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ST NINIANS.

SCHOOL BOARD.—On Friday forenoon the usual monthly meeting of the School Board for the parish was held in the office of the Clerk (Mr J. L. Philp, Stirling)—Major Wilson presiding. There were also present—Messrs D. G. MacNaughton, M. Nimmo, and J. T. S. Paterson. *The Board's Loans.*—The Clerk intimated a letter from the accountant to the Board, requesting particulars of a loan of £1000 from Mrs Law, and to know what arrangements had been made by the Board for its repayment. He also submitted a statement showing the probable income and expenditure to Whitsunday next, giving a probable credit at that term of £550, and he was instructed to reply that the Board hoped to be able to pay off a portion of the loan at Whitsunday next. A letter was also read from the Secretary to the Public Works Loan Board, intimating that £30 would be due in repayment of loan and interest on 7th November, and that £140 would be due on 20th November next. *Officer's Report.*—The officer's monthly report was read, and showed the attendance to be good. The application of the teacher at East Plean for repairs to school window blinds, and for two new door handles was granted. *Probable Expenditure for the Month.*—The probable expenditure for the month was stated at £355, and the chairman and treasurer were authorised to sign a cheque for £360. *Defaulters.*—Mrs Somerville, a defaulter, appeared at the meeting, and on her undertaking to send her children to school regularly in future, she was dismissed. Another defaulter, Mrs Aitken, Roadside, Bannockburn, failed to appear, and she was ordered to be prosecuted.

DOUNE.

DISTRIBUTION OF GAME.—The Earl of Moray arrived at Doune Lodge last Thursday, and on Friday and following days all the game which had been shot during the week was distributed amongst the farmers, feuars, and crofters of the barony, and the workmen on the estate. On this, as on former occasions, the poor of the neighbourhood were not forgotten. His lordship's visit has given great pleasure to the people of the district.

ESTATE IMPROVEMENT.—Mr Hugh Campbell, Doune, has been entrusted with the erection of a fence, above a mile and a half in length, for enclosing the farm lands of Netherton of Argaty, of which Mrs Hume is proprietrix. The structure will consist of 3 feet 6 inches of stone work, coped with stout iron standards for the support of two lines of strong wire fence. The iron gates at the entrances to fields are substantial, and are carefully balanced.

IRISH POLITICAL MEETING.—A political meeting of the Irishmen of this district was held in the Union Hall here on Tuesday evening, between eight and nine o'clock. The following gentlemen of the party were present among others:—Mr John Corbert, chairman; and Messrs Joseph Walsh, James Connelly, John Connelly, Andrew Chrystal, John Pigot, John Manion, William Jackson, Mike Scuffie, John M'Leod, Michael Joyce, Mike Madden, John Adam. The meeting was called to consider Mr Parnell's programme, which it was unanimously resolved to support.

ARDOCH.

THE WEATHER.—The weather has been very good here of late, and very suitable for the storing of turnips.

THE MARKETS.—Cattle and sheep still command extremely low prices, and most unremunerative to graziers.

The School Board of Ardoch met on Friday last—Mr David Ballingall, Blair Drummond, in the chair. The other members present were—Rev. G. M'Naughton, Braco; Messrs John Finlayson, Harperstone; John Stirling, Netherton; and John Duncan, Topfold. The business before the meeting was the appointing of a teacher for the East Public School, Braco, and after an examination of the certificates of the candidates, who were very numerous, it was agreed by a majority of the Board to give the situation to Miss Jessie Walker, daughter of Sergt. Walker, drill instructor to the Dunblane volunteers.

KILLEARN.

YOUNG MEN'S GUILD.—On Saturday, 7th inst., the members of the above association held their usual fortnightly meeting in the old Session-house—Mr Malcolm Sinclair, president, in the chair. The evening was devoted to songs and readings, which were very ably given by the following gentlemen:—Messrs James Houston, John Sinclair, Wm. Gil-

FALKIRK v. LENZIE.—At Brockville Park, and resulted in favour of Falkirk by five goals to one. The home team lost the toss, and had to play up hill. In the first half the game was pretty even, each side scoring one goal. Falkirk put on the pressure in the second half, and added other four goals to their score, while the Lenzie score stood unaltered. For the losers, Broadfoot in goal, Walker, and Tod played best, while the winners all round showed good form.

DUNFERMLINE v. KINGSEAT.—At Lady's Mill, Dunfermline, and ended in a win for the Dunfermline team by one goal to nothing.

DUNBLANE v. DRUMPELLIER.—At Coatbridge, before a large turn-out of spectators, and resulted in a draw, each team scoring one goal. The Dunblane team scored another goal, but the referee decided no goal, as time had been previously called.

2D DUNBLANE v. 2D DRUMPELLIER.—At Dunblane. The home team won easily by eleven goals to one.

Correspondence.

(To the Editor of the Stirling Journal and Advertiser.)

SIR,—May I be permitted to draw your attention as well as that of your readers to an error which has crept into your report of the proceedings at the last meeting of the Stirling Burgh School Board. The *Stirling Journal* says—"The Chairman read a letter from Mr Neustadt, master of modern congnages, asking the board to allow him to spend the sum of £36 12s, (*sic*) for examination papers and other stationery," now, I would scarcely venture to ask the Board for such a large sum. All I want is £3 12s per annum for printing of examination papers, for which I have hitherto paid all expenses out of my own pocket.—I am, &c.

EUGEN NEUSTADT.

High School,
 Stirling, Nov. 11th 1885.

SIR WM. STIRLING MAXWELL AND SIR D. CURRIE—A CONTRAST.

SIR,—As you are no doubt aware, we were honoured in this quarter on the 5th inst. with a visit from Sir Donald Currie, in prosecution of his canvass for re-election as a member of Parliament for the Western Division of the county of Perth. Mr Buchanan, younger of Leny, occupied the chair. After Sir Donald had finished his speech, which was largely interspersed with references to Colonel Moray and the Tories, for their shortcomings and general stupidity, which many present considered as in bad taste and too personal, questions were invited by the chairman, and a number were handed up, including one from the undersigned who asked the following question:—"Will Sir Donald explain how he has attended so few divisions in Parliament during the last four sessions?" Sir Donald amid much laughter exhibited the bill circulated in the district (as he alleged) by the Tories, as to his attendances at divisions in the House of Commons, and said he was prepared for it, as he was always asked this terrible question. He then, amid much laughter, repeated the answer he had given at Dunblane and Doune, and said that if Colonel Moray had been away at the two divisions when he voted against the Franchise Bills in 1878-1879 it would have been a good thing for Perthshire. Now what in the name of wonder has Colonel Moray had to do with Sir Donald's negligence and shortcomings? The above is an evasive answer of the purest water. Now behold the contrast. In the month of November, 1868, the late Sir William Stirling-Maxwell came through the county seeking re-election. The undersigned was staying at Killin at the time, and had never before seen Sir William. After the address, questions were invited, as in the present case, so the undersigned put one or two *viva voce* to the honourable baronet, who answered in a similar manner. As the party were retiring, Sir William came up to the undersigned, and taking him by the hand, expressed the hope that his answers were satisfactory. "Perfectly," was the reply. Now, this was the mode that Sir William acted towards strangers who took the liberty of putting a question to him. He was uniformly a gentleman. Now, mark the contrast between the two gentlemen in manner. Sir William was renowned for his social culture and literary eminence, but Sir Donald appears to be never right except when he is storming, and sneering, and jeering. His varied accomplishments would not be difficult to gauge. Apologising for occupying so much of your valuable space.—I am, &c.

M. COLQUHOUN.

Callander, 11th Nov., 1885.

MR BOLTON AT BRIDGE OF ALLAN.

SIR,—I take the liberty of addressing you on the subject of Mr Bolton's meeting, which took place here on Saturday last. Mr Bolton came here as a candidate seeking the suffrages of the electors of a not unimportant part of the county, but to what extent he will be successful, I am not inclined to predict. It is needless to state—and Mr Bolton well knows—that the church question is one which is engaging the earnest attention of the whole

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fillan, John Malcolm, John Houston, Wm. Houston, Alex. Munro, John M'Intyre, Wm. M'Donald, and Malcolm Sinclair. A most enjoyable evening was spent, and a hearty vote of thanks having been given, the meeting was brought to a close by the members singing "Auld Lang Syne."

D E N N Y .

BREACH OF THE PEACE.—John Burnett, a slater, residing in Denny, was charged at the Stirling County Court—before Sheriff Buntine—with having on the 18th ult., committed a breach of the peace in Dunipace, by conducting himself in a noisy and disorderly manner. He pled guilty, and was fined 7s 6d, with the alternative of seven days' imprisonment.

K I L S Y T H .

BREACH OF THE PEACE.—Thomas Stark and Jas. Anderson, miners, residing at Kilsyth, were charged before Sheriff Buntine, at Stirling, on the 6th inst., with committing a breach of the peace in Main Street, Kilsyth. They pled guilty, and were fined—Stark 10s, and Anderson 7s 6d, with the option of seven days in prison.

C A M P S I E .

ASSAULT.—John Houston, a confectioner, residing at Lennoxton was charged at the Stirling County Court—before Sheriff Buntine—with assaulting Robert Crooks, a labourer, residing there, by striking him several blows on the face and kicking him on the ground. He pled guilty and was fined 10s, with the option of 7 days' imprisonment.

T O R R A N C E O F C A M P S I E .

AN OBSTREPEROUS SQUAD.—Joseph Ferns and James Ferns, labourers, John M'Cormick, Hugh M'Cormick, Francis M'Cormick, John Devine, miners, and Mary Butler or Smith, all residing at Campsie, were charged yesterday in the Stirling County Court—before Sheriff Buntine—with committing a breach of the peace on the 25th ult., at Torrance of Campsie. They pled guilty, and were each fined 7s 6d, with the option of seven days' incarceration.

T W E C H A R .

BREACH OF THE PEACE.—James Clark, a labourer, John Clark, a boatman, William M'Anlay, and Wm. Martin, both miners, residing at Twechar, near Kirkintilloch, were brought up at the Stirling County Court—before Sheriff Buntine—charged with a breach of the peace, committed in the Main Street, Kilsyth, on the 24th ult. They pled guilty, and were fined 7s 6d each.

Sporting News.

F O O T B A L L .

VALE OF BANNOCKBURN v. STIRLING OLYMPIC.—Played at Bannockburn. Olympic, 2 goals; Vale 1.

KIRKINTILLOCH ATHLETICS v. LIVINGSTONE.—On ground of Livingstone. Athletics won by four goals to none.

2ND KIRKINTILLOCH ATHLETICS v. 2ND LIVINGSTONE.—At Kirkintilloch. The Athletics won by three goals to none.

KILSYTH RANGERS v. LENNOXTOWN THISTLE.—Played on ground of former, and resulted in favour of the Thistle by six goals to one.

2ND LINTHOUSE v. 2ND ALPHA (MOTHERWELL).—At Govan, on ground of former. Linthouse won by three goals to none.

2D KING'S PARK v. 2D ALLOA ATHLETICS.—Played at Gowanbank. The visitors in the first half had it all their own way, scoring seven goals without losing a point. On change of ends the Athletic scored other two, but one of them was disallowed. King's Park now scored their only goal, and the game was soon after stopped, leaving the Athletic victors by eight goals to one.

VALE OF FORTH (ALLOA) v. SEAVIEW (FALKIRK).—Vale won by eleven goals to none.

CLYDE v. CAMPSIE.—At Barrowfield Park, before about 800 spectators, and resulted in an easy win for the Clyde by nine goals to one. The Clyde tried two second-eleven players, Young and Twaddle, both showing fair form. M'Lachlan got his eye hurt, and had to retire about half-hour before time. Campsie were not fully represented, two of their best men being away assisting the Thistle at Dundee.

POLLOKSHAW v. EAST STIRLINGS SHIRE.—At Pollokshaws before a fair turn-out of spectators. The visitors kicked off with the ground in their favour, and pressed the home team for a little, but the Pollokshaws men breaking away the game became very fast, and it was not until nearly half-time that the strangers scored their first and only goal. The second half was, if anything, in favour of the home team, who were often at the strangers' goal, but; owing to the good defence, they were unable to score. Thus the fastest and pleasantest game played at Broom Park this season ended in favour of the strangers by one goal to nothing.

electorate, but Mr Bolton, in his speech, did not make the slightest reference to it, and, had he not been heckled on the question, it never would have been referred to at all. Mr Bolton was asked the question, whether or not, in the event of his re-election, he would support the resolution of which notice had been given by Dr Cameron, to the effect that disestablishment of the Church should take place forthwith, and a simple and unqualified answer was requested, but it was not given. Mr Bolton, because he had not seen the resolution (the nature and purpose of which was indicated in the question) declined to say how he would treat it. Various other questions were asked, another on Disestablishment, and one affecting the amendment of the Ground Game Act of 1880 (which did not receive the consideration it deserved from the chairman), but they were either from indecision or intention—I assume the latter—shuffled in a similar manner. Mr Bolton explains his omission of any reference to Disestablishment by the fact that he discussed it fully, and expressed his opinion upon the question during his candidature of 1880. But has the efflux of time not brought a change, and a change of an important nature? Has the electorate not been increased by the recent Franchise Act, and did the new voters give the same attention to matters political in 1880—when they had no vote, as they do now—when they have one, and are about to exercise it? Surely these new voters, and as a matter of right the old ones also, are entitled to a fair and frank statement of the views of the candidate on this as on other, perhaps less important, questions. Since ever I have had the privilege of being a voter, I have accorded my support to the Liberal party, although the recent innovations which have been made upon the principles of what I consider Liberalism have to a certain extent shaken my confidence in the party. In view, however, of the position taken up by Mr Bolton on Saturday I have determined, so far as this election is concerned, to transfer my vote and influence to the other side. I went to the meeting in the expectation of getting a clear and decided statement of Mr Bolton's views and intentions; I was disappointed, and I left it

A DISGUSTED LIBERAL.

Bridge of Allan, 10th Nov., 1885.

Scottish Bankrupts.

ROBERT DUNN, farmer, Burdiehouse Mains, near Loanhead.

JAMES YATES SIMPSON, sometime writer in Largs, presently residing at 11, Broomhill Avenue, Partick.

WM. ALEXANDER FRASER, engineer, 129, West Campbell Street, Glasgow.

JAMES M'GHEE, draper, Bonhill, Dumbartonshire.

LEWIS DUNBAR, pavement merchant, residing in Thurso, Caithness.

JAMES H. THOMSON, farmer, Gilchrist and Knocknaha, near Campbeltown.

Births, Marriages, and Deaths.

B I R T H S .

At Barnhill, Dumbartonshire, on the 9th inst., the wife of ROBERT EMSALL FINDLAY, of Boturich, Dumbartonshire, of a daughter.

At 59, Hamilton Drive, Glasgow, on the 9th inst., the wife of the Rev. BUCHANAN BLAKE, B.D., late of Bombay, of a daughter.

At 3, Middle Craigs, Stirling, on the 10th inst., the wife of THOMAS OSWALD, compositor, of a son.

At the School-House, Ruskie, Port-of-Monteith, on the 8th inst., the wife of JAMES HOLM-KENNEDY of a son.

M A R R I A G E S .

At Myrtle Park, on the 3d inst., by the Rev. J. C. Stewart, LL.D., of St Bernard's Parish Church, JAMES BELL, steward, to CHARLOTTE BROWN KERR, late of Aberfoyle.—New Zealand and Australian papers, please copy.

At St Columba's Episcopal Church, Edinburgh, on the 10th inst., by the Rev. Dr Dowden, assisted by the Rev. C. E. Bowden, WILLIAM SOMERSET CLARK SHAW, stockbroker, Edinburgh, eldest son of the late Rev. W. G. SHAW, St John's Episcopal Church, Forfar, to HELEN, eldest daughter of H. W. Cornillon, Solicitor Supreme Courts.

D E A T H S .

At the Free Church Manse, Larbert, on the 8th inst., MAGGIE, youngest daughter of Rev. Finlay Macpherson. Friends will please accept of this intimation.

At Rumbling Bridge Hotel, on the 5th inst., DUNCAN MACARA, in his seventy-eighth year.

At Morrison's Croft, Port of Monteith, on the 9th inst., JOHN STEWART ANDERSON, youngest son of James Anderson. Friends omitted will please accept of this intimation. (American papers please copy).

At Douglas Hotel, Stirling, on the 8th inst., aged 17 years, ROBERT, eldest son of Robert Grindlay; deeply regretted.—Friends omitted, please accept of this intimation.

STIRLING NATURAL HISTORY AND
ARCHÆOLOGICAL SOCIETY.

The following paper was read by Mr R. Kidston, F.G.S., at the November meeting of the above Society:—

NOTES ON FOSSIL SPORES FROM THE COAL MEASURES,
KELLYBURN, NEAR DOLLAR, PERTSHIRE

Spores subserv the same purpose to the Cryptogamic or Flowerless Plants that seeds do to the Phanerogamic or Flowering Plants, namely, the reproduction of the species. Seeds are of very complex structure and contain an embryo or young plant. Spores on the other hand are usually little globular or elliptical bodies, though they occasionally assume other forms, consisting of a single cell, generally enveloped by a wall composed of two coats, the outer or *exosporium* being often ornamented with spines or ridges, has a great variety of surface ornamentation, which causes them to form beautiful objects for the microscope. Many plants, as Ferns, Lycopods, &c., develop their spores by free cell formation, in others, as in Algae and Mosses, the spores result from a sexual process—hence the word *spore* in its fullest sense has a very wide application. The spores brought before you this evening are all Lycopodiaceous, and therefore developed by free cell formation. In the *Lycopodiaceae* are included several well marked genera and of these three are British—*Lycopodium*, *Selaginella*, and *Isotria*. They are all found in this neighbourhood, the two former are terrestrial, the last mentioned, terrestrial or aquatic, but only the aquatic species are found in Scotland. In *Lycopodium* the spores are of one kind and are borne in *sporangia* situated at the base of the stem leaves or in terminal cones. In *Selaginella* the spores are of two kinds—*microspores* and *macrospores* borne in terminal cones. The *macrospores*, almost invariably four in number, enclosed in a *sporangium*, are usually situated in the lower part of its cone; the *microspores*, generally very numerous, occupy *sporangia* on the bracts of its upper portion. In all these cases the spores are developed in groups of four, having at their upper surface, where the four spores press upon each other, a triradiate ridge, at which part the spore splits in germination for the protrusion of the young plant (called the *prothallium*) which arises from the spore. The development of *Lycopodium* is but imperfectly understood. In *Selaginella* the *microspores* (or small spores) produce the male organs (*antheridia*) and the *macrospores* (or large spores) the female (*archegonia*), the fertilization of the latter producing a plant similar to that which bore the spore. There is here an example of that mode of reproduction which has been distinguished as “alternation of generation”—that is to say, between the parent Lycopod and the young seedling Lycopod, there is interposed a growth—the *prothallium*—which in form and structure differs much from the plant that gave it birth, but which is designed to bear the male and female organs by which the parent species is perpetuated. The occurrence of spores in coal has been familiar to botanists for many years. In 1833, Witham, while describing the microscopic structure of the coal to prove its vegetable origin, figures in his now classic work on the “Internal Structure of Fossil Vegetables found in the Carboniferous and Oolitic Deposits of Great Britain,” several sections of coals from different localities. On pl. xi., fig. 4-5, is given a transverse and longitudinal section of “some species of Cannel Coal from Lancashire,” where Mr Witham says, “I have certainly found decided traces of organization.” (l. c., p. 50.) “The appearances, however, are so undecided, that, although I should be inclined to consider them indicative of a Monocotyledonous plant, I shall not venture upon any conjecture respecting them.” What Mr Witham here mistakes for the vessels of a monocotyledonous wood, are numerous spores. This is as far as I am aware, the first figure or note of the occurrence of spores in the fossil condition, though Mr Witham at the time mistook their true nature. Notwithstanding the interest of this field of investigation thus opened up, little seems to have been done in the microscopical study of coal plants for some years afterwards. In Silliman’s *Journal* for Nov., 1847, Mr S. E. Tschermacher calls attention to his discovery of small seeds, with apparently spinous appendages, in coal, but his description of them is too insufficient to decide whether his small fossils are spores or really small seeds allied to *Cardiocranus*. Of late years many allusions have been made to the occurrence of spores (usually erroneously called *sporangia*) in coal, and at one time a very warm discussion took place, as to the share they took in its formation, but in all these cases, they were only examined as found in the coal by sections of it being cut and prepared as transparent objects for microscopical examination. By this means only a very imperfect knowledge of the form and varieties of the individual spores was arrived at, and even when examined as opaque objects on clean fractured surfaces of the coal containing them, there is only obtained a very imperfect idea of their structure, hence the discovery of a means by which spores could be isolated from the matrix and

from each other by the structure of the leaf-scar and the vascular impressions, but it is here unnecessary to enter more fully into these distinctions. (See *Annals and Mag. Nat. Hist.*, vol. xvi., pp. 173-4, 1885.) As far back as 1840, Prof. Morris (*Trans. Geol. Soc.*, Lond., 2 Ser., vol. v., Pl. xxxviii.), described a *Lepidodendron* cone in which the spores were seen; these were mamillate and similar to some shown this evening. Among the Sigillarian spores are some with smooth exterior, and some whose outer surface is also mamillate. These were first figured by Goldenberg in 1855 (*Flora sarapontana fossilis*, Pis. B. fig. 18-25; IV, fig. 3; X. fig. 1-2), but more fully by Zeiller in 1884, as already mentioned. Several Generic names have been applied to fossil spores. In 1868 Sir John Wm. Dawson described two species in his *Acadian Geology* under the name of *Sporangites*, his two species being *S. papillata* and *S. glabra*. Professor Williamson has also figured and described some very interesting forms under the names of “Macrospores,” *Traquaria*, *Zygosporites* (see his *Memoirs on the Organization of Fossil Plants from the Coal Measures*; Phil. Trans., part ix., 1878; part x., 1880; part xii., 1883); but with our present amount of knowledge of these reproductive bodies, a satisfactory classification is impossible, most of them probably being the spores of plants with which we are familiar in other conditions. Dr Remisch, in a valuable and interesting work on this subject, where he illustrates some hundreds of spores, proposes to include under the name of *Triletes* all those which are provided with a triradiate ridge. This arrangement is altogether provisional, but for the sake of convenience is adopted here (see *Reinsch. Micro-Paleo-Phytologia Formationis Carbonifere*, vols. i., ii.: Erlangen, 1884). From characters derived from the marking on the outer surface of the spore, they can be conveniently placed in the following minor groups:—*Triletes*—(a.) Outer surface smooth. This is a common form, and is probably referable to *Sigillaria*, as some very similar spores have been described as occurring in the cones of that genus. (b.) Outer surface covered with papillae. Of spores whose surface is covered with papillae, several marked forms occur. On one, the papillae are numerous, and about four times their breadth in length. The second form has larger and broader papillae. The third and fourth varieties have very short pyramidal spines, and differ chiefly from each other in the size of the spores. In all these, the surface on which the triradiate ridge occurs has the papillae much smaller, except at the periphery, where they are of normal size, but decrease as we approach the triradiate ridge, in which neighbourhood they appear as little dots. (c.) Outer surface covered with bristles. This form is rare. The whole of the non-triradiate surface is covered with irregularly scattered bristle-like hairs. (d.) Body of spore smooth, but surrounded by an equatorial band of appendages. Two distinct forms of these spores are found at Kelly Bank. The first has the equatorial band formed of flattened hair-like appendages, which are occasionally bifid and trifid at their extremities. When viewed by transmitted light, the appendages have a beautiful amber colour. The second variety has a solid equatorial band, which in structure appears as if composed of a number of hair-like segments, which had become confluent. These last two varieties are not uncommon. These *macrospores* average from 1.80 mm. to 1.30 mm. in diameter, but little variation in size takes place among the individuals of a given species. In addition to the above, several other small organisms were collected, including *microspores*, which are perhaps Lycopodiaceous, and some small spores which may belong to ferns. To these must be added some nondescript individuals, whose true nature we have not yet succeeded in deciphering. Before concluding this subject, we must briefly refer to the economic value of spores. The spores of recent Lycopods are of little value, but from their highly inflammable nature, a quality arising from the great porportion of resinous matter which enters into their composition, they were formerly used for producing lightning in theatrical performances, but electricity has in great measure superseded them for such a purpose. They were also used to roll pills in, as their resinous composition was not easily wetted by the saliva, and so prevented the nauseous flavour of the drug from reaching the sensitive papillae of the tongue. To fossil spores, however, a much higher place must be assigned. Professor Huxley, in his paper “On the Formation of Coal,” published in the *Contemporary Review* of 1870, ascribes to them a place of the first importance in the formation of coal, and though some coals are composed in great part of spores, still such occurrences are the exception, not the rule. That this is so has been shown by Sir John W. Dawson in his memoir “On Spore Cases in Coal” (*Annals and Mag. Nat. Hist.*, vol. vii. p. 321, 1871), which may be regarded as a reply to the conclusions arrived at by Professor Huxley. From my own experience, when spores occur in any great quantity in coal, they are usually restricted to narrow bands, an inch or an inch or two in thickness, and though some spores may probably be distributed throughout the entire coal seam, still the proportion taken by them in the formation of coal generally, (excepting the bands already referred to), seems very small when compared with the other vegetable remains

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examined by the microscope individually, at once gave fuller opportunity for their examination, resulting in the discovery of many different kinds and varieties of spores from the carboniferous formation alone. It may be interesting here to mention the circumstances that led to the discovery of a very simple means by which these minute fossils can easily be isolated for microscopical examination. This discovery is due to Mr James Bennie, one of the staff of the Geological Survey of Scotland. So far back as 1869, while washing some boulder clay from Abercorn clay-field, Portobello, with the object of ascertaining, if it was as rich in *Foraminifera* as the glacial clays of Paisley and Glasgow, he found in a layer of sand, lying between two beds of clay, about 14 feet below the present surface, a number of small spores; these he subsequently recognised as similar to spores that form a band in the splint coal worked at Whitehill Colliery, near Rosewell, Midlothian—the identification of the Portobello spores with those occurring in the coal at Whitehill was, however, only made in 1883, when Mr Bennie discovered that he could isolate the spores from their matrix and, like many other discoveries, it was found out accidentally. Having heard from Mr Kirkby, Windygates, Fife, of there being great numbers of small organisms in the first two inches of shale above the "Encrinite Bed" at Pittenween, he visited that locality to collect some specimens of the shale, and as the coal on which the shale lay was much weathered, portions of it adhered to the shale. These specimens were thoroughly dried and subsequent steeping or boiling in water reduced them to a mud, which, when washed, left a fine sediment behind. While examining the residue thus obtained, it was discovered that it contained numerous spores in a fine state of preservation. This led to the collection of a number of samples of such material from different localities, which almost always were found to contain spores. It is perhaps best that I quote a paragraph from a letter from Mr Bennie, which gives the general results of his investigations in this branch of fossil botany:—

"Following up the clue thus by circumstances placed in my hands, I tried all the likely fireclays and coals exposed in the cutting of the New Edinburgh Suburban Railway, Niddrie, (Millstone Grit) and found spores in all of them in a lesser or greater degree. I next tried coals and shales of the same rocks by the shore at Joppa with a like result, then the coals and shales of the same period on the opposite Fife coast at Dysart, with similar results. Next the poor coals and shales of the Calciferous Sandstones, below the Carboniferous Limestone Series and the richer coals and shales of the coal measures, and though not finding spores universally in all, yet in so many that I can say that almost all coals, shales and many plant beds have free spores embedded in them in such a way that they can be separated from the matrix by the simple methods of artificial weathering and washing."

The question that next suggests itself to one's mind is:—What fossil plants were likely to produce these spores? Now, it is known that nearly all the Carboniferous Plants were Cryptogamic, probably the only exceptions being those large stems, some of which were so fully described by Witham many years ago, and which were referred to the Coniferæ, though more recent investigation has shown that some, if not all of these trees, may be more appropriately referred to the Cycadaceæ, a group of plants closely allied by many of its structural characters to the Coniferæ. Cryptogamic plants appear to have attained their maximum degree of development during the Carboniferous period, and of these two Genera at least, *Lepidodendron* and *Sigillaria*, are now known to have produced spores very similar to those from Kelly Burn. The plants of both these genera attained to great dimensions, the *Lepidodendron* reaching the height of 100 feet, with a basal circumference of 12 feet. The *Sigillaria*, also attained to arborescent dimensions, stems having been found with a circumference of 15 feet. Recent Lycopods are of small size, seldom exceeding 2 or 3 feet in height. The stems of *Lepidodendron* are covered with lozenge-shaped leaf-scars, which are either placed in close contiguity or separated from each other by a greater or less interval. The leaves were lanceolate or long and grass-like. Their fruit was borne in cones, either at the ends of the young branches or placed on two opposite rows on the older stems. The lower scales or bracts of these cones bore *macrospores*, and the upper *microspores* in a similar manner to what obtains in the little cones of *Selaginella*. In *Sigillaria* the stems are either smooth or furrowed; the leaf scars on the smooth barked individuals are contiguous or distant; in the furrowed species they are either placed on the ribs closely together in vertical rows or more or less distant from each other. These also produced cones, but they are a much rarer fossil than those of *Lepidodendron*, and it was not till the middle of 1884 that it was affirmatively known that *Sigillaria* bore cones, when M. Zeiller announced the discovery of specimens showing them attached to stems bearing the characteristic leaf scars of the *genus*. Till then the Lycopodiaceous nature of *Sigillaria* had been doubted by many foreign botanists. (Ann. d. Science, nat. 6 sér. Bot., vol. xix., p. 256. Pls., xi.-xii.) It will thus be seen that *Lepidodendron* and *Sigillaria* have many characters in common, but they are easily distinguished

which enter into its composition. Such spore bands are, however, very common and a good example is seen in the coal worked at Tullygarth Pit, Clackmannan, yet, even limiting the distribution of spores to such bands, they must contribute a considerable quantity of valuable coal, but, notwithstanding the part they here play and even if some be distributed throughout the whole seam they probably form, proportionally, only a small quantity of the whole coal contained in the various British coal fields. The occurrence of spores in bands is quite accounted for by a not uncommon phenomenon in the neighbourhood of large pine forests, where, under certain conditions, when the pollen is ripe, it is shed in such quantities that the ground is completely covered with the yellow grains. Such falls of pollen have frequently been referred to under the name of "Sulphur Showers." It has often been remarked and even in a complaining tone, that of the quantity of seeds or spores produced, very few ever fulfil their mission by developing into plants, but one should remember that the reproduction of their kind is not the only end of their creation. In elucidation of this, I could not do better than give an extract from the paper by Prof. Huxley "On the Formation of Coal":—

"Finally, yet another curious consideration. Let us suppose that one of the stupid, salamander-like Labyrinthodonts, which pottered, with much belly and little leg, like Falstaff in his old age, among the coal forests, could have had thinking power enough in his small brain to reflect upon the showers of spores which kept on falling through years and centuries, while perhaps not one in ten million fulfilled its apparent purpose, and reproduced the organism which gave it birth, surely he might have been excused for moralizing upon the thoughtless and wanton extravagance which Nature displayed in her operations. But we have the advantage over our shovel-headed predecessor—or possibly ancestor—and can perceive that a certain vein of thrift runs through this apparent prodigality. Nature is never in a hurry, and seems to have had always before her eyes the adage, "Keep a thing long enough and you will find a use for it." She has kept her beds of coal many millions of years without being able to find much use for them; she has sent them down beneath the sea and the seabests could make nothing of them; she has raised them up into dry land, and laid the black veins bare, and still, for ages and ages, there was no living thing on the face of the earth that could see any sort of value in them; and it was only the other day, so to speak, that she turned a new creature out of her workshop, who by degrees acquired sufficient wits to make a fire, and then to discover that the black rock would burn. I suppose that nineteen hundred years ago, when Julius Cæsar was good enough to deal with Britain as we have dealt with New Zealand, the primeval Britain, blue with cold and woad, may have known that the strange black stone of which he found lumps here and there in his wanderings, would burn, and so help to warm his body and cook his food. Saxon, Dane, and Norman swarmed into the land. The English people grew into a powerful nation, and nature still waited for a full return for the capital she had invested in the ancient club-mosses. The eighteenth century arrived, and with it James Watt. The brain of that man was the spore out of which was developed the steam engine, and all the prodigious trees and branches of modern industry which have grown out of this. But coal is as much an essential condition of this growth and development as carbonic acid is for that of a club-moss. Wanting coal, we could not have smelted the iron needed to make our engines, nor have worked our engines when we got them. But take away the engines and the great towns of Yorkshire and Lanarkshire vanish like a dream. Manufactures give place to agriculture and pasture, and not ten men can live where now ten thousand are amply supported."

It is but fifteen years since the paragraphs just quoted were penned, and is there not now a rival in the midst of us, electricity, which is eagerly contesting the claims of coal, both as a motive and illuminating power.

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