From Nos 4 and 6, Black Shales.

Sphenopteris affinis, L. & H.

Leperditia Scoto-Burdigalensis, Hibbert.

From No. 7, Limestone.

Stigmaria, with rootlets.

Leperditia Scoto-Burdigalensis, Hibbert.

II. *On the Occurrence of Chonetes comoides (a Brachiopod new to Scotland) in the Carboniferous Limestone of Mayfield, Dalkeith.* By ALEXANDER SOMERVAIL.

III. *On the Rounded and Ball-like Structure of Weathered Rocks.*
By D. J. BROWN, Councillor.

There was laid on the table a series of Palæontological works, presented to the Society by Professor DE KONINCK, M.D., Liège, a Foreign Corresponding Fellow. The thanks of the Society were awarded to Professor DE KONINCK for his handsome donation.

The following Gentlemen were elected Fellows of the Society :—

1. DUNCAN M'LAREN, M.P. for the City of Edinburgh.
2. JAMES WILSON, 42 Morrison Street.
3. JOHN M'LEOD, 7 Oxford Street.

Thursday, 4th December 1873.

HENRY CADELL, Esq. of Grange, Vice-President, in the Chair.

The following Communications were read :—

- I. *Notes on the Dutch Peat Industry.* By RALPH RICHARDSON, W.S., Honorary Secretary. With Specimens of Peat-Fuel obtained by him in Holland in August last; also Specimens of British, French, and German Manufactured Peat-Fuel.

(Abstract.)

Mr Richardson began by alluding to the general use of peat instead of coal in Holland—in hotels, in the kettle-warmers placed beside each party of tourists at breakfast-time; in churches, in the feet-warmers used by the ladies of the congregation; and in the kitchens of hotels and houses of the best class. Referring to a paper by Mr Danchell of Horwich, read before the

British Association in September 1873,* he pointed out that the substitution of peat for coal is common also in Westphalia, Hanover, Holstein and Schleswig, Denmark, Pomerania, Austria, Bavaria, Northern Italy, Switzerland, and extensive districts in the north and south of France. In these countries, as also in Holland, the people are compelled to use peat instead of coal, because of the scarcity of the latter; Mr Richardson referring to the fact that Holland is but the alluvial delta of the Rhine, of which it is the gift, as Egypt was said to be of the Nile. The soil of Holland is mainly composed of peat, the only coal workings being in the extreme south-easterly province of Limburg. Mr Richardson dwelt upon the immense importance to the Dutch peat industry of the wonderful canal-system of Holland,—ubiquitous canals affording economical transport for peat from the remotest peat-bogs to the very doors of the consumers in all parts of Holland.

The paper then proceeded as follows:—We penetrated as far north as Hoogeveen, a town of some 10,000 inhabitants, in Drenthe, a north-eastern province of Holland, and seldom or never visited by tourists. The town is situated at the junction of four canals, over which passes, morning, noon, and night, a never-ending succession of peat-barges, laden with Friesland and Drenthe peat, bound for Amsterdam, the Hague, Rotterdam, 90 to 120 miles away. Here, at Hoogeveen, we were enabled to form some idea of the magnitude of the Dutch peat industry, and of the facilities for it afforded by these canals which ramify over Holland in every direction.

Alphonse Esquiros estimated, in 1859, in his work on Holland,† that the production of peat-fuel in the Netherlands amounted to several millions of tons annually; and stated that, during the eighteen years preceding 1859, the use of peat in the factories of the Netherlands had increased by much more than one million tons. It is used everywhere in Holland,—in the kitchen, parlour, and drawing-room. Bakers bake their bread with it; brickmakers fire their bricks with it; it is also extensively employed in limekilns, breweries, distilleries, and oil-mills. I find, in last edition of the “*Encyclopædia Britannica*,”‡ that, in 1853, the produce of the Dutch peat industry amounted to 31,525,998 tons, on which an excise duty was paid to the Dutch Government of L.120,267, after deduction of 10,370,762 tons exempted from excise as being employed in other manufactures. We see then that, even twenty years ago, the manufac-

* See “*Engineering*,” of 10th October 1873.

† “*La Néerlande et la vie Hollandaise*.” Translated by Mr Lascelles Wrexall in 1861. See also “*Papers on Peat*,” Dublin, 1873, by Mr Meadows, M.E., a member of the Irish Peat-Fuel Commission.

‡ Eighth Edition, 1856; art. “*Holland*.” A new edition is presently in preparation.

ture of peat into fuel in Holland was a most important branch of industry. I observe from Mr Martin's admirable "Statesman's Year-Book,"* that the excise duty on peat-fuel during 1864-5 was estimated by the Dutch Government at L.137,500, being an increase of L.17,233, or nearly 13 per cent. since 1853. Thus we see peat not only furnishes fuel to the people of Holland, but affords the Dutch Government a considerable yearly revenue besides.

Let us now consider how and where the Dutch obtain their peat-fuel. There are *three* kinds of peat found in a natural state in Holland,—viz., 1st, Lange turf; 2d, Korte turf; and 3d, Derrie turf. But before describing these, I must acknowledge my indebtedness to Dr A. Brester, junior, Professor of Chemistry in Delft, whose acquaintance I had the pleasure of making in Utrecht, and who furnished me with many of the following details.

The *first* kind of Dutch peat, "Lange turf," literally "long peat" (because the sods are long), is commonly called "Friesche turf," or Friesland peat, as it mostly comes from the peat-bogs of that province. It is *surface* peat, as opposed to peat dredged-up from below water; in short, this "lange turf" is similar to the peat to which we are accustomed in Scotland, and of which we may have about a million acres or so. I exhibit a specimen of this "lange turf" from Friesland, which I obtained at a peat-store in The Hague. You will observe that it is light in weight, fibrous in texture, and that it resembles the peat of our Highland moors after being well dried.

In Holland there are *two* kinds of peat-bogs. The one called a "hoog veen,"† literally a "high fen," yields this "lange turf," or surface peat. The other, called a "loog veen," literally a "low fen," yields the *second* description of Dutch peat, viz., "korte turf."

"Korte turf" differs from surface peat in existing, in a natural state, not as a coherent or more or less fibrous mass, but as a paste or mud saturated with water, and in having to be dredged from the bog.‡ "Korte turf," literally "short peat" (the sods being shorter than the preceding), is also known in Holland as "steek turf" or "bagger turf,"§ and, as I have said, is obtained by dredging in low-lying, water-covered bogs. In quality it is superior for fuel to surface peat, being more dense and containing more heating power. It is the unmanufactured peat principally used in hotels and the better class of houses in Holland. I

* For 1865. This is an annual publication. Excise duty is also paid, in Holland, on coals, butcher meat, &c. It is not a cheap country to live in.

† Hence the name of the town Hoozeveen.

‡ See "Peat and its Uses," an exhaustive treatise by Professor Johnson of Yale College, U.S. New York, O. Judd & Co., 1866.

§ This is also a German term for it (from "baggern," to dredge), and signifies *dredged* peat.

exhibit two specimens of "korte turf," both obtained at The Hague. One of these specimens is peat dredged up at Wateringen, a village in the vicinity of The Hague. The other specimen is from the famous Haarlem Meer, once an extensive lake, but now, the lake being completely drained, a rich agricultural and pastoral district. You observe that this dredged peat differs from the surface peat already exhibited, in being darker, heavier, more compact, and less fibrous.

The mode of dredging this peat is described by Alphonse Esquiros. The peat lies beneath a layer of surface soil, and is found covered by water. Owing to the low level of the greater part of Holland, and the immense number of canals of all sizes, a very small excavation indeed is required to reach water. I saw houses being built at The Hague, the foundations of which stood in the midst of water. Well, the peat being reached after the removal of the surface earth, a workman, provided with long waterproof boots, descends into the hole, and digs or scoops out of the water the peat which lies beneath it. A barge moored conveniently near (and barges, thanks to the water, are always at hand in Holland) receives the peat, which is conveyed to land and trodden under foot by workmen, roots and fibres being likewise removed from it. After being kneaded in this manner, and after four or five hours' exposure to the sun, it is levelled by another workman, having small boards fastened under his feet. It is then divided into regular pieces, which, after being dried in the open air, are sold and used all over the Netherlands.

The *third* and last kind of Dutch peat, called "derrie turf," is not a commercial commodity, and is interesting to us as geologists rather than as economists. "Derrie" is a layer of peat which is found under the sand-dunes of the coast of Holland near Haarlem, The Hague, &c., and which has been compressed by the overlying sand. It is a compact peat, and is used for fuel; but it is comparatively rare.

These, then, are the *three* kinds of peat naturally produced in Holland. Peat-fuel prepared by mechanical means is, however, very largely used by the Dutch, and notably that called "Rahder turf," made by the firm of Rahder at Valkenheim, about two miles distant from the town of Hoogeveen. This "Rahder turf," of which I exhibit a specimen obtained when I visited Valkenheim, is considered to be the best peat fuel in Holland. You will notice that every piece has the name "Rahder" impressed upon it. The mode of its production is somewhat similar to, although simpler than, the process of Messrs Clayton of London, which I described to the Society on 6th March last.*

* Treatise by Mr Ralph Richardson, "On Peat as a Substitute for Coal," published by Messrs A. & C. Black, Edinburgh, 1873 (now out of print). Abstract in Society's *Transactions*, page 205 of this volume.

A diagram of Messrs Clayton's peat-condensing machinery is on the wall; and I may mention that Messrs Clayton received a prize medal for this machinery at the late Vienna Exhibition (1873). Messrs Rahder's process is as follows:—The raw peat being cut from the bog is thrown into a vertical cylinder, about six feet high and three feet in diameter, in which revolves a vertical shaft, having several sharp arms, which tear up the peat, which is ultimately forced by a screw, whilst in a state of pulp, through a pipe at one side. The peat is cut into pieces as it issues from this pipe, and these pieces are dried in the open air.*

Mr Rahder, the inventor, died in November last, after having realised a fortune by the manufacture of peat-fuel; and the firm now consists of his son and Mr Jacobsen, the latter of whom I saw at Valkenheim. The Rahder Company's *depôt* is at Amsterdam, although their fuel is sold all over Holland by peat merchants. Mr Jacobsen informed me that the working season for the manufacture of their peat-fuel extended from May to August. The climate of Holland is, like our own, very variable, want of drainage and the immense number of canals promoting moisture and frequent rainy weather. The Dutch winter, probably from the same causes, is very much more severe than ours.

I shall now refer, in conclusion, to a very important point for economists, viz., the *prices* at which the various kinds of Dutch peat are sold; and I am enabled, by the kindness of Dr Brester, to give the quotations for peat-fuel both at the peat-bog (exclusive of conveyance) and at the peat merchants' stores at Delft. Peat is generally sold in Holland by the 1000 pieces,† which Mr Jacobsen informs me is equivalent to between 600 and 700 kilogrammes. So that, assuming 1000 pieces to be 660 kilogrammes, they should amount in English imperial measure to about 13 cwts., or 7 cwts. below our standard measure of weight, one ton. Converting the measures accordingly, we find the prices of Dutch peat to be as follows, viz. :—

1st, "Hollandsche korte turf," or Dutch dredged peat.—This is sold at the peat-bog for 5 gulden 50 cents per 1000 pieces, or about 14s. 1d. per ton. It is sold at Delft for 7 gulden per 1000 pieces, or about 18s. 11d. per ton. This is the best un-manufactured peat in Holland.

2d., "Haarlemmer meer lange turf."—Surface peat from Haarlem Meer. Dr Brester informs me that this is a very bad kind of peat-fuel. It is sold at the peat-bog for 2 gulden 50 cents

* See Report by Irish Peat-Fuel Commission (Alderman Purdon's). Dublin, 1873.

† Dr Brester states that in Friesland prices are calculated by the ton, a measure of capacity equal to 2 hectolitres, or about 5½ imperial bushels.

per 1000 pieces, or about 6s. 5d. per ton. He could not ascertain the price of this peat in Delft.

3*d*, "Friesland lange turf."—Surface peat from Friesland, one of the north-eastern provinces of Holland. This peat is sold at the peat-bog for almost 5 gulden per 1000 pieces, or about 12s. 10d. per ton. At Delft it is sold for 7 gulden per 1000 pieces, or about 18s. 11d. per ton.

4*th*, "Friesland korte turf."—Dredged peat from Friesland. This is sold at the peat-bog for 4 gulden per 1250 pieces (or about 16 cwts.), equivalent to about 8s. 4d. per ton. It is sold at Delft for 5 gulden 50 cents per 1000 pieces, or about 14s. 1d. per ton.

Finally, 5*th*, "Rahder turf"—the peat manufactured by the Rahder Company—is sold at the works, as I am informed by Mr Jacobsen, at the price of 3 gulden 75 cents per 1000 pieces, equal to about 9s. 7d. per ton. Dr Brester writes me that it is sold at Delft for 7 gulden 50 cents per 1000 pieces, or about 19s. 3d. per ton—that is to say, more than double its original price. The distance from Hoogeveen to Delft (above 100 miles) is probably the cause of this. Mr Meadows, M.E., of Dublin, a most intelligent member of the Irish Peat-Fuel Commission, and to whom I was much indebted for information for my Dutch tour, mentions that the actual cost of manufacture of the "Rahder turf" is, as he calculated on visiting the works, 6s. 6d. per ton.

After an exhibition and description of various other peat-fuels, —British, French, and German,—Mr Richardson brought his paper to a close, by stating that his main object in reading it was to call public attention to the fact that a great industry, namely, that of peat-fuel, exists in Holland which does not exist in this country; and that peat is put there to many and important uses to which it is not applied here. We have, he remarked, as great, indeed far greater, supplies of peat in the United Kingdom than are to be found in the small country of Holland. It would be well, especially during the present coal famine, and to avert the recurrence of such famines, that these supplies were turned by us to some account. And if any should wish to know how to do so, or if any should doubt the possibility of peat being ever made, in a national sense, a substitute for coal, he had only to ask them to take, as he had done, a trip to Holland.

The Society's Hall was, on this occasion, heated by two fires of the Challeton de Brughat peat-fuel, manufactured by the new "Peat Coal and Charcoal Company, Limited," of London. These fires burned brilliantly, and gave great heat. Mr Parker Rhodes, the secretary of the company, who had travelled from London to be present at the Society's meeting, was introduced by Mr Richardson, and gave a short address on the subject of

the company's peat coal and peat charcoal. A discussion took place on the peat-fuel question generally, in which Mr Dudgeon of Cargen, chairman of the "South of Scotland Peat-Fuel Company," Dumfries; Mr Binning Home of Argaty, Doune; Mr John Reid, manager of the Edinburgh and Leith Gas Company, and others, joined.

II. *Notes on a Visit to Connorree Copper and Sulphur Mine, County Wicklow, Ireland.* By DAVID MARSHALL, C.A., Edinburgh. (With a Diagram.)

The beautiful Vale of Ovoca, rendered classical by the poet Moore, has, since the poet's day, become a scene of considerable mining activity. The scarped hills, trenchings, shafts, adits, and mining buildings, with their accompanying smoke, steam and water power, while in no way detracting from the picturesqueness of the valley, are cheering as giving indications of a spirit of enterprise only too rare in Ireland.

The railroad, which between Bray and Wicklow skirts close by the sea, takes a sharp turn inland at the latter place, and enters a mountainous region. After leaving Rathdrum, about ten miles from Wicklow, it pursues its course up the Vale of Ovoca between hills of considerable height. About five miles above Rathdrum, the Avonbeg and Avonmore join their streams and form the Ovoca river. This spot, famous as "the Meeting of the Waters," is a centre of mining operations, and in that neighbourhood is situated the Connorree Mine which I visited.

The district from the seaboard and for many miles inland is entirely Lower Silurian, and has been subjected to great denudation. This is apparent from the very rounded form of the hills, and from large erratic blocks of granite scattered about, which must have been borne from a great distance. One of these, of huge size, rests on the top of a hill close to Connorree, where it forms a conspicuous object. The strike of the Silurian rocks is about N.E. by N., the dip being almost invariably at a very high angle, and most commonly towards the S.E. Seams of shale occur in the Wicklow Silurians, containing graptolites similar in character to those of our own Dumfriesshire beds; and, looking to the strike of the strata, I think there is reason to suppose that the Wicklow Silurians are a continuation of the same series of rocks. The metal lodes, with some slight variations due to faults, pursue a similar course, N.E. by N., and resemble very much in character the lodes worked by the Mona Mining Company in Anglesea, forming a presumption that the Anglesea lodes belong to the same series, and are contemporaneous in origin.

The whole mining region is intersected with numerous trap