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ON BRITISH CARBONIFEROUS BRACHIOPODA.

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FOUR years have elapsed since I first commenced my researches among the Carboniferous Brachiopoda of Great Britain; and I should certainly by this time have completed my task, had not the unfortunate delay in the publication of the last two or three volumes of the Palæontographical Society induced me to undertake other work which would not require to lie printed and unpublished for upwards of one year and a half. My monograph cannot, consequently, be completed or entirely published for some time to come, perhaps a year or more; but as my researches in connection with the subject are almost ended, since the whole series of species at present known have been as carefully examined as my means and materials would permit, it may, perhaps, be as well that I should at once expose the results of my laborious enquiry, in the hope that by so doing some further assistance and advice may be proffered; which might enable me to make the monograph still more complete, and at the same time admit of my correcting in the concluding pages those unavoidable mistakes which have been committed during the interval which has elapsed since the commencement of its publication.

It may be thought by some while perusing the accompanying catalogue that the work to be gone through was but small in comparison with the time employed, but such would be an erroneous assumption, and a sad return to the numerous friends in England, Scotland, and Ireland, who have so zealously afforded their valuable and valued assistance, by incessantly ransacking the country in order to obtain every possible specimen that might assist and tend to complete the history of British Carboniferous species. Thousands and thousands of specimens have been assembled and transmitted to me by rail and post; and if I refrain from mentioning names it is because my full

acknowledgements are recorded in my larger work, which, when complete, will compose a quarto volume, illustrated by some fifty or more plates. I may likewise mention that, with very few exceptions, I have had the great advantage of obtaining the loan of the original specimens from which each species had been first described, so that my comparisons have generally commenced with the type.

As a great many so-termed species have been rejected, it will be desirable to enter upon some few explanatory details.

At the time when I commenced my researches among the British Carboniferous Brachiopoda, some two hundred and fifty so-termed species had been recorded; but after a most searching investigation, I could not conscientiously make out more than about one hundred and eight; and even of this number some few should be located among the varieties, so that the determined species would not, at the present time, in all probability exceed about a hundred. In the second and improved edition of Prof. Morris's "Catalogue," published in 1854, one hundred and ninety three species are recorded, but of these about eighty-one only are retained in our lists.

It would be impossible in this short paper to enter into many statistical details; but we may mention that in 1836 Prof. Phillips enumerated about one hundred species, as having been found in England, and of which fifty-two are by us retained. Since the period of the publication of the "Geology of Yorkshire," many more species have been discovered, so that about ninety-seven are provisionally catalogued. The species from Scotland have been carefully examined, and from forty-nine to fifty retained. The Irish species have not, perhaps, been so completely studied as we might wish; and it is very possible and probable that the rocks of that island have afforded some few more than the seventy-three here admitted.

In 1844, Prof. M'Coy described two hundred and twenty-nine species, stated by him to have been found in Ireland, but figured only about sixty; and to this number several others were subsequently added by other naturalists, so that Mr. Kelly's Catalogue* comprises no less than two hundred and thirty-seven! If we compare Mr. Kelly's lists with the one here given a very great difference will be perceived; for notwithstanding all my good will and the liberal assistance of many Irish geologists, who assembled for my use every possible species, I have not been able, as already stated, to identify more than about seventy-three. Mr. Kelly's Catalogue comprises a great number of Silurian and Devonian species not known to me to occur in any Carboniferous rocks hitherto examined; and I may without hesitation assert that the larger number are, at any rate, due to incorrect identification; for the examination of many of the original specimens in Sir Richard Griffith's collections have convinced Prof. de Koninck, Mr. Salter, and myself of this important fact.

* "On the Localities of Fossils of the Carboniferous Limestone of Ireland:" Journal of the Geological Society of Dublin: 1855.

Many of M'Coy's so-termed Devonian species were not, however, to be found in any of the Irish collections, and their existence as Carboniferous fossils must, consequently, remain as "not proven," for the author of the "Synopsis," does not furnish us with any evidence as to the correctness of his determinations in the shape of illustrations.

Mr. Kelly, whose knowledge of Irish geology appears to equal, or even exceed that of any other man, expresses himself very averse to my rejecting so many Devonian species, said to have been found in his Carboniferous strata and localities, and considers I am not justified in passing judgment on the contents of between seventeen and eighteen thousand square miles of Carboniferous limestone said to exist in the sister island; but I do not presume to pass sentence upon any but those I am certain to be due to incorrect identification, and which have been so stamped by Prof. de Koninck, Mr. Salter, and myself, and at present existing in Sir R. Griffith's collection. All I wish to say with reference to the others is that, never having been able to procure the sight of a specimen, I am bound to state and believe that their existence is "not proven;" but I shall be delighted to admit and catalogue hereafter any of which a specimen or correct figure can be produced, and which on comparison will be found to agree with Silurian or Devonian types. In my monograph I have described those species only of which I have seen a specimen, or of whose existence I felt certain, and of which I was able to give a figure; for it appeared to me preferable to limit myself to what was certain, than to swell out my work by the introduction of a large amount of very doubtful matter. Mr. Kelly has informed me by letter that a large portion of the doubtful fossils were got in localities of the Calciferous slate, a band which lies next under the limestone; that out of some seventy not proven to me, because I have not seen specimens, twenty-two were obtained at Lisnapaste and Donegal; that in these localities there is a great variety; and that they occur in black soft shale, as soft and as easily decomposed by exposure to the atmosphere as any that occurs in the coal-measures; that a lump of this black shale exposed to sun and rain for one summer, would slake or fall to pieces; and he therefore supposes that by far the larger number of Lisnapaste specimens that were originally in Sir R. Griffith's collection were lost by their removal to the Great Exhibition held in Dublin, in 1852, as those tender shales would not bear the agitation of carriage, and consequently mouldered away into very small fragments. That there are six or eight other localities in the Calciferous slate in which similar shales occur with fossils, and that he finds upon looking over his lists that most of the Devonian species I object to were obtained in those localities. Along with Lisnapaste there is Larganmore, Bruckless, Kildress, (the red shales near Cookstown in the Old Red series), Bundoran, Malahide, Curragh, etc.

Having premised so much, we will now give a catalogue of all the species at present known to us from England, Scotland, and Ireland.

In my Collection.	CATALOGUE OF BRITISH CARBONIFEROUS BRACHIOPODA.	England.	Scotland.	Ireland.
*	<i>Terebratula sacculus</i> , Martin, Petrif. Derb., tab. xlvi., figs. 1, 2, 1809; Dav. Mon.,* pl. i., figs. 23, 24, 27, 29, 30, etc.	+	+	+
*	— <i>hastata</i> , Sow. Min. Con., tab. ccccxlvi., figs. 2-3, 1824; Dav. Mon., pl. i., figs. 1-12; var. <i>virgoides</i> , M'Coy, var. <i>ficus</i> , M'Coy.	+	+	+
*	— <i>Gillingensis</i> , Dav. Mon., pl. i., figs. 18-20; pl. iii., fig. i., 1847.	+		
*	— <i>vesicularis</i> , De Koninck, An. Foss. de la Belgique, sup., pl. lvi., fig. 10, 1851; Dav. Mon., pl. xxv., figs. 1-7, = <i>Seminula seminula</i> , M'Coy.	+	+	
*	<i>Athyris Royssii</i> , L'Eveillé, Mémoires de la Soc. Geol. de France, vol. ii., pl. ii., figs. 18-20, 1835; Dav. Mon., pl. xviii., figs. 1-11, = <i>T. fimbriata</i> , Phil., = <i>T. glabristria</i> , Phil., = <i>T. depressa</i> , M'Coy.	+	+	+
*	— <i>expansa</i> , Phil., Geol. York, vol. ii., pl. x., fig. 18, 1836; Dav. Mon., pl. xvi., figs. 14-16 and 18; pl. xvii., figs. 1-5.	+		
*	— <i>lamellosa</i> , L'Eveillé, Mem. de la Soc. Geol. de France, vol. ii., pl. figs. 21-23, 1855; Dav., pl. xvi., fig. 1, and pl. xvii., fig. 6, = <i>T. squamosa</i> , Phillips.	+		+
*	— <i>plano-sulcata</i> , Phillips' Geol. York, vol. ii., pl. x., fig. 15, 1836; and Dav. Mon., pl. xvi., figs. 2-13, 15, = <i>A. paradoxa</i> , M'Coy, = <i>A. obtusa</i> , M'Coy, = <i>T. oblonga</i> , Sow.	+	+	+
*	— <i>globularis</i> , Phillip's Geol. of York., vol. ii., pl. x., fig. 22, 1836; and Dav. Mon., pl. xvii., figs. 15-18.	+		
*	— <i>ambigua</i> , Sow., Min. Con., pl. cccclxxvi., 1822; and Dav. Mon., pl. xv., figs. 15-23, = <i>T. sublobata</i> ,* Portlock, = <i>T. pentaedra</i> , Phillips.	+	+	+
*	— <i>subtilita</i> , Hall. Howard Stansbury's Exploration of the Valley of the Great Salt Lake of Utah, pl. iv., figs. 1-6, 1852; Dav. Mon., pl. i., fig. 21-22, pl. xvii., figs. 8-10.	+		+
*	— <i>squamigera</i> , De Kon., Desc. An. Foss. de la Belgique, sup., pl. lvi., fig. 9, 1851; and Dav. Mon., pl. xviii., figs. 12, 13.	+		+
*	<i>Retzia radialis</i> , Phillips' Geol. of York., vol. ii., pl. xii., figs. 40, 41, 1836; Dav. Mon., pl. xvii., figs. 19-21.	+	+	
	— <i>ulotrix</i> , De Kon., Desc. des Animaux Foss. de la Belgique, pl. xix., fig. 5, 1843; and Dav. Mon. Carb., pl. xviii., figs. 14, 15.	+		
*	<i>Spirifera striata</i> , Martin, Petrif. Derb., t. xxiii., 1809; Dav. Mon., pl. ii., figs. 12-21, and pl. iii., figs. 2-6, = <i>T. spirifera</i> , Lamk., = <i>Sp. attenuata</i> , Sow., = <i>S. princeps</i> , M'Coy, = <i>S. clathrata</i> , M'Coy, = <i>S. condor</i> , D'Orb., = <i>S. triplicatus</i> , Hall, <i>Logani</i> , Hall.	+		+
*	— <i>Mosquensis</i> , Fischer, Programme sur la Chorisites, 1825; Dav. Mon., pl. iv., figs. 13, 14, = <i>C. Sowerbii</i> and <i>Kleinii</i> , Fischer, = <i>S. chorisites</i> , V. Buch, = <i>incisa</i> , Goldfuss, = <i>S. priscus</i> , Eichwald.	+		+

* Mon. refers to my Monograph of Carb. Brachiopoda, published by the Palaeontographical Society; S. Mon. refers to my Monograph of Scottish Carboniferous Brachiopoda.

In my
Collection.

Catalogue of British Carboniferous Brachiopoda.

England.

Scotland.

Ireland.

*	<i>Spirifera humerosa</i> , Phil., Geol. York., pl. xi., fig. 8, 1836, and Dav. Mon., pl. iv., figs. 15, 16.	+		
*	— <i>duplicicosta</i> , Phillips' Geol. York., vol. ii., pl. x., fig. 1, 1836; and Dav., pl. iii., figs. 7-10, pl. iv., figs. 3-11, = <i>S. furcata</i> , M'Coy, = <i>S. fasciculata</i> , M'Coy.	+	+	+
*	— <i>planata</i> , Phillips' Geol. York., pl. x., fig. 3, 1836; and Dav. Mon., pl. vii., figs. 25, 36.	+		
*	— <i>triangularis</i> , Martin, Petrif. Derb., pl. xxxvi., fig. 2, 1809; and Dav. Mon., pl. v., figs. 16-24.	+		+
*	— <i>trigonalis</i> , Martin, Petrif. Derb., pl. xxxvi., fig. 1, 1809; and Dav. Mon., pl. v., figs. 25-35.	+	+	
*	— <i>bisulcata</i> , Sow., Min. Con., pl. cccxciv., figs. 1, 2, 1825; and Dav. Mon., pl. iv., figs. 1, 2, pl. v., fig. 1, pl. vi., figs. 1-22, pl. vii., figs. 1-4, 7-16, = <i>S. semicircularis</i> , Phillips, = <i>S. calcarata</i> , M'Coy (not Sow.), = <i>S. transiens</i> , M'Coy, = <i>S. grandicosta</i> (?), M'Coy, = <i>S. crassa</i> , De Kon., = <i>S. planicosta</i> , M'Coy, etc.	+	+	+
*	— <i>convoluta</i> , Phillips' Geol. of York., vol. ii., pl. ix., fig. 7, 1836; and Dav. Mon., pl. v., figs. 9-15.	+		
*	— <i>rhomboidea</i> , Phillips' Geol. of York., vol. ii., pl. ix., figs. 8-9, 1836; and Dav., pl. v., figs. 2-8.	+		+
	— <i>fusiformis</i> , Phillips' Geol. of York., pl. ix., figs. 10, 11, 1836; Dav. Mon., pl. xiii., fig. 15. This is a doubtful species.	+		
	— <i>mesogonia</i> , M'Coy, Synopsis, pl. xxii., fig. 13, 1844; and Dav. Mon., pl. vii., fig. 24.			+
*	— <i>distans</i> , Sow., Min. Con., pl. cccxciv., fig. 3, 1825; and Dav. Mon., pl. viii., figs. 1-17 and 18 (?), = <i>S. bicarinata</i> , M'Coy.	+		+
*	— <i>cuspidata</i> , Martin, Trans. Lin. Soc., vol. iv., pl. iii., figs. 1-4, 1796; Dav. Mon., pl. viii., figs. 19-24, pl. ix., figs. 1, 2, = <i>S. subconicus</i> , Martin.	+		+
*	— <i>triradialis</i> , Phil. Geol. York., vol. ii., pl. x., fig. 7, 1836; Dav. Mon., pl. ix., figs. 4-12, = <i>S. trisulcata</i> , Phil., = <i>S. sevradialis</i> , Phil.	+		+
	— <i>Reedii</i> , Dav. Mon., pl. v., figs. 40, 47, 1857. Doubtful species.	+		
	— <i>pinguis</i> , Sow., Min. Con., pl. cclxxi., 1820; and Dav., pl. x., figs. 1-12; = <i>S. rotundata</i> , Sow. (not Martin), = <i>S. sub-rotundata</i> , M'Coy.	+	+	+
*	— <i>ovalis</i> , Phillips' Geol. York., vol. ii., pl. x., fig. 5, 1836; Dav. Mon., pl. ix., figs. 20-26, = <i>S. exarata</i> , Fleming, = <i>hemisphaerica</i> , M'Coy.	+	+	+
*	— <i>integricosta</i> , Phillips' Geol. York., pl. x., fig. 2, 1836; Dav., pl. ix., figs. 13-19, = <i>S. rotundata</i> , Martin (?), = <i>paucicosta</i> , M'Coy (?).	+		
*	— <i>glabra</i> , Martin, Petrif. Derb., pl. xlvi., figs. 9, 10, 1809; Dav. Mon., pl. xi., figs. 1-9, and pl. xii., figs. 1-5, 11, 12, = <i>S. obtusa</i> and <i>S. oblata</i> , Sow., = <i>S. linguifera</i> and <i>S. decora</i> , Phillips.	+	+	+
*	— <i>rhomboidalis</i> , M'Coy, Synopsis, pl. xxii., fig. 11, 1844; and Dav. Mon., pl. xii., figs. 6-7.			+

In my Collection.	Catalogue of British Carboniferous Brachiopoda.	England.	Scotland.	Ireland.
*	<i>Spirifera Uriei</i> , Fleming, Br. An., p. 376, 1828; and Dav. Mon., pl. xii., figs. 13, 14, and Dav. Sc. Mon., pl. i.*, fig. 30, = <i>unguiculus</i> , Phil., = <i>clannyana</i> , Kon.	+	+	+
*	————— <i>Carluikiensis</i> , Dav. Mon., pl. xiii., fig. 14, 1857.		+	
*	————— <i>lineata</i> , Martin, Petrif. Derb., pl. xxxvi., fig. 3, 1809; Dav. Mon., pl. xiii., figs. 4-13, Sc. Mon., pl. i.*, fig. 31, = <i>M. strigocephaloides</i> , M'Coy, = <i>S. reticulata</i> , = <i>S. mesoloba</i> , Phil., = <i>S. imbricata</i> , Sow.	+	+	+
*	————— <i>elliptica</i> , Phil. Geol. York., pl. x., fig. 16, 1836; Dav. Mon., pl. xiii., figs. 1-3.	+		+
	<i>Spiriferina laminosa</i> , M'Coy, Synopsis, pl. xxi., fig. 4, 1844; and Dav. Mon., pl. vii., figs. 17, 22, = <i>S. tricornis</i> , De Kon.	+	+	+
*	————— <i>cristata</i> , var. <i>octoplicata</i> , Sow., Min. Con., pl. dlxii., figs. 2-4, 1827; and Dav. Mon., pl. vii., figs. 37-47, 60, 61, = <i>Sp. partita</i> , Portlock.	+	+	+
	————— <i>minima</i> , Sow., Min. Con., tab. cccclxxvii., fig. 1, 1822; Dav. Mon., pl. vii., figs. 56-59. A very doubtful species.	+		
*	————— <i>insculpta</i> , Phil., Geol. York., pl. ix., figs. 2, 3, 1836; Dav., pl. vii., figs. 48, 55, = <i>S. quinqueloba</i> , M'Coy.	+	+	+
*	<i>Cyrtina septosa</i> , Phillips' Geol. York., vol. ii., pl. ix., fig. 7, 1836; Dav. Mon., pl. xiv., figs. 1-10, pl. xv., figs. 1, 2.	+		
	————— <i>dorsata</i> , M'Coy, Synopsis, pl. xxii., fig. 14, 1844; Dav. Mon., pl. xv., figs. 3, 4.			+
*	————— <i>carbonaria</i> , M'Coy, Br. Pal. Fossils, pl. iii.D, figs. 12-18, 1855; Dav. Mon., pl. xv., figs. 5-14.	+		
*	<i>Rhynchonella reniformis</i> , Sow., Min. Con., pl. ccccxvii., figs. 1-4, 1825; and Dav. Mon., pl. 19., figs. 1-7.	+		+
*	————— <i>cordiformis</i> , Sow., Min. Con., tab. ccccxv., fig. 2, 1825; and Dav. Carb. Mon., pl. xix., figs. 8-10. A doubtful species.	+		+
*	————— <i>acuminata</i> , Martin, Petrif. Derb., pl. xxxii., figs. 7, 8, and pl. xxxiii., figs. 5, 6, 1809; and Dav. Mon., pl. xx., figs. 1-13, pl. xxi., figs. 1-20, = <i>T. platyloba</i> , Sow., = <i>T. mesogonia</i> , Phil.	+		+
*	————— <i>pleurodon</i> , Phillips' Geol. of York., vol. ii., pl. xii., figs. 25-30, 1836; and Dav. Mon., pl. xxiii., figs. 1-20, = <i>T. Mantice</i> , Sow., = <i>T. ventilabrum</i> , Phillips, = <i>T. pentatoma</i> , De Kon., = <i>T. triplex</i> , M'Coy, = <i>Davreuxiana</i> , De Kon.	+	+	+
*	————— <i>flevistria</i> , Phillips' Geol. York., pl. xii., figs. 33, 34, 1836; and Dav. Mon., pl. xxiv., figs. 1-8, = <i>T. tumida</i> , Phillips, = <i>H. heteroplycha</i> , M'Coy.	+		+
*	————— <i>pugnus</i> , Martin, Petrif. Derb., tab. xxii., figs. 4-5, 1809; and Dav. Mon., pl. xxii., figs. 1-15, = <i>T. sulcirostris</i> , Phil., = <i>A. laticliva</i> , M'Coy.	+	+	+
*	————— <i>angulata</i> , Linnæus, Syst. Nat., p. 1154, 1767; and Dav. Mon., pl. xix., figs. 11-16.	+		+
	————— <i>trilatera</i> , De Kon., Animaux Foss. de la Belgique, pl. xix., fig. 7, 1843; and Dav. Mon., pl. xxiv., fig. 23-26.	+		

In my
Collection.

Catalogue of British Carboniferous Brachiopoda.

England.

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- Rhynchonella* ? *gregaria*, M'Coy, Synopsis, pl. xxii., fig. 18, 1844; and Dav. Carb. Mon., pl. xv., figs. 27, 28. Not sufficiently studied.
- { *Rh. nana*, M'Coy, Synopsis, pl. xxii., fig. 19, 1844; Ireland.
 { *R. semisulcata*, M'Coy, Synopsis, pl. xxii., fig. 15; Ireland: doubtful species ?.
- * *Camarophoria crumena*, Martin, Petrif. Derb., pl. xxxvi., fig. 4, 1809; and Dav. Mon., pl. xxv., figs. 3, 9, = *C. Schlothemi*, V. Buch. + + +
- Var. ? *T. proava*, Phil., Geol. of York., vol. ii., pl. xii., fig. 37, 1836; and Dav. Mon., pl. xxv., fig. 10; England.
- * ——— *globulina*, Phil., Ency. Met., vol. iv., pl. iii., fig. 3, 1834; Dav. Mon., pl. xxiv., figs. 9-22; *T. rhomboidea*, Phil., = *T. seminula*, Phil., = *H. longa*, M'Coy ? +
- *isorhyncha*, M'Coy, Synopsis, pl. xviii., fig. 8, 1844; and Dav. Mon., pl. xxv., figs. 1, 2. Not sufficiently studied, from want of material. +
- ? *laticliva*, M'Coy, Br. Pal. Foss., pl. iii.d, figs. 20, 21, 1855; Dav. Mon., pl. xxv., figs. 11, 12. Not sufficiently studied, from want of material. +
- * *Strophomena (rhomboidalis)* var. *analoga*, Phillips' Geol. of York., pl. vii., fig. 10, 1836; Dav. Mon., pl. xxviii., figs. 1, 13, = *P. depressa*, Sow., = *P. rugosa*, His., = *C. quadrangularis*, Steininger, = *L. tenuistriata*, Sow., = *L. distorta*, Sow., = *L. nodulosa*, Phil., = *L. multi-rugata*, M'Coy. + + +
- * *Streptorhynchus crenistria*, Phillips' Geol. York., pl. ix., fig. 6, 1836; and Dav. Mon., pl. xxvi., fig. 1, pl. xxvii., figs. 1-5, and 10 ?, pl. xxx., figs. 14-16, = *S. senilis*, Phil., = *Lept. anomala*, J. de C. Sow., Min. Con., tab. dext., fig. 1b, = *O. umbraculum*, var. Portlock, = *O. Bechei*, M'Coy, = *O. comata*, M'Coy, = *O. caduca*, M'Coy, = *O. keokuck* and *O. robusta*, Hall. + + +
- * Var. A. *T. arachnoidea*, Phillips' Geol. of York., vol. ii., pl. xi., fig. 4, 1836; Dav. Mon., pl. xxv., figs. 19-21, pl. xxvi., figs. 2-4 (lower fig.) 5,6, = *O. Portlockiana*, Semenow; England, Scotland, Ireland.
- Var. B. *S. Kellii*, M'Coy, Synopsis, pl. xxii., fig. 4, 1844; Dav. Mon., pl. xxvii., fig. 8; England, Scotland, Ireland.
- Var. C. *S. cylindrica*, M'Coy, Synopsis, pl. xxii., fig. 1, 1844; and Dav., pl. xxvii., fig. 9; Ireland.
- * Var. D. *S. radialis*, Phillips' Geol. York., pl. xi., fig. 5, 1836; Dav. Mon., pl. xxv., figs. 16-18; England, Scotland, Ireland.
- * *Orthis resupinata*, Martin, Petrif. Derb., pl. xlix., figs. 13, 14, 1809; Dav. Mon., pl. xxix., figs. 1-6, and pl. xxx., figs. 1-5, = *O. connivens*, Phil., = *O. gibbera*, Portlock, = *O. latissima*, M'Coy. + + +
- * ——— *Michelini*, L'Eveillé, Mem. Soc. Geol. France, vol. ii., figs. 14-17, 1835; Dav. Mon., pl. xxx., figs. 6-12, = *S.* + + +

In my Collection.	Catalogue of British Carboniferous Brachiopoda.	England.	Scotland.	Ireland.
	<i>filiaria</i> , Phil., = <i>O. circularis</i> , M'Coy, = <i>O. divaricata</i> , M'Coy.			
*	<i>Orthis Keyserlingiana</i> , De Kon., An. Foss. de la Belgique, pl. xiii., fig. 12, 1843; Dav. Mon., pl. xxviii., fig. 14.	+		
*	— ? <i>antiquata</i> , Phil., Geol. York, tab. xi., fig. 20, 1836; and Dav. Mon., pl. xxviii., fig. 15. Not sufficiently studied from want of material.	+		
*	<i>Productus giganteus</i> , Martin, Petrif. Derb., pl. xv., fig. 1, 1809; and Dav. Mon., pl. xxxvii., xxxviii., xxxix., and xl., = <i>A. crassa</i> , Martin, = <i>P. aurita</i> , Phil., <i>P. Edelburgensis</i> , Phil., <i>P. maxima</i> , M'Coy, = <i>P. hemisphericus</i> , part Sow.	+	+	+
*	— <i>latissimus</i> , Sow., Min. Con., tab. cccxxx., 1822; and Dav. Mon. Scottish Brach., pl. ii., figs. 8, 9; and Mon., pl. xxxv., figs. 1-4.	+	+	+
*	— <i>Cora</i> , D'Orb., Palæont. du Voyage dans l'Amérique Meridionale, p. 58, pl. v., figs. 8-10, 1842; De Koninck, Mon. du Genre Productus, pl. iv., fig. 4, pl. v., fig. 2, = <i>P. corrugata</i> , M'Coy; Dav. Mon., pl. xxxvi., fig. 4.	+	+	+
*	— <i>semireticulatus</i> , Martin, Petrif. Derb., pl. xxxii., figs. 1, 2, pl. xxxiii., fig. 4, 1809; Dav. Mon. Scottish Brach., pl. iv., figs. 1-12; and Mon., pl. xliii., figs. 1-6, and pl. xliv., figs. 1-3, = <i>A. antiquata</i> , Martin, = <i>P. concinna</i> , Sow., = <i>P. pugilis</i> , Phil., = <i>P. scotica</i> , Sow., = <i>P. sulcata</i> , Sow., = <i>P. flexistria</i> , M'Coy (according to Prof. De Koninck), <i>A. producta</i> , Parkinson.	+	+	+
	Var. <i>Martini</i> , Sow. Min. Con., pl. cccxvii, figs. 2-4; Dav. Mon., pl. xliii., figs. 7-11; England, Scotland, Ireland.			
*	— <i>longispinus</i> , Sow., Min. Con., tab. lxxviii., fig. 1, 1814; Dav. Scottish Carb. Mon., pl. ii., figs. 10-19, and Mon., pl. xxxv., figs. 5-17 = <i>P. Flemingii</i> , = <i>P. lobata</i> , = <i>P. spinosa</i> , Sow., = <i>P. setosa</i> , Phil.	+	+	+
*	— <i>humerosus</i> , Sow., Min. Con., tab. cccxxii., 1822; Dav. Mon., pl. xxxvi., fig. 1-3.	+		
*	— <i>striatus</i> , Fischer, Oryct. du Gouv. de Moscou, pl. xix., fig. 4, 1830 and 1837; Dav. Mon., pl. xxxiv., figs. 1-5, = <i>P. inflata</i> , Phil., = <i>P. limaformis</i> , V. Buch, = <i>L. anomala</i> , J. de C. Sow., Min. Con., tab. dcxv., fig. 1, a, c, d, (not b).	+		
*	— <i>margaritaceus</i> , Phillips, Geol. York., pl. viii., fig. 8, 1836; Dav. Mon., pl. xlv., figs. 5-8, = <i>P. pectinoides</i> , Phil.	+		+
*	— <i>proboscideus</i> , De Vern., Bulletin de la Soc. Geol. de France, vol. xi., pl. iii., fig. 3, 1840; Dav. Mon., pl. xxxiii., figs. 1-4.	+		
*	— <i>ermineus</i> , De Koninck, Desc. des Animaux Foss. de la Belgique, pl. x., fig. 5, 1843; and Dav. Mon., pl. xxxiii., fig. 5.	+		
*	— <i>sinuatus</i> (<i>Lept. sp.</i>) De Koninck, An. Foss. de la Belgique, sup., t. lvi., fig. 2; and Dav. Mon., pl. xxxiii., figs. 8-11.	+	+	

In my
Collection.

Catalogue of British Carboniferous Brachiopoda.

England.

Scotland.

Ireland.

*	———— <i>costatus</i> , Sow., Min. Con., pl. dlx., fig. 1, 1827, = <i>P. costellatus</i> , M'Coy; Dav. Mon., pl. xxxii., figs. 2-9.	+	+	+
*	———— <i>muricatus</i> , Phil., Geol. York, vol. ii., pl. viii., fig. 3, 1836; Dav. Scottish Carb. Mon., pl. ii., fig. 25, pl. iv., fig. 25; England, Scotland; Dav. Mon., pl. xxx., figs. 10-14.			
	———— <i>carbonarius</i> , De Kon., Desc. des An. Foss. de la Belgique. pl. xii. bis, fig. 1, 1843; and Dav. Mon., pl. xxxiv., fig. 6.		+	
*	———— <i>undatus</i> , Defrance, Dic. des Sc. Nat., vol. xliii., p. 354, 1826; De Kon., Desc. des An. Foss. de la Belgique, pl. xii., fig. 2; Dav. Mon., pl. xxxiv., figs. 7-12, = <i>P. tortilis</i> , M'Coy?	+	+	+
*	———— <i>arcuarius</i> , De Kon., Desc. des Animaux Foss. de la Belgique, pl. xii., fig. 10, 1843; Dav. Mon., pl. xxxiv., fig. 17.	+		
*	———— <i>aculeatus</i> , Martin, Petrif. Derb., pl. xxxvii., figs. 9, 10, 1809; and Dav. Mon., pl. xxxiii., fig. 16-20, = <i>P. laxispina</i> , Phil.	+	+	+
*	———— <i>Youngianus</i> , Dav. Mon. of Scottish Carb. Brach., pl. ii., fig. 26, and pl. v., fig. 7, 1860; and Mon., pl. xxxiii., figs. 21-23.	+	+	+
*	———— <i>Keyserlingianus</i> , De Kon., Desc. des An. Foss. de la Belgique, pl. x., fig. 8, 1843; Dav. Mon., pl. xxxiv., figs. 15, 16.	+		
*	———— <i>Wrightii</i> , Dav., Carb. Mon., pl. xxxiii., figs. 6, 7, 1861.			+
*	———— <i>tessellatus</i> , De Kon., Desc. des An. Foss. de la Belgique, pl. ix., fig. 2, 1843; and Dav. Mon., pl. xxxiii., figs. 24, 25, and pl. xxxiv., fig. 14.	+		+
*	———— <i>plicatilis</i> , Sow., Min. Con., tab. ccclix., fig. 2; and Dav. Mon., pl. xxxi., figs. 3-5.	+	+	+
*	———— <i>mesolobus</i> , Phillips' Geol. of York., vol. ii., pl. vii., figs. 12, 13, 1836; Dav. Mon., pl. xxxi., figs. 6-9.	+	+	+
	———— <i>sub-lævis</i> , De Kon., Desc. des An. Foss. de la Belgique, pl. x., fig. 1, 1843; Dav. Mon., pl. xxxi., figs. 1, 2.	+		
*	———— <i>Christiani</i> , De Kon., Monographie du Genre Productus, pl. xvii., fig. 3, 1847; Dav. Mon., pl. xxxii., fig. 1.	+		
*	———— <i>scabriculus</i> , Martin, Petrif. Derb., pl. xxxvi., fig. 5, 1809; Dav. Scottish Carb. Mon., pl. iv., fig. 18, and pl. v., fig. 6, Mon., pl. xlii., figs. 5-8; = <i>P. quincuncialis</i> , Phillips.	+	+	+
*	———— <i>pustulosus</i> , Phillips' Geol. of York., vol. ii., pl. vii., fig. 15, 1836; Dav. Mon., pl. xli., figs. 1-6, and pl. xlii., figs. 1-4, = <i>P. ovalis</i> , Phil., = <i>P. rugatus</i> , Phil., = <i>P. pyxidiformis</i> , De Kon.	+	+	+
*	———— <i>spinulosus</i> , Sow., Min. Con., tab. lxxviii., fig. 3, 1814; Dav. Mon., pl. xxxiv., figs. 18, 20, = <i>P. granulolus</i> , Phillips.	+	+	+
*	———— <i>punctatus</i> , Martin, Petrif. Derb., pl. xxxvii., fig. 6, 1809; Dav. Scottish Carb. Br., pl. iv., figs. 20, 22, Mon., pl. xli., figs. 9-18, = <i>P. elegans</i> , = <i>P. laciniatus</i> , M'Coy	+	+	+
*	———— <i>fimbriatus</i> , Sow., Min. Con., tab. ccclix., fig. 1, 1823; and Dav. Mon., pl. xxxiii., figs. 12-15.	+	+	+

In my Collector.	Catalogue of British Carboniferous Brachiopoda.	England.	Scotland.	Ireland.
*	<i>Chonetes papilionacea</i> , Phil., Geol. of York., pl. xi., fig. 2, 1836, Dav. Mon., pl. xlv., figs. 3-6, = <i>Lept. multidentata</i> , M'Coy, <i>C. papyracea</i> , M'Coy.	+		+
*	— <i>Dalmaniana</i> , De Kon., Desc. des Animaux Foss. de la Belgique, pl. xiii., fig. 3, and pl. xiii. bis, fig 2, 1843.	+		
	— <i>comoides</i> , Sow., M. C., tab. cccxxix, 1816.	+		+
*	— <i>Buchiana</i> , De Kon., Desc. des An. Foss. de la Belgique, pl. xiii., fig. 1, 1843; and Dav. Scottish Carb. Mon., pl. ii., fig. 1.	+	+	+
	Var. <i>crassistria</i> , M'Coy, Synopsis, pl. xx., fig. 10, 1844; and British Carb. Foss., pl. iii. n, fig. 5; England, Ireland.			
?	Var. <i>tuberculata</i> ?, M'Coy, Synopsis, pl. xx., fig. 5, 1844; Ireland.			
	Var. <i>bifurcata</i> , Dav. Mon. Settle, Yorkshire.			
*	— <i>Hardrensensis</i> , Phil., Figs. and Descr. of the Pal. Foss. of Cornwall and West Somerset, pl. ix., fig. 184, 1841; and Dav. Mon. of Scottish Carb. Br., pl. ii., fig. 2-7, = <i>C. (Lept.) sub-minima</i> and <i>C. (Lept.) gibberula</i> M'Coy.	+	+	+
	<i>Doubtful species, varieties, or synonyms.</i>			
	<i>C. volva</i> , M'Coy, Synopsis, tab. xviii., fig. 14; Ireland.			
	<i>C. (Orthis) sulcata</i> , M'Coy, " " " 6; "			
	<i>C. (Lept.) perlata</i> " " " 9; "			
	<i>C. (Lept.) serrata</i> " " " 10; "			
	<i>C. polita</i> , M'Coy, Br. Pal. Foss., t. iii. d., fig. 30; England.			
	<i>C. Laguessiana</i> , De Kon., An. Foss. de la Belgique, tab. xii. bis, fig. 4; England.?			
*	<i>Crania quadrata</i> , M'Coy, Synopsis, pl. xx., fig. 1, 1844; and Dav. Scottish Carb. Mon., pl. v., fig. 12-21.	+	+	+
	— ? <i>Rychholtiana</i> , De Kon., Animaux Foss. de la Belgique, pl. xxiii., fig. 5, 1843, = <i>C. vescicularis</i> , M'Coy, Synopsis, pl. xx., fig. 3, 1844.	+		+
	— ? <i>trigonalis</i> , M'Coy, Synopsis, pl. xx., fig. ii, 1844.			+
*	<i>Discina nitida</i> , Phillips' Geol. of York., vol. ii., pl. xi., figs. 10-13, 1836; and Dav. Scottish Carb. Mon., pl. v., figs. 22-29, 1860, = <i>O. cincta</i> , Portlock, = <i>D. bulla</i> , M'Coy.	+	+	+
	— <i>Davreuxiana</i> , De Kon., An. Foss. de la Belgique, pl. xxi., fig. 4, 1843.			+
*	<i>Lingula squamiformis</i> , Phillips' Geol. York, vol. ii., pl. xi., fig. 14, 1836; and Dav. Scottish Carb. Mon., pl. v., fig. 30-35, 1860, = <i>L. marginata</i> , Phil., <i>L. Portlockii</i> , M'Coy.	+	+	+
*	— <i>mytiloides</i> , Sow., Min. Con., tab. xix., fig. 1, 2, 1813; Dav. Scottish Carb. Mon., pl. v., figs. 38-43, = <i>L. elliptica</i> , Phil., = <i>L. parallela</i> , Phil.	+	+	+
*	— <i>Credneri</i> , Genitz, Versteinerungen des Zechsteingebirges, pl. iv., figs. 23, 29, 1848.	+		
*	— <i>Scotica</i> , Dav. Scottish Carb. Br., pl. v., figs. 36, 37, 1860.		+	
		97	51	73

Total to Great Britain, 107 species.?

OBSERVATIONS.

Terebratula.—Four species have been provisionally admitted; but as they appear all so closely connected by intermediate or passage shapes, it may still remain a question whether they in reality are more than varieties or modifications in shape of a single species? It has often been said and thought that *T. hastata* was no more than an elongated full-grown condition of Martin's *T. sacculus*, and it is at times hardly possible to distinguish certain examples of *T. Gillingensis* and *T. vesicularis* from Martin's shell. *T. virgoides* has been supposed to be distinct from *T. hastata*; but after a lengthened examination of the original specimen figured in the "Synopsis," and another from the same locality (Windmill, in Ireland), I could not make up my mind to separate it from *T. hastata*, to some specimens of which it bears much resemblance. *T. vesicularis* is a very variable shell; for, while some specimens present the deep triundate or triplicated dorsal valve, or frontal margin, in the greater number of individuals this is very slightly marked, and even absent. *T. vesicularis* was for long believed to be a small shell not exceeding seven lines in length, but some large examples recently discovered at Bowertrapping, in Scotland, have exceeded an inch in length.

It would, therefore, not be impossible that all the British Carboniferous *Terebratulæ* hitherto discovered may, perhaps, belong to a single species, capable of assuming different shapes, and not presenting a greater extent of modification than what we find in the *T. Australis* as well as in many other recent and fossil species. Are not the Jurassic *Ter. plicata* and *T. fimbriata* entirely smooth up to a certain age, and indeed often so to an advanced age, when they suddenly, or by degrees, becomes more or less regularly or irregularly plicated during the remaining period of their growth? For the present, however, and until our ideas as to the *absolute necessity* of enlarging the circle or range of variation to be permitted to a species be admitted and understood, the four species of *Terebratula* recorded may be provisionally retained.

Athyris or *Spirigera*.—In external shape the species of this genus approach more to *Terebratula* than to any other, and therefore in a good or natural arrangement should precede *Spirifer*. Of *Athyris*, eight species have been provisionally retained from among the many synonyms, while the value of *A. globularis* and *A. squamigera* may still require confirmation, for of both these shells the material at my command has been very scanty; and it is even uncertain whether the identification with *A. squamigera* (de Koninck) be correct.

Of *Retzia* there appears to exist two species, of which *R. radialis* is both the less rare and most variable shell; for in some localities it appears to occur as a small race with slender ribs, which in other localities individuals twice the size with stronger ribs are prevalent. Of *Retzia ulotrix* I am acquainted with but two or three British examples, so that a search for more would be very desirable.

Spirifera.—Twenty-five species (?) are here provisionally retained, for the reasons already given, viz., the want of sufficiently certain connecting links; but it is highly probable that with time and study some few of these may be dispensed with, or retained as mere varieties. Martin's *Spirifera striata* is the largest and most typical form of the genus, and must therefore always be considered a good species; but I would recommend a further study of *Sp. Mosquensis*, *Sp. humerosa*, and *Sp. duplicicosta*, in order to ascertain whether they are also good species, or modifications of *Sp. striata*; for I confess that many examples of the three last-mentioned species could be but doubtfully separated from Martin's shell. *Sp. planata* and *Sp. triangularis* appear to be good species. *Sp. bisulcata* has varied considerably in form; and I am quite disposed to agree with my friend, Prof. de Koninck, in the idea that *Sp. crassa* and *Sp. grandicostata* are simple modifications in the shape of *Sp. bisulcata*. It is even a question requiring further examination whether *Sp. trigonalis* should be considered separate; and, although *Sp. convoluta* is a wonderfully transverse and curious shell, I am not yet quite satisfied that it is not likewise related to *S. bisulcata*. *Sp. rhomboidea*, Phill., is still an uncertain form, of which my material has been too scanty; and as I am uncertain whether I was justified when uniting it to *Sp. convoluta*, it will be better for the present, at least, to retain it as separate. Of *Sp. fusiformis* but a single fragmentary specimen has been hitherto discovered, so that its specific claims cannot be definitely admitted.

Sp. mesogonia is also a rare shell, for I have never seen of it more than the figure in the "Synopsis;" and Irish geologists and collectors will do well in searching for more specimens. *Sp. cuspidata* is a good species, distinct from *Sp. distans*; to which last I would unite *Sp. bicarinata*, which M'Coy established on a single imperfect specimen from Cork, in the possession of Dr. Haimes, and which has much of the appearance assumed by certain examples of *S. distans*. *Sp. triradialis* is a good species, but very variable in the arrangement and number of its ribs; and of which the *Sp. trisulcosa* and *Sp. sexradialis* of Phillips are evident modifications. *Sp. Reedii* must be looked upon as a doubtful species, requiring, perhaps, to be hereafter expunged; my material was very scanty, and I have since had doubts as to its validity. *Sp. pinguis* is a good but variable species, into which should perhaps be combined, as varieties, *Sp. ovalis* and *Sp. integricosta*, for many intermediate shapes are often found, so much so that the palæontologist is often puzzled how to determine with which of the three they should be located; but, the larger number of specimens being tolerably distinct and easily recognisable, we may be excused for provisionally retaining the three denominations.

Sp. glabra is another excellent species, or a type round which are clustered many modifications not sufficiently marked to constitute separate species; for, although the typical form of *Sp. glabra* possessed smooth valves, it is not uncommon to find in other examples faint indications of lateral plication, or obscurely flattened or slightly rounded ribs, the fold and sinus remaining always smooth. These

modifications lead us gradually to *Sp. rhomboidalis*, which might also be nothing more than a variety of *Sp. glabra*. I merely express here on this and other questions the results of my own impressions or personal observations, which may be more or less erroneous. *Sp. Urvii* is a good little species, which I believe to be a recurrent form of the Devonian, and present also in the Permian strata, notwithstanding Prof. King's assertion to the contrary.

Sp. Carluikiensis, as far as I know, is also distinct; while *Sp. lineata* is another excellent species, but exceedingly variable in shape and sculpture; at one time I felt disposed to unite with it *Sp. elliptica*; but having subsequently felt somewhat uncertain, have since preferred to consider it provisionally separate.

Sp. Urvii, *Sp. lineata*, and I believe *Sp. elliptica* had their surfaces closely covered with numerous small spines, and it is possible that other forms were so invested.

Spiriferina.—Of this subgenus three species only appear to have been properly distinguished, viz., *Sp. laminosa*, *Sp. insculpta*, and *Sp. cristata*, var. *octoplicata*. *Sp. minima* has been established on one or two specimens still very doubtfully characterized; as all my efforts have been unsuccessful in the endeavour to obtain more, I consider the name hardly worth retaining.

Cyrtina.—Of this subgenus two good species appear to exist, viz., *C. septosa* and *C. carbonaria*, a third, *C. dorsata*, is somewhat doubtfully determined, on account of the imperfect material at my command, which consisted of two fragments only from the Carboniferous limestone of Cork, in Ireland. It would, therefore, be very desirable that geologists in that locality should have a search for better specimens.

Rhynchonella.—Nine species are provisionally retained; but the claims of *Rh. cordiformis* have not been satisfactorily established; and of *Rhynchonella? gregaria* but two imperfect valves have come under my examination. *Rhynchonella? trilatera* appears to be also a very rare species, for I am acquainted with only a very few specimens from Derbyshire, in the British Museum, and in that of the School of Mines: it appears also to be a rare shell in Belgium. *Rh.? nana* and *Rh. semisulcata* are by far too doubtful to deserve more than a passing notice; and it is deeply to be regretted that palæontologists can bring themselves to fabricate *species* on such insufficient and imperfect material, adding only confusion where such should be carefully avoided.

Camarophoria.—Four species have been recorded; but more abundant and better material with reference to *C. isorhyncha* and *C. lateralis* must be obtained before these can be definitely adopted. Of the first I am acquainted with but a single imperfect example: of the second, with those only in the Cambridge Museum.

C. Crumena, Martin, is a well made out species, and evidently the same as that from the Permian rocks known under the designation of *C. Schlotheimi*; and although I consider myself justified in referring *Terebratula rhomboidea* and *T. seminula* of Phillips to the same

author's *C. globulina*, the matter may perhaps demand some further examination.

Strophomena analoga.—This species appears to have been recurrent from the Silurian and Devonian periods; and although certain small differences of secondary value may be observed in the *St. rhomboidalis* (Silurian) and the *St. analoga*; they are both constructed on a similar model, and appear to be varieties of a single species. As however some small differences in detail may be noticed in the Carboniferous shell, the term *analoga* should perhaps be retained, if not as a specific, at least as a varietal designation.

Streptorhynchus crenistria, Phillips. Many so-termed species have been fabricated out of varieties or variations in the shape of this very variable shell; and of which the larger number (if not all) are undoubted synonyms. Three or four of these may however still demand further examination and study, so as to determine whether they should be considered more than varieties of *S. crenistria*? I have therefore provisionally retained the following designations, *S. arachnoidea*, *S. Kellii*, *S. cylindrica*, and *S. radialis*, as named varieties of *S. crenistria*. Of *S. cylindrica* I have never seen any other than the type, and although *S. Kellii* is stated to be plentiful in certain Irish localities, but three specimens in all have passed under my observation. Prof. Phillips informs me that he believes *S. radialis* to be quite distinguishable and distinct (except from *S. Darwiniana*) from *S. crenistria*; and M. De Verneuil expresses a similar opinion.

Orthis.—Of this genus *O. resupinata*, *O. Michelini*, and *O. Keyserlingiana* are well made out species; but the *Orthis? antiquata* has not been sufficiently studied; and indeed all my efforts have been unsuccessful to procure the sight of any other than the original specimen figured in the Geology of Yorkshire, now in the British Museum.

Productus.—Of this genus some thirty species have been retained: nor does the attentive study I have made of the species lead me to imagine them more variable or difficult of recognition or identification than are the other Brachiopoda of the Carboniferous period; but have been perhaps less attentively studied by the generality of geologists. In my monograph I have endeavoured to describe and illustrate all their external and internal details; but with reference to some few the material in my possession or at command was insufficient; and I would urge upon those who may be favourably located to search for specimens which would enable palæontologists to clear away those doubts that may still remain unsolved.

Productus giganteus is both the largest and typical species of the genus, but very variable in its shape. Large examples are abundant in certain localities; while young specimens appear to be less commonly found or collected.

P. hemisphæricus is a badly made out species? and I am not yet able to concur in the opinion recently expressed upon the subject by my learned and much esteemed friend, Prof. de Koninck; and to whose labours science is so much indebted. I am, on the contrary,

disposed to believe that Sowerby's figures of *P. hemisphæricus*, belong to varieties of *P. giganteus*. This matter will be further discussed in my monograph, for the limits prescribed to this communication will not permit of more lengthened explanations. *P. humerosus* has been established on some singular internal casts; the shell itself not having been hitherto discovered; but I cannot agree with those who would refer these casts to either *P. giganteus* or *P. semireticulatus*. The prominences in the casts or deep conical hollows (in the shell) for the accommodation of the oral arms indicate that the ventral valve was enormously thickened. The position of the adductor or oclusor muscle in the ventral valve is also slightly different from that common to *P. giganteus*, and which would of itself, in this instance, denote a specific difference. The material, however; is so very imperfect and insufficient that very little can be said upon the subject. *P. proboscideus*, and *P. ermineus*, *P. arcuarius*, are new species to England, and a very interesting discovery entirely due to the indefatigable exertions of my zealous and kind friend, Mr. Burrow, who has in the most liberal and generous manner presented me with his best, and by me figured specimens. The discovery of *P. proboscideus*, (known in one Belgian locality only,) and of so many other species at Settle, in Yorkshire, render that locality especially interesting, as it exactly represents with us the equivalent of the celebrated locality of Visé, in Belgium.

P. sub-lævis is also a new species to Britain; but I am not yet satisfied regarding the differences said to exist between it and *P. Christiani*; and should urge a search for more examples of both of these large and almost smooth species of *Productus*. The first has been obtained at Leek, in Staffordshire, as well as at Llangollen. The second is stated by Prof. de Koninck to be from Wales, but of which the locality is still unknown.

P. Wrightii is a small species with fringe, found by Mr. J. Wright, at Middleton, near Cork, in Ireland, it differs from *P. tessellatus* in several respects, and both appear good but rare British shells. *P. Youngianus* has appeared to me new; and in this opinion I am supported by Prof. de Koninck, *P. carbonarius* (if a good species) is decidedly very rare, for I have never seen more than two British examples which would agree with Prof. de Koninck's description and illustrations of the species. The distinction between *P. costatus* and *P. muricatus* are also difficult to determine, and I am now disposed to believe that if the last is not a distinct species, it may be a good variety of *P. costatus*.

Productus sinuatus, under the designation of *Leptaena sinuata*, appears to have been noticed for the first time in England by Prof. M'Coy, and, notwithstanding its well defined area, should be located under *Productus*, of which it possesses all the characters, with the exception of its well-defined ventral area, a character rare but not impossible in the genus *Productus*; and I am glad to find that Prof. de Koninck entirely coincides with the opinions I have expressed upon the subject relating to his remarkable species. *P. sinuatus* has also been recently

discovered at Bowertrapping, in Scotland; and which I was happy, to recognise among some duplicates kindly presented to me by Mr. Young. *Prod. Griffithianus* de Koninck has been recorded by Mr. Morris and others as a British species; but no examples referable to that shell have come under my observation. We need not prolong our observations with reference to the other well-known species of this important genus, but pass at once to *Chonetes*, for its species appear still involved under considerable confusion, and will require much further investigation under favourable circumstances before they can be properly or satisfactorily arranged. The difficulty is principally caused by a number of badly defined so-termed species, fabricated in Ireland and America on insufficient material.

The only British species which I have been able to recognise with any degree of certainty are *C. comoides*, *C. papilionacea*, *C. Buchiana*, *C. Hardrensis*, and perhaps *C. Dalmaniana*; but I am still uncertain with reference to this last, (although we possess examples identical with those of Belgium,) on account of the great resemblance certain specimens bear to others of *C. papilionacea*. *C. Buchiana* appears to be a well marked species, on account of its fewer or stronger ribs; but these also vary to a considerable extent. It is quite evident that the shell figured as *Lept. crassistria*, by Prof. M'Coy, in the "British Pal. Fossils" is a synonym of *C. Buchiana*; but I am still under some uncertainty whether the typical form of *C. crassistria*, published in the "Synopsis," be really the same. Anyhow, on account of its fewer and simpler ribs, it will be preferable to provisionally locate both it and *C. tuberculata* under *C. Buchiana* as uncertain varieties. The next difficulty is in the determination of what are the synonyms of the good species for which we have retained the designation of *C. Hardrensis*, and of which *C. sub-minima* and *C. gibberula* in M'Coy are evidently synonyms; but I would not venture to speak with so much confidence with reference to *C. volva*, *C. sulcata*, *C. perlata*, and *C. serrata*, M'Coy, all established on imperfect Irish specimens; but it is at the same time highly probable that if not all, the greater number are simple variations in shape of a single species. All we know of *C. sulcata* consists of a single ventral valve. *C. (Lept.) serrata* is fabricated from not even half of a similar valve! *C. volva* bears much resemblance to *C. Hardrensis*; while *C. perlata* is perhaps also a small variety of the same? *C. polita*, M'Coy, although described as smooth? looks very like many examples of *C. Hardrensis* or *C. volva*? in which the ribs are somewhat obliterated. It would therefore be impossible with the scanty material at my command; and in the present state of our information to determine which of these Irish forms are species or synonyms; and it would therefore be very desirable that Irish geologists or collectors should carefully assemble numerous specimens of *Chonetes* from the localities where the so-termed species were mentioned to occur. The *C. Laquessima* stated to occur at Derwick in England, and Rahoran in Ireland, is probably also nothing more than a variation of *Hardrensis*? Having done all that was within my power to clear up these difficulties,

without that success I had anticipated, I must leave the matter as an open question, notwithstanding the advantages I had of being able to examine the original specimens or fragments upon which the so-termed Irish species? have been founded.

Crania.—Three species have been retained; but of these *C. quadrata* is the only satisfactorily determined species. Of *Crania? trigonalis* I have never seen more than the original type, and it is still uncertain whether it is a Brachiopod, notwithstanding that we are acquainted with several similarly striated or costated species in the rocks of other periods. Of *Crania? (Patella) Ryckholtiana* de Koninck = *C. vesicularis*, M'Coy, I am acquainted with but a single Irish specimen; but the shell would appear to be less rare in certain Derbyshire localities. It would be very desirable however to procure more specimens of both *C. trigonalis*, and *C. Ryckholtiana*, and especially those showing the interior.

Discina.—Two species only have been retained, viz., *D. nitida* and *D. Davreuxiana* de Kon.; but as of this last but a single example has been found by Mr. J. Wright, in the limestone of Little Island, in Ireland, it is therefore here doubtfully recorded. I may also mention that I am strongly impressed with the idea that the Permian *D. Koninckii* cannot be specifically separated from the Carboniferous *D. nitida*.

Lingula.—The many so-termed species are reduced to four, viz., *Lingula squamiformis*, (which has sometimes attained upwards of one inch and a half in length). *L. mytiloides*, a more elongated species, *L. Credneri*, which may possibly be a variety of *L. mytiloides*, and *L. Scotica* which is separable from all the others by its tapering beaks and peculiar external sculpture.

Having thus briefly exposed the present state of my researches in connection with British Carboniferous Brachiopoda, as well as mentioned some of the difficulties which still beset my mind with reference to the positive value of certain so-termed species, and exposed my ignorance as well as the absolute necessity for much further research, let us cast a rapid glance on the Brachiopodous life during the deposition of contemporaneous (?) Carboniferous rocks in other parts of the world, in order to ascertain whether our British fauna in this respect was not to a certain extent universally represented. In Europe we find that where carboniferous strata prevail a vast majority of the same species exist; and as those of Belgium, France, Russia, etc., are already so well known, from the researches of several distinguished palæontologists, we will at once proceed to India, where out of twenty-five or twenty-six species of Carboniferous Brachiopoda hitherto determined, some fourteen or fifteen were found (on an examination I have recently made) to be specifically identical with British forms of *Spirifera striata*, *S. lineata*, *S. octoplicata*, (cristata,) *Athyris Royssii*, *A. subtilita*, *Retzia radialis*, *Rhynchonella pleurodon*, *Streptorhynchus crenistria*, *Orthis resupinata*, *Productus striatus*, *P. costatus*, *P. semi-reticulatus* and *P. longispinus*, and a further research in these distant regions will no doubt bring to light a larger number of common species.

The Australian and Tasmanian carboniferous rocks have also afforded their quota of common species, for although the forms from those continents have not been sufficiently examined, still from a passing glance I have given to collections sent home from Bundaba, and Port Stephen in Australia, as well as from Van Diemen's land, I have already been able to recognize *T. hastata*, *Sp. striata*, *Sp. glabra*, *S. lineata*, *Rh. pleurodon*, *Strept. crenistria*, *Orthis Michelini*, *Prod. cora*, etc. If again and by a rapid stride we should find ourselves cast on some of the Spitzbergian frozen coasts, we may there pick up several of our common species, such as *Sp. octoplicata*, *Strept. crenistria*, *Pro. semireticulatus*, *P. costatus*, etc., along with other forms not known in Britain, and lastly, not to extend the limits of this paper beyond reasonable bounds, should we visit the prodigiously extended carboniferous regions of America, we shall there also find a vast percentage of species identical with our own, but which in many instances are still hiding their true characters under the disguise of borrowed names. Possessing as I do a very extensive series of American Carboniferous species, and for which I am indebted to the kindness of Mr. Worthen, as well as to that of some other American geologists, and having compared these with our British species and specimens, I may mention from among others not yet sufficiently studied, the following few as being identical with our own *S. sacculus*, *Athyris ambigua*, *A. subtilita*, *A. plano-sulcata*, *A. lamellosa*, *A. Royssii*, *Retzia radialis*, *Spirifera striata*, *S. bisulcata*, *S. lineata*, *S. Uvii*, *S. octoplicata*, *Rh. pleurodon*, *Orthis Michelini*, *Strept. crenistria*, *Prod. cora*, *P. punctatus*, *P. longispinus*, *P. semireticulatus*, *P. scabriculus*, *P. costatus*, *Crania quadrata*, *Discina nitida*, *Lingula mytiloides*, etc.

This rapid but convincing proof of the existence and distribution of many characteristic British species all over the world where contemporaneous carboniferous rocks have been deposited, should inculcate upon us the absolute necessity of carefully examining and re-examining our species, so as to avoid the unfortunate results that may ensue from arbitrarily narrowing their limits of variation—thus violating the law of nature, as well as retarding the advance of science.*

Much indeed may be expected from the rising generation of young naturalists, who, unprejudiced and unfettered, may work out for themselves a new path; and by seeking to determine with more attention than has hitherto been done what are the resemblances that exist between so-termed species, may be able to trace and connect those modifications that have been produced by time and circumstances

* Darwin considers the term species as one arbitrarily given, for the sake of convenience, to a set of individuals closely resembling each other; and it does not effectually differ from the term variety, which is given to its less distinct and more fluctuating forms: that the term variety, again, in comparison with mere differential differences is also applied arbitrarily, and for convenience sake; that no one can draw any clear distinction between individual differences and slight varieties, or between individual differences or more plainly marked varieties, or sub-species or species.

on the descendants of the parent type, although it would not be possible for me fully to subscribe to Darwin's theory—which I do not perfectly realise, without much further examination and reflection—still there is so much truth in many of his views and statements regarding "The struggle for existence" and "principle of natural selection," that the subject has full claim to a calm and dispassionate examination, and may lead us by degrees to the better understanding of many problems relating to species and their origin than we at present possess.

A CHRISTMAS LECTURE ON "COAL"

BY J. W. SALTER, F.G.S.

(Continued from page 13.)

IN our last lecture stress was laid on the fact that coal-beds, unlike mineral veins, are stratified—not injected, or filling cracks in the earth as metals do. And when we use the term stratified, we mean that the materials we are considering—coal, ironstone, sandstone, clay, shale—were all deposited sheet over sheet, layer over layer, principally by the agency of water.

In scarcely any other way, except by water, can we conceive of materials being spread abroad over vast surfaces, in that even and regular manner which we call "stratified." As a rule, the matters ejected from the mouths of fiery volcanos are only rudely heaped up, and unless they fall into the sea, do not undergo this smoothing, spreading-out process. The sand of the sea-shore however, and the pebbles on its margin, and the mud of its great depths, are truly "stratified;" and if a fertile plain, or a marshy district were submerged in the waters, the materials on that surface would be soon covered over by the ooze and sand and shingle, and would then be said to be "interstratified" with them. In this way coal-beds occur among beds of sandstone and other rocks.

It is seldom that any coal-field contains more than twenty-five or thirty workable seams: and perhaps these altogether do not amount to above eighty or one hundred feet at the utmost, while in South Wales the coal *strata* are twelve thousand feet thick. The mass, you see, is rock.

The miners have names for all the other beds, or "measures" as they term them. Some of them are amusing. In Staffordshire, for instance, the beds of sandstone (once loose sand) receive the names of White, grey, green, and blue rock; Rough rock; and "Peldon." This last is a very common term.