Transactions of the Royal Society of Edinburgh

<http://journals.cambridge.org/TRE>

Additional services for *Transactions of the Royal Society of Edinburgh*:

Email alerts: [Click here](#)

Subscriptions: [Click here](#)

Commercial reprints: [Click here](#)

Terms of use : [Click here](#)

XV.—On some new Species of Fossil Scorpions from the Carboniferous Rocks of Scotland and the English Borders, with a Review of the Genera Eoscorpium and Mazonia of Messrs Meek and Worthen.

B. N. Peach

Transactions of the Royal Society of Edinburgh / Volume 30 / Issue 01 / January 1881, pp 397 - 412

DOI: 10.1017/S0080456800029094, Published online: 06 July 2012

Link to this article: http://journals.cambridge.org/abstract_S0080456800029094

How to cite this article:

B. N. Peach (1881). XV.—*On some new Species of Fossil Scorpions from the Carboniferous Rocks of Scotland and the English Borders, with a Review of the Genera Eoscorpium and Mazonia of Messrs Meek and Worthen.* . Transactions of the Royal Society of Edinburgh, 30, pp 397-412 doi:10.1017/S0080456800029094

Request Permissions : [Click here](#)

XV.—*On some new Species of Fossil Scorpions from the Carboniferous Rocks of Scotland and the English Borders, with a Review of the Genera Eoscorpius and Mazonia of Messrs Meek and Worthen.* By B. N. PEACH, A.R.S.M., F.R.S.E., of the Geological Survey of Scotland. (Plates XXII. and XXIII.)

(Received 24th June 1881).

In the progress of the Geological Survey of the South of Scotland, specimens referable to the genus *Eoscorpius* have been gradually accumulating. In 1876 J. BENNIE, Fossil Collector to the Survey, obtained an example from the Coal-measures of Fife. Since then fragments have been disinterred by him and by A. MACCONOCHIE, also Fossil Collector to the Survey, from the Calciferous Sandstone series in the counties of Edinburgh, Berwick, Roxburgh, Dumfries, and Northumberland and Cumberland. It was not till the spring of last year (1880) that they began to be found in such a state as to necessitate a description of the fossils. In the summer of that year A. MACCONOCHIE obtained an almost entire example from the neighbourhood of Langholm, in Dumfriesshire. This year (1881) J. BENNIE has secured several good though fragmentary specimens from the neighbourhood of Edinburgh, while A. MACCONOCHIE has sent in several from the counties of Berwick and Northumberland. In my capacity of Acting Palæontologist, I have had an opportunity of studying these remains, and by the permission of A. C. RAMSAY, LL.D., F.R.S., Director General of the Geological Survey of Great Britain, and Professor A. GEIKIE, LL.D., F.R.S., Director of the Geological Survey of Scotland, I have been allowed to describe them.

PREVIOUS LITERATURE RELATING TO CARBONIFEROUS SCORPIONS.

- In 1835 Count STERNBERG published a description of a fossil scorpion from the Coal formation of Chomle, near Radnitz, Bohemia.
 - In 1836 CORDA described and named the above specimen under the appellation of *Cyclophalmus senior*, from the smaller eyes being arranged in a circle round the two central larger ones. (CORDA in "Böhmischen Verhandlungen," 1836, and WIEGMANN'S "Archiv," 1836, vol. ii. p. 360). Figured in the Transactions of the Bohemian Museum.
 - In the same year Dr BUCKLAND reproduced the figures in his "Bridgewater Treatise," pls. 46' and 46", fig. 13, the description being given in vol. i. p. 407.
 - In 1839 CORDA added a new genus to the Pseudo-scorpions under the name of *Microlabis*, the specimens being obtained from the same locality as the *Cyclophalmus*.
 - In 1868 Messrs MEEK and WORTHEN described the remains of a fossil scorpion (*Eoscorpius*) from
- VOL. XXX. PART I. 3 Q

the Lower Carboniferous Rocks of Mazon Creek, Morris Grundy County, Illinois, U.S.A., in the "American Journal of Science and Art," 2d ser. vol. xlv. p. 25, and also in the "Memoirs of the Geological Survey of Illinois and Iowa," vol. iii. p. 560. They also describe a specimen which they consider to belong to the Pseudo-scorpions, and call it *Mazonia Woodiana*, from the locality whence it was derived, Mazon Creek (*ibid.* p. 563).

In 1873 HENRY WOODWARD, Esq., F.R.S., read a paper before the Geological Society of London on remains of fossil scorpions from the Coal-measures of England and a doubtful tail segment from the Carboniferous Limestone series of Carlisle, Scotland, which he refers to the genus *Eoscorpius*, Meek and Worthen, and ranks under one species *Eoscorpius Anglicus* (Quart. Journal of the Geolog. Soc., vol. xxxii. p. 57).

In 1881 a newspaper notice of a meeting of the Geological Society of Glasgow records the exhibition of a tail segment of *Eoscorpius* by Mr Coutts from the Carboniferous Limestone Rocks of East Kilbride, Scotland.

DESCRIPTION.

Genus *Eoscorpius*, Meek and Worthen, 1868.*

Eoscorpius tuberculatus, n. sp. (Plate XXIII. figs. 8 to 8h).

The characters of this species are made out from several fragmentary specimens obtained from the valley of the Forth. These all show it to have been small. One specimen exhibits the carapace and six of the segments of the abdomen. If the rest of the body bore the same proportions to this as obtains in the present *Scorpio afer*, the whole animal ought to be about $2\frac{1}{2}$ inches long from the anterior margin of the carapace to the point of the tail sting.

Cephalothorax.—The carapace is subquadrate with rounded off angles, and narrower in front than behind. It is produced into a slight peak anteriorly in the middle line. The posterior margin is concave, and bordered by a broad band which is slightly peaked backwards in the middle. A deep depression divides the carapace into right and left halves. On each side of it the test is raised into swollen cheek-like lobes which occupy the whole breadth at the anterior and antero-lateral margins, which they overhang and entirely hide when the carapace is viewed from above. From this they taper backwards to blunt points on each side of the depression near the posterior margin. Exterior to these are two less raised triangular areas which occupy the remaining portions of the carapace. Towards the anterior end of the mesial furrow rises a comparatively large pyriform eminence with its narrow end directed backwards, the broader portion being set with two large circular or slightly oval simple eyes placed so as to look upwards, forwards, and slightly outwards. The eminence is composed of two connate tubes which rise at an angle of about 20° from the plane of the sulcus in which they are set, and diverge outwards at an angle of from 30° to 40° . The corneas of the eyes appear like "bull's eyes" at the mouths of the tubes. In cases where the overlapping cheek-like lobes of

* "American Journ. Science and Arts," 2d ser., vol. xlv. p. 25.

the carapace have been pushed aside by the fossil being crushed obliquely, smaller eyes are seen at the antero-lateral angles. In one case three were observed on one side, though it is probable that there was at least one more still hidden. From the specimens at command the exact number cannot be made out. The character of the test of the carapace is horny, and where swollen up it is thicker than at other parts, and dotted over with larger and smaller tubercles in an irregular manner. The floor of the sulcus and the eminence bearing the mesial eyes are smooth, while the triangular areas at the posterior angles are thin and wrinkled.

Appendages of Cephalothorax.—Falces unknown. Palpi chelate, short, and comparatively stout. Walking limbs unknown, with the exception of the coxæ of four of the limbs on one side, which are preserved as triangular flattened plates converging in front of the segment bearing the comb organs.

Abdomen.—Six segments only are preserved. The dorsal plates of those in front are short, each succeeding segment gradually becoming deeper, so that the sixth is three times the depth of the first. All seem to be about equally broad. They all have a broad thickened smooth articular margin in front, the parts left uncovered being dotted all over with smaller tubercles, and the posterior margin slightly fimbriated and set with two rows of larger tubercles. Their lateral margins are rounded. The ventral plates of only the first four segments are preserved. Nothing can be said of the first two, except that one of them bears the combs. The third is an apron-like flap, narrow in front and widening posteriorly, and rounded at the angles. It is as deep as three of the dorsal plates opposite which it is placed. Within the rounded postero-lateral angles of this plate two fine slits occur which are the openings into the air sacs. The fourth is too much crushed for description. These plates are united by their lateral margins to the dorsal portions by longitudinally folded thinner skin, which is constricted opposite the articulations.

Abdominal Appendages.—The combs are large in proportion to the animal. In the best specimen they are well preserved, though they are folded back upon themselves, so as only to show their form near the tips. They seem to be made up of a broad triangular rachis ornamented with an irregular embossed scale-like pattern, which reminds one of that on *Eurypterus* and *Pterygotus*, and edged at the lower side with a row of comparatively large leaf-like teeth. These are constricted at their bases, they then suddenly expand, the sides then become parallel, and as suddenly become truncated to a blunt point. Being nearly all of a length when seen together, their upper and lower edges form nearly parallel lines. In their present crushed state the individual leaflets overlap each other like the splints of a venetian blind.

Tail and Poison Gland unknown.

The above characters have been ascertained from the study of several

specimens collected by J. BENNIE, Fossil Collector to the Survey. The first and best specimen (fig. 8), was obtained from the Coal-measures at Blair Point, near Dysart. The others, with one exception, were obtained by him from the Calciferous Sandstone series from Redhall and Cramond, in the vicinity of Edinburgh. The specimen from which figs. *f* and *g* were taken was got by Mr THOMAS JARDINE from Redhall, during one of Professor GEIKIE's class excursions.

This species has been purposely described first because the carapace and eyes have been found together in the same specimen with the comb-like organs. It will be necessary to refer to this again when the genera *Eoscorpius* and *Mazonia* of Meek and Worthen come to be discussed.

Eoscorpius glaber, n. sp. (Plate XXII. figs. 2 to 2*l*).

Body, without the tail and appendages, about $1\frac{1}{2}$ inches long.

Cephalo-thorax.—The inner surface of portions of the carapace only is seen. It appears to be smooth and not tuberculated. Eyes not observed. Falces: a pair of stout chelicerae, having the biting edges denticulated. Palpi cheliform, the biting portions being remarkably long compared with the rest of the limb. The basal joints of the palpi are strongly tuberculated and act as jaws. Walking limbs: four on each side, the foremost being short and directed forwards, the next even shorter, and the last two pairs being much longer than the rest and directed backwards, the hindmost being the longest, though they do not extend beyond the fifth abdominal segment. The basal joints or the coxae of these limbs in their present flattened state appear as triangular plates, which converge upon the thorax, those of the first pair probably acting with the palpi as maxillae. The other three almost meet near the middle line, and enclose some small plates, the number and arrangement of which are not shown. The second joints are short and subquadrate, the third joints are longer and flattened laterally; the fifth short, with the under margin gibbous, making it easily recognisable. The tarsi are each composed of one joint, somewhat narrower at the base than the extremity (which is the case with all the limb joints) where it is produced beneath into a strong spine. The manus is supplied with a stout fixed spine and two movable hooks, which do not seem to be toothed on their lower margins.

The *abdomen*, exclusive of tail, consists of seven segments, the dorsal portions of which are represented by seven subovate plates, the front ones being not so deep as those farther back. The first six are all of nearly equal breadth. The seventh narrows so suddenly that its posterior margin is only half the breadth of the anterior one, which is as broad as the posterior margin of the sixth segment. All the segments have a broad marginal band in front. Five ventral plates are visible, each corresponding in shape and breadth to the dorsal plate from the third to the seventh segment inclusive, except the foremost which is much deeper. Slit-like spiracles, surrounded with a raised

margin, have been observed within the postero-lateral angles of those of the third and fourth segment, and it is probable that the next two bear them also. The ventral portions of the first two segments are only made known by the cast of one side of the comb-like organ, a magnified representation of which is given in fig. 2*g*, in which the rachis of the comb is seen to be ornamented by a similar embossed pattern to that of *E. tuberculatus*.

Tail.—Only the first joint of this is preserved in the form of a narrow cylindrical body now flattened, of the same breadth as the posterior margin of the seventh segment, and bearing longitudinal crests. The test is smooth, or only slightly wrinkled throughout, except on the palpi, which bear a very few tubercles. It is from this character, which is so unlike the preceding *E. tuberculatus*, that the name is proposed.

Observations.—As the specimen from which the above description is taken is one of the most complete and best preserved of the fossil scorpions in the Survey Collection, it may be allowable to make some remarks regarding it. It occurs embedded in shale, which has split so well that portion of the specimen adheres to one side and portion to the other. Fig. 2*a* shows the dorsal aspect of the parts that are represented by a darker shade, and the cast of the ventral surface where it is lighter. Fig. 2 being the counterpart is just the converse. In one respect this is unfortunate, as it precludes the possibility of making out the character and position of the eyes which have not been observed. On the other hand it has given us a view of the parts on the ventral surface of the animal. From the manner in which it has been crushed, the abdomen looks a good deal broader than it would do otherwise, for not only do we see the full breadth of the dorsal plates from a back view, but also a portion of the ventral plates bent over, as well as the intervening folded test. I have endeavoured to represent the appearance of the fossils to the naked eye as truthfully as possible in figs. 2 and 2*a*. To illustrate them by showing my own interpretation of them I have prepared fig. 2*b*, exhibiting the ventral aspect, which combines all the parts found in both specimens, the portion of the tail not shaded and drawn with dotted lines being the only parts supplied entirely from inference. Both for reference to these and the other specimens I have made an outline drawing of a recent scorpion in the same position, fig. 1. Fig. 2*l* shows the posterior angles of the third and fourth ventral plates, considerably magnified, to exhibit the stigmata for comparison with a corresponding portion of one of the segments of a recent scorpion (fig. 2*m*). An enlarged outline of one of the chelicerae is given in fig. 2*e* to show the denticulation. Portions of the two last joints of one of the hindermost walking feet, showing the arrangement of the spines and claws, are shown magnified in fig. 2*h*. It is unnecessary to enter into the microscopic structure of the test at this stage, for when we come to treat of the dissecta membra of the collection, we shall have to discuss it,

and show that the smallest portion of skin is sufficient to reveal the nature of its original possessor.

Collector—A. MACCONOCHIE.

Locality.—River Esk, four miles south of Langholm, Dumfriesshire.

Horizon.—Near the base of the Cementstone group (Lower Carboniferous).

Since the above was written another specimen of this smooth-skinned scorpion has been obtained by J. BENNIE among some of the shales forming the plant-bed from Redhall, Water of Leith, near Edinburgh. Fortunately this specimen exhibits the interior of portion of the carapace which, though very imperfect, shows that it had similar large mesial eyes to those of *E. tuberculatus*. The only portion of the antero-lateral margin preserved bears one of the small lateral eyes. The cheeks of the carapace have been embossed into lobes like *E. tuberculatus*, but no tuberculations are observable. The inner side of the lobes is marked with radiating wavy grooves, which are probably vascular markings. Similar markings are found on casts of *E. inflatus* to be described. The junction line of the raised lobes with the posterior wrinkled portion of the carapace is strengthened by buttresses of folded test, and the posterior margin by a wide band which is corrugated transversely. Some of the body segments are preserved, but in too crushed a state for study. It also shows the chelicerae, which are strongly denticulated. One of the palpi of the same form as those of fig. 2 shows that the nipping edge is supplied with numerous fine saw-like teeth and terminates in a bluntly-hooked end. Four of the tail segments are also preserved. One flattened laterally exhibits the anterior articular surface, and in addition shows that the body of the segment, which is cylindrical, was ornamented beneath with longitudinal ridges, four of which are seen on the exposed side, showing that it must have been fluted like an Ionic pillar, see fig. 2*d*. Another segment lying loose has been compressed vertically, and shows the posterior articular face as a perfect ring, and is seen to pass down through more than one layer of the shaly fire-clay in which it is embedded. This scorpion must have been considerably dismembered before being covered up previous to fossilization.

Locality—Redhall, Water of Leith, near Slateford, Edinburgh.

Horizon.—Calcareous Sandstone series.

Eoscorpius egyptus, n. sp. (Plate XXII. figs. 3 to 3*d*).

A large species, so called from the beauty of its combs.

Cephalothorax.—Carapace unknown. The chelicerae are strongly denticulated. Palpi large and cheliform, the basal joints strongly tuberculated, and acting with the coxae of the first walking limb as jaws. The second joints of the palpi are marked on their under side with diverging lines of tubercles. The whole limb is strong and set with tubercles and strong spine-

like hairs. The biting portions long, and hooked at the extremities, the biting edge being supplied with regular, very fine saw-like teeth, set with the points directed inwards. At intervals a larger tooth interrupts the evenness of the line. Walking limbs four on each side, portions of all of which have been preserved (figs. 3 and 3a). The coxæ of the six hindermost are triangular in shape, the posterior ones being the longest. They converge upon four small plates, which enclose a small lozenge-shaped space or plate, where their angles intersect, the coxæ along with these latter forming an efficient sternum. The first movable joints are small and triangular, the next are long and somewhat flattened laterally, having their under edge marked with a row of tubercles which make this portion easily recognised in the fossil state. Only the extremity of one walking limb is preserved, and as that is crushed on to one of the palpi, it does not show its structure well, though it can be seen to be supplied with movable claws.

Abdomen.—The only portion of this preserved exhibits the ventral side of part of the first four segments. The interior of portion of two dorsal plates is seen, the posterior margin of one being supplied with a row of tubercles which appear on the inside as pits. The genital orifice is situated in the middle line just beneath the small plates of the sternum. It is covered by a small valve-like plate in shape like a half disc, which is hinged on the straight side to allow it to open upwards. In the specimen from which fig. 3 was taken the operculum is open. On its inner side a narrow raised line, which divides it mesially, fits into a corresponding groove when it is shut. Both on the lid and the portion covered by it, the skin is puckered up and “drawn” into the orifice, which appears as a transverse slit almost as wide as the hinge of the valve. Placed on each side of the orifice and slightly beneath it two mounds rise to which the bases of the combs are articulated. These organs are, roughly speaking, in the form of two right angle triangles with the most acute angles directed outwards and articulated by their right angles, the remaining angles meeting in the middle line. The hypotenuse is occupied by the leaflets or “teeth” of the comb, which appear to the naked eye like a fringe a line in depth. When magnified, the triangular rachis is seen to be ornamented with a similar embossed scale-like pattern to that on the preceding species, while the fringe resolves itself into a row of very numerous overlapping leaflets, narrow at the bases, with parallel sides, and suddenly cut off to a point, reminding one of the blade of an ancient Greek sword. Towards the inner part of the row, the fringe is single, but near the tips, there is the appearance of a double row of leaflets which overlap in an imbricating manner like tiles.

Observations.—This must have been a large species, for if the other parts wanting be in proportion to those we have preserved it ought to bear favourable

comparison with the Indian scorpions for size. I propose to name it from its exceedingly beautiful combs which are the most complex that have as yet come under my notice in the present collection. Fossil combs often turn up among the disjecta membra of scorpion, so that a specific character founded on these may be useful for recognition. The tuberculations on the under edge of the third joint of the walking limbs, and on the dorsal segments are sufficient to distinguish it from *E. glaber*, while the comb is quite distinct in shape from *E. carbonarius* (Meek and Worthen), and its limbs seem to be shorter and stouter. From *E. Anglicus* (Woodward), the shape of the palpi at once distinguishes it.

Locality.—River Esk, four miles south of Langholm, Dumfriesshire.

Horizon.—Near the base of the Cementstone group, Calciferos Sandstone series (Lower Carboniferous).

Collector.—A. MACCONOCHIE.

Eoscorpius, sp. (Plate XXIII. figs. 11 to 11a).

A specimen which among other crushed and unrecognisable portions of a small scorpion shows more than half of a carapace which is distinct from that of *E. tuberculatus*. It has a corresponding groove mesially, near the anterior of which is set an eminence with two eyes directed forwards. The swollen cheek-like portions, however, are much more complicated by being divided by lateral grooves into three distinct portions on each side. One of these is small and elongated, well-covered with tubercles, and lies just within and parallel to the antero-lateral margin. The middle portion is the largest, and rises above the rest of the carapace, with steep sides all round, the side overlooking the mesial groove being steepest. This eminence is covered with large irregular pustules, some of which are compound, almost like a strawberry. The posterior eminence representing the hinder portion of the swollen cheek in *E. tuberculatus* is triangular in shape and divided into two horns by a deep mesial depression and is almost free from tubercles. The postero-lateral angles are rounded, and enclose, with the outer margin of the eminence, triangular areas of the wrinkled test as in *E. tuberculatus*. Mesial eyes are two large simple ones, set in front of an elongated triangular eminence, which has its apex directed backwards. The eminence, as in *E. tuberculatus*, is nothing more than two connate tubes, which very gradually rise from the level of the floor of the mesial sulcus, and the long axes of which diverge at an angle of only 15° to 20°, no portions of the tubes being free, differing in both the latter characteristics from *E. tuberculatus*. Four lateral eyes are visible on the right antero-lateral margin. Behind the fourth the margin is incomplete, so that there may have been more. One of the lateral eyes is shown magnified in fig. 11a.

Fig. 13 shows a portion of a carapace from Dalmeny railway cutting.

From the character of the pustulation it probably belongs to the same species as the above. The above carapace is interesting in being intermediate in character between *E. tuberculatus* and a carapace, which is not an uncommon fossil in the Langholm bed, which, however, has the tubes of its mesial eyes separated throughout by a sulcus.

Locality.—River Esk, four miles south from Langholm, Dumfriesshire.

Horizon.—Near the base of the Cementstone group, Calciferous Sandstone series (Lower Carboniferous).

Collector.—A. MACCONOCHIE.

Eoscorpheus inflatus, n. sp. (Plate XXIII. figs. 12 to 12d).

All that is known of this scorpion is the carapace, which is not an uncommon fossil in the shales at the locality on the River Esk, near Langholm, Dumfriesshire, which has proved so rich in other rarities. Owing to the thicker portions of the test being generally filled with calcareous calculi till not a portion of the original material is visible, the carapaces are not crushed but still retain their original raised or embossed character. In a few cases where the calculi are sparse the carapaces are flattened, and the nature of the horny skin is revealed. It is evident from this that the calculi must have been introduced in the interval between the death of the scorpion and its interment, and it shows that the remains must have been subjected for some time to the action of "hard water."

Specific Characters.—Carapace subovate, a little broader than long, and narrower in front than behind. The greater portion of the surface is puffed up into six lobules, arranged symmetrically in pairs, and divided off from each other by deep sulci. Two of these mounds, of an elongated shape, form the antero-lateral margins, one on each side. Two large, almost circular, mounds occupy the greater part of the posterior portions of the carapace, and two smaller, triangular, ones are situated between them and those first described. A deep mesial furrow runs from the anterior to the posterior margin, and sends off branches between the monticules. Near the anterior end of this furrow two small tubes, which in this case are separated by a groove, rise gradually from the carapace, and diverge at a slight angle, the front extremities being occupied by two large circular eyes, smaller in proportion to the carapace than in any of the formerly described species. Underneath the elongated mounds occupying the antero-lateral margins, and entirely overhung by them, are at least four small oval eminences on each side which appear to be lateral eyes. These fossils are invariably preserved "back up," a circumstance that is easily accounted for (see fig. 12c).

The carapace is ornamented by numerous pustulations on the raised portions, while the sulci are plain, and the posterior and postero-lateral portions

thin and wrinkled. The only portions of the carapace usually exposed are the thickened raised mounds, and it is only in one or two out of over thirty specimens in the Survey Collection that the posterior portion of the carapace is preserved.

Observations.—The appearance of the above fossil when filled in with calculi is much like a gigantic ostracod, and bears a great resemblance to *Beyrichia*, though the test, where not destroyed by calculi, exhibits under the microscope the characters borne by that of spiders and insects. By treating those that are most destroyed by calculi with hydrochloric acid the calcareous matter can be dissolved out, and as the test is not soluble, the portions not entirely split up still exhibit structure. It is just possible that this is not a portion of a scorpion, but that it is referable to the genus *Cyclus* (de Koninck), undoubted species of which occur in the same beds with the above fossil and with their tests similarly infested. It may be as well to mention that almost all the fossil scorpions in the Survey Collection have the horny substance of the test still preserved. It is elastic, of a brownish-red colour and slightly transparent, and seems to have undergone very little alteration. It is quite insoluble even in strong hydrochloric acid,—a useful character, as it allows the specimens to be cleaned for microscopic examination.

Disjecta Membra.—Among the fragments that cannot with certainty be referred to any known species, there are many specimens that help to clear up points in the morphology of these ancient scorpions. Combs often occur, and it is a fortunate circumstance that they are so easily recognisable and so characteristic. Figs. 16 and 16a represent a portion of one, both natural size and enlarged, showing the nature of ornament like irregularly dropping embossed scales, reminding one very much of that on *Eurypterus* and *Pterygotus*. A few of the teeth which fringed the lower edge are still preserved. This specimen comes from the rich bed near Langholm. Several combs are found among the fragments from the Calciferos Sandstone near Edinburgh.

The abdominal plates are also frequently obtained. Fig. 17 represents one from the ventral surface (natural size), with the combs pressed through it. This probably belongs to *E. tuberculatus*, several carapaces of which have been obtained from the same beds near Cramond. Walking legs are not uncommon. Fig. 6 is a copy of an almost perfect one from Coldstream, Berwickshire, from the Cementstone group (Lower Carboniferous). Some fragments of the walking legs from Berwickshire are very large, being over two inches long and one third of an inch wide in their flattened state, showing to what a large size some of these old scorpions must have attained. Fig. 4 shows the tarsus and manus of one (natural size) from the well-known locality of Lennel Braes, River Tweed, near Coldstream. The spines and movable terminal hooks are well shown. This must have belonged to a very large individual. Fig. 5

is the tarsal joint of a still larger one, but even the owner of this must have been small compared with the scorpion to which the penultimate joint of the *Palpus* represented in fig. 18 (natural size) belonged. Fig. 20 is a drawing of a tail segment from Cramond which shows the articular surface on the anterior portion, the longitudinal ridges, and the abruptly truncated posterior margin. The only portion referable to the poison gland is a specimen represented by fig. 21. It is ovoid in shape, and has its articular surface placed not symmetrically but slightly on one side. It is unfortunate that at the very place where the sting should be, an ostracod shell (*Leperditia*) interferes with the specimen. The line of the ventral margin is seen beyond this, but soon becomes lost. A harder portion of the test of a scorpion is seen where the sting should be were it present, but it would not be safe to say definitely that it was the sting itself, however much it might suggest its being such. The poison gland of a recent American scorpion is drawn in fig. 22 for comparison.

Figs. 18*a*, 18*b* show the microscopic structure of the test of the specimen represented in fig. 18. It is composed of two layers, the upper surface being made up of a network of hexagonal cells. Irregularly placed depressions are found at intervals, and these sometimes pass through both layers. In other instances they are merely dimples as it were in the test. When the test supports hairs each always rises out of the centre of such a depression (fig. 18*a*). The tuberculations seem to be very irregularly disposed over the test of such species as exhibit them. The movable claws of *E. glaber* do not seem to be serrated on the lower edges, while those of the foot from Lennel Braes (fig. 4) appear to be notched. Fig. 18*c* represents the magnified muscular bundles found in the joint of the specimen (fig. 18).

The disjecta membra show that there must be several species of scorpion in these Carboniferous rocks besides those which have been found sufficiently complete to show specific characters, a fact that should incite local geologists to search for them. That they are not rare, may be inferred from the fact that nearly one hundred fragments have been got by the Survey collectors from several widely separated localities and horizons since the year commenced.

The type specimen of *E. carbonarius* for which Messrs MEEK and WORTHEN made the genus, unfortunately did not exhibit any of the organs on which generic classification usually proceeds.* The consideration of the present collection puts us in a better position, and while retaining their name I would propose the following characters as being distinctive of the genus.

* *Vide* Messrs MEEK and WORTHEN's description in the "Memoirs of the Geological Survey of Illinois," vol. iii. pp. 560-562. Figs. 23 to 23*b* are a reproduction of the woodcut accompanying their description.

Genus *Eoscorpheus*, Meek and Worthen.*

Generic Characters.—True scorpions with inflated carapaces bearing two large mesial eyes in front of tubes, directed so as to look “obliquely forwards, outwards, and upwards,” and placed near the anterior margin, and in addition eight or more small lateral eyes placed half at each of the rounded anterior margins. Falces and palpi chelate. Walking limbs eight in number, and ending in movable claws. Combs ornamented with an embossed scale-like pattern and bearing numerous short and stout leaflets. Body suddenly narrows at the seventh abdominal segment, and becomes a narrow cylindrical jointed tail, the joints being fluted longitudinally on the ventral surface.

From *Cyclophthalmus* (Corda), the only other described Carboniferous genus, the arrangement of the eyes distinguishes it. In the former, the lateral eyes are placed in a circlet round the large mesial ones, from which arrangement, the name is derived; † the falces are not chelate, and the abdomen does not contract suddenly at the spring of the tail as in the latter. The position, size, and arrangement of the large mesial eyes and the more elaborate combs distinguish *Eoscorpheus* from recent genera.

Although there seems to be sufficient reason to separate the genus from any recent one, these ancient scorpions appear not to differ in any essential character from those now living. As far as the horny test, the only part now preserved to us, is concerned, they were as highly organised and specialised towards the beginning of the Carboniferous period as their descendants at the present day. It is unfortunate on that account that Messrs MEEK and WORTHEN should have chosen the name *Eoscorpheus*, for the dawn of the scorpion family must have been at a much earlier period, and we may hope that their remains will yet turn up in the Devonian and Silurian plant-beds when these come to be thoroughly searched.

In the same volume in which they described the *E. carbonarius*, Messrs MEEK and WORTHEN give a description of a fossil from the Carboniferous rocks of Illinois, which they consider to be the remains of a pseudo-scorpion, and to which they give the name of *Mazonia Woodiana*, forming the genus for its reception.‡ Figs. 24 and 24a give a copy of some of the figures. After having had the opportunity of studying the above collection of Scotch scorpions, I have little hesitation in looking upon their *Mazonia* as a true scorpion, and their remarks show them to have had a strong inclination in the same direction. The

* “American Journ. Science and Arts,” 2d ser. vol. xlv. p. 25.

† *Vide* Buckland’s “Bridgewater Treatise,” vol. ii. pls. 46’ and 46”, where there is a reproduction of CORDA’s figures. Fig. 25 is a copy after Buckland of the carapace of *C. senior* enlarged, showing the mesial and lateral eyes.

‡ “Geological Survey of Illinois,” vol. iii. pp. 563–565.

carapace of the *Mazonia* is almost identical with that of *E. tuberculatus* above described. Had their fossil been preserved so that the overhanging portion of the carapace above the antero-lateral margin had been pushed back, the lateral eyes, which in all probability exist, would no doubt have settled the question. Fig. 24 is a copy of their figure; the firm lines show the boundaries of the portions they found preserved, while the dotted lines show what was left to conjecture. Only one of the antero-lateral angles is preserved (the left), and even there the lateral eyes could not be seen if the carapace were like that of any of our species of *Eoscorpius*. The posterior lateral angles seem to be broken away also. The inflated portion of the carapace, the large mesial eyes placed in the same position, and identical in arrangement and structure with that exhibited by the present *E. tuberculatus*—so much so that the same words were unwittingly used in this description of the latter as those employed by Messrs MEEK and WORTHEN in describing their *Mazonia*—all tend to show that the two are very nearly allied. This conjecture is greatly strengthened by the study of the abdomen of their figure. The dorsal portions of seven segments are shown with just space enough between the posterior margin of the carapace and the first segment for another, but there is no reason to believe that there ever was an eighth.* The seventh is suddenly contracted posteriorly, and abruptly truncated, evidently pointing to there having been a tail attached to it. The detached limb which is preserved is in all probability, from its elongated appearance, one of the hinder walking legs, and not one of the palpi. A comparison of the *Mazonia* carapace with their figure of the *E. carbonarius* is also very instructive (fig. 23). If their figure of the latter be a good representation of the specimen, then the posterior part of the eminence on which the mesial eyes was set is still shown, and the rim of the left mesial eye is also apparent. Taking all these things into consideration there is every reason to look upon the *Mazonia* as belonging to their genus *Eoscorpius*, but a distinct species from their *E. carbonarius*. It would then require to be changed to *E. Woodianus*.

* The lithographer has shaded this space as if it were a portion of another segment, a mistake which was not observed till the plates were struck off.

EXPLANATION OF PLATES.

PLATE XXII.

- Fig. 1. Ventral aspect of a recent scorpion of the family *Buthides* (Koch), for comparison with the fossils with which it closely agrees in its proportions.*
- Fig. 2. *Eoscorpheus glaber*, N.S. Natural size. The darker portions show where the test is retained—the lighter portions, the parts represented by casts. This remark holds good for all the figures. From Langholm.
- Fig. 2a. *E. glaber*. Counterpart of fig. 2.
- Fig. 2b. Figure combining all the parts exhibited in figs. 2 and 2a to compare with fig. 1. The darker shaded portions show the ventral parts, and the lighter, the dorsal, the dotted portion of the tail left unshaded is added from inference.
- Fig. 2c. *E. glaber*. Natural size. From specimen obtained from Redhall, showing carapace, several body segments, chelicerae, chelae, some of the walking limbs, and four tail joints of a dismembered individual. It occurs in a shaly fire-clay crammed with seeds, *Carpolithes Grantoni* (Linley and Hutton), fern stems, and leaves (*Cyclopteris*, &c.).
- Fig. 2d. Interior of carapace of fig. 2c, showing mesial eyes as depressions, one lateral eye, raised lobes with vascular markings and posterior margin. Magnified 3 diameters.
- Fig. 2e. Left mandible of fig. 2c to show denticulation. Magnified 3 diameters.
- Fig. 2f. Right palpus of fig. 2c. Magnified 3 diameters.
- Fig. 2g. Cast of rachis of comb of fig. 2 to show nature of its embossed markings. Magnified 3 diameters.
- Fig. 2h. Foot of hindermost left walking limb of fig. 2a to show spines and hooks. Magnified 3 diameters.
- Fig. 2i. A tail-joint of fig. 2c, showing the character of its anterior articulation and the fluting on its ventral surface. Magnified 3 diameters.
- Fig. 2k. Another tail-joint of fig. 2c, showing posterior articular surface "end on." Magnified 3 diameters.
- Fig. 2l. Portion of fig. 2a to show two of the stigmata or breathing slits at right posterior angles of the third and fourth ventral plates of the abdomen; as also the longitudinally folded skin connecting the dorsal and ventral plates. Magnified about 3 diameters.
- Fig. 2m. Stigma at corresponding angle of the third abdominal plate of a recent scorpion, for comparison with fig. 2l. Magnified nearly 3 diameters.
- Fig. 3. *E. euglyptus*, N.S. Natural size of specimen, obtained from near Langholm.
- Fig. 3a. To show more clearly the portions exhibited by fig. 3 for comparison with fig. 1.
- Fig. 3b. Portion of fig. 3, magnified 3 diameters, showing the operculum raised so as to expose the genital orifice; also the combs in place, and the nature of their ornamentation. The dotted lines show the probable extension of combs.
- Fig. 3c. Portion of comb of fig. 3, magnified, 10 diameters, to show nature of fringe of leaflets near distal end.
- Fig. 3d. Portion of comb of fig. 3, magnified about 20 diameters, showing that the fringe is made up of a double row of leaflets nearer its apical end.
- Fig. 4. Tarsus and hand of a very large scorpion from Lennel Braes. Natural size.
- Fig. 5. Tarsus of scorpion from Cramond. Natural size.
- Fig. 6. Leg of scorpion from Coldstream. Natural size.

* This scorpion agrees very closely with the description of GÉRAIS of his *Scorpio Cummingii* in WALCKENAER'S "Insectes Aptères," and would fall under the genus *Ischnurus* of KOCH.

PLATE XXIII.

- Fig. 7. Dorsal aspect of recent scorpion, fig. 1.
- Fig. 8. *Eoscorpis tuberculatus*. Natural size. From specimen obtained from Blair Point, Fife, showing six abdominal segments with the combs in place. The carapace, shown by cast, is displaced, turned round, and lying underneath the abdomen.
- Fig. 8a. *E. tuberculatus*. Portion of carapace, magnified 2 diameters, to show mesial eye and one lateral one. Taken from counterpart of specimen from which fig. 8 was obtained.
- Fig. 8b. *E. tuberculatus*. Flattened carapace showing mesial and lateral eyes. From Cramond. Magnified 2 diameters.
- Fig. 8c. *E. tuberculatus*. Portion of another carapace from Cramond. Magnified about 3 diameters.
- Fig. 8d. Portion of fig. 8, magnified $3\frac{1}{2}$ diameters, to show nature of the combs, the right comb being represented only by a cast.
- Fig. 8e. The tip of the right comb from counterpart of specimen represented in fig. 8. Magnified about 6 diameters.
- Fig. 8f. *E. tuberculatus*. Two dorsal segments to show nature of articular facet and the arrangement of tuberculation. Specimen from Redhall. Magnified 4 diameters.
- Fig. 8g. Ventral abdominal plate showing stigma, from same small piece of shale as fig. 8f. Magnified 4 diameters.
- Fig. 8h. Magnified portion of test of fifth dorsal segment of fig. 8.
- Fig. 9. View of left side of first seven abdominal segments of recent scorpion, showing the coxa of hindmost leg, and combs in place, to illustrate the position in which specimen represented by fig. 8 is fossilized.
- Fig. 9a. Dorsal plate of recent scorpion, magnified 2 diameters, to compare with fig. 8f.
- Fig. 10. Comb of recent scorpion, magnified 5 diameters, for comparison with figs. 8d and 8e.
- Fig. 11. *Eoscorpis*, species. Portion of carapace, magnified $3\frac{1}{2}$ diameters, showing mesial and lateral eyes, and lobes of carapace subdivided into lobules. From Langholm.
- Fig. 11a. One of the lateral eyes of fig. 11. Magnified 8 diameters.
- Fig. 12. *E. inflatus*. Portion of carapace, natural size, showing the mesial eyes and the lobes divided into lobules. From Langholm.
- Fig. 12a. *E. inflatus*. Carapace of another specimen. Magnified 2 diameters. From Langholm.
- Fig. 12b. *E. inflatus*. Cast of portion of carapace of another individual, magnified 4 diameters, to show vascular markings. From Langholm.
- Fig. 12c. *E. inflatus*. View of front portion of cast of carapace of another individual, magnified about 3 diameters, looking obliquely at the left antero-lateral margin, a portion of the anterior lobe being removed to show four of the lateral eyes on the left side (*l, l, l, l*); shows also the mesial eyes (*m, m*) and one of the lateral eyes on the right margin (*l'*). From Langholm.
- Fig. 12d. Sketch taken "face on" to show relative position of mesial and lateral eyes in *E. inflatus*.
- Fig. 13. Portion of scorpion, probably lobe of carapace. Natural size. From Cramond.
- Fig. 14. Flattened joint of walking limb? of scorpion. Natural size. From Cramond.
- Fig. 15. Portion of second joint of palpus of scorpion. Natural size. From Pathhead Mill, Dunse.
- Fig. 16. Natural size of portion of comb of scorpion, *E. euglyptus*? From Langholm.
- Fig. 16a. Same magnified 4 diameters, to show nature of ornament.
- Fig. 17. Third ventral abdominal segment and portions of comb of scorpion. Natural size. From Cramond.
- Fig. 18. Part of the hand and moveable finger-joints of palpus of scorpion. Natural size. From Langholm.

- Fig. 18a. Portion of test detached from specimen fig. 18 to show nature of pits and hairs. Magnified about 20 diameters.
- Fig. 18b. Portion of test highly magnified to show cellular external layer.
- Fig. 18c. Bundle of muscular fibres seen in digital joint of palpus of fig. 18. Magnified 10 diameters.
- Fig. 19. Five tail segments of scorpion, with portion of seventh abdominal segment, all attached, natural size, from Coldstream Bridge, to compare with figs. 7 and 20.
- Fig. 20. Tail junk of scorpion, natural size, shows anterior articular surface and longitudinal grooving. From Cramond.
- Fig. 21. Poison gland of scorpion, showing the nature of the articulation, hairs, &c. Magnified 4 diameters. From Larriston Burn, Upper Liddesdale. The depression near the narrow end is due to an ostracod shell (*Leperditia*).
- Fig. 22. Poison gland and sting of recent scorpion, magnified 3 diameters, for comparison with 21.
- Fig. 23. *E. carbonarius* (Meek and Worthen). Reproduction of Messrs MEEK and WORTHEN'S figures, from the "Memoirs of the Geological Survey of Illinois," vol. iii. p. 560.
- Fig. 23a. *E. carbonarius*, magnified comb, *ibid*.
- Fig. 23b. *E. carbonarius*, magnified dorsal plate, *ibid*.
- Fig. 24. *Mazonia Woodiana* (Meek and Worthen). Reproduction of Messrs MEEK and WORTHEN'S figure, from the "Memoirs of the Geological Survey of Illinois," vol. iii. p. 563.
- Fig. 24a. *M. Woodiana*, carapace magnified for comparison with the present collection, *ibid*.
- Fig. 25. *Cyplophthalmus*, senior (Corda), carapace magnified. Reproduction of figure from BUCKLANDS' "Bridgewater Treatise," vol. ii. pl. 46'.

LIST OF LOCALITIES AND GEOLOGICAL HORIZONS FROM WHICH THE ABOVE
FOSSILS HAVE BEEN OBTAINED.

COUNTY.	LOCALITY.	GEOLOGICAL HORIZON.
Fife,	Blair Point, near Dysart,	Coal measures.
Edinburgh,	Redhall, Water of Leith, near Slateford,	Calciferos sandstone series.
Linlithgow,	Cramond, about three miles N.W. from Edinburgh,	" "
"	Dalmeny, Railway Cutting,	" "
Berwick,	Coldstream Bridge, River Tweed,	" "
"	Lennel Braes, near Coldstream,	" "
"	Pathhead Mill, Blackadder Water, near Dunse,	" "
Roxburgh,	Larriston, Upper Liddesdale,	" "
Dumfries,	River Esk, near Glencartholm, Langholm,	" "

The calciferous sandstone series of Scotland is now regarded by the Geological Survey as the equivalent of part of the lower portion of the carboniferous limestone series of England.