

44. DESCRIPTION of the SPECIES of the OSTRACODOUS GENUS BAIRDIA, M'Coy, from the CARBONIFEROUS STRATA of GREAT BRITAIN. By PROFESSOR T. RUPERT JONES, F.R.S., F.G.S., and JAMES W. KIRKBY, Esq. (Read May 28, 1879.)

[PLATES* XXVIII.-XXXII.]

THE genus *Bairdia* was instituted by Professor M'Coy, in 1844, for the reception of two species of Entomostraca from the Carboniferous Limestone of Ireland. Since then other species belonging to the same genus have been described from the rocks of the same age occurring in Scotland, Bohemia, Russia, and Australia; and many species have been made known from the Silurian, Permian, Triassic, Jurassic, Cretaceous, and Tertiary strata, as well as from existing British and foreign seas.

The recent forms of *Bairdia* are all marine, and are found at various depths, ranging from 10 to 500 fathoms; and the Carboniferous species (and those found in other formations) occur in limestones, and calcareous ironstones and shales, together with Corals, Crinoids, Polyzoa, and marine Shells of all classes.

Bairdia, in fact, is exceptionally marine in its mode of occurrence in Carboniferous strata. Other marine genera of Palæozoic Entomostraca often have some stray species occurring with equivocal associates. *Leperditia*, for example, which is a markedly marine genus, has one representative, *L. scotoburdigalensis*, met with as a very common fossil in the Calciferous-Sandstone series of the east of Scotland, where it repeatedly occurs with the remains of *Lepidodendron*, *Sphenopteris*, and Ganoid Fishes. *Beyrichia*, another marine group, has *B. arcuata* as a Coal-measure species, occurring with Plants, Fishes, and other fossils characteristic of that formation, but of dubious habitat. And so with *Kirkbya*, all the species of which are marine, though at times two of them, *K. plicata* and *K. spiralis*, appear in Lower-Carboniferous strata with *Sphenopteris affinis*, *Lepidodendron*, and *Stigmaria*.

We do not say that such doubtful companions indicate purely fresh-water habits on the part of these Entomostraca, though such occurrences must mean differences in physical conditions compared with those prevailing during the formation of the limestones and other calcareous beds in which the species of these genera are usually found. Among the *Bairdiæ* we know of no such exceptions to the rule; they never occur with Fish- or Plant-remains. In the thin limestones intercalated in the thick Calciferous-Sandstone series of Fife-shire *B. plebeia*, *B. Hisingeri*, and *Leperditia scotoburdigalensis* occur, with *Orthoceras*, *Murchisonia*, *Schizodus*, and other marine shells; but the *Bairdiæ* always disappear, as well as the Mollusca, in the

* The cost of lithographing these Plates has been defrayed by a grant from the Royal Society.

intermediate beds, though *L. scotoburdigalensis* continues on in the shales and ironstones, where Plant- and Fish-remains come in as common fossils. We may here mention that six or seven species of the Ostracodous genus *Carbonia* *, with varieties, appear to have been constant inhabitants of the freshwater or brackish lagoons and shallow shore-waters where the British Coal-measures were formed; and they have not been found in any *marine* stratum of the Carboniferous series.

The *Bairdia* which we have to describe in this paper include all that are known from British Carboniferous strata. They are from the Upper and Lower divisions of the Carboniferous-Limestone series and the Calciferous-Sandstone series of Scotland, from the Yoredale Rocks and Scar Limestone of the Northern Counties of England, and from the Carboniferous Limestone of Wales and the West of England. The lowest portion of the series where they have been seen is probably the Calciferous Sandstone of Fife, where *B. plebeia*, *B. nitida*, and *B. siliquoides* are found from 3000 to 3800 feet below the base of the Carboniferous-Limestone series. The highest position in which Carboniferous *Bairdia* have been found in Scotland is in the upper division of the Carboniferous Limestone; and in England they occur in a somewhat equivalent position in the upper beds of the Yoredale Rocks. Though we have no specimens from the Millstone-grit or the Coal-measures, it is evident that several of the species continued to exist, in other areas, during the deposition of these Upper Carboniferous strata, for they reappear in abundance in the Permian rocks of Durham and Yorkshire and of Germany.

It should be mentioned that we are largely indebted to Mr. John Young, of Glasgow, for specimens and for information as to distribution; also to Messrs. James Thomson, James Armstrong, and David Robertson, of the same city; to Mr. J. R. J. Hunter, of Braidwood; to Mr. R. Etheridge, Jun., formerly of the Geological Survey of Scotland, now of the British Museum; to Mr. Charles Moore, of Bath, Dr. H. B. Holl, and others. Our examination of hundreds of specimens belonging to the Geological Survey of Scotland has greatly enlarged our knowledge of these Entomostraca.

BAIRDIA, M'Coy.

Professor M'Coy briefly described the genus as:—"Shell elongate, fusiform, suddenly tapering at both ends; a very short proportion of the valve overlaps the abdominal margin."

The generic characters have been more fully noticed by one of us in a 'Monograph of the Entomostraca of the Cretaceous Formation,' 1849, p. 22, and in a paper on "Permian Entomostraca from Durham," 'Trans. Tyneside Field-Club,' vol. iv. 1859, p. 139. More recently Prof. G. S. Brady has given an account of the genus, from a study of the recent species, in the 'Transactions of the Linnean Society,' vol. xxvi. p. 388, and the 'Transactions of the Zoological Society,' vol. x. p. 383.

* See Ann. & Mag. Nat. Hist. ser. 5, vol. iii. p. 28, pls. ii. & iii.

The Carboniferous (and Permian) forms are, like many others, usually more or less subdeltoidal in the general shape of the carapace, with the posterior end the smallest, and often pointed or rostrate. Other forms are subcylindrical, and others subovate, in outline. The left valve always overlaps the right along both margins, but most strongly and regularly on the dorsal margin. The surface is usually smooth, though occasionally pitted. In some examples the muscle-spot is seen; it consists of a congeries of small raised spots (seen as depressions on the internal casts), circularly arranged within a faintly sunken area.

1. *BAIRDIA CURTA*, M'Coy. Plate XXVIII. figs. 1-8.

Bairdia curtus (only partly exposed in its matrix *), M'Coy, 1844, Synopsis Carboniferous Limestone Fossils of Ireland, p. 164, pl. xxiii. fig. 6.

Cythere (Bairdia) curta, Jones, 1849, in King's Monograph of Permian Fossils, p. 61, pl. xviii. fig. 3.

Bairdia curta (freed from its matrix), Jones, 1870, Monthly Microscopical Journal, vol. iv. p. 185, pl. lxi. fig. 1.

After some oscillation of opinion, we think it best to look upon *B. curta* as distinct from *B. plebeia*. We discussed this question in 1859, when describing some Permian *Bairdiæ* †; and we returned to it in 1866, when we were inclined to look upon the two forms as belonging to one species ‡. But after further examination, with the help of additional material, it appears to be *least* objectionable to consider those specimens which have the anterior extremity angulated above as belonging to *B. curta*, and the specimens with the same extremity rounded both above and below as belonging to *B. plebeia*. In coming to this decision we are aware that the most is made of small differences, and that the existence of intermediate forms is in a measure ignored. But this is only what we have had to do in studying the Carboniferous *Bairdiæ* generally, and to some extent among the Ostracoda from other formations. The longer we investigate, and the more specimens we examine, the greater difficulty do we find in grouping the various forms and varieties into species. Doubtless had we the animal, as well as the carapace that enclosed it, to assist us in determining the species, important differences might be seen, which are only hinted at in the materials preserved to us §. And this possibility has been allowed to have some weight in the present instance as well as in others. We describe the species under notice as follows:—

* See 'Transact. Tyneside Field-Club,' vol. iv. p. 151; and Ann. & Mag. N. H. ser. 3, vol. xviii. p. 42.

† Trans. Tyneside Field-Club, 1859, vol. iv. p. 150.

‡ Ann. & Mag. Nat. Hist. 1866, ser. 3, vol. xviii. p. 42.

§ Not only specific, but even generic differences would probably be shown by the soft parts, were they preserved. Carapaces which we are obliged to refer to the one genus, *Bairdia*, may possibly belong to such different groups as *Bythocythere*, *Macrocypris*, *Paracypris*, and *Cytherura*, as defined by the researches of G. S. Brady, G. O. Sars, and others.

Carapace elongately subdeltoid in outline; length in type specimen less than two and a half times the height, in others considerably more than that. Dorsal border arched (in some examples flatly so), with both slopes slightly concave; ventral border straight or faintly incurved. Anterior extremity broad, rounded below, and angulate above; posterior extremity produced and rostrated. Left valve overlaps the right moderately on both borders. Surface smooth. Length $\frac{1}{25}$ to $\frac{1}{14}$ inch.

Fig. 1 represents Sir R. Griffith's original specimen (cleared from the matrix), from which Prof. McCoy described the species. Fig. 3 is from a very beautiful example in the collection of Mr. John Young. Both it and fig. 6 are relatively longer, flatter in the arching of the dorsal border, and with a more broadly rostrated anterior end than the type specimen. Fig. 5 represents a right valve which is included in this species with some doubt. The posterior extremity is less elevated than in other specimens, and is acutely pointed rather than rostrated, and it has a straight slope on the hinder third of the dorsal border. Still the specimen has more the character of *curta* than of any other species; we refer to it as *B. curta*, var. *terebra*, and notice that it is near the Permian *B. rhomboidea*, Kirkby, Trans. Tyneside N. F.-Club, 1859, vol. iv. pp. 147 & 149.

Fig. 7 represents a variety which we name *bicornis*. Its dorsal border is elevated and flat in the middle region, with deeply excavated anterior and posterior slopes, both of which curve upward to form acutely angular extremities. The extremities make two strong convex curves, meeting at the middle of the ventral border, which is thus sinuated and incurved at the centre; it is rather more protuberant anteriorly than behind. The anterior extremity is thus broad and trenchant, and the posterior acutely and obliquely rostrated. The central portion of the valves rises abruptly from the regions adjoining the ventral border and the ends, which are compressed. The lateral outline of the carapace resembles the shape of a Scythian bow.

Fig. 8, var. *deformis*, is from an example from Steeraway, Salop, that has much in common with the one just noticed; but the slopes of its dorsal margin do not curve upward to acute points as in fig. 7, and the anterior third of the carapace is much more protuberant ventrally. In Mr. Charles Moore's collection.

Localities of Bairdia curta.

In England. *Carboniferous Limestone*: Wyebourne, Cumberland; Settle, Yorkshire; Steeraway, near Wellington, Salop.

In Scotland. *Carboniferous Limestone (Upper)*: Kennox Water (Douglas) and Wester House (Carluke), both in Lanarkshire.

Carboniferous Limestone (Lower): Braidwood (Carluke), Brockley (near Lesmahagow), Shields Farm (East Kilbride), Calterside (South Shiells), all in Lanarkshire; Causland and Fernie Hill (Gilmerton), in Edinburghshire.

In the 'Annals & Mag. N. Hist.' ser. 1, 1847, vol. xx. p. 229,

&c., Prof. McCoy, writing of the Carboniferous Entomostraca of Australia, refers to *B. curta* as occurring in the Dunvegan shales, together with a form which he recognizes as "*Cythere impressa*," McCoy (*Beyrichia*?) : see Ann. N. H. ser. 3, vol. xviii. p. 44, &c.

2. BAIRDIA PLEBEIA, Reuss. Plate XXVIII. figs. 9-19.

Bairdia plebeia, Reuss, 1854, Jahresbericht wetterau. Gesellsch. 1854, p. 67, fig. 5.

B. Geinitziana, Richter, 1855, Zeitsch. deut. geol. Ges. vol. vii. p. 530, pl. 26. fig. 12.

B. plebeia, Kirkby, 1858, Annals Nat. Hist. ser. 3, vol. ii. p. 324, pl. x. figs. 1-7.

B. plebeia, Kirkby & Jones, 1859, Trans. Tyneside Nat. Field-Club, vol. iv. pp. 141-146, pl. ix. fig. 7.

Cythere (Bairdia) plebeia, Kirkby, 1861, Quart. Journ. Geol. Soc. vol. xvii. p. 308.

Cythere (Bairdia) plebeia, Kirkby, 1862, Annals of Nat. Hist. ser. 3, vol. x. p. 203, pl. iv. figs. 5-10.

Cythere plebeia, E. E. Schmid, 1867, Neues Jahrbuch, &c. 1867, p. 581, pl. vi. fig. 26 (not figs. 1-25 & 27-45; these are all grouped together at pp. 582 & 588).

Bairdia plebeia, Jones & Kirkby, 1875, Ann. Nat. Hist. ser. 4, vol. xv. p. 56, pl. vi. figs. 6, 7.

B. plebeia, as a Permian species, has been described by both Reuss and ourselves; but we will briefly notice its leading features from Carboniferous specimens.

Subdeltoid in outline, with the valves convex except at the ends, which are compressed; length a little more than twice the height. Dorsal border arched, with the posterior slope always concave, and the anterior slope occasionally so; ventral border straight or slightly incurved. Anterior extremity rounded, most prominent above; posterior extremity rostrated. The right valve strongly overlapped by the left on the dorsal border, and on the centre of the ventral border. Surface smooth; rarely pitted. Length $\frac{1}{25}$ to $\frac{1}{18}$ inch.

Carboniferous specimens of this species present many variations of form. These variations mainly consist of increase in relative length, of sinuation or non-sinuation of the anterior slope, of the tendency of the anterior extremity to become subangulated, and proportionate length and rostration of the posterior extremity.

Fig. 15 is from a Craigenglen specimen, showing a coarsely pitted surface, in which character it resembles *B. ampla*; nevertheless the general form of the carapace is that of *plebeia*.

Figs. 16-18 show a much inflated form from the Carboniferous Limestone of Backwell, near Bristol. The lateral contour and end view of this specimen differ considerably from those of ordinary *B. plebeia*.

B. plebeia appears to have been the prevailing form of the genus during the Upper Palaeozoic periods. The following *Localities* are some of those where it has been found:—

In England and Wales. *Yoredale Rocks*: Whorlton and Barnard Castle, in Durham.

Carboniferous Limestone: Weardale, Durham; Wyebourne, Cumberland; Settle, Yorkshire; Great Ormes Head, Caernarvonshire; Backwell and Charterhouse, in Somerset; Weston-super-Mare, Somerset; Brocastle, South Wales.

In Scotland. *Carboniferous Limestone (Upper)*: Pathhead, Fife; Levenseat Limestone-Pits, Edinburghshire; Gare, Carlisle, and Robroystone, in Lanarkshire; Garple Burn (Muirkirk), Williamswood near Cathcart, and Orchard near Pollokshaws, in Renfrewshire; Swindridge and Highfield (Dalry) in Ayrshire.

Carboniferous Limestone (Lower): Pitlessie Limeworks, coast near Ardross, and coast east of St. Monans, in Fifeshire; Darcy Quarry, Currielee Limeworks, Magazine Limeworks, Causland, West Mains Farm (Baads), Mount Lothian, Fullarton, Bents, Mansfield, all in Edinburghshire; Prestongrange, East Lothian; Galabraes, Linlithgowshire; Calderside, South Shieles, East Drunnoch, Shield's Farm (East Kilbride), High Blantyre, Brockley (Lesmahagow), Carlisle, Brankumhall Quarry, all in Lanarkshire; Corriecburn (Sculliongeur), Craigenglen, Campsie, in Stirlingshire; Broadstone, Howrat (near Beith), Craigie (Kilmarnock), in Ayrshire; Campbeltown, Argyleshire.

Calcareous Sandstone: Coast near Randerstone; coast east of Pittenweem, and coast west of Pittenweem, Fifeshire; Donkin's Quarry, near Ecclefechan, Dumfriesshire.

3. BAIRDIA HISINGERI, Münster. Plate XXIX. figs. 4-10.

Cythere Hisingeri, Münster, 1830, Jahrbuch für Mineralogie, p. 65.

Bairdia Schauerothiana, Kirkby, 1858, Annals Nat. Hist. ser. 3, vol. ii. p. 329, pl. x. fig 14.

Cythere Schauerothiana, Geinitz, 1861, Dyas, p. 36.

Cythere (Bairdia) Schauerothiana, Kirkby, 1862, Ann. Nat. Hist. ser. 3, vol. x. p. 203, pl. 4. figs. 1-12.

Bairdia Hisingeri, Jones & Kirkby, 1865, Ann. Nat. Hist. ser. 3, vol. xv. p. 408, pl. xx. fig. 12.

Subrhomboidal in outline; convex: length rather more than twice the height. Dorsal border straight or slightly convex in the middle portion, with an easy slope to the anterior extremity, and an abrupt one to the posterior extremity; ventral border incurved anteriorly, and rounded towards each end. Anterior extremity broad, rounded, and overhanging above; posterior extremity projecting (ram-like), subangulate, or slightly rostrated. The left valve overlaps the right strongly along the dorsal border; also along the ventral border, where a flange projects about the anterior third. Surface smooth. Muscle-spot placed near the centre of the valve, and formed by a central dot, surrounded by eight or more others, all of which are somewhat raised above the surface of a shallow circular excavation. Length $\frac{1}{10}$ inch.

This robust species is distinguished by its great size, rhomboidal form, and abrupt posterior slope—also, in many specimens, by the strong overlap of the left valve, especially on the ventral border, and, in consequence, by a more distinct antero-ventral curve, amounting almost, in some cases, to a blunt angle.

Next to *B. plebeia*, this species is, perhaps, of the most common occurrence in Carboniferous strata. Some of the *Localities* known to us are given below:—

In England and Wales. *Carboniferous Limestone*: River Wansbeck, Northumberland; Wyebourne, Cumberland; Great Ormes Head, Caernarvonshire; Steeraway, Salop; Holwell, Somerset.

In Scotland. *Carboniferous Limestone (Upper)*: Gillfoot, Carlisle, and Kennox Water (Douglas), in Lanarkshire.

Carboniferous Limestone (Lower): Mayfield Quarry and Currielee Limeworks (near Dalkeith), West Mains Farm (Baads), Fullarton, Mount Lothian, all in Edinburghshire; Galabraes, White Baulks, North Mine Quarry, in Linlithgowshire; Prestongrange (East Lothian), Hillhead Quarry (Wilsontown), South Shiells, Fullwood (Carlisle), Braidwood (Carlisle), Brockley (Lesmahagow), in Lanarkshire; Craigenglen, Campsie, Stirlingshire; Craigie (near Kilmarnock) and Howrat (near Dalry) in Ayrshire.

Lower Carboniferous Series: Donkin's Quarry (near Ecclefechan) and Bonshawburnhead Quarry, in Dumfriesshire.

4. BAIRDIA AMPLA, REUSS. Plate XXVIII. figs. 20–23; Pl. XXIX. fig. 3; Pl. XXXII. figs. 17, 18.

B. ampla, Reuss, 1854, Jahresb. der wetterau. Ges. p. 68, fig. 7.

B. ampla, 1859, Jones, Trans. Tyneside Field-Club, vol. iv. pp. 162 & 166, pl. xi. figs. 14, 19.

B. ampla, Kirkby, 1861, Quart. Journ. Geol. Soc. vol. xvii. p. 308.

B. ampla, Jones & Kirkby, 1875, Annals Nat. Hist. ser. 4, vol. xv. p. 56, pl. vi. fig. 5.

B. ampla is not of very common occurrence in Carboniferous strata, though examples are found showing the punctate surface-ornament characteristic of the species in the Permian formation. Of the specimens figured, perhaps the valve from Whorlton (Pl. XXIX. fig. 3) is the most typical, having the finely arched dorsal border, with the convex slopes, the broad and evenly rounded anterior extremity, and the nearly straight ventral border of good Permian examples.

The internal cast of a left valve from Wyebourne (fig. 23) shows an impression of the muscle-spot, which is formed of six small spots grouped round a central spot. This cast approaches *B. brevis*, J. & K., in outline, but differs therefrom in its greater relative length.

Localities of B. ampla.

In England. *Yoredale Rocks*: Whorlton, Durham.

Carboniferous Limestone: Wyebourne, Cumberland.

In Scotland. *Carboniferous Limestone (Upper)*: Levensseat, Edinburghshire.

Carboniferous Limestone (Lower): Darcy Quarry (Dalkeith) and Mount Lothian, in Edinburghshire; North Mine Quarry (Linlithgowshire), Hairmyres (East Kilbride), Auchenbeg (Lesmahagow), in Lanarkshire; Dockra (Beith), Craigie (Kilmarnock), in Ayrshire.

Other figures of this species are here given for the purpose of showing the pitted surface that often characterizes well-preserved specimens.

Fig. 17, Pl. XXXII., is from Hairmyres, East Kilbride.

From Blinkbonny Quarry and some other localities we have specimens, collected by the Geological Surveyors of Scotland, showing an irregularly reticulated surface, as depicted in fig. 18, Pl. XXXII. These specimens approach *B. plebeia* in some of its forms; but from that species they differ in having a decidedly convex ventral border, and much greater rotundity of valves, with greater relative length.

5. *BAIRDIA GRANDIS*, n. sp. Plate XXIX. figs. 1, 2.

Cythere (Bairdia) plebeia, Reuss, var. *grandis*, Jones, 1859, Trans. Tyneside Field-Club, vol. iv. p. 162, pl. xi. fig. 13.

From Whorlton and some other localities we have a large form of carapace-valve that well answers to the cast described and figured as *B. plebeia*, var. *grandis*, as above quoted. The carapace reminds us rather more of *B. subdeltoidea*, as to its shape, than *B. plebeia*. Its size, too, and its relatively greater height and less produced posterior extremity, all distinguish it from *B. plebeia*. Hence we raise it to specific rank, and describe it thus:—

Subdeltoid in outline; length less than twice the height. Dorsal border boldly convex, with sinuous anterior and posterior slopes; ventral border straight. Anterior extremity broad, rounded; posterior extremity bluntly pointed. Surface smooth. Length $\frac{1}{2}$ inch.

B. grandis has been found in *Yoredale Rocks* at Whorlton, Durham, and in *Carboniferous Limestone (Lower)* at Carlisle, Lanarkshire.

6. *BAIRDIA MUCRONATA*, Reuss. Plate XXIX. fig. 11.

B. mucronata, Reuss, 1854, Jahresb. wetterau. Ges. p. 67, fig. 6.

B. mucronata, 1855, Richter, Zeitschrift deutsch. geol. Ges. vol. vii. p. 531, pl. 26. figs. 18, 19,

We have a single specimen of a carapace-valve from Whorlton, which corresponds closely with the figure of *B. mucronata* given by Reuss and Richter, except in being somewhat higher—a difference of, perhaps, no moment as to specific relationship. Reuss describes the species as follows:—"Elongately elliptical; rounded in front; running out behind into a long, narrow, compressed flap; upper margin arched; under margin almost straight; surface smooth." This answers very well for our specimen.

In *Yoredale Rocks* at Whorlton, Durham.

7. *BAIRDIA SUBMUCRONATA*, n. sp. Plate XXIX. figs. 12-18.

B. mucronata, Reuss, var. *submucronata*, Jones and Kirkby, 1867, Trans. Geol. Soc. of Glasgow, vol. ii. p. 222.

We have specimens from Whorlton and from various localities in Scotland that possess some affinity to *B. mucronata*, but which differ from it in having an elliptical ventral margin, a more symmetrical and less pointed posterior extremity, and a lateral contour which, though convex, is flattened over its central portion. Some of the specimens show a tendency to become subrhomboidal, with a faintly rostrated posterior extremity, and so approach *B. plebeia*. But we are inclined to look upon these specimens as distinct both from the latter species and *B. mucronata*, and describe them as follows:—

Subpyriform or subrhomboidal in outline; greatest height about the anterior third; length about two and a half times the height, or less. Both dorsal and ventral borders convex. Anterior extremity roundly prominent; posterior extremity rather acutely pointed. Lateral contour flatly convex, with the posterior end the most acute. Surface smooth. Length $\frac{1}{25}$ inch.

Localities of B. submucronata.

In England and Wales. In *Yoredale Rocks* at Whorlton, Durham; and in *Carboniferous Limestone* at Great Ormes Head, Caernarvonshire.

In Scotland. *Carboniferous Limestone (Upper)*: Gare (Carluke) and Robroystone in Lanarkshire; Orchard, near Pollokshaws, in Renfrewshire.

Carboniferous Limestone (Lower): Currielee Limeworks, Magazine Limeworks, Mansfield, in Edinburghshire; Corrieburn, Craigenglen (Campsie), and Sculliongeur, in Stirlingshire; Carluke and Brockley in Lanarkshire.

Lower Carboniferous Series: Bonshawburnhead Quarry, Dumfriesshire.

8. BAIRDIA SUBELONGATA, n. sp. Plate XXX. figs. 1–11 & 16.

B. subcylindrica (Münster), Jones & Kirkby, 1867, Trans. Geol. Soc. Glasgow, vol. ii. p. 221.

B. subcylindrica (Münster), Armstrong & Young's Catalogue of Carb. Foss. of Western Scotland (1871).

We have many specimens of a long, narrow form of *Bairdia*, which have much in common with *B. elongata*, Münster, but do not approach near enough to that species (so far as we know it) to permit of absolute identification. This form we describe under the name of *subelongata*.

Elongate; length more than three times the height. Dorsal border straight or very slightly convex; ventral border straight or very slightly concave, and parallel (or nearly so) with the dorsal border. Anterior extremity broadly rounded, evenly so in many cases, but sometimes most prominent above; posterior extremity bluntly pointed, being diagonally truncate, as it were, above and below. Dorsal overlap moderate. Lateral contour about four times as long as wide, flat or flatly convex for a good central third, with pointed ends, the anterior being rather the most acute. Surface smooth. Length $\frac{1}{18}$ inch.

This description applies most exactly to the more typical examples, which are always to be distinguished by their nearly straight backs, regularity of height, and well-rounded anterior ends.

Specimens, however, occur whose backs are decidedly curved, whose height is not so equal throughout, and whose anterior ends lose the normal broadly rounded form of typical examples. Possibly such specimens (figs. 6, 8, 9) may represent a variety; but, as their lateral contour shows little or no variation, we look upon them as not showing too great a divergence from the type of this species.

Other specimens, while retaining the almost straight and parallel borders of the species, possess more pointed posterior extremities, as shown in figs. 7 & 10.

We were once inclined to look upon the examples having a convex dorsal border as probably the same as Münster's *B. subcylindrica*; but that species has the dorsal border more finely arched, a smaller anterior extremity, and a more convex lateral contour than any of the elongate forms of *Bairdia* we are noticing. This will be seen on comparing the latter with figures 14 & 15, which are from a Bavarian example of Münster's species.

Figs. 12, 13, inserted for comparison, represent what we consider to be an elongate form of *B. Hisingeri*, from Campsie.

Localities of B. subelongata.

Wales. In *Carboniferous Limestone*, at Great Ormes Head, Caernarvonshire.

Scotland. *Carboniferous Limestone (Upper)*: Ravenscraig, near Kirkcaldy, Fifeshire; Levenseat Limestone-pit, Mid Lothian; River Avon, below Kinneil Mill, Linlithgowshire; Garple Burn, near Muirkirk, Ayrshire; Orchard, near Pollokshaws, Renfrewshire; Gare (Carluke), Meikle Earnock Burn, Climpy (Wilsontown), Gillpott (Carluke), Auchenbeg (Lesmahagow), in Lanarkshire.

Carboniferous Limestone (Lower): Seafeld Tower and Inverteil Quarry near Kirkcaldy, Abden near Kinghorn, Pitlessie Quarries, Wilkinson Quarry near Cupar, Ladedda Quarry near Cupar, Woodtop Quarry (Teasses), St. Monan's, Woodend Quarry near Fordel, Charleston Quarry, in Fifeshire; Brunston Colliery, Blinkbonny Quarry, Darcy Quarry (S.W. of Dalkeith), Magazine Lime-works, Mount Lothian, Baad's Mill, Mansfield, Fullarton, Currielee, in Mid Lothian; Catteraig Land Quarry, near Dunbar, in East Lothian; North Mine Quarry, Galabraes Quarry, in Linlithgowshire; Craigenglen (Campsie), Corrieburn, in Stirlingshire; Carllops Quarry, Whitefield Old Quarry, in Peeblesshire; Calder-side Quarry, Boghead (Hamleton), East Drumock, Hillhead Quarry near Wilsontown, Ponfeigh Burn and Craighburn near Douglas, Fulwood and Braidwood (Carluke), Mousewater near Lambeatch, Sheills, Brankumhall Quarry, Brockley near Lesmahagow, High Blantyre, in Lanarkshire; Craigie (near Kilmarnock), Dockra (Beith), in Ayrshire.

Calcareous Sandstone: Billow Ness, Fifeshire.

9. BAIRDIA SUBGRACILIS, Geinitz. Plate XXX. fig. 17.

Bairdia gracilis, Jones (non M'Coy), 1850, in King's Monogr. Perm. Foss. p. 63, pl. 18. fig. 7.

B. gracilis, Reuss, 1854, Jahresb. wetter. Gesellsch. 1854, p. 65, figs. 2 a, 2 b, 3.

B. gracilis, Richter, 1855, Zeitsch. deut. geol. Ges. vol. vii. p. 530, pl. 26. figs. 16, 17.

Cythere (Bairdia) gracilis (M'Coy?), Jones, 1859, Trans. Tyne-side N. F.-Club, vol. iv. p. 163, pl. xi. fig. 15.

Bairdia subgracilis, Geinitz, 1861, 'Dyas,' p. 34, figs. 9a-c.

From the "Main Limestone" of the Carlisle district we have examples of an elongate *Bairdia* (fig. 17) possessing a more strongly convex dorsal and incurved ventral border than any specimens we have described as belonging to *B. subelongata*. They have altogether a curved outline, the dorsal border being convex and the ventral border concave, with the anterior half of the carapace considerably the larger. The posterior extremity is pointed, and the anterior rounded. These specimens have not the shell well preserved; but, so far as can be judged, they come very near the Permian form, which one of us identified with *B. gracilis*, M'Coy, and which Dr. Geinitz has since named *subgracilis*.

The figures given for this species by Reuss, Richter, and Geinitz differ somewhat among themselves as to the relative proportions of the posterior third of the carapace; but the general shape sufficiently accords throughout to indicate a specific alliance.

10. BAIRDIA BREVIS, Jones & Kirkby. Plate XXXI. figs. 1-8.

B. brevis, J. & K. 1867, Trans. Geol. Soc. Glasgow, vol. ii. p. 221.

B. brevis, J. & K. 1871, Armstrong and Young's Cat. Carb. Foss. of West Scotland, p. 25.

Subrhomboidal; length about half as much again as the height. Dorsal border boldly convex, the posterior slope of the arch being much the deepest and rather concave; ventral border convex in most examples, but in some nearly straight in the centre and rounded towards the ends. Anterior extremity broad, rounded, or subtruncate, most prominent above; posterior extremity rostrated, with the beak usually more or less acute. Lateral contour broadly lenticular, with the greatest width in the centre, which is rather less than half the length. Surface smooth. Length $\frac{1}{25}$ to $\frac{1}{20}$ inch.

The specimens figured show the most important variations of outline. Such variations mainly relate to the amount of inward slope of the anterior extremity, as depicted in figs. 3 & 5, and to the convexity of the ventral border, which, in such examples as are represented by figs. 2 & 3, forms a bold sweep continuous with the inferior slopes of the two extremities, while in others (fig. 5) it is flattened in the centre to nearly a right line.

Compared with its height (about two thirds of the length), this is the shortest species of the genus.

Localities. In England this species has been found in the Carbo-

niferous-Limestone series of Wyebourne, Cumberland; Weardale, Durham; Charterhouse, Somerset; and Scremerston, near Berwick-on-Tweed.

In Scotland. *Carboniferous Limestone (Upper)*: Climpy, Wilsontown, Lanarkshire.

Carboniferous Limestone (Lower): Seafield Tower and Inverteil Quarry (near Kirkcaldy), Abden (Kinghorn), Roscobie and Charles-ton Quarry (near Dunfermline), Ladedda, Wilkinson, and Woodtop Quarries (near Cupar), Pitlessie Quarries, in Fifeshire; Hillhead Quarry (near Cockmuir Bridge), Blinkbonny Quarry, Brunston Colliery, in Mid Lothian; Salton Limeworks, Kidlaw Quarry, Paiston Quarry, Cateraig Land Quarry and Burlage Quarry (near Dunbar), in East-Lothian; Craigenglen (Campsie), Spouthead Burn, in Stirlingshire; Brockley (Lesmahagow), Braidwood (Carlisle), in Lanarkshire; Bonshawburnhead Quarry, Dumfriesshire.

11. *BAIRDIA SILIQUOIDES*, sp. n. Plate XXXI. figs. 9-14.

Siliquiform, or pod-shaped; length from two and a quarter to less than three times the height. Dorsal border almost evenly arched, with the extremities nearly alike, the anterior being rather wider or less acute than the posterior; ventral border convex. Lateral contour plumply lenticular. Surface smooth? Length $\frac{1}{20}$ to $\frac{1}{18}$ inch.

Most of the examples of this species which we have seen were collected by the officers of the Geological Survey of Scotland, from a shale of the Carboniferous-Limestone series, on the River Avon, Linlithgowshire. These specimens are all single valves, and do not show the hinging as well as could be wished. We have one specimen from a thin limestone of the Calciferous-Sandstone series of Fife, with the valves united, but not in such preservation as to display clearly the amount of overlap along the dorsal border. Still we have not much doubt of the species belonging to *Bairdia*; it is a well-characterized form, and comes nearest to the little-known Permian species *Bairdia acuta*, Jones.

Localities.—Scotland. *Carboniferous Limestone (Upper)*: River Avon, below Kinneil Mill, Linlithgowshire; Kennox Water, Douglas, Lanarkshire.

Calciferous Sandstone: Coast near Randerstone, south of Kingsbarns, Fifeshire.

12. *BAIRDIA AMPUTATA*, Kirkby. Plate XXXI. figs. 15-18.

Bairdia truncata, Kirkby, 1858, Ann. Nat. Hist. series 3, vol. ii. p. 433, pl. xi. fig. 4.

Cythere amputata, Kirkby, 1859, Trans. Tyneside F. C. vol. iv. pp. 155, 156, & 167, pl. xi. fig. 22.

We have a single specimen from Paiston Quarry, East Lothian, that apparently belongs to the Permian species *Cythere amputata*, Kirkby. But this example is larger and in better condition than any Permian specimens (casts) we have seen; and it shows in the overlap of the right valve by the left, along the dorsal edge, and in the rostrated form of the posterior extremity, that the species is more properly placed with *Bairdia* than *Cythere*.

This Carboniferous specimen is relatively higher and has the dorsal border more angulate than Permian examples. It may be described as follows:—

Elongately subpentagonal; convex: length twice the height, which is greatest at the anterior third, from which point the dorsal border descends in right lines towards each extremity. Anterior extremity broad, truncated inwards; ventral border projecting (flap-like) at the anterior ventral angle, and sloping inwards behind towards the posterior extremity: this end of the valves is bluntly rostrated, the upper slope being deep and abrupt. Lateral contour lenticular; greatest width about the anterior third, and more than one third of the length. Surface smooth. Length $\frac{1}{18}$ inch.

B. amputata is a strongly characterized species. It can always be distinguished by the angularity of its general outline and its abruptly truncate anterior end.

As a Carboniferous species, it has only occurred in the Lower Carboniferous-Limestone shale of Paiston Quarry, East Lothian, where it was found by the officers of the Geological Survey of Scotland.

13. BAIRDIA PRÆCISA, n. sp. Plate XXXII. figs. 1–6.

Ovately subrhomboidal, compressed; length less than twice the height. Dorsal border strongly convex, with the posterior slope much the deepest; the anterior slope forms an abrupt angle with the anterior extremity, which is broad and obliquely truncate inwards and downwards; ventral border straight; posterior extremity rounded or slightly subangular. The left valve overlaps the right along the whole of its border, most strongly so dorsally and at the antero-dorsal angle. Lateral contour more or less wedge-shaped, the greatest width being at the anterior third. Surface smooth? Length $\frac{1}{22}$ inch.

The specimens on which the preceding description is based were found in a thin limestone of the Calciferous-Sandstone series near Randerstone, Fife. Their outline somewhat resembles a reversed *Leperditia*; their mode of hingement, however, their truncated anterior end, and wedge-like lateral contour show that such likeness is not real.

This species has been met with only at the above-mentioned locality.

14. BAIRDIA NITIDA, n. sp. Plate XXXII. figs. 9–12.

Elongately subovate; highest at the anterior third; rounded in front, tapering to a point behind; very convex: length two and a half times the height; width greater than the height. The dorsal border slopes gently downwards from the anterior to beyond the posterior third, whence it descends abruptly to form the posterior extremity; the ventral border is convex. Overlap of the left valve moderate. Lateral contour tumidly lenticular, widest in the centre. Surface smooth. Length $\frac{1}{20}$ inch.

This neat and plump form of carapace has apparently no very near Carboniferous relations. Perhaps it approaches most closely to the mucronate forms of the genus.

The only example which we have found occurred at Anstruther,

Fifeshire, in one of the thin limestones of the Calciferous Sandstone, about 3800 feet below the base of the Carboniferous-Limestone series. It was there associated with *Beyrichia subarcuata* and species of *Spirorbis*, *Myalina*, *Macrocheilus* (?), and *Orthoceras*. This, we believe, is the earliest appearance of *Bairdia* in Carboniferous strata.

15. *BAIRDIA CIRCUMCISA*, sp. n. Plate XXXII. figs. 13-16.

Reniform, compressed; length about twice the height. Dorsal border arched; extremities rounded, the anterior being the highest and most blunt; ventral border straight. Dorsal overlap of left valve strong. Lateral contour compressed in the centre, pointed at the ends; width rather over a fourth of the length. Surface smooth. Length $\frac{1}{20}$ inch.

The only example we have seen of this form is slightly injured near the anterior end, as shown in the figures. Its general outline resembles that of *Cythere bilobata*, Münster; but that species is very convex, and has an incurved ventral margin. *Bairdia æqualis*, D'Eichwald, seems to be a related form.

From the *Carboniferous Limestone* (Lower) of Whitebaulks Quarry, near Linlithgow. The specimen belongs to the Geological Survey of Scotland.

16. *BAIRDIA*, sp. ? Plate XXXII. figs. 7, 8.

We have seen in the collection of the Geological Survey of Scotland the curious carapace from the *Carboniferous Limestone* (Lower) of Cowden's Quarry, near Dunfermline, Fifeshire, that is represented by figs. 7 & 8, Pl. XXXII. It looks like a very much attenuated relative of *B. præcisa*. It may probably be somewhat malformed; for the postero-ventral region shows traces of injury. Until other examples turn up we forbear doing more than figure it.

CONCLUSION.

The species of *Bairdia* we have described and figured in this paper are, it is believed, all that have been found in British Carboniferous rocks, with the exception of M'Coy's *B. gracilis*, about which little is known*. Two Bavarian species described by Count Münster (*B. elongata* and *B. subcylindrica*) have not yet occurred in Britain. Neither have four Russian forms described by D'Eichwald†, nor the Australian *B. affinis*, Morris. Including these, there are twenty-three Carboniferous species belonging to the genus.

Seven of these species are found recurrent in the overlying Permian formation; but none of them are known to extend into Mesozoic strata; and, excepting one doubtful instance‡, none appear to be recurrent from the Devonian or Silurian rocks beneath.

In the following Table we give a list of all the Palæozoic *Bairdiæ* known to us (omitting such as appear to be but varieties or synonyms), with references to figures of the species not noticed in this paper. The Table also shows the occurrence and recurrence of the species in the different subdivisions of the two upper systems of Palæozoic strata.

* See *Annals Nat. Hist.* ser. 3, vol. xviii. p. 42 (1866).

† See also *Ann. N. H.* ser. 4, vol. xv. p. 52 (1875).

‡ D'Eichwald refers to *B. curta* as having been found in the Old Red of Russia.

Table of Palæozoic Species of BAIRDIA.

	Permian.				Carboniferous.				Devonian.	Silurian.
	Upper Magnesian Limestone.	Middle Magnesian Limestone.	Lower Magnesian Limestone.	Lower Red Sandstone.	Coal-measures.	Millstone-grit.	Carboniferous Limestone (Upper).	Carboniferous Limestone (Middle).	Carboniferous Limestone (Lower).	Lower Carboniferous.
<p><i>Note.</i>—The species which have no references for Illustrations attached to them are described and figured in the foregoing memoir.</p>										
PERMIAN AND CARBONIFEROUS.										
1. <i>Bairdia plebeia</i> , Reuss	*	*	*	*	*
2. <i>B. Hisingeri</i> (Münster)	*	*	*	*	*
3. <i>B. ampla</i> , Reuss	*	*	*	*	*
4. <i>B. Kingii</i> , Reuss, Ann. Nat. Hist. ser. 3, vol. ii. pl. x. f. 8.	*	*	*	*	*
5. <i>B. berniciensis</i> , Kirkby, loc. cit. f. 15	*	*	*	*	*
6. <i>B. rhomboidea</i> , Kirkby, loc. cit. pl. xi. f. 3	*	*	*	*	*
7. <i>B. amputata</i> , Kirkby	*	*	*	*	*
8. <i>B. subgracilis</i> , Geinitz	*	*	*	*	*
9. <i>B. acuta</i> , Jones, King's Monogr. Perm. Foss. pl. 18. f. 10	*	*	*	*	*
10. <i>B. grandis</i> , Jones	*	*	*	*	*
11. <i>B. mucronata</i> , Reuss	*	*	*	*	*
12. <i>B. drupacea</i> , Richter, Zeitschr. deutsch. geol. Ges. vol. vii. pl. 26. f. 10	*	*	*	*	*
CARBONIFEROUS.										
13. <i>B. gracilis</i> , McCoy, Syn. Carb. Foss. Ireland, pl. xxiii. f. 7	*	*
14. <i>B. curta</i> , McCoy †	*	*
15. <i>B. submucronata</i> , Jones & Kirkby	*	*
16. <i>B. brevis</i> , Jones & Kirkby	*	*
17. <i>B. subcylindrica</i> (Münster)	*	*
18. <i>B. elongata</i> (Münster), Ann. Nat. Hist. ser. 3, vol. xv. pl. xx. f. 13.	*	*
19. <i>B. subelongata</i> , Jones & Kirkby	*	*
20. <i>B. siliquoides</i> , Jones & Kirkby	*	*
21. <i>B. præcisæ</i> , Jones & Kirkby	*	*
22. <i>B. nitida</i> , Jones & Kirkby	*	*
23. <i>B. circumcisa</i> , Jones & Kirkby	*	*
24. <i>B. æqualis</i> , D'Eichwald, Lethæa Rossica, livr. 7, pl. lii. f. 6.	*	*
25. <i>B. distracta</i> , D'Eichwald, loc. cit. f. 12.	*	*
26. <i>B. Qualeni</i> , D'Eichwald, loc. cit. f. 4.	*	*
27. <i>B. ? excisa</i> , D'Eichwald, loc. cit. f. 8.	*	*
28. <i>B. affinis</i> , Morris, in Strzelecki's 'Phys. Descrip. N. S. Wales,' p. 291, pl. 18. f. 10	*	*
SILURIAN.										
29. <i>B. protracta</i> , D'Eichwald, loc. cit. f. 19	*	*
30. <i>B. Phillipsiana</i> , Jones & Holl, Ann. N. H. ser. 4, vol. iii. pl. xiv. f. 7.	*	*
31. <i>B. Murchisoniana</i> , Jones & Holl, loc. cit. vol. ii. pl. vii. f. 9	*	*
32. <i>B. Griffithiana</i> , Jones & Holl, loc. cit. f. 10	*	*
33. <i>B. Salteriana</i> , Jones & Holl, loc. cit. f. 11.	*	*
34. <i>B. ? Browniana</i> , Jones, Trans. Geol. Soc. Edinb. vol. ii. p. 321; Geol. Mag. ser. 2, vol. i. p. 511, fig. 1	*	*

† Quoted from the Old Red Sandstone of Russia by D'Eichwald, 'Lethæa Rossica,' vol. ii. p. 1338. See Bigsby's 'Thesaurus Devonico-Carboniferus,' p. 26.

EXPLANATION OF THE PLATES.

PLATE XXVIII.

(All the specimens are magnified 25 diameters.)

- Fig. 1. *Bairdia curta*, M'Coy; left valve of the original specimen, *freed from matrix*. Granard, co. Longford, Ireland. Fig. 2, ventral view of same.
3. *B. curta*; right valve and edge of left valve of a specimen belonging to Mr. John Young. From Brockley, near Lesmahagow. Fig. 4, ventral view of same.
5. *B. curta*, var. *terebra*; single right valve. Wyebourne, Cumberland.
6. *B. curta*; left valve. Settle, Yorkshire.
7. *B. curta*, var. *bicornis*; right valve of a specimen belonging to Mr. James Thomson. From West Broadstone, Ayrshire.
8. *B. curta*, var. *deformis*; right valve. Steeraway, Salop. In Mr. Charles Moore's collection.
9. *Bairdia plebeia*, Reuss; left valve. Newfield Quarry, High Blantyre. Fig. 10, dorsal view; fig. 11, ventral view; and fig. 12, end view of same.
13. *B. plebeia*; left valve. Newfield Quarry.
14. *B. plebeia*; right valve. Craigenglen, Campsie.
15. *B. plebeia*; left valve, showing surface-ornament. Craigenglen.
16. *B. plebeia*; left valve of a gibbose specimen. Backwell, Somerset. Figs. 17 & 18, ventral and end views of the same. In Mr. C. Moore's collection.
19. *B. plebeia*; left valve of a small specimen. Brocastle, South Wales. In Mr. C. Moore's collection.
20. *Bairdia ampla*, Reuss; right valve. Hairmyres, East Kilbride. Figs. 21 & 22, dorsal and end views of the same.
23. *B. ampla*; cast of left valve, showing muscle-spots. Wyebourne, Cumberland.

PLATE XXIX.

(All the specimens are magnified 25 diameters.)

- Fig. 1. *Bairdia grandis*, n. sp.; left valve. Whorlton, Durham. Fig. 2, dorsal view of same.
3. *Bairdia ampla*, Reuss; left valve. Whorlton.
4. *Bairdia Hisingeri* (Münster); right valve and edge of left valve. Craigenglen, Campsie. Fig. 5, dorsal view; fig. 6, ventral view; fig. 7, anterior view; and fig. 8, posterior view of the same.
9. *B. Hisingeri*; left valve. Craigenglen.
10. *B. Hisingeri*; right valve, with shell partly removed, showing impression of muscle-spot. Craigenglen.
11. *Bairdia mucronata*, Reuss; left valve. Whorlton.
12. *Bairdia submucronata*, n. sp.; left valve. Bonshawburnhead Quarry, Dumfriesshire.
13. *B. submucronata*; left valve. Whorlton.
14. *B. submucronata*; right valve. Craigenglen. Fig. 15, ventral view; fig. 16, dorsal view; and fig. 17, end view of same.
18. *B. submucronata*; right valve. Carluke, Lanarkshire.

PLATE XXX.

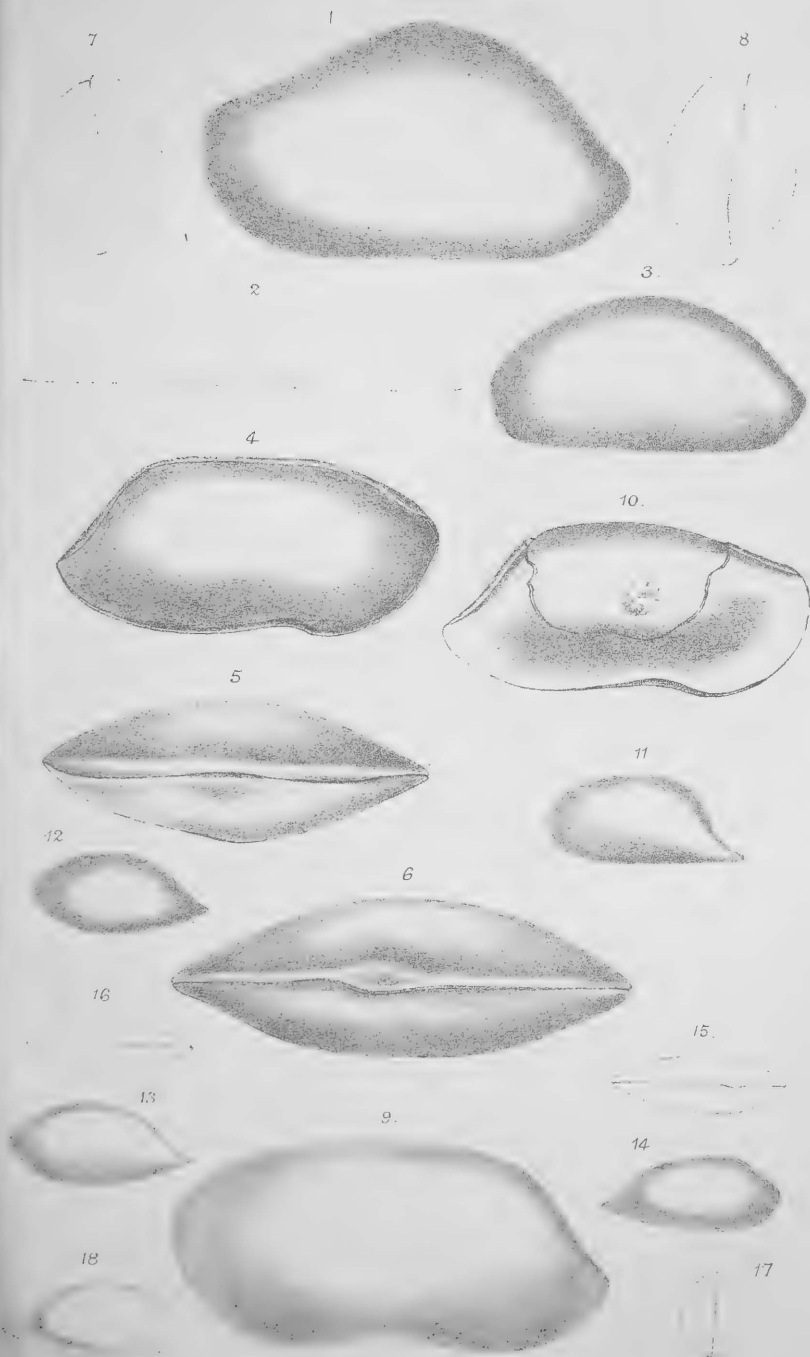
(All the specimens are magnified 25 diameters.)

- Fig. 1. *Bairdia subelongata*, n. sp.; left valve. Woodend Quarry, near Fordel, Fife. Fig. 2, dorsal view of the same.
3. *B. subelongata*; right valve. Ladedda Quarry, Fife. Fig. 4, ventral view; fig. 5, end view of the same.



CARBONIFEROUS BAIRDIAE.



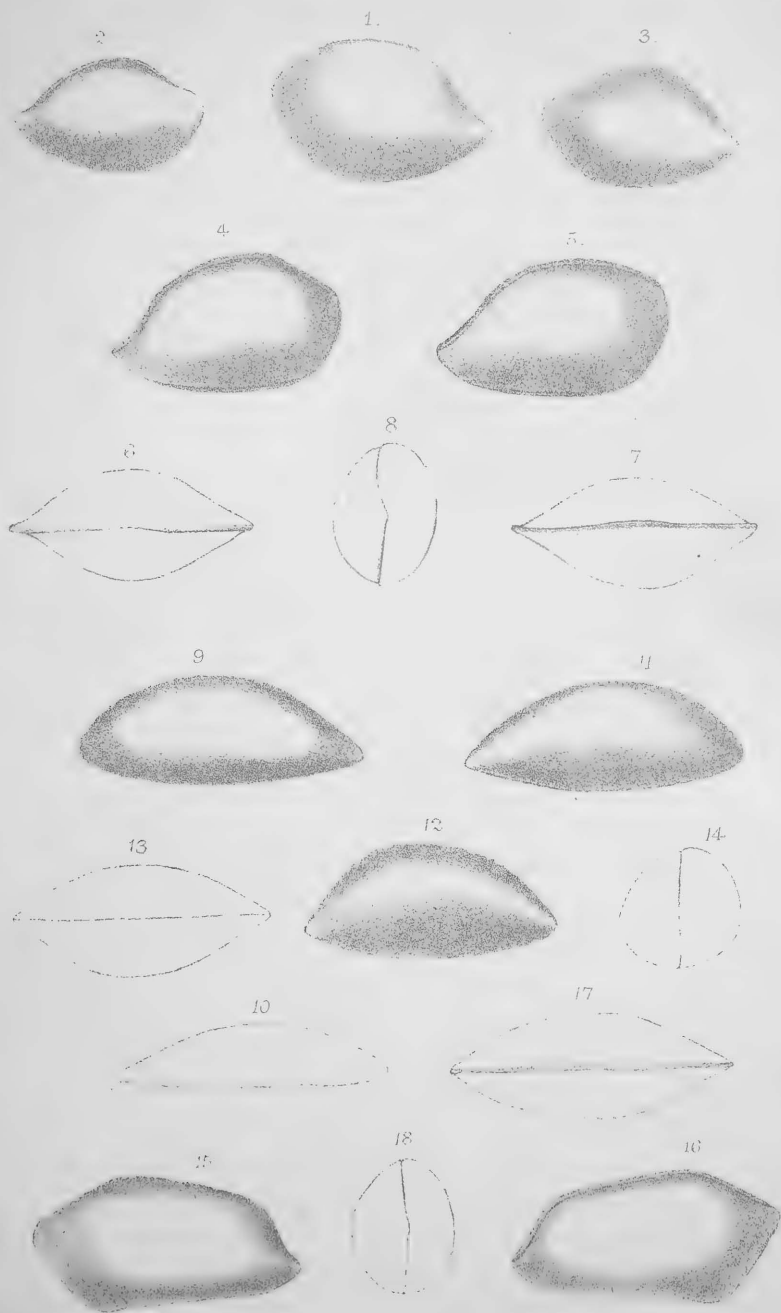


CARBONIFEROUS BAIRDIAE.





13.





- Fig. 6. *B. subelongata*; right valve. Blinkbonny Quarry, Mid Lothian.
 7. *B. subelongata*; left valve. Ladedda Quarry,
 8. *B. subelongata*; right valve. Paiston Quarry, East Lothian. Fig. 9,
 ventral view of the same.
 10. *B. subelongata*; right valve. Newfield Quarry. Fig. 11, dorsal view
 of the same.
 12. *B. Hisingeri* (Münster), elongate variety; left valve. Craigenglen,
 Campsie. Fig. 13, dorsal view of the same.
 14. *Bairdia subcylindrica* (Münster); right valve of a Bavarian specimen
 from Tragenau, near Hof. Fig. 15, dorsal view of the same.
 16. *B. subelongata*, n. sp.; right valve. Pittlessie, Fifeshire.
 17. *Bairdia subgracilis*, Geinitz; right valve. Carluke, Lanarkshire.

PLATE XXXI.

(All the specimens are magnified 25 diameters.)

- Fig. 1. *Bairdia brevis*, J. & K.; left valve. Kidlaw Quarry, East Lothian.
 2. *B. brevis*; right valve. Inverteil Quarry, near Kirkcaldy, Fifeshire.
 3. *B. brevis*; left valve. The same locality.
 4. *B. brevis*; right valve. Abden, Kinghorn, Fifeshire.
 5. *B. brevis*; right valve. East Salton, East Lothian. Fig. 6, dorsal
 view; fig. 7, ventral view; fig. 8, end view of the same.
 9. *Bairdia siliquoides*, n. sp.; left valve. River Avon, near Kinneil
 Mill, Linlithgowshire. Fig. 10, dorsal view of the same.
 11. *B. siliquoides*; right valve. Same locality.
 12. *B. siliquoides*; left valve. Randerstone, Fife. Fig. 13, ventral
 view; fig. 14, end view of the same.
 15. *Bairdia amputata*, Kirkby; right valve. Paiston Quarry, East
 Lothian.
 16. *B. amputata*; left valve. Same locality. Fig. 17, dorsal view;
 fig. 18, end view of the same.

PLATE XXXII.

(All the specimens are magnified 25 diameters.)

- Fig. 1. *Bairdia præcisa*, n. sp.; left valve. Randerstone, Fifeshire.
 2. *B. præcisa*; right valve. Same locality.
 3. *B. præcisa*; right valve. Same locality. Fig. 4, ventral view;
 fig. 5, dorsal view; fig. 6, end view of the same.
 7. *Bairdia*, sp.; right valve. Cowden's Quarry, Fife. Fig. 8, ventral
 view of the same.
 9. *Bairdia nitida*, n. sp.; left valve. Anstruther, Fife. Fig. 10, right
 valve; fig. 11, ventral view; fig. 12, end view of the same.
 13. *Bairdia circumcisa*, n. sp.; right valve and edge of the left valve.
 Whitebaults Quarry, Linlithgowshire. Fig. 14, left valve; fig. 15,
 dorsal view; fig. 16, end view of the same.
 17. *Bairdia ampla*, Reuss; left valve, showing pitted surface. Hair-
 myres, East Kilbride.
 18. *B. ampla*, var.; left valve, showing reticulated surface. Blinkbonny
 Quarry, Mid Lothian. Fig. 19, ventral view; fig. 20, end view of
 the same.

45. A CONTRIBUTION to SOUTH-AMERICAN GEOLOGY. By GEORGE ATTWOOD, Esq., F.G.S., Assoc.Inst.C.E., Mem. Am. Inst. M.E. *With an APPENDIX by the Rev. Prof. T. G. BONNEY, M.A., F.R.S., Sec.G.S.* (Read June 25, 1879.)

[PLATE XXXIII.]

THE paper which I have the honour to present to the Society, entitled "A Contribution to South-American Geology," refers to a tract of country about 150 miles in length, commencing from a small port called Puerto de Tablas on the Orinoco river in the State of Guayana, Venezuela, and taking a south-easterly direction into the interior as far as the Caratal Gold district, as shown on the Map (Pl. XXXIII.).

Mr. Carlos Seigert, a German surveyor who has spent many years in the country, has lent me his notes in relation to the line of country I have surveyed and described; and his observations confirm the map I have compiled. The elevations marked on the section have been computed by the aneroid and mercurial barometers, and they were carefully checked by the boiling-point test made with Casella's hypsometers, as shown in the following Table (p. 583).

After landing at Puerto de Tablas and climbing up the sandbank, large exposures of weathered rock-masses are seen. It is only after a careful examination that the rock is found to be crystalline and of igneous origin. Parallel lines of alteration are so distinct and so regular on the outer surfaces that, until the weathered portions have been broken off and the unaltered rock exposed, it is not possible that a definite conclusion can be arrived at. The rock presents a highly crystalline appearance, and consists chiefly of felspar, with some quartz and a dark green mineral. It contains 64·83 per cent. silica, and 6·80 per cent. iron=protoxide 8·34 per cent., or peroxide 8·84 per cent. The rock may be called a syenite (with microlite); but until Prof. Bonney kindly examined my microscopic slides I did not feel certain on the point, especially as I found the amount of silica to be unusually large and more than is generally found in syenites.

On the south bank of the Orinoco river the syenite extends some 50 miles east of the port of Las Tablas, and about 90 miles west, as far as the city of Bolivar, near which place a granitoid rock appears, and further west a true granite.

Having left the river, "the road"* takes a south-easterly direction, and passes over about two miles of tableland, the rocks being syenitic and the same as those found at Las Tablas.

An open plain, called by the natives "sabanah," has then to be crossed, and a change in the rocks occurs. The rock is of a greyish-white colour, and consists of felspar, quartz, mica, and a little oxide of iron; it contains 71·50 per cent. silica, and 2·75 per cent. iron=peroxide 3·57 per cent.

* I call "the road" the course taken by myself from the river to the interior.