

NO. XIV.—ON THE DISTRIBUTION OF POSIDONOMYA CORRUGATA,
ETHER. JUN., IN THE CARBONIFEROUS LIMESTONE OF THE
GLASGOW DISTRICT. By PETER MACNAIR, F.R.S.E., F.G.S.,
and HARRY R. J. CONACHER.

[Read 15th February, 1912.]

INTRODUCTION.

WHEN recently examining the Lower Carboniferous Limestone Series as seen in the different burn sections at Corrieburn, we discovered immediately above the upper post of the Hosie limestone a dark shale which is literally crammed full of the shells of *Posidonomya corrugata*. Upon examining the various records giving the geological and geographical distribution of this species in the Glasgow neighbourhood, we were much struck with the conclusive manner in which the evidence went to show that *P. corrugata* is particularly well developed in certain beds towards the top of the Lower Limestone Series. The recent advances that have been made in the correlation of the different members of the Lower Limestone Series have also made it possible to show with more exactness that beds rich in *P. corrugata* seem to occupy fairly well-defined geological horizons. We also believe that the occurrence of this fossil upon certain definite geological horizons has an important bearing upon the question that has again been raised as to the position of the Hosie limestone in the East Kilbride district, and for these various reasons we have ventured to bring the matter before the Society.

Until the recent publication of the memoir on “The Geology of the Glasgow District,”¹ the exact position and relationships of the different limestones and other strata seen at Corrieburn do not seem to have been very well understood. Thus we find the late Dr. John Young, in his “Geology of the Campsie District,”² saying, “The relationship which the Corrieburn beds bear to those seen further west in the Campsie Valley has not

¹ *Mem. Geol. Sur.*, “The Geology of the Glasgow District.”

² *Trans. Geol. Soc. Glas.*, vol. i., third edition, p. 46, 1894.



D. Gourlay, del.

Posidonomya corrugata, Ether. (natural size), Boghead, near Hamilton.
From a Specimen in Kelvingrove Museum.

yet been very clearly established. At one time I thought that they might be higher in the series, but since I have seen equivalent strata in other parts of the country, I am inclined to place them in a lower position, and it is very probable that they are in that of the main limestone series, or of beds still lower in the system. From the occurrence of *Naiadites crassa* of Fleming in the Corrie beds, I am inclined to regard them as of the same age as the thick limestone at Beith, in Ayrshire, and at Cult Hills, in Fifeshire. In all of these localities this shell is very abundant, and I have never met with it in any other horizon in our limestone strata. From the similarity of many of the corals and other shells in the Corrie limestone to those found in the limestone of the Bathgate Hills, I would also connect them as of one age, especially as the two groups are further marked by the occurrence of contemporaneous traps and ash beds at their base." In the memoir to Sheet 31³ the officers of the Survey give the following description of the Corrieburn section:—"The lowest of the three limestone groups is only exposed here in three different places, where its strata peep out against the large fault which flanks the Campsie Hills. These are most typically seen in the Corrie and Queenzie Burns and their tributaries between the two parallel faults. There, immediately overlying the tuffs of the cement-stone group, a thin white concretionary limestone occurs, full of encrinite stems and corals. A few fathoms higher a thick bed of blue limestone has been extensively quarried. It represents the Hurler limestone. Not more than 10 feet of alternating beds of limestone and shale are visible, the base being never exposed. For at least 50 fathoms in ascending order the succeeding strata consist more or less of blue clay-shales, with nodules and bands of clay ironstone, with at least three thin bands of limestone, known as the 'Hosie's.' One of the above-mentioned burns exposes a cliff of from 80 to 100 feet of these blue clays, with layer after layer of clay ironstone nodules. Towards the upper limit of the Hosie's limestone the intervening strata contain several beds of sandstone. One band of shale is crowded with a *Lingula*." These two quotations contain, so far as we are aware, the only definite statements that, up till the recent

³ *Mem. Geol. Sur.*, explanation of Sheet 31, p. 28, 1879.

publication of "The Geology of the Glasgow District," had been made regarding the stratigraphical position and correlation of the different strata seen in the Corrieburn section. From these it will be seen that Dr. J. Young considered that they could not be correlated with the Campsie strata, and he inclines to favour the view that they should be placed on a lower horizon than the Campsie limestones. On the other hand, the officers of the Survey correctly identify the thick bed of limestone worked in the Corrieburn section as the equivalent of the Hurlet. In the Survey Memoir just issued this identification is corroborated, and further details are given regarding the correlation of the different beds exposed at Corrieburn. The reader is referred to the memoir for details; we only here give a summary of the views stated therein. We reprint from the memoir the following table, so as to add perspicuity to our remarks:—

	Feet.
Black Oily Shale, with <i>Lingula</i> , - - - - -	40
Limestone, with <i>Bellerophon</i> (HOSIE LIMESTONE) top of the Lower Limestone Group, - - - - -	2
Strata, with Thick Yellow Sandstone (Hosie Sandstone), - - -	—
Black Shale, with Septarian Ironstone Nodules, marine fossils near base, - - - - -	70
Limestone, partly Marine, with Encrinites, partly Dolomitic, Oolitic, with Entomostraca (BLACKHALL LIMESTONE), - - - - -	—
Strata—Black Shales and Sandstones, with Ironstone Band, - - -	150
HURLET LIME { Upper Hard Band, - - - - - Calmy Band, - - - - - Lower Hard Band, - - - - -	15
Large growth forms of Brachiopods and Mollusca. Base of the Carboniferous Limestone Series, - - - - -	
Strata, with thin Coal, - - - - -	—

CORAL LIMESTONE.

Strata passing down into volcanic detritus.

The officers of the Geological Survey point out that throughout the Campsie, Lennoxton, and Corrie area a definite succession of the following recognisable horizons has been established:—

- 6 Bellerophon Limestone (Hosie Limestone).
- 5 Yellow Sandstone (Mount Hulle and Hosie Sandstone).
- 4 Black Shales, with Septarian Nodules.
- 3 Blackhall Limestone.
- 2 Black Shales, with Sandstone, in Corrie district.
- 1 Hurlet Limestone.

After describing the limestones in the Campsie neighbourhood, it is remarked that the section of the Lower Limestone at

Corrie differs from those already described only in the beds that immediately underlie the Hurlet limestone, and this we are quite willing to corroborate. The Hurlet coal has dwindled down to a few inches at Corrie, but there can be no doubt as to the identity of the alum shale at Corrie with that at Campsie, as it holds exactly the same fauna. It is beyond the scope of the present paper to discuss in detail the correlation of the strata that lie below the Hurlet coal at Corrie with that of the Campsie district, and, though it is frankly admitted that at first inspection the strata seem to be totally different in the two areas, yet a closer examination convinces us that they are undoubtedly the equivalents of the limestones which lie immediately below the Hurlet coal as seen in other parts of Lanark, Renfrew, Dumbarton, and Ayrshire. This view seems to be confirmed by the presence of the thick band of coralline limestone, and by the presence at the base of the section of the well-defined band of *Naiadites crassa*.

Whatever doubt there may be as to the correlation of the beds below the Hurlet coal, there cannot be any regarding the beds that lie above it. The Hurlet limestone has indeed increased in a very short distance from 4 feet in thickness to 15 feet, but this is nothing exceptional. In the type locality at Hurlet we find a similar phenomenon taking place, for at the village of Hurlet the limestone averages about 4 feet in thickness, while at Nethercraigs, only 3 miles distant, it rises to some 30 feet in thickness, and there cannot, we think, be any reasonable doubt as to the identity of the limestones at the two localities. It is also quite clear that the limestone exposed in the bed of the western burn at the base of the great scar of shales and ironstone nodules is the Blackhall limestone, and identical with that seen in the same position further to the west in the Campsie district. Above the Blackhall limestone, separated from it by the black shales and Hosie sandstone, comes the Hosie limestone. It is exposed in the Corrieburn section in a small stream a little to the east of the Blackhall limestone. This limestone, which is in two beds, has sometimes been called the Bellerophon limestone, because it contains large numbers of a small species referable to that genus.

Above the Hosie limestone lies the bed of black shale con-

taining *Posidonomya corrugata* which it is the particular object of this paper to describe. The surface of the black shale is simply covered with the shells, which vary in size from 1 up to 6 inches in breadth. They have been preserved in iron pyrites, and their bright metallic lustre makes a striking contrast against the dark shale. So far as we have been able to observe, this is the only species which occurs in this particular bed.

We have already pointed out that we consider the occurrence of this bed to the north of Glasgow has an important bearing upon the question that has again been recently raised as to the position of the Hosie limestone in the East Kilbride district, and it is necessary that we should here briefly state the two views that have been held upon this matter by Mr. Neilson and the officers of the Geological Survey. As Mr. Neilson's views were enunciated about a year previous to those of the Survey, we may consider them first. His paper was read before the Society in December, 1872, and in it he deals with the section of Carboniferous Limestone near Busby, and describes the well-known Thornton, Thorntonhall, Braehead, and Phillips-hill Quarries.⁴ The following extract from his paper will best express his opinion as to the stratigraphical position of the strata seen in these quarries and his reason for assigning them that position:—"The highest shale in the section at the quarries contains many well-preserved fossils. When first we visited it, being under very favourable circumstances, many fine and rare specimens were found, among which may be mentioned nearly a dozen *Goniatites*, about the same number of *Leda longirostris* and *Nautilus subsulcatus*, besides specimens of *Eumorphalus tuberculatus* and others. On comparing the group of fossils with that of the list from the Hosie limestone series on the south Hill of Campsie given by Mr. John Young in his paper on 'The Geology of the Campsie District,' there can be no doubt that the beds are on the same geological horizon, many of the fossils being alike in both, and a large entomostracan (*Polycopse Youngiana*) being, so far as hitherto observed, confined to this same series of beds.

"The locality on the south Hill of Campsie was long a

⁴ *Trans. Geol. Soc. Glas.*, vol. iv., p. 123, "On some sections of Carboniferous Limestone near Busby.

favourite one with our local geologists, and in the admirable catalogue of carboniferous fossils of the West of Scotland by Messrs. Young and Armstrong it is mentioned with an expression of regret that the shale heaps are now obliterated, and directions are given to look for future pit sinkings along the south hill. At that time the authors did not expect it to appear about 15 miles to the southward.

"Many of the fossils in this shale are converted into iron pyrites, and have a very fine appearance, especially when first laid open. This change does not seem to have taken place indiscriminately or by chance, but according to species; some of the species seem to have had a peculiar affinity during fossilisation to this sulphuride, while with others it is wanting.

"The distance between the Hosie and main limestones at Campsie is about 22 fathoms, and at Carluke 19 fathoms, and from the fact that there are three or four ironstones wrought under the Hosie limestone at Campsie, we are of opinion that the missing strata here should be placed between the lowest ironstone and the three post limestones."

From this quotation, then, it will be seen that Mr. Neilson regards the top limestone seen in the Busby Quarries as the equivalent of the Hosie band of the Campsie district. This, of course, would necessitate the placing of all the limestones above it in the Upper Limestone series, including the Calderwood cement-stone group. In the "Carboniferous Fossils of the West of Scotland" the Calderwood cement-stone group is placed in the Upper Limestone Series. But in the "Catalogue of Western Scottish Fossils," published at a later date, it is curious to note that in no instance is the cement-stone group referred to a definite horizon. It seems as if the compilers of the catalogue were dubious as to whether they should be placed in the Upper Limestone Series, with Mr. Neilson, or in the Lower Limestone Series, with the officers of the Survey. In the memoir to Sheet 23, published in 1873,⁵ in the section dealing with the East Kilbride district, the Survey place the Busby Quarries group of limestones in the Lower Limestones of the Lower Limestone Series, and the cement-stone group in the Upper Limestones of the Lower Limestone Series, so that they differed from Mr.

⁵ *Mem. Geol. Surv.*, explanation of Sheet 23, p. 28, 1873.

Neilson as to whether the cement-stone group should be placed in the Upper or Lower Limestone Series. No attempt, however, is made by the Survey to correlate in detail the limestones of the East Kilbride district with those in other parts of the West of Scotland. But it is worthy of note that the cement-stone band of East Kilbride is correlated with the first Kingshaw bed of Carluke district. In the recent re-survey of the East Kilbride district a considerable advance was made, because it was found possible to correlate in detail the limestones of that area with those of the typical Hurlet locality. The limestones in the Busby Quarries were identified as the Blackbyre and Hurlet, the Hurlet corresponding to Mr. Neilson's Hosie; the Blackhall, with all its characteristic features, was found in its proper position; the Hairmyres was identified with the Hosie; while the cement band is considered as lying at the top of the Lower Limestone Series. It is the purpose of this paper to show that in the East Kilbride district there is a well-marked band of shale lying above the cement-stone full of *Posidonomya corrugata*, and that this band can be correlated with the *P. corrugata* band of the Kilsyth and Campsie districts, thus confirming the correlation made by the Survey officers.

POSIDONOMYA CORRUGATA, ETHER.

The earliest notice that we have of the occurrence of *P. corrugata* in the Carboniferous rocks of the west of Scotland is that made by Messrs. Young and Armstrong in their paper on "The Carboniferous Fossils of the West of Scotland."⁶ At page 45 it is referred to the genus *Anomia*, and is named *Anomia corrugata*, Etheridge MS. The following note is appended:—Rare. Upper Limestone, Boghead, in thin band of limestone contained in upper black shale, Linn limestone, Dalry. It is further noted, under the head of localities, that at Kirktonholm, near East Kilbride railway station, whole colonies of *Anomia corrugata* occur in a shale, along with *Leda attenuata* and a few other bivalves. In 1873 Mr. Etheridge, in an appendix to the memoir on Sheet 23,⁷ describes the specific characters of the shell, makes a number of observations

⁶ *Trans. Geol. Soc. Glas.*, Supplement to vol. iii., 1871.

⁷ *Mem. Geol. Sur.*, explanation of Sheet 23, p. 103.

upon it, and gives a list of localities where it has been found in Sheet 23. His description is as follows:—

“*Sp. Chars.*—Irregularly ovate, variable, compressed, occasionally assuming an oblique form, at times narrowed towards the beaks, and expanded towards the ventral margin; beaks in the ovate forms nearly central, in the oblique forms nearer the anterior end, sharp, prominent; anterior end rounded; posterior end somewhat truncated; the distinguishing character of the shell is the very irregular concentric corrugated wrinkles which cover the surface; in nearly all adult specimens these are supplemented by a variable number of strong, wrinkle-like ribs, which radiate from the beak to the ventral margin on the central portion of the shell only, leaving the anterior and posterior ends merely covered with the concentric markings; shell very thin.”

Mr. Etheridge says *P. corrugata* was highly gregarious, and at certain localities, in beds of the Lower Limestone Series, more especially those of the Calderwood cement-stone series around East Kilbride, very common. He gives seventeen localities where *P. corrugata* has been collected in the East Kilbride and Carluke districts, and all these, with but two exceptions, are from horizons either immediately above or below the Calderwood cement-stone.

Both *Posidonomya corrugata* and *P. becheri* appear to have favoured certain physical conditions when they were enabled to spread over large areas in great numbers. Thus Mr. R. G. Carruthers, of the Geological Survey, has recently discovered a band of *P. becheri* in Calder Glen, East Kilbride, below the main limestone associated with *Pterinopecten papyraceus*. Since this paper was written we have also found the same shell in considerable numbers in the shale overlying the Blackhall limestone of the Campsie district, this being the band whose stratigraphical position in the Campsie and East Kilbride districts has been already discussed.

THE POSIDONOMYA CORRUGATA BED IN THE CAMPSIE AND KILSYTH DISTRICT.

Though we have only recently noted the occurrence of the *P. corrugata* band at Corrieburn, yet its existence on a certain

definite horizon in the Campsie and Kilsyth district has long been known, as will be seen from the foregoing part of this paper. Previous to the recent revision of the Campsie area, the succession of the Lower Limestone Series to the north of Glasgow was not very well understood, the true Hosie limestone at the top of the Lower Limestone series being often mixed up with the Blackhall limestone, which lies upon a lower horizon, and whose lithological and palæontological characters are quite different from those of the Hosie limestone. The Hosie limestone to the north of Glasgow is in two bands which come close together. The lower, which is about a foot thick, is similar to the upper, which is a hard grey limestone, and full of the remains of a small *Bellerophon*. So far as we are aware, the true Hosie limestone does not appear in the South Hill of Campsie, the highest strata seen on that hill being the Hosie sandstones, which lie immediately below the Hosie limestone. The limestone which is named the Hosie limestone by Dr. Young in his "Geology of the Campsie District"⁸ in the journal of bore passed through in sinking a pit near the summit level of the South Hill, and called the Black or Hosie limestone, is not the Hosie limestone proper, but the Blackhall limestone. This is of considerable importance, as it was clearly from the Blackhall limestone horizon that Dr. Young obtained the assemblage of fossils of which he gives a list in the "Catalogue of Western Scottish Fossils." It was upon the supposed similarity of this fauna with that found in the Upper Shales of the Thorntonhall Quarries that Mr. Neilson identified the top limestone of these quarries with the Hosie limestone. An examination of the fossil lists from various localities in the Carlisle and East Kilbride district, however, reveals the fact that the species cited by Dr. Young as being among the more typical forms from the South Hill, Campsie, also occur on a horizon immediately above the Calderwood cement-stone group, so that they cannot be claimed as peculiar to the Blackhall limestone horizon. But this matter will be further referred to when we come to consider the East Kilbride district. It now remains for us to show that the *P. corrugata* band to the north of Glasgow occupies a well-defined and constant position above

⁸ *Trans. Geol. Soc. Glas.*, vol. i., third edition, p. 61.

the top Hosie or Bellerophon limestone, and thus marks the upper limit of the Lower Limestone Series. Beginning at the most easterly exposure, we find that *P. corrugata* has been recorded from the river Carron, above Mill, $1\frac{1}{4}$ miles west of Denny. We have not been able to identify the exact position of this locality, but as it is recorded in Explanation to Sheet 31 as being in the shales and nodules above the Hosie limestone, we have no doubt that it occupies the same geological horizon as those about to be described. The next locality is in the burn below Drumressie, $2\frac{1}{4}$ miles east-north-east of Kilsyth. At this point the exposure is somewhat obscure, but specimens in a somewhat badly preserved condition have been collected by us. There seems, however, to be no doubt that here again *P. corrugata* occurs in the shales overlying the Hosie limestone. About a mile further to the west, at Brockieside, the band has been found on exactly the same stratigraphical position. So far as we are at present aware, the most westerly exposure of this band to the north of Glasgow is that to be seen in the Shields Burn, about a mile to the north of the Milton of Campsie. The stratigraphical succession from the thin, sandy, encrinital band, about 10 fathoms above the Hurlet limestone, up to the Hosie limestones is exceedingly well displayed in this burn, and in the shales above the Hosie limestones the *P. corrugata* band, though much weathered, has been distinctly traced. The band has much the same appearance here as that seen at Corrie-burn, but, as has been observed, the shells are in a much less perfect condition of preservation. The pyrites in which they are preserved has been altered, and the bedding planes of the shales have been coated with fine secondary crystals of gypsum.

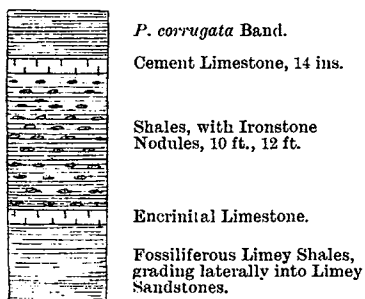
In the neighbourhood of Lennoxtown *P. corrugata* has been recorded from quite a number of localities, both on the north and south Hills of Campsie. But at these localities the shell is found at a much lower stratigraphical position than those which have already been described. Specimens of *P. corrugata* are recorded by the Survey as having been found in a "burn passing Benclouch Mill, above wall forming limit of cultivated ground N.E. of Lennoxtown." We are unable to identify this locality, but it seems most likely that the shell was here

found in the alum shale below the Hurlet limestone. We have been able to prove that *P. corrugata* occurs in the alum shale below the Hurlet limestone both at Boyd's Burn Mine and in Glen Wynne, on the South Hill. At the former locality it was found in the alum shale put out with the lime. At the latter there is a very clear section from the alum shale to the base of the Craigenglen series, showing what we believe to be the representatives of the Hollybush, Blackbyre, and Baldernock limestones. *P. corrugata* makes its appearance for the first time in the alum shale along with the characteristic fauna of that horizon.

THE POSIDONOMYA CORRUGATA BAND IN THE EAST KILBRIDE AND
CARLUKE DISTRICTS.

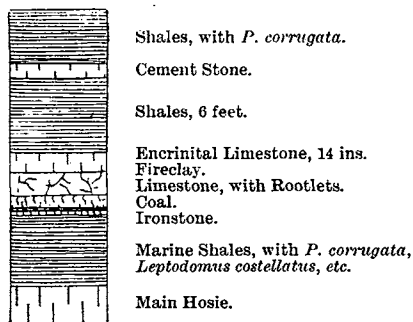
We now pass to a consideration of the occurrence of this band in the East Kilbride and Carluke districts. We have already in this paper pointed out the different interpretations that have been advanced of the succession of the Carboniferous Limestones by Mr. Neilson and the officers of the Geological Survey, and we must frankly state that, so far as our own observations have gone, they completely confirm the general conclusions of the Survey. On evidence which need not here be discussed, we believe that the strata seen in the Thorntonhall Quarries range from the Hurlet limestone at the top to the base of the Blackbyre limestone. Fairly continuous sections from the Hurlet limestone to the *P. corrugata* band are shown in the Kittoch Water and in Calderwood Glen, and these will be briefly described for the purpose of fixing the position of the *P. corrugata* band. Beginning at the main post limestones on the Kittoch Water, where it is exposed at the waterfall near Arrotshole, we have above the main post the Hurlet limestone, the succession being practically the same as that seen in the Thorntonhall Quarries. About 100 yards further up the stream is crossed by the Blackhall limestone, and above this comes a series of shales and thin ironstones. The stream now winds through a plantation, and on its left bank are seen shales, with occasional courses of grit and bands of clay ironstone, which pass upwards into a calcareous grit, which marks the position of the main Hosie limestone. Crossing the East Kilbride Road,

we find the Calderwood cement-stone series exposed in the burn, and in a few small sections that are still seen at the Burnbrae Quarries. The section is as follows:—



Section of Calderwood Cement Group as seen at
Burnbrae (Kirktonholm), near East Kilbride.

An equally clear section is exposed in Calderwood Glen. About 350 yards below Calderwood Castle the Hurlet limestone is succeeded by the Blackhall limestone, which passes upwards into a series of shales, with bands of ironstone (the Crossbasket ironstones). Near the castle these are succeeded by a thick group of sandstones and shales, which dip up the stream at a low angle, and are succeeded above the waterfall by the main Hosie limestone. The Hosie limestone appears at the base of the section near the level of the stream, and in the cliff above it there is a fine section of the Calderwood cement series, as shown in the following diagram.



Section of Calderwood Cement Stone Series
as seen in Calderwood Glen.

The Calderwood cement-stone has been worked at the following localities:—Calderside, Binnie's Holm, Brankumhall, Capelrig, Black Braes, Limekilns, Stuartfield, Kirktonholm, and Burnbrae, and in these and in numerous natural sections, wherever the cement-stone is exposed, it is invariably accompanied by the *P. corrugata* band, which in this district marks a well-defined horizon.

The *P. corrugata* band has also been traced at several localities in the Carluke district at what we consider to be close upon the same horizon as it is found in the districts of Campsie and East Kilbride. In the Explanation to Sheet 23 it was pointed out by the Survey that the East Kilbride cement-stone is the equivalent of the Calmy limestone that overlies the first Kingshaw bed of Carluke District, and both the Lingula limestone and the shale that underlie it are rich in *P. corrugata*. Specimens have been collected from this horizon at the following localities:—Fiddler's Burn, about $1\frac{1}{4}$ miles east-south-east of Carluke, in the shale below the Raesgill Ironstone, and at Hallcraig Bridge, on the left bank of Jock's Burn, about 1 mile west of Carluke, in the shale between the first Kingshaw lime and the Lingula lime.

SUMMARY OF CONCLUSIONS.

(1) That immediately above the top Hosie of Corrieburn and the Campsie district generally, and that in the Denny, Kilsyth, East Kilbride, and Strathaven districts in relationship to the limestones referred to there can be traced a bed of black or grey shale characterised by the great abundance of *Posidonomya corrugata*, Ether.

(2) That both the stratigraphical and other palæontological evidence shows that this bed of *Posidonomya corrugata* marks the position in all these districts of the top Hosie limestone of the Campsie district.

(3) That the characteristic fauna discovered by John Young in the shales above the Blackhall limestone of the South Hill of Campsie also occurs above the Hurlet of Thorntonhall and the Calderwood cement-stone series of East Kilbride. But it seems likely that this fauna is limited to the Lower Limestone Series, and does not pass into the Upper Limestone.

(4) That the aforementioned fauna is associated with species that range from the top to the bottom of the Limestone Series.

(5) That *Posidonomya corrugata* is a comparatively rare shell on other horizons than that immediately above the top Hosie.

(6) That both the palæontological and stratigraphical evidence confirms the correlation made forty years ago by the Geological Survey between the strata seen to the south and north of the Clyde, and which has recently been established in still fuller detail in the "Geology of the Glasgow District."