found, together with its accompanying cluster-cup, the æcidiosporous condition of *Puccinia persistens*,

* The reader is referred to the "Quarterly Journal of the Geological Society," Feb., 1892 (Vol. 48) for the sections and one of these photographs.

† Read before the Worcestershire Naturalists' Field Club, July 12th, 1892.

Plow. The Meadow Rue I have noticed also on the left bank opposite the Northwick brickfield, and in the Grimley brickfield to-day, whilst in the former brickfield itself, the not common Flowering Rush (*Butomus umbellatus*). On Bevere Island I found last year Dame's Violet (*Hesperis matronalis*), and though doubtless an escape, it is still worthy of record. At the headland opposite the outfall of the Droitwich Canal, the Soap-wort (*Saponaria officinalis*) grows abundantly, and, I have traced this flower growing on either bank from Shrewsbury downwards. The Droitwich Canal is itself chiefly noticeable for the profusion of Wild Celery (*Apium graveolens*) occurring on its banks, a remnant of the old marine vegetation of the Malvern Straits. In the Grimley brickfield to-day I noticed the Frog-bit (*Hydrocharis Morsus-ranæ*) growing in great profusion. Below Holt Lock, a few years ago, I gathered the Great Yellow Loosestrife (*Lysimachia vulgaris*), but its specific name belies its occurrence in this county. On Holt Bank I have found the Evening Primrose (*Œnothera biennis*) growing apparently wild, as also at two other stations on the Severn. In Shrawley Wood the Giant Bell Flower (*Campanula latifolia*) and the Spreading Bell Flower (*Campanula patula*) flourish in great luxuriance, and the leaves of the Lily of the Valley (*Convallaria majalis*) are to be met with, but the flowers of the same are very scarce, and most botanists bear witness to the fact of its shyness in flowering when in a wild condition. I have myself searched a good half acre of these plants in Monk's Wood, and found not a single bud. *Campanula patula* has a restricted range of distribution, and is principally confined to the counties of Worcester, Stafford, Gloucester, Norfolk, Surrey, and Kent. The Highland Cudweed (*Gnaphalium sylvaticum*) grows in dense tufts in the wood. The Lesser Teasel (*Dipsacus pilosus*) is a striking object on the banks of Dick Brook. I may mention incidentally that in August two years ago I saw a fine Otter (*Lutra vulgaris*) playing in the Severn just below Shrawley Wood. At Redstone Hermitage I have gathered Livelong (*Sedum Telephium*), no doubt a remnant of the old hermits' garden. At Blackstone the Maiden Pink (*Dianthus deltoides*) is recorded as growing, but I have not been so fortunate as to find it in recent years. Lastly, I would mention the occurrence of *Coronilla varia* growing on the right bank of the Severn in great profusion in a patch a little below Dowles Church. This plant, though not admitted to the English Flora by Hooker, seems to me hard to account for here as an escape, as I am informed that it is not cultivated in the gardens of the neighbourhood, or at Arley, in the adjoining county. I have found it now for the last five years, at least, well established; and whether its introduction is due to the consumption of oil and linseed cakes or other foreign feeding foods, I am not in a position to offer an opinion; but that it is due to admixture with seeds I think improbable, seeing that the field itself is a meadow. I believe this plant was erroneously referred by John E. Nowers in the March number of this year's "Science Gossip" to *Ornithopus roseus*, but I have since written to correct that statement.

CELLS AND HERMITAGES IN WORCESTERSHIRE.*

BY JOHN NOAKE, AUTHOR OF "THE RAMBLER," ETC.

There were in the Middle Ages two classes of religious ascetics, namely, hermits and anchorets. The hermits were wanderers, who took up their abode in caves and rocks in the banks of rivers and the vicinity of running streams, and generally maintained their liberty and freedom, except from the dominance of the bishop of the diocese. Anchorets were recluses, who lived immured—that is, walled up or locked in for life in a peculiar chamber in or near a church or cathedral, or sometimes in a separate dwelling with an oratory attached to it. Even women who had renounced the world, but who wished for seclusion more rigid than that of the nunnery, were permitted to have a chamber within the walls of a church, having only a grated aperture opening into the building, through which their food was passed and the Holy Sacrament administered. Occasionally the recluse was a criminal, who accepted of a cell as a commutation for death, or the punishment due to his offence. When sufficient materials are collected for an account of these two classes of ascetics a long and most interesting chapter will be gained for the history of Worcestershire—a county which contains, not only numerous hermitages, but also remains or traces of cells, or apartments attached to churches for the use of the *inclusi*.

As early as the Saxon days we read of one Wolsius, a recluse of great reputation, who for forty years had led a solitary life (probably in or near to our cathedral), and who, by sharply reprehending that great and good man, Wulstan, for his obstinacy and disobedience in refusing the general call to accept the office of bishop over the Worcester flock, at length induced him to obey the

* Read before the Worcestershire Naturalists' Field Club, July 12th, 1892.

unanimous wish. By the thirteenth century these recluses had become numerous in Worcestershire, and William de Beauchamp, in 1298, left the sum of 4s. "to every anchoret in Worcester and the parts adjacent." Traces of them are found in wills, where various sums are bequeathed to them, until nearly the time of the Reformation, and a memorandum occurs in a book of one of the Priors of Worcester, "for brycks, lyme, and sonde, to ye repa'con of ye anckras howse (reparation of the anchoret's house) by ye charnel house *ex devocione*, xs." This cell near the charnel house may have been either attached to that house or an enclosure over the north porch of the cathedral, where for many centuries apartments were evidently occupied either in this way or by some officers belonging to that edifice, as in the present day. At the church of Stoke Prior and many other churches in this diocese there was an apartment, generally over the porch, which is supposed to have been a *domus inclusorum*, but these cells must not be confounded with the chambers of priests, sacristans, or persons appointed to watch over chapels and costly shrines. Sometimes the chambers were so constructed as to allow the recluses to see the altar of the church to which they belonged, as well as to hear its services; and not unfrequently they were like tombs, from their purposely contracted dimensions—that in which St. Dunstan immured himself having been only 5ft. long, $2\frac{1}{2}$ft. wide, and not high enough to stand upright in. I must, however, not detain you on this branch of the subject, which might be indefinitely extended, and so let us pass on to consider the hermitages.

> "Aged the sires who dwelled such caves within—
>   Head-shaking sages prone to moralize,
> And him disciple who made there his inn.
>   Their cheeks were hollow, slender was their size,
> And ever on the ground they bent their eyes.
>   One book they had—the book of holy lore,
>   Against the wall the cross stood leaning-wise,
> A table small a skull and cross-bones bore,
>   And bosky ivy hid the bell above the door."

It seems that hermits were subject to episcopal rule, as in 1431 Thomas Polton, Bishop of Worcester, licensed Richard Spetchley to be a hermit. These licenses were as much a matter of episcopal business as were the presentations to livings. I have a copy of the vow taken by Richard Spetchley, in which he promises to observe perpetual chastity "after the rewle of seynt poule."

Blackstone Rock, on which we now stand, is one of the most interesting relics we have in the county, as associated with hermits, for here is not the simple hole or cell which formed the abode of the early ascetic, but a set of apartments showing a somewhat advanced type of hermitage. It is cut in a solid rock, to which entrance is gained by a low doorway into what was probably the kitchen, which has for a chimney a circular hole cut perpendicularly through the rock; another apartment was evidently used as a chapel, and there are likewise a pantry, with a chamber over, an inner room, closets with a loft over, a study with shelves cut for books, and another opening in the rock, either for a belfry or chimney. Small and rudely cut openings in the rock served for windows. In front of the cell is a seat cut in the rock, from whence the hermit looked down on the Severn (which then ran closer to the rock than it does now), and invoked a blessing on the traffickers up and down, and in return received the coppers of the boatmen. There is a tradition that in more modern times this cave was used by smugglers, and still later as a cider-making house.

Southstone Rock, near Stanford, was another retreat of this kind, having cells hewn in the stone, with steps once leading to a chapel on the summit, dedicated to St. John the Baptist, at the festival of whose nativity there was a general offering from devout persons, who ascended the stairs to deposit in the chapel their gifts in a brazen dish kept for the purpose. This dish (engraved in Nash's "Worcestershire") was preserved at Stanford Court till about the year 1807, when it was supposed to have been stolen during some repairs at the Court. The rock is nearly 200ft. above the Teme, and having become split by the action of the water, the hermits' cells and the chapel have disappeared. A fuller description of this relic, from the pen of the late Sir T. Winnington, will be found in the Worcester Architectural Society's volume for 1863.

At Redstone, in a rock by the Severn, in the parish of Astley, is a still more important specimen of the mediæval hermitage, which was said to be "a place of great resort for devotees of high quality in Papal times," and concerning which Bishop Latimer expressed much apprehension on account of its capacity for concealing large numbers of thieves or traitors. This rock dwelling was afterwards turned into an ale-house, and in the present century a school was kept in a part of the rock! The entrance to the hermitage was through what is called the chapel; and an arched passage with openings at the sides led to the dormitories (afterwards formed into dwellings), and to the right was the refectory. Over the doorway was an opening, reached by some steps from the interior, from which, according to tradition, the monk or hermit would pray for the safety of passengers crossing the ferry.

There are also caves, which may have been hermits' cells, in the parish of Hartlebury; in the Red Cliff, near Suckley; at Drakelow, near Cookley Wood; also in the hamlet of Alfrick, and the parish of Stone; but the brief account I have now given will probably be sufficient for the present occasion. It has been justly said that hermits were not entirely useless to the community, for many of them, being sincere though mistaken Christians, afforded at least examples of self-denial; while, from the results of their studies, they were not unfrequently skilled in useful sciences, such as pharmacy, or in arts formerly little practised with skill, such as fine smith's work and horticulture; and again, as their abodes were usually held sacred even by men of violent and unscrupulous habits, travellers and fugitives often found hospitality and security in the cell of the hermit during disturbed times, or in districts where these could nowhere else be secured.

"My lands I gave to feed the poor
And sacred altars raise;
And here, a lonely anchorite,
I came to end my days.
No more the slave of human pride,
Vain hope and sordid care;
I meekly vow'd to spend my life
In penitence and prayer."

THE FIXATION OF ATMOSPHERIC NITROGEN BY LEGUMINOUS PLANTS.*

BY T. B. BLUNT, M.A.

The following short account of recent investigations on this subject may have some interest:—It is hardly necessary to remind those who are interested either in agriculture or gardening that the continuous cultivation of most crops exhausts the nitrogen naturally present in the soil as a constituent of vegetable and animal residues, and renders necessary the addition of artificial supplies in the form of ammonia salts, nitrates, or dung; but it has long been known that to this general rule the bean-tribe forms a great exception; leguminous plants are not only able to supply themselves with the nitrogen required by their tissues, but they actually enrich the ground for succeeding crops of other kinds. The explanation of this problem has occupied the attention of chemists for upwards of fifty years. At one time it was thought that nitrogen was absorbed and assimilated by the leaves of the plants, but this view was disposed

* Read at the annual meeting of the Caradoc Field Club, September 22nd, 1892.

of by Boussingault and Sir John Lawes many years ago. Warington, one of our greatest authorities on agricultural science, writing in 1886, says:—"The nutrition of leguminous crops is not at present perfectly understood; a good crop of red clover when cut for hay removes a large quantity of nitrogen from the land, but it nevertheless leaves the surface soil actually richer in nitrogen than it was before, from the residue of roots and stubble left in the soil. From whence," he asks, "comes the nitrogen?" and his inference is that leguminous crops possess to some extent a distinct source of nitrogen, which he supposes, however, to be obtained by some process peculiar to themselves from the soil or subsoil. I have here a figure showing the different effect of want of nitrogen in the soil upon the leguminosæ and other orders. It is taken, I believe, from a photograph, and shows a pot culture of hemp and clover; in the centre pot the absence of nitrogen has dwarfed the hemp plant almost to atrophy, while the clover is even more luxuriant than in the left-hand pot containing a full supply of it. It is only within the last year or two that the true explanation of these remarkable facts has been discovered. On examining the roots of leguminous plants they may be seen to bear small nodular bodies, which are found to contain a very large proportion of nitrogen. It has been shown by two investigators, Hellriegel and Wilfarth, that these are not actually a part of the plant, but contain separate organisms of the kind to which the name microbe has been given; they are, from one point of view, parasites, but from another they are grateful guests, rendering to their hosts an invaluable service; they are, in fact, the real agents by which the plant is rendered independent of the nitrogen of the soil. The following is a brief account of the experiments by which the fact was established:—In 1883 Hellriegel began an investigation, in the course of which he sowed peas in washed sand, mixed with mineral manures only, in which there was no nitrogen. As a rule, the plants produced were limited in their growth by the amount of nitrogen supplied by the seed itself; here and there, however, a plant grew very luxuriantly, and on examination it was found that abundant nodules had formed upon the roots of these well-grown plants, while none were found upon the others. Guided by these results the experimenter, Hellriegel, with his colleague, Dr. Wilfarth, repeated the trials, with the addition to the sand of a small quantity of an extract made by shaking a fertile soil with distilled water, and allowing the greater part to subside. In some instances the extract was added without further treatment; in others it was heated sufficiently to destroy organisms—that is to say, it was sterilised. Where the fresh, untreated extract was used there was, almost always, luxuriant growth and abundant formation of root-nodules, but where the extract had been sterilised, the plants were meagre and ill-grown as before. These experiments were conducted principally with peas, beans, or vetches, but further trials showed that in the case of lupins similar results might be obtained by watering with an appropriate extract derived from soil in which those plants were growing, though the extract which was so successful in the case of peas was without effect in that of the other plants named. A curious point is thus raised as to the existence of varieties or species of microbes appropriate to each plant. Hellriegel and Wilfarth's experiments were repeated later by Gilbert and Lawes, and confirmed in every particular; they also determined the nitrogen actually present in the crops under the different conditions, and found that, without soil extract, and in the absence of nodules, there was no gain of nitrogen, but that with soil extract, and consequent nodule formation, there was many times as much nitrogen in the produce as in the seed sown, and the conclusion drawn was that atmospheric nitrogen must have been fixed by the plant, and that this took place in the course of the development of the organisms within the nodules, the resulting nitrogenous compounds being absorbed and utilized by the host. Within the last year MM. Schloesing, fils, and Emile Laurent have published researches which prove that the power of fixing free nitrogen is not confined to the Leguminosæ, but that some of the "inferior green plants" (mosses and algæ) possess the same property. The commensalism or symbiosis in which the organism of the nodule supplies the host plant with food, in the shape of nitrogenous compounds, throws light upon, and at the same time helps to confirm, the views of Schwendener, and, after him, of De Bary, with regard to the nature of lichens. Indeed, one objection to those views on the part of biologists lay in the fact that no analogous instance could be found in nature. Schwendener teaches that every lichen is a compound organism, consisting of a fungus and an alga, which bear to each other somewhat the same relation as a tree to its leaves; the fungus supplies the nitrogenous matter to the alga, while the alga, by means of its chlorophyll, builds up carbohydrates for the support of the fungus out of the carbonic acid of the atmosphere. We see here a very close and suggestive analogy to the case of a leguminous plant and its nitrogen-fixing nodules.

[Our readers will find much interesting matter for reflection on the subject of this paper in a valuable contribution by Prof. Percy F. Frankland, F.R.S., read before the Royal Institution of Great Britain, printed in "Nature," June 9th, 1892.—Eds. "Mid. Nat."]

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(*Continued from page 239.*)

Report for 1875 :—

* **Vicia gracilis**, *Lois.* On gravelly ground near Worcester, John Fraser, M.D. This is not a new record. It was noted by the late Edwin Lees, at Tibberton and Powick, near Worcester. See "Bot. of Wor.," p. 41; also Tab., p. 9, Severn and Malvern district; see also "Mid. Nat.," Vol. XIV., p. 41 (February, 1891).

* **Myosotis repens.** Worcestershire, F. A. Lees. Not localised. Previously noted by Edwin Lees, "Bot. Wor.," Tab., p. 20. Severn district? Malvern district. Also unlocalised. See also "Mid. Nat.," Vol. XV., p. 20. Gathered by the writer in Wyre Forest, Worcester side, 25th June, 1858, Sp.! Dr. Arnold Lees's locality was probably the same, as I possess from him a specimen from the same locality, 1883, Sp.!

The Report for 1876 contains no new Worcester matter.

Report for 1877 :—

The report for 1877 is said to close the first quinquennial volume.

Anthoxanthum Puelii, *Lec.* and *Lam.* Thompson and Mathews. Hazley. For Hazley read Hagley. A field near the Birches was full of this plant in 1877, Sp.! Probably introduced with clover seed. *First record.* A summary of the new records appears in this number.

Second Quinquennial Volume.

Report for 1878 :—

This contains nothing new from the county of Worcester.

Report for 1879 :—

The same.

Report for 1880 :—

* **Geranium lucidum**, Bagnall. "Possibly introduced," unlocalised. *Not a new record.* Purton, "Midland Flora," 1817. "In the lanes about Wolverley, and on the rocks at Great Malvern." Edwin Lees, "Botany of the Malvern Hills," first edit., 1843, "very plentiful on the rocks." "Botany of Worcester," Tab. 8. In all the districts except Avon.

Report for 1881 and 1882 :—

* **Saxifraga granulata.** Worcestershire, F. A. Lees. "Rather common on sandy and rocky banks by road leading from Greenhill Farm to the Hurcott Paper Mill, near Kidderminster." "Personal authority lacking in Top. Botany." Stokes in Withering, Bevere, 1787; see "Midland Naturalist," Vol. X., p. 150; Lees's "Botany of Malvern," "Botany of Worcester." Tab. 15. In all the districts. Well known in the county for the last fifty years.

* **Orchis incarnata.** F. A. Lees. "Several stations." *Anticipated.*

Polygonatum multiflorum. "Rocky wooded bank at Fenny Rough, Stone," in plenty. *First certain record*, but see Lees's "Bot. Wor.," xxxi., Tab. 23.

* **Potamogeton zosterifolius.** Worcester. Mathews, Lees. "Pools near Churchill." *Anticipated.*

* **Acorus Calamus**, *L.* Worcester, Fraser. Harvington Hall Moat, abundantly. *Not a new record.* Stokes in Withering, 1787. River Avon, near Pershore. Bailard.

* **Agrostis nigra.** Worcester, Bagnall. *Not a new record.* Scott, 1832. See "Mid. Nat.," Vol. XI., p. 41.

Third Quinquennial Volume.

Report for 1883. Published in 1884. New county records:

* **Ranunculus Lenormandi.** W. Mathews. *Not new.* See J. of B., Vol. IX., 1871.

* **Corydalis claviculata.** Melvin. "North Hill, Malvern." *Not new.* See Lees's "Bot. Malvern Hills," p. 34, 1843. Nash, 1881, see "Mid. Nat.," Vol. X., p. 122.

Fumaria confusa. Towndrow. Malvern Link. *First record of segregate?* See J. of B., Vol. XXII., p. 39.

Polygala eu-vulgaris. Railway bank near Kidderminster. F. A. Lees. *First record of segregate?* See J. of B., Vol. XXII., p. 39.

* **Sagina ciliata.** Near Kidderminster. F. A. Lees. *Not new.* Blakedown. Gathered by the writer, 1848, and confirmed by Professor Babington.

* **Melilotus arvensis.** "Frankley," Mathews. *Not new.* See Lees's "Bot. Wor.," p. 12; "Mid. Nat.," Vol. XIV., p. 40.

* **Agrimonia odorata.** Mathews and Towndrow. "Hannington (Hunnington) and Pershore." *Not new.* See with the same localities Lees's "Bot. of Wor.," "Mid. Nat.," Vol. XIV., p. 41.

Cratægus oxyacanthoides. Lees and Thompson. "Lane north of Hartlebury Common." *First record of this variety.*

* **Epilobium obscurum.** Not new. "Bot. Wor.," see "Mid. Nat.," Vol. XIV., p. 111.

* **Hieracium murorum.** Mathews. Fenny Rough, Stone. *Not new.* Gathered by the writer in the place indicated. Also, in the same locality, by W. G. Perry. "Mag. Nat. Hist.," Vol. IV., 1831, p. 450-452. See "Mid. Nat.," Vol. X., p. 258.

* **H. vulgatum.** *Not new.* See previous record.

Barkhausia taraxacifolia. Lees and Thompson. Rail sidings, Wribbenhall. First record.

Scrophularia umbrosa, Dum. (Ehrharti). At Pixham. Mr. R. F. Towndrow. *First certain record.*

Linaria repens. "Clent Hill," Mathews and Oliver. Discovered in this locality by Mr. Amphlett, of Clent. *First certain record.* See, however, "Bot. of Wor.," p. 30; "Mid. Nat.," Vol. XIV., p. 189.

* **L. minor.** F. A. Lees. "By rail track, Bewdley Branch Line, near Stour Viaduct, Kidderminster." *Not a new record.* See Lees's "Bot. Malvern Hills," 1st ed., 1843, p. 31; "Mid. Nat.," Vol. XII., p. 183.

* **Orobanche eu-minor.** On clover, "Wick, Pershore." Mathews (July 19th, 1857!). Not new. See "Bot. Wor.," same loc., p. 49; see "Mid. Nat.," Vol. XIV., p. 235.

* **Myosotis sylvatica.** Mathews. "Frankley; Alvechurch." *Not new.* Ed. Lees's "New Botanists' Guide;" "Mid. Nat.," Vol. XI., p. 279. Not localised. Lees's "Botany Malvern Hills," 1st edit., p. 16; "Mid. Nat.," Vol. XII., p. 184; "Bot. Wor.," see "Mid. Nat.," Vol. XV., p. 20.

* **Glaux maritima.** F. A. Lees. By one of the brine pits at Droitwich, 1883. *Not new.* Buckman, "Ancient Straits of Malvern," 1849. See "Mid. Nat." Vol. XIII., p. 164.

Potamogeton obtusifolius. Thompson, Towndrow. "Pool, Trimpley." "Pond, Malvern Link." *First record.* Queried in "Top. Bot.," Ed. 2. Sp. from both localities! Previous record doubtful.

* **P. eu-natans.** F. A. Lees and Mathews. Pool at Harvington. *Not new.* Edwin Lees in Hastings' "Ill. Nat. Hist. Wor.," 15. See "Mid. Nat.," Vol. XI., p. 206.

* **Juncus obtusiflorus.** F. A. Lees. "Ditch side, marsh, west of Severn, north of Tewkesbury. *Not new.* Edwin Lees, "Bot. Malvern Hills," 2nd ed., 1852. See also "Mid. Nat.," Vol. XIII., p. 187.

* **J. Gerardi.** F. A. Lees. "By brackish canal, Droitwich." *Not new.* "Bot. Wor.," 1867. See "Mid. Nat.," Vol. XV., p. 70.

‡ **J. tenuis.** In Herefordshire, but close to Worcestershire boundary. Discovered by Mr. R. F. Towndrow. *First record.*

* **Eriophorum latifolium.** F. A. Lees. "Bog above Shelfield Coppice, Wyre Forest." *Not new.* Recorded by T. W. Gissing, in "Phytologist," 2nd series, Vol. I., p. 151. Probably also intended by Perry, "Mag. Nat. Hist.," 1831. I have specimens gathered in the forest in 1846, 1847, 1886.—Sps. !

* **Carex axillaris.** Towndrow. "Madresfield," F. A. Lees. "By canal near Kidderminster." *Not new.* "Bot. Wor.," Edwin Lees. "C. axillaris I give on the authority of Mr. Thomas Westcombe, as occurring at Norton, near Kempsey."

(To be continued.)

Reviews.

Catalogue of Canadian Plants. Part VI., Musci., pp. v., 295. By John Macoun, M.A., F.L.S., F.R.S.C. Montreal: 1892. 25 cents.

The preceding parts of this very valuable work, which give a full account of the Flowering Plants, Ferns, Fern Allies, and Hepaticæ, have, as they appeared from time to time, been noticed in former numbers of the "Midland Naturalist." The present part is devoted to the Musci or true mosses, and is a very full and comprehensive account of the various species and varieties that have been found by Professor Macoun in the Dominion of Canada during the thirty-one years he has devoted to the study of these plants, together with the work of his coadjutors, and the records to be found in herbaria, proceedings of societies, and other sources. The commencement of this investigation must have been surrounded with difficulties that can scarcely be realised by British naturalists, and must have required great courage and determination; but he has persevered, and now, after thirty-one years of unremitting labour, is able to present to the botanical world a work remarkable for its thoroughness, and one of which he and his fellow countrymen have a right to feel proud.

To go into the minuter details of so voluminous a work would require more space than can be allowed. But I may, in a few words, give some slight idea of what has been done. In the present part, Professor Macoun records 1,070 species and varieties as the total moss flora of Canada ; thus he gives a much larger record, for the Dominion alone, than is given by Lesquereux and James in their "Manual of the Mosses of North America," published in 1884. This volume included not only the United States but also Canada, their record being 1,020 species and varieties. But this comparison does not in any way represent the real value of Professor Macoun's work. Of the 1,070 mosses which he records, 400 species and varieties are given in "The Catalogue" that are not recorded in "The Manual," so that Professor Macoun has raised the moss flora of America from 1,020, as given in "The Manual" to 1,420 ; and, what is still more remarkable, of these 400 additional plants, upwards of 200 *are new to science*, so that it may be truly said this work is an epoch in American bryology. In 1887 Professor Macoun began to correspond with the great Swedish bryologist, Professor Nils Conrad Lindberg, who examined great numbers of the mosses collected ; the assistance of Dr. Carl Mueller, of Halle, was also obtained. To our greatest living authority on that difficult genus, Orthotrichum, Dr. Venturi, the various specimens of that group were sent for confirmation or determination, while Dr. Warnstorf, of Neuruppin, has examined all the specimens of Sphagnum, so that the record is stamped by an authenticity of unquestionable value. The present part abounds throughout with notes and observations on the minuter differences to be observed in these plants, and all the new species are fully and ably described, so that the work is of real value to every moss student, and its author may be congratulated on having so well fulfilled the promise given in the preface to the first part of "The Catalogue":—"The purpose of this work is to place in the hands of Canadian botanists, in a connected form, the knowledge so far obtained of the extent and distribution of the flora of Canada." This has been carried out even beyond the author's expectation ; he has presented to the Canadian botanist a work that must command his respect and admiration, and one that will be the basis of all future floras of Canada.

J. E. Bagnall.

Elementary Text Book of Entomology. By W. F. Kirby, F.L.S., F.E.S. Second Edition. Revised and Augmented. London: Swann, Sonnenschein, and Co. 1892.

The demand for a second edition of this book seven years after the publication of the first, has given the author the opportunity of correcting errors and making additions, which have greatly added to the value of his work. To the other corrections, however, we wish one addition had been made—that the term *Arthropoda* had been substituted for *Annulosa* as the title for that division of the animal kingdom to which the Insects are assigned, since Mr. Kirby must be aware that the latter name has dropped out of use among the leading comparative anatomists of the day. The term *Annulosa* (with the alternative *Articulata*) is objectionable, because it was formerly used to comprise not only the Arachnida, Crustacea, Myriopoda, and Insecta, animals to which the author now restricts it, but also the large and varied class of the Worms. The latter, however, differ from the four first named classes in the important feature that they do not possess limbs composed of separate parts articulated together: the presence of this character in each of the above mentioned classes has caused them to be grouped together as Arthropoda (αρθρος, joint; ποδα, feet). By using, not this term, but Annulosa, the author withholds from his less learned readers a knowledge of modern and correct views, and at the same time perpetuates an old mistake. With this exception, we have nothing but praise for the new edition of Mr. Kirby's "Text Book," which is a great improvement on the last, in that it is now possible, by means of the excellent index, to at once find whether or not a given insect is mentioned within its pages. In the first edition it was only with considerable difficulty, if at all, that a neophyte in Entomology could obtain the same information from the table of contents, which was incomplete, and, of course, not arranged alphabetically. The usefulness of the book is also further increased by an index to the species of Insects which are figured on the plates. Of the accuracy of the information contained in the work we need say nothing: Mr. Kirby's reputation is a sufficient guarantee of that. The printing is good, and the illustrations are clear and helpful. In fact, the second edition of this "Text Book of Entomology" may be well recommended to all who desire a short and readable account of the principal families and genera of Insects. A. B. B.

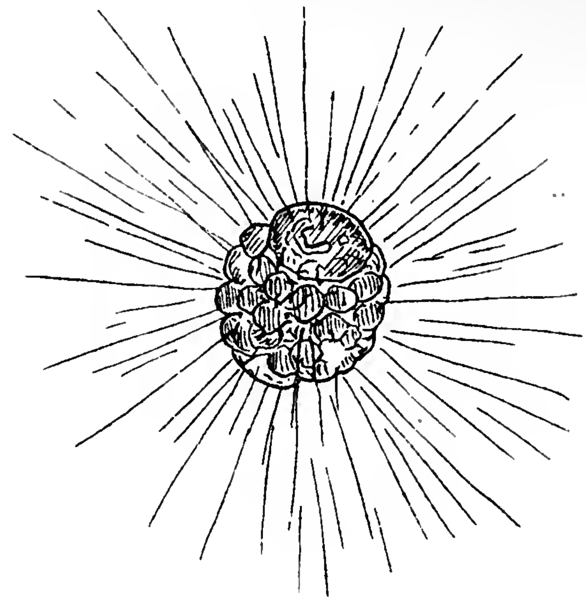
Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL MEETING. October 4th. Mr. J. F. Goode, President, in the chair. A number of specimens were exhibited prepared by the members of the sub-section. Mr. A. H. Martineau exhibited a section of boxwood in balsam, and polycystina mounted dry; Mr. Edmonds, a spider mounted whole in pure balsam; Mr. Hodgson, some algæ from Barnt Green in Deane's gelatine, and, on behalf of Mr. C. J. Watson, some botanical sections in glycerine jelly. Mr. Edmonds also exhibited an abnormal form of mushroom, *Agaricus campestris*.—BIOLOGICAL SECTION. October 11th. Professor T. W. Bridge, M.A., in the chair. Mr. T. V. Hodgson exhibited Appendicularia and a series of specimens from the Mason College Museum (kindly lent by Professor Bridge for the purpose), typical of the whole group, amongst which were *Doliolum*, *Ascidia mamillata*, *Polycyclus Revieri*, *Salpa fusiformis*, and *Pyrosoma gigantea*, the structure and special features of which he explained. The chairman then gave a very interesting discourse on the theory of development of the Vertebrate Eye, as elucidated by the development of that organ in the larval form of a Compound Ascidian. He also exhibited *Halyphysema (Foraminifer)*, *Lycandia ciliata* and *Ascandia contorta* (Sponges). Mr. J. Edmonds exhibited a photograph of two mushrooms *(Agaricus campestris)* joined together by the root of one resting upon the apex of the other. Mr. W. B. Grove exhibited a specimen of *Rosa rugosa* in fruit, and a fungus, *Agaricus meleagris*. Also, for Miss Gingell, *Agaricus terreus*, *Clavaria pistillaris*, *Cl. aurea* and *Helvella crispa*, from Minchinhampton. A vote of thanks to the exhibitors concluded the meeting.—Geological Section. October 18th. Mr. T. H. Waller in the chair. Messrs. C. J. Levi and F. G. Smith were elected associates of the society. Mr. C. J. Watson exhibited photographs of Arthur's Seat, Edinburgh. Mr. C. Pumphrey exhibited specimens from a Vitrefied Fort, and Mr. R. W. Chase specimens of granite from Lundy Island. The Rev. W. H. Painter then read a paper on "The Rocks of North Devon," which was abundantly illustrated with diagrams, photographs, and about sixty specimens of fossils, rocks, etc.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—September 18th. Special—Conchology. Mr. J. Collins showed a small collection of land shells from Ilfracombe; Mr. Rolan, a collection of land shells from South Wales; Mr. J. Madison, a large collection of Unios and Anodons, showing many varieties, both British and foreign; one taken in the Avon, which may prove to be a new species; also specimens of the molluscs in spirit, and a series of drawings of the same; Mr. Linton, a very complete series of *Helix aspersa*, *H. nemoralis*, *H. hortensis*, *H. pisana*, and *H. arbustorum*; Mr. White, marine shells from Barmouth; Mr. J. Moore, photomicrographs of molluscan palates; Mr. Darlaston, foreign marine shells. Under the microscope, Mr. Hawkes, several species of blight on leaves; Mr. Collins, *Ophrydium versatile*.—September 25th. Mr. Mulliss showed cotton plant in fruit. Mr. H. W. H. Darlaston then read a paper on "First Experiences in Microscopy." The writer said the object of the paper would be to give a few personal experiences in the preparation and mounting of objects that would, he hoped, clear away some of the difficulties so often encountered by beginners in this fascinating study. His first studies were in the insect world, and the preparations were mainly mounted in balsam. A number of specimens were then mentioned, and the writer's experience in each given. After whole insects one came to dissections; the readiest methods of mounting these were described, both with and without pressure. The great difficulty in the latter was arranging them nicely under the cover glass, so as to show the various parts. After referring to botanical preparations and the ready method of making microscopic drawings, the writer concluded an interesting paper by showing what good work could be accomplished by patience and care. A series of microscopic preparations and drawings was shown.—October 3rd. The President in the chair. Mr. J. Collins showed a specimen of *Zannichellia palustris*, also a number of herbarium specimens from the Severn Valley; Mr. W. J. Parker, a series of beautifully-executed drawings, with manuscript notes relating to entomology, by Mr. Freeth, of this city; Mr. Rolan, geological specimens from the Severn tunnel and polished incrustations from steam boilers.—October 10th. "Limelight Exhibition of Photographs," by Mr. W. Tylar. The exhibitor read a short paper, "Notes on a Recent Visit to the Channel Islands," the pictures being taken during the tour. They comprised a series of views of Weymouth, Guernsey and Jersey, both instantaneous and time exposures; the exhibitor remarking that some of the best pictures were taken with an inexpensive portable camera, and that a photographic outfit was now within the reach of all.—October 17th. Practical Microscopy. Mr. J. W. Neville gave a demonstration of mounting objects in balsam without pressure. In a few preparatory remarks, he said the ultimatum of all microscopical mounting was to present objects to the eye in their natural form and colour. When whole insects had to be mounted there was no alternative but to apply pressure, although it gave them a distorted and unnatural appearance; but when dissections were mounted the flattening process was not only unnecessary but mischievous. A series of objects was then mounted, being transferred from the water in which they were washed into the balsam, through carbolic acid. Several collections of slides were then exhibited—by Mr. H. Hawkes, mounts of wild flowers; by Mr. J. Collins, British mosses; by the demonstrator, molluscan palates and insect preparations. Mr. G. H. Corbett showed specimens of *Stromatopora striatella* and *S. concentrica*, cut and polished in several directions, from Wenlock limestone.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—October 10th. Mr. R. C. Bradley in the chair. Mr. A. W. Walker, Ingleside, Harborne Road, Edgbaston, was elected a member. The following were exhibited:—By Mr. P. W. Abbott, *Colias Edusa*, from Wyre Forest, one specimen; *Triphæna subsequa*, from Freshwater, Isle of Wight, and *T. orbona*, to compare with it. By Mr. G. W. Wynn, from Wyre Forest, bred series of *Vanessa Io* and *V. c-album*, two bred *Notodonta chaonia*, and a single specimen of *Sesia cynipiformis;* from Cannock Chase, a bred series of *V. cardui;* and a single specimen of *Colias Edusa*, from Meriden, near Coventry. By Mr. R. C. Bradley, nice series of *Philonicus albiceps* and *Thereva annulata*, taken at Barmouth. By Mr. W. Harrison, insects taken at Frankley, near Harborne, quite close to the town, *Cidaria testata*, *Thyatira derasa*, etc.; also from Wyre Forest, *Eucosmia undulata*, *Phorodesma bajularia*, etc. Mr. A. H. Martineau read a paper upon the social ants, in which he gave some account of the various species, and the most interesting facts in their life histories, habits, etc. He showed nests of *Lasius niger*, *L. flavus*, and *Myrmica ruginoides*, with many individuals in each; also dried and mounted specimens of other species.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—This society accomplished its usual programme of work this year. The annual meeting was held in Shrewsbury, on March 15th, at which the President, Dr. C. Callaway, gave his annual retiring address, which has since appeared in the "Midland Naturalist." The first field meeting took place at Oswestry, on May 24th. Some attention was given to the glacial sands and gravels near the town and on the top of the high ridge to the west of Oswestry, Mr. A. C. Nicholson, F.G.S., acting as guide; but stormy weather interfered with the work. The long meeting was in the Midlands. The headquarters of the Club were at Leamington. Particulars of the excursions were published in our July number. The last meeting of the year was held at Pontesbury, on July 28th. The Uriconian rhyolites of Pontesford Hill were studied under the guidance of the President. The party then proceeded to the valley to the east of the hill, where they were shown the Longmyndian conglomerates containing large rounded fragments of rhyolite similar to the Uriconian. The Hon. Secretary, the Rev. R. C. Wanstall, Vicar of Condover, was unable to be present at this meeting on account of sudden indisposition, and on the following day the Club was deprived of his services by death. Mr. Wanstall was a most energetic officer of the Club, and his loss is deeply deplored.



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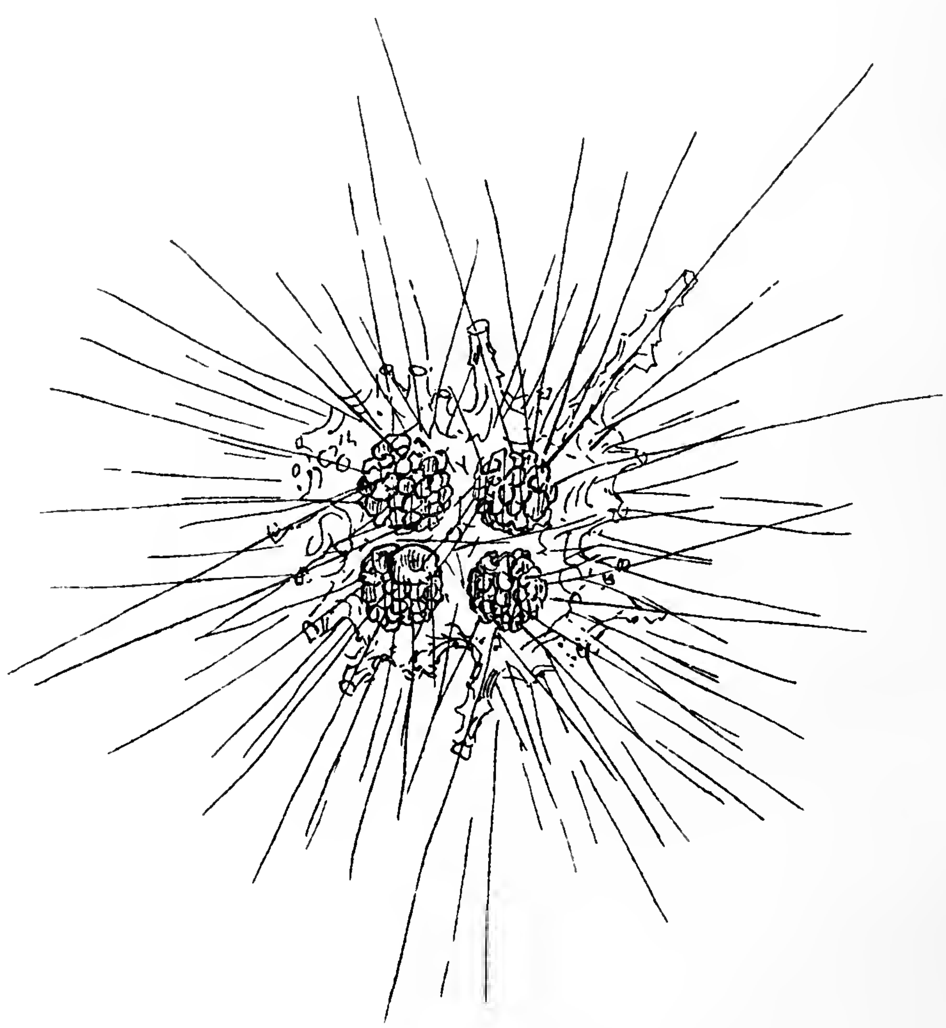

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A FRESH-WATER FORAMINIFER.

Herald Press Lith Birm. H.M.J.U. del.

MICROSCOPIC POND-LIFE.*

Ever since I began to use the microscope I have been fond of studying the minute forms of pond-life, and of taking their portraits. I showed a series of these at the Soirée of the Midland Union of Natural History Societies, held at Oswestry last August, and there may be one or two points of sufficient interest in the lecture, apart from the pictures which are really the lecture, for me to give a short account of it in the pages of this journal.

"Microscopic Pond-life" is a subject which is no doubt familiar to most, and to me one of the fascinating things in these tiny "organisms" is to notice, as we start from the lowest forms and gradually go higher in the scale, the appearance one by one of the different "organs," all of which are indispensable to the higher animals.

We see first how good a name is "organism," for every animal is "organised;" that is, has some parts of it planned and made for a special purpose. It cannot be a living creature without organs—or, at least, an organ; for it is astonishing with how few organs life can be carried on. The one organ which cannot be done without is a heart. Even the Amœba, which has no mouth, feet, nor digestive organs, has a heart. Of course, it is a very simple heart, and, no doubt for this reason, some kind people have given it a long name—they call it a contractile vesicle. No one not in the secret would correctly name the organ which, next to the heart, seems most useful to the carrying on of the processes of life. He would be sure to say a mouth, or feet, or something like that. But it is a skeleton; that is, a hard part, for stiffening out and protecting the fragile body of the creature. A little above the Amœba in complexity of organisation, but closely allied to it, comes the Actinosphærium. This is a unicellular animal, of course, but it has a sort of granular body; and instead of distending and contracting its whole body, as the Amœba does, it sends out fine threads or rays, which answer some purposes of feet, but which may be withdrawn into the body of the animal. There is no more "common object of the microscope" than a slide of foraminifera, and everybody knows that they are practically Amœbæ with shells or skeletons. They are all marine, and, as far as I know, no one has yet recorded a fresh water example.

* Notes from a lecture delivered at the Midland Union of Natural History Societies' Soirée, held at The Quinta, near Oswestry, August 23rd, 1892.

Some few years ago, when I was hunting for "Collared Monads" with a high power objective, I came across some Actinosphæria possessing a curious case or shell. As may be seen by comparing the scales of magnification of the two diagrams (Plate VIII.), it is considerably smaller than the common Actinosphærium. It is less than $\frac{1}{1000}$ of an inch in diameter, while a very small Actinosphærium is at least $\frac{3}{1000}$ of an inch across. Its method of reproduction is the same as that of the Actinosphærium; but in that creature, as soon as a new one is formed, it splits off and forms a separate animal. The shell or skeleton of this creature retards complete separation, and I saw some specimens with only one animalcule in a shell, and which looked, save for the shell, like the common Actinosphærium. Some specimens had two in a shell; others three; others four, as in the figure; while a few shells contained five or six animalcules. The rays or hairs came through little warts in the shell, and these warts were every here and there prolonged into tubes, as shown in the drawing. It seems to me that what I found is practically a freshwater foraminifer. Perhaps it has been seen before, perhaps not. At any rate it seems very scarce at Oxford, for I have never seen it before or since. But it might be easily overlooked on account of its small size, for it is by no means as conspicuous as the common Actinosphærium, large specimens of which are a hundredth of an inch or more in diameter. But, whether or no it is a "new species," it is very interesting as showing that the lowly amœba-forms of life have hard parts or skeletons in freshwater as well as in the sea. As for the texture of the shell, it is quite transparent and very fragile compared with the shell of a foraminifer, just as the shells of freshwater mollusca are much more fragile than sea-shells. I think that the figure that I have given will enable anyone reading this who meets with specimens of it to recognise it.

I cannot very well reproduce my lecture here without a number of figures, which I have no time to draw, and which the editor would not care to print. But I should like to point out that every class of the lowly animals known as Infusoria gives us some individuals possessing hard parts or skeletons, and some individuals without them. In the Monads, if we place them next above Amœbæ in the scale, we find, for example, the genus Salpingœca (Pitcher-dwellers), with a skeleton, and Codosiga (Silent Bell) without. Monads have no mouths, but they eat only at one part of their body, and not all over it as do Amœbæ. The well-known Vorticellidæ have a distinct mouth, but no digestive organs. A large genus, known as Vaginicola, have skeletons, although most of the family are without them. In these two families—Monads and Vorticellidæ—the cell is the unit, for the animal consists of only one cell. Yet they have a way of living in "colonies," which suggests the Metazoa, or animals whose bodies are made up of many cells. Sponges are very interesting and puzzling things to the Zoologist who makes classification his hobby. Is a sponge "an animal"—one of the Metazoa?—or does it belong to the Protozoa?—in which case it is not "an animal" but is only a huge "colony" of unicellular "animals." There is a good deal to be said on both sides. In its canals may be found organisms identical with the collared monads, which are apparently indivisible from the animal. This goes to show that it is merely an overgrown colony of monads. But it has a skeleton of spicules not unlike the spicules of gorgonia, and, in the autumn, it produces a kind of "winter egg," which has a hard shell. This makes one think it "an animal" and belonging to the Metazoa. And, in favour of this view, I would suggest that the "collared monads" in the canals, which no sponge is ever found without (if you look for them in the right way), may really be individual monads living in partnership with the higher animal—a case of "symbiosis," in fact.

Passing from the Protozoa to the Metazoa, let us take for example the common Hydras. Those found in most of our rivers are without the vestige of a skeleton, but there is a genus first found in brackish water, and which is very abundant in a perfectly freshwater canal at Chester, which has a hard case or skeleton, like the marine relatives of the Hydra. This is called Cordylophora, and it is a very picturesque little creature, with the usual sting-cells in its skin. Most microscopists have heard of and seen these sting-cells. Few know how they act. The little sting is coiled up inside the cell, something like the hair-spring of a watch. The common idea is that the animal uncoils the stings when it likes, and pierces its prey with them, the stings remaining attached to its arms. That is a mistake. There is a kind of trigger projecting from the skin a little way. When this is pressed by the arm of the animal squeezing its prey it releases the spring, which uncoils "like a flash" and becomes perfectly straight and rigid. The sting, which has a little round head to it, comes right out of the Hydra, and sticks into its prey like a tiny pin, with the head outermost, of course. Hundreds of these atomic pins are shot out by the Hydra against (say) a water flea, and by the time it is dead, the poor little Daphnia looks like a round pincushion full of pins.

I do not think that I can make any of my little observations on the Rotifers and Polyzoa clear without my pictures; so I will conclude this scrappy paper by saying that they, like the other animalcules which I have already mentioned, afford us examples of some individuals possessing skeletons and some without them. Of course, they have mouths, and far more highly organised digestive and reproductive apparatus than the Hydras, and may be considered to be quite highly organised animals.

H. M. J. Underhill.

DOMICILES.*

BY A. SIDGWICK, M.A.

To prevent any disappointment from misplaced expectations, let me say at once that I do not intend in this paper to give a general review of the domiciles of insects—a subject much too large for the modest limits of the time and the knowledge at my disposal. But having, in the course of my rather desultory study of the ways of moths and butterflies, been latterly in the habit of keeping the cases, cocoons, and shells of the larvæ and the pupæ that I bred, I thought it might be of some interest to show a few of these, and say a word or two in explanation of their peculiarities.

The butterflies are for the most part open feeders, and are not in need of a special domicile to protect them from their enemies. They do their own protection either by the usual method of resembling the plant on which they live, like the larva of the small white butterfly, so hard to discern from the green nasturtium or cabbage leaf on which it lives; or by the equally common means of being bright-coloured and nasty, like the large white butterfly larva, which, with its speckled and yellow-striped back, is so objectionable and conspicuous an object in our kitchen gardens. But that common yet splendid butterfly, the Scarlet Admiral—which may be seen any sunny day now on the ivy blossom—has in the caterpillar stage a distinct domicile. If anybody will walk at the end of July along the nettle beds—say on the Woodstock Road—he will be pretty sure to see the leaves of some of the plants puckered or drawn-in rather near the top of the stem. If with a scientific disregard of being stung he will gently

* Read before the Oxford Natural History Society, October 13th, 1892.

unroll the same, he will find a largish, spiky, dusky, greenish, unwholesome-looking caterpillar concealed there. This is the larva of the Scarlet Admiral. The domicile is not tightly constructed, nor is it hard to find when once you know the sort of place to look in; but it is to the casual eye a perfect concealment, and a bird or other foe who wished to make a meal of the beast would have first to alight in the middle of the nettle bed, and then look up underneath the puckered leaf; a trick which he might have to wait some time before he thoroughly learned.

Among the hawk-moths there is one family which all have domiciles, but they are difficult to get at, inasmuch as the grub feeds entirely inside the wood of a bush or tree. The commonest of these is the Currant Clear-wing, whose grub feeds on the pith of the currant-shoots; you find them by looking out for dead currant-shoots in spring. Of course, the average gardener knows nothing of this, and so the Currant Clear-wing is a great deal commoner than he ought to be. There is another which feeds inside the poplar, and this spring I found a poplar on the Cherwell banks quite riddled with these insects; they had evidently had a home there undisturbed for years, I took half a dozen of their cases in various stages of decay, and exhibit them along with two of the sloughs of the pupæ; in the latter case the moth lay alongside, so like a hornet that I was most unwilling to touch him except with the greatest precautions, even though I knew that the beast had no sting.

But it is among the Bombyces and Bombycoids—those fat, fluffy, and various-patterned moths—described so delightfully in "In Memoriam," in a passage that I have never seen noticed :—

> "And bats went round in fragrant skies,
> And wheel'd or lit the filmy shapes
> That haunt the dusk, with ermine capes
> And woolly breasts and beaded eyes."

It is among these that the cocoons and domiciles are most various and interesting. Of the cocoons the neatest by far are the so-called Eggars, the two commonest being the Oak Eggar and the Small Eggar, specimens of both of which I exhibit. The caterpillar of the largest species is about three inches long, and looks almost as thick as the cocoon. It is really incredible how he gets inside it at all, much more how he can manage to spin it from the inside. It is almost as if a man, evolving from his interior an endless coil of leather, were to spin round himself a Gladstone bag two feet in length and thick in proportion. And it is hardly less of a marvel how the moth can come out of so small a place, even though one may have seen the thing happen hundreds of times. To return, however, to our domiciles. The Small Eggar not only makes this neat dwelling for its pupa, but, when a caterpillar, lives in a common habitation—a sort of college consisting of a huge web, where they live packed like herrings in the day, and whence they emerge at night to devour the neighbouring leaves. They usually live on the sloe, and seem to prefer the clumps of that plant on high roads; at least, I have always found them on the roadside. What the domicile or web is for I do not think is known; it can hardly be for concealment, as the caterpillar is hairy and conspicuously coloured—sure signs of its being nasty; and besides the web itself is very visible—can be seen 200 yards off.

Another beautiful cocoon is that of the Emperor Moth, not uncommon on heather. Large as it is, you will see from the way in which the specimen I show is embedded in heather how difficult it is to be seen in its natural situation. There is another peculiarity about it worth notice: the end of it is spun open, like the mouth of a pipe. It is said that if you cut the cocoon open and take out the chrysalis—which with many kinds may be done with impunity—the wings of this insect will never expand properly; it seems to require the squeeze of the elastic exit to force the expanding juices into the wings. Perhaps someone can confirm or refute this statement. The next one in my show is the cocoon of the lovely tussock caterpillar, known in Kent as the Hop-dog; here, where there are no hops, it lives on nut and oak, and spins among dead leaves, or forks or cracks in the bark. There is a good deal of fine silk expended on the domicile. Then there follows a very common slim cocoon, that of the Drinker, soberly but agreeably coloured with pale yellow, like dead grass or leaves, whether for purpose of hiding or not I cannot say. I can only say that though the beast is very common, I have never yet found the chrysalis, so that presumably it is well hidden.

The next domicile which I exhibit belongs to an insect which is interesting on more grounds than one. In the first place, it is, as everybody can see, extremely beautiful, having the forewings of a brilliant green, delicately shaded with three silvery lines drawn aslant the veins, the hind wings being of a pearly white. It is appropriately named the Green Silver Lines Moth. Secondly, the cocoons are marvellously neat; they are built precisely like a round-prowed boat turned upside down, and resting on the leaf or base, whatever it may be; it keeps its resemblance to a boat by having a sharply-cut, sloping stem where the rudder would come. This rudder stem is the exit for the moth; but the moth has not, as in most cocoons, to gnaw its way through; the sides of the boat—so to speak—are brought close together, but they are not spun together or in any way joined; the moth, when fully formed, has only to push from within and the boat's stern bulges with the pressure and lets her through. Why then, you may ask, can not an enemy or a thief get in where the tenant gets out? That is the very point of the ingenuity; as long as the chrysalis is inside the pressure on the elastic sides of the cocoon acts as a spring, and keeps the edges together; it is a genuine valve, giving easy passage out, but absolutely barred to the foe who would attempt to force an entrance from without. It is quite easy to see the mechanism with an empty cocoon; and I have brought two empty ones for the purpose. All you have to do is to put a slight pressure with a finger on the top, and the rudder is at once bent from a single line into the two sides of a circular opening.

But there is another point of interest in these cocoons. You will observe in my three specimens that the two which are spun on leaves are dark or darkish brown; while the one which is constructed on the fragment of a chip box is quite white. In fact, in each case the colour of the surroundings is almost exactly imitated by the colour of the cocoon. You will also notice that the same is the case with two other of the sets of cocoons exhibited in this case, namely the Hop-dog and the Small Eggar. Now the question arises at once, is it conceivable that the caterpillar has the power to change the colour of the silk it spins according to the tint of its surroundings? It seems to be proved by recent researches, in which Mr. Poulton has taken a distinguished part, that the pigment on caterpillars can certainly be determined—not by natural selection only, though, of course, this acts as usual—but by some sensitiveness of the organs in the life-time of the individual larva, so as to resemble the surroundings; but the case is different with the silk that forms the cocoon, and would require, of course, to be separately proved. The question is at this very moment being hotly debated. Take the case of the Small Eggar: you will see that the cocoon which I show which was spun in a chip box is white; whereas the usual colour is dark brown. Other experiments were made by Mr. Poulton and others; and when the larva was put into a box with white surroundings he always seemed to spin a white or whitish cocoon. This looked conclusive; but the next experiment showed the need of care in drawing conclusions. Last week, Mr. Bateson showed before the Entomological Society a long series of similar cocoons; and he showed that whenever the larva was left undisturbed and was allowed to crawl into white surroundings the cocoon was of the normal brown colour; but wherever the caterpillar had been taken away, *vi et armis*, from his leaves, and put into another place—whether white or dark—he spun a light-coloured cocoon. This put a wholly new face on the matter; it indicated that the light colour was due not to the surroundings, but to the disturbance. The dark colour is apparently a secretion; and when the animal is vexed or out of condition—and nothing so much alarms him as being pulled about when he is going to change—he loses the power of secreting this colour, and spins white. This rebuff set Mr. Poulton experimenting again with another beast—namely, this very Green Silver Lines—and he tells me that he has again succeeded in getting white cocoons in white surroundings from undisturbed larvæ; nay, in the very same glass case, those larvæ which spun among the white were white in their silk, and those which spun among leaves or in the open were of the usual dark colour. There at present the matter rests; and a very pretty quarrel it is, and very illustrative on all sides of the methods and the difficulties of scientific research, and the stages of its progress. If the results so far reached are confirmed—and very wide and careful experiments are needed to make the ground sure—the outcome will be this: that some species have, and others have not, the remarkable power of accommodating the colour of their cocoons to their surroundings; and it will be needful to try a great variety of species on a large scale to find out in what the difference lies.

To return to our domiciles. Nothing is more remarkable in the domiciles of the pupæ than the great difference in the apparent comparative security of the pupa-cases even of allied species. Let me take a case of a safe and an unsafe one for the sake of contrast. Perhaps the safest of the commoner kinds is that of the Puss-moth. The specimen I show is unfortunately not made under natural conditions, as there are no chip-boxes to be found concealed in the roots of willow trees. But even from the specimen I show can be seen the extremely business-like character of the structure. It is made of bits of wood, carefully gnawed, and fastened together by a natural glue which the creature exudes for the purpose, and which dries very quickly into one of the hardest cements one can imagine. In nature the spot selected for dwelling is some recess between two prominences of the bark, and the outside being covered by the outside bits of the bark, and, being rapidly weathered into exactly the same colour, it is almost impossible to find it as long as the beast is inside. Speaking for myself, I have often looked for them, and those which I have found have always been empty. Of course, when they are empty, they are easy enough to find ; your eye is attracted to the place by the hole whereby the perfect insect has escaped. I should very much like to know if even a wood-pecker—which can extract larvæ from the middle of a branch of a willow—could get through with its powerful beak the outside coating of the Puss-moth pupa-case. I should be inclined to bet on the Puss-moth. As a contrast to this take the chrysalis case of that rare moth, the Lobster, of which I exhibit a specimen. This singular larva—shaped something like a cross between a shrimp and an earwig—lives on the beech tree in the end of the autumn. When it is full fed, instead of spinning a proper cocoon like other Bombycoids, or going down into the earth as so many of its own relations do, it considers it sufficient to fasten together two beech leaves, turn into a chrysalis inside this simple egg-shaped domicile, and in that condition trust itself to the chapter of accidents. Let us see what will happen. Occasionally, in a very sheltered situation, when the beech is a young and compact one, and if the winter is unusually free from strong wind the dry leaves will remain all the winter on the tree. I have found them thickly clothing the trees so late as March —in fact till they are pushed aside by the new growth of the spring. Well, if this happens, of course the beast will be quite safe, but this will rarely occur ; much oftener the leaves will get looser until one fine day—or rather one very wet day —they will be beaten down by the rain or blown down by the wind. It is sad—from a collector's point of view—to think of this fine, rare moth lying in such an insecure position all the winter—stifled by the wet weeds that surround it ; trampled on by a passing beast ; or at the mercy of any half-starved field mouse or centipede that has the happy inspiration to see what there is between those two beech leaves that seem to bulge out in the middle. On the specimen that I show of this cocoon—if it can be called a cocoon—you will see only one of the two beech leaves ; the other is torn away to show the texture of the fine silk with which this singular domicile is lined and attached, and on which you will still see very plainly the ribs of the upper leaf that has been taken away, almost as if the leaf had been stamped in a mould. Before I finally leave the Puss-moth, I should like to mention the very similar cocoons of a smaller relation of the Puss, most appropriately named the Kitten. I show four cocoons of this species: two made under more natural conditions, and two on the cork and chip box, which was the only material that I supplied them with. They are all extremely neat and secure domiciles; but you will see that the cases that were constructed on the twig—two on the same twig—are more compact and natural looking; they might be hardly more than a casual thickening of the sallow bough, and much more adapted to escape detection.

I now pass to an insect of very retired habits, which is well named in Latin, *Reclusa*; it is, indeed, of the nature of a hermit or a recluse. I was once hunting on the rough ground that lies at the foot of the mountain called Moel Siabod, in North Wales. There was very little foliage about, and it did not look a promising locality; but I saw under some low, irregular rocks, that rose up between patches of rather swampy ground, some straggling bushes of the dwarf sallow, only a foot or two high, and looking rather shrivelled with the heat of the first days of September, and altogether the worse for wear; when it flashed upon my mind that I had heard an entomologist say that the dwarf sallows near Moel Siabod were frequented by this very Recluse Moth. I looked close and saw that the leaves had been considerably devoured. Now I will ask you to remember that the entomologist has to acquire one art which at the first sight may seem a little marvellous. He sees a leaf eaten, and he gets to know by experience, first, what sort of an animal has eaten it—for it may be anything from a saw-fly larva to a cow—and secondly he has to learn how long it is since it was eaten. It is not difficult to get to the stage when one is able to say with some confidence whether a leaf has been nibbled within the last few hours, or a couple of days ago, or a fortnight or more ago. You can also tell easily if the eating has been done within the last few minutes; but naturally that rarely happens. Well, now I saw that these dwarf sallows had been devoured within a few hours; and consequently the culprits were not far off. But for some time I could see nothing of them; and was just about to conclude that I was, by a hair's breadth, too late, when I noticed an obscure crumpling together of some leaves. To open this was the work of a moment, and inside, sure enough, was the Recluse larva. The riddle was now an open secret; and I spent the next few minutes in detecting one hermit after another, and dragging them from their retirement. In the place where a short time before I could have sworn that there was not a single larva, I got, in no time, over a dozen; and I dare say that there were as many again which I missed. This brief tale is enough to show in a convincing manner how complete the concealment of this larva has been made by nature. Their history has been made out somewhat as follows: At first they are gregarious, when hatched from the egg ; they draw two leaves together, lie low like Brer Rabbit during the day, and then, when the dark conceals them, they come forth from the lair and eat the leaves, always returning before the dawn. After the first few weeks they develop more solitary habits ; each spins his own hermitage, like the one which I exhibit, and in this they continue to reside all the hours of daylight, till the time comes for them to change into chrysalides ; they have then obviously no need to spin cocoons ; their domicile becomes their pupa-case, "in life their hermitage, in death their tomb"—as the poet says, or ought to say.

The two last specimens which I exhibit are given as instances of the complete way in which the pupa-cases of some insects are hidden out of sight, even though there may be no covering at all, or nothing but the flimsiest web of transparent silk. One of these grubs was feeding on heather, and the other on Scotch fir ; in both cases I had not kept the caterpillar before, and did not know what he would do ; in both cases he lived in a small jampot with the least little tuft of his plant to eat. And yet, when they came to spin, though I knew they were there, I had the greatest difficulty to find them. I had in each case to cut away the plant, until there was nothing left to hide them ; and then, of course, I saw them. You will see—though only the core of the tufts is left—how very easily they could escape notice even now.

Of the remaining families one word will suffice. The Geometers or looping caterpillars—what the Americans call "Inchbugs"—are sufficiently protected by their resemblance to sticks ; but the two families of very small grubs have well-marked domiciles. The Tortrices are so called from their habit of rolling the tips or corners of leaves ; here they dwell, as all people fond of a garden know by the way they roll up the rose leaves in May and June. The last family, the Tineæ, are, perhaps, not so well known, though everybody must have seen their domiciles. The bulk of them live in a very safe house, between the upper and the lower cuticle of the leaf ; these cuticles form the walls of their house, and the green stuff between the walls is their food ; so they have all they want at hand : protection and food. If anything happens to the leaf—if it is plucked, or falls, or a large larva eats it—then, of course, they are done ; but mostly they are very safe and comfortable. One very well-known kind of Tinea is the Clothes' Moth; there are about a dozen different species of these, and I need not tell you that their domiciles are little galleries, ingeniously constructed in your best woollen articles of attire, with a special partiality for sealskin. I will not describe them all; but the commonest is a little, pretty, white-shouldered moth, of which I have brought a specimen. They never attack, as the ladies know, any clothes which are in use; it is those that are laid aside in a drawer that are assailed. I will ask you to look at this moth so as to know him again; I have so frequently seen the most innocent vegetable-feeding moths slain as Clothes' Moths that I feel quite sensitive on this subject, and wish the blame to be laid, and the penalty to fall, on the right shoulders.

With this domicile I close my paper, and I have the satisfaction of feeling that, if all the rest is useless, in showing the Clothes' Moth I have, at least, given one practical bit of information which may be new to some here, and will prevent them from henceforth laying murderous hands upon the guiltless.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(*Continued from page 260.*)

1884, 1885, 1886. Published in 1887.

* **Ranunculus penicillatus** (Hiern). R. pseudo-fluitans. River Cole, Yardley. *Anticipated.*

* **Potentilla verna.** Towndrow. "Little Malvern." *Not new.* Edwin Lees, "New Botanists' Guide"; see "Mid. Nat.," Vol. XI., 279.

Rosa scabriuscula, Smith. Var. of R. tomentosa, E. F. Linton, Bromsgrove Lickey; name certified by J. G. Baker. *First record.*

R. obtusifolia, Desv. Var. of R. canina, E. F. Linton. Bromsgrove. *First record.*

R. verticillacantha, Mérat. Var. of R. canina, E. F. Linton. Barnt Green. *First record.* This removes the ambiguity in Edwin Lees's "Bot. Wor.," Add. and Corr., see "Mid. Nat.," Vol. XIV., p. 111.

* **Epilobium eu-tetragonum**, Linn. Towndrow. "Newland," near Malvern. *I think this cannot be new,* though certainly *it is a confirmatory record.* E. tetragonum, L., is recorded by Sheward, Nash's "Supplement," 1799. "Foot of Malvern Hill." Ed. Lees's "Bot. Wor.," Tab. 11. In all the districts. Unlocalised. "Mid. Nat.," Vol. XIV., p. 111. Witley Court plantations, 1845, Wm. M.; Sp.!

Mentha pubescens, Willd. Towndrow. Banks of Leigh Brook, Alfrick. *First record.*

* **Atriplex erecta.** Towndrow. "Madresfield." *Not new.* See Ed. Lees's "Bot. Wor." p. 51; "Mid. Nat.," Vol. XV., p. 23.

Sparganium neglectum, Beeby. Towndrow. Malvern Link. *First record.*

Carex Bœnninghauseniana, Weihe. Amphlett and Mathews. Fenny Rough, Stone, Kidderminster. Wm. M., Sp. ! 5th June, 1886. *First record.*

In the "New Locality List" for 1883, Dr. F. A. Lees notices under the head of "Filago apiculata" a remarkable plant, growing in sandy fields near Kidderminster (Dr. Fraser), with crimson tipped phyllaries. Prof. Babington refers it to F. germanica.

I now take up the "List of the Flowering Plants and Ferns of the Clent and Lickey Hills and Neighbouring Parts of the County of Worcester," by W. Mathews (Mark and Moody, Stourbridge, 1881). All the plants are given in the list, but I have extracted the rarer ones only. Localities observed subsequently are added.

Ranunculus heterophyllus. Pools. Frequent. This is the form also known as R. diversifolius var. radians. *First record.*

R. peltatus. Pools. Frequent. *First record.*

* **R. circinatus.** Pools. Frequent. Harborne Reservoir; Blakedown, Churchill, and Stakenbridge Pools; pools at Halesowen; Harvington Hall Moat; Stanklin Pool.

* **R. Lenormandi.** See "J. of Bot.," Vol. IX., 1876, 244. "Mid. Nat.," Vol. XV., p. 287.

* **R. fluitans.** Hoo Brook.

* **R. parviflorus.** Clent. Mr. Amphlett. The Oddnalls, Clent, 1882. Field on Clent Hill. In abundance. 1883. Mr. Amphlett. Calcot Hill, Clent. In profusion. 1892.

* **Corydalis claviculata.** Lower Lickey, Hurcott Wood, Alvechurch.

Fumaria muralis was an error. No form of Capreolate Fumitory has been found within this district.

* **Arabis perfoliata** (Turritis glabra). Lanes about Hagley, Churchhill, Stourbridge, and Kidderminster.

* **Cardamine impatiens.** Wychbury Wood, 1883. Clatterbatch, Clent. Mr. Amphlett, 1883. Fenny Rough, Stone, 1884 !

* **Erysimum cheiranthoides.** Clent Hill, Hagley Brake, Churchill, Walton Hill.

Diplotaxis muralis. Goods sidings at the Stourbridge Railway Station. Rev. J. H. Thompson ! *First record.*

‡ **Camelina sativa.** Churchill. Introduced with corn seed. *First record.*

* **Teesdalia nudicaulis.** Sandy places, Blakedown.

* **Lepidium Smithii.** Various places.

* **Viola palustris.** Brake Mill Pool, Hagley! Alvechurch. Mr. Daniel Mathews. Brake Mill Pool, 1883! Near the Birches, 1883! Lower Lickey, 1884.

Drosera rotundifolia. Near Alvechurch. Mr. D. Mathews. Destroyed at Bromsgrove Lickey.

Polygala depressa. Dry banks and heaths; locally abundant. *First record of segregate.*

* **Dianthus deltoides.** Warwick Hall, Bromsgrove. Mr. John Humphreys.

* **Silene anglica.** Among barley, Churchill, 1879; introduced with clover seed, Wm. M.! Purton, Vol. III., p. 37. "Mid. Nat.," Vol. X., p. 255.

* **Sagina ciliata.** Blakedown, 1848.

* **Lepigonum rubrum.** Dry sandy places.

* **Hypericum dubium.** About Hagley and Churchill.

* **H. humifusum.** Bromsgrove Lickey; Twiland Wood; Frankley; Hagley Brake; Churchill; Blakedown; Clent Hill.

* **Geranium sylvaticum.** Furnace Coppice, Halesowen; Cradley.

* **G. columbinum.** Hagley; Fenny Rough.

* **G. lucidum.** Mucklow Hill, Halesowen; Pigeon House, Northfield; Clent Grove.

Tilia parvifolia, T. grandifolia, have been inserted by mistake.

* **Rhamnus catharticus.** Woods.

* **R. Frangula.** Romsley and Frankley Woods.

(To be continued.)

The Fecundity of Plants.—I recently had the curiosity to estimate the number of seeds yielded by two parsnip plants, and found it to be 12,768. The plants were by no means fine ones, being two that were overlooked last winter.—C. J. Watson.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical Meeting. November 1st. Mr. J. F. Goode, President, in the chair. Mr. S. B. Bolton exhibited under a microscope the ova of an arachnid, showing the young inside. Mr. S. Elliott exhibited *Stercorarius pomatorhinus* from Donegal. Mr. W. S. Wilkinson exhibited the fruit of a species of Pyrus. Mr. T. V. Hodgson then read a full report of the excursions made during the past season, and while regretting the extremely superficial character of the work done, noted the discovery of two microscopic fungi, *Septocylindrium macrosporum* and *Hormactina dispersa*, as new to the district. These were obtained at Middleton, where a small number of specimens of *Pedalion mira* were also found. The only other noteworthy specimen was *Daphnia Jardinii* from Olton Reservoir.—

November 4th, SUB-SECTION FOR MICROSCOPICAL MOUNTING. Mr. C. Pumphrey gave a practical and interesting demonstration of the methods of obtaining the palates of the gasteropoda and of preparing them for mounting.—BIOLOGICAL SECTION. November 8th. Mr. W. H. Wilkinson, Vice-president, in the chair. Mr. A. J. Parker was proposed for membership. The chairman exhibited the following seaweeds from the Isle of Man:—A rare form of *Fucus nodosus*, *Fucus caniculatus*, and also, under the microscope, a section of the fructification of the latter species. Mr. E. C. Rossiter exhibited a specimen of *Colias Hyale*, and a series of twenty males taken near Market Harborough, and called attention to the fact that those taken in September were considerably smaller in expanse of wings than those taken in June. Mr. W. E. Collinge then read a paper on "British Slugs and Land and Freshwater Shells," which he illustrated by a number of specimens forming part of the Hunter-Barron collection from the Mason College, and also by many specimens of slugs preserved in spirit by himself.—GEOLOGICAL SECTION. November 15th. Mr. T. H. Waller, B.A., B.Sc., in the chair. There was a very large attendance, quite filling the Biological Theatre, Mason College. Mr. A. J. Parker, of Mariemont, Birchfields, was elected a member of the Society. Mr. T. V. Hodgson exhibited specimens of Cicadæ, perfect insect and pupæ, from Melbourne. Messrs. C. Pumphrey and C. J. Watson exhibited and described pictures (many geological subjects), taken during an excursion in Ireland. The chairman in welcoming the visitors to this sectional meeting, cordially invited them to become members of the Society.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—October 24th. Mr. J. Wykes showed two drawings of the planet Jupiter made on the nights of October 5th and 19th. Mr. J. W. Neville (for Mr. W. Tylar) exhibited lichens from Scotland. Mr. J. W. Neville read a paper on the "Circulatory System of Insects." The writer described the circulation in the higher animals, and traced it down to the Insecta, where it became of a simple type. The apparatus that did service for a heart was a dorsal vessel with valvular partitions, along which the blood circulated from the posterior to the anterior extremity. It was then carefully traced along the lateral branches and through the tissues, visceral cavity, &c. The latter part of the paper dealt with the various methods by which the blood was brought into contact with the air to be re-oxygenised. The spiracles and tracheæ of caterpillars, the leaflets from tail of larva of Dragonfly, abdominal gills of Ephemera and tracheæ in rectum of Dragon-fly were severally described. The paper was illustrated with drawings and a series of microscopical preparations.—October 31st. Mr. J. Moore showed specimens of Mason Wasp, *Odynerus murareus*, with nest; Mr. H. Hawkes, twelve botanical slides illustrating the arrangement of elementary tissues; Mr. J. Round, fossils from Cromer; Mr. Rolan, mercury ore and other minerals; Mr. Bleasdale, a large collection of fossils, &c., from various localities; Mr. G. H. Corbett, polished specimens of fossil corals from the Oolite, Carboniferous, Devonian, and Wenlock formations. Under the microscope, Mr. W. J. Parker, *Cypris ornata*; Mr. Wykes, *Cristatella mucedo*; Mr. Hawkes, annular vessels in maize; Mr. J. W. Neville, section of coal through a fern stem.—November 7th. Annual Meeting, election of Officers and Presidential address, the President in the chair. The following reports were read and duly passed:—General Secretary's, Secretary of Committee's, Curator's, and Treasurer's, the latter showing a balance in hand. The President nominated Professor Bridge as President for the ensuing year, which was unanimously carried. Messrs. S. White and C. Cardwell were elected Vice-Presidents; Messrs. W. J. Parker and H. W. H. Darlaston, Secretaries. The other officers were re-elected. After votes of thanks to the retiring President and Officers had been suitably replied to, the President delivered the address. He said:—We Britons are a wandering people, whether we are the representatives of the lost tribes or not; we are accustomed to quit the scenes we are used to, and wander to pastures new. Priority of place is generally given to the seaside or mountains; of these two resorts geologists and botanists prefer the latter, and so to the mountains I will ask you to go with me to-night, and consider what tale a mountain has to tell you. For the first 1,000ft. the vegetation would alter but little, but at 1,500ft. many of our well-known trees would have gone; at 3,000ft. the two last trees of the plain would have disappeared. At 3,000 or 4,000ft. new beauties would meet our eyes—floral stars that are not found on the plains, a class of plants known as Alpine plants. Whence did these plants come? If we go to the Alps, Sweden, or Scotland, we find the same plants; not in one only, but in numerous cases, this is true. This tells us that our problem is not one of local mountains, but of mountains generally, and we look for some theory that will show how some time or other mountain tops have been joined together. The climatic differences between places on the same lines of latitude were traced to their causes, the difference between western Europe and eastern America being dependent on the Gulf Stream. The botanist can produce no force that will account for Alpine plants. The geologist tells us that the present levels of the land were not always arranged the same. In Greenland, remnants have been found of a flora that could not thrive at the present time. There was a close connection between Alpine plants and Arctic plants, and if the ice can have changed its locale, it will explain the distribution of these plants. We must now appeal to astronomy. This will tell us that these things are not stable, and that at some future time, owing to the oscillations of the north and south poles, an ice-sheet will once more cover northern Europe, and the whole plains will be covered with Alpine plants. The mountain side furnishes a problem that geologists, botanists, and astronomers have tried to unravel—a history before which the history of mankind sinks into a small record.—November 14th. Mr. J. W. Neville showed a specimen of *Haliotis splendens*, and odontophore of the same; Mr. H. Hawkes, a large specimen of the false puff-ball, *Scleroderma vulgare*, and some of its varieties, calling attention to its rapid mode of growth; Mr. J. Collins, an adder from Wyre Forest; Mr. J. Linton, specimens of *Helix aspersa* from France; Mr. Foster, a case of Australian insects, and a series of photographs of that country; Mr. W. J. Parker, death-watch beetles, *Anobium sp.*

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—November 14th. Mr. R. C. Bradley in the chair. The Secretary called the attention of the society to the death of two of its members, Messrs. J. T. Harris, of Burton-on-Trent, and Robert Allday, of Handsworth. These were the first losses by death the society had experienced. The following were exhibited:—By Mr. W. Harrison; living larvæ of *Trochilium apiforme*, from Arley; also one of the same preserved. By Mr. C. J. Wainwright, the genus *Dioctria*, including *Reinhardi* from Wyre Forest. *rufipes*, from Sherwood Forest and Sutton; and *Baumhaueri*, from Sherwood Forest. By Mr. R. C. Bradley, series of *Limnobia bifasciata* and *Amalopis littoralis*, from Wyre Forest.