

20. *On the AFFINITIES of ANTHRACOPTERA and ANTHRACOMYA.* By WHEELTON HIND, M.D., B.S., F.R.C.S., F.G.S. (Read February 22nd, 1893.)

[PLATES VII., VIII., IX., & X.]

PART I.—THE AFFINITIES OF ANTHRACOPTERA.

THE first mention of these shells is by Sowerby in Prestwich's memoir on the geology of Coalbrookdale, where four species are figured—one as *Modiola*, a second as *Mytilus*, and the other two as *Avicula*. These were hesitatingly referred to *Myalina* or *Avicula* by Salter, in 'Iron Ores of South Wales,' Mem. Geol. Surv. 1861, where in a footnote (p. 230) he hazards the conjecture that they may belong to *Anthracomya*, a genus then described for the first time to contain shells previously referred to *Unio*. In 1862, in the memoir on the 'Geology of the Country round Wigan,' he proposed the name *Anthracoptera* for certain shells previously described and figured as *Avicula*, *Modiola*, and *Myalina*; he there detailed the specific characters and gave a diagrammatic woodcut of the genus.

In the Supplementary Chapter to 'Acadian Geology,' 1860, Sir J. W. Dawson proposed the name *Naiadites* to include all Coal Measure shells; he then figured no shell referable to this genus, although Salter, in his paper 'On some fossil Crustacea from the Coal-measures of British North America,' Quart. Journ. Geol. Soc. vol. xix. (1863) p. 79, figured a shell, *Anthracoptera carbonaria*, evidently correctly, but erroneously identified it with Dawson's figure (fig. 42, p. 204), which really represents an *Anthracomya*. Subsequently, in the 2nd edition, in 1868, Sir J. W. Dawson showed that he believed *Naiadites carbonaria* to be synonymous with *Anthracoptera carbonaria*, Salter, and *Naiadites levis* with *Anthracoptera levis*, the figures given resembling *Anthracomya* rather than *Anthracoptera*.

In 1852 Ryckholt figured, under *Mytilus*, three specimens from the neighbourhood of Mons. These doubtless belong to the genus under discussion; and Ludwig, as *Dreissenia*, describes four species from the Coal Measures of Germany.

ASIPHONIDA (INTEGROPALLIALIA).

Family MYTILIDÆ.

Genus ANTHRACOPTERA, Salter.

Syn. *Modiola*, Sowerby, Trans. Geol. Soc. ser. 2, vol. v. pt. 3, pl. xxxix. figs. 15-18.
Mytilus, ibid. ibid.
Avicula, ibid. ibid.
Myalina, Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' p. 230.
Anthracoptera, Salter, Geol. Surv. Mem., 'Country round Wigan,' 1862.
Mytilus, Ryckholt, 'Mélanges paléontologiques,' 1852.
Dreissenia, Ludwig, 'Palæontographica,' vol. viii. (1859-1861).

- Myalina*, McChesney, 'New Sp. of Palæozoic Fossils,' 1860.
 ,, Meek & Worthen, Proc. Acad. Nat. Sci. Philad. 1860.
 ,, ,, Proc. Acad. Nat. Sci. Chicago, 1866.
Modiola, Brown, 'Fossil Conchology,' 1849.
 ,, Lea, Journ. Acad. Nat. Sci. Philad. vol. ii. 1853.
 No name, R. Garner, 'Nat. Hist. of County of Stafford,' pl. E, figs. 19,
 21, 22 (1844).

Generic Description.—Shell modioliform, obliquely triangular, inequivalve, the left valve being most tumid, the right valve flattened, both valves notched for the byssus, the left one slightly more so. Hinge-line straight. Hinge-plate in some species almost obsolete, in others markedly striated. Edentulous. Anterior end small and oblique, forming a lobe anterior to the umbonal ridge. Beaks almost terminal, slightly pointed anteriorly at apices. Umbonal ridge strong in left valve, less marked in right, extending from the umbones to the posterior part of the shell, where it becomes lost in most species before it reaches the posterior border. Surface ornamented with flat concentric lamellæ, and lines of growth and wrinkled periostracum over the posterior end. Below the oblique ridge the striæ are close, and arising from the umbo diverge until they reach the ridge, where they turn upwards at wider and regular intervals, and are continued to the superior border.

Interior.—The pallial line is represented by a dotted line. The post-adductor scar is circular, large, situated near the posterior end, $\frac{1}{3}$ distance from the superior to the inferior border. Anterior-adductor scar small, pit-like, anterior to the umbo. There are two accessory, pit-like scars, for the pedal and byssal muscles—one umbonal, and one midway between the umbo and the anterior-adductor scar. Scars for the pedal and byssal muscles about the centre of the superior border, and just below the hinge-line.

Observations.—I have been fortunate enough to obtain some weathered-out interiors of this genus from the Ten-Feet and Hard Mine seams of the North Staffordshire Coalfield, which possess a well-marked, striated hinge-plate, showing the close affinity of these shells with *Myalina*, under which they were once described. They differ, however, in not possessing triangular septa within the beaks for the insertion of the anterior-adductor muscle. It is in these beds that the genus appears in such profusion, both in numbers and in its specific forms.

Continental authors have described these shells as *Dreissenia*, but they are undoubtedly in error. The absence of the shelf for the anterior adductor, and the shape and position of the posterior-muscle scar, which in *Dreissenia* is riband-like and flat, and is inserted into the shell close to the upper border, show a divergence from *Dreissenia*.

M^cCoy, 'Brit. Palæozoic Foss.,' p. 492, thinks that there were two anterior adductors, each arising from the large anterior muscle-pit, but crossing each other to be inserted into the smaller scar near the umbo. This may be so; but from dissections of *Mytilus*, *Modiola*, and *Dreissenia*, I believe the uppermost scar to be that of the anterior pedal muscle. The shells now under consideration closely resemble

those described by Mr. R. Etheridge, Jun., as *Myalina*,¹ and he says that his specimens from the Cults Limestones, Pitlessie, Fife, are covered with *Spirorbis*, a frequent occurrence on North Staffordshire specimens. Sir J. W. Dawson considers these shells to be embryonic forms of *Unio*, to which family he states that the shell is closely allied in structure ('Acad. Geol.' 2nd ed. p. 202).

There is a good deal of variation in size, shape, and tumidity of the shells of the different species to which names have been given, and, indeed, it would be easy to show a series of shells passing gradually from species into species; nevertheless, there are well-marked variations, which may be regarded as being of specific value. They were evidently gregarious in habit. Mr. R. Etheridge, Jun., in his 'Palæozoic Conchology of Scotland,' quotes a specimen of *Calamites* surrounded by a number of individuals of *Anthracopectera*, lying as if attached to it by a byssus.

The specific forms of this genus may be identified as:—

ANTHRACOPTERA MODIOLARIS. (Pl. VII. figs. 1, 1 a, 1 b, 3, 4, 5, 6.)

Avicula modiolaris, Sowerby, Trans. Geol. Soc. ser. 2, vol. v. pt. 3, pl. xxxi. fig. 18.

? Non *Avicula tenua*, sic Brown, Trans. Manch. Geol. Soc. vol. i. (1841) pl. v. fig. 23.

? Non *id.* Brown, 'Fossil Conchology,' pl. lxxviii. fig. 9.

Avicula modiolaris, Brown, *ibid.* pl. lxi. ** figs. 23, 24.

Mytilus Wesemaelianus, Ryckholt, 'Mélanges paléontologiques' (Mémoires couronnés. Acad. roy. Belg. t. xxiv. 1852), pl. viii. figs. 11, 12.

Dreissenia inflata, R. Ludwig, 'Palæontographica,' vol. viii. p. 190, pl. lxxi. figs. 8-10.

Dreissenia laciniosa, R. Ludwig, 'Palæontographica,' vol. viii. pl. v. figs. 15-19.

Modiola funata, Brown, 'Fossil Conchology,' pl. lxxi. figs. 12-13.

Modiola wyomingensis, Lea, Journ. Acad. Nat. Sci. Philad. vol. ii. pt. 3, 1853, p. 203, pl. xx. fig. 1.

Myalina modiolaris, Salter, 'Iron Ores of South Wales,' pl. ii. fig. 14.

? Non *Anthracopectera Browniana*, Salter, Mem. Geol. Surv. 'Country round Wigan,' 2nd ed. p. 37, fig. 3, p. 38, fig. 3, a, b.

Anthracomya modiolaris, Ward, Trans. North Staffs. Inst. Min. & Meeh. Eng. vol. x. (1890) pl. i. fig. 13.

R. Garner, 'Nat. Hist. of County of Stafford,' pl. E, figs. 21, 22, no description.

Specific Characters.—Shell triangular, compressed; hinge-line nearly or quite as long as the greatest length of the shell; posterior extremity rounded or straight and somewhat emarginate, meeting the hinge-line at an obtuse angle. The left valve is slightly more convex than the right. There is a flattened ridge starting at the umbo passing backwards parallel to the hinge-line at first, then obliquely downwards and backwards, becoming lost on the lower part of the posterior half of the shell. Beaks almost terminal, curved inwards and forwards, not contiguous, slightly elevated above the hinge-line. Anterior part of shell almost obsolete, with byssal notch. Posterior part expanded, flattened, and obtusely curved at the lower angle. Hinge-plate thick and transversely striated; I have counted as many as ten striæ on one plate.

¹ Ann. & Mag. Nat. Hist. ser. 4, vol. xv. (1875) p. 427, pl. xx.

Interior.—Attachment of mantle marked by a dotted line in casts, corresponding to small pits in the shell. Anterior muscle-scars three in number, pit-like. The anterior is the largest, and is situated in the umbo; the next is situated just below the horizontal part of the ridge, and the most posterior on the ridge, exactly at the point where it changes its direction downwards. The posterior scar is large, obovate antero-posteriorly, situated close to the posterior superior angle of the shell. Faint traces of byssal muscles are seen near the upper border. Two or three slight diverging grooves arise from the upper part of the keel, and are seen as ridges in casts.

Surface ornamented with fine striæ and lines of growth, which arise from the anterior side of the umbo, and pass along the anterior part, until they reach the ridge, when they become separated by regular and wider intervals, and reflected strongly, passing across the shell to the superior border. Periostracum wrinkled. Shell moderately thick.

Dimensions:—Greatest antero-posterior length, 31 mm. ($1\frac{1}{4}$ inch); greatest dorso-ventral depth, 24 mm. (about 1 inch); thickness, 8 mm. ($\frac{1}{3}\frac{1}{2}$ inch).

Remarks.—This form varies very much in the length of the hinge-line, which may even exceed the length of the shell; also in the shape of the posterior end. In many the hinge-line passes by a gentle curve into the posterior border; in others the two borders join at an obtuse angle, in which case the posterior border is slightly sinuated at the upper part. This shell is more nearly triangular than any of the other groups.

Salter's figures in 'Iron Ores of South Wales,' pl. ii. fig. 14, and 'Country round Wigan,' 2nd ed. p. 37, fig. 2, no. 3, and p. 38, fig. 3, have the long hinge-line and emarginate posterior end.

In compressed forms from shales the periostracum is extremely wrinkled. The best-preserved specimens are from ironstone-beds.

Localities.—North Staffordshire Coalfield: roof of Hard Mine, Banbury, and Holly Lane Coals, Moss Shale, Knowles Ironstone; South Wales: Darran Pins; Coalbrookdale: White Flats; Lancashire Coalfield: Rochdale, 30 feet below the Arley Mine; Yorkshire Coalfield: Wakefield.

I am unable to identify Brown's *Avicula tenua* (sic), to which Salter gave the name *Anthracopectera Browniana*, as belonging to this genus. According to Brown's figures (Trans. Geol. Soc. Manch. vol. i. pl. v. fig. 23, and 'Foss. Conch.' pl. lxxviii. fig. 9) the shell has a definite *Avicula*-like form. Salter, 'Country round Wigan,' figs. 2, 3, figures what he supposed to be fragments of Brown's shell, dotting in an outline as if it had the shape of an *Anthracopectera*. Both Brown's figures appear to be those of complete shells, and probably represent a species of shell hitherto called *Posidonia* from the Lancashire coalfield. I have therefore dropped both names as synonyms of the shell described above.

Brown's figure of *Avicula modiolaris*, purporting to be a copy of Sowerby's in the 'Geology of Coalbrookdale,' is unrecognizable; but his description, though meagre, is evidently of our shell. The figures

of his *A. funata* and *Modiola subtruncata* are much better, and have every appearance of the shell under description. They are both, moreover, from the same locality (Wakefield).

ANTHRACOPTERA TRIANGULARIS. (Pl. VII. figs. 7, 8, 9, 9 a.)

Mytilus triangularis, Sowerby, Trans. Geol. Soc. ser. 2, vol. v. pt. 3, pl. xxxix. fig. 16.

? *Avicula modioliformis*, Brown, 'Fossil Conchology,' pl. lxi.* fig. 19.

Myalina Swallowi, McChesney, 'New Sp. Palæozoic Foss.' p. 57, 1860.

" " " " Illustrations to same, pl. ii. figs. 6, 6 a.

" " " " Meek & Worthen, 'Geol. of Illinois,' Palæont. vol. ii. (1866) pl. xxvii. fig. 1 a, b, c, d.

Specific Characters.—Shell much compressed, obliquely ovate, with pointed anterior end, and the posterior regularly and semicircularly curved into the upper and lower borders. Hinge-line straight, about $\frac{1}{3}$ length of shell, from which point the superior border slopes gently downwards into the curve of the posterior end. Left valve most convex, with a diagonal ridge proceeding from the umbones, which becomes lost when it has traversed $\frac{1}{3}$ the length of the shell. It is not twisted as in previous species. Beaks situated at $\frac{1}{3}$ length from the anterior end of the hinge-line, only slightly curved forwards. Anterior end small and tumid. Inferior border nearly straight. The posterior end, produced, slightly expanded, and flattened, comprises $\frac{3}{4}$ of the shell.

Interior.—Three pit-like, anterior-adductor muscle-scars; one posterior, position uncertain.

Surface-markings as in previous species.

Greatest length, 38 mm. ($1\frac{7}{8}$ inch); greatest dorso-ventral depth, 21 mm. ($1\frac{3}{8}$ inch; this is close to the posterior end); thickness, 10 mm. ($\frac{3}{8}$ inch).

Remarks.—The shells form a group, distinguished from *A. modiolaris* by a comparatively short hinge-line, and flatter, more oblique form, with a less-marked diagonal ridge, which has not the obtuse change in direction near its apex. It is distinguished from *A. carinata* by its more expanded and produced form, and less tumid and keeled valves; but intermediate forms exist, connecting all three forms.

Localities.—North Staffordshire: roof of Hard Mine Coal; Coalbrookdale: Crawstone; Woodhall, Water of Leith (Rhind).

ANTHRACOPTERA CARINATA. (Pl. VII. figs. 2, 2 a, 10, 10 a, 11, 12, 12 a.)

Modiola carinata, Sowerby, Trans. Geol. Soc. ser. 2, vol. v. pt. 3, pl. xxxix. fig. 15.

Modiola carinata, Brown, 'Fossil Conchology,' pl. lxi.*** figs. 19, 20.

Myalina carinata, Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' pl. ii. fig. 15.

Dreissenia dilatata, Ludwig, 'Palæontographica,' vol. viii. pl. lxxi. figs. 5, 6, 7.

Anthracomya carinata, Hull, 'Coalfields of Great Britain,' 4th ed. pl. facing p. 38, fig. 3.

A. carinata, Ward, Trans. North Staffs. Inst. Min. & Mech. Eng. vol. x. (1890) p. 129, pl. i. fig. 9.

No name, R. Garner, 'Nat. Hist. of County of Stafford,' pl. E, fig. 19.

Specific Characters.—Shell obliquely rhomboidal, but the anterior lobe is larger comparatively than in the two foregoing species. Anterior and posterior margins almost parallel; lower margin short and

rounded. Hinge-line as long as the greatest length of the shell. Valves convex, with a blunt ridge rising from the superior border at $\frac{1}{5}$ of its distance from the anterior end. This ridge proceeds downwards at an acute angle to the line of obliquity of the shell, and becomes lost near the inferior border. The anterior part of the shell is swollen above, then compressed obliquely, parallel to and in front of the ridge, expanding again into the ridge, and it consists of rather more than $\frac{1}{3}$ of the whole shell. The posterior part is compressed near the hinge-line, more tumid and produced below. The lower border forms a U-shaped curve, obtusely rounded.

Interior.—Three muscle-scars, pit-like, anteriorly; one posterior, rounded near the posterior superior angle. Fine lines of growth starting from the anterior extremity along the inferior border, diverging slightly, reach the ridge and become reflected upwards to the inferior and posterior borders. Periostracum wrinkled.

Size.—Greatest length diagonal, 25 mm. (1 inch); length of hinge-line, 9 mm. (about $\frac{3}{8}$ inch); greatest width from side to side, 8 mm. ($\frac{1}{3}\frac{1}{2}$ inch).

Localities.—North Staffordshire: Hard Mine, Ten-foot, Moss Seams; Coalbrookdale: Crawstone; South Wales: Blue Vein and Darran Pins.

Observations.—This shell is easily distinguished from other groups by its shape and gibbosity. The longer forms approach somewhat to *A. triangularis*, and the flatter, broader forms to *A. quadrata*.

ANTHRACOPTERA QUADRATA. (Pl. VIII. figs. 1-4.)

Avicula quadrata, Sowerby, Trans. Geol. Soc. ser. 2, vol. v. pt. 3, pl. xxxix. fig. 17.

Avicula quadrata, Brown, 'Fossil Conchology,' pl. lxi.** figs. 27, 28.

Myalina quadrata, Salter, 'Iron Ores of South Wales,' pl. ii. fig. 16.

Myalina meliniiformis, Meek & Worthen, 'Geol. of Illinois,' Palæont. vol. ii. (1866) pl. xxvii. fig. 3.

Myalina recurvirostris, *ibid.* pl. xxvi. fig. 9 a, b, c.

Specific Characters.—Shell compressed, quadrate or U-shaped, very slightly oblique. Anterior side almost obsolete. Posterior expanded and flattened. Left valve slightly more convex than right valve. Hinge-line straight, longer than or as long as the greatest antero-posterior diameter. The lower border is almost semi-circular. Anterior side narrow, compressed, with sinuated margin at the byssal notch. There is a blunt keel, which starts from the hinge-line at $\frac{1}{6}$ of the length from the anterior end and passes downwards and slightly backwards, becoming soon expanded and lost on the shell. The posterior end is flattened, expanded above its posterior border, being almost straight, meeting the hinge-line at an obtuse angle. Umbones almost terminal, slightly elevated above the hinge-line, and bent anteriorly.

Interior.—Three anterior muscle-scars, pit-like; one posterior, which seems to vary slightly in position, in one specimen being close up to the posterior superior angle, in another midway between this angle and the middle point of the shell. Hinge-plate thickened and striated. Surface-markings as in previous species. Periostracum wrinkled.

Size.—Length of hinge-line, 30 mm. ($1\frac{1}{5}$ inch); greatest dorso-ventral measurement, 25 mm. (1 inch); thickness, 12 mm. ($\frac{7}{16}$ inch). Another specimen: length of hinge, 23 mm. ($1\frac{5}{8}$ inch); dorso-ventral measurement, 25 mm. (1 inch); thickness, 5 mm. ($\frac{1}{2}$ inch).

Localities.—North Staffordshire: Hard Mine, Ten-foot, and Banbury Seams; Coalbrookdale: White Flats; South Wales: Darran Pins; Bunker's Hill, W. of Rochdale, 30 feet below the Arley Mine.

Remarks.—This species is easily distinguished from others. It is somewhat rare; but its flat, peculiar U-shaped form, and expanding posterior side, separate it from all others. The oblique ridge, too, is occasionally nearly at a right angle to the hinge-line, but mostly at a very obtuse angle. A series of specimens with slight variations show the close connexion of this form and *Anthracoptera modiolaris*.

ANTHRACTOPTERA TUMIDA. (Pl. VII. fig. 13, 13 a, 14.)

R. Etheridge, Jun., Mem. Geol. Surv. Scot. Expl. Sheet 31, p. 82, no figure.

Specific Characters.—Transverse, triangular, gibbous, with strong diagonal ridge, dividing the valves into two nearly equal parts. Anterior side well marked, tumid. Sinuated border, with byssal notch most marked in the left valve. The posterior end is obliquely truncate, the margin with the hinge-line forming an obtuse angle, occasionally emarginate. Hinge-line shorter than length of shell; lower margin obtusely rounded. Diagonal ridge and umbonal region very convex, forming the most gibbous part of the shell. Ridge almost median, rather (if anything) anterior, curved forwards along the hinge-line, to become almost terminal. Beaks prominent, separated, raised above the hinge-line.

Interior.—There are three pit-like muscle-scars anteriorly, as in the preceding species; but I have not ascertained the position of the posterior muscle.

Size.—Antero-posterior measurement, 13 mm. ($\frac{1}{2}$ inch); dorso-ventral, 12 mm. ($\frac{7}{16}$ inch); from side to side, 11 mm. ($\frac{3}{8}$ inch).

Localities.—Shale above the Brownstone portion of the Bo'ness Lower Ironstone, Edge Coal Series; Hard Mine, Dividy Lane, Longton.

Remarks.—Mr. R. Etheridge, Jun., observes that the convexity of shell distinguishes this species from *A. triangularis*; the more prominently developed anterior end, the median position of the diagonal ridge, and its more direct course, from *A. carinata* and *A. quadrata*. I have adhered in greater part to his own description.

Two specimens at Jermyn Street, described as *Anthracoptera Sowerbyi* (Etheridge, MSS.), are probably of this species.

ANTHRACTOPTERA OBESA.

R. Etheridge, Jun., Quart. Journ. Geol. Soc. vol. xxxiv. (1878) pp. 12-13, pl. i. figs. 12, 13 (& 14?).

“*Sp. Char.*—Trigonal, very gibbous, inequality of the valves distinctly marked; anterior side pointed, well marked, and defined by the byssal furrow in each valve; posterior side but little flattened,

its margin slightly sigmoidal. Hinge-line straight, as long as the shell, its margin thickened on each valve, leaving in casts two long grooves. Umbones well developed, contiguous, but not touching, anterior, but not quite terminal, with a broad, very obtusely rounded, diagonal ridge proceeding from each, to which the shell owes much of its exceedingly convex form. Byssal furrows shallow, most pronounced in the left valve; marginal notch not deeply excavated. Anterior muscular impressions quite anterior, infra-umbonal. Surface of the shell covered with concentric subimbricating lamellæ crowded and striiform on the anterior end, but opening out and becoming lamellar on the diagonal ridge and posterior wing."

"*Obs.*—The much more central position of the diagonal ridge, greater convexity of the shell, and the sigmoidal margin of the posterior end at once distinguish *A. obesa* from either *Anthracoptera*? or *Myalina* (*Avicula*) *quadrata*, Sow., *A.*? or *M.* (*Avicula*) *modiolaris*, Sow., *A.*? or *My.* (*Modiola*) *carinata*, Sow."

I personally know nothing of this form, and have copied word for word Mr. R. Etheridge's description and remarks.

ANTHRACOPTERA ELONGATA, sp. nov., Wheelton Hind. (Pl. VII. figs. 15, 15 a, 16, 17.)

Specific Characters.—Shell inequivalve, very inequilateral, modioliform, or transversely elongated, tumid. Hinge-line straight, about $\frac{2}{3}$ the length of the shell. Beaks almost terminal, separated, directed forwards. A very tumid ridge extends from the umbones diagonally across the shell to the posterior inferior angle. Anterior end almost obsolete, swollen, with wide byssal sulcus. Posterior end tumid below, flattened upwards and backwards, and somewhat expanded. Posterior border bluntly curved above, truncate below. The inferior border would, if produced forwards, make an acute angle with the hinge-line, is broadly sinuated, and notched for the byssus.

Interior.—All that is known is that there is a very large anterior-adductor muscle and another pit-like scar in the umbo.

Exterior.—Surfaces marked with fine striæ and lines of growth anteriorly, which diverge slightly until they reach the oblique ridge, where they become rapidly reflected upwards and pass to the superior border.

Size.—Greatest antero-posterior measurement, 23 mm. ($1\frac{5}{8}$ inch); greatest dorso-ventral measurement, $\frac{1}{3}$ from posterior end, 8 mm. ($\frac{1}{3}\frac{1}{2}$ inch); from side to side, 5 mm. ($\frac{1}{4}$ inch).

Remarks.—This is a rare species, limited, so far as I know, to the Knowles Ironstone of Fenton and Longton. It can be distinguished from all other species by its tumid, elongated, subparallel form. There is a block of Knowles Ironstone in the Museum of Practical Geology, Jermyn Street, which contains a large number of these shells. The younger forms are more oblique and less tumid. This species very closely resembles some species of *Anthracomya*; but the distinctive features of the umbonal region serve to point out the differences.

Locality.—Knowles Ironstone, Fenton Park, North Staffs.

ANTHRACOPTERA BROWNIANA, Salter.

In the Trans. of the Manchester Geol. Soc. vol. i. pl. v. fig. 23, in illustration of a paper by Mr. Binney, Capt. Brown figured a specimen from the Pendleton coal-pits, but without naming or describing it. However, in his 'Fossil Conchology,' pl. lxxviii. fig. 9, he refigures the specimen and appends a short description. The figures of his shell are in both cases of unbroken specimens, but I cannot say anything further as to their correct affinity. When, however, Salter published his description of *Anthracopectera Browniana* (Geol. Surv. Mem., 'Country round Wigan,' 2nd ed. p. 38, fig. 3 a, b) he figured a shell evidently, judging from its lines of growth, a complete specimen, and like Brown's; but he changed it into a form of his new genus by adding parts to the shell where the shape did not agree with his new form.

I have been unable to see in any museum, or to collect, forms of shell like Brown's; but, if his figure be correct, they probably will be more accurately referred to the *Posidonia*, and I have therefore not recognized *Anthracopectera Browniana* as a species of this genus.

I have redescribed the four forms originally figured by Sowerby, though I should be very loth to guarantee the absolute separation of these four species. Probably, had I been describing these forms for the first time, I should have created only two species, considering *Anthracopectera modiolaris* and *A. quadrata* as varying forms of the one, *A. triangularis* and *A. carinata* of the other.

I have been unable to examine Continental and American types, which I have given as synonyms, except from plates and descriptions. These, however, all agree very closely with the forms to which I have suggested their relationship. This reference must be regarded as only tentative, and liable to be modified by the results of further investigations.

PART II.—THE AFFINITIES OF ANTHRACOMYA.

Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' p. 230.

This genus was established by Salter in 1862 for certain shells which had been described by Sowerby, Trans. Geol. Soc. ser. 2, vol. v., 'Geology of Coalbrookdale,' under *Unio*, and as *Modiola* (Binney) and *Naiadites* (Dawson), possessing a common character in the periostracum, which he considered distinctive of the family Myadæ, hence the name. At that time, however, the interiors were quite unknown, and the correct place of the genus could only be guessed. Sir J. W. Dawson looked upon the fossils as embryonic forms of *Unio*, from the microscopic structure of the shell, which he describes as presenting an internal lamellar and subnacreous layer, a thin layer of vertical prismatic shell, and periostracum. The ligament is external, there are no hinge-teeth or byssal sinus, and he did not think they could have been burrowers ('Acadian Geology,' in which are figured two specimens of *Anthracomya*, *A. carbonaria*, Dawson, non Salter, Quart. Journ. Geol. Soc. vol. xix. 1863). Another

species of this genus is described by Williamson (1836) in Phil. Mag. vol. ix. p. 351, as *Unio Phillipsii*, and by Phillips in Murchison's 'Silurian System,' p. 88, as a thin compressed shell from the neighbourhood of Manchester; while Ludwig, 'Palæontographica,' vol. viii. pl. iv. figs. 13-15, under *Unio obtusus*, figures one of this genus, and in vol. x. pl. iii. figures *Anodonta obstipa*, *Cyclas obuncula*, *Unio Goldfussanus*, *Anodonta subparallela*, *Unio Eichwaldanus*, and *Anodonta tenera*, which may probably belong to this genus.

ASIPHONIDA (INTEGROPALLIALIA).

Family UNIONIDÆ.

Genus ANTHRACOMYA.

Generic Characters.—Shell transverse, slightly inequivalve, inequilateral, the anterior end being small and rounded, posterior produced, compressed and expanded, generally truncate. The umbones are small, and situated near the anterior end, very little raised above the hinge-line, which is straight, long, and edentulous, and has a narrow interior ridge in its posterior portion. There is a blunt oblique swelling which arises at the umbones, and, expanding as it passes downward and backward, is lost on the posterior part of the shell. There is what appears to be a byssal furrow, parallel and anterior to the ridge, but it is extremely doubtful whether it is not an ancestral relic, as I have been unable to find evidence of a byssal notch in any of the species. Ligament external, as in *Anodon*. Many of the species seem to gape at both extremities.

Interior.—Nacreous and smooth, with concentric laminae, and fine radiating striæ, most marked at the pallial line. No trace of pallial sinus or hinge-teeth. Anterior-adductor impression situated at the extreme anterior-superior angle of the shell, rounded, with a small accessory muscle-scar above it. Posterior-adductor scar also circular, just below and in front of the posterior end of the hinge-line.

Exterior.—Surface marked by fine concentric striæ and lamellæ of growth. Periostracum wrinkled.

Remarks.—I have replaced this genus in the Unionidæ, as a member of which it was originally described by Sowerby; writers have since that time included it among the Mytilidæ and Myacidæ.

It may now be taken as settled (specimens having been discovered showing the interior) that *Anthracomya* does not belong to the former, though in some forms the shape approaches somewhat that of certain of the Modiolæ.

As to its affinity to the Myadæ, it is somewhat difficult to understand why so many characteristics of that family were assumed for *Anthracomya*. There were a few points only in common between the two, but these were not of generic value. The gaping ends, produced flattened posterior, and wrinkled periostracum are possessed by members of the Unionidæ, as well as Myacidæ, while the peculiar V-shaped marking on *Anthracomya senex* resembles the

ornamentation of some recent Siamese Unios, and is therefore in no way peculiar to the burrowing Myacidæ.

There is no evidence at all that these shells were burrowers; indeed I believe, from the fact that they are always associated with byssiferous *Anthracopectera* and other members of the Unionidæ, that they were not so. They are never found lying at right angles to the lines of stratification in North Staffordshire, but always horizontal. The simple edentulous hinge-line, external ligament (I can find no evidence of an internal one in casts), the absence of pallial sinus, position and shape of the adductor-muscles (though the accessory scars posterior to the anterior adductor appear to be absent, as Prof. King pointed out to be the case in *Anthracosia*) all are characteristic of the family Unionidæ.

The shells approximate closely to *Anodon*, under which name Ludwig has described several Continental forms, but they lack the eroded obsolete beaks, the supplementary anterior-adductor muscle-scar, and the equal valves of this form. From *Anthracosia* (King) they differ in the expanded shape of the posterior end, the small inconspicuous beaks, and the absence of a peculiar hinge-plate and teeth.

D'Orbigny quotes a byssiferous form of *Anodon* as found in the river Paraná, South America. Most forms of the genus have traces of a byssal sinus, although they have no longer a byssus. The sinuation of the inferior border, the obliquity of the valves, and the absence of a byssal notch in *Anthracomya* induce one to suppose that its ancestors or embryos may have been byssiferous.

Salter firmly believed that the beds in which *Anthracosia*, *Anthracomya*, and *Anthracopectera* were found were of marine or highly brackish-water origin, his view being formed by the supposed affinities of the latter two genera. He also quotes Agassiz and De Koninck as authorities for the marine character of *Anthracosia*; but it must be remembered that both these observers confused the shells with *Cardinia*, a typical marine genus, and their view has not been accepted by subsequent writers on the subject.

There are, fortunately, very typical marine beds of various depths in the Coal Measures, which contain an unimpeachable marine fauna, e. g. *Productus*, *Spirifer*, *Lingula*, *Discina*, *Orthoceras*, *Goniatites*, *Nautilus*, *Aviculopecten*, *Posilonia*, *Edmondia*, *Sanguinolites*, etc., not only at the base in the Gannister Beds, but, as occurs in North Staffordshire, much higher up in the Coal Measures proper. In none of such beds do *Anthracosia*, *Anthracomya*, and *Anthracopectera* occur; but, on the other hand, these genera are found associated with a peculiar fauna of fishes and reptiles, annelids and crustaceans, which have a close affinity with recent forms and inhabit fresh water, together with a flora of ferns, *Sigillaria*, *Calamites*, and *Lepidodendron*.

The fact of typical marine fossils being found in a few beds of small extent, intercalated in the coal strata, seems to me to afford strong evidence that the rest of the beds were not of marine origin; it would indeed be unaccountable, if all the beds were marine, that the typical fossils should not be more generally distributed.

for we may safely assume that the forms were surviving in the seas of that period.

The thick, wrinkled periostracum possessed by these shells was one of the characters on which Salter relied as a generic peculiarity. This feature would be considered typical of a freshwater habitat among recent molluscs; it is indeed necessary in these forms, to prevent excessive erosion by the carbon dioxide dissolved in river and lake waters, and thus it constitutes an additional link in the chain of evidence of the freshwater origin of the Coal Measures.

The other affinities of *Anthracoptera* and *Anthracomya* to recent freshwater shells afford strong presumptive evidence of the freshwater origin of the greater part of the Coal Measures; and the occasional simultaneous presence of fluviatile forms with marine, said to occur in a few beds, may be easily accounted for by the supposition that they inhabited estuarine and tidal rivers, whence some would be washed out seawards, and so become mingled with marine types. I must confess, however, that I have never seen this intermixture of forms, and can obtain no evidence of it from many fellow-workers in various coalfields. Salter, Geol. Surv. Mem., 'Country round Wigan,' 2nd ed. p. 34, quotes the occurrence of *Anthracosia* and *Goniatites* not actually in the same layers, but closely intermixed, and states that *Anthracosia acuta* is found in "undoubtedly marine" beds at Clitheroe. (I cannot understand the last allusion.)

ANTHRACOMYA ADAMSII. (Pl. VIII, figs. 5, 5 a, 6, 7, 8.)

Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' p. 230, pl. ii. fig. 7.
 Non Ward, Trans. N. Staffs. Inst. Min. & Mech. Eng. vol. x. (1890) p. 125,
 pl. i. fig. 2.

Specific Characters.—Shell obliquely ovate, compressed, ventral margin much curved, narrower at the short, rounded, anterior end, broadest at about $\frac{1}{4}$ distance from the posterior margin, which is obliquely truncate. Anterior end short, moderately convex, straight above, rounded and sinuated below. Posterior end flattened and expanded. Valves slightly unequal, the left being more convex. An oblique, obtuse swelling passes diagonally from the umbo, across the valves; the byssal furrow is broad and shallow, but there is no perceptible marginal notch; lunule elongate and narrow. Hinge-line straight, $\frac{5}{8}$ length of the shell. Edentulous cartilage external, in grooves on each side of the hinge. Umbones broad, tumid, raised above the hinge-line, almost contiguous, situated $\frac{2}{5}$ distance from the anterior end of the hinge-line. Shell thin.

Interior smooth.

Exterior marked with fine eccentric lines and folds of growth, starting from the anterior end, close together, but separating as they pass across the shell in regular curves, to reach the posterior part of the hinge-line and the posterior border. Periostracum strongly wrinkled.

Size.—Antero-posterior measurement, 65 mm. ($2\frac{2}{3}$ inches); from side to side, 10 mm. ($\frac{2}{5}$ inch); dorso-ventral measurement at $\frac{1}{3}$ from posterior end (the greatest depth), 45 mm. ($1\frac{1}{3}$ inch).

Remarks.—This is a well-marked form of wide distribution, compressed in comparison with its other proportions. Some of my specimens show distinct bands of colour; it occurs chiefly in ironstone-bands. When young it resembles closely *Anthracomya Phillipsii* in shape.

Localities.—Soap Vein, South Wales; Little Mine Ironstone, Fenton and Longton; New Mine Ironstone, Biddulph.

ANTHRACOMYA ADAMSII, var. EXPANSA, Wheelton Hind. (Pl. IX. figs. 2, 3.)

Anthracomya Adamsii, Ward, Trans. North Staffs. Inst. Min. & Mech. Eng. vol. x. (1890) p. 125, pl. i. fig. 2.

Specific Characters.—Shell obliquely subquadrate, compressed and expanded. Hinge-line straight. Umbones obtuse, slightly raised above the hinge-line, contiguous, situated at $\frac{1}{5}$ distance from the anterior end. Cartilage external. Anterior end almost obsolete, very obtuse, no oblique sulcus; but an obtuse diagonal swelling starts from the umbones, where it is most pronounced (the thickest part of the shell), to be lost rapidly on the posterior part of the shell. This posterior part is flattened and expanded. The anterior, inferior, and posterior borders are part of one general curve which meets the superior border posteriorly at an obtuse angle. There is no relic of a byssal notch. The left valve is the more tumid.

Interior same as in *Anthracomya Adamsii*.

Exterior.—Surface with fine concentric lines and bands of growth. Periostracum much wrinkled.

Size.—Antero-posterior measurement, 53 mm. ($2\frac{1}{4}$ inches); greatest dorso-ventral, 42 mm. ($1\frac{5}{8}$ inch); from side to side, 8 mm. ($\frac{1}{3}\frac{1}{2}$ inch).

Remarks.—This shell is found in the same beds with the previous species, of which I believe it to be a variety. A very large form, 65 mm. ($2\frac{3}{5}$ inches) long, and measuring 55 mm. ($2\frac{1}{5}$ inches) dorso-ventrally, is found in the New Mine Ironstone, Biddulph. It is distinguished by its produced and rounded inferior border, and obsolete anterior end. It looks very much like the figure of *A. dolabrata*, Sowerby, *op. jam cit.*; but the latter has its anterior end broken off, and is therefore imperfect. It is also very much more convex than the specimen under description.

Localities.—Little Mine Ironstone, Fenton, Longton, and Hanley; New Mine Ironstone, Biddulph.

ANTHRACOMYA DOLABRATA. (Pl. VIII. figs. 9, 9 a, 10, 10 a; Pl. IX. figs. 1, 1 a, 4, 5.)

Unio dolabratus, Sowerby, Trans. Geol. Soc. ser. 2, vol. v. pt. 3, pl. xxxix. fig. 9.

Modiola curtata, Brown, 'Fossil Conchology,' pl. lxxii. figs. 19, 20.

A. dolabrata, Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' p. 230, no fig.

Specific Characters.—Shell tumid, equivalve, transversely elongated. Hinge-line straight, much raised, about $\frac{5}{8}$ length of the shell. Umbones obtuse and gibbous, raised above the hinge-line, situated at $\frac{1}{3}$ length of the hinge-line from the anterior end.

Lunule long and narrow. The lower border is nearly straight, or very slightly sinuated; if produced anteriorly, it would form an angle of 35° with the hinge-line. At its posterior end it curves rapidly upward into the posterior border, which is bluntly rounded below, but obliquely truncated above its superior border. Anterior end short, much lower than the umbones, somewhat acute, with a broad diagonal sulcus. An obtuse, very tumid ridge passes from the umbones, diagonally across the shell, to the posterior-inferior angle. Posterior to the ridge, the shell becomes flattened upward towards the hinge-line.

Interior unknown.

Exterior ornamented by fine striæ and lines of growth, which become rapidly deflected upward, when they reach the oblique groove, to the superior border.

Size.—Antero-posterior measurement, 45 mm. ($1\frac{1}{8}$ inch); dorso-ventral, 28 mm. ($1\frac{1}{16}$ inch); from side to side, 22 mm. ($\frac{7}{8}$ inch).

Remarks.—This species was the first member of the genus to be figured and described. It is closely allied to *Anthracomya Adamsii*, but differs in its dimensions. The greatest thickness is umbonal, not, as in *A. Adamsii*, at the centre of the shell; while the relatively greater length, compared with its dorso-ventral measurement, also serves to distinguish this shell; the oblique ridge and sulcus are much more marked.

Through the kindness of Prof. Prestwich, I have been able to examine the original type-specimen. It is without the anterior end, the absence of which gives a much more quadrate and subparallel appearance to the fossil. I have, with his permission, figured it again. It is for this reason that Sowerby, in his description of the specimen, says its anterior side is small and rounded, and he is followed by Salter (*op. jam cit.*), who says that the anterior side is almost obsolete. The original type is a little more compressed posteriorly than the specimen from North Staffordshire. The specimens of this species from the Oldham district are somewhat different in appearance; they are shorter antero-posteriorly and altogether more thick-set. The posterior end is obliquely truncate, and not so flattened. I have figured two specimens of this form from the cabinet of Mr. J. Ward, F.G.S., of Longton. This shell is mimicked very closely in North Staffordshire by *Anthrocoptera tumida*.

Localities.—The Pennystone Beds, Coalbrookdale; Little Mine Ironstone, North Staffordshire; Black Mine, Middle Coal Measures, Oldham, Lancashire.

ANTHRACOMYA PHILLIPSII. (Pl. IX. figs. 6, 6a, 7, 8; Pl. X. fig. 27.)

Unio Phillipsii, Williamson, Phil. Mag. vol. ix. (1836) p. 351 (without description).

Unio linguiformis, Phillips, 1839, Murchison's 'Silurian System,' p. 88.

Modiola sp., Binney, 1855, Mem. Lit. Phil. Soc. Manchester, 2nd series, vol. xii. p. 221, note (without description).

Anthracomya Phillipsii, Huxley and Etheridge, 1865, Cat. Foss. Mus. Pract. Geol. pp. 157 & 160 (without description).

Anthracomya Phillipsii, T. Rupert Jones, Geol. Mag. for 1870, p. 217, pl. ix. figs. 3 & 18.

Anthracomya Phillipsii, R. Etheridge, Jun., Geol. Mag. for 1877, pp. 243-244, pl. xii. figs. 6, 7.

Specific Characters.—Transversely-obliquely oval, modioliform, elongated in the direction of the diagonal. Anterior end obsolete, its margin rounded; posterior end compressed, expanding into the hinge-line, which is elevated posteriorly. Hinge-line straight, almost half the length of the diagonal of the shell. Ventral margin convex, passing with a gentle curve into the anterior end, or becoming straight shortly before it reaches the anterior end. Beaks anterior, almost terminal, very obtusely rounded and inconspicuous; in the uncrushed condition there is no diagonal ridge. The shell is tumid, becoming flattened above posteriorly.

Interior unknown.

Exterior.—The markings consist of concentric lines and fine striae.

Size.—Antero-posterior measurement, 20 mm. ($\frac{4}{5}$ inch); dorso-ventral, 10 mm. ($\frac{2}{5}$ inch); lateral, 8 mm. ($\frac{3}{8}$ inch); another specimen, 23 mm. ($\frac{7}{8}$ inch), 15 mm. ($\frac{3}{5}$ inch), and 5 mm. ($\frac{1}{5}$ inch) respectively.

Remarks.—This shell has a very wide distribution, both horizontally and vertically. It must have existed in immense numbers, especially in the upper beds of the Coal Measures, and was gregarious.

Prof. T. Rupert Jones, F.R.S., *loc. supra cit.*, points out the general resemblance of this shell to *Estheria*, and suggests that the small shells figured by Salter in 'Iron Ores of South Wales,' pl. ii. figs. 1-5, are forms of this species, the black bands in which it there occurs being very characteristic of its situation; but I describe these forms under *A. minima* below. The Bassy Mine Ironstone and Shale of North Staffordshire are literally filled with compressed shells of this species, with *Stigmaria* and other plant-remains.

Phillips, 'Silurian System,' p. 88, in a letter quoted by Murchison, describes four different shells (*Unios*) as occurring in these beds. "One, smooth, tumid, with prominent beaks, but with very distinct lines of growth, and rather short, straight hinge-lines, looks like a young *Modiola*; a second form, with nearly elliptical hinge-line, deviating considerably from parallelism with the front, ends in a prominent angle; lines of growth strong, shell very thin, beaks slightly prominent. Mr. Williamson has inaccurately referred this shell to *Unio nuciformis*. It occurs in the red beds above the limestone, Black Bass, and underlying Coal Measures."

A third species, "which I named *U. linguiformis* (*U. Phillipsii* of Williamson), is transversely elongated, three times as wide as long; the hinge-line deviates very little from parallelism to the front lines of growth; shell fine, very thin, and smooth."

The fourth species, "which I named *U. rugulosus*, is of obliquely expanded or semi-elliptical form, the hinge-line forming the diameter [I suppose he means when both valves are lying flattened out, connected with a hinge]; surface concentrically marked with broken undulations, often showing radiations on the posterior slopes; shell exceedingly thin. Unionidæ of the same species occur in the bed

of mottled marls above the [*Spirorbis*-] limestones, in the Black Bass or shale above the Main Limestone, and in the shale beneath all the calcareous bands."

Of these four, I suspect the last is the shell figured by Salter, Quart. Journ. Geol. Soc. vol. xix. (1863), as *Naiadites levis*, and referred to by Prof. T. Rupert Jones, Geol. Mag. for 1870, pl. ix. fig. 15, p. 220; but I refer again to this under *A. scotica*.

The 2nd and 3rd are probably different forms of the shell under description, which does vary in shape as described.

I am indebted to the Curators of the Owens College Museum for the loan of Prof. Williamson's type-specimen, and for permission to figure it.

Localities.—In the blackbands, ironstones, and shales of the North Staffordshire Coalfield, as far down as the Bassy Mine; in the Knowles Ironstone; Upper Coal Measures of the Lancashire Coalfield: Ardwick; Coal Measures, Bradford; Blackband, South Wales.

ANTHRACOMYA SCOTICA. (Pl. X. fig. 31.)

R. Etheridge, Jun., Geol. Mag. for 1877, pl. xii. fig. 8, pp. 244, 246.

Specific Characters (Etheridge).—"Obliquely-broad-ovate, flattened, abruptly truncated along the dorsal margin. Anterior end rounded; posterior end produced ventrally, its margin obliquely rounded. Hinge-line not so long as the shell, passing insensibly into the oblique posterior margin. Umbones anterior, but not terminal, inconspicuous. Shell marked with exceedingly close, fine, microscopic thread-like striæ, with a few transverse wrinkles, which at times give it the appearance of being partially radiately striated."

Remarks.—Mr. R. Etheridge, Jun., thinks this form closely resembles *Naiadites levis* (Dawson), though the latter is much smaller, and the concentric striæ closer, finer, and more numerous; the posterior end is more obliquely truncated, and the beaks more anterior. Salter, Quart. Journ. Geol. Soc. vol. xix. (1863) p. 80, identifies Sir J. W. Dawson's shell with one found in the Upper Coal Measures of Manchester. Dawson's shell was in 1870, by Prof. T. Rupert Jones, Geol. Mag. pl. ix. fig. 15, Appendix, p. 220, described as an *Estheria*, and p. 218, the fragment of a similar shell is mentioned from the Ardwick beds; but in 1877 the same writer is quoted by R. Etheridge, Jun., in the paper from which I take the latter's description of the shell under discussion, as having independently referred the Scottish fossil to Sir J. W. Dawson's species.

I figure a pretty little shell found in the Ardwick Limestone, which may belong to the form in question, but I cannot venture to pronounce on the point until I have been able to obtain specimens of the Scottish and American species for study and comparison. Mr. Etheridge (*op. cit.* p. 245) suggests that Hibbert's *U. nuciformis*, from the Burdiehouse Limestone, is an uncrushed example of *A. scotica*, a particularly convex and globose form, but unfortunately Hibbert's specimen has entirely disappeared.

Localities.—Cement-stone Group, Burdiehouse Limestone; Binn

Hill, Burntisland, Fife; Calder Hall and Calder Wood, Inchkeith (Firth of Forth); Wardie Shales, Water of Leith.

ANTHRACOMYA MODIOLARIS. (Pl. X. figs. 24, 25, and 26.)

Unio modiolaris, Sowerby, Trans. Geol. Soc. ser. 2, vol. v. pt. 3, pl. xxxix. fig. 10.

Anthracomya modiolaris, Salter, Mem. Geol. Surv., 'Iron Ores of South Wales,' pl. ii. fig. 13.

Anthracomya modiolaris, Ward, Trans. North Staffs. Inst. Min. & Mech. Eng. vol. x. (1890) pl. i. fig. 10.

Specific Characters.—Shell inequilateral, equivalve, transversely elongated, convex. Dorsal and ventral margins subparallel, hinge-line straight, somewhat elevated posteriorly. Umbones obtuse, adpressed, situated about $\frac{1}{4}$ distance of the hinge-line from the anterior end. An obtuse oblique ridge, in some forms subangular, passes obliquely backwards from the umbones in the direction of the posterior-inferior angle, becoming lost on the surface of the shell, just before it reaches this point. Anterior end short, rounded, much compressed below, with well-marked diagonal sulcus, anterior to the ridge. Posterior end flattened rapidly from the oblique ridge, and expanded; the posterior end is truncate, with rounded superior and inferior angles. The inferior border is straight, and gently curved where it passes into the anterior and posterior borders.

Interior.—Pallial sinus entire. Anterior-adductor scar elongate, at the junction of the hinge-line and the anterior border. Posterior-adductor scar large, ovate, near the posterior-superior angle of the shell.

Exterior.—Surface marked with lines and striæ parallel to the lower border, becoming curved posteriorly, very slightly so anteriorly. Striæ more dense at the inferior part of the shell.

Shell thin. Periostracum strongly wrinkled in some specimens.

Size.—Antero-posterior measurement, 44 mm. ($1\frac{3}{4}$ inch); dorso-ventral, 23 mm. ($\frac{7}{8}$ inch); from side to side, 18 mm. ($\frac{11}{8}$ inch).

Remarks.—This shell somewhat resembles *A. dolabrata*. It occurs at an entirely different horizon, the two species never appearing together in North Staffordshire.

Salter's figure in 'Iron Ores of South Wales,' pl. ii. fig. 13, hardly agrees with Sowerby's shell, but has all the appearance of a small form of *A. Adamsii*. The comparative measurements and shape are very similar; it lacks the straight lower border, the more acute form of the diagonal ridge, and besides its anterior end is too high, joining the inferior border with too great a curvature to belong to the species under description. It does occur in the South Wales Coalfield. I have had the opportunity of examining a shell from the locality in the collection of Mr. J. Ward.

This species is the only member of the genus which has been identified from a Scottish coalfield, though Mr. R. Etheridge, Jun., mentions some crushed specimens from the Bo'ness Series; the former is confined to the Middle Coal Measures.

Locality.—Hard Mine and Ten-foot Seams, North Staffordshire Coalfield; Crawstone, Coalbrookdale; Black Mine, Oldham; ? South Wales; Durham Coalfield; Scotland.

ANTHRACOMYA ELONGATA. (Pl. X. figs. 1–12.) Williamson MSS.

Modiola Williamsoni, Brown, 'Fossil Conchology,' pl. lxxi. figs. 24, 25.
Non *Naiadites* (*Anthracomya*) *elongata*, Dawson, 'Acadian Geology,' 2nd ed. (1868) p. 204, fig. 43.

Specific Characters.—Slightly inequivalve, the left being the larger; inequilateral; transversely elongate; greatest dorso-ventral measurement at the posterior end of the shell. Hinge-line straight, edentulous, raised posteriorly. Umbones small, contiguous, situated at rather less than $\frac{1}{3}$ distance of the hinge-line from the anterior margin. Inferior border nearly straight, slightly sinuated about its centre. Lunule small and elongated. Anterior end sharp, compressed, with an acutely rounded border passing rapidly downward into the inferior border. Posterior end expanded and very slightly flattened, except above, where it is rapidly compressed into the hinge-line, its posterior border being truncate with bluntly rounded angles; generally gaping. A broad, obtuse gibbosity passes from the umbones diagonally across the shell, in the direction of the inferior-posterior angle, with a slight oblique sulcus anterior to it, reaching the inferior margin about its centre. Cartilage external. Shell small.

Interior nacreous; pallial sinus entire, with lamellar markings; above and over the oblique gibbosity some fine, radiating lines. Anterior-adductor muscle-scar situated just within the anterior border, at the anterior-superior angle; large, rounded accessory scar above, and nearer the umbo. Posterior-adductor scar situated just below the posterior end of the hinge-line, large and rounded.

Exterior.—Surface covered with fine concentric lines, which become parallel to the inferior border as they pass across the shell. Shell very thin.

Size.—Antero-posterior measurement, 35 mm. ($1\frac{3}{8}$ inch); dorso-ventral, near posterior end, 17 mm. ($\frac{1}{6}$ inch); greatest lateral measurement at the centre of the shell, 5 mm. ($\frac{1}{5}$ inch).

Remarks.—This pretty little shell is very variable, scarcely two specimens being exactly alike. Its chief variations are in the position of the umbones, length of the anterior end, comparative length of the shell, and shape of the posterior end, which may be bluntly rounded and much compressed. I find in Brown's 'Fossil Conchology' a figure which agrees closely with mine, to which that author has given the name of *Modiola Williamsoni*, at the same time referring it to *M. elongata*, MSS. Williamson. I adopted the latter specific name as having the right of priority, and with the greater pleasure because it does away with a meaningless, purely complimentary, barbarous term.

Locality.—Hard Mine roof, North Staffordshire Coalfield (where it is fairly common). Most museums in the country possess these shells from this bed.

ANTHRACOMYA LANCEOLATA, sp. nov., Wheelton Hind. (Pl. X. figs. 13, 13 a.)

Modiola lithodomoides. R. Etheridge, Jun., & J. Ward, Trans. North Staffs. Inst. Min. & Meeh. Eng. vol. x. (1890) p. 130, pl. i. fig. 11.

Specific Characters.—Shell slightly inequivalve, much elongated transversely, with rounded ends. Hinge-line straight, about $\frac{4}{5}$ length of the shell, not raised posteriorly. Umbones small, only just raised above the hinge-line, obtuse, not contiguous, situated $\frac{1}{4}$ length of the shell from the anterior end. Lunule narrow and elongated. Anterior end much lower than the umbones, short, almost straight above, rounded below, convex. The posterior end is elongated, flattened, lanceolate, only slightly expanded below. There is a slight oblique sulcus which indents the inferior border, at the junction of the anterior with the middle third of the shell. The shell is moderately convex in its anterior two-thirds, being gradually flattened above, below, and posteriorly in the hinder third. Inferior border straight for $\frac{1}{3}$ its length, then slightly sinuated, and then produced downward in a straight line at a slight angle, till it curves bluntly upward to meet the posterior border.

Interior smooth; anterior-adductor muscle large, just within the anterior-superior angle of the shell. Posterior unknown. Shell thin, ligament external.

Exterior.—Surface covered with fine lines and laminae of growth.

Size.—Antero-posterior measurement, 32 mm. ($1\frac{1}{4}$ inch); greatest dorso-ventral, $\frac{1}{3}$ from posterior end, 10 mm. ($\frac{2}{5}$ inch); from side to side, centre of shell, 7 mm. ($\frac{5}{8}$ inch).

Remarks.—I know of only two examples of this species, which is separated from other species by the absence of a raised hinge-line posteriorly, and by the acute and generally flattened posterior end. It has no similarity to *Modiola lithodomoides*, R. Etheridge, Jun., Geol. Mag. for 1875, p. 241, a Mountain Limestone species much larger than our specimen. One was picked up at the Glebe Colliery, Fenton; exact horizon unknown.

Locality.—Bowling Alley Seam, Middle Coal Measures, Whitfield Colliery, North Staffordshire.

ANTHRACOMYA OBTUSA. (Pl. X. figs. 14, 14 a.)

Unio obtusus, Ludwig, 'Palæontographica,' vol. viii. pl. iv. figs. 13-15.

Pleurophorus subcostatus, Meek & Worthen, 'Geol. of Illinois,' Palæont., vol. ii. (1866) pl. xxvii. figs. 2, 2 a.

Specific Characters.—Shell very inequilateral, oblong. Anterior end very bluntly, obtusely rounded. Posterior end truncate; the superior and inferior angles rounded; the superior and inferior borders nearly parallel. Hinge-line curved anteriorly as far as the umbo, afterwards straight and slightly elevated, edentulous. Umbones almost anterior, otherwise separate, about as high as the hinge-line. Lunule well marked. Inferior border very slightly sinuated. Anterior end almost obsolete, moderately convex; posterior elongated, gently flattened, compressed above into the hinge-line. An almost

obsolete diagonal swelling crosses the shell obliquely from the umbones.

Interior.—Smooth. Pallial line simple. Anterior-adductor scar at the superior-anterior angle; posterior large, hemispherical, at the upper part of the posterior end.

Exterior.—Surface marked with fine concentric lines, parallel for most part of the way to the inferior border.

Size.—Antero-posterior measurement, 25 mm. (1 inch); dorso-ventral, 12 mm. ($\frac{7}{16}$ inch); from side to side, 8 mm. ($\frac{1}{3}\frac{1}{2}$ inch).

Remarks.—This shell is somewhat rare. It is differentiated from other species by its oblong rectangular form, and obsolete anterior end. I believe this shell is similar to that described and figured by Meek and Worthen in the 'Palæontology of Illinois.' They referred their shell to a Permian species (King) on account of a few radiating lines on the posterior surface, a kind of ornament which also obtains in *Anthracomya*; and describe the groove in casts, on each side at the posterior end of the hinge-line, as impressions of long lateral teeth, instead of as an expansion of the articulating plate. It is, however, impossible to speak positively without handling the American specimens.

Locality.—Hard Mine Seam, North Staffordshire.

ANTHRACOMYA ANGUSTA, sp. nov., Wheelton Hind. (Pl. X. fig. 15.)

Specific Characters.—Shell very transversely elongated, narrow. Hinge-line straight, nearly as long as the shell, not raised posteriorly. Umbones small, obtuse, very slightly raised above the hinge-line, situated about $\frac{1}{8}$ length of the shell from the anterior end. The inferior border is straight, being broadly grooved for the byssal sinus. Anterior end obsolete, tumid; posterior end elongated and flattened. An obtuse angular ridge extends from the umbones, becoming lost on the posterior part of the shell, and there is a broad sinus just anterior to it. Posterior border bluntly truncated.

Interior unknown.

Exterior.—Surface ornamented with fine concentric lines parallel to the lower border, which become strongly reflected upward over the posterior part of the shell towards the superior border. Peristroacum very strongly wrinkled.

Size.—Antero-posterior measurement, 11 mm. (about $\frac{2}{5}$ inch); dorso-ventral, 6 mm. (about $\frac{1}{5}$ inch).

Remarks.—I know of only one specimen, which is in my own collection. It is distinguished from other species by its narrow, elongated form, and by its surface-markings.

Locality.—Hard Mine Seam, Bucknall, North Staffordshire.

ANTHRACOMYA SUBCENTRALIS. (Pl. X. figs. 30 and 30 a.)

Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' pl. ii. figs. 9 and 9 a, p. 231.

Specific Characters.—Transversely oblong, convex. Anterior end rounded, tumid, somewhat prominent. Posterior end bluntly

rounded, with a blunt swelling which passes from the umbones to the posterior-inferior angle of the shell; the surface above this swelling is compressed into the hinge-line. There is a very slight, broad, oblique sinus anterior to the ridge. The hinge-line and ventral margin are nearly parallel, the latter being sinuate in its middle third. The umbones are prominent, raised above the hinge-line, and situated at $\frac{1}{3}$ length of the latter, which is not quite so long as the shell, from the anterior end. The beaks are apart. Lunule large and elongated. Cartilage external.

Interior unknown.

Exterior.—Surface almost smooth, with nearly obsolete striæ and lines of growth. Periostracum strongly wrinkled.

Size.—Antero-posterior measurement, 20 mm. ($\frac{4}{5}$ inch); dorso-ventral (at umbo), 7 mm. ($\frac{5}{16}$ inch); from side to side, 5 mm. ($\frac{1}{5}$ inch).

Remarks.—Salter observes that the more convex form and central beaks distinguish this species from *A. pumila*, to which it most nearly approaches. This appears to be a very rare form.

Localities.—South Wales: No. 6 pit, Victoria, over the Three-quarter Coal; Hard Mine, Longton, North Staffordshire.

ANTHRACOMYA PUMILA. (Pl. X. figs. 17, 18, 18 a, 19, 28, and 29.)

Salter, Geol. Surv. Mem. 'Iron Ores of South Wales,' pl. ii. fig. 10, p. 230.

Specific Characters.—Shell transversely oblong, slightly convex. Hinge-line and ventral margin nearly straight, almost parallel. Umbones small, apices depressed, situated about $\frac{1}{3}$ length of the hinge-line from the anterior end. Lunule narrow and elongated. Anterior end short and somewhat pointed, with or without a slight oblique depression. The posterior end, which is bluntly rounded and truncate, has an obtuse diagonal ridge arising at the umbones and passing to the posterior-inferior angle of the shell. Gently flattened and slightly expanded above the ridge.

Interior.—Anterior and posterior muscle-scars as in other species of this genus. Pallial line simple, ligament external.

Exterior.—Surface covered with fine striæ and lines of growth. Periostracum wrinkled.

Size.—Antero-posterior measurement, 19 mm. (about $\frac{4}{5}$ inch); dorso-ventral, 10 mm. ($\frac{2}{3}$ inch); from side to side, 7 mm. ($\frac{5}{16}$ inch).

Remarks.—I feel very uncertain as to this form, as I have been unable to see the type-specimen. I think it very probable that the form here described may eventually be recognized as the young of the commonest species in the Hard Mine Beds of North Staffordshire, to which I have given the name of *A. elongata* (see p. 266). If this prove to be the case, the name of *pumila* will have to be removed. Salter's figure shows the posterior end to be less in the dorso-ventral dimensions than is the case with the family generally.

ANTHRACOMYA SENEX. (Pl. X. figs. 20, 20 *a*, and 21.)

Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' pl. ii. fig. 12, p. 231.

Specific Characters.—They are thus described by Salter:—
“ One inch wide (antero-post.), very unequal-sided (modioliform), the beaks close to the anterior end, which is divided by a well-marked byssal furrow and notch from the posterior side; the latter is convex along the blunt siphonal ridge. Anterior side very short, its edge falling vertically under the rather prominent beak. The posterior side (or slope) is expanded and very convex; the hinge-line raised; the ventral margin sinuate and concave.

“ Epidermis deeply wrinkled V-fashion over the posterior slope.”

Remarks.—The type-specimen is in the Museum of Practical Geology, Jermyn Street. I have obtained and I figure here specimens of this form from the Hard Mine Seam, Longton, North Staffordshire.

ANTHRACOMYA OBOVATA, sp. nov., Wheelton Hind. (Pl. X. figs. 22 and 22 *a*.)

Specific Characters.—Shell obovate, inequivalve, the left valve being more convex. Anterior end almost obsolete, tumid, bluntly pointed. Posterior end expanded, flattened backward and downward and into the hinge-line, which is much raised. The hinge-line is straight, about $\frac{3}{4}$ length of the shell. Umbones prominent, blunt, separate, situated $\frac{1}{2}$ distance of the hinge-line from the anterior end. The inferior border is curved rapidly downward from the anterior end, then becomes bluntly and gently rounded into the posterior border, which extends in the form of a regular semicircular curve from the inferior to the superior angle. A blunt swelling, rapidly flattened on its posterior side, extends from the umbo to a point in the inferior border, anterior to its posterior limit. There is no appreciable byssal sulcus, but there appears to have been a byssal notch at the junction of the anterior and middle thirds of the inferior border.

Interior smooth, with folds of growth; anterior- and posterior-adductor scars as in other species. Ligament external. Lunule distinct.

Size.—Antero-posterior measurement, 30 mm. ($1\frac{1}{3}$ inch); greatest dorso-ventral (at posterior end), 17 mm. ($\frac{7}{10}$ inch); from side to side, 7 mm. ($\frac{5}{8}$ inch).

Remarks.—I have found only one specimen of this very distinct and characteristic form. It looks much like some forms of *Anthracoptera*, from which it can be distinguished by its umbones and hinge-line. It has occurred to me that this may well be an example of mimicry, the more so because the new form *Anthracoptera elongata* resembles very closely certain forms of *Anthracomya* (see p. 256); in fact, it is only on very close examination of the umbones and hinge-lines that these forms can be correctly referred to their proper genera. This shell closely resembles *Naiadites* (*Anthracomya*) *carbonaria*, Dawson,

'Acadian Geology,' 2nd ed. p. 204, fig. 42; but I have not been able at present to compare the two forms.

Locality.—Hard Mine Seam, Dividy Lane, North Staffordshire.

ANTHRACOMYA, sp. nov. (?), Wheelton Hind. (Pl. X. fig. 23.)

Specific Characters.—Shell oblong, ovate, tumid. Anterior end $\frac{1}{4}$ of the shell, has its superior border much below the umbones, and is bluntly rounded. Inferior border almost straight, joining the anterior and posterior borders with rounded angles. Hinge-line straight, about $\frac{2}{3}$ length of the shell. If it and the inferior border were produced anteriorly, they would meet at a very acute angle. Umbones obtusely broad, more conspicuous, more elevated and separated than usual with this genus, at $\frac{1}{4}$ distance of the hinge-line from the anterior end. Posterior border oblique, truncate from above downwards, rounded below. The shell has a very slight oblique constriction anteriorly, more marked in the left valve. There is no oblique ridge, but the shell becomes generally swollen, being only slightly compressed towards the anterior end.

Interior normal.

Exterior (?).

Size.—Antero-posterior measurement, 38 mm. ($1\frac{1}{2}$ inch); dorso-ventral, 20 mm. ($\frac{4}{5}$ inch); lateral, 15 mm. ($\frac{3}{5}$ inch).

Remarks.—This shell may possibly prove to be a local variety of *A. modiolaris*, but is distinguished from the typical form by the comparative measurements, by the absence of an oblique ridge, and by the short hinge-line and much truncated posterior border.

Locality.—Durham Coalfield.

ANTHRACOMYA WARDI, Salter MSS. (Pl. IX. figs. 9 & 10.)

Ward, Trans. North Staffs. Inst. Min. & Mech. Eng. vol. x. (1890) p. 126, with description by R. Etheridge, F.R.S.

Specific Characters.—Shell small, oblong, margins sub-parallel, moderately convex. Hinge-line straight, nearly as long as the shell, not elevated posteriorly. Anterior end about $\frac{1}{4}$ of the shell; its border forms a right angle with the hinge-line above, bluntly rounded below. Posterior end obliquely truncate above, bluntly rounded at the lower angle, flattened above along the hinge-line and backward into the margin. Umbones situated in the anterior third of the shell. A blunt, oblique tumidity extends from the umbonal area towards the lower part of the posterior end, where it becomes lost.

Exterior.—Surface smooth, with fine, close, concentric striæ and lines of growth, rapidly curving up to the posterior hinge-line. Periostracum thin.

Size.—Antero-posterior measurement, 40 mm. ($1\frac{3}{5}$ inch); dorso-ventral, 16 mm. (about $\frac{7}{10}$ inch). These measurements are, in a specimen belonging to Mr. Geo. Wild, of Oldham, respectively 33 mm. ($1\frac{1}{2}$ inch) and 10 mm. ($\frac{2}{5}$ inch).

Remarks.—I know of only one specimen from North Staffordshire, a right valve, from the cabinet of Mr. J. Ward, F.G.S. It was evidently described by Mr. Etheridge with the preconceived idea that the shell belonged to the Anatinidæ. The specimen is much broken along the anterior half of the hinge-line, and on a cursory examination a fractured fold might be taken for a central umbo. On a closer inspection it will be seen that more anteriorly the shell has disappeared, and left the cast of a small umbo in the normal position of the genus, at the junction of the anterior and middle thirds. I figure another specimen from the cabinet of Sir U. K. Shuttleworth, with the kind permission of that gentleman. This fossil is in a better-preserved condition than the type-specimen, and shows both valves lying open, displaying the characteristic posterior border and shape of the shell; it has a more pronounced ridge than the crushed type, and the umbones are seen to be at $\frac{1}{4}$ length of the hinge-line from the anterior end.

In the Geol. Surv. Mem. of the Country round Bolton, p. 35, Salter notes the occurrence of *Anthracomya sanguinolaris*, MSS., in the Ganister series of Burrs, half-a-mile north of Bury. He had seen Mr. Wild's specimen, and named it *Orthonota* (?) or *Sanguinolites* (?); I am unable to find any specimen bearing the name *A. sanguinolaris*, and hazard the conjecture that it may have been a specimen similar to that described.

Localities.—Holly Lane Coal, roof, Adderley Green, North Staffordshire; Low Baton Bed, Fulledege, Burnley, Lancashire.

[ANTHRACOMYA MINIMA, sp. nov., Wheelton Hind. (Pl. IX. figs. 11 and 12.)

Anthracomya, undescribed forms, Salter, Geol. Surv. Mem., 'Iron Ores of South Wales,' pl. ii. figs. 1, 2, 3.

Specific Characters.—Shell triangular, very small. The hinge-line, if produced, would meet the inferior border at an acute angle. Anterior end short, tumid, border rounded. Posterior expanded and flattened into the borders, behind an oblique obtuse swelling, which passes from the umbones towards the posterior-inferior angle. The posterior border is obtusely rounded below, sloping rapidly upwards into the hinge-line. The hinge-line is a little more than half the length of the shell; the umbones are small, situated about $\frac{1}{5}$ length of the hinge-line from the anterior end. The inferior border is nearly straight, very slightly situated about the centre.

The shell is constricted by an oblique groove anterior to the oblique swelling, and is marked by fine lines of growth.

Interior casts show the arrangement of muscle-scars as in other species of the genus.

When young, the shell is more elongate, and not so triangular; it appears to grow in an oblique direction towards the posterior border.

Size.—Antero-posterior measurement, 9 mm. (about $\frac{3}{8}$ inch); dorso-ventral, 4 mm. (about $\frac{1}{6}$ inch); lateral, 3 mm. (about $\frac{1}{8}$ inch).

Remarks.—Blocks of clay-ironstone crammed with shells of this species were sent me for description by Mr. C. Roeder of Manchester, from the Middle Coal Measures of Prestolee. They agree in form with those figured by Salter (*op. supra cit.*), and I have come to the conclusion that the more transverse forms are only the young of these, more expanded posteriorly and triangular. The specimens I have described were obtained by calcining the blocks of stone.

Localities.—Middle Coal Measures, Prestolee, Manchester; Blackband, Blaina, South Wales.

ANTHRACOMYA CARINATA, sp. nov., Wheelton Hind. (Pl. X. figs. 16 and 16 a.)

Specific Characters.—Shell transversely elongate, anterior end almost obsolete, moderately tumid, pointed bluntly above the border, sloping quickly into the inferior edge, which is slightly convex in its outline. Posterior part of shell produced. Nearly $\frac{7}{8}$ of the shell with a strong oblique swelling passing downward from the umbones to the inferior border, at the junction of its third and posterior fourth. The extremity is flattened, and gradually compressed into the border, which is bluntly rounded. The hinge-line is straight, about $\frac{3}{4}$ length of the shell. Umbones very anterior, tumid, obtuse.

Interior unknown.

Exterior.—Surface covered with fine striæ and lines of growth, which, starting from the anterior end, become curved upwards, as they reach the oblique swelling, and are reflected to the superior border. The greatest dorso-ventral measurement is at the posterior end of the hinge-line. Periostracum wrinkled.

Size.—Antero-posterior measurement, 22 mm. ($\frac{9}{10}$ inch); dorso-ventral, 8 mm. ($\frac{1}{3}\frac{1}{2}$ inch); lateral, 8 mm. ($\frac{1}{3}\frac{1}{2}$ inch).

Remarks.—I know of only two specimens of this form, one from the Strickland Collection of the University of Cambridge, and one from the Middle Coal Measures of Prestolee, Manchester, kindly lent me by Mr. C. Roeder. Its distinctive characteristics are the strong oblique swelling, transverse form, short anterior end, and rounded posterior extremity. It most closely resembles *Anthracomya lanceolata* (see p. 267), which has a similar posterior border, but does not possess so stout an anterior end, nor so strong an oblique tumidity.

Localities.—Middle Coal Measures, Manchester; South Wales Coalfield, Merthyr Tydvil.—March 15th, 1893.]

[*Note.*—I find that Eichwald, in ‘Lethæa Rossica’ (Partie ancienne), pp. 976–978, and pls. xxxviii.–xxxix., describes and figures under *Modiolopsis* several species from the Coal Measures of Russia which are evidently *Anthracomya*: they are *Mod. conspicua*, *M. tenera*, *M. tenuissima* (fig. in ‘Urwelt Russlands,’ Heft i. p. 100, pl. iv. fig. 1), and *M. Pallasii*. For the last-named, and for *M. Teploft*, he quotes De Verneuil, ‘Paléont. de la Russie,’ pp. 316, 318, pl. xix. figs. 16, 17.—April 19th, 1893.]

EXPLANATION OF PLATES VII, VIII, IX, & X.

PLATE VII.

- Figs. 1, 1 a, 1 b. *Anthracoptera modiolaris*, showing striated hinge-plate and pit-like muscle-scars. Ten-foot Seam, roof. Bucknall, North Staffs.
- 2, 2 a. *Anthracoptera carinata*, showing the striated hinge-plate and muscle-scars.
3. Cast of interior of *Anthracoptera modiolaris*, showing the muscle-scars and pallial line. Hard Mine, Adderley Green, North Staffordshire.
4. *Anthracoptera modiolaris*, with short form of hinge-line. Hard Mine, Adderley Green.
- 5, 6. *Anthracoptera modiolaris*. Hard Mine, Adderley Green.
7. ——— *triangularis*. Hard Mine, Adderley Green.
8. ———, intermediate form between *A. triangularis* and *A. carinata*. Hard Mine, Adderley Green.
- 9, 9 a. *Anthracoptera triangularis*, in profile. Hard Mine, Adderley Green.
- 10, 10 a. *Anthracoptera carinata*. Hard Mine, Adderley Green.
11. ———, form approaching *A. quadrata*. Hard Mine, Adderley Green.
- 12, 12 a. *Anthracoptera carinata*. Hard Mine, Adderley Green.
- 13, 13 a. ——— *tumida*. Hard Mine, Adderley Green.
14. ———, mimicking *Anthracomya dolabrata*. Collection of Mr. J. Ward, F.G.S.
- 15, 15 a. *Anthracoptera elongata*. Knowles Ironstone, Fenton Park, North Staffordshire.
16. *Anthracoptera elongata*, young of. Knowles Ironstone, Fenton Park.
17. *Anthracoptera elongata*, form approaching *A. carinata*. Knowles Ironstone, Fenton Park.

PLATE VIII.

- Fig. 1. *Anthracoptera quadrata*. Hard Mine, Adderley Green, North Staffs.
2. ———, flattened form. Hard Mine, Adderley Green.
3. ———. Hard Mine, Adderley Green.
4. ———, compressed specimen. 'Stinking coal-shale,' Froghall.
5. *Anthracomya Adamsii*. Little Mine Ironstone, Great Fenton, North Staffordshire.
- 5 a. *Anthracomya Adamsii*, view of hinge and umbones. Little Mine Ironstone, Great Fenton.
6. *Anthracomya Adamsii*, showing straight, edentulous hinge-line. Great Fenton.
7. *Anthracomya Adamsii*, specimen showing colour-bands. Great Fenton.
8. ———, more transverse form. Great Fenton.
- 9, 9 a. ——— *dolabrata*, approaching *Adamsii*. Little Mine, Great Fenton.
- 10, 10 a. ———. The second figure shows the tumidity. Little Mine, Great Fenton.

PLATE IX.

- Figs. 1, 1 a. *Anthracomya dolabrata*. Type-specimen from the cabinet of Prof. Prestwich, F.R.S. See Sowerby's figure in 'Geology of Coalbrookdale.'
2. *Anthracomya Adamsii*, var. *expansa*. Great Fenton, North Staffs.
3. ———. Pitts Hill. In the collection of Mr. F. Barke.
- 4, 5. ——— *dolabrata*. Collection of Mr. J. Ward, F.G.S. Longton, North Staffordshire.
- 6, 6 a. ——— *Phillipsii*. Knowles Ironstone, Fenton, North Staffordshire.
7. ———, specimen differing slightly in form.
8. ———, crushed specimen from the Blackband Ironstone.
9. ——— *Wardii*. Mr. J. Ward's specimen.
10. ———. From the collection of Sir U. K. Shuttleworth, from Burnley.

PLATE X.

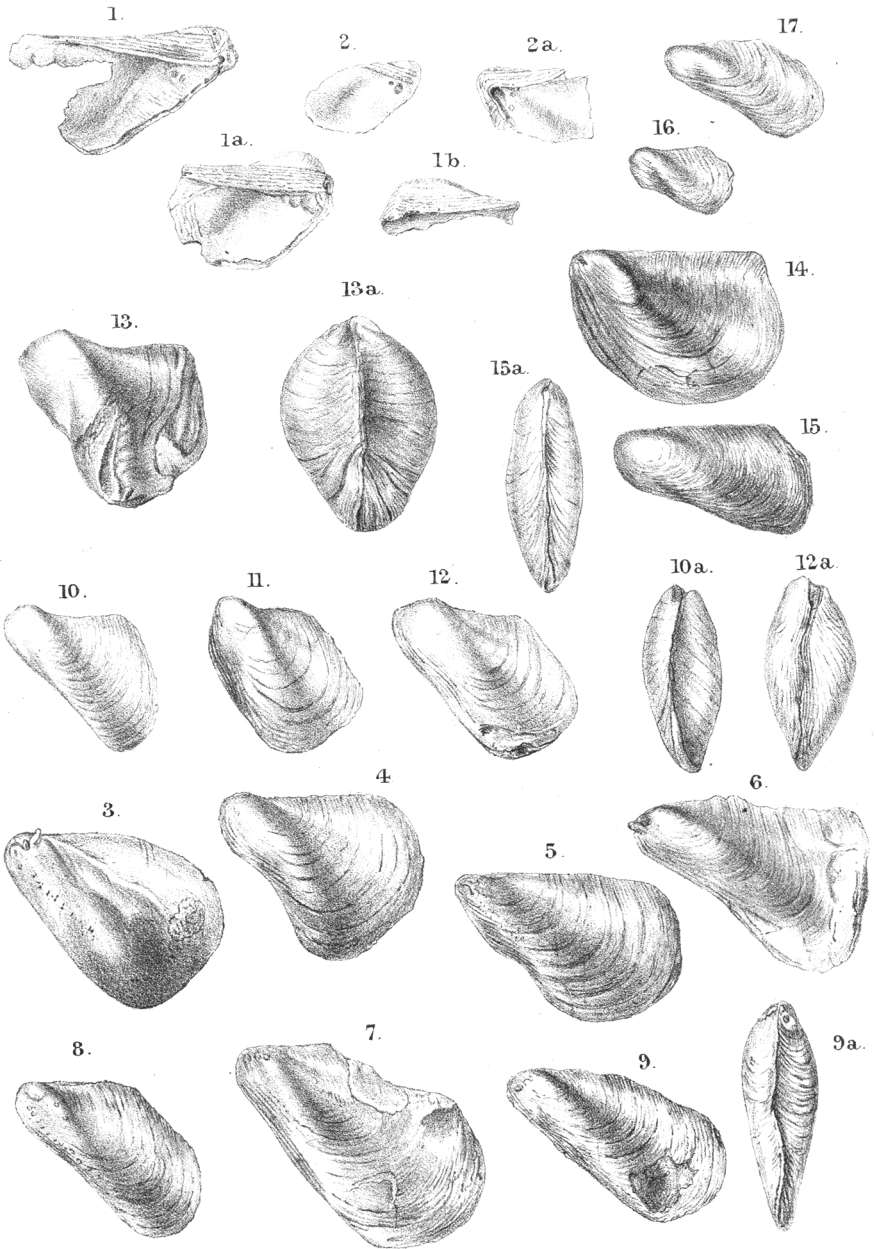
- Fig. 1. *Anthracomya elongata*. Longton, North Staffordshire.
 1 a. ———, profile.
 2-5, 9-12. *Anthracomya elongata*, showing variations in form. No. 12
 from the collection of Mr. J. Ward, F.G.S.
 6. *Anthracomya elongata*, showing muscle-scars.
 7, 8. ———, testiferous specimens.
 13, 13 a. *Anthracomya lanceolata*. Fenton, North Staffordshire.
 14, 14 a. ——— *obtusa*. Longton, North Staffordshire.
 15. ——— *angusta*. Bucknall, North Staffordshire.
 16, 16 a. ——— *carinata*, wrinkled specimen from Merthyr Tydvil. From
 the Strickland Collection, Woodwardian Museum, Cambridge.
 17-19. *Anthracomya punila*?, probably young of *A. elongata*.
 28, 29. ———. Pitts Hill.
 20, 20 a, 21. *Anthracomya senex*. Longton, North Staffordshire.
 22, 22 a. *Anthracomya obovata*. Same locality.
 23. ——— sp. ? *modiolaris*. Durham.
 24-26. ——— *modiolaris*. Bucknall, North Staffordshire.
 27. ——— *Phillipsii*. Type-specimen from Owens College, Manchester.
 30, 30 a. ——— *subcentralis*. Specimen at Owens College, Manchester.
 31. ——— ? *scotica*. Ardwick Limestone.

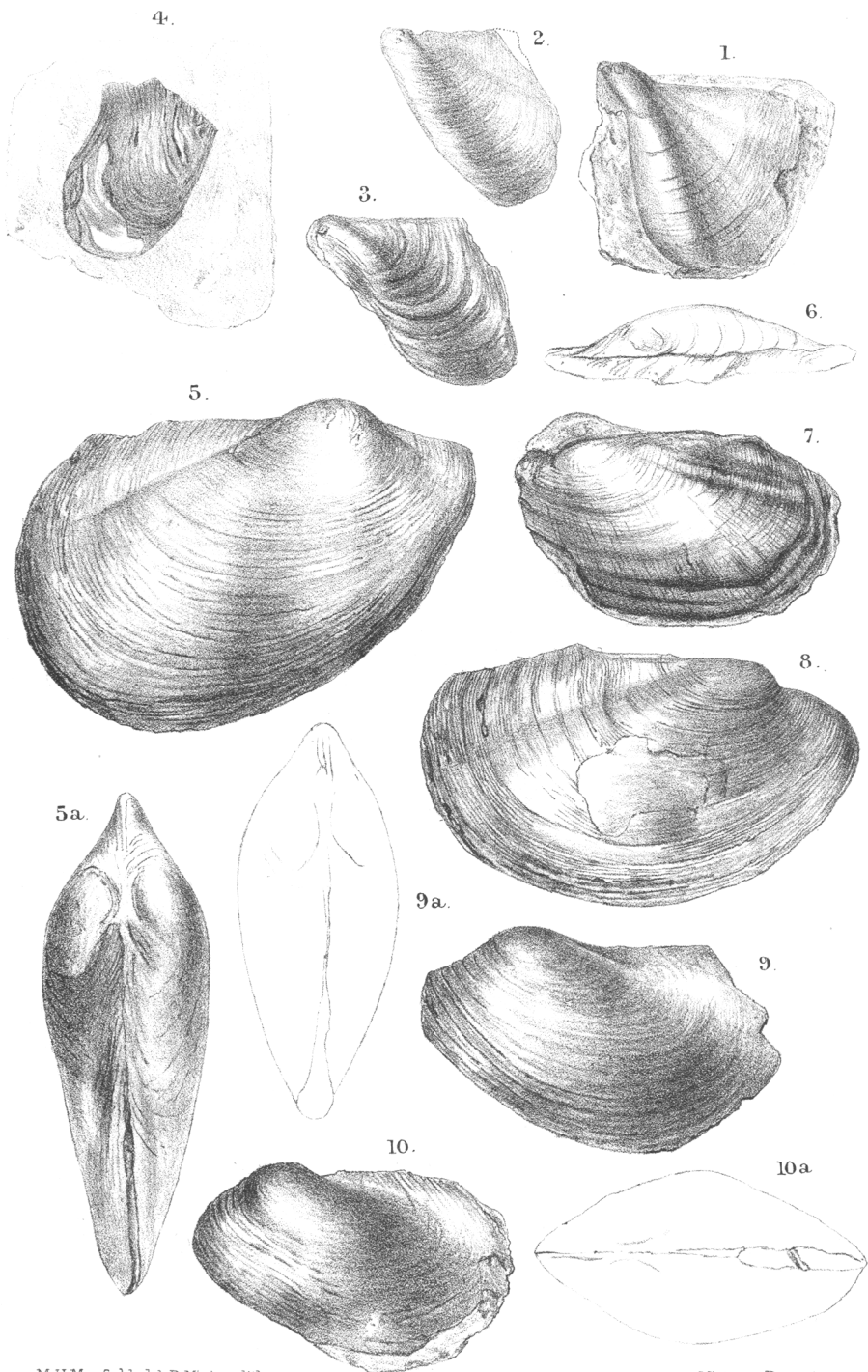
DISCUSSION.

The PRESIDENT had no doubt that this was a useful piece of palæontological work. The forms of life described by the Author had not received the attention which they deserved. An alternation of salt and freshwater beds in the Coal Measures, as in other formations, was easy to understand. He thought that the Author was probably correct in referring these fossils to the Unionidæ, and spoke of the analogies between *Anthracomya* and *Anodon*.

Mr. B. B. WOODWARD congratulated the Author on the results of his labours in a hitherto much neglected corner of palæontology. He pointed out that Fischer had placed both the genera in question under *Myalina*, but had included that group in the Mytilidæ. The Author's proposal to separate these forms from the Mytilidæ, and to place them nearer to the Unionidæ, would receive support from the fact that *Dreissenia*, which, like *Anthracoptera*, closely resembled the Mytilidæ in external form, had lately been shown by its anatomy to be a near ally of the Unionidæ. He hoped Dr. Wheelton Hind would extend his researches to *Anthracosia* with the view of confirming or correcting Amalizky's recent researches.

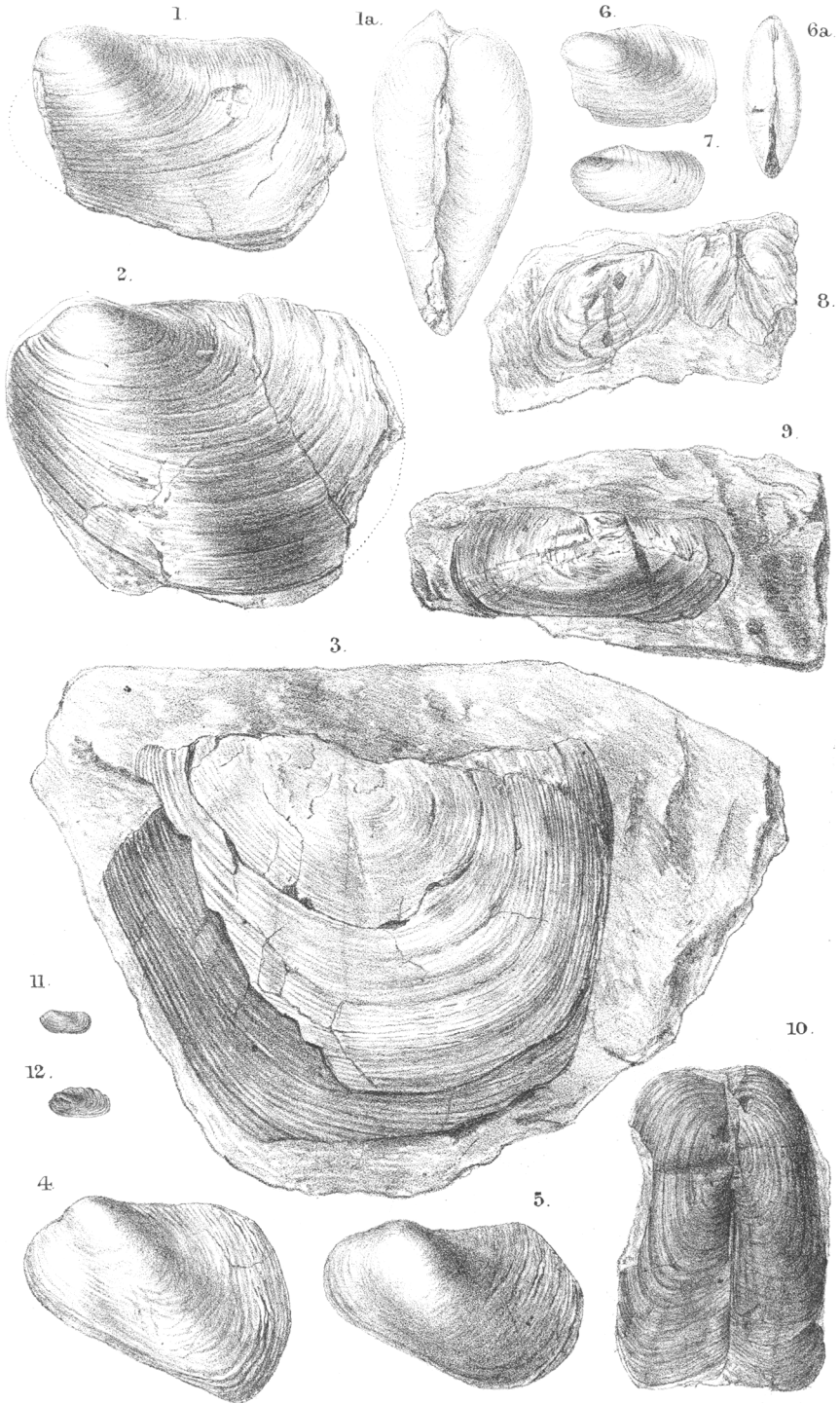
Prof. J. F. BLAKE also spoke, and the AUTHOR replied.





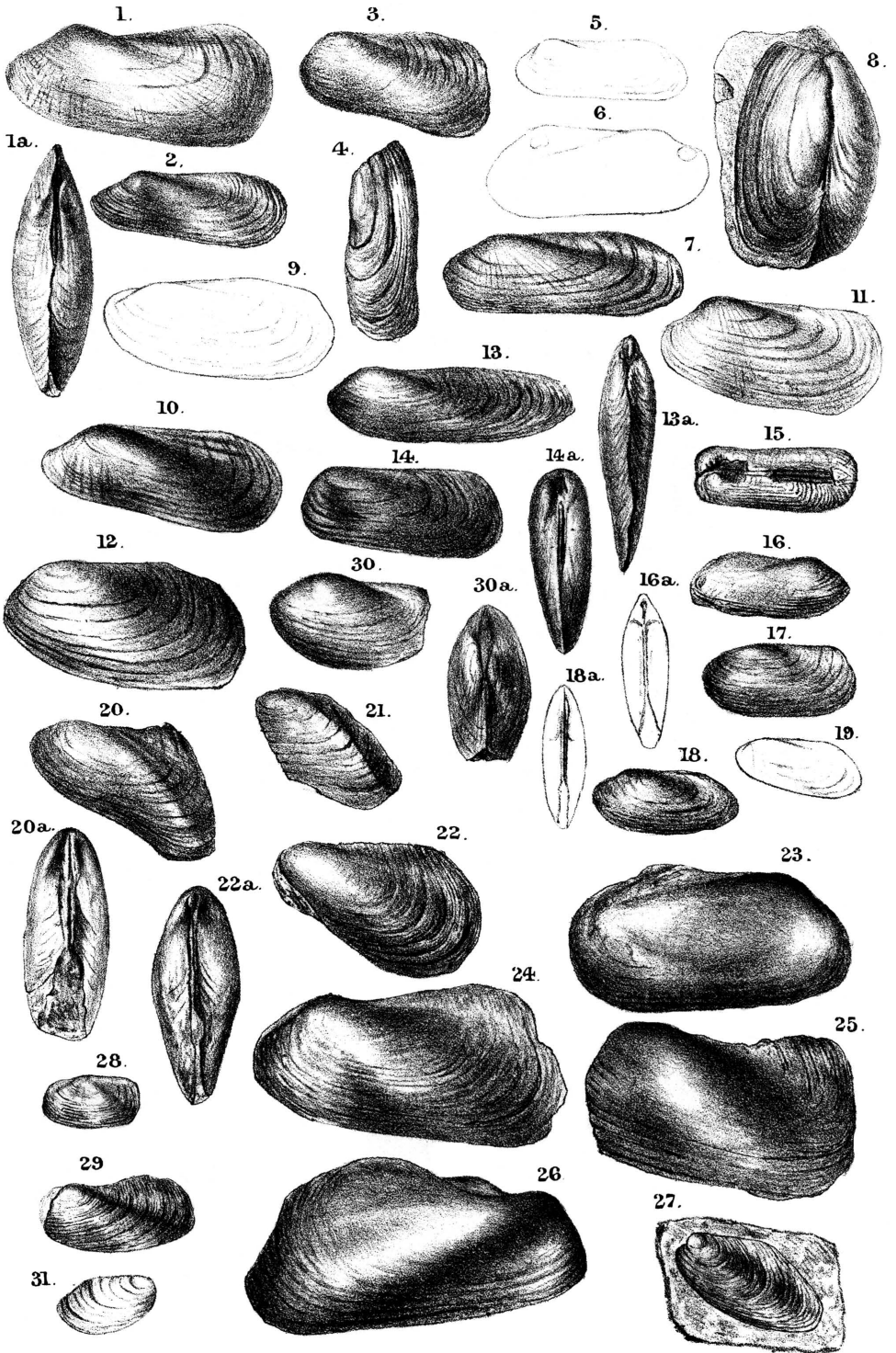
M.H. Marfield. del. R. Mintern lith.

Mintern Bros. imp.



M.H. Manfield del. R. Mintern lith.

Mintern Bros. imp.



M.H. Manfield del. R. Mintern lith.

Mintern Bros. imp.