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JOURNAL

OF

THE ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

VOL. VI.—SECOND SERIES.

PHILADELPHIA:
PRINTED FOR THE ACADEMY,
BY MERRIHEW & SON.

1866—1869.



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P4A 1225
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| 1 | Extra copies printed for the Author, | May, 1866. |
| 2 | “ “ “ | July, 1866. |
| 3 | “ “ “ | December, 1866. |
| 4 | “ “ “ | August, 1867. |
| 5 | “ “ “ | December, 1868. |
| 6 | “ “ “ | December, 1868. |
| 7 | “ “ “ | December, 1868. |
| 8 | “ “ “ | July, 1869. |
| 9 | “ “ “ | August, 1869. |

JOURNAL
OF THE
ACADEMY OF NATURAL SCIENCES
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ART. I.—*New Unionidæ, Melanidæ, etc., chiefly of the United States.*

By ISAAC LEA.

UNIO QUADRILATERUS. Pl. 1, fig. 1.

Testa lævi, oblonga, subinflata, ad latere planulata, inæquilaterali, postice biangulata et truncata; valvulis crassiusculis; natibus prominulis, ad apices undulatis; epidermide tenebroso-fusca, eradiata vel obscure radiata; dentibus cardinalibus parviusculis, tuberculatis, in utroque valvulo duplicibus; lateralibus sublongis, lamellatis subrectisque; margarita albida vel purpurea vel salmonea et valde iridescente.

Shell smooth, oblong, somewhat inflated, flattened at the sides, inequilateral, biangular and truncate behind; valves somewhat thick; beaks a little prominent, undulate at the tips; epidermis dark brown, without rays or obscurely rayed; cardinal teeth rather small, tuberculate, double in both valves; lateral teeth rather long, lamellar and nearly straight; nacre whitish, purple or salmon and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 192.

Hab.—Abbeville District, South Carolina, Dr. Barratt; Neuse River, near Raleigh, Dr. Emmons; and Catawba River, North Carolina, C. M. Wheatley.

My cabinet and cabinets of Dr. Emmons and Mr. Wheatley.

Diam. .7, Length 1.4, Breadth 2.3 inches.

Shell smooth, oblong, somewhat inflated, flattened at the side, inequilateral, biangular and truncate behind; substance of the shell rather thick; beaks slightly prominent, undulate at the tips; ligament rather small and dark brown; epidermis dark brown, without rays or obscurely rayed, with distant marks of growth; umbonial slope raised and obtusely angular; posterior slope rather narrow, raised into a carina; car-

dinal teeth rather small, tuberculate, double in both valves; lateral teeth rather long, lamellar and nearly straight; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices small and placed over the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks very shallow and rounded; nacre whitish, purple or salmon colored and very iridescent.

Remarks.—About a dozen of this species were sent to me by Dr. Emmons. Nearly all of them are purple or salmon colored. It is closely allied to *hebes*, (nobis), but is not quite so square, nor so truncate at the posterior margin. The cardinal teeth are larger and not so oblique. The adults are without rays, while the younger are obscurely rayed on the posterior half of the disk and have two dark rays from the tips to the posterior margin on each valve. The epidermis of *hebes* is also darker. The undulations of the tips are few and not fine.

UNIO RALEIGHENSIS. Pl. 1, fig. 2.

Testa lævi, oblonga, inflata, valde inæquilaterali, postice obtuse biangulata, antice rotundata; valvulis suberassis, antice crassioribus; natibus subprominentibus; epidermide luteo-fusca vel rufo-fusca, valde radiata; dentibus cardinalibus parviusculis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subcurvisque; margarita alba vel purpurea et iridescente.

Shell smooth, oblong, inflated, very inequilateral, obtusely biangular behind, rounded before; valves somewhat thick, thicker before; beaks somewhat prominent; epidermis yellowish brown or reddish brown and very much rayed; cardinal teeth rather small and double in both valves; lateral teeth long, lamellar and somewhat curved; nacre white or purple and iridescent.

Proc. Acad. Nat. Sci. 1863, p. 191.

Hab.—Neuse River, six miles east of Raleigh, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. 1,

Length 1.6,

Breadth 2.7 inches.

Shell smooth, oblong, inflated, very inequilateral, obtusely biangular behind and rounded before; substance of the shell rather thick, thicker before; beaks somewhat prominent; ligament rather thick, short and dark brown; epidermis yellowish brown and reddish brown, very much rayed, with distant marks of growth; umbonial slope raised and obtusely angular; posterior slope rather broad and somewhat carinate; cardinal teeth small, crenulate and double in both valves; lateral teeth long, lamellar and slightly curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed immediately over the centre of the cavity of the beaks; cavity of the shell somewhat deep and wide; cavity of the beaks shallow and rounded; nacre white or purple and iridescent.

UNIO PERTENUIS Pl. 2, fig. 4.

Testa lævi, obovata, inflata, sublenticulari, inæquilaterali, postice obtuse biangulari, antice rotundata; valvulis pertenuibus, antice parum crassioribus; natibus subprominentibus, ad apices rugoso-undulatis; epidermide virente et radiis indutis; dentibus cardinalibus parvissimis, compressis, obliquis; lateralibus acicularis rectisque; margarita cæruleo-alba et valde iridescente.

Shell smooth, obovate, inflated, sublenticular, inequilateral, obtusely biangular behind, rounded before; valves very thin, somewhat thicker before; beaks somewhat prominent, rugosely undulate at the tips; epidermis greenish and covered with rays; cardinal teeth very small, compressed, oblique; lateral teeth acicular and straight; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 193.

H.b.—Neuse River, near Raleigh, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. .5, Length .8, Breadth 1.4 inches.

Shell smooth, obovate, inflated, sublenticular, inequilateral, obtusely biangular behind, rounded before; substance of the shell very thin, slightly thicker before; beaks somewhat prominent, rugosely undulate at the tips; ligament very thin and pale brown; epidermis greenish, with rays over the whole disk, and with very distant marks of growth; umbonial slope swollen and rounded: posterior slope rather wide, usually covered with green rays, and raised into a high carina nearly amounting to a wing; cardinal teeth very small, compressed and oblique; lateral teeth acicular, double in the left and single in the right valve; anterior cicatrices distinct, rather large and slightly impressed; posterior cicatrices confluent and scarcely visible; dorsal cicatrices placed immediately over the cavity of the beaks; cavity of the shell rather deep and rounded; cavity of the beaks rather shallow and subangular; nacre bluish white and very iridescent.

Remarks.—This is a small, thin species, which, in outline, is very near to *Tappanianus* (nobis). It also has nearly the same color and rays on the epidermis, but it is not so high in the carina. In the lateral teeth they differ entirely, *Tappanianus* having a single one in both valves, while *pertenuis* is single in the right and double in the left valve. It has also some resemblance to *Prattii* and *Soladoensis*, (nobis), but cannot be confounded with either of them. The tips of the beaks have on each valve three or four double rugose undulations.

UNIO CHARLOTTENSIS. Pl. 2, fig. 5.

Testa lævi, elliptica, subcompressa, inæquilaterali, ad latere parum planulata; valvulis subtenuibus, antice crassioribus; natibus vix prominentibus; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus parvissimis, compressis, valde obliquis; lateralibus parviusculis, lamellatis et acuminatis; margarita albida et iridescente.

Shell smooth, elliptical, somewhat compressed, inequilateral, a little flattened on the sides; valves rather thin, thicker before; beaks scarcely prominent; epidermis dark brown, without rays; cardinal teeth very small, compressed, very oblique; lateral teeth rather small, lamellar and pointed; nacre whitish and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 191.

Hab.—Near Charlotte, Mecklenberg Co., North Carolina, E. Emmons, M. D.

My cabinet.

Diam. 1.4,

Length 2.2,

Breadth 4 inches.

Shell smooth, regularly elliptical, rather compressed, inequilateral, slightly flattened at the sides, obtusely biangular behind and rounded before; substance of the shell somewhat thin, thicker before; beaks very slightly prominent; ligament rather small, light brown; epidermis very dark brown, without rays, with rather distant marks of growth; umbonial slope inflated and rounded; posterior slope narrow elliptical and somewhat carinate; cardinal teeth very small, striate, compressed, very oblique and disposed to be double in both valves; lateral teeth rather small, lamellar and sharp at the end; anterior cicatrices distinct, very large and moderately impressed; posterior cicatrices confluent, very large, very slightly impressed; dorsal cicatrices very small and placed under the posterior end of the cardinal tooth; cavity of the shell shallow and very wide; cavity of the beaks very shallow and obtusely angular; nacre white and iridescent.

Remarks.—This is a very distinct species, and is not very closely allied to any one I know. The teeth are very small and peculiar. It is to be regretted that a single specimen only was sent by Dr. Emmons. Others might differ in the size of the teeth, but this in all respects is a perfect specimen, except a slight erosion of the beaks, which forbids any observations as to the undulations of the tips. In this specimen the margin beyond the deposit of the nacre is disposed to be purplish.

UNIO LUCIDUS. Pl. 2, fig. 6.

Testa lævi, elliptica, inflata, valde inæquilaterali, postice subbiangulata, antice rotunda; valvulis subtenuibus; natibus prominulis, epidermide rufo-fusca vel fusco-virente, radiata, ad latere micante; dentibus cardinalibus parvis, obtuso-conicis, crenulatis, in utroque valvulo duplicibus; lateralibus sublongis, lamellatis subcurvisque; margarita cæruleo-alba et valde iridescente.

Shell smooth, elliptical, inflated, very inequilateral, subbiangular behind, round before; valves somewhat thick; beaks a little prominent; epidermis reddish brown, rayed and shining on the sides; cardinal teeth small, obtusely conical, crenulate, double in both valves; lateral teeth rather long, lamellar and somewhat curved; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci. 1863, p. 192.

Hab.—Livingston's Creek, Brunswick Co., North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. .5, Length .9, Breadth 1.6 inches.

Shell smooth, elliptical, inflated, very inequilateral, subbiangular behind and round before; beaks somewhat prominent; substance of the shell rather thin; ligament short, thin and dark brown; epidermis reddish brown or brownish green, radiate, with distant marks of growth, polished on the sides towards the beaks; umbonial slope raised, obtusely angular or rounded; posterior slope somewhat broad, usually with capillary rays, slightly carinate; cardinal teeth small, obtusely conical, crenulate, double in both valves; lateral teeth rather long, lamellar and somewhat curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, rather large and very slightly impressed; dorsal cicatrices small and placed over the centre of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks shallow and rounded; nacre bluish white and very iridescent.

Remarks.—More than a dozen of this little species were received from Dr. Emmons. None of these were colored in the nacre, except that a few were tinted with salmon in the cavity of the beaks. The older ones have lost the polish on their umbones, as well as the rays, which are almost capillary and usually cover the posterior half of the disk. The beaks of all the specimens were eroded, so that the character of the undulations could not be ascertained.

This species is nearly allied to *pusillus*, (nobis), but it is smaller, not so narrow an ellipse, is of a thinner nacre, and smoother and more polished on the sides and towards the beaks. The umbonial slope is also usually more raised.

UNIO VIRIDULUS. Pl. 3, fig. 7.

Testa lævi, lata subcompressa, ad latere planulata, valde inæquilaterali; valvulis tenuibus, antice ad marginem parum crassioribus; natibus prominulis, ad apices undulatis; epidermide virente, obsolete radiata, valde polita; dentibus cardinalibus parvissimis, tuberculatis; lateralibus longis, acicularis subrectisque; margarita cæruleo-alba et valde iridescente.

Shell smooth, wide, rather compressed, flattened at the sides, very inequilateral; valves thin, somewhat thicker at the anterior margin; beaks a little prominent, undulate at the tips; epidermis greenish, obscurely radiate, very much polished; cardinal teeth very small, tuberculate; lateral teeth long, acicular and nearly straight; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. 1863, p. 193.

Hab.—Neuse River, near Raleigh, North Carolina, E. Emmons, M. D.

My cabinet.

Diam. .31, Length .52, Breadth 1.34 inches.

Shell smooth, wide, somewhat compressed, flattened at the sides, very inequilateral,

obtusely biangular behind and round before; substance of the shell thin, thicker before at the margin; beaks slightly prominent, undulate at the tips; ligament small, thin and pale brown; epidermis greenish, obscurely radiate, highly polished, with a distant mark of growth; umbonial slope slightly raised and rounded; posterior slope very narrow, slightly carinate, with two impressed lines in each valve from the beak to the posterior margin; cardinal teeth very small, tuberculate, slightly compressed; lateral teeth long, acicular and nearly straight; anterior cicatrices distinct, rather large, and moderately well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices very small and placed behind the centre of the beaks; cavity of the shell shallow and wide; cavity of the beaks very small, scarcely perceptible: nacre bluish white and iridescent.

Remarks.—Only a single specimen of this pretty little species was received. It may not be full grown, but I doubt if it becomes much larger. It has some resemblance to a young *lanceolatus*, (nobis), but differs in outline, not being so oblique, and is not of the same color in the epidermis, this being more green. There is in this specimen only one mark of growth, and that is about the middle of the disk and it is broad. The beaks are not perfect, but they show two or three imperfect rather distant undulations at the tips.

UNIO WELDONENSIS. Pl. 3, fig. 8.

Testa lævi, elliptica, subinflata, sublenticulari, inæquilaterali, postice subbiangulari, antice rotunda; valvulis subcrassis, antice parum crassioribus; natibus subprominentibus; epidermide tenebroso-fusca vel viridi-fusca, radiata; dentibus cardinalibus parviusculis, crenulatis, in utroque valvulo duplicibus; lateralibus prælongis, lamellatis subcurvisque; margarita alba vel purpurea et iridescente.

Shell smooth, elliptical, somewhat inflated, sublenticular, inequilateral, biangular behind, round before; valves rather thick, slightly thicker before; beaks somewhat prominent; epidermis dark brown or greenish brown and rayed; cardinal teeth somewhat small, crenulate and double in both valves; lateral teeth very long, lamellar and somewhat curved; nacre white or purple and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 191.

Hab.—Roanoke River, at Weldon, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. 1·4,

Length 2·2,

Breadth 4 inches.

Shell smooth, elliptical, somewhat inflated, sublenticular, inequilateral, subbiangular behind and round before; substance of the shell somewhat thick, slightly thicker before; beaks somewhat prominent; ligament long, thick and dark brown; epidermis dark brown in the old, inclining to greenish and being much rayed in the younger, with distant marks of growth; umbonial slope raised and rounded; posterior slope rather compressed and slightly carinate; cardinal teeth rather small, crenulate

and double in both valves; lateral teeth very long, lamellar and slightly curved; anterior cicatrices distinct, large and deeply impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather deep and very wide; cavity of the beaks shallow and rounded; nacre white or purple and very iridescent.

Remarks.—I have before me six specimens, of different ages. The oldest has some of the epidermis gone and the beaks much eroded. None have the beaks perfect enough to make out the undulations of the tips. There is enough, however, to see that the undulations are not very fine. This species belongs to the *complanatus* group, and resembles *Mecklenbergensis*, herein described; but it is not so thick a shell, is not so high on the umbonial slope and differs in the cardinal teeth.

UNIO NASUTULUS. Pl. 3, fig. 9.

Testa lævi, valde transversa, compressa, ad latere planulata, valde inæquilaterali, postice acute acuminata, antice oblique rotundata; valvulis subtenuibus; natibus prominulis, fere terminalibus; epidermide tenebroso-fusca, radiata; dentibus cardinalibus parvissimis, acuminatis, in utroque valvulo duplicibus; lateralibus prælongis, tenuibus rectisque; margarita subsalmonea et valde iridescente.

Shell smooth, very wide, compressed, flattened at the sides, very inequilateral, acutely pointed behind, obliquely rounded before; valves somewhat thin; beaks a little prominent, nearly terminal; epidermis dark brown, radiate; lateral teeth very long, thin and straight; nacre somewhat salmon colored and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 192.

Hab.—Livingston's Creek, Brunswick County, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. .40,

Length .60,

Breadth 1.70 inches.

Shell smooth, very transverse, compressed, flattened at the side, very inequilateral, acutely pointed behind and obliquely rounded before; substance of the shell rather thin; beaks slightly prominent, nearly terminal; epidermis dark brown, somewhat shining, rayed, with distant marks of growth; ligament very small, thin and dark brown; umbonial slope slightly raised and subangular; posterior slope very narrow, dark, covered with rays and somewhat carinate; cardinal teeth very small, acuminate and double in both valves; lateral teeth very long, thin and straight; anterior cicatrices distinct, rather small and well impressed; posterior cicatrices confluent, rather small and slightly impressed; dorsal cicatrices very small and placed behind the centre of the cavity of the beaks; cavity of the shell very shallow and wide; cavity of the beaks very shallow, scarcely observable; nacre somewhat salmon and very iridescent.

Remarks.—This is evidently a very small species. There are three specimens before me, all very nearly of the same size. It is most nearly allied to *Fisherianus*,

(nobis), but is a smaller species, with a higher umbonial slope and a higher carina. It is also very near to *rostriformis*, (nobis), but is smaller, not so flat in the sides. It is more polished, darker in the epidermis and higher on the umbonial slope. Neither of the specimens are perfect enough in the beaks to give the character of the undulations of the tips.

UNIO OBLATUS. Pl. 4, fig. 10.

Testa lævi, oblonga, subinflata, ad latere parum planulata, inæquilaterali, postice biangulata; valvulis crassiusculis, antice crassioribus; natibus prominulis; epidermide tenebroso-castanea, eradiata, polita; dentibus cardinalibus parviusculis, tuberculatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis rectisque; margarita salmonea, aliquando albida et valde iridescent.

Shell smooth, oblong, somewhat inflated, somewhat flattened at the sides, inequilateral, biangular behind; valves somewhat thick, thicker before; beaks a little prominent; epidermis dark chestnut, without rays, polished; cardinal teeth somewhat small, tuberculate and double in both valves; lateral teeth long, lamellar and straight; nacre salmon color, sometimes whitish and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 193.

Hab.—Long Creek, Gaston County, North Carolina, C. M. Wheatley; North Carolina, J. G. Anthony.

My cabinet and cabinets of Mr. Wheatley and Mr. Anthony.

Diam. .7, Length 1.3, Breadth 2.4 inches.

Shell smooth, oblong, slightly inflated, sometimes rather compressed, somewhat flattened at the sides, biangular behind; substance of the shell somewhat thick, thicker before; beaks a little prominent; ligament rather long, large and dark brown; epidermis dark chestnut color, without rays, polished on the sides and with rather close marks of growth; umbonial slope slightly raised and rounded; posterior slope rather narrow and carinate; cardinal teeth rather small, tuberculate, striate and double in both valves; lateral teeth long, lamellar, somewhat corrugate and straight; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed immediately over the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks very shallow and rounded; nacre salmon color, sometimes white, and very iridescent.

Remarks.—Nearly a dozen specimens are before me, from Mr. Wheatley and Mr. Anthony. The exact habitat of the latter's specimens was not mentioned. Several specimens were much more compressed than the others, and these very closely resemble *Burkensis*, (nobis), in outline and epidermis, but they differ entirely in the form of the cardinal teeth, and in *Burkensis* having rays. The salmon color in the

nacre prevails. Two specimens only are whitish, and one inclining very slightly to purple. Some specimens are less oblong than others, running almost into elliptical.

UNIO LIVINGSTONENSIS. Pl. 4, fig. 11.

Testa lævi, oblonga, subinflata, fere alata, valde inæquilaterali, postice obtuse biangulata, antice rotundata; valvulis subtenuibus; natibus subprominentibus; epidermide tenebroso-fusca, eradiata vel obsolete radiata; dentibus cardinalibus parvis, lobatis; lateralibus longis, lamellatis subrectisque; margarita cæruleo-alba vel purpurea vel salmonea et valde iridescente.

Shell smooth, oblong, somewhat inflated, almost winged, very inequilateral, obtusely biangular behind and rounded before; valves rather thin; beaks somewhat prominent; epidermis dark brown, without rays or obscurely rayed; cardinal teeth small, lobed; lateral teeth long, lamellar and nearly straight; nacre bluish white, purple or salmon color and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 192.

Hab.—Livingston's Creek, Brunswick County, North Carolina, E. Emmons, M. D.
My cabinet and cabinet of Dr. Emmons.

Diam. .8,

Length 1.4,

Breadth 2.2 inches.

Shell smooth, oblong, somewhat inflated, almost winged, very inequilateral, obtusely biangular behind and rounded before; substance of the shell rather thin; beaks somewhat prominent; ligament long, rather thin and dark brown; epidermis dark brown, on the younger yellowish brown, without rays or obscurely rayed, with rather close marks of growth; umbonal slope swollen and rounded; posterior slope rather narrow, imbricate and raised into a high carina; cardinal teeth small, lobed; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct, rather small, somewhat impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices placed immediately over the centre of the cavity of the beaks; cavity of the shell somewhat deep and wide; cavity of the beaks very shallow and rounded; nacre bluish white, purplish or salmon color and very iridescent.

Remarks.—Nearly a dozen of this species were sent by Dr. Emmons. None were perfect enough to observe the character of the undulations of the tips. In outline it is very nearly allied to *inusitatus*, (nobis), but differs in the roughness of the epidermis, some of the specimens being rough nearly over the whole disk. None of the specimens have the enlargement of the umbones which *inusitatus* has. At first I thought it might be a variety of *hepaticus*, (nobis), but that shell is ovately oblong, with a less carina and a smooth, polished epidermis. It is to be regretted that none of the specimens were perfect enough to ascertain the form of the undulations of the beaks. The cardinal teeth are very small, usually double in the left and single in

the right valve, but sometimes disposed to be double in the right valve. Some of the specimens are larger than the one figured, but they are very imperfect.

UNIO INDEFINITUS. Pl. 4, fig. 12.

Testa lævi, oblonga, inflata, ad latere planulata, valde inæquilaterali, postice biangulata, antice rotundata; valvulis suberassis, antice parum crassioribus; natibus subprominentibus; epidermide fusconigricante; dentibus cardinalibus parviusculis, tuberculatis, striatis; lateralibus longis, lamellatis subcurvisque; margarita alba, aliquando purpurea et iridescente.

Shell smooth, oblong, inflated, flattened at the sides, very inequilateral, biangular behind, rounded before; valves somewhat thick, slightly thicker before; beaks somewhat prominent; epidermis blackish brown; cardinal teeth rather small, tuberculate, striate; lateral teeth lamellar and somewhat curved; nacre white, sometimes purple and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 192.

Hab.—Long Creek, Mecklenberg County, North Carolina, C. M. Wheatley; and Neuse River, near Raleigh, E. Emmons, M. D.

My cabinet and cabinets of C. M. Wheatley and Dr. Emmons.

Diam. :8, Length 1·9, Breadth 2·4 inches.

Shell smooth, oblong, inflated, flattened at the sides, very inequilateral, biangular behind, rounded before; substance of the shell somewhat thick, slightly thicker before; beaks somewhat prominent; ligament rather short, thick and dark brown; epidermis dark brown, inclining to black, usually without rays, sometimes obscurely rayed, with rather close marks of growth; umbonial slope swollen and rounded; posterior slope rather wide and somewhat carinate; cardinal teeth rather small, tuberculate, striate, double in the left valve and disposed to be so in the right; lateral teeth long, lamellar and somewhat curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed immediately above the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks somewhat deep and angular; nacre usually white, sometimes purple and iridescent.

Remarks.—A number of specimens, of different ages, are before me. The old individuals are nearly black, the young are greenish brown. It belongs to the *complanatus* group, and is allied to *quadrilaterus*, herein described, but has not so high a carina, is higher on the umbonial slope and rather more inflated.

UNIO PERLATUS. Pl. 4, fig. 13.

Testa lævi, perlata, valde compressa, ad latere planulata, valde inæquilaterali, valvulis tenuibus, antice parum crassioribus; natibus prominulis, ad apices undulatis; epidermide fusco-virente, obsolete radiata; dentibus cardinalibus parvissimis, tuberculatis, in utroque valvulo duplicibus; lateralibus prælongis, acicularis rectisque; margarita cæruleo-alba et valde iridescente.

Shell smooth, very wide, very much compressed, flattened at the sides, very inequilateral; valves thin, somewhat thicker before; beaks a little prominent, undulate at the tips; epidermis brownish green, obscurely rayed; cardinal teeth very small, tuberculate, double in both valves; lateral teeth very long, acicular and straight; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 193.

Hab.—Black Rock Landing, Cape Fear River, North Carolina, E. Emmons, M. D. My cabinet and cabinet of Dr. Emmons.

Diam. .4, Length .8, Breadth 2.5 inches.

Shell smooth, very wide, much compressed, flattened at the sides, very inequilateral; substance of the shell translucent behind, slightly thickened before; beaks slightly prominent, undulated at the tips; ligament thin, very long and brown; epidermis brownish green, obscurely rayed, with strong distant marks of growth; umbonial slope raised towards the middle and angular; posterior slope compressed, raised into a carina, with two impressed lines from the beaks to posterior margin in each valve; cardinal teeth very small, tuberculate and double in both valves; lateral teeth very long, acicular and straight; anterior cicatrices distinct, rather small and slightly impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed nearly in the centre of the cavity of the beaks; cavity of the shell very shallow and very wide; cavity of the beaks scarcely perceptible; nacre bluish white and very iridescent.

Remarks.—This species need not be confounded with any other with which I am acquainted. It is nearest to *naviculoides*, (nobis), but it is a smaller shell and wider in proportion. It differs also in color, being greenish, and the posterior biangular margin is not so broad. The cardinal teeth are also smaller, and the form of the umbonial slope is very different. In *perlatus* the greatest transverse diameter is nearly two-thirds down the umbonial slope. This is very characteristic of this species. The superior cicatrix of the anterior group is placed over that of the tractor muscle, and alongside and separate from the great adductor cicatrix. The undulations of the beaks are not perfect, even in the youngest specimen before me, but they are enough so to make out three or four, which are irregular and transverse. The specimens before me have two or three marks of growth, the second one being always broad and well defined. The posterior slope has the epidermis imbricate.

UNIO WACCAMAWENSIS. Pl. 5, fig. 14.

Testa lævi, triangulari, inflata, ad latere planulata, valde inæquilaterali, postice subbiangulata, antice rotundata; valvulis tenuibus; natibus prominentibus; epidermide fusco-virente vel olivacea, obsolete radiata; dentibus cardinalibus parvissimis, compressis, obliquis, in utroque valvulo duplicibus; lateralibus longis, lamellatis rectisque; margarita cæruleo-alba et iridescente.

Shell smooth, triangular, inflated, flattened at the sides, very inequilateral, sub-biangular behind, rounded before; valves thin; beaks prominent; epidermis brownish green or olivaceous, obscurely rayed; cardinal teeth very small, compressed, oblique, double in both valves; lateral teeth long, lamellar and straight; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. 1863, p. 193.

Hab.—Waccamaw Lake, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Mr. Emmons.

Diam. .6, Length .7, Breadth 1.4 inches.

Shell smooth, triangular, inflated, flattened at the sides, very inequilateral, somewhat biangular behind, rounded before; substance of the shell thin; beaks prominent; ligament short, thin and brown; epidermis brownish green or olivaceous, obscurely rayed and with distant marks of growth; umbonial slope very much raised and sharply angular; posterior slope wide, flattened and somewhat carinate; cardinal teeth very small, compressed, oblique and double in both valves; lateral teeth long, lamellar and straight; anterior cicatrices distinct, rather small and slightly impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather deep and wide, and showing the angle of the umbonial slope; cavity of the beaks rather deep and angular; nacre bluish white and iridescent.

Remarks.—Only two specimens and a few odd valves were received from Dr. Emmons. It is to be regretted that more were not obtained, as none of them are very perfect, the beaks of all being more or less imperfect, and none affording the character of the undulations of the tips, if there be any. This is a well characterized species, and in the outline and high angular umbonial slope closely resembles *triangularis* Bar., but it differs totally in the coloring of the epidermis, the beautiful arrowheaded marks on *triangularis* being replaced in this shell by obscure thin rays. In the substance of the shell they also differ, *Waccamawensis* being thin, while *triangularis* is a thick shell.

UNIO MECKLENBERGENSIS. Pl. 5. fig. 15.

Testa lævi, elliptica, subcompressa, inæquilaterali, ad latere parum planulata, postice biangulata, antice rotundata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide tenebroso-fusca, obsolete radiata; dentibus cardinalibus subgrandibus, striatis crenulatisque; lateralibus longis, lamellatis corrugatisque; margarita albida vel purpurea et valde iridescente.

Shell smooth, elliptical, somewhat compressed, inequilateral, somewhat flattened at the side, biangular behind and rounded before; valves thick, thicker before; beaks a little prominent; epidermis dark brown, obscurely rayed; cardinal teeth rather

large, striate and crenulate; lateral teeth lamellar and corrugate; nacre whitish or purplish and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 191.

Hab.—Near Charlotte, Mecklenberg County, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. 1.2, Length 2.2, Breadth 3.8 inches.

Shell smooth, elliptical, slightly compressed, inequilateral, slightly flattened at the sides, biangular behind and rounded before; substance of the shell thick, thicker before; beaks slightly prominent; ligament large and dark brown; epidermis dark brown, obscurely rayed, with rather distant marks of growth; umbonial slope slightly raised and obtusely angular; posterior slope rather narrow and slightly carinate; cardinal teeth rather large, striate and crenulate, double in the right and disposed to be treble in the left valve; lateral teeth long, lamellar, somewhat curved and corrugate; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed immediately above the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks shallow and obtusely angular; nacre whitish or purple and very iridescent.

Remarks.—There were but three specimens of this species from Dr. Emmons, differing much in size. It belongs to the *complanatus* group, and is nearest perhaps to *Savannahensis* (nobis), but is not so high nor angular on the umbonial slope, is more elliptical in the outline, differs in the teeth, has closer marks of growth, and has a darker epidermis. The beaks were not perfect enough to observe any undulations at the tips.

UNIO PERLUCENS. Pl. 5, fig. 16.

Testa lævi, elliptica, subinflata, valde inæquilateral; valvulis subtenuibus, antice parum crassioribus; natibus prominulis; epidermide luteo-virente, perlutescens et radiis indutis; dentibus cardinalibus parvis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subrectisque; margarita cæruleo-alba et valde iridescente.

Shell smooth, elliptical, somewhat inflated, very inequilateral; valves rather thin, rather thicker before; beaks a little prominent; epidermis yellowish green, very bright and covered with rays; cardinal teeth small, compressed, crenulate, double in both valves; lateral teeth long, lamellar and nearly straight; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 193.

Hab.—Six Runs, Sampson County, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. .7, Length 1, Breadth 2 inches.

Shell smooth, elliptical, somewhat inflated, very inequilateral; substance of the shell rather thin, slightly thicker before; beaks somewhat prominent; ligament small, thin and light brown; epidermis yellowish green, very bright, nearly covered with rays, with rather distant marks of growth; umbonial slope raised and rounded; posterior slope rather broad, elliptical, with numerous green rays, slightly raised into a carina; cardinal teeth small, compressed, crenulate, double in both valves; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed nearly in the centre of the cavity of the beaks; cavity of the shell somewhat deep and wide; cavity of the beaks very shallow and rounded; nacre bluish white and very iridescent.

Remarks.—Three specimens and an odd valve were all I received from Dr. Emmons. One only is adult. The epidermis is remarkable for its polished, bright surface, presenting as it does the appearance of being varnished. In this respect it is very like to *micans* (nobis), and it has a resemblance in the outline, but is very different in the umbonial slope, which in *perlucens* is swollen, while in *micans* it is flattened. It is also less pointed in the posterior margin and is a thinner shell.

UNIO CISTELLÆFORMIS. Pl. 6, fig. 17.

Testa lævi, oblonga, valde inflata, ad latere planulata, inæquilaterali, postice obtuse biangulata, antice rotunda; valvulis crassiusculis; natibus prominulis; epidermide fusco-nigricante, eradiata; dentibus cardinalibus parvis, tuberculatis, in utroque valvulo duplicibus; lateralibus sublongis, lamellatis subrectisque; margarita alba et iridescente.

Shell smooth, oblong, very much inflated, flattened at the side, inequilateral, obtusely biangular behind, rounded before; valves somewhat thick; beaks somewhat prominent; epidermis blackish brown, without rays; cardinal teeth small, tuberculate, double in both valves; lateral teeth rather long, lamellar and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 192.

Hab.—Neuse River, near Raleigh, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. .9,

Length 1,

Breadth 1.8 inches.

Shell smooth, oblong, very much inflated, flattened at the side, inequilateral, obtusely angular behind, rounded before; substance of the shell somewhat thick; beaks somewhat prominent; ligament rather short and dark brown; epidermis dark brown, without rays, with rather close marks of growth; umbonial slope swollen and rounded; posterior slope broad, flattened, scarcely carinate; cardinal teeth small, tuberculate, double in both valves; lateral teeth rather long, lamellar and nearly straight; anterior

cicatrices distinct, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell deep and wide; cavity of the beaks rather shallow and rounded; nacre white and iridescent.

Remarks.—This is a small species which reminds us of *parvus*, Bar., but it has an oblong outline, while *parvus* is elliptical. It is in outline near to *modestus*, Fer., and resembles it in color of the epidermis. It is, however, a larger and much more inflated species. It is also near to *cicur*, (nobis,) but is not so carinate and not so thin a species. I have over a dozen specimens before me, differing little in the outline or size. The old female individuals are very much enlarged on the umbonial slope, which gives a projection of the margin, and causes a slight emargination of the basal margin. None of them were perfect enough in the beaks to observe the character of the undulations of the tips. Some of the specimens are nearly cylindrical.

UNIO GASTONENSIS. Pl. 6, fig. 18.

Testa lævi, subelliptica, compressa, valde inæquilaterali, ad latere planulata, postice vix biangulata, antice rotunda; valvulis crassiusculis, antice crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus parviusculis, in valvulo sinistro tripartitibus; lateralibus longis, lamellatis subcurvisque; margarita purpuresciente et iridescente.

Shell smooth, subelliptical, compressed, very inequilateral, flattened at the sides, scarcely biangular behind, round before; valves somewhat thick, thicker before; beaks a little prominent: epidermis dark brown without rays; cardinal teeth rather small, tripartite in the left valve; lateral teeth long, lamellar and somewhat curved; nacre purplish and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 191.

Hab—Mine Creek, Gaston County, North Carolina, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .9, Length 1·8, Breadth 3 inches.

Shell smooth, subelliptical, compressed, very inequilateral, flattened at the sides, nearly biangular behind, round before; substance of the shell somewhat thick, thicker before; beaks slightly prominent; ligament rather long, narrow and dark brown; epidermis dark brown, without rays and with rather proximate marks of growth; umbonial slope slightly raised and rounded; posterior slope very narrow and carinate; cardinal teeth rather small, treble in the left and double in the right valve; lateral teeth long, lamellar and somewhat curved; anterior cicatrices distinct, rather large, well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed immediately over the centre of the cavity of the beaks; cavity of the shell very shallow and wide; cavity of the beaks very shallow and rounded; nacre purplish and iridescent.

Remarks.—Two specimens only of this species were submitted to me by Mr. Wheatley. One is not quite so elliptical as the other. It is one of the *complanatus* group, and is nearly allied to *Plantii*, (nobis,) but is not so lenticular as that species, nor is it of so regular an ellipse, the basal margin being nearly straight. In the cardinal teeth the two species differ entirely, *Plantii* having the cardinal tooth double in the left valve, while that tooth is tripartite in *Gastonensis*, in which also these teeth are larger.

UNIO CHATHAMENSIS. Pl. 6, fig. 19.

Testa lævi, lato-elliptica, subcompressa, valde inæquilaterali, postice obtuse biangulata, antice rotundata; valvulis subtenuibus, antice parum crassioribus; natibus prominulis; epidermide tenebroso-fusca vel tenebroso-viridi, radiata; dentibus cardinalibus parvis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subrectisque; margarita alba vel purpurea et valde iridescente.

Shell smooth, widely elliptical, somewhat compressed, very inequilateral, obtusely biangular behind, rounded before; valves rather thin, somewhat thicker before; beaks a little prominent; epidermis dark brown, or dark green, rayed; cardinal teeth small, crenulate, double in both valves; lateral teeth long, lamellar and nearly straight; nacre white or purple and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 191.

Hab.—Rocky Run, Chatham County, North Carolina, E. Emmons, M. D.; and James' River, near Richmond, Va., Maj. Le Conte.

My cabinet and cabinet of Dr. Emmons.

Diam. .6,

Length 1.1,

Breadth 2.1 inches.

Shell smooth, widely elliptical, somewhat compressed, very inequilateral, obtusely biangular behind, rounded before; substance of the shell rather thin, slightly thicker before; beaks a little prominent; ligament small and dark brown; epidermis dark brown or very dark green, much rayed and with distant marks of growth; umbonial slope slightly raised and obtusely angular; posterior slope very narrow, slightly carinate, with two impressed lines in each valve from the beaks to the posterior margin; cardinal teeth small, crenulate, double in both valves; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct, small and well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed immediately over the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks shallow and rounded; nacre white or purple and very iridescent.

Remarks.—Only two specimens were received from Dr. Emmons of this species. In outline it is near to *Tuomeyi* and *ineptus* (nobis), but cannot be easily confounded with either. It is smaller than the former and not so oblique, and it is larger than the latter. Neither of the specimens were perfect enough at the beaks to show the character of the undulations of the tips.

UNIO SQUALIDUS. Pl. 7, fig. 20.

Testa lævi, suboblonga, subinflata, valde inæquilaterali, postice subbiangulata, antice rotundata; valvulis subcrassis, antice parum crassioribus; natibus subprominentibus; epidermide furva, squalida, imbricata, eradiata; dentibus cardinalibus parvulis, striatis, in utroque valvulo duplicibus; lateralibus sublongis, lamellatis subrectisque; margarita cæruleo-alba vel purpurea et iridescente.

Shell smooth, somewhat oblong, somewhat inflated, very inequilateral, subbiangular behind and rounded before; valves somewhat thick, somewhat thicker before; beaks somewhat prominent; epidermis dusky, squalid, imbricate, without rays; cardinal teeth small, striate, double in both valves; lateral teeth rather long, lamellar and nearly straight; nacre bluish white or purple and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 192.

Hab.—Neuse River, near Raleigh; Roanoke, near Weldon, and Deep River, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. .7,

Length 1.1,

Breadth 2 inches.

Shell smooth, somewhat oblong, rather inflated, very inequilateral, subbiangular behind, rounded before; substance of the shell somewhat thick, slightly thicker before; beaks somewhat prominent; ligament rather short and dark brown; epidermis dusky, squalid, imbricate, without rays and with rather distant marks of growth; umbonal slope raised and obtusely angular; posterior slope rather broad and somewhat carinate; cardinal teeth small, striate and double in both valves; lateral teeth rather long, lamellar and nearly straight; anterior cicatrices distinct, rather large and deeply impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks very shallow and rounded; nacre bluish white or purple and iridescent.

Remarks.—This unattractive species was sent to me by Dr. Emmons from three habitats in North Carolina. It has that rough, squamose epidermis which is generally found in the group of which *obesus*, (nobis,) may be considered the type. It has the same color of epidermis and the same dark squamose appearance, particularly on the posterior slope. The beaks of ten specimens before me are all eroded, so that the character of the tips cannot be observed. The undulations may have the same convolute character which that group possesses. In several specimens there is a disposition to tripartition of the cardinal tooth in the left valve.

In outline this species is nearer to *Blindingianus*, (nobis,) than to *obesus*, but it is more transverse and less raised in the carina.

UNIO CURATUS. Pl. 7, fig. 21.

Testa lævi, elliptica, subinflata, ad latere parum planulata, inæquilaterali, postice biangulata; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide crocea, eradiata, micante; dentibus cardinalibus parviusculis, striatis, acuminatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subrectisque; margarita salmonia et valde iridescente.

Shell smooth, elliptical, somewhat inflated, somewhat flattened at the sides, inequilateral, biangular behind; valves somewhat thick, thicker before; beaks slightly prominent; epidermis saffron yellow, without rays, shining; cardinal teeth rather small, striate, acuminate and double in both valves; lateral teeth long, lamellar and nearly straight; nacre salmon colored and very iridescent.

Proc. Acad. Nat. Sci. 1863, p. 193.

Hab.—Sugar Creek, North Carolina, C. M. Wheatley.

Cabinet of Mr. Wheatley.

Diam. .9,

Length 1.5,

Breadth 2.9 inches.

Shell smooth, elliptical, somewhat inflated, slightly flattened at the sides, inequilateral, biangular behind; substance of the shell rather thick, thicker before; beaks somewhat prominent; ligament large, thick, and light brown; epidermis saffron yellow, without rays, shining, with rather distant marks of growth; umbonial slope slightly raised and rounded; posterior slope rather narrow, somewhat carinate, with two impressed lines from the beaks to the posterior margin on each valve; cardinal teeth rather small, striate, acuminate, double in both valves; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct, large and well impressed; posterior cicatrices distinct, large and slightly impressed; dorsal cicatrices nearly in the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks shallow and obtusely angular; nacre salmon color and very iridescent.

Remarks.—A single specimen only is before me, and that has imperfect beaks; consequently the character of the undulations is not observable. The outline is of a very regular ellipse. The nacre is of a very pale tint of salmon, but this may not be universally so. I should suppose, from the general character of the epidermis and the nacre, that the prevailing color would be salmon; perhaps sometimes it may be found white, but I doubt if this species be found of a purple color. The single specimen which was received has no appearance of rays. In outline it is near to *lamellatus*, (nobis,) but is not allied to that shell in its general characteristics. It properly belongs to the group of which *Savannahensis* may be considered the type, having a saffron yellow epidermis and salmon nacre. It is nearly allied to *subflavus*, (nobis,) but is wider and of a more regular ellipse.

UNIO MEDIOCRIS. Pl. 7, fig. 22.

Testa lævi, lato-elliptica, subinflata, valde inæquilaterali, postice subbiangulata, antice rotundata; valvulis subtenuibus, antice parum crassioribus; natibus prominulis; epidermide luteo-fusca, valde radiata; dentibus cardinalibus parvis, striatis, crenulatis; lateralibus longis, lamellatis subrectisque; margarita albida vel purpurea et valde iridescente.

Shell smooth, widely elliptical, somewhat inflated, very inequilateral, subbiangular behind, rounded before; valves rather thin, somewhat thicker before; beaks slightly prominent; epidermis yellowish brown, very much rayed; cardinal teeth small, striate, crenulate; lateral teeth lamellar and nearly straight; nacre whitish, or purple and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 191.

Hab.—Neuse River, Raleigh, North Carolina, E. Emmons, M. D.

My cabinet and cabinet of Dr. Emmons.

Diam. .7,

Length 1.1,

Breadth 2.1 inches.

Shell smooth, widely elliptical, somewhat inflated, very inequilateral, subbiangular behind, rounded before; substance of the shell rather thin, slightly thicker before; beaks a little prominent, with a few rather coarse undulations at the tips; ligament rather small and brown; epidermis yellowish brown, with green oblique rays on the whole disk, and with rather distant marks of growth; umbonial slope raised and rounded; posterior slope rather wide and slightly carinate; cardinal teeth small, striate, crenulate, single in the right and double in the left valve; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed slightly above the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks very shallow and rounded; nacre white or purple and very iridescent.

Remarks.—Only three specimens were received. Two appear to be of full size, the third is quite young. It reminds one of *Griffithianus*, (nobis,) but it is not quite so wide and is not so much compressed. It also differs in the teeth. The tips of the beaks were not perfect enough to ascertain well the character of the undulations.

ANODONTA DOLIARIS. Pl. 8, fig. 23.

Testa lævi, oblonga, valde ventricosa, subæquilaterali, postice obtuse biangulata, antice oblique rotundata; valvulis crassis, antice parum crassioribus; natibus prominentibus et valde inflatis; epidermide luteo-virente, valde radiata et micante; margarita dilute carnea et valde iridescente.

Shell smooth, oblong, very much inflated, subequilateral, obtusely angular behind, obliquely rounded before; valves thick, slightly thicker before; beaks prominent and very much inflated; epidermis yellowish green, very much rayed and shining; nacre pale flesh color and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 193.

Hab.—Stewart's Mill Dam, Union County, North Carolina, C. M. Wheatley.
Cabinet of Mr. Wheatley.

Diam. 2·2, Length 2·8, Breadth 4·7 inches.

Shell smooth, oblong, very much inflated, nearly equilateral, obtusely biangular behind, obliquely rounded before; substance of the shell thick, slightly thicker before; beaks prominent and very much inflated; ligament large and dark brown; epidermis yellowish green, very much rayed and shining and with two very distant marks of growth; umbonial slope very much raised and obtusely angular; posterior slope very wide, somewhat carinate and nearly covered with dark green rays; anterior cicatrices confluent, very large and very slightly impressed; posterior cicatrices confluent, very large and very slightly impressed; dorsal cicatrices not perceptible; cavity of the shell very deep and very wide; cavity of the beaks very deep and subangular; nacre very pale flesh color and very iridescent.

Remarks.—A single specimen only of this fine large species was procured by Mr. Wheatley. This is greatly to be regretted, as the description made from an individual may not give all the true characters of the species. It is more quadrate than any other of our species with which I am acquainted,—more so than *tetragona*, (nobis,)—and none are more inflated. The specimen before me has a pale flesh-colored nacre, changing towards the border to white, the posterior edge beyond the nacre being a dark salmon red. This disposition of colors may not prevail in all cases. The beaks are not perfect enough to observe any undulations of the tips. From the same habitat was received a large and fine specimen of *gigantea*, (nobis,) but that species is quite different in outline and other characters.

ANODONTA LEONENSIS. Pl. 9, fig. 24.

Testa lævi, elliptica, inflata, inæquilaterali, postice subbiangulata, antice oblique rotundata et aliquanto sulcata; valvulis tenuibus, antice aliquanto crassioribus; natibus prominentibus, tumidis, ad apices nodosis; epidermide fulgida, luteo-virente vel fuscescente vel obsolete radiata vel eradiata; margarita cæruleo-alba et valde iridescente.

Shell smooth, elliptical, inflated, inequilateral, subbiangular behind, obliquely rounded and somewhat sulcate before; valves thin, slightly thicker before; beaks prominent, swollen, nodulose at the tips; epidermis polished, yellowish green or brownish, obscurely radiated or without rays; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci., 1862, p. 169.

Hab.—Leon County, Texas, Lieut. E. F. Beale, U. S. Army.

My cabinet and cabinet of Smithsonian Institution.

Diam. 1·5, Length 2, Breadth 3·5 inches.

Shell smooth, elliptical, inflated, inequilateral, subbiangular behind, obliquely

rounded and somewhat sulcate before; substance of the shell thin, slightly thicker before; beaks prominent, swollen, with two series of undulations which form two rows of nodes; ligament rather long, narrow and light brown; epidermis polished, yellowish green or brownish, obscurely radiated or without rays, with two or three very distant lines of growth; umbonial slope raised and rounded; posterior slope elliptical, rather broad, with three brownish lines from the beaks to the margin on each valve; anterior cicatrices confluent, large and very slightly impressed; posterior cicatrices confluent, very large and very slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell deep and wide; cavity of the beaks rather deep and rounded; nacre bluish white and very iridescent.

Remarks.—Nearly a dozen specimens were brought by Lieut. Beale, the largest of which are about four inches wide. In outline it is very nearly the same with *Gesneri* (nobis), but it is not so large or heavy, that shell being sometimes as wide as $7\frac{1}{2}$ inches. It differs also in the epidermis, the *Gesneri* being usually yellow and the nacre thicker. The *Leonensis* reminds one of *Benedictii* (nobis,) and *Footiana* (nobis;) but it is not winged like the former, and it differs from the latter in being more medial, and in the marks of growth being fewer and more distant. It cannot be confounded with *Stewartiana* (nobis), a Louisiana species, for that is much more inflated and is not so transverse. The epidermis of the young specimens are greenish, while the old ones are a dusky brown.

ANODONTA BEALEI. Pl. 9, fig. 25.

Testa lævi, ovato-oblonga, subinflata, inæquilaterali, postice subbiangulata, antice rotundata; valvulis tenuibus; natibus subprominentibus, ad apices undulatis; epidermide olivacea, polita, obsolete radiata; margarita cæruleo-alba et iridescente.

Shell smooth, ovately oblong, somewhat inflated, inequilateral, subbiangular behind, rounded before; valves thin; beaks somewhat prominent, undulate at the tips; epidermis olivaceous, polished, obscurely rayed; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 194.

Hab.—Leon County, Texas, Lieut. Beale; Verdigris River, Texas, Mr. F. Hawn.

My cabinet and cabinet of Smithsonian Institution.

Diam. 1·3,

Length 1·7,

Breadth 3·2 inches.

Shell smooth, ovately oblong, somewhat inflated, inequilateral, subbiangular behind, rounded before; substance of the shell thin; beaks somewhat prominent, undulate at the tips and forming two rows of granules; ligament rather long, thin, brown; epidermis olivaceous, obscurely rayed, polished, with two or three distant marks of growth; umbonial slope regularly rounded; posterior slope rather narrow, somewhat flattened, with three indistinct rays from the beaks to the posterior margin on each valve; posterior cicatrices large and confluent; anterior cicatrices large and

confluent; dorsal cicatrices placed in the upper part of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather deep and rounded; nacre bluish white and iridescent.

Remarks.—This species has very much the general appearance of *Williamsii*, from Virginia, herein described, but it is a smaller species, not so much inflated and is more inequilateral. It is named after Lieut. Beale, U. S. Army, who obtained it in Texas with several other fresh water *Mollusca*.

Specimens were subsequently received from Mr. F. Hawn, of a larger size and somewhat thicker. These show a slight thickening on the anterior basal portion of the valves. The largest of Mr. Hawn's specimens is $5\frac{1}{2}$ by 3 inches. He sent to me besides this new species the following *Unionidæ*, which show a striking similarity to the Ohio River basin, viz.: *U. solidus*, *U. gibbosus*, *U. undulatus*, *U. luteolus*, *U. meta-never*, *U. cornutus*, *U. rubiginosus*, *U. aureus*, *U. tuberculatus*, *U. parvus*, *U. Ruter-villensis*, *U. rectus*, *U. occidentis*, *U. purpuratus*, *Margaritana complanata*, *M. marginata* and *Anodonta edentula*.

ANODONTA WILLIAMSI. Pl. 10, fig. 26.

Testa lævi, ovato-oblonga, inflata, subæquilaterali, postice subbiangulata, antice rotundata et aliquanto sulcata; valvulis subtenuibus, antice ad marginem incrassatis; natibus prominulis, inflatis, ad apices undulatis; epidermide vel viridi vel luteo-oliva, fulgida, obsolete radiata vel eradiata; margarita cæruleo-alba et valde iridescente.

Shell smooth, ovately oblong, inflated, subequilateral, subbiangular behind, rounded and somewhat sulcate before; valves rather thin, thickened before towards the margin; beaks a little prominent, inflated, undulate at the tips; epidermis green or yellowish olive, shining, obscurely radiate or without rays; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci., 1862, p. 169.

Hab.—Potomac River at the White House, below Mt. Vernon, H. C. Williams; Othcalooga Creek, Georgia, Bishop Elliott.

My cabinet and cabinets of Smithsonian Institution and Bishop Elliott.

Diam. 1.6, Length 2.1, Breadth 3.8 inches.

Shell smooth, ovately oblong, inflated, nearly equilateral, subbiangular behind, rounded and somewhat sulcate before; substance of the shell rather thin, thickened before towards the margin; beaks a little prominent, inflated, undulate at the tips; ligament long, thin and light brown; epidermis green, or yellowish olive, shining, obscurely radiate or without rays, having very distant marks of growth; umbonial slope flattened; posterior slope wide, carinate, with three slightly raised lines and rays from the beaks to the margin on each valve; anterior cicatrices distinct, large and slightly impressed; posterior cicatrices confluent, large and very slightly im-

pressed; dorsal cicatrices very small and placed near the centre of the cavity of the beaks; cavity of the disk deep and wide; cavity of the beaks very shallow and rounded; nacre bluish white and iridescent.

Soft Parts.—*Branchiæ* large, much rounded below, the inner ones much the larger, free nearly the whole length of the abdominal sack. *Pulpi* moderately large, subtriangular, not united on the posterior edges. *Mantle* very thin, with a small margin. *Branchial opening* large, with numerous small, brown papillæ. *Anal opening* small, with very small brown papillæ. *Super-anal opening* small and united some distance below; color of the mass dirty white.

Remarks.—Four specimens of this species were sent to me among others from the collection of the Smithsonian. I recognized it at once to be different in outline from any I had seen from the rivers of the Middle States, and I am surprised that it should not have been observed before. We might very naturally suspect that it would be likely to be an aberration of *fluviatilis*=*cataracta*, Say, but its oblong form, submedial beaks, carina and callous margin at once forbid its being confounded with that species. In the callous margin it reminds one of *implicata* Say, = *Newtonensis* (nobis), but that species is more transversely oblique and more biangular posteriorly, and usually of a darker epidermis. In outline it is nearest to *Benedictii* (nobis), but the carina is not, like that species, elevated into a wing, nor has the *Benedictii* a callous margin. In the undulations of the tips of the beaks it is allied to *implicata*, having no double curve or granulations like *fluviatilis* and *Benedictii*. In the specimens before me two are green with obscure rays, two are yellowish olive without rays. All have one or two rather broad, brown marks of growth. The inflation is great about the middle of the disk, and there is a disposition to flattening about the medial portion which causes, at the basal margin, a slight emargination. I name this after H. C. Williams, who sent these specimens to the Smithsonian, and I am permitted, by the liberality of the Secretary, to retain two specimens as types in my cabinet.

ANODONTA TRYONII. Pl. 10, fig. 27.

Testa lævi, obliqua-elliptica, subcompressa, sublenticulari, valde inæquilaterali, postice subbiangulari, antice rotundata; valvulis tenuibus; natibus prominulis, subcompressis, ad apices undulatis; epidermide fulgida, vel virente vel fuscescente, obsolete radiata; margarita cæruleo-alba et valde iridescente.

Shell smooth, obliquely elliptical, rather compressed, sublenticular, very inequilateral, subbiangular behind, rounded before; valves thin; beaks a little prominent, somewhat compressed, undulate at the tips; epidermis shining, green or dull brown, obscurely radiate; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci., 1862, p. 169.

Hab.—Schuylkill River above Philadelphia, Delaware River at League Island.

G. W. Tryon, Jr.; Flemington, Conn., Prof. Shepard; Westfield, Mass., Dr. Shurtleff; and Potomac, near Chain Bridge, above Washington, Prof. Henry.

My cabinet and cabinets of Mr. Tryon, Academy of Natural Sciences and Smithsonian Institution.

Diam. 1, Length 1.7, Breadth 2.8 inches.

Shell smooth, obliquely elliptical, rather compressed, sublenticular, very inequilateral, subbiangular behind, rounded before; substance of the shell thin; beaks a little prominent, somewhat compressed, undulate at the tips with double curves; ligament rather long, somewhat thin and light brown; epidermis shining, green or dull brown, obscurely radiate, with distant and usually with broad dark brown lines of growth; umbonial slope slightly raised and rounded; posterior slope narrow elliptical, very slightly raised, with three dark rays from the beaks to the margin on each valve; anterior cicatrices confluent, large and very slightly impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices very small and placed nearly in the centre of the cavity of the beaks; cavity of the disk rather shallow and very wide; cavity of the beaks very shallow, scarcely observable; nacre bluish white and iridescent.

Remarks.—Many years since I observed, though of very rare occurrence, a compressed *Anodonta*, which I considered then a variety of the common *fluviatilis*. Subsequently I received specimens of the same character from Prof. Shepard, from Connecticut, and Dr. Shurtleff, of Massachusetts. Very recently Mr. Tryon called my attention to a well characterized specimen which he found on League Island, a few miles below our city. Still more recently some twenty specimens came in a box sent for examination from the Smithsonian Institution. These last were of different ages and stages of growth, and satisfied me entirely that the species was distinct from *fluviatilis*, which is more transverse and more inflated. It cannot be confounded with *implicata*, Say, which is a larger species, more transverse, and has a thickened margin which this has not. Nor can it be confounded with *Williamsii*, herein described, which is a larger species, more medial and has a thickened border. Some of the specimens are of a dull olive brown to the first mark of growth, which is broad and dark, and below which the disk is often of a fine green color. The dark mark of growth is usually accompanied, on the inside, with a milk white transverse band. I have great pleasure in dedicating this species to Mr. G. W. Tryon, Jr., who kindly gave me his fine specimen.

ANODONTA DALLASIANA. Pl. 11, fig. 28.

Testa laevi, subelliptica, subinflata, inaequilaterali, postice obtuse angulata, antice rotundata; valvulis tenuibus, subdiaphanis; natibus subelevatis, ad apices granulatis; epidermide luteo-viridi vel tenebrosa, eradiata; margarita caeruleo-alba et iridescente.

Shell smooth, subelliptical, somewhat inflated, inequilateral, obtusely biangular

behind and rounded before; valves thin, somewhat translucent; beaks somewhat elevated, granulate at the tips; epidermis yellowish green or darkish, without rays; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab.—Lake Winnipeg, at the mouth of the Saskatchewan River, R. Kennicott.

My cabinet and cabinets of Smithsonian Institution and Academy of Natural Sciences.

Diam. .6, Length 1.1, Breadth 1.9 inches.

Shell smooth, subelliptical, slightly inflated, inequilateral, obtusely angular behind and rounded before; substance of the shell thin, semi-transparent; beaks somewhat raised, granulate at the tips; ligament rather large, light brown; epidermis yellowish green or dark approaching to mouse color, with four or five rather distant, distinct marks of growth; umbonial slope slightly raised and rounded; posterior slope rather contracted, slightly carinate, with three indistinct greenish lines on each valve from the beaks to the posterior margin; anterior cicatrices confluent, large and indistinct; posterior cicatrices confluent, large and indistinct; dorsal cicatrices placed in the upper part of the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks rather shallow and subangular; nacre bluish white and iridescent.

Remarks.—Quite a number of this species were brought by Mr. Kennicott, but many were broken in the carriage for so long a distance. None were brought in alcohol, so that the soft parts were not observed. This species is allied to *Kennicottii* and *Simpsoniana*, (nobis), but differs in the outline, color of the epidermis, and has fewer and more distant marks of growth. The beaks of the three species are very much the same, having a double row of small undulations at the tips, which undulations rise into granules. I name this species after the Hon. Mr. Dallas, Governor of the Hudson's Bay Company, and successor of Sir George Simpson, who has liberally and efficiently promoted the objects of Mr. Kennicott's expedition to Arctic America, and has been interested in the increase of our knowledge of the natural history and resources of the country under his supervision, extending facilities at all times to the operations of the Smithsonian Institution.

MONOCONDYLÆA COMPRESSA. Pl. 11, fig. 29.

Testa lævi, transversa, valde inæquilaterali, valde compressa, ad latere planulata, postice angulata, antice rotundata; valvulis pertenuibus; natibus vix prominentibus, ad apices undulatis; epidermide micante olivacea, obsolete radiata; dente cardinali in dextra valvula solum et minimus; margarita albida et valde iridescente.

Shell smooth, transverse, very inequilateral, very much compressed, flattened on the sides, angular behind and rounded before; valves very thin; beaks scarcely

prominent, undulated at the tips; epidermis shining, olivaceous, obscurely rayed; cardinal tooth in the right valve only and very small; nacre whitish and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab.—Siam, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .5, Length 1.4, Breadth 2.9 inches.

Shell smooth, transverse, very inequilateral, very much compressed, flattened on the sides, angular behind and rounded before; substance of the shell very thin; beaks scarcely prominent, with a few undulations nearly parallel with the dorsal margin; ligament dark brown, long and thin; epidermis shining, olivaceous, obscurely rayed and with very distinct marks of growth; umbonial slope very slightly raised, flattish; posterior slope very much compressed, raised into quite a high carina, making the dorsal line perfectly straight; cardinal tooth compressed, very small and existing only in the right valve; anterior cicatrices rather large and very slightly impressed; posterior cicatrices large and scarcely visible; dorsal cicatrices small and placed behind the cavity of the beaks; cavity of the shell very shallow and wide; cavity of the beaks scarcely perceptible; nacre whitish and very iridescent.

Remarks.—This species is very nearly of the same outline with *Anodonta exilis*, (nobis,) but it has a higher carina and is not quite so transverse. It might be confounded with that species if it were not the fact that this species has, in the right valve, a small compressed tooth which does not exist in any *exilis* I have seen, and which of course separates them generically. In the left valve I cannot trace along the dorsal line any elevation or depression, the small compressed tooth of the right valve closing over the line of the left. In the specimen before me, the only one I have seen, the nacre is thickened after the second growth, which gives it a clouded appearance, and this is tinted with a slight salmon color. The nacre is so thin and transparent that the cells of the base membrane may be seen over the whole disk with the Stanhope lens, by holding it up to the light.

The following species from Dr. Kirk, of Edinburgh, are of unusual interest. They are the first which I have seen from Central Africa, and for them I am greatly indebted to his liberality. He accompanied the Zambezi Expedition, under the British Government, and was chief officer under Dr. Livingstone during five years. There are six in number, all of which I believe to be undescribed. The three *Spathæ* have the peculiar African type, and probably were furnished with syphons. In one of the species we have, for the first time, an *alate* type. The three *Uniones* differ from any type I have heretofore seen from Africa, and they take more of that of India in the

subtriangular form—*Rajahensis*, (nobis,) for instance—and in the subplicate character of some of our southern species, inclining to nodulous. It is greatly to be regretted that none of the soft parts were preserved, that we might compare their anatomy with those from America. Lake Nyassa is one of the three great central lakes of Africa, and has a southern drainage in the Zambezi River. It is, in extent, as Dr. Kirk informs me by letter, “exceeding two hundred miles north and south, and from fifteen to sixty miles wide, and is fifteen hundred feet above the sea. It lies between the parallels of 10° and 14° south latitude.”

UNIO KIRKII. Pl. 12, fig. 30.

Testa plicata, triangulari, subinflata, ad latere planulata, inæquilaterali, antice rotundata, postice angulata; valvulis crassis, antice crassioribus; natibus valde prominentibus, solidis, ad apices undulatis; epidermide viridi, radiis capillaris indutis; dentibus cardinalibus crassis, sulcatis; lateralibus subrectis, curtis, crassis, in valvulo sinistro tripartitibus; margarita argentea et iridescente.

Shell plicate, triangular, somewhat inflated, flattened at the sides, inequilateral, rounded before and angular behind; valves thick, thicker before; beaks very prominent, solid, undulate at the tips; epidermis greenish and covered with capillary rays; cardinal teeth thick, sulcate; lateral teeth nearly straight, short, thick, and treble in the left valve; nacre silvery white and iridescent.

Proc. Acad. Nat. Sci., 1864, p. 108.

Hab.—Lake Nyassa, Central Africa, John Kirk, M. D., of the Zambezi Expedition. My cabinet.

Diam. .7,

Length 1.1,

Breadth 1.2 inches.

Shell plicate, triangular, somewhat inflated, flattened at the sides, inequilateral, rounded before and angular behind; substance of the shell thick, thicker before; beaks very prominent, solid and undulate at the tips; ligament short, thick and light brown; epidermis greenish and covered with capillary rays on the sides, and with distant marks of growth; umbonial slope raised and angular; posterior slope flattened, elliptical, yellowish, with a dark green elliptical centre and distinct capillary line on each valve from the beaks to posterior basal margin; cardinal teeth thick, very much divided and sulcate; lateral teeth nearly straight, short, thick, double in the right and treble in the left valve; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, rather large and well impressed; dorsal cicatrices placed within the cavity and near the base of the cardinal tooth; cavity of the shell rather shallow and wide; cavity of the beaks rather shallow and subangular; nacre silvery white and iridescent.

Remarks.—This species reminds us at once of an Asiatic and an American species as regards its outline, but having folds on the anterior and posterior slopes it differs from both in this character. It is not so rounded on the basal margin as *Rajahensis*, (nobis,) nor quite so much inflated, and has not so flat a posterior slope. Like

elegans, (nobis,) it has flattened sides, but it is not so rounded at the basal margin nor is it so flat on the posterior slope. In the character of the rays it differs entirely, *elegans* having beautiful zig-zag rays over the whole disk, while *Kirkii* has capillary rays only. In the tripartite character of the lateral teeth it differs entirely. The posterior slope of this species has a beautiful and remarkable posterior slope, the central part being a fine regular well defined ellipse of a dark green, surrounded by a yellowish area, through which on each valve there is a well defined capillary line running from the beak to the posterior basal margin. The folds on the specimen before me are small and delicate, and are only found on the slopes before and behind the beaks and on the points of the beaks. I have great pleasure in dedicating this interesting little species to Dr. Kirk, to whom all malacologists are indebted for the development of the shells of Lake Nyassa.

UNIO NYASSAENSIS. Pl. 12, fig. 32.

Testa plicata, triangulari, subinflata, ad latere planulata, inæquilaterali, antice rotundata, postice angulata; valvulis subcrassis, antice crassioribus; natibus prominentibus, solidis, ad apices undulatis; epidermide luteo-cornea, obsolete radiata; dentibus cardinalibus parviusculis, sulcatis; lateralibus subrectis, curtis, crassis, in utroque valvulo duplicibus; margarita salmonis colore tincta et iridescente.

Shell plicate, triangular, somewhat inflated, flattened at the side, inequilateral, rounded before and angular behind; valves somewhat thick, thicker before; beaks prominent, solid and undulate at the tips; epidermis yellowish horn color, obscurely rayed; cardinal teeth rather small and sulcate; lateral teeth nearly straight, short, thick, double in both valves; nacre salmon color and iridescent.

Proc. Acad. Nat. Sci., 1864, p. 108.

Hab.—Lake Nyassa, Central Africa, John Kirk, M. D., of the Zambezi Expedition.

My cabinet.

Diam. .6,

Length .9,

Breadth 1.2 inches.

Shell plicate over most of the disk, triangular, somewhat inflated, flattened at the sides, inequilateral, rounded before and angular behind; substance of the shell somewhat thick, thicker before; beaks prominent, solid and undulate at the tips; ligament short and dark brown; epidermis yellowish horn color, obscurely rayed and with two distant marks of growth; umbonial slope raised and obtusely angular; posterior slope rather narrow, cordate, somewhat flattened, with an impressed and a colored narrow line from the tips to the posterior basal line; cardinal teeth rather small, sulcate and much divided; lateral teeth nearly straight, short, thick and double in both valves; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, rather large and moderately impressed; dorsal cicatrices within and above the cavity of the beaks; cavity of the shell rather deep and wide;

cavity of the beaks rather shallow and angular; nacre salmon colored, paler towards the margin and iridescent.

Remarks.—A single specimen only is before me. In outline it is nearly allied to *Kirkii*, herein described, but it has more folds, two-thirds of the disk being covered with small ones, which come in regular rows from the anterior and posterior portions, and form on the sides irregular and zig-zag corrugations. It differs from *Kirkii* in color, folds, rays and the teeth. The nacre of this specimen is salmon in the cavities, but whitish towards the margin. Other specimens may prove to be white, and others again of a darker salmon. It is not likely that any will be found pink or purple. This specimen reminds one somewhat of *apiculatis*, Say, but that is larger, more square, and has rough nodules over the whole disk, while this has small interrupted folds which border on granulations. The last remark may also be applied to *Aferulus*, herein described.

UNIO AFERULUS. Pl. 13, fig. 34.

Testa valde plicata, obliqua, subcompressa, valde inæquilaterali, antice rotunda, postice subbiangulata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, solidis, ad apices undulatis; epidermide luteo-cornea; dentibus cardinalibus parviusculis, sulcatis; lateralibus subrectis, curtis, in utroque valvulo duplicibus; margarita dilute sulmonis colore tineta et valde iridescente.

Shell much folded, oblique, somewhat compressed, very inequilateral, round before, somewhat biangular behind; valves somewhat thick, thicker before; beaks somewhat prominent, solid, undulate at the tips; epidermis yellowish horn color; cardinal teeth rather small and sulcate; lateral teeth nearly straight, short and double in both valves; nacre pale salmon color and very iridescent.

Proc. Acad. Nat. Sci., 1864, p. 109.

Hub.—Lake Nyassa, Central Africa, John Kirk, M. D., of the Zambezi Expedition.

My cabinet.

Diam. .5,

Length .8,

Breadth 1.1 inches.

Shell very much folded, oblique, somewhat compressed, very inequilateral, round before and somewhat biangular behind; substance of the shell somewhat thick, thicker before; beaks somewhat prominent, solid and undulate at the tips; ligament rather short and light brown; epidermis yellowish horn color, with two distant marks of growth; umbonial slope slightly raised and obtusely angular; posterior slope narrow elliptical, with one dark impressed line on each valve from the beak to the posterior basal margin; cardinal teeth rather small and sulcate; lateral teeth nearly straight, short and double in both valves; anterior cicatrices distinct, rather small and well impressed; posterior cicatrices confluent, large and moderately impressed; dorsal cicatrices placed immediately over the centre of the cavity of the

beaks; cavity of the shell rather shallow and wide; cavity of the beaks rather shallow and angular; nacre pale salmon, satin-like and very iridescent.

Remarks.—Like the preceding, only a single specimen was sent to me by Dr. Kirk. It is closely allied to *Nyassaensis* herein described. It seems to be a smaller species, with more folds which corrugate in the middle, quite oblique, and with a beautiful rich satin-like pearly nacre, which is very pale in this specimen, but may be darker or even white in others.

SPATHA ALATA. Pl. 12, fig. 31.

Testa alata, sulcata, triangulari, compressa, valde inæquilaterali, antice oblique rotundata, postice obtuse angulata; valvulis crassiusculis; natibus parvis, vix prominulis; epidermide olivacea, nitida, obsolete radiata; margarita purpurea et valde iridescente.

Shell winged, sulcate, triangular, compressed, very inequilateral, obliquely rounded before, obtusely angular behind; valves rather thick; beaks small, scarcely prominent; epidermis olive green, shining, obscurely rayed; nacre purple and very iridescent.

Proc. Acad. Nat. Sci., 1864, p. 109.

Hab.—Lake Nyassa, Central Africa, John Kirk, M. D., of the Zambezi Expedition.

My cabinet.

Diam. .8,

Length 1.8,

Breadth 3.1 inches.

Shell winged, sulcate, triangular, compressed, flattish on the sides, very inequilateral, obliquely rounded before and obtusely angular behind; substance of the shell rather thick; beaks small, scarcely prominent; ligament long, rather thin and dark brown; epidermis olive green, shining, with distant lines of growth and obscurely rayed; umbonial slope slightly raised and obtusely angular; posterior slope raised into rather a high wing; anterior cicatrices distinct, large and well impressed; posterior cicatrices distinct, large and well impressed; dorsal cicatrices form a line across the centre of the cavity of the beaks and are well impressed; cavity of the shell shallow and wide; cavity of the beaks scarcely perceptible; nacre purple, paling towards the margin and very iridescent.

Remarks.—This species differs much from any I have seen of the genus in having a well developed wing which rises from the point of the beaks to the outer edge, taking in this respect somewhat the appearance of some of the *Uniones*, viz.: *delphinulis*, Morelet, and *levissimus*, (nobis.) Its greatest perpendicular line is from the outer angle of the wing to the base. It narrows down towards the anterior margin. In this specimen the rays are greenish and stronger on the anterior third of the disks. The epidermis is so thin that the iridescence of the nacre is perceptible through it. This specimen is slightly emarginate at the base, but this may not be a permanent

character. The beaks are slightly eroded, but there appears at the tips a slight indication of undulations. The angle of the umbonial slope causes a well-marked furrow on the corresponding line of the interior. The wing in this species does not seem to be connate, as the ligament in this specimen is entirely uncovered, and is perfect the whole length. In young specimens this may be found to be otherwise, as it is with some of our species of *Unio* and *Anodonta*. I feel greatly obliged to Dr. Kirk for bringing this interesting species to the knowledge of Malacologists.

SPATHA NYASSAENSIS. Pl. 13, fig. 33.

Testa subsulcata, elliptica, lenticulari, compressa, valde inæquilaterali, antice rotunda, postice obtuse angulata; valvulis crassiusculis; natibus parvis, vix prominulis, ad apices minute undulatis; epidermide rufo-castanea vel luteola, obsolete radiata; margarita purpurecente et valde iridescente.

Shell subsulcate, elliptical, lenticular, compressed, very inequilateral, round before, obtusely angular behind; valves somewhat thick; beaks small, scarcely prominent, minutely undulate at the tips; epidermis reddish chestnut color or yellowish, obscurely rayed; nacre purplish and very iridescent.

Proc. Acad. Nat. Sci., 1864, p. 109.

Hab.—Lake Nyassa, Central Africa, John Kirk, M. D., of the Zambezi Expedition. My cabinet.

Diam. .5,

Length 1.2,

Breadth 2 inches.

Shell subsulcate, elliptical, lenticular, compressed, very inequilateral, round before and obtusely angular behind; substance of the shell somewhat thick; beaks small, very slightly prominent, minutely undulate at the tips; ligament long, thin and dark brown; epidermis reddish chestnut color or yellowish, obscurely rayed and with distant marks of growth; umbonial slope depressed and rounded; posterior slope very narrow; elliptical and raised into a deep carina; anterior cicatrices distinct, very large and well impressed; posterior cicatrices distinct, large and slightly impressed; dorsal cicatrices well impressed and placed in the centre of the cavity of the beaks; cavity of the shell very shallow and very wide; cavity of the beaks scarcely perceptible; nacre purplish and very iridescent.

Remarks.—The description is made from a mature, well characterized specimen with the beaks decorticated. Quite a young specimen accompanied it, which I think is of the same species, but still it may belong to another. This has a yellowish epidermis and a white nacre. The soft parts were dried in this, but were not perfect enough after softening in water to make out any of its anatomy. I could not ascertain if it had the two siphons which designate the genera *Iridina* and *Spatha*. It may really belong to the genus *Anodonta*. *Nyassaensis* is near in outline to *S. rubens* Lam., but is more oval, approaching an obovate outline. It is also more lenticular and is a much smaller species. It differs also in outline from an African mussel de-

scribed by Mr. Rang as *Anodonta Chaiziuna*, but which I have always suspected to be of the genus *Spatha*, but it must be remembered that he does not describe or figure syphons.

SPATHA MODESTA. Pl. 13, fig. 35.

Testa subsulcata, transversa, subcompressa, inæquilaterali, postice et antice rotunda; valvulis tenuibus; natibus parvis, prominulis, ad apices minute undulatis; epidermide tenebroso-olivacea, eradiata, nitida; margarita cæruleo-alba et valde iridescente.

Shell subsulcate, transverse, somewhat compressed, inequilateral, round behind and before; valves thin; beaks small, a little prominent and minutely undulate at the tips; epidermis dark olive, without rays, shining; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci., 1864, p. 109.

Hab.—Fresh waters near Mozambique, Africa, John Kirk, M. D., of the Zambezi Expedition.

My cabinet.

Diam. .6,

Length .7,

Breadth 2.2 inches.

Shell somewhat sulcate, transverse, somewhat compressed, inequilateral, round behind and before; substance of the shell thin; beaks small, a little prominent, pointed and minutely undulate at the tips; ligament long, thin and bright brown; epidermis dark olive green, without rays and shining; umbonial slope slightly raised and rounded; posterior slope very narrow, long, elliptical, slightly carinate and furnished with two lines on each valve from the beaks to the posterior margin; anterior cicatrices distinct, very large and very slightly impressed; posterior cicatrices distinct, large and very slightly impressed; dorsal cicatrices placed across the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks very small; nacre bluish white and very iridescent^{aq}.

Remarks.—This small and modest species is allied to *S. cælestis* (nobis), but may at once be distinguished by being less transverse, and in having a rounded posterior margin. It is evidently a smaller species. Like that species the nacre is bluish, and there is a deposit in the cavity of the beaks which gives a greenish blue color to the tips when the epidermis is worn off. The specimen before me is without rays— younger and more perfect specimens may sometimes have them. The furrows on this are well marked only on the anterior half and on the margin of the other parts. It is greatly to be regretted that we have not the soft parts to examine.

UNIO THORNTONII. Pl. 14, fig. 36.

Testa lævi, subrotunda, tumida, ad latere aliquanto planulata, ad basim compressa, valde inæquilaterali, antice et postice rotundata; valvulis crassis; natibus valde elevatis, tumidis; epidermide rufo-fusca, maculata; dentibus cardinalibus crassis crenulatisque; lateralibus percrassis subcurvisque; margarita alba et iridescente.

Shell smooth, subrotund, swollen, slightly flattened at the sides, compressed at the base, very inequilateral, rounded before and behind; valves thick; beaks very much raised & swollen; epidermis reddish brown, spotted; cardinal teeth thick, crenulate; lateral teeth very thick and somewhat curved; nacre white and iridescent.

Proc. Acad. Nat. Sci., 1857, p. 83.

Hab.—Tuscumbia, Alabama, L. B. Thornton, Esq.

My cabinet.

Diam. 1,

Length 1·5,

Breadth 1·4 inches.

Shell smooth, subrotund, swollen, slightly flattened at the sides, compressed at the base, very inequilateral, rounded before and behind; substance of the shell thick, slightly thicker before; beaks very much raised, swollen and incurved; ligament short, thick and brown; epidermis reddish brown, maculate, the rays being interrupted at each mark of growth, these latter being numerous and approximate, smooth and shining above and striate and dull below; umbonial slope raised and rounded; posterior slope very oblique, flattened, cordate, with two indistinct impressed lines from the beaks to the margin on each valve, and with a few very indistinct interrupted rays; cardinal teeth rather small, thick and crenulate; lateral teeth very thick, very oblique, somewhat curved and disposed to be double in both valves; anterior cicatrices scarcely distinct, rather small, very deeply impressed; posterior cicatrices distinct, rather small and well impressed; dorsal cicatrices placed above the centre of the cavity of the shell and on the base of the cardinal tooth; cavity of the shell deep and rounded; cavity of the beaks very deep and angular; nacre silvery white and iridescent.

Remarks.—A very interesting species, belonging to the group of which *dollabelloides*, (nobis,) may be considered the type. It is between that and *cor*, Conrad. The rays consist of oblong spots formed by the interruption of the frequent marks of growth, the larger marks being immediately before the umbonial slope. These rays rise at the point of the beaks and make gentle curves over the disk towards the basal margin, but cease when they reach the striate portion. The plate above the cardinal tooth is very large. No specimen before me has perfect beaks, and therefore the undulation is not observed. Neither were any received with the soft parts. I have great pleasure in naming this after L. B. Thornton, Esq., who most kindly sent me many new species from this habitat.

UNIO MOORESIIANUS. Pl. 14, fig. 37.

Testa lævi, subtriangulari, tumida, ad latere planulata, ad basim compressa, postice subangulata, valde inæquilaterali; valvulis crassis, antice crassioribus; natibus valde elevatis, tumidus; epidermide rufo-fusca, maculata, dentibus cardinalibus crassis, obtuso-conicis, crenulatis, in utroque valvulo duplicibus; lateralibus crassis subrectisque; margarita alba et iridescente.

Shell smooth, subtriangular, swollen, flattened at the sides, compressed at the base, subangular behind, very inequilateral; valves thick, thicker before; beaks very much raised and swollen; epidermis reddish brown, spotted; cardinal teeth thick, obtusely conical, crenulate, double in both valves; lateral teeth thick and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci., 1857, p. 83.

Hab.—Tuscumbia, Alabama, Mr. H. Moores.

My cabinet and cabinets of Mr. Moores, Rev. W. White and L. B. Thornton, Esq.
Diam. 1, Length 1·5, Breadth 1·5 inches.

Shell smooth, subtriangular, swollen, flattened at the sides, compressed at the base, subangular behind, very inequilateral; substance of the shell thick, thicker before; beaks very much raised and swollen; ligament rather thick and short; epidermis reddish brown, with maculate rays; umbonial slope raised and obtusely angular; posterior slope very oblique, flattened, cordate, with an indistinct impressed line from beaks to margin; cardinal teeth thick, obtusely conical, crenulate and double in both valves; lateral teeth very thick, oblique, corrugate, nearly straight and disposed to be double in both valves; anterior cicatrices slightly distinct, rather small and deeply impressed; lateral cicatrices very distinct, rather small, very well impressed; dorsal cicatrices placed above the centre of the cavity of the beaks and along the base of the cardinal tooth; cavity of the shell deep and rounded; cavity of the beaks rather deep and obtusely angular; nacre silvery white and iridescent.

Remarks.—Several specimens of this species, of various ages, are before me. It is nearly allied to *Edgarianus*, (nobis,) but is a larger species, not so triangular, and it has not the natural high polish of it. It reminds one of *dollabelloides* and *Thorntonii*, (nobis,) but it is subtriangular in its outline, and has a more flattened side and less raised beaks than in the latter. The rays, in their interrupted character and their becoming obsolete towards the margin, are alike. The marks of growth are very much the same, being numerous. None were received in alcohol. In naming this interesting species after Mr. H. Moores, of Columbus, Ohio, I have to acknowledge the favor of frequently receiving species from many different habitats, and much aid in various ways in investigating this family.

UNIO MUNDUS. Pl. 14, fig. 38.

Testa lævi, obliqua, tumida, postice subangulata, valde inæquilaterali; valvulis crassis, antice crassioribus; natibus valde elevatis tumidis; epidermide vel lutea vel luteo-fusca, maculata; dentibus cardinalibus parvis, crenulatis, compresso-conicis; lateralibus sublongis obliquis, crassis subcurvisque; margarita alba et iridescente.

Shell smooth, oblique, swollen, subangular behind, very inequilateral; valves thick, thicker before; beaks very much raised; epidermis yellow or yellowish brown and spotted; cardinal teeth small, crenulate, compressed, conical; lateral teeth rather long, oblique, thick and somewhat curved; nacre white and iridescent.

Proc. Acad. Nat. Sci., 1857, p. 83.

Hab.—Tuscumbia, Alabama, L. B. Thornton, Esq.

My cabinet and cabinet of Mr. Thornton.

Diam. .9,

Length 1.1,

Breadth 1.4 inches.

Shell smooth, oblique, swollen, subangular behind, slightly flattened on the sides, very inequilateral; substance of the shell very thick, thicker before; beaks very much raised and incurved; ligament rather small and light brown; epidermis yellow or yellowish brown, with green spots on the sides formed of interrupted rays, with numerous rather close lines of growth; umbonial slope raised and rounded; posterior slope rather broad, flattish, cordate, without rays, but with two indistinct impressed lines, from the beaks to the margin, on each valve; cardinal teeth small, crenulate, compressed-conical; lateral teeth rather long, very stout, oblique, somewhat curved and very thick on the plate; anterior cicatrices confluent, small and very deeply impressed; posterior cicatrices distinct, rather small and well impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks rather deep and obtusely angular; nacre pearly white and iridescent.

Remarks.—This belongs to a very interesting group, of which *clavus*, Lam. may be considered the type. The beaks are not, however, so elevated, nor is it so wide. It is allied to *Thorntoni*, herein described, but is a smaller and more oblique species. The rays are interrupted at each stage of growth, and thus become maculate.

UNIO TESSERULÆ. Pl. 15, fig. 39.

Testa lævi, quadrata, cuboides, valde tumida, valde inæquilaterali, postice obtuse angulata, antice truncata; valvulis crassis, antice crassioribus; natibus prominentibus, tumidis, incurvatis, ad apices rugoso-undulatis; epidermide mellea, micanti, radiis interruptis indutis; dentibus cardinalibus parvisculis, subconicis corrugatisque; lateralibus curtis, obliquis rectisque; margarita argentea et valde iridescente.

Shell smooth, quadrate, cubical, very much swollen, very inequilateral, obtusely

angular behind, truncate before; valves thick, thicker before; beaks prominent, swollen, incurved, rugosely undulate at the tips; epidermis honey yellow, shining, covered with interrupted rays; cardinal teeth rather small, subconical and corrugate; lateral teeth short, oblique and straight; nacre silver white and very iridescent.

Proc. Acad. Nat. Sci., 1861, p. 392.

Hab.—Nolachucky River, Tenn., J. G. Anthony.

My cabinet and cabinet of Mr. Anthony.

Diam. .7,

Length .8,

Breadth 1.1 inches.

Shell smooth, quadrate, cubical, very much swollen, very inequilateral, obtusely angular behind and truncate before; substance of the shell thick, thicker before; beaks prominent, swollen and incurved; ligament very short; epidermis honey yellow, shining, with interrupted green rays on the sides and with rather close lines of growth; umbonial slope very much raised and obtusely angular: posterior slope cordate, flattened, with a few obscure rays; cardinal teeth rather small, subconical and rough; lateral teeth short, oblique and straight; anterior cicatrices distinct, rather large and very deeply impressed; posterior cicatrices distinct, moderately large and well impressed; dorsal cicatrices placed immediately over the centre of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks shallow and obtusely angular; nacre silver white and very iridescent.

Remarks.—A single specimen only of this unusually shaped little species was sent to me by Mr. Anthony. It is an inch and two-tenths wide, by eight-tenths long, and the diameter being seven-tenths, it closely approaches a cubical form. It may not be full grown, but I suspect that it does not obtain a much larger size, there being nine lines of growth upon it. The interrupted rays rise at the lines of growth and fade before reaching the next lower one. This specimen has these rays on the sides only, the anterior part having none, while the posterior slope has two or three very indistinct ones. Others no doubt will be found well covered with rays, and others again with still fewer. The nacre of the posterior portion is thin enough to permit the rays to show through it, while the anterior and upper portions are thick and dense. The beaks are not perfect, but the undulations remaining show that they are few and rather coarse. In outline this species is nearest to *arcaeformis*, (nobis,) but it differs in many respects, and cannot be confounded with that interesting species. It is a much smaller shell, has not the elevated umbonial slope, nor the groove or carina of the posterior slope. In the system of rays they totally differ, the *arcaeformis* having capillary rays over the whole disk, while this has interrupted rays on the sides, which are flattened. The anterior end is also more enlarged and flattened. I think from the form this is a male.

UNIO CRAPULUS. Pl. 15, fig. 40.

Testa lævi, obliqua, ventricosa, ad umbones valde tumida, valde inæquilaterali, postice rotundata, antice truncata; valvulis pererassis, antice crassioribus; natibus valde prominentibus crassisque; epidermide luteo-fusca, eradiata; dentibus cardinalibus pererassis, pyramidatis, corrugatis, in utroque valvulo duplicibus; lateralibus pererassis, corrugatis, obliquis subcurvisque; margarita alba et paulum iridescente.

Shell smooth, oblique, very much inflated, much swollen towards the beaks, very inequilateral, rounded behind, truncate before; valves very thick, thicker before; beaks very prominent and thick; epidermis yellowish brown, without rays; cardinal teeth very thick, pyramidal, corrugate, double in both valves; lateral teeth very thick, corrugate, oblique and somewhat curved; nacre white and somewhat iridescent.

Proc. Acad. Nat. Sci., 1861, p. 39.

Hab.—Etowah River, Georgia, Rev. G. White.

My cabinet and cabinet of Mr. White.

Diam. 1,

Length 1·2,

Breadth 1·5 inches.

Shell smooth, oblique, very much inflated, swollen at the beaks, very inequilateral, almost terminal, rounded before and truncate behind; substance of the shell very thick, thicker before; beaks very prominent and thick; ligament short and thick; epidermis yellowish brown, more yellow on the inferior portions and browner above, without rays, with many close equidistant marks of growth; umbonial slope much raised and rounded; posterior slope broad and flat, cordate, with a broad indistinct furrow on each valve from the beaks to the posterior margin; cardinal teeth very thick, pyramidal, corrugate and double in both valves; lateral teeth very thick, corrugate, oblique and slightly curved; anterior cicatrices distinct, small, very deeply impressed; posterior cicatrices distinct, rather small and deeply impressed; dorsal cicatrices placed on the base of the cardinal tooth in the cavity of the beaks; cavity of the shell rather shallow and rounded; cavity of the beaks shallow and obtusely angular; nacre white and slightly iridescent.

Remarks.—This belongs to the group of oblique species which are disposed to rotundity. It is nearly allied to *cor*, Con., but it is rather more rotund, and although remarkably high in the beaks, is not so much so, by any means, as that remarkable species. The beaks of the only specimen which came into my possession are much eroded, and therefore the undulations, if they had any, could not be observed. In perfect specimens the beaks no doubt will be found to be incurved. The cardinal tooth in the left valve, described as being double, is disposed, in this specimen, to be trifold, and the lateral tooth in the same valve is very much thickened and disposed

to duplicature. The marks of growth are very numerous, regular and close. This specimen evidently had over twenty.

UNIO CREBRIVITTATUS. Pl. 15, fig. 41.

Testa lævi, valde obliqua, antice tumida et truncata, postice compressa rotundaque; valvulis crassis, antice crassioribus; natibus tumidis, elevatis incurvatis terminalibusque; epidermide tenebroso-fusca, transverse et crebrivittata; dentibus cardinalibus subgrandibus, striatis corrugatisque; lateralibus longis, crassis, corrugatis subcurvisque; margarita argentea et iridescente.

Shell smooth, very oblique, swollen and truncate before, compressed and rounded behind; valves thick, thicker before; beaks swollen, raised, incurved and terminal; epidermis dark brown, transversely and thickly banded; cardinal teeth rather large, striate and roughened; lateral teeth long, thick, roughened and somewhat curved; nacre silver white and iridescent.

Proc. Acad. Nat. Sci., 1861, p. 60.

Hab.—Coosawattee River, Ala., Bishop Elliott.

My cabinet and cabinet of Bishop Elliott.

Diam. 1, Length 1·2, Breadth 2·1 inches.

Shell smooth, very oblique, swollen and truncate before and compressed and rounded behind; substance of the shell thick, thicker before; beaks swollen; elevated incurved and terminal; ligament rather large, thick and light brown; epidermis dark brown, transversely and closely banded along the numerous lines of growth, shining above and striate below; umbonial slope rounded; posterior slope slightly raised, elongate, heart-shaped, with an obscure impressed line from the beak to the posterior margin in each valve; cardinal teeth rather large, striate, corrugate and nearly parallel with the lateral tooth; lateral teeth long, thick, corrugate, slightly curved and nearly horizontal; anterior cicatrices distinct, small and deeply impressed; posterior cicatrices distinct, rather small and well impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks shallow and rounded; nacre silver white and iridescent.

Remarks.—I have several specimens before me of different ages, all bearing the same character of numerous close transverse bands along the lines of growth. It is closely allied to *decisus* (nobis,) but may be distinguished by its close lines of growth and having more elevated beaks. On the other side it is allied to *cluvus*, Lam., but it is not rayed like that species, nor has it the same flatness before the umbonial slope. The coloring matter in the epidermis in this species seems to be expended in the markings of the lines of growth. The anterior slope is sharply truncate, and has a well-defined cordate impression.

UNIO LEIBII. Pl. 15, fig. 42.

Testa lævi, quadra, subcompressa, valde inæquilaterali, postice emarginata, antice rotundata; valvulis subcrassis, antice crassioribus; natibus subprominentibus, fere terminalibus; epidermide straminea, eradiata; dentibus cardinalibus subgrandibus, erectis striatisque; lateralibus curtis, rectis crassisque, in utroque valvulo duplicibus; margarita alba et aliquanto iridescente.

Shell smooth, quadrate, subcompressed, very inequilateral, emarginate behind and rounded before; valves rather thick, thicker before; beaks somewhat prominent and nearly terminal; epidermis straw yellow, eradiate; cardinal teeth rather large, erect and striate; lateral teeth short, straight, thick and double in both valves; nacre white and slightly iridescent.

Proc. Acad. Nat. Sci., 1862, p. 168.

Hab.—Erie County, Michigan, G. C. Leib, M. D.

My cabinet and cabinet of the Smithsonian Institution.

Diam. .8,

Length 1,

Breadth 1.3 inches.

Shell smooth, quadrate, subcompressed, very inequilateral, emarginate behind and rounded before; substance of the shell rather thick, thicker before; beaks somewhat prominent and nearly terminal; epidermis straw yellow, without rays, with numerous close lines of growth; umbonial slope slightly raised and rounded; posterior slope raised into a high carina, almost a wing, and so impressed as to form an emargination on the posterior margin; cardinal teeth rather large, erect, striate and disposed to be tripartite in the right valve; lateral teeth short, straight, thick and double in both valves; anterior cicatrices distinct, small and well impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed under the base of the cardinal tooth; cavity of the shell rather deep and round; cavity of the beaks rather shallow and angular; nacre white and slightly iridescent.

Remarks.—Two odd valves only of this small species were among a number of common species from the Michigan Zoological District. It is remarkably quadrate in the outline. In these specimens the cardinal tooth is trifid in the right and double in the left valve, and the lateral teeth double in both valves. But this may not pervade all this species, as we find aberrations in the teeth of many of the species. The outline of this shell is very unusual. It is remarkably quadrate, and it is greatly to be regretted that perfect specimens of both valves were not in our possession, better to describe its characteristics. I name it after Dr. Leib, who sent it to the Smithsonian Institution.

UNIO PARVULUS. Pl. 16, fig. 43.

Testa plicata, transversa, subinflata, ad latere compressa, postice obtuse angulata, valde inæquilaterali; valvulis tenuibus, antice aliquanto crassioribus; natibus prominulis; epidermide olivacea, subviridimaculata; dentibus cardinalibus parvis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus longis subrectisque; margarita cærulea et iridescente.

Shell plicate, transverse, somewhat inflated, compressed at the sides, obtusely angular behind, very inequilateral; valves thin, slightly thicker before; beaks a little prominent; epidermis olivaceous, slightly green spotted; cardinal teeth small, compressed, crenulate, double in both valves; lateral teeth long and nearly straight; nacre bluish and iridescent.

Proc. Acad. Nat. Sci., 1861, p. 307.

Hab.—Coosa River, Alabama, E. R. Showalter, M. D.; Chattanooga, Georgia, A. Gerhardt.

My cabinet and cabinets of Dr. Showalter and Smithsonian Institution.

Diam. .47, Length .75, Breadth 1.65 inches.

Shell plicate, wide, somewhat inflated, compressed at the side, obtusely angular behind, very inequilateral; substance of the shell thin, slightly thicker before; beaks a little prominent; ligament rather short and light brown; epidermis olive green, with numerous minute angular markings over the disk, and with rather distant marks of growth; umbonial slope inflated and rounded; posterior slope slightly carinate and covered with curved folds; cardinal teeth small, compressed, crenulate and double in both valves; lateral teeth long and nearly straight; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, large and faintly impressed; dorsal cicatrices placed across the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks very shallow and slightly angular; nacre bluish, with a few salmon-colored spots, and iridescent.

Soft Parts.—*Branchial uterus* fully charged, having ten broad branchial ovisacks pendent from the middle of the outer leaf, and occupying only one third of the length. *Branchia* rather large, wide, curved below, inner one somewhat the larger, free more than half the length of abdominal sack. *Palpi* very small, subtriangular, united only at the superior portion. *Mantle* very thin, much thickened on the posterior half of the margin, which is there crenulate and very dark colored. *Branchial opening* small, with numerous light brown papillæ. *Anal opening* rather large, with very small light brown papillæ on the inner edges. *Super-anal opening* small, lined with black and united below. Color of the mass whitish.

Embryonic shell elongate-pouch shape, small, nearly the same with *H. acutissimus*, (nobis.)

Remarks.—There were two specimens of this species received, with a single one of *acutissimus*, from Dr. Showalter, and at first sight I was disposed to think it a strong variety only of that shell, but on examining the soft parts, I found a female which had a well charged branchial uterus, differing very much in the form and position of the branchial ovisacks from that shell. The *acutissimus* has many more sacks, and they extend nearly the whole breadth of the outer branchiæ. In the *parvulus* they are placed in the middle, and occupy not more than one-third the breadth. The thick posterior edges of the mantle were also much darker. The enveloping hard part differs from *acutissimus* in being greenish and not salmon-colored, while the epidermis agrees in the form of the minute angular spots. In outline it is much like *Conradius*, having the same folds on the posterior slope, but differs in the epidermis, not having rays like that species. It evidently belongs to that group which includes the small species *acutissimus*, *Conradius*, *penicillatus* and *rubellinus*, and the cicatrix on the lower edge of the foot shows it is furnished with a *byssus* like others of this little group.

UNIO PERPURPUREUS. Pl. 16, fig. 44.

Testa lævi, elliptica, subinflata, inæquilaterali, postice et antice rotundata; valvulis suberassis, antice crassioribus; natibus prominulis; epidermide tenebroso-viridi, nigricente, radiis capillaribus; dentibus cardinalibus parviusculis, erectis, conicis, in utroque valvulo duplicibus, striatis; lateralibus longis rectisque; margarita valde purpurea et iridescente.

Shell smooth, elliptical, somewhat inflated, inequilateral, rounded behind and before; valves rather thick, thicker before; beaks somewhat prominent; epidermis dark green inclining to black, with capillary rays; cardinal teeth rather small, erect, conical, double in both valves and striate; lateral teeth long and straight; nacre very purple and iridescent.

Proc. Acad. Nat. Sci., 1861, p. 41.

Hab.—Tennessee, J. G. Anthony.

My cabinet and cabinets of the Academy of Natural Sciences and Mr. Anthony.

Diam. .57,

Length .97,

Breadth 1.62 inches.

Shell smooth, oblong, somewhat compressed, flattened at the side, nearly equilateral, obtusely angular behind, round before; substance of the shell rather thin, slightly thicker before; beaks slightly prominent; ligament rather small and dark brown; epidermis dark green, inclining to black, with numerous capillary rays on the posterior portion; umbonial slope slightly raised and rounded; posterior slope rather small, very dark, with two obscure impressed lines on each valve from the beaks to the posterior margin; cardinal teeth rather small, erect, conical, double in both valves and striate; lateral teeth long, straight and somewhat corrugate;

anterior cicatrices distinct, rather large and deeply impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks shallow and obtusely angular; nacre very purple and iridescent.

Remarks.—Two specimens of this small species were presented to the Academy of Natural Sciences by Mr. Anthony. They were labelled *U. Vanuxemii*, (nobis,) but they certainly are not that species, which is wider and not so dark in the nacre or the epidermis. Both the specimens have a dark purple nacre. It is very near to *fuscatus* (nobis) in outline, but is not quite so transverse, is a thicker and darker shell. The fine hair-like rays on the posterior portion remind one of *Troostii*, (nobis), but it cannot be confounded with that species.

UNIO BIEMARGINATUS. Pl. 16, fig. 45.

Testa lævi, triangulari, inæquilaterali, postice biangulata, ad latere sulcata, ad basim et postice emarginata; valvulis subcrassis, antice crassioribus; natibus prominentibus, compressis; epidermide rufosca, valde radiata; dentibus cardinalibus parvis, valde crenulatis, subconicis, in utroque valvulo duplicibus; lateralibus curtis, crassis rectisque; margarita alba et iridescente.

Shell smooth, triangular, inequilateral, biangular behind, sulcate on the side, emarginate at the base and behind; valves rather thick, thicker before; beaks somewhat prominent and compressed; epidermis reddish brown, very much rayed; cardinal teeth small, very crenulate, somewhat conical, double in both valves; lateral teeth short, thick and straight; nacre white and iridescent.

Proc. Acad. Nat. Sci., 1857, p. 83.

Hab.—Florence, Alabama, Rev. G. White.

My cabinet and cabinet of Mr. White.

Diam. .64, Length 1.10, Breadth 1.41 inches.

Shell smooth, triangular, inequilateral, biangular behind, sulcate on the side, emarginate at the base and behind; substance of the shell rather thick, thicker before; beaks somewhat prominent and compressed; ligament short, rather thick and brown; epidermis reddish or yellowish brown, very much rayed, with distinct and rather distant marks of growth; umbonial slope raised and biangular; posterior slope somewhat flattened, cordate, with a wide groove from the beaks to the margin; cardinal teeth small, very much crenulate, somewhat conical and double in both valves; lateral teeth short, thick, straight, thicker towards the end; anterior cicatrices distinct, small and well impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices placed over the cavity of the beaks and along the case of the cardinal tooth; pallear cicatrices emarginate; cavity of the shell shallow; cavity of the beaks rather deep and obtusely angular; nacre silvery white and iridescent.

Remarks.—I have a number of females as well as males before me. Unfortunately none were received with the soft parts. It is of the group to which *Stewardsonii* (nobis) belongs, and is nearly allied to that species, but cannot be confounded with it. It is much smaller, has two emarginations and two angles on the umbonial slope, neither of which characters belong to *Stewardsonii*. But like it the female enlargement is at the basal termination of the lateral furrow, and in some females it is quite large and generally of a dark green. It protrudes beyond the basal emargination. The rays which usually extend over the whole disk are broad anteriorly and capillary posteriorly. None of the specimens had beaks perfect enough to give the character of the undulations. The female is figured.

UNIO GRANULATUS. Pl. 16, fig. 46.

Testa plicata, elliptica, subinflata, valde inæquilaterali, postice obtuse angulata, antice rotunda; valvulis subtenuibus, antice aliquanto crassioribus; natibus prominulis, ad apices undato-granulatis; epidermide tenebroso-oliva, eradiata, transverse striata; dentibus cardinalibus parvis, compressis, obliquis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, acicularis, tenuis subrectisque; margarita purpurescente et valde iridescente.

Shell folded, elliptical, somewhat inflated, very inequilateral, obtusely angular behind, round before; valves rather thin, slightly thicker before; beaks a little prominent, undulate and granulate all over; epidermis dark olive, without rays, transversely striate; cardinal teeth small, compressed, oblique, crenulate and double in both valves; lateral teeth long, acicular, thin and nearly straight; nacre purplish and very iridescent.

Proc. Acad. Nat. Sci., 1861, p. 60.

Hab —Big Prairie Creek, Alabama, E. R. Showalter, M. D.

My cabinet and cabinet of Dr. Showalter.

Diam. .45,

Length .62,

Breadth 1.10 inches.

Shell folded, elliptical, rather inflated, very inequilateral, obtusely angular behind, sulcate and round before; substance of the shell rather thin, slightly thicker before; beaks a little prominent, undulated granulations all over; ligament very small, thin and light brown; epidermis dark olive, without rays, transversely striate below, and with distant lines of growth; umbonial slope inflated and rounded; posterior slope narrow elliptical, very slightly raised, with two obscure yellowish rays on each valve; cardinal teeth small, compressed, oblique, crenulate, double in both valves; lateral teeth long, acicular, thin and nearly straight; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, rather large and very slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell somewhat deep and wide;

cavity of the beaks rather shallow and subangular; nacre purplish and very iridescent.

Remarks.—This species is very much the size and form of some varieties of *parvus*, Bar., and of course somewhat like *germanus* (nobis,) but it differs from both entirely in the undulations of the beaks. Both of these have them subconcentric, while in *granulatus* the beaks are covered with wave-like granulations, which are remarkable, and extend for some distance down the sides, being different in this character from any species I know in this country, but which closely resemble those in *Napeanensis*, Con., from Australia. In outline it is more elliptical than that shell, and it differs in the color of the nacre being purple, and in the epidermis not being black, also in being comparatively a diminutive species. In the character of the undulations it is very closely allied, but in our species they are closer and smaller, and extend further in proportion to the sizes of the two shells. The undulations, in the specimen before me, are visible in the cavity of the beaks. It is to be regretted that I have only a single specimen, and that without the soft parts to compare with *parvus* and *germanus*. The specimen before me has a single dark line of growth more than half-way down, and may not be full grown. This specimen is disposed to be sulcate on the anterior portion of the disk, and this may possibly be a permanent character.

UNIO GERMANUS. Pl. 19, fig. 54.

Testa lævi, elliptica, subinflata, inæquilaterali, postice subbiangulata, antice rotunda; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, ad apices concentrice rugoso-undulatis; epidermide tenebroso-fusca, eradiata, transverse striata; dentibus cardinalibus parvis, erectis, compressis, crenulatis, acuminatis; lateralibus tenuibus subcurvisque; margarita purpurecente et valde iridescente.

Shell smooth, elliptical, somewhat inflated, inequilateral, subbiangular behind and round before; valves somewhat thick, thicker before; beaks rather prominent, with rough concentric undulations at the tips; epidermis dark brown, without rays, transversely striate; cardinal teeth small, erect, compressed, crenulate and pointed; lateral teeth thin and somewhat curved; nacre purplish and very iridescent.

Proc. Acad. Nat. Sci., 1861, p. 40.

Hab.—Coosa River, Alabama, E. R. Showalter, M. D.

My cabinet and cabinet of Dr. Showalter.

Diam. .55, Length .82, Breadth 1.40 inches.

Shell smooth, elliptical, somewhat inflated, inequilateral, subbiangular behind and round before; substance of the shell somewhat thick, thicker before; beaks rather prominent, concentrically and rugosely undulate at the tips; ligament short, thin and lightish brown; epidermis dark brown, without rays, transversely striate,

slightly sulcate before; umbonial slope raised and obtusely angular; posterior slope rather broad, with two dark lines on each valve; cardinal teeth small, erect, compressed, crenulate and acuminate; lateral teeth thin and somewhat curved; anterior cicatrices distinct, small and well impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks shallow and obtusely angular; nacre purplish and very iridescent.

Soft Parts.—*Branchial uterus* not changed, but numerous very small ova were found in the ovarium. *Branchiæ* small and lightly curved below, inner ones rather the larger, free nearly two-thirds the length of abdominal sack. *Palpi* large, oblique, subtriangular, united half-way down the posterior edges. *Mantle* very thin and without the caruncle which is so remarkable in *parvus* and *paulus*, closely allied species. *Branchial opening* rather large, with numerous small papillæ on the inner edges. *Anal opening* rather small, with numerous small papillæ. *Super-anal opening* large, colored on the edges and not united below in this specimen. Color of the mass light salmon tint.

Remarks.—Only a single specimen was received from Dr. Showalter, but fortunately it was in alcohol, which gave the advantage of an anatomical examination; at once satisfying my doubts of its being distinct from *parvus* Bar. The epidermis is of the same color, and the outline nearly the same, *parvus* not being quite so transverse. The nacre is quite purple, a color I have never seen in *parvus*, which is usually of a rich pearly white. Like *parvus* it has six or seven concentric undulations on the tips, but these seem coarser in *germanus*. In the soft parts, although this is a female, there is no sign of a *caruncle* below the *branchial* opening, so remarkable in *parvus*.

UNIO RASUS. Pl. 17, fig. 47.

Testa lævi, lata, inflata, valde inæquilaterali; valvulis crassis, antice crassioribus; natibus prominentibus, ad apices parum undulatis; epidermide rasa, dilute straminea, eradiata; dentibus cardinalibus compressis, corrugatis, crenulatis, in utroque valvulo duplicibus; lateralibus prælongis, corrugatis subrectisque; margarita argentea et parum iridescente.

Shell smooth, wide, inflated, very inequilateral; valves thick, thicker before; beaks prominent, somewhat undulate at the tips; epidermis smooth, pale, straw-color, without rays; cardinal teeth compressed, corrugate, crenulate and double in both valves; lateral teeth very long, corrugate and nearly straight; nacre silver white and somewhat iridescent.

Proc. Acad. Nat. Sci., 1863, p. 189.

Hab.—Assyria, C. M. Wheatley.

Cabinet of Mr. Wheatley.

Diam. .9,

Length 1.2,

Breadth 2.3 inches.

Shell smooth, wide, approaching the elliptical, inflated, very inequilateral; substance of the shell thick, thicker before; beaks rather prominent, with four or five small, granular undulations at the point of the tips; ligament rather long, broad and light brown; epidermis very smooth, shining, light straw color, with a single mark of growth towards the margin, without rays; umbonial slope raised and rounded; posterior slope rather broad, with two indistinct, impressed lines in each valve from the beaks to the posterior margin; cardinal teeth compressed, corrugate, crenulate and double in both valves; lateral teeth very long, corrugate, enlarged towards the end and nearly straight; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and moderately well impressed; dorsal cicatrices placed on the upper part of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather deep and obtusely angular; nacre silver white and somewhat iridescent.

Remarks.—This is a well characterized species, and it is to be regretted that a single specimen only should be observed, as others might present different characters. It has a remarkably smooth, clean epidermis, of a clear, pale straw color. Fortunately the tips are perfect, and present at the point very small granular undulations in two rows. The single mark of growth which is presented in this specimen is broad and well defined, and is placed near to the margin. I doubt if this species is ever rayed, yet on one valve there are obscure indications of rays. In outline and in color of the epidermis this species is very closely allied to *Anodontoides*, (nobis,) from the Mississippi and Ohio basins, and particularly like the very thick ones found near Cincinnati. It differs entirely in the system of the undulations of the beaks, in having no rays, and in being less iridescent. Among the Asiatic species it is most nearly allied to *Mosulensis* and to *Bourguignatianus*, herein described, but it is a thicker shell than the former, more transverse, and in the system of the undulations of the beaks entirely different. It is a larger and thicker shell than the latter, is more transverse, is less iridescent, and has not the same marks of growth.

UNIO DIGNATUS. Pl. 17, fig. 48.

Testa lævi, valde obliqua, inflata, ad apices tumida, valde inæquilaterali, ad latere parum planulata; valvulis percassis, antice crassioribus; natibus prominentibus, tumidis, incurvis, terminalibus, ad apices parum granulatis; epidermide vel lutea vel luteo-fusca, micante, eradiata; dentibus cardinalibus erectis, compressis et crenulatis; lateralibus prælongis, lamellatis subcurvisque; margarita argentea et valde iridescente.

Shell smooth, very oblique, inflated, swollen at the beaks, very inequilateral, slightly flattened at the sides; valves very thick, thicker before; beaks prominent, swollen, incurved, terminal, somewhat granulate at the tips; epidermis yellow or yellowish brown, shining, without rays; cardinal teeth erect, compressed and crenu-

late; lateral teeth very long, lamellar and somewhat curved; nacre silver white and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 189.

Hab.—River Tigris, at Bagdad, C. M. Wheatley.

My cabinet and cabinets of C. M. Wheatley and Rev. Mr. Beadle.

Diam. 1·2,

Length 1·6,

Breadth 3·1 inches.

Shell smooth, very oblique, inflated, swollen at the tips, very inequilateral, somewhat flattened at the side; substance of the shell very thick, thicker before; beaks prominent, swollen, incurved, terminal, slightly granulate at the tips; ligament short, thick and dark brown; epidermis yellow or yellowish brown, shining, without rays, with very distant marks of growth; umbonial slope very much raised and rounded; posterior slope rather wide, flattened, depressed between the beaks; cardinal teeth erect, compressed, corrugate and crenulate; lateral teeth very long, lamellar and somewhat curved; anterior cicatrices distinct, very deeply impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed on the upper side of the cavity of the beaks; cavity of the shell deep and wide; cavity of the beaks deep and subangular; nacre beautifully white and very iridescent.

Remarks.—I owe the possession of several specimens of this remarkable species to the kindness of Mr. Wheatley. It had been supposed to be the *U. Tigris*, Fer., or *Tigridis*, Bourg., but it certainly is not either of them. I have both these species in my cabinet. It is very much larger than either, and although of nearly the same outline, presents several distinct characteristics, such as its flattened sides and remarkably recurved beaks. In outline and size it is very near to *truncatus*, Swain., but differs totally in the form of the cardinal teeth. Some of my specimens are nearly of the size of the figures of Mr. Swainson in his Zool. Illus., 2d series. The fine, erect cardinal teeth in *dignatus* are remarkable, being compressed and locking in, as it were. The marks of growth are distant and very distinct, being broad and dark brown on the yellow epidermis of the younger specimens. The nacre is very much thickened at the anterior basal margin. The granulations of the tips are small, in a double row and scarcely visible.

UNIO MOSULENSIS. Pl. 17, fig. 49.

Testa lævi, elliptica, subinflata, valde inæquilaterali; valvulis crassiusculis, antice crassioribus; natibus prominulis, ad apices minute undulatis; epidermide straminea, micante, eradiata; dentibus cardinalibus parviusculis, corrugatis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subrectisque; margarita alba et iridescente.

Shell smooth, elliptical, somewhat inflated, very inequilateral; valves somewhat thick, thicker before; beaks a little prominent, minutely undulate at the beaks;

epidermis straw-color, shining, without rays; cardinal teeth rather small, corrugate, crenulate and double in both valves; lateral teeth long, lamellar and nearly straight; nacre white and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab.—River Tigris, at Mosul, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .9, Length 1.2, Breadth 2.5 inches.

Shell smooth, elliptical, somewhat inflated, very inequilateral; substance of the shell somewhat thick, thicker before; beaks a little prominent, minutely undulate at the tips; ligament rather short and brown; epidermis straw-color, shining, without rays and with two or three distant marks of growth; umbonial slope rounded; posterior slope narrow and slightly carinate; cardinal teeth rather small, roughened, crenulate, double in both valves; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed on the upper side of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks obtusely angular and shallow; nacre white and iridescent.

Remarks.—Among the shells from the Tigris sent to me by Mr. Wheatley were three of this species, very slightly differing in outline. In outline it is near to that variety of *Batavus* called *Retzii* by Nilsson, but it is more oblique and is yellow, while that is dark brown. It is also near to *Jordanicus*, Bourg., but is a wider shell. *Mosulensis* has a pale straw-colored epidermis, with two or three distant marks of growth indicated by distinct dark bands. The undulations of the beaks are numerous, small and beautiful.

UNIO ORONTESENSIS. Pl. 18, fig. 50.

Testa lævi, quadrata, inflata, valde inæquilaterali; valvulis parum crassis, antice crassioribus; natibus prominulis, ad apices crebre et minute undulatis; epidermide rufo-fusca, obsolete radiata; dentibus cardinalibus parviusculis, compressis, acuminatis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subrectisque; margarita vel albida vel dilute purpurea et valde iridescente.

Shell smooth, quadrate, inflated, very inequilateral; valves somewhat thick, thicker before; beaks a little prominent, closely and minutely undulate at the tips; epidermis reddish brown, obscurely radiate; cardinal teeth rather small, compressed, acuminate, crenulate and double in both valves; lateral teeth long, lamellar and nearly straight; nacre whitish or pale purple and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab.—River Orontes, Syria, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .8, Length 1, Breadth 1.8 inches.

Shell smooth, quadrate, inflated, very inequilateral; substance of the shell somewhat thick, thicker before; beaks somewhat prominent, closely and minutely undulate at the tips; ligament rather short and brown; epidermis reddish brown, dark on the posterior slope, obscurely rayed, with four or five rather distant marks of growth; umbonial slope somewhat raised and rounded; posterior slope rather broad and somewhat carinate; cardinal teeth rather small, compressed, crenulate and double in both valves; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed on the upper part of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather shallow and obtusely angular; nacre whitish with a very pale purplish hue posteriorly.

Remarks.—Two specimens of this rather small species are before me. The beaks are beautifully sculptured over all the upper part, the undulations being very regular and very distinct. It reminds one of *Batavus*, Lam., but it is quadrate, while *Batavus* is oval and disposed to obliqueness. It is more inflated in the middle and the undulations of the beaks are finer and more numerous. The anterior portion of both specimens is white while the posterior is faintly purplish and very iridescent. One of them is slightly salmon colored in the cavity of the beaks. In outline it is near to *Bruguierianus*, Bourg., but it is rather more quadrate, more inflated, of a darker color, and has undulations at the tips which are not mentioned by M. Bourguignat in his species. His *M. Vescoi* and *Schwerzenbackii* have raised striæ on the beaks, but the character of them is totally different from *Orontesensis*.

UNIO BOURGUIGNATIANUS. Pl. 18, fig. 51.

Testa lævi, obliqua, inflata, inæquilaterali, ad latere parum planulata; valvulis percrassis, antice crassioribus; natibus prominentibus, tumidis; epidermide straminea, eradiata; dentibus cardinalibus magnis, erectis, in utroque valvulo duplicibus, subcompressis, corrugatis crenulatisque; lateralibus prælongis, crassis, corrugatis subcurvisque; margarita alba et valde iridescente.

Shell smooth, oblique, inflated, inequilateral, somewhat flattened at the side; valves very thick, thicker before; beaks prominent, swollen; epidermis straw color, without rays; cardinal teeth large, erect, and double in both valves, compressed, rough and crenulate; lateral very long, thick, corrugate and somewhat curved; nacre white and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 189.

Hab.—Tigris River at Mosul, Asia Minor, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. 1·1,

Length 1·6,

Breadth 2·9 inches.

Shell smooth, oblique, inflated, inequilateral, slightly flattened at the side, round

before and biangular behind; substance of the shell very thick, thicker before; beaks prominent, swollen; ligament rather short and thick; epidermis straw yellow; without rays, with distant marks of growth; umbonial slope raised and obtusely angular; posterior slope broad, flattened, with two obscure impressed lines in each valve from the beaks to the posterior margin; cardinal teeth large, erect, rather compressed, corrugate, crenulate and double in both valves; lateral teeth very long, thick, corrugate and somewhat curved; anterior cicatrices distinct, large and deeply impressed; posterior cicatrices distinct, large and well impressed; dorsal cicatrices placed on the upper side of the cavity of the beaks and on the cardinal tooth; cavity of the shell deep and wide; cavity of beaks rather deep and obtusely angular; nacre white, satin-like and very iridescent.

Remarks.—Two specimens only of this fine species are before me, but they are very perfect. It is allied to *dignatus* on one side and *vasus*, both herein described, on the other, but need not be confounded with either. It is not so oblique as the former nor so transverse as the latter. It is biangular behind which neither of the others are. It does not seem to have any undulations on the tips. Although the epidermis is removed from the tips they appear to be otherwise perfect, and I cannot find a trace of undulation. The marks of growth are very dark and are very distant. This specimen has four. I have great pleasure in naming this species after M. J. R. Bourguignat, who has described so many new species of *Unionidæ* from Asia Minor, in the “Voyage autour de la mer morte par De Sauley,” and in the “Revue et Magazin de Zoologie.”

UNIO DAMASCENSIS. Pl. 18, fig. 52.

Testa lævi, quadrata, compressa, valde inæquilaterali; valvulis crassiusculis, antice crassioribus; natibus prominulis, ad apices crebre et oblique undulatis; epidermide luteo-viridi et obsolete radiata; dentibus cardinalibus parviusculis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis rectisque; margarita argentea et iridescente.

Shell smooth, quadrate, compressed, very inequilateral; valves somewhat thick, thicker before; beaks a little prominent, closely and obliquely undulate at the tips; epidermis yellowish green and obscurely rayed; cardinal teeth rather small, compressed, crenulate and double in both valves; lateral teeth long, lamellar and straight; nacre silver white and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab.—River Barada, Damascus, Asia Minor, C. M. Wheatley.

Cabinet of Mr. Wheatley.

Diam. .6,

Length .9,

Breadth 1.6 inches.

Shell smooth, quadrate, compressed, very inequilateral; substance of the shell somewhat thick, rather thicker before; beaks slightly prominent, closely and obliquely

undulate for some distance; ligament long, narrow and light brown; epidermis yellowish green, obscurely rayed, with very distant marks of growth; umbonial slope but little raised, rounded; posterior slope very much compressed, carinate, with two slightly impressed lines in each valve, from the tips to the posterior margin; cardinal teeth rather small, compressed, crenulate and double in both valves; lateral teeth long, lamellar and straight; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent rather large and slightly impressed; dorsal cicatrices placed on the upper part of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks shallow and obtusely angular; nacre silver white and iridescent.

Remarks.—A single specimen only is before me. It cannot be confounded with any species from Asia Minor I have seen. In outline and color of the epidermis it is very much like some of our half grown white varieties of *M. complanatus*, but the system of undulations of the beaks is totally different. These undulations cover a large space as they do in *Orontesensis*, herein described, but there is a marked difference in this characterization between the two, the *Orontesensis* having the undulations crimped, irregular and subconcentric, while *Damascensis* has them crimped on the anterior part, oblique and paralleled on the middle, and angular on the umbonial slope. There is a well marked line of growth on the middle of the disk, but if this species grows larger, as I believe it probably does, there may be additional ones on them.

UNIO SYRIACUS. Pl. 19, fig. 53.

Testa sulcata, subelliptica, inflata, valde inæquilaterali; valvulis subtenuibus, antice incrassatis; natibus prominentibus, tumidis; epidermide tenebroso-olivacea, eradiata; dentibus cardinalibus parvis, acuminatis, subcompressis, in utroque valvulo duplicibus; lateralibus parviusculis, lamellatis subcurvisque; margarita albida et iridescente.

Shell sulcate, subelliptical, inflated, very inequilateral; valves rather thin, thickened before; beaks prominent, swollen; epidermis dark olive, without rays; cardinal teeth small, pointed, somewhat compressed and double in both valves; lateral teeth rather small, lamellar and somewhat curved; nacre whitish and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 189.

Hab.—River Orontes, Syria, C. M. Wheatley.

Cabinet of Mr. Wheatley.

Diam. .6,

Length .8,

Breadth 1.2 inches.

Shell sulcate, subelliptical, nearly straight at the base, inflated, very inequilateral; substance of the shell rather thin, thickened before; beaks prominent, swollen; ligament short and thick; epidermis dark olive, inclining to brown, without rays,

with rather distant marks of growth and with rather indistinct and irregular furrows; umbonial slope inflated and obtusely angular; posterior slope rather broad and scarcely carinate; cardinal teeth small, acuminate, rather compressed, double in both valves; lateral teeth rather small, lamellar and slightly curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices distinct, moderately well impressed and rather large; dorsal cicatrices placed on the upper part of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks rather deep and angular; nacre white before and slightly tinted with salmon color behind.

Remarks.—A single specimen only of this little species was sent to me by Mr. Wheatley. It has all the appearance of being adult. It is so much eroded that the character of the beaks and the posterior slope cannot be perfectly ascertained. It is unlike all other species I have seen from Asia Minor. In outline it is somewhat like a stunted variety of *Batavus*. There is no appearance of rays in this specimen, but perfect specimens may perhaps present them. The furrows are stronger over the posterior half, but are irregular and imperfect.

UNIO TRIPARTITUS. Pl. 19, fig. 55.

Testa sulcata, subelliptica, subinflata, subæquilaterali; valvulis crassis, antice crassioribus; natibus prominentibus, solidis, parum undulatis; epidermide viridi-lutea, obsolete radiata, micante; dentibus cardinalibus crassis, valde corrugatis, in utroque valvulo duplicibus; lateralibus curvatis, percrassis, valde corrugatis et in valvulo sinistro tripartitibus; margarita dilute salmonia et elegantissime iridescente.

Shell sulcate, subelliptical, somewhat inflated, subequilateral; valves thick, thicker before; beaks prominent, solid, somewhat undulate; epidermis greenish yellow, obscurely radiate, shining; cardinal teeth thick, corrugate and double in both valves; lateral teeth curved, corrugate, very thick and in the left valve tripartite; nacre slightly salmon and richly iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab.—Jillingee River, India, M. Burrough, M. D.

My cabinet.

Diam. 1·1, Length 1·5, Breadth 2·4 inches.

Shell sulcate, subelliptical, somewhat inflated, subequilateral; substance of the shell thick, thicker before; beaks prominent, solid and somewhat undulate at the tips; ligament rather thick, short and light brown; epidermis greenish yellow, obscurely radiate and shining, and with two or three distant marks of growth; umbonial slope raised and rounded; posterior slope rather wide, greenish, with three rays from the beaks to the posterior margin on each valve; cardinal teeth thick, corrugate, double in both valves; lateral teeth curved, corrugate, very thick,

double in the right and treble in the left valve; anterior cicatrices distinct, rather large and very deeply impressed; posterior cicatrices confluent, large and well impressed; dorsal cicatrices placed on the upper part of the cavity of the beaks; cavity of the shell wide and somewhat deep; cavity of the beaks deep and obtusely angular; nacre pale salmon color, rich, satin-like and very iridescent.

Remarks.—A single specimen of this species has been a long time in my possession. It was brought by Dr. Burrough from India, among the many fine and rare shells he so frequently procured during his voyages and his residence in India. Recently I procured two specimens from a dealer, which are slightly thicker than the other. I had always considered the specimens brought by Dr. Burrough as a large variety of *corrugatus*, Retz., although there were but few corrugations on them. My new acquisitions satisfy me that the species is certainly distinct. The three specimens above mentioned are much larger and thicker, and weigh three times as much; they are sulcate, which *corrugatus* is not, and they are also of a broader oval; and what separates them conclusively from *corrugatus*, and all other species with which I am acquainted, except one, the *trifidus* (nobis) from Buenos Ayres, is the tripartite lateral tooth. In *trifidus* the treble tooth is in the *right* valve, while in *tripartitus* it is in the *left* valve. The upper division of the cardinal teeth is compressed, while the lower is deeply and beautifully corrugate. In all the valves before me there is an indistinct ventral cicatrix, and the curve of the basal margin is slightly protruded. The nacre is among the richest I have ever seen. The color of the epidermis of the specimen from Dr. Burrough is brownish above and yellowish green below. On the other two bright straw yellow prevails, being greenish above. The habitat of Dr. Burrough is certainly Jillingee River, but those specimens bought from a dealer, while evidently from India, may not be from that river.

UNIO DELICATUS. Pl. 19, fig. 56.

Testa lævi, elliptica, subinflata, inæquilaterali; valvulis subtenuibus; natibus prominulis, ad apices undulatis et granulatis; epidermide straminea, cradiata; dentibus cardinalibus parvis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus sublongis, lamellatis rectisque; margarita albida et iridescente.

Shell smooth, elliptical, somewhat inflated, inequilateral; valves rather thin; beaks a little prominent, undulate and granulate at the tips; epidermis straw-color, without rays; cardinal teeth small, compressed, crenulate and double in both valves; lateral teeth rather long, lamellar and straight; nacre whitish and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 189.

Hab.—River Orontes, Syria, C. M. Wheatley.

Cabinet of Mr. Wheatley.

Diam. .42,

Length .60,

Breadth 1.01 inches.

Shell smooth, elliptical, somewhat inflated, inequilateral; substance of the shell rather thin; beaks slightly prominent, undulate at the tips and slightly granulose; ligament short and thin; epidermis straw-yellow, shining and without rays; umbonial slope slightly raised and rounded; posterior slope narrow elliptical, with two obscure impressed lines in each valve from the beaks to the margin; cardinal teeth small, compressed, crenulate and double in both valves; lateral teeth rather long, lamellar and straight; anterior cicatrices distinct, rather small and slightly impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed on the upper side of the cavity of the beaks; cavity of the shell rather deep and rounded; cavity of the beaks shallow and obtusely angular; nacre whitish, inclining to salmon, and iridescent.

Remarks.—This is a small delicate shell, unlike any other I have seen from Asia Minor. A single specimen only was received and this may not be adult. There is but a single mark of growth and that is near the margin. The beaks are perfect and exhibit two rows of granules. In the outline it is very regularly oval, having somewhat the aspect of a young *ochraceus*, Say, but they differ altogether in the system of undulations of the tips.

Most of the species from Asia Minor described in this paper were received by Mr. Wheatley through the Rev. E. R. Beadle, of Hartford.

UNIO NATALENSIS. Pl. 20, fig. 57.

Testa plicata, antice sulcata, oblonga, ad latere planulata, valde inæquilaterali, antice rotundata, postice obtuse angulata; valvulis subcrassis, antice aliquanto crassioribus; natibus subprominentibus, acuminatis, ad apices undulatis; epidermide luteola, eradiata; dentibus cardinalibus compressis, obliquis corrugatisque; lateralibus longis, lamellatis subcurvisque; margarita dilute salmonia-colore tincta et valde iridescente.

Shell folded, sulcate before, oblong, flattened at the sides, very inequilateral, rounded before and obtusely angular behind; valves rather thick, somewhat thickened before; beaks somewhat prominent, acuminate and undulate at the tips; epidermis yellowish, without rays; cardinal teeth compressed, oblique and corrugate; lateral teeth long, lamellar and somewhat curved; nacre pale salmon color and very iridescent.

Proc. Acad. Nat. Sci., 1864, p. 113.

Hab.—Umpingave River, Port Natal, South Africa, Rev. J. McKen.

Cabinet of the Academy of Natural Sciences.

Diam. .54,

Length .80,

Breadth 1.60 inches.

Shell folded, sulcate beyond the folds, oblong, flattened at the sides, very inequilateral, rounded before and obtusely angular behind; substance of the shell rather

thick, somewhat thickened before; beaks somewhat prominent, acuminate and undulate at the tips; ligament light brown, somewhat thick and short; epidermis yellowish, without rays and with rather distant marks of growth; umbonial slope somewhat raised and obtusely angular; posterior slope narrow elliptical and nearly covered with small folds and corrugations; cardinal teeth compressed, corrugate, crenulate and oblique; lateral teeth long, lamellar, somewhat curved, single in the right and double in the left valve; anterior cicatrices small, distinct and well impressed; posterior cicatrices large, confluent and very slightly impressed; dorsal cicatrices placed within the cavity and near the base of the cardinal tooth; cavity of the shell rather shallow and wide; cavity of the beaks rather shallow and obtusely angular; nacre pale salmon color, satin-like and very iridescent.

Remarks.—A single specimen only of this pretty little species was received by the Academy. It is very nearly allied to *fluctiger*, (nobis,) but it is a wider and larger species, and differs in the form of the folds. Those in *fluctiger* combine near the middle of the valve, and form angles pointing to the base of the shell, while those of *Natalensis* combine on the umbonial slope and point to the posterior basal margin. In outline it seems to be the same with *U. Africanus*, (nobis,) but the specimen from which the description of *Africanus* was made has only a few undulations at the beaks, which induced me to place it with the smooth group of *Uniones*. When full suites may be obtained it is possible they may prove to be the same. In the specimen of *Natalensis* before me the nacre is very rich, soft and satin-like, and the small exterior undulations are plainly visible on the inside.

UNIO PARAMATTENSIS. Pl. 20, fig. 59.

Testa crebre et leviter sulcata, elliptica, subinflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominulis, ad apices radiis undulatis; epidermide tenebroso-fusca, nigricante, eradiata; dentibus cardinalibus parvis, valde compressis, obliquis, valvulo dextro duplicibus; lateralibus prælongis, lamellatis subrectisque; margarita alba et valde iridescente.

Shell closely and finely sulcate, elliptical, somewhat inflated, very inequilateral, obtusely angular behind and rounded before; valves somewhat thick, slightly thicker before; beaks a little prominent, with radiating undulations at the tips; epidermis dark brown, blackish, without rays; cardinal teeth small, much compressed, oblique and double in the left valve; lateral teeth very long, lamellar and nearly straight; nacre white and very iridescent.

Proc. Acad. Nat. Sci., 1862, p. 176.

Hab.—Paramatta River, New South Wales, Smithsonian Institution.

My cabinet and cabinet of the Smithsonian Institution.

Diam. .7,

Length 1.1,

Breadth 2.2 inches.

Shell closely and delicately sulcate, elliptical, somewhat inflated, very inequilateral, obtusely angular behind and rounded before; substance of the shell a little thick, somewhat thicker before; beaks slightly prominent, with radiating undulations at the tips; ligament rather long, thin and dark brown; epidermis dark brown, nearly black, without rays and with rather distant marks of growth; umbonial slope raised and rounded; posterior slope narrow, elliptical, carinate, with obscure impressed lines from the beaks to the posterior margin; cardinal teeth small, very much compressed, oblique, abrupt at the end, *single* in the *left* and *double* in the *right* valve; lateral teeth very long, lamellar and nearly straight; anterior cicatrices confluent, rather small and slightly impressed; posterior cicatrices confluent, rather large and very slightly impressed; dorsal cicatrices in a row across the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks very shallow and rounded; nacre white and very iridescent.

Remarks.—Several specimens were among the shells sent to me by the Smithsonian Institution for examination. Like many Asiatic species, it has the double cardinal tooth in the right and the single one in the left valve. In the lateral tooth of the left valve the upper branch is very much the smaller. The undulations of the tips of the beaks do not diverge from the apical point, as is usual with the South American species, but two sets meet in the centre and form an angle. In outline this species is very close to *U. Wilsonii*, (nobis,) but the two species differ much in color of epidermis and in the beaks.

UNIO PAZIL. Pl. 21, fig. 60.

Testa lævi, obliqua, antice inflata, valde inæquilaterali, postice acuto-angulata et attenuata, antice rotundata; valvulis crassiusculis, postice aliquanto crassioribus; natibus tumidis, subterminalibus; epidermide olivacea, obsolete radiata et transverse late vittata; dentibus cardinalibus longis, lamellatis, valde obliquis corrugatisque; lateralibus prælongis, obliquis, lamellatis corrugatisque; margarita vel alba vel cærulea et valde iridescente.

Shell smooth, oblique, inflated before, very inequilateral, acutely angular and attenuate behind, rounded before; valves somewhat thick, slightly thicker before; beaks swollen and nearly terminal; epidermis olivaceous, obscurely rayed and transversely broadly banded; cardinal teeth long, lamellar, very oblique, corrugate; lateral teeth very long, oblique, lamellar and corrugate; nacre white or bluish and very iridescent.

Proc. Acad. Nat. Sci., 1862, p. 176.

Hab.—China, Don Patricio Maria Paz, of Madrid; Siam, W. D. Hartman, M. D.

My cabinet and cabinets of Don P. M. Paz and Dr. Hartman.

Diam. .9,

Length 1.1,

Breadth 2.4 inches.

Shell smooth, oblique, inflated before, very inequilateral, acutely angular and attenuate behind, rounded before; substance of the shell somewhat thick, slightly thicker before; beaks swollen and nearly terminal; ligament long, rather thin and brown; epidermis rather dark olive, with indistinct rays over nearly the whole disk, usually with two broad, distant, yellowish bands marking the lines of growth; umbonial slope obtusely angular and very oblique; posterior slope very narrow, dark green, with two indistinct raised lines on each valve from the beaks to the margin; cardinal teeth long, lamellar, very oblique, corrugate, single in the left and double in the right valve; lateral teeth very long, oblique, lamellar and corrugate; anterior cicatrices distinct, large and moderately well impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices small and placed above the centre of the cavity of the beaks; cavity of the shell deep; cavity of the beaks rather deep and wide; nacre white or bluish, very rich and very iridescent.

Remarks.—I have three specimens of this interesting species before me. It was first called to my attention by Don P. M. Paz, who procured several specimens in Europe and brought them, kindly, to this country, to submit to me. I have great pleasure in giving it the name of that zealous zoologist. Subsequently Dr. Hartman submitted some specimens to me. To both these gentlemen I am indebted for specimens of this very interesting species. All those which I have seen are more or less worn at the tips of the beaks, and therefore the characters of the undulations, if there be any, cannot be described. In one of the specimens there is a slight appearance of transverse undulations. The beaks are nearly terminal, and the swelling is enlarged anteriorly over the disk. All these specimens have but three lines of growth, which of course are very distant. They are broad, yellowish and very distinct. Two of the specimens have a rich satin-like pearly lustre; the third is bluish white, and not satin-like. It belongs to that group of oblique species which have long, oblique cardinal teeth, *single* in the *left* and *double* in the *right* valve, of which *tumidulus*, (nobis,) from Siam, may be considered the type. It may be at once distinguished from it by being a wider and thinner species, and having a darker and smoother epidermis. It is very nearly of the same outline as *Tigris*, Fer., from Bagdad, but that is a much smaller species, with a brown polished epidermis, and differs totally in the cardinal teeth, which in *Tigris* are not lamellar or oblique, but double in the left valve. It is closely allied to *Ingallsianus*, (nobis,) but it is a larger species, with more terminal beaks and much greater inflation of the anterior half of the shell. It will be observed above that two habitats (China and Siam) are given. I think it probable that they are from China only.

UNIO LAOSENSIS. Pl. 21, fig. 61.

Testa lævi, arcuata, in medio compressa, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis; natibus prominulis, subcompressis; epidermide tenebroso-fusca vel rufo-fusca, postice obsolete radiata; dentibus cardinalibus parvis, striatis, lobatis; lateralibus longis, corrugatis subrectisque; margarita alba et iridescente.

Shell smooth, arcuate, compressed in the middle, very inequilateral, rounded before and behind; valves somewhat thick; beaks a little prominent and somewhat compressed; epidermis dark brown or reddish brown, obscurely rayed behind; cardinal teeth small, striate and somewhat lobed; lateral teeth long, somewhat rough and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab —Laos Mountains, Cambodia, Siam, Mons. Mouhot, per H. Cuming, Esq.

My cabinet and cabinets of Mr. Cuming and Mr. Wheatley.

Diam. .9, Length 1.2, Breadth 3 inches.

Shell smooth, arcuate, compressed in the middle, very inequilateral, rounded before and behind, disposed to be sulcate before; substance of the shell somewhat thick; beaks a little prominent and somewhat compressed; ligament long and light brown; epidermis dark brown or reddish brown, obscurely rayed behind and with distant marks of growth; umbonial slope slightly raised and rounded; posterior slope long and narrow, slightly carinate, and with a single dark ray from the beaks to the posterior margin on each valve; cardinal teeth small, striate and somewhat lobed; lateral teeth long, somewhat rough and nearly straight; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices distinct, large and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; ventral cicatrices small and dotted over the middle of the disk; cavity of the shell wide and shallow; cavity of the beaks rather shallow and obtusely angular; nacre white and iridescent.

Remarks.—This new *Unio* was sent with two other species for my inspection by Mr. Cuming. These were *U. Myersianus*, (nobis,) and *U. Sumatrensis*, (nobis.) There were two specimens only of this new species, which is interesting from its form, and which differs much from any I have seen from Asia. Indeed it very closely resembles in outline two *Unionidæ* from Europe, viz.: *Unio crassus*, Retz., and *Margaritana margaritifera*, (Shum.,) the latter being also an inhabitant of the Northern United States and Oregon. It is a thinner and wider shell than *crassus*, with much less thick teeth, but has an epidermis very much like it. The outline is very close to some varieties of *margaritifera*, and so is the cardinal tooth, and like it it has dotted ventral cicatrices. In both the specimens before me the nacre under the cardinal teeth is irregularly deposited, and in the cavity of the beaks it is dis-

posed to be salmon color. Both the specimens gap anteriorly, and the basal and anterior margins are reddish at the edge of the nacre.

SPATHA NATALENSIS. Pl. 20, fig. 58.

Testa subsulcata, oblonga, compressa, subnitida, valde inæquilaterali, ad latere planulata, antice rotunda, postice rotundata; valvulis crassiusculis, antice aliquanto crassioribus; natibus vix prominulis, ad apices minute undulatis; epidermide tenebroso-rufo-fusca, eradiata; margarita purpurea et valde iridescente.

Shell subsulcate, oblong, compressed, somewhat shining, very inequilateral, flattened at the side, round before and rounded behind; valves somewhat thick, slightly thicker before; beaks slightly prominent and minutely undulate at the tips; epidermis dark reddish brown, without rays; nacre purple and very iridescent.

Proc. Acad. Nat. Sci., 1864, p. 113.

Hab.—Umpingave River, Port Natal, South Africa, Rev. J. McKen.

My cabinet and cabinet of the Academy of Natural Science.

Diam. .9, Length 1·7, Breadth 3·5 inches.

Shell subsulcate, oblong, compressed, somewhat shining, very inequilateral, flattened at the sides, round before and rounded behind; substance of the shell somewhat thick, slightly thickened before; beaks very slightly raised and minutely undulate at the tips; ligament long, rather thin, dark brown and nearly concealed; epidermis dark reddish brown, without rays, with distant marks of growth; umbonial slope flattened and without any angle; posterior slope very narrow and long, and with three rather broad lines on each valve from the tip to the posterior margin; anterior cicatrices distinct, very large and well impressed; posterior cicatrices distinct, slightly impressed, the inferior very large; dorsal cicatrices rather large, well impressed and placed near to the centre of the cavity of the beaks; cavity of the shell very shallow and very wide; cavity of the beaks very small, scarcely observable; nacre purple and very iridescent.

Remarks.—Several specimens of this new *Spatha* were given to the Academy by the Rev. J. McKen, connected with the Missionary establishment at Port Natal. On first examining it I supposed it might be a strong variety of *S. rubens* (*Iridina Lam.*,) being far removed from the habitats of the Senegal and the Nile, but that is a larger shell and much heavier, as well also differing in being elliptical. The undulations of the tips of the beaks are also in *rubens* still more minute and can only be seen at the very tips or points. The epidermis is also smooth and green, while in *Natalensis* it is dark reddish brown and sulcate. In this species the muscular scars are all large, as is usual in the *Spathæ* and *Iridinæ*, and the posterior great scar, has a ridge on each side of the line of increment along the line of displacement. All the specimens

which I have examined are slightly inequivalve, having the right valve very slightly over-wrapping the left about the region of the beaks. This is caused by a slight thickening and elevation on the edge of the left valve under the point of the beaks, which meets with a corresponding depression in the right. The same condition is perfectly observable in the *Spatha rubens*, which are perfect.

MONOCONDYLÆA MOUHOTIANA. Pl. 21, fig. 62.

Testa lævi, ovata, compressa, valde inæquilaterali, antice rotunda, postice subbiangulata; valvulis tenuibus; natibus prominulis; epidermide luteo-fusca, eradiata; dentibus cardinalibus parvissimis, lobatis; margarita albida et valde iridescente.

Shell smooth, ovate, compressed, very inequilateral, rounded before, subbiangular behind; valves thin; beaks a little prominent; epidermis yellowish brown, without rays; cardinal teeth very small, lobed; nacre whitish and very iridescent.

Proc. Acad. Nat. Sci., 1863, p. 190.

Hab.—Laos Mountain, Cambodia, Siam, Monsieur Mouhot, per H. Cuming, Esq.

My cabinet and cabinet of Mr. Cuming.

Diam. .7, Length 1.3, Breadth 2.5 inches.

Shell smooth, ovate, compressed, very inequilateral, rounded before, subbiangular behind; substance of the shell thin; beaks slightly prominent; ligament long, thin and brown; epidermis yellowish brown, with three or four distant marks of growth; umbonal slope very slightly raised and rounded; posterior slope very narrow, raised into a carina; cardinal teeth very small, lobed; anterior cicatrices distinct, rather large and slightly impressed; posterior cicatrices confluent, large and scarcely perceptible; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell very shallow and wide; cavity of the beaks very shallow and rounded; nacre whitish and very iridescent.

Remarks.—Two specimens of this new species were sent to me, very kindly, by Mr. Cuming. They differ in the smaller being higher in the carina, almost forming a wing, and in the posterior slope being without color while the larger is there nearly covered with green. Both specimens have small obscure undulations on the umbonal slope. Specimens may be found with this character more developed. In outline it is very near to *Monocondylæa Saulcyi* (Unio) Bourg. It is also near to *M. Bonellii* (Unio) Fer. It differs from the latter in being less transverse, in having a higher carina and in having the beaks more medial. I dedicate this species to Monsieur Mouhot, a very indefatigable collector, who fell a sacrifice to his ardor in collecting eight hundred miles from the coast. Among five or six species of *Unionidæ* procured by him two were new, and it is but justice to him that one should bear his name.

ART. II.—*On the Structures and Distribution of the Genera of the Arciferous Anura.*

By EDWARD D. COPE.

ARCIFERA.

Acromials and coracoids divergent, the former directed forward and connected with the latter by a longitudinal arched cartilage, which is free from and overlapped by the corresponding cartilaginous arch of the opposite side. Teeth on the upper jaw; tongue present. Tubæ Eustachii not overarched so as to be prolonged towards the median line.

In this tribe the extremes of the series are more diverse than in the others, and depend on the following features:

- (1.) In that nearest the Aglossa, the vertebræ are like those of the latter and of the Salamanders, concave posteriorly and convex anteriorly: in the other extreme the reverse. These features are not as irreconcilable as might at first sight appear, as the intervertebral spheres do not become firmly attached to either centrum at maturity in some individuals of *Borborocaetes peronii*, *Pelobates fuscus* (Stan-
nius) and *Cultripes provincialis* (Dugès).
- (2.) Those with opisthocœlian vertebræ agree with the bulk of the tribe in possessing dilated sacral diapophyses, whilst those at the other extreme exhibit them cylindrical.
- (3.) A few of the former possess small ribs, and (4) approach the normal condition of the so-called coccygeal vertebræ in possessing one pair of transverse processes;
- (5.) most of these, with the adjoining less extreme forms, have a vertical or cat-like pupil.
- (6.) Many

* The material from which the observations in this contribution, and that on the special characters of the Squamata (Proc. Acad. Phila. 1864, 224) were made, is that of the principal osteological collections of Europe, and alcoholic collections of Washington, Philadelphia, Berlin, London, Paris and Vienna. Vide Günther Zoolog. Record, 1864, where an inaccurate report of the latter article is given.

I may mention here an inadvertent omission in the memoir on Squamata, of a known distinctive feature between the Lacertilia and Ophidia; they should be contrasted thus:

Lacertilia.

Continuity of parietal and sphenoid walls interrupted.
Palatines united by suture with maxillaries and vomer.
Rami of the mandible united by suture.

Ophidia.

Continuity of parietal and sphenoid walls complete.
Palatines not in contact with maxillaries and vomer.
Rami of mandible united by ligament.

of the same group exhibit a degraded or obliterated auditory apparatus; but this feature is not uniformly coincident with the preceding ones. (7.) The xiphisternum is formed of divergent limbs; in the bulk of the tribe it is an emarginate cartilaginous plate, and in the opposite extreme an osseous style, as in the Ranidæ.

Of these features, the first, third, fourth and sixth are agreements with, or approximations to the structures of the same elements of the Salamanders; the resemblances are borne out in the physiology of the same types.

In the observed examples of the above types, that is, of the Discoglossidæ, Pelodytidæ and Scaphiopodidæ, the eggs are deposited in small clusters, (Pelodytes), a short thick loop, (Pelobates), or in a series with a slender, tough, thread-like attachment, (Alytes). In the family following that of the Pelobates, that is, the New World tree-toads, the eggs are, in the only Old World species,—*Hyla arborea*,—deposited in globular masses, as among the Ranidæ, but much smaller; while in our *Hyla pickeringii* the masses include but from four to ten eggs. In the first mentioned forms, the male seizes the female in front of the arms, while in the remaining and major number of species, as well as in the observed Raniformia and Bufoniformia, she is seized round the axillæ.

In respect to the deposition of eggs, the peculiarity mentioned is an approximation to the mode observed by the Salamanders, which are deposited singly in the water (Triton, *Notophthalmus*)* on leaves, or on the land, connected by a tough thread (*Desmognathus*). Salamanders also seize the female in advance of the arms, but with the *hind* limbs; (*Notophthalmus*, Triton).

Additional peculiarities in the development of Alytes, Pelodytes,† *Cultripes* and *Pelobates* are, that they spawn at two seasons instead of one, and that their larvæ attain a larger size than those of other Anura before completing their metamorphosis. This latter feature is, however, repeated near the other end of the series—among those with cylindrical pelvic supports, in the genus *Pseudis*. What the significance of these peculiarities is, and what their coördination with structural characters, is not yet known.

The occurrence of a xiphisternal style similar to that of the Ranidæ, may be regarded as an indication of superiority, not only in consideration of this affinity, but as a greater degree of specialization and ossification of the part. It appears, however, not merely among the most Raniform Arcifera, but among some with procoelian vertebræ, which have the salamander-like mode of reproduction, and also among some of the opisthocœlian species.

* *Notophthalmus viridescens* lays its eggs singly on leaves, e. g., at the union of the capillary segments of *Myriophyllum*, or along their length, pressing them together on the egg as it is deposited. They adhere closely to its gelatinous surface, and serve to conceal it.

† Thomas, *Ann. Sci. Nat.* 1854, 290.

The seven natural families are characterized as follows :

I. Sacral diapophyses dilated; vertebræ opisthocælian.

Ribs; xiphisternum of two divergent limbs; usually fronto-parietal fontanelle and coccygeal diapophyses; outer metatarsi separated by web, Discoglossidæ.

No ribs or coccygeal diapophyses; usually complete frontoparietals, and single coccygeal condyle: xiphisternum an osseous style; external metatarsi bound, Asterophrydidæ.

II. Sacral diapophyses dilated; vertebræ procoelian.

Terminal phalanges simple conic continuous; coccyx united by condyles, Pelodytidæ.

Terminal phalanges continuous conic; coccyx connate with sacrum, Scaphiopodidæ.

Terminal phalange with a swollen base and slender curved claw-like termination, articulated beneath the penultimate; coccyx united by condyles, Hylidæ.

III. Sacral diapophyses cylindric; vertebræ procælian.

Mandible bearing teeth, Hemiphractidæ.

Mandible edentulous; external metacarpals usually bound together, rarely free, Cystignathidæ.

The only family features as above given, which seem to have a functional significance, are the structure of the terminal phalanges as an adaptation to arboreal life in the Hylidæ, and the increase of raptorial power by the addition of another set of teeth in the Hemiphractidæ. Yet for the first mentioned function how many other arrangements are employed among other genera?

We are at present acquainted with 265 species of this tribe, which represent 69 generic types: they represent the families in the following proportions and regions:

| | Gen. | Sp. | Distribution. |
|---------------------------|------|----------------|---|
| Discoglossidæ, | 5 | 6, | R. Palæarctica. |
| Asterophrydidæ, | 4 | 5, | R. Palæotropica, Australis. |
| Pelodytidæ, | 2 | 2, | R. Palæotropica; Palæarctica. |
| Scaphiopodidæ, | 5 | 9, | R. Palæarctica, Nearctica. |
| Hylidæ, | 17 | 132, | (R. Palæotropica) R. Palæarctica, Nearctica, Neotropica, Australis. |
| Hemiphractidæ, | 1 | 2, | R. Neotropica. |
| Cystignathidæ, | 35 | 109, | R. Neotropica; Australis. |

The generic forms are all peculiar to their zoological regions, except Hyla, found wherever its family occurs, and Borborocætes, common to Australia and the southern portion of South America.

The number of species so far known to inhabit these regions is as follows :

| | | | |
|------------------|-------|------------------|-------|
| Regio Australis, | 39, | R. Palæarctica, | 9, |
| R. Neotropica, | 176, | R. Æthiopica, | 0, |
| R. Nearctica, | 25, | R. Palæotropica, | 7, |
| | <hr/> | | <hr/> |
| | 240, | | 16. |
| In two regions, | 1, | In two regions, | 2. |

The small proportion of species occurring in the old world, exclusive of Australia, is evident, though they represent five families, while those of the new world represent but four.

The slight attachment of the integuments to the muscles is a well known feature of the *Batrachia Anura*. The manner of this attachment presents many varieties in the different groups. The typical arrangement is uniform among the *Raniformia*, but reappears frequently among the other groups; it is as follows: A transverse partition of connective tissue holds the integument along the acromials, and another along the coracoids; a longitudinal band on each side of the back (frequently marked externally by a glandular fold) and one below it on each side of the abdomen. A band or line along the hinder inferior face of the thighs extending nearly to the popliteal region, and a delicate one along the upper hinder face of the same, from the groove between the superior and posterior muscles.

Among *Bufoniformia* the attachments are similar to the last in the *Dendrobatidæ*, in *Paludicola* and in *Brachycephalus*. In *Engystoma ovale* the lateroventral line is broad, or composed of several series of fibres and laminæ, and in *E. carolinensis* it is composed of two septa. In *Pseudophryne* the dorso-lateral septum, as well as the last mentioned, is widened; *Phryniscus* is similar, except that the dorso-lateral is narrow posteriorly, but rapidly widening, meets its mate on the nape, forming a broad transverse attachment. In *Atelopus laevis* the integument between the dorso- and ventrolateral septa is attached, forming a broad lateral adherent band. In *Rhinophrynus dorsalis* this lateral attachment is carried so far as to leave only narrow free dorsal and ventral regions, while it is further peculiar in wanting the coracoid septum, as in *Discoglossus* and *Dactylethra*. *Epidalea*, *Bufo*, *Phrynoidis* and *Peltaphryne*, in their numerous species, add to the *Raniform* structure the attachment of the whole dorsal integument. The following table exhibits the other attachments:

Belly broadly free, very narrow lateroventral attachment: *B. haematiticus*, *leschenaultii*.

Do., broad lateroventral attachment: *B. americanus*, *lentiginosus*, *cognatus*, *chilensis*, *boreas*, *vulgaris*, *naricus*, sp. *Vera Paz*, *vallifrons*.

Do., posterior fourth or fifth abdomen attached: *gracilis*, *speciosus*, *pantherinus*.

Lateroventral attachment very broad, leaving but narrow free abdominal space: *B.*

coniferus, *quercinus*, *intermedius*, *punctatus*, *alvarius*, *diptychus*.

Ventral integument attached: *B. coccifer*, *insidiar*, *viridis*, *kelaartii* (posterior half attached.)

A considerable variety is exhibited by the families of the Arcifera. In the genera of Discoglossidæ examined (*Discoglossus* and *Bombinator*) the attachments are as in Ranidæ, except the absence of the coracoid septum, as in *Dactylethra*. On the contrary, in the Scaphiopodidæ, the integument is more or less entirely adherent above and below. The greater number, as well as typical forms of Hylidæ, add to the Raniform arrangement a close areolar attachment of the abdominal skin, while it is characteristic of many species of Cystignathidæ to possess one or two transverse, simple posterior abdominal septa. For the many variations and exceptions, see under the respective families.

Of the Aglossa, *Dactylethra* lacks the coracoid, and inferior femoral attachments; there is a double or treble but not wide lateral adhesion low down, which may be a combined dorsolateral and dorsoventral, or broad dorsoventral only. In *Pipa* all the attachments are wanting, except two closely approximated lateral lines, and a superior posterior and anterior inferior femoral.

The species of Arcifera, so far as known, exhibit some peculiar structures during the breeding season; either an extension of the natatory membrane, or the development of corneous plates or spurs, as aids to prehension. There is more variety and efficiency displayed in this point than among the Bufoniformia, but is in especial contrast to the apparent absence of all but the weakest modifications among the Raniformia. It is perhaps in compensation for the structure of the sternum, whose lateral halves being movable, offer a slighter basis of resistance for the flexor and extensor muscles of the fore limbs.

In the Discoglossidæ, *Bombinator* extends the natatory membrane in the male, but does not develop horny plates. In *Discoglossus* two file-like oval plates cover the superior surfaces of the short second digit, and the tubercle-like first, or thumb, which is here developed as in no other anurous batrachian. Dermal rugosities on the upper and under surfaces, including the gular region, are armed with corneous tips, as in *Telmatobius*. No peculiarity has been noticed in *Alytes*. The Asterophrydidæ are unknown.

In *Pelodytes* file-like plates are developed, one on the second and one on the third digit, one much larger on the forearm, one slightly smaller on the inside of the humerus, and a small one on each side of the breast.

Among Scaphiopodidæ the American species develop elongate laminae on the

superior inner face of the inner (second) third and even fourth digits. No peculiarities are recorded as appearing in the European species.

Many Hylidæ,—*Agalychnis*, *Trachycephalus*—develop a corneous shield on the inner superior aspect of the inner metacarpal, which is prolonged on the digit.

While no appendages of the season have been observed in some *Cystignathidæ*, in several genera two acute spurs appear on the superior aspect of the thumb, and rarely spur-like tubercles on the breast; the body is sometimes shielded with hardened points on the rugosities, or the lip surrounded by an arched series of corneous rugæ. In one species the arms themselves increase remarkably in thickness and bulk, especially the brachium.

With regard to the differences in the arrangement and structure of the internal organs, a great deal remains to be observed. Henle (*Anatomie des Kehlkopfes*) points out some inconsiderable differences in the form of the cartilages of the larynx. The size and number of the pulmonary cells vary considerably. Among Hylidæ, especially those species with a loud voice, they are fewer and larger than in *Discoglossidæ* and *Scaphiopodidæ*. The forms of the sinus, auricles, ventricle and *bulbus arteriosus*, the three aorta bows, of which the median form the aorta roots, etc., appear quite identical externally in the *Discoglossus*, *Scaphiopus*, and *Phyllomedusa*. Internally the two former present the known characters of the *Anura*, *i. e.*, the union of the distinct ducts of the 1st (pulmonary) and 2d (aortic) aorta bows throughout much of their length, the separate union of the two former and continuance on the left side of a high free septum of the *bulbus*, till they are finally turned over the right division toward the right, and have a common issue from the ventricle. A conic pocket valve is at the origin of the bifurcation of the *ductus communis* of the second and third aorta bows, but none in any part of the course of the pulmonary.

The form of the liver does not differ from the usual type in any of the various species examined. In the alimentary canal there appears to be little variety in important points. The stomach has generally a more longitudinal position than among *Bufo* forms, except among *Scaphiopodidæ* and in *Ceratophrys*, where it is equally transverse. No intestinal valves were observed in *Pelobates*, *Hyla*, *Phyllomedusa*, *Ceratophrys*, but a strong pyloric muscular constriction in *Pleurodema*, and one at the extremity of the small intestine in *Cystignathus pachypus*.

The testes are single in examples of all the types examined, and not strictly symmetrical; they are variously situated with reference to the kidneys. Thus in *Ranoidea aurea*, and *Trachycephalus lichenatus* they are elongate and at the middle of the length of the kidneys, while in *Hyla boans* and *Scytopus venulosus* they are oval and one or both at the anterior extremity of the latter. In *Phyllomedusa scleroderma* they are more than half the length of the broad

kidneys, the right originating at the anterior extremity of the latter, the left but little behind it; both have their posterior apices in close contact, at the posterior fourth of the length of the kidneys, which are in close connection for their posterior third. In *Discoglossus*, the testes are oviform, well separated, and anterior, and during the breeding season attain a remarkably large size. During the same in *Cystignathus pachypus*, they are not materially enlarged, are elongate, and only in contact with kidneys for a small posterior part of their length.

The ovaries and oviducts do not essentially vary among the Anura; when the latter are fully occupied by eggs in an advanced stage they are folded, but differently in the same species. The oviducts are remarkably slender in *Hyla nasuta* (*Litoria* Günther), and in *Scytopus venulosus*. The fontanelle is on each side behind the partial diaphragm, at the superior anterior outer angles of the liver; in several young female specimens of *Ranoidea aurea* of the size of *Rana silvatica*, in which the frontoparietal fontanelle is not closed, the oviducts do not extend further anterior than the ovaries; in adults, with the cranium complete, they have the usual extent. In *Gnathophysa ocellata** and *gigas* the "uterine" sacs at the exit of the oviducts are of great size and at certain seasons distended with an albuminous gelatine, when they present several convolutions. In spirits they occasion the presence of a large convoluted coagulated mass. In one specimen on one side this lay for the greater part of its length outside the abdominal muscles and above the lateroventral septum.

The tribe Arcifera was first defined and its extent and distribution indicated by the author in the *Natural History Review*, 1865, though explained a year previously at a meeting of the Zoological Society of London. The sternal feature characterizing it has been noticed by Steetzen, Cuvier and others in isolated cases, but its general significance not perceived: Dugès (*Recherches*, 64) attributes it to the tree-toads, the toads, and the Bombinator, *Alytes* and *Pelobates*. In Stannius'† *Zootomie der Amphibien* (73), it is assigned to the *Aglossa* and *Bufo*, as distinguished from *Rana* and *Cystignathus*. The characters of the last genus must have been taken from the Old World *Cassina* (formerly called *Cystignathus*), as the structure in *Cystignathus* and its allies is that of the true Arcifera.

These arches extend behind the so-called acromials to the extremity of the scapula; they have the same form and structure as during the earlier portion of the larval life of the Raniformia. In the latter, in maturing, they unite, and contract to a slender median rod, which gives with the superior transverse portions, a T-shaped element. Dugès has regarded this cartilage and its halves as equivalent to the fur-

* *Rana ocellata* L., *R. pentadactyla* of Laur., not *Cystignathus ocellatus* of later writers.

† A work which should be in the hands of all students of comparative anatomy.

cular clavicle of birds, Monotremata, and Lacertilia, (where it is often called mesosternum,) which view possesses much in its favor; but the presence of the arched cartilages connecting coracoids and acromials, *in addition* to the presence of the furcular and true clavicles in Lacertilia, opens the position to objection, and renders it quite possible that neither kind of clavicle exists among the Anura.* The question is therefore open to further investigation.

That the type of Arcifera is inferior to that of Raniformia, the structure of the sternum renders clear; it is also proven by the most usual undeveloped condition of the cranium in the former, its completeness in the latter, and the usual imperfection of what exists of the sternum, *i. e.*, the manubrium and xiphisternum, in the former, contrasted with its development in the latter.

The Bufoniformia extend still lower, adding to the inferior sternum, the larval character of want of teeth; in many of the types, however, the sternum approaches, but never equals, the form of the Ranidæ, and offers a mark of superiority equivalent to the presence of teeth in the Arcifera.

C. Bruch, in an article on the Anura,† contends that the Bufones are the most elevated of this order, on account of their greater intelligence of movement, persistency of object, and adaptability. But this cannot weigh against developmental considerations, and is moreover a common order of things. The superior Quadrumana have every appearance of inferior intelligence to the dog or elephant; the Corvidæ are much more intelligent than the superior Turdidæ, and Woodward complains that the Maiid crabs are psychically much inferior to the Cancrid family, which are structurally below them. Perhaps this "intelligence" is only *impressibility* and *educability*, features which distinguish the young from the adult man as well, and are not consistent with that stamp of peculiarity fixed upon types by the greater length of their developmental scale.

DISCOGLOSSIDÆ.

Vertebræ opisthocœlian.‡ Diapophyses of sacrum dilated. First coccygeal vertebra united as usual with the second or style, but furnished with posteriorly divergent diapophyses, and attached to the sacral by two cotyloid cavities (with one exception). Short ribs articulated to the anterior diapophyses.§ Ossa fronto-parietalia enclosing a fontanelle (in existing genera). External metatarsi more or less separated by a web. Terminal phalanges continuous, simple. Xiphisternum of two slender postero-

* Vid. Natural Hist. Rev., l. c., where I have taken this view.

† Which contains much of interest, and advanced views on the systematic position of the European Arcifera. See Wurtzbürger Wissenschaftliche Zeitschrift, 1862, 222.

‡ Observed by Dugès and Gervais in *Alytes*.

§ Noticed by Dugès in *Alytes* and *Bombinator*, and Duméril in *Discoglossus*.

exteriorly diverging fibro-cartilaginous or cartilaginous styles. Tongue round, entire, and little or not at all free behind. Males without vocal vesicle.

If we commence the series of the Arcifera with the great family of the Cystignathidæ, we will end it with the families Asterophrydidæ and Discoglossidæ, which are perhaps equally connected with that which precedes them—the Scaphiopodidæ. The former leads to Dactylethra through Palæobatrachus; the latter, as far as our present knowledge indicates, finds its completest development in the extinct genus Latonia, established by Von Meyer on the *L. seyfriedi* from the miocene of Oeningen. A species also occurs in the freshwater deposits of Sansan, *L. rugosa*, whose salamander-like vertebræ have been noticed by Gervais.* These animals were nearly related to Discoglossus, and had, like it, short posteriorly-directed processes on the ribs, as in the genus Salamandra; they were, however, much larger, had the fronto-parietal bones completely ossified, and the whole of the cranium roughened externally by a dermo-ossification. On this account the genus has been compared with Ceratophrys, which belongs to the family of Cystignathidæ. This dermo-ossification occurs in various families, especially in the New World.

In the remaining and recent genera, the structure of the sternum is worthy of note. In old individuals of Discoglossus, it is sometimes fibro-cartilaginous, as in Pipa. The xiphisternum, proximally homologous with the xiphisternum of the Lacertilia, consists distally of the united hæmapophysial cartilages of the anterior ribs. In the genera in question,† this part is divided nearly up to the point of attachment to that preceding, each moiety being directed outwards and backwards, and tapering into a lateral linea semilunaris. Between these and the pubes there are in Discoglossus the usual three pairs of lineæ semilunares, connected on the median line by a strong linea alba.

In Discoglossus the prefrontalia are strongly developed, being in contact for most of their length, sometimes touching the fronto-parietalia. In Alytes they are also in contact throughout, but are transverse and do not reach the fronto-parietals; the fontanelle is larger, and the ribs without processes: the whole animal is weaker. In this genus, as well as the preceding, the pupil is a vertical slit; elsewhere found in Hylorhina, Platyplectrum, Limnomedusa, Pelodytidæ and the Scaphiopodidæ. A species, *A. troschelii*,‡ has left its remains in the miocene Braunkohle along with Palæobatrachus. Bombinator is similar to Alytes in its osseous structure, except that the prefrontalia are in contact anteriorly only, and that the sacrum presents but one condyle for the articulation of the coccyx, as is typical of the Asterophrydidæ and Aglossa. Along with Alytes and Dactylethra it has true ossa

* Palæontologie Française, p. 494.

† Dugès has given a figure of it in *Bombinator*, pl. 3, fig. 24.

‡ *Rana troschelii* (Von Meyer, Palæontographica, iii. p. 138) is undoubtedly an *Alytes*.

nasalia, which bound the external nares exteriorly, thus explaining their anomalous position in *Breviceps*, where they are inferior. In this genus there is no cavum tympani or auricular ossicles, and the tubæ Eustachii are rudimentary or wanting. This character is said by Tschudi and Bruch not to be exceptionless in adults, and that the tubæ and tympanum are always present in the young of both this genus and *Pelobates*. All European.

- Cephalic integument involved in cranial ossification, which completes the o. o. fronto-parietalia. Two coccygeal cotyli and diapophyses; ribs with posterior process, LATONIA.
- Cephalic integument involved in cranial ossification; an open fronto-parietal fontanelle; no coccygeal diapophyses, two condyles. Temporal fossa roofed over, ZAPHRISSA.
- Cephalic integument free; a small fronto-parietal fontanelle, (sometimes *apparently* closed by the ethmoid.) Prefrontalia largely in contact. Two coccygeal cotyli; ribs with posterior process. Pupil round. Cavum tympani present. No parotoid glands, DISCOGLOSSUS.
- Cephalic integument free; a fronto-parietal fontanelle. Prefrontalia in contact throughout. Two coccygeal cotyli. No rudimental digit. Tympanum and cavum tympani distinct. Pupil erect. Parotoid glands present, ALYTES.
- Cephalic integument free from cranium; a fronto-parietal fontanelle; prefrontalia in contact anteriorly. One coccygeal cotylus. No inner digit developed. No tympanum or cavum tympani; Eustachian tubes rudimental or wanting. Parotoid glands none, BOMBINATOR.

LATONIA.

Von Meyer, *Säugethiere Vögel u. Reptilien von Oeningen*, p. 18.

L. seyfriedi von Meyer, l. c. Tab.

Habitat. Oeningen, Baden.

L. rugosa Cope, *Nat. Hist. Review*, 1865, 105. *Rana rugosa* Lartet (*Notice sur la Colline de Sansan*, p. 41); Gervais *Palæontologie Française*, p. 494. Tab. ? *Rana gigantea* Lartet, l. c.

Habitat. Sansan, Southern France.

On account of the great brevity of Lartet's descriptions, it is not possible to deduce any characters by which to distinguish this species from the last. In both the temporal fossa is overarched, as in *Cultripes*, but in neither is the sacral diapophysis as much dilated as in this genus and *Pelobates*. The *L. rugosa* may, however, differ

in many points, since of the remains we possess, the humerus offers some distinctive marks. The latter exhibits two opposite proximal alæ, and one internal distally; all very strong. These are not represented in Von Meyer's figures of the largest of the *seyfriedi*. In the *rugosa* the front is a little swollen; there is no median superior process on the coccyx.

The remains of a vertebral column with sacral diapophyses much more dilated than either of the preceding, probably pertains to one of the species described by Lartet as *Rana sansaniensis* or *R. laevis*. Whether this be another *Latonina*, or an animal allied to *Pelobates*, is not easily determined. In the Natural History Review for 1865, No. 1, I stated that a large species of *Pelobates* occurs in the miocene Braunkohle of Rott, near Bonn, Rhine-Prussia. A further study of a single specimen has convinced me that the species must be referred to the neighborhood of the genus *Latonina*; the sacrum is more dilated than in the known species, and resembles that of *Pelobates*. This is

ZAPHRISSA m.

Z. eurypelis sp. nov.

The general form is well displayed by an inferior view of the whole skeleton. The extremities, especially the feet, and the pelvis of this species, are elongate. The terminal phalanges were short conic; the exterior or long metatarsals are closely juxtaposed, the outer the shorter of the two. The tarsal bones are preserved; the cuneiform was small and little prominent. The length of the astragalus and calcaneum is little less than half the tibia: the latter is relatively slender, flattened and grooved at both ends. The ilia are slightly incurved, slightly compressed distally, and as long as the femora. The impression of the coccyx does not display a strong dorsal keel; its position corresponds with the axis of the sacrum, although other portions of the skeleton have been much disarranged; the traces of a small sacral condyle indicate the union with the sacrum by double condyle, as usual in this family.

The sacral diapophyses are remarkably expanded, almost as in *Pipa* or *Cultripes*: they articulate with the proximal three-fifths of the ilia. The remaining vertebræ have been much disarranged; they were probably eight in number. The atlas is distinct, without processes, necessarily much expanded anteriorly for articulation with the large and separated occipital condyles, and about as long as wide. The diapophyses of the second, third and fourth vertebræ are the only ones preserved; those of the second are longest, and articulate without constriction, with a cylindrical costal appendage. The terminal portion of this is lost, but it has not probably exhibited a posterior process, nor been much dilated. The third pair of diapophyses are the

shortest, and are rather depressed at their articulation with the ribs, which are the longest, nearly straight and slightly widened distally. The fourth diapophyses is equal to the third, but heavier and directed anteriorly; its rib is transverse, heavier, but shorter than the last.

The cranium is broad, with its whole surface roughened by the development of numerous minute, inosculating ridges, forming a coarser pattern than in any recent species, and leaving a nodular relief. The temporal fossa was overarched by a thick lamina, as portions remaining indicate, and the ossification formed a supra-orbital ala beyond the brain case, as in *Latonia seyfriedi* and *Ceratophrys*. The impression of the fronto-parietal bones is interrupted medially by an elongate oval elevation of the matrix. This is bounded before by the concave border of a smooth bone, whose impression is of the usual form of the superior ethmoid plate. I cannot conceive this to be anything other than an indication of a frontoparietal fontanelle, though I know of no form combining this feature with dermoossification, or the overarched temporal fossæ. The impressions of the prefrontals are very distinct; the greater part of the substance of one remains. Their form bears some resemblance to that in *Pelobates*; their common anterior suture does not measure one-half their longitudinal extent. The superior ethmoid plate presents a *narrow* posterior concavity for the fontanelle; it has left no rugose impression in the matrix. The frontoparietals exhibit a broad lateral wing, as occurs in *Latonia* and *Pelobates*, which passes into the postorbito-temporal arch. The latter is broad, and continues into a strong posterior dilatation of the "temporo-mastoid," which includes with the end of the quadratum a deep sinus.

The anterior limb is elongate. Scapula and supra-scapula preserved, undivided: humerus broad proximally, and with a right anterior outline, which is probably a bicipital ridge; no apparent posterior ridge. Distally more transversely compressed than in *Pelobates fuscus*, at the base of the prominent condyle. Forearm with two distal longitudinal grooves. The impressions of the carpals are very distinct; that of the lunare larger than that of the cuneiforme; and that of the unciforme representing a bone larger than any other, but not prominent. The impressions visible are three proximal, two distal. The fingers are elongate.

The sternum and one arm were pressed across the cranium, and are mutilated; hence the important point as to whether the xiphisternum is bifurcate or styloid remains for a more fortunate observer. Measurements are as follows:

| | In. | Lines. |
|---|-----|--------|
| Length from end muzzle to posterior margin ethmoid, | | 5 |
| " " level of occipital condyle, | | 12·5 |
| Interorbital breadth (behind middle), | | 5·3 |
| Breadth of temporal arch, | | 4·3 |

| | In. | Lines. |
|--|-----|--------|
| Thickness of temporal arch, | | .8 |
| Breadth between extremities of quadrata, as crushed, | . 1 | 7.5 |
| Transverse extent of third vertebra with appendage, | | 8 |
| " " fourth " " | | 8 |
| " " sacral " " | | 5.8 |
| Length of sacral diapophysis, | | 8 |
| " of ilium, | . 1 | 3.6 |
| " of coccyx, | | 9 |
| " of femur, | . 1 | 2 |
| " of tibia, | . 1 | 2 |
| " of tarsus, | | 7 |
| " of fifth metatarsus (exterior), | | 4.5 |
| " of fourth " | | 5.5 |
| " of first " | | 2 |
| " of third digit from tarsus, | | 11 |
| " of humerus, | | 10 |
| " of ulna and radius, | | 7.3 |
| " of third metacarpus, | | 3.2 |

This species was the cotemporary of the *Morelia papyracea*, the *Palæobatrachi* *Ranæ* and *Cyprinidae* of the period and place of deposit of the Braunkohle of Rhine-Prussia.

ASTEROPHRYDIDÆ.

Vertebræ opisthocœlian. Diapophysis of sacrum dilated, of first coccygeal vertebra wanting; the latter attached by but one cotyloid cavity (except in one genus). Ribs none. External metatarsi not separated for a web; terminal phalanges continuous, simple. O. fronto-parietalia not strongly ossified medially, but without fontanelle. Superior plate of the ethmoid well developed anteriorly. Ear perfectly developed. Xiphisternum a slender osseous style (first two genera not examined).

Genera: *Cryptotis*, *Gthr.*; *Asterophrys*, *Tsch.*; *Megalophrys*, *Kuhl*; *Xenophrys*, *Gthr.*

The *Palæobatrachidæ* differ from this family in the conversion of their seventh, eighth, and ninth vertebral centra and diapophyses into a sacrum, instead of the ninth only; and in the osseous covering of the cavum tympani and tuba Eustachii.

Cryptotis, the only Australian genus of the family, possesses two sacral condyles for the articulation of the coccyx; it has a long tooth-like process on the os dentale, similar to that seen in *Rana macrodon*, and *R. kuhlii*.

The other genera belong to the Malayan Islands, except *Xenophrys*, which has only been found in the mountains of India. There are no arboreal or aquatic forms embraced in this family. The whole number of species known is five.

a. Toes free.

Two coccygeal cotyli. O. dentale with a dentiform process. Vomerine teeth; no parotoids; palpebra simple, *CRYPTOTIS*.

One coccygeal cotylus. No dentiform process. Head large angular; upper palpebral border with cutaneous appendages. Vomerine teeth. Tongue entirely adherent. Tympanum hidden, perfect, *ASTEROPHRYS*.

No dentary apophysis. Head ordinary, no dermal appendages. No vomerine teeth. Tongue broad, but little free. Tympanum distinct, *XENOPHRYS*.

aa. Toes partially webbed.

Very much depressed; cleft of mouth large. Vomerine teeth little developed. A superciliary dermal appendage. Tongue broad, free behind: (tympanum concealed), *MEGALOPHRYS*.

PELODYTIDÆ.

Vertebræ procelian; no ribs or diapophyses of coccyx. Sacrum united with the coccyx by condyle, its diapophyses thin and largely dilated. Xiphisternum an osseous style, with terminal disc. External metatarsi bound together.

The species of this family are of weak organization; the fronto-parietal bones are undeveloped in one of the two genera embraced by it, and they are very weak in the other. Their affinities are altogether between the *Asterophrydidæ* and *Scaphiopodidæ*. Their vertebræ only distinguish them from the former, and their distinct bicondyloid coccyx from the latter. In both genera the auditory apparatus is developed, and the cephalic integument is free; in neither is there a metatarsal shovel.

Fronto-parietal bones complete; no vomerine teeth; one sacral condyle for coccyx: tongue partially free, *LEPTOBRAHIUM*.

Fronto-parietal bones embracing a large fontanelle; vomerine teeth; two sacral condyles for the coccyx; a weak parotoid gland; pupil elliptic erect; tongue partially free. Atlas and axis confluent, . . . *PELODYTES*.

SCAPHIOPODIDÆ.

Vertebræ procelian; no costal elements or coccygeal diapophyses; diapophyses of ninth vertebra much dilated, thin and triangular; coccygeal style without condyloid

articulation, its axial portion restricting that of the sacrum and connate with it: external metatarsi bound; distal phalange continuous, simple. Manubrium cartilaginous. Tongue rounded, nearly entire.

The small number of species embraced in this family are of stout toad-like habit, and furnished with a shovel-like development of the cuneiform bone and a coriaceous posterior digital palmation, to aid them in removing earth while making their subterranean abodes. Many of them very seldom come to the surface of the earth, and then only in darkness; for this habit the vertical cat-like pupil is an adaptation, a peculiarity not exhibited by the toads, which are crepuscular.

Group I. Cavum tympani and tympanum wanting. Xiphisternum with an ossified proximal style. Cuneiform bone and sheath well developed. Pupil erect. Toes webbed.

Derm involved in cranial ossification. Temporal fossa with a strong roof.

Vomerine teeth: no parotoid glands, CULTRIPES.

Derm involved in cranial ossification. No roof over the temporal fossa, or parotoid glands. Vomerine teeth, PELOBATES.

Derm distinct from cranium, which is undeveloped above, two lateral fronto-parietal bars enclosing a median fontanelle. Vomerine teeth.

No parotoids, DIDOCUS.*

Group II. Cavum tympani and tympanum present. Xiphisternum entirely cartilaginous. Cuneiform bone and sheath well developed. Toes more or less webbed. Pupil elliptic erect.

Derm involved in the cephalic ossification, which is complete. Parotoid glands and vomerine teeth, SCAPHIOPUS.

Derm distinct from cranium, which is only ossified superiorly in two superciliary bars. Parotoid glands and vomerine teeth, SPEA.†

The extreme of divergence of the series of this family is, then, that representing its type in a preëminent degree. This is seen in the genus *Cultripes* where the ossification of the superior cranial walls is especially thickened, obliterates the sagittal

* Type *Rana calcarata* Michahelles Isis von Oken, 1830, 160. In the lack of a good series of specimens of *Cultripes provincialis*, I should have hesitated to separate this species generically from the latter, remembering the very late period of completion of the cranium in *Ranoidea aurea* of Australia. But Dugès' "Rech. Ost. et Myol.," etc., p. 93, says that the parasphenoid and frontoparietal bones are simultaneously and early completed, and illustrates in a figure the confluence of the latter while quite young. Duméril, *Erp. Générale*, viii. 484, states, moreover, that the temporal roof is developed before the tail of the larva has disappeared. In our specimen, which is fully developed, though not of large size, the temporal muscles are only enclosed by the usual fascia. The species occurs in southern Spain. See my forthcoming memoir in the *Smithsonian Contributions*.

† Type *Scaphiopus bombifrons* Cope; embraces *S. hammondii* Baird, and *S. multiplicatus* Cope.

suture, and is extended in an arch over the temporal fossa. The anterior ossification of the coccyx is applied by its axial portion beneath the axis or centrum of the sacral vertebra, and becomes consolidated with it shortly after its commencement, furnishing a structure not rare among burrowing Anura. This character is maintained in the descending scale by *Pelobates*, *Didocus*, *Scaphiopus* and *Spea*, though none of these have the temporal fossa overarched. *Cultripes*, with *Pelobates* and *Didocus*, exhibit an ossified basal xiphisternal piece, while in all below it is cartilaginous, as in most *Arcifera*: the extreme position of the former is also maintained by the obliteration of many portions of the auditory apparatus. The succeeding forms *Scaphiopus*, *Spea* and *Helioporus*, resemble the first group in the toad-like form, and in the strong cuneiform shovel and webbed feet, but in the last the usual bicondyloid articulation of coccyx brings us within the limits of the *Cystignathidæ*, and with *Spea*, an incomplete cranium marks a descent. The more elongate *Cystignathid* form of *Chiroleptes* maintains the *Scaphiopus* foot, with a strong cranium, while in the same family the superficially similar *Hyperolia* exhibits no longer the cuneiform shovel, or any true mark of affinity.

The distribution of the species of the family is as follows:

| | R. Austr. | R. Neotrop. | R. Nearctica. | R. Palæarct. | R. Aethiop. | R. Palæotropica. |
|---------------------|-----------|-------------|---------------|--------------|-------------|------------------|
| <i>Cultripes</i> , | 0 | 0 | 0 | ? 1 | 0 | 0 |
| <i>Pelobates</i> , | 0 | 0 | 0 | 1 | 0 | 0 |
| <i>Didocus</i> , | 0 | 0 | 0 | 1 | 0 | 0 |
| <i>Scaphiopus</i> , | 0 | 0 | 3 | 0 | 0 | 0 |
| <i>Spea</i> , | 0 | 1 | 2 | 0 | 0 | 0 |
| | | <hr/> | <hr/> | <hr/> | | |
| | | 1 | 5 | 3 | | |

The inferior dermal attachments of seven species of this family are as follows:

Didocus calcaratus; belly more than half attached.

Pelobates fuscus; from half to two-thirds attached; same in larva, with long tail.

Femur one line below.

Scaphiopus holbrookii; free only opposite sternum; thigh attached only below on basal half.

Scaphiopus couchii. Triangular free area to middle abdomen.

Spea hammondii, very wide lateral inferior attachments, which do not meet till femora.

Spea bombifrons. Belly with a free median band; femoral lines, below and above behind.

Spea multiplicata. A free dorsal line, very narrow in front, but wide as ilia behind; abdominal area with a broader free space.

HYLIDÆ.

Vertebræ procœlian. Sacral diapophyses dilated, the simple coccyx articulated to two condyles. External metacarpi bound together. Terminal phalanges articulated inferiorly on to the extremity of the penultimate, globular or swollen proximally, and giving rise, usually from a central emargination, to the curved, acute distal portion which is of a more compact tissue. O. frontoparietalia shortened anteriorly, usually embracing a fontanelle. Superior plate of ethmoid never covered by frontoparietals, usually produced anteriorly, between frontonasals. Ear perfectly developed. Abdominal integument areolate.

This family embraces the tree-toads of Australia and America. It presents comparatively little structural variety, not containing as undeveloped types as the Cystignathidæ, nor as high ones: it possesses neither earless genera, nor fossorial, nor really aquatic.

The adaptive modifications are: first, those which accompany a terrestrial habitat, *i. e.*, the diminution of the digital dilatations and palmation. These occur in regularly increasing degree, in a small number of the species of the typical genus *Hyla*, and are general in, and distinctive of, two other genera. Second, those which adapt the extremities to grasping a limb by opposition of digits, instead of adhering to a surface by expansion of them in one plane. This first appears in a species of *Agalychnis*, and is permanent in *Pithecopus* and *Phyllomedusa*. Third, those which restrict the light admitted to the retina, first, by the lateral contractility of the pupil; second, by the rendering opaque of the inferior palpebra. The first characterizes the three genera just mentioned, the last occurs in the first two, but is inconstant in the second, and appears in two species of the genus *Hyla*. Fourth, that which adapts the female during the breeding season to localities without water, or where perhaps the water contains enemies, by the inversion of the dorsal integument so as to form a sack, in which the eggs are carried. This occurs in, and is accepted as characteristic of two genera, of one species each, but as it occurs in but one sex its value is questionable.

Another feature, which may have a functional value, is the union of the abdominal integuments with the superficial fascia of the muscles by an areolar or fibrous network, continuous with that of the usual latero-ventral band. The skin of the inferior surfaces of these creatures, as in the Raniform tree frogs, has a thickening in numerous close areolæ, the nature and function of which is like that of the digital dilatations, and the derm of the tuber on the thumb of the male *Rana*, *i. e.*, to secrete an adhesive fluid as aid in maintaining the peculiar positions assumed. In proportion to the developement of these, is the extent of the abdominal attachment, and hence may be supposed to be adapted for relieving the other areolar connections from the

strain of the animal's weight when in an appressed or vertical position. Its uniformity in the burrowing genera of the Bufonidæ and Scaphiopodidæ, and especially on their dorsal surface, rather confirms this view.

This connection is, however, evidently not necessary to the use of the abdominal integument as an adhesive support, as this faculty is nowhere better seen than in *Acris*, where the derm is free. This creature will adhere for days to a vertical glass plate, not only by the abdomen and digits, but by the interdigital membranes, and will light securely from a long leap on such a surface. Daudin and Duméril have related the same adhesive faculty in *Pelodytes punctatus*, which is not known in regard to the dermal attachments, but has not the abdominal areolæ present in *Acris*. The extent of the attachment is least where the dilatations are smallest, as follows:

Abdomen entirely attached; 18 sp.

Phyllomedusa two sp. *Pithecopus* two sp. *Agalychnis* three sp. *Trachycephalus* two sp. *Nototrema* one sp. *Scytotis* two sp. *Smilisca baudinii*.
Hyla albomarginata, *boans*, *agrestis*, *krefftii*, *phyllochroa*.

Posterior half or third of abdomen attached; latero-ventral band wide.

Tripurion petasatus.

Hyla fusca, *arenicolor*,* *gratiosa*, *versicolor*, *femoralis*; *squirella*, *andersonii*, *cyanea*.
Ranoidea aurea.

Chorophilus triseriatus.

Less than posterior third abdomen attached; the latero-ventrals wide.

Hyla arborea, *regilla*, *lateralis*, *cadaverina*† *miotympanum*; *pickeringii*.

Chorophilus nigritus.

Abdomen entirely free.

Hyla leseurei, *curta*, *gracilipes*. *Acris gryllus*.

Of distinguishing features, which refer to the conditions of the elements of the vertebrate skeleton, their degree of developement, etc., it may be said that they exhibit far fewer cases of questionable or intermediate existence than those of the previous class. They are, first, the developement of the o. o. frontoparietalia; second, of the prefrontalia; third, of the superficial cranial rugosities; fourth, of vomerine teeth; fifth, of a postfrontal arch; sixth, of the ethmoid arch.

| | | |
|--------------------------------------|-----------|-----|
| Whole number of species, | | 131 |
| Frontoparietals fully developed, | | 19 |
| “ with rugosities penetrating derm., | | 11 |
| Prefrontals developed, | | 17 |

* *H. affinis* Baird, not Spix.

† *H. nebulosa* Hallow., not of Spix.

| | |
|----------------------------------|-----|
| With vomerine teeth, | 128 |
| With postfrontal arch, | 1 |
| Ethmoid arch complete, | 130 |

Of the above characters, the lack of vomerine teeth is inconstant in *Pithecopus*, being present in one, and wanting in another species.

There is a tendency to the *Pseudis* and *Rana* liberation of the outer metatarsus in *Hyla americana*, *hyposticta* and *dimolops*, and *Ranoidea aurea*.

Parotoid glands occur in some species of *Hylidæ* as an extensive stratum of crypts, but never exhibit the definition seen in *Bufo*iform and some *Cystignathid* genera. It even occurs in *Scytopus venulosus* irregularly, being sometimes present, and sometimes wanting, in the female at least.

The xiphisternum exhibits the form which exists in the greater number of *Cystignathidæ*, excepting in eight species, where it only lacks the posterior emargination.

The natural genera are as follows :

I. No frontoparietal fontanelle.

a. Cephalic derm occupied by the external rugosities of the cranial bones: prefrontals in contact.

A series of parasphenoid teeth or acute serrations; vomerine teeth.

No dorsal sac; labial margin much prolonged, *TRIPRION.*

Vomerine teeth; no parasphenoids or dorsal pouch, *TRACHYCEPHALUS.*

Vomerine teeth; a dorsal pouch; no parasphenoids, *OPISTHODELPHYS.*

aa. Skin free from the surface of the cranium.

A dorsal dermal pouch in ♀; prefrontals partly united: vomerine teeth; dilatations small, *NOTOTREMA.*

No dorsal dermal pouch; prefrontals united; cranium with carinæ; vomerine teeth, *OSTEOCEPHALUS.*

No dorsal pouch; prefrontals united; no cranial carinæ; vomerine teeth, *SCYTOPIS.*

No dorsal pouch; prefrontals narrow, well separated; outer metatarsi bound; a ? coccygeal diapophysis; vomerine teeth, *DRYOMELICTES.*

No dorsal pouch; vomerine teeth; outer metatarsi slightly free; no coccygeal diapophysis, *RANOIDEA.*

II. Frontoparietal bones embracing an extensive fontanelle.

a. A dagger-shaped postorbital process of the frontoparietal bone.

Vomerine teeth; form stout, feet webbed, *SMILISCA.**

aa. Frontoparietal simple.

* Species, *S. baudinii* (*Hyla baudinii* D. and B.); the name "*dauliniæ*" must probably be considered an erroneous orthography of the same.

b. Posterior digits free, two opposed to three; xiphisternum entire; pupil vertical.

A large prominent paratoid; inferior palpebra transparent; tongue extensively free laterally and behind, PHYLLOMEDUSA.

Paratoid very thin or wanting; tongue free; inferior palpebra netted or transparent; second toe shorter than inner, PITHECOPUS.*

bb. Posterior digits rarely opposable, pupil rarely vertical; xiphisternum deeply emarginate.

c. Pupil vertical; inner posterior digits more or less opposable. Tongue elongate, extensively free laterally and behind; inferior palpebra latticed; toes more or less webbed, second longer than inner; sometimes thin paratoids, AGALYCHNIS.†

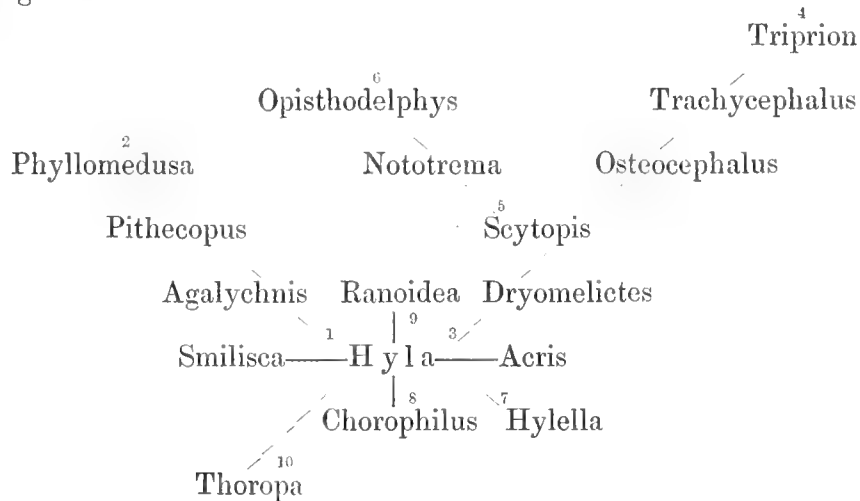
cc. Pupil horizontal; posterior digits webbed, not opposable. Tongue short, attached or little free; palpebra usually transparent; vomerine teeth, HYLA.

Tongue short; palpebra transparent; no vomerine teeth, HYLELLA.

Tongue extensively free; dilatations minute, palmation extensive behind; vomerine teeth, ACRIS.

ccc. Pupil horizontal; posterior digits flat, free. Superior ethmoid plate osseous; prefrontal bones separated, CHOROPHILUS. Superior ethmoid plate cartilaginous, the prefrontals developed, in contact medially, THOROPA.

The affinities of these genera are most readily exhibited by an arrangement like the following :



* Type *P. azureus*; second species *P. hypochondrialis* (*Hyla hypochondrialis* Daudin).
 † Includes *Phyllomedusa dacnicolor* Cope.

In the series 1—2 to Phyllomedusa a final diminution of palmation accompanies continued size of the digital pallettes and increase in the length and breadth of the ethmoid, and diminution of the frontoparietals, which features, however, are as marked in *Hyla palmata* as in these succeeding types: they carry to its fullest development the cranial peculiarities of the family, and add other features before mentioned; they inhabit the continental subregion of the Neotropical. The other main series (3—4) leads, first, to a fuller development of the frontoparietals, then to an extension of the prefrontals, and finally to covering of the cranium with “dermoössification,” on the one hand with the superaddition of a dorsal dermal sac, on the other without it. This extreme finds its greatest expansion in the West Indian subregion. A singular incompleteness of the cranial box seems to mark *Thoropa*, which has the strong nasal roofing of this second series.

Chorophilus exhibits an affinity to the *Cystignathidæ*, as does also *Thoropa*, which represents in inferiority *Eusophus* in the same family.

The following is the geographical distribution of the genera and species:

| | R. | R. | R. | R. | R. | R. |
|---------------------------|------------|-------------|------------|--------------|------------|------------------|
| | Australis, | Neotropica, | Nearctica, | Palæarctica, | Aethiopia, | Palæotropica, |
| Tripriion, | . | 1 | | | | |
| Opisthodelphys, | . | 1 | | | | |
| Trachycephalus, | . | 9 | | | | |
| Osteocephalus, | . | 2 | | | | |
| Nototrema, | . | 1 | | | | |
| Scytopis, | . | 3 | | | | |
| Ranoidea, | 1 | | | | | |
| Dryomelictes, | . | 1 | | | | |
| Pithecopus, | . | 2 | | | | |
| Phyllomedusa, | . | 2 | | | | |
| Agalychnis, | . | 4 | | | | |
| Smilisca, | . | 1 | | | | |
| Hyla, | 17 | 62 | 12 | 1 | 0 | (2 from without) |
| Hylella, | . | 2 | | | | |
| Acris, | . | . | 1 | | | |
| Chorophilus, | . | . | 5 | | | |
| Thoropa, | . | 1 | | | | |
| | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> |
| | 18 | 93 | 18 | 1 | 0 | (2) |

Total, 131.

This family was first defined by the author in the *Natural History Review*, 1865. The most nearly correct limitation previously existing was that of Günther, who, however, placed the species with parotoids in other families.

HEMIPHRACTIDÆ.

Diapophyses of the sacral vertebra cylindrical; mandible supporting a series of teeth. Cranium fully osseous. Terminal phalanges?

Of this family almost nothing is known, as it is as yet represented by but two rare species of the forests of the Neotropical region. It is probably intermediate between the Hylidæ and Cystignathidæ; in superficial appearance it approaches nearest the genus *Tripriion* m., where the cephalic ossification and development of additional teeth are carried far, and the digital dilatations are in like manner not largely developed.

HEMIPHRACTUS.

Wagler, *Isis* v. Oken, 1828, 735, 743, t. x. Peters, *Monatsb. Preuss. Acad.* 1862, 145.

In both species the vomerine teeth are in longitudinal series between the nares, curved outwards, and there appears to be teeth on the palatine arch. They have an acute prominence on the end of the muzzle, and the terminal tooth of the mandibular series is several times as large as the others, and prominent.

CYSTIGNATHIDÆ.

Vertebræ procelian; no ribs; sacral diapophyses cylindrical, obtrihedral or slightly depressed distally, inclined upwards. Coccyx separate, attached to two condyles, without diapophyses. Terminal phalanges continuous, either uniformly conic, or with divergent terminal processes or their rudiments. Manubrium wanting or cartilaginous;* xiphisternum distinct. Auditory apparatus developed.† No teeth on the mandible.

This, after the Hylidæ the most extensive family of the Arcifera, embraces 101 species, which represent thirty-four generic types; four additional species represent four other supposed genera.

The most completely developed genus exhibits a cranium without fontanelle and with complete ethmoid arch, and a styloid osseous xiphisternum, with terminal cartilaginous disc; the auditory organs perfectly developed: the lowest, undeveloped ethmoid arch and frontoparietal roof, and disciform cartilaginous xiphisternum without style, with Eustachian tubes and membranum tympani wanting. Consistently

* Except in *Limnocharis*.

† Except in *Alsodes*, according to one author.

with this succession, we have four modifications of this structure to adapt to as many modes of life: the aquatic, the terrestrial, the arboreal, and the subterranean. As the earth's surface is the common medium between the above extremes, so the species of terrestrial habits furnish us with none of the adaptive extremes of structure, but remain an intermediate group, from which the succession of structures, interrupted, it is true, passes towards the divergent types. Developmental structures accompany and confirm the adaptive, but by no means coincide; moreover, the adaptive is the evanescent character, while the developmental is the definitive.

The aquatic habit is attained when the digits behind are not only webbed, but when the external metatarsi are separated by membrane also. The arboreal, when the terminal phalanges are furnished with a terminal transverse limb, which supports an adhesive disc. The subterranean is shortened, and furnished with a great development of the first cuneiform bone of the tarsus, which is covered by a corneous sheath, and serves as a spade. The first may be combined with the third, as in *Mixophyes* and *Chiroleptes*, or it may be furnished with a bony over-roofing of the temporal muscles, and penetration of its integuments by the ossification of the cranium.

The fossorial spur is weak in *Helioporus*, weaker in *Platyplectrum*, and just represented in *Ceratophrys* and *Gomphobates*. The palmate foot is diminished in *Calyptocephalus*, reduced in *Mixophyes* and *Chiroleptes*, and represented by a trace in *Hylorhina* and *Limnomedusa*. The undeveloped ear is seen on one side only in a species of *Crinia*, and in *Alsodes*.

With regard to the dermal attachments, the following important varieties occur; in the family generally, but especially among *Hylodes* and *Cystignathi*, the dorsolateral septum is placed especially high up:—

PSEUDES.—Septa in *Pseudis* as in *Rana*; in *Lysapus* the lateroventral line is a little widened. In *Mixophyes fasciolatus* the lateroventrals are very wide, and leave the ventral free space very narrow behind the middle.

CERATOPHRYDES.—In (*Gomphobates* and) *Tomopterna* the lateral septa are narrow, and there are two posterior abdominal transverse septa, similar to those attached to the sternum. In *Ceratophrys ornatus* these are wanting, but the dorsolateral line is very broad.

CRINÆ.—Among these animals I have examined species of *Helioporus*, *Platyplec-*

trum,* Crinia, Borborocætes, Eusophus and Hyperolia, and in none can I find more than lateral traces of the epicoracoid and coracoid septa, except in the *Hyperolia marmorata*, where they are complete. The posterior abdominal is well developed in *Eusophus nebulosus*.

PLEURODEMÆ.—Ventrolateral low down, and posterior abdominal well developed in *Pleurodema bibronii*.

HYLODES.—Dorsolateral and ventrolateral far apart: the transverse posterior abdominal septum in the species of *Lithodytes*, in *Ephirexis longipes*, in *Enhydrobius vomerinus* (*Elosia* Girard) and *Phyllobates ridens*. I have not found it in *Lithodytes* (*Craugastor*) *conspicillatus* Gthr., *Enhydrobius parvus*† (*Hylodes* Gird.) and *Limnocharis fuscus* Bell (*Elosia nasus* Girard).

CYSTIGNATHI.—In all the species the structure is similar to that of *Rana*, except in the approximation of the dorsolateral lines, and the presence of the postabdominal septum, which is continuous with the lateroventrals, and is indicated externally in several of the species by a fold in its line of attachment.

The accompanying table exhibits the affinities of the genera, and the groups into which they naturally fall:

* *P. occidentale*, sp. nov.

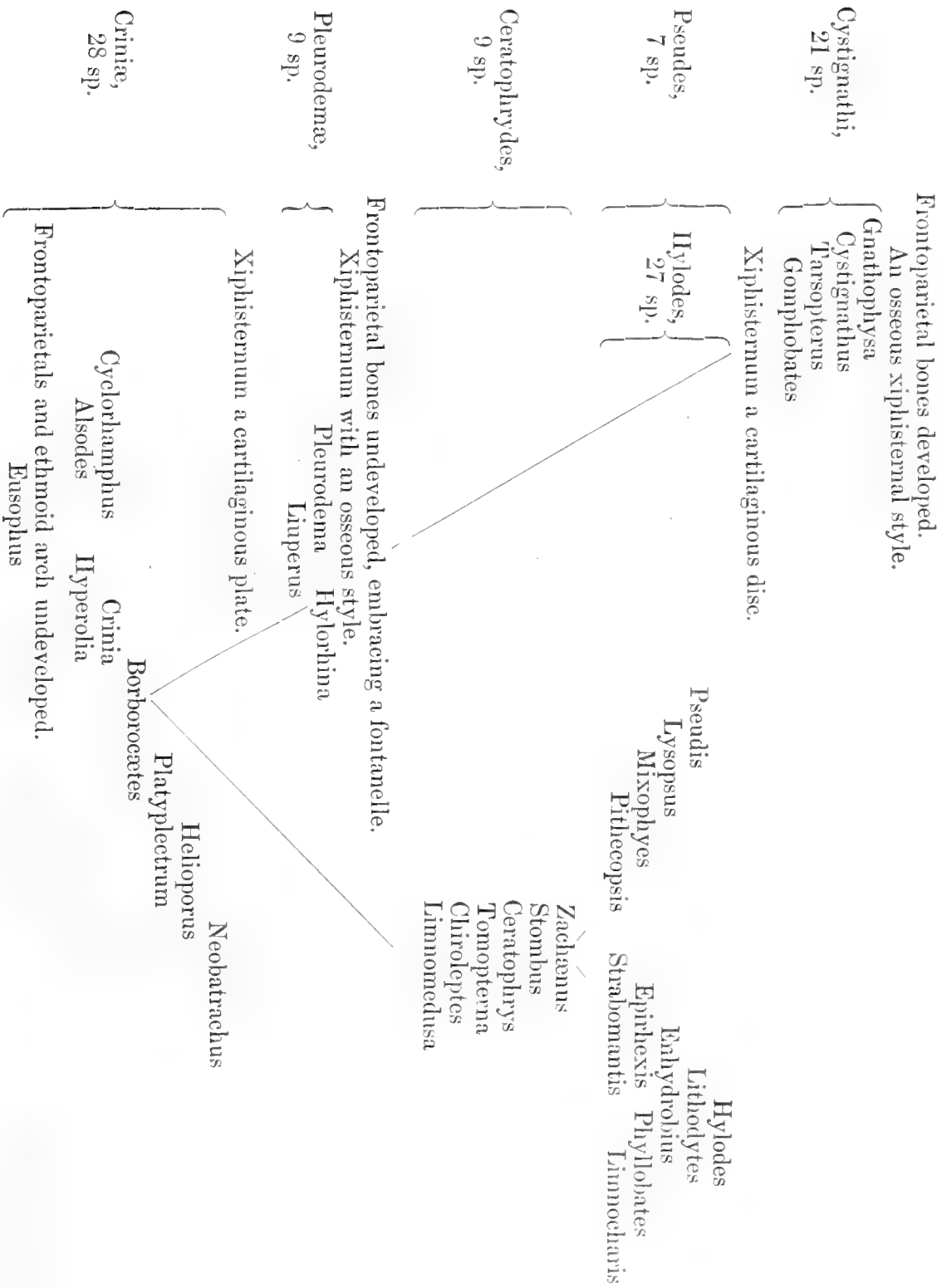
Skin smooth; crural gland small; above medially dark, laterally pale ash, below dirty white; pupil erect; orbit less than length of muzzle.

Habit stout; distal end of tarsus not quite extending to end of muzzle; breadth of head behind scarcely less than one-half length of head and body, and one-eighth more than from posterior border of tympanum to opposite end of muzzle. Muzzle depressed in profile, retreating from prominent labial border, nostril nearer orbit than margin, the former distance equal narrowest interorbital breadth. Eyes not prominent; eyelids narrow. Vomerine series extending to exterior of choanæ, which, with the ostia tubæ Eustachii, are of usual size. Tongue extensively free. Tympanum concealed by skin. First, second and fourth fingers *equal*, the two inner with very large penultimate subarticular tubercles. Brachium attached under angle of mouth; middle of antebrachium extended measures end of muzzle. Tarsus broad, short, scarcely equal antebrachium; metatarsus moderate, with none but the cuneiform tubercle, which is incurved and pale edged. Toes short, except the fourth, with a trace of web, and margined.

Total length 1 in. 9.4 l.; muzzle to angle of jaws 8.5 l.; tibia 9 l.; foot 1 in. 2.1 l.

Habitat.—West Australia, *Daniel*.

† Perhaps owing to small size of specimen.



The geographical distribution of these forms is as follows :

| | Regio Australis. | Regio Neotropica. | | | |
|----------------|------------------|---------------------------|----------|----------|--------------|
| | | Chili and S. of La Plata. | Central. | Mexican. | West Indian. |
| Cystignathi, | 0 | 2 | 18 | 1 | 3 |
| Hylodes, | 0 | 0 | 16 | 3 | 8 |
| Ceratophrydes, | 1 | 1 | 7 | 0 | 0 |
| Pseudes, | 1 | 0 | 6 | 0 | 0 |
| Pleurodemæ, | 0 | 3 | 6 | 0 | 0 |
| Criniæ, | 23 | 7 | 0 | 0 | 0 |

There are then known twenty-five Australian species, of which all but two possess an incomplete cranium, and none a bony xiphisternal style. In the Patagonian subregion thirteen species, of which ten exhibit an incomplete cranium, and five a complete bony xiphisternal style. In the Brazilian subregion fifty-three species, of which only six have an incomplete brain case, and twenty-four the osseous xiphisternal style. Mexico, three species with complete cranium, and one of these with style; the West Indies with eleven, none having the fontanelle, and three the style.

| | R. Australis, | S. R. Patagonica, | S. R. Brasil., | S. R. Mexic., | S. R. Ind. Occ. |
|------------------------------|---------------|-------------------|----------------|---------------|-----------------|
| Total, | 25. | 13. | 53. | 4. | 11. |
| Prefrontals fully developed, | 0 | 3 | 22 (appr.) | 3 | 10 |
| Ear imperfect, | 1 | 4 | 0 | 0 | 0 |
| No vomerine teeth, | 9 | 1 | 13 | 0 | 1 |
| Toes webbed, | 3 | 2 | 6 | 0 | 0 |
| Fossorial shovel, | 7 | 1 | 1 | 0 | 0 |

In regard to the cranial development, the West Indian region is preëminent in this family as in the Hylidæ, the Brazilian inferior, and the Australian vastly below all; the degradation appearing in a certain degree regular. In the lack of vomerine teeth, (a feature of immaturity,) the Australian forms predominate. In possession of the Raniform xiphisternum the West Indian and Mexican subregions show fewer representatives than the Brazilian.

One species,—*Lithodytes ricordii*,—wanders from the R. Neotropica into the southern projection—Florida—of North America; no others are known to occur beyond the borders already stated. No species is common to the R. R. Australis and Neotropica, and but one genus,—*Borborocætes*. Two Brazilian species occur in the Southern West Indies, and two in Southern Mexico; probably three of the same country must be included in the Buenos Ayrean list.

The whole number of species must be reckoned at 108, which fall into 35 genera.

As yet we are acquainted with the fossil remains of but one species of Cystignathidæ,—a *Ceratophrys*, from a Brazilian cave. It has been regarded as identical with the *C. dorsata* by Günther, Ann. Mag. Nat. Hist. 1859, pl. xv.

This family was first characterized by the author in Proc. Acad. Nat. Sci. 1863, 46; excluding, however, the genera *Ceratophrys* and *Tomopterna*; and subsequently more exactly in the Nat. Hist. Review 1865. Several changes, approximations to nature, are now proposed, and the genera for the first time defined. These were distributed in the last systematic arrangement (1858) in six *different families*.

Group I. PSEUDES.—Frontoparietal bones fully developed. Toes webbed, external metatarsi free; terminal phalanges acute. Xiphisternum a cartilaginous plate.

Ear perfectly developed. Tongue broad, entire, adherent.

Cephalic derm distinct: vomerine teeth: no cuneiform shovel or lumbar gland. Prefrontals closely united; pupil horizontal, . PSEUDIS.

Cephalic derm distinct: vomerine teeth: no cuneiform shovel or lumbar gland: prefrontals widely separated from each other and frontoparietals, LYSAPSUS.

Cephalic derm distinct; vomerine teeth; a cuneiform shovel; no lumbar gland; prefrontals not closely united; pupil vertical, . MIXOPHYES.

Cephalic derm distinct; vomerine teeth; no cuneiform shovel; a lumbar gland; eyes anterior; prefrontals well united, transverse, PITHECOPSIS.

Cephalic derm involved in a rugose cranial ossification, temporal fossa overarched, completing postorbital arch; vomerine teeth; no cuneiform shovel or lumbar gland; eyes anterior; prefrontals extensively united and prolonged posteriorly, CALYPTOCEPHALUS.

Group II. CERATOPHRYDES.—Frontoparietal bones fully developed. Toes free or slightly webbed; the external metatarsi bound; terminal phalanges simple. Xiphisternum a cartilaginous plate (so far known, emarginate). Ear perfectly developed. Tongue entire, little free.

a. A cuneiform shovel; cephalic derm distinct; no postorbital arch.

Eyelids not prolonged; prefrontals well separated; vomerine teeth; toes slightly webbed; inner finger opposable; form more elongate, CHIROLEPTES.

Prefrontals more or less united; eyelids not prolonged; vomerine teeth; toes slightly webbed; cranium elevated; form toad-like; inner finger not opposable; abdominal derm areolate, TOMOPTERNA.

aa. A cuneiform shovel; cephalic derm involved in cranial ossification. A postorbital bony arch.

Prefrontals wholly or in part separated; eyelids with a dermal prolongation; vomerine teeth; toes more or less palmate; cranium elevated; form toad-like; inner finger not opposable; pupil transverse, CERATOPHRYS.

aaa. No cuneiform shovel or postorbital arch; cephalic derm not involved in ossification.

Prefrontals widely separated; eyelids with dermal prolongation; vomerine teeth; toes nearly free; cranium elevated, form toad-like; inner finger not opposable, STOMBUS.*

Prefrontals in close contact; eyelids not prolonged; vomerine teeth on palatine arch; toes free; cranium broad; eyes subanterior, pupil horizontal; form squat, abdomen smooth, ZACHÆNUS.†

Prefrontals not united, removed from the frontals; vomerine teeth; toes nearly free; pupil vertical, LIMNOMEDUSA.‡
? ?

Prefrontals? eyelids simple; no vomerine teeth; toes free; eyes lateral, pupil horizontal; form frog-like, NATTERERIA.

Group III. CRINLÆ.—Frontoparietal bones embracing a large fontanelle; cephalic derm free. Auditory apparatus developed, minute, or wanting. External metatarsi bound, digits free, or rarely, webbed; terminal phalanges simple. Prefrontals never closely united, rarely in contact. Xiphisternum not distinguishable into style and disc, broad, emarginate, cartilaginous. Tongue largely free.

a. Ethmoid bone with superior arch complete; a metatarsal shovel; toes margined or webbed. Vomerine teeth in straight transverse series; form stout.

Parotoid glands continued to groin and on dorsum; feet nearly free; pupil round, HELIOPORUS.

No parotoid glands; feet fully webbed, NEOBATRACHUS.

No parotoid glands; feet webless, PLATYPLECTRUM.

? { *aa.* Ethmoid arch complete; no metatarsal shovel; toes webbed; form depressed.
Auditory apparatus minute; vomerine teeth; xiphisternum with a proximal semiossified portion, CYCLORHAMPHUS.
aaa. Ethmoid arch complete, or nearly so; digits free; no cuneiform shovel.

Large parotoid glands; no vomerine teeth, HYPEROLIA.

No parotoid glands; vomerine teeth in transverse series; xiphisternum broad, (with some basal bony deposit,) BORBOROCÆTES.§

* Type *Ceratophrys boiei* Wied.

† Type *Cystignathus parvulus* Girard.

‡ Type *Cystignathus macroglossus* Dum. and Bibr.

§ Includes *Limnodynastes* Fitz. Günther.

No parotoid glands; vomerine teeth wanting or in minute fasciculi; xiphisternum slender, without bony deposit. Abdominal integumen usually areolate, CRINIA.*

aaaa. Ethmoid arch completed by cartilage above; digits free; no shovel.

No parotoids; vomerine teeth; pupil round; auditory organs rudimental, EUSOPHUS.

aaaaa. Ethmoid arch? No metatarsal shovel. "Auditory organs wanting." Toes slightly webbed.

Vomerine teeth; no parotoids, ALSODES.

Group IV. PLEURODEMÆ.—Frontoparietal bones embracing a fontanelle; auditory apparatus developed; digits free, or slightly webbed; external metatarsals bound, terminal phalanges simple; xiphisternum an osseous style, with one or more distinct terminal cartilage discs. Tongue entire. Cephalic derm free.

a. Inguinal glands; pupil horizontal; xiphisternal cartilage emarginate or bifurcate.

Vomerine teeth; prefrontals well separated; terminal phalanges short, PLEURODEMA.

aa. No inguinal glands; pupil horizontal.

No vomerine teeth; prefrontals entirely separated; terminal phalanges short, LIUPERUS.

aaa. No inguinal glands; xiphisternal cartilage entire; pupil erect.

Vomerine teeth; prefrontals widely separated by the osseous ethmoid; terminal phalanges elongate; limbs elongate, HYLORHINA.

Group V. HYLODES.—Frontoparietal bones and auditory apparatus fully developed; digits free, or nearly so; external metatarsi bound; terminal phalanges with a transverse limb, which supports dermal discs. Cranium elongate, plane. Xiphisternum without style, scutiform, emarginate or bilobed, osseous or cartilaginous.

* *Crinia ignita* m. sp. nov.

Prefrontals well separated; sides, throat, thorax and abdomen areolate; back without folds, but with numerous oval and elongate warts; two metatarsal tubercles; black, with scattered red spots; groins and femora behind red, pink varied; limbs brown above, black banded; below white. A strong short tarsal fold; toes narrowly margined; base of fourth toe extends to nostril; heel to orbit; sacral region nearly flat; tympanum indistinct, one-third orbit; tubercles of palm numerous, strong, two exterior largest. A flat glandular aggregation at rictus oris; nostril as near lip as orbit. End of forearm to end of muzzle. Length of head and body about an inch.

This species has a considerably shorter head than the following.

Habitat.—West Australia, *Daniel*. Mus. Acad. Nat. Sci.

- a.* Prefrontals well separated, rarely the convexities of the inner borders in contact.
- b.* Manubrium cartilaginous.
- Muzzle and canthus rostralis angulated, projecting; vomerine teeth; digital dilatations small, ENHYDROBIUS.*
- Muzzle and canthus rostralis contracted, little marked; vomerine teeth; digital dilatations large, EPIRHESIS.†
- Muzzle and canthus rostralis prominent, angulated; no vomerine teeth, PHYLLOBATES.‡
- bb.* Manubrium osseous, styloid.
- Muzzle and canthus rostralis angulated; no vomerine teeth, LIMNOCHARIS.
- aa.* Prefrontals united throughout by close suture, and usually in contact with frontoparietals.
- Abdomen smooth; xiphisternum broad, LITHODYTES.
- Abdomen areolate; xiphisternum slender, entirely cartilaginous, HYLODES.
- Group VI. CYSTIGNATHI.—Frontoparietals and auditory apparatus fully developed. Cephalic derm free. External metatarsi bound, digits free, terminal phalanges simple. Xiphisternum a distinctly defined slender osseous style, with distal undivided cartilaginous disc.
- a.* Xiphisternal style emarginate, and with two distal cartilaginous discs.
- Form toad-like; no parotoids or vomerine teeth; isolated inguinal glands; two acute metatarsal spurs; pupil horizontal, GOMPHOBATES.
- ? { Form more elongate; no parotoids or vomerine teeth; no inguinal glands; metatarsal tubercles small, TARSOPTERUS.
- aa.* Xiphisternal style and distal disc undivided.
- No inguinal glands, CYSTIGNATHUS.
- Glandular aggregations on the loins, GNATHOPHYSA.

Genera incertæ sedis.

1. Probably in Group Ceratophrydes.

- Superior cranial plane much contracted, with elevated ridges behind. Eyelids not prolonged; no cuneiform shovel or parotoid glands; small dilatations on toes of posterior extremity; no palmations; belly areolate, STRABOMANTIS.

2. Among Cystignathi, or a new group.

- Superior cranial plane contracted, probably no fontanelle; auditory apparatus undeveloped; digits webbed, outer metatarsi bound, no dilatations; no vomerine teeth; pupil round, TELMATOBIUS.

* Includes *Elosia* Tschudi.

† Type *Batrachyla longipes* Baird.

‡ Includes *Crossodactylus* Dum., Bibr.

3. Hylodes, probably.

Cranium broad, rounded; digital dilatations supported by a strong cross-limb; no parotoids; xiphisternum with a distal, entire cartilage; vomerine teeth; muzzle and canthus, not marked, BATRACHYLA.

4. Hylodes or Cystignathi?

Head normal; vomerine teeth; parotoid gland; digits not webbed; thumb of male spurred; minute posterior digital dilatations, PLECTROMANTIS.

5. To ? Cystignathi or Ceratophrydes.

A cavum tympani. Xiphisternum? Sacrum? Cuneiform bone little developed; form elongate; toes free; parotoid glands; no vomerine teeth; tongue extensively free; cranium probably complete above pupil? NATTERERIA.

Supplement on the osseous structures of the Types of the Urodela.

It is as yet not always possible to distinguish differing plans of structure from differing degrees of development of a single plan. The assumption of the faculty of reproduction and cessation of development at any of the various stages through which most vertebrates pass, would give rise to a variety of genera and species. That the comparative characters of existing genera, etc., do in very many cases illustrate in part such a hypothesis, is well known; and the fact, which has been laid down* as a rule of zoology, that “*every character distinguishing suborders, families, and genera, will be found among the individuals of some species, living or extinct, to mark mere varieties or stages of growth,*” is also in its favor; but it is opposed by the frequent existence of superadded structures, which are of the nature of adaptations to external circumstances. Both the more comprehensive “plans” or “groups” and the subordinate “genera,” differ from each other in ways which have the above two kinds of significance separate or together.

With reference to these propositions, and the ultimate problem of the origin of species, no group presents greater facilities for investigation than the Urodela Batrachia. A few points are collated in the following pages, with this in view.

The Batrachia Urodela have been regarded as naturally distinguished into those with persistent, and those with temporary branchiæ,—perennibranchiata and caducibranchiata,—by almost all naturalists. The feature has been regarded either as of primary importance, as by Wagler and Buonaparte, or as secondary, as by Cuvier, Duméril, and Müller. The types known as Perennibranchiates are Siren, Proteus, Necturus and Siredon. The skeletal features presented by these are so diverse

* Proc. Acad. Philada. 1862, 75: on p. 66 (middle) “generic” should be read *genetic*.

as to indicate at once their pertinence to widely different groups; and in the case of Siredon, an identity with a known series of the Caducibranchiates, the *Amblystomata*. This identity is rendered plain in the appended diagnosis.

In certain species of the genera *Spelerpes* and *Amblystoma*,* the branchiæ remain to near the adult age, and are the last larval features to disappear. I have frequently seen the apparently adult *Amblystoma mavoritium* with considerable stumps of the branchiæ remaining, and even a few fimbriæ. The abundance and size of the larvæ of *Spelerpes salmoneus*, and rarity of the adults, have been pointed out by Prof. Baird,† who also has recorded his belief in the great probability of the *Siredon pisciformis* being the larva of some unknown *Amblystoma*. The latter creatures are known to lay eggs, and hence the probability of their being adults, and not larvæ. In another species with completely developed gills and dorsal and caudal fin, brought by Dr. Coues from Arizona, I find largely developed ovaries filled with eggs, some in an advanced stage. Moreover, the carpal and tarsal bones are ossified, although cartilaginous in many *Urodela*, which lose the branchiæ.

The question appears, however, to be finally settled by the remarkable facts observed recently at the Jardin des Plantes by Prof. A. Duméril. Siredons laid eggs, which hatched; the larvæ developed into Siredons, and, continuing to change, became *Amblystomas*! a confirmation of the suspicion of Prof. Baird. The character is in this case *not even specific*.

The position and tissue of the external branchiæ render them liable to injury; the following illustrates how little such injury affects the vitality of the individual: Dr. Coues states that his Siredons were taken in a well, by a baited hook. They were laid in the scorching sun, and remained there nearly an hour before being carried away and placed in water. They recovered perfectly; the skin exuded moisture during their exposure to the heat. The gills were *black* in this species, in life.

Some years ago I had occasion to observe a Siren confined in an aquarium, which had been taken near Alton, Ill. (Lat. 39°). I first saw it in midwinter; it was then without gills, but frequently came to the surface and took mouthfuls of air, parts of which would escape through the slits on the neck. There were frequently convulsive movements of the latter region, by which the anterior and sometimes the posterior slits were opened. Water was at the same time drawn in through the *external nares*, and probably reached the pharyngeal cavity. The animal was said to have suffered an absorption of the gills, which lasted two weeks, during which time it would take no

* In *Amblystoma punctatum* and *opacum* the branchiæ disappear while the animal is but half its future size: the period at which they disappear in *Desmognathus fusca* appears to vary, but averages as the preceding; in *Hemidactylum scutatum* and *Geotriton carbonarius* their absorption takes place while the animal is very small. In *Plethodon erythronotus* they also remain a very short time and are of no functional value, as the larva does not enter the water after leaving the egg.

† Jour. Acad. Nat. Sci. Philada., i. p. 281.

food; but I suspected they had been nibbled off by some Pomotes (Sunfish) confined in the same aquarium, who, attracted by their rosy color, thought them lawful prey. There were very small stumps remaining, of which the two anterior, seventeen days after my first observation, developed a minute brown fringe on the under side. Twenty-four days later, the stumps were longer, and the two anterior now bore a double series of processes, which were of a rosy slate color. The animal still came to the surface for air, and disliked excessively to be removed from the water. It measured 9 in. 9 lin. in length, and was at first pale brown, with numerous black dots above, and pale slate below,—but became darker and the spots larger. There was a golden band on the side of the lip and “cheek,” and the toes were tipped with a corneous cap. Further observations went no further than to show that this Siren could live for more than two months deprived of its branchiæ, and that the latter can be reproduced.

I have seen a specimen of the *Siren striata* in which the branchial fimbriæ were thickened, and the three main rami adherent throughout their length to the pharyngeal walls between the fissures; being thus entirely abortive and in part atrophied. In skeletal and other features, this species does not differ from the *Siren lacertina*.

Another feature characteristic of the immature stages of both tailed and tailless Batrachia, is permanent in the “perennibranchiate” types just mentioned, and in the *Amphiuma* and *Protonopsis*,—*i. e.*, the cartilaginous condition of the intervertebral tissue, and consequent retention of the biconcave or fish-like vertebra. It does not appear to have been previously pointed out that this feature persists in all the species of the American types *Amblystomidæ* and *Plethodontidæ*, contrary to the condition in the forms of the Old World.

Prof. Baird, in the first synopsis of our genera published, pointed out the difference between *Amblystoma* and our other genera, in the ossification of the tarsus and carpus of the former, and cartilaginous state of the latter. This is again a strictly developmental difference, identical with the *Perennibranchiates* and extinct *Xenorhachia*.

With respect to the cranial and tarsal ossifications, the Siredon is first identical with the larva of *Amblystoma*,—*e. g.*, *punctatum*,—when half the dimensions of the adult; bearing distinct nasal and prefrontal bones with maxillaries, and the longitudinal palatines with a slight ligamentous connection with the reduced pterygoids, forming an arch separate from the parasphenoid. In *some* Siredons the carpal and tarsal bones are fully ossified,—a condition which I have not yet observed in any *Amblystoma* larva.

The structural features of *Necturus* are very different, as has been in part pointed out by authors, and are identical with those of the larva of *Spelerpes rubra* and *salmonæa*. Both types lack the maxillaries, nasals and prefrontals, and exhibit a broad

continuous palato-pterygoid arch, in close contact with the parasphenoid. The two ceratohyals are confluent, the posterior is present, and there are but three superior hyoid arches. These structures coëxist in the larva of *Spelerpes salmonea*, at a period when it has attained double the size of that of *Amblystoma punctatum*, and equal to that of its adult. The hyoid elements only I have not yet seen as fully ossified in *Spelerpes* larva, as in the *Necturus*. The relation then between *Necturus* and *Spelerpes* is probably the same as that between *Siredon* and *Amblystoma*, and the same (as I have pointed out, *Proc. Acad. Phil.* 1862, p. 66) as that between *Protonopsis* and *Megalobatrachus*, in respect to the pharyngeal fissures and hyoid pleurapophyses.

Dr. Gray, after Prof. Baird, has very judiciously excluded the *Siredons* from the *Perennibranchiates* proper, though Müller retained them as the type of his family *Acholotida*. They undoubtedly belong to the group *Caducibranchiata*, and family *Amblystomidæ*. *A priori*, therefore, *Necturus* might be placed among the *Plethodontidæ* of the same great series, but its structure, so far as observations have been made, is permanent. It also represents a far less advanced larval bony structure than *Siredon*, but so do the adult *Plethodontidæ* in most respects than the *Amblystomas*. The incomplete coincidence of advance in different organs may be thus illustrated :

| AMBLYSTOMIDÆ. | PLETHODONTIDÆ. |
|---------------------------------|----------------------------------|
| Superior. | Inferior. |
| Carpus and tarsus osseous. | Carpus and tarsus cartilaginous. |
| Premaxillary fontanelle closed. | Premaxillary fontanelle open. |
| Inferior. | Superior. |
| O. pterygoideum persistent. | O. pterygoideum obliterated. |

The inferiority of some *Plethodontidæ* is seen in the non-distinction of the digits (*Geotriton*), the thinness of the ossification of the parietal membrane bones (*Batrachoseps*), and in *Spelerpes lineolus m*, from Vera Cruz, the persistence of the membranous cranium by the limitation of the parietal bones to two small oval lateral scales, and the wide divarication of the posterior extremities of the frontals.

We may then conclude that developmental features are thoroughly constant in most types, but in some one or more cases in many, some are known and the others will probably be found, to illustrate the law of variation above laid down. We are then brought face to face with phenomena of modification of species, which do not come to view in the irregular aspect of a theory of "descent with modification" by a fortuitous "natural selection," which could affect only a certain class of structures. We want a theory which will explain the times and causes of the stability of types consisting of co-existent structures, and the instability of such co-existences; just as the compounds of the elements have their conditions of stability and instability; the elements, of stable or unstable union. We want to ascertain that law of harmony by which the coincidences of structures have been varied by their reproduction being shifted from stage to stage of individual development, till the present faunæ are the result.

This view has not been overlooked by Darwin, who, however, treats of it very briefly, and appears to attach it to the theory of adaptations, or modification for a physiological purpose. He says, *Origin of Species*, 388, (American Edition, 1860): "We may extend this view to whole families or even classes. The fore limbs, which served as legs in the parent species, may become, by a long course of modification, adapted in one descendant to act as hands, in another as paddles, in another as wings; and on the above two principles,—namely, of each successive modification supervening at a rather later age, and being inherited at a correspondingly late age,—the fore limbs in the embryos of the several descendants of the parent species will still resemble each other closely, for they will not have been modified. But in each individual new species, the embryonic fore limbs will differ greatly from the fore limbs in the mature animal; the limbs in the latter having undergone much modification at a rather late period of life, and having thus been converted into hands, paddles or wings." He then inclines to assign this change to the necessity of external circumstance. But such modification must be the same in kind as others, which the same hypothesis must explain; and of which the same author remarks (p. 382): "We cannot, for instance, suppose that in the embryos of the Vertebrata the peculiar loop-like course of the arteries near the branchial slits are related to similar conditions in the young mammal, which is nourished in the womb of its mother, in the egg of the bird which is hatched in a nest, and in the spawn of a frog under water. We have no more reason to believe in such a relation than we have to believe that the same bones in the hand of a man, wing of a bat, and fin of a porpoise, are related to similar conditions of life. No one will suppose that the stripes on the whelp of the lion or the spots on the young blackbird are of any use to these animals, or related to the conditions to which they are exposed."

Among the higher groups of animals can be detected series "homologous" on the same principle as the alcohols (? compound radicals) and their derivatives; and the component types of each can be, and have been in many instances, shown to be "heterologous," as are the ethers,—mercaptans, aldehydes, acids, etc. Among the Mammalia two (homologous series) have been pointed out: Implacentalia and Placentalia;* possibly such are the types Altrices and Præcoces among Aves. Of a lesser grade in this class are the parallel series of Pullastræ and Gallinæ, of Clamatores and Oscines. Among Tortoises I have alluded to the Pleurodira† as compared with the remainder of the order, already parallelized by Wagler; and of lesser grade, the series among Lacertilia of Acrodonta and Iguania, parallelized by Dumèril and Bibron, and of Teidæ and Lacertidæ, compared by Wiegmann: I have discovered a

* Perhaps more exist, as Flower and Huxley cast doubts upon some of the supposed distinctions of these two. Professor Dana's *Megasthenes* and *Microsthenes* may also be such, but they lack as yet the necessary anatomical demonstration.

† *Proc. Acad. Philada.*, 1864.

full parallelism between the Raniform and Arciferous Anura.* It is carried out between the Characini and a group of remaining Physostomous fishes perhaps not yet well defined:† it is exhibited between the orders Diptera and Hymenoptera among insects. None of these comparisons can be allowed, of course, without the most searching anatomical, histological, and embryological analysis.

This *heterology* is what Swainson and others called "analogy," as distinguished from affinity. It *generally* relates genera of different zoological regions. Mimetic analogy, on the contrary, relates genera of the same region; it is a superficial imitation which has occurred to critical biologists, and is of much interest, though as yet but little investigated. It has as yet been observed in external characters only, but occurs in internal also; it has been accounted for in the first case by the supposed immunity from enemies, arising from resemblance to well defended types. No such explanation will, however, answer in the latter case. I believe such coincidences express merely the developmental type common to many heterologous series of a given Zoological "Region." This will be alluded to a few pages later.

To return from this digression.

Three principal types of Urodela may be discovered in their skeletal arrangements; viz.:

TRACHYSTOMATA (Mueller).

O. maxillaria wanting; nasalia embraced by spine of premaxillaria: prefrontalia wanting; palatina wanting; pterygoidea wanting; orbitosphenoids large, anterior, forming part of palate; mandible with condyle, without teeth on the dentale. Ceratohyals, first two distinct.

With branchiæ, biconcave vertebræ, and cartilaginous carpus, as characters of less intrinsic value.—

Fam. Sirenidae. Genus Siren.

PROTEIDA (Mueller).

O. maxillare and prefrontalia wanting; palatinum and pterygoideum present, continuous; nasalia wanting; orbitosphenoid elongate, not forming part of palate; mandible with teeth on the dentale. Ceratohyals, first two connate.

Subordinate features: branchiæ, biconcave vertebræ, and cartilaginous carpus and tarsus.—

Fam. Proteidae; Proteus and Necturus.

CADUCIBRANCHIATA.‡

O. maxillare present; prefrontale present, (with one exception); premaxillaria embraced by nasalia; palatina present, not approximated to usually present pterygoidea; orbitosphenoid large, not reaching palatal surface; mandible with teeth on the dentale.

* Proc. Acad. Nat. Sci., 1864, 181.

† Gill's Eventognathi and Nematognathi being of course omitted.

‡ This name, though not strictly applicable to Siredons included in the suborder, may be retained.

Branchiæ or fissures present or absent; vertebræ amphi- or opisthocœlian; tarsus and carpus cartilaginous or osseous.—

Families Amphiumidae, Protonopsidae, Desmognathidae, Plethodontidae, Amblystomidae, Hynobiidae, Salamandridae, Pleurodelidae.

PROTEIDA.

This suborder was established by J. Müller, and is the same as the Proteidæ of Gray.

But one species of Proteus is generally recognized, though Fryer* in 1846 pointed out the probable existence of a second, and Fitzinger in 1850† described and named seven. The latter author had over four hundred specimens at his disposal, and gives good diagnoses from external characters, including color. The latter feature is liable to change of shade according to Michahelles,‡ who states that of twenty specimens kept by him, only six retained their original flesh color after a lapse of some months, the remainder becoming bluish black. Dr. Fitzinger promised to make public the results of an anatomical study of his species, but has not yet, to my knowledge, accomplished it. In the meantime I drew up the following characters of five undoubted species from seven skeletons, types of the above, preserved in the private museum of Prof. Hyrtl, in Vienna.

A. Two condyles on the o. o. supraoccipitale.

Longitudinal and transverse occipital crests none. Vertebræ 23. Premaxillary teeth, seven each side; mandibulars seventeen, no teeth on the o. operculare. From coronoid process to angle of ramus, nearly as long as from coronoid to symphysis. Muzzle narrowed, canthus rostralis weak, zoisii.

AA. No condyles on the supraoccipitale.

I. Twenty-three dorsal vertebræ; an occipital crest.

Premaxillary teeth eight, mandibulars twenty-one, a few operculars. Coronoid process scarcely developed. Muzzle, and hence the o. o. frontalia exceedingly slender; latter, with the parietals convex, (? from drying?) carrarae.

II. Twenty-five to six dorsal vertebræ; a longitudinal occipital crest.

a. No teeth on o. operculare; premaxillaries 8—9.

21—2 mandibulars; from coronoid process to angle much shorter than from former to symphysis; no groove below coronoid process. Muzzle longer than following; o. o. frontalia concave medially, parietalia plane; canthus rostralis strong,

xanthostictus.

* Archiv. für Naturgeschichte, 189.

† Sitzungsberichte Wiener Academie, 291.

‡ Isis von Oken, 1831, 505.

aa. Teeth on operculare; premaxillaries 8.

Mandibulars 21; from coronoid to angle much shorter than from former to symphysis; groove below coronoid extending anteriorly; muzzle shorter; frontals plane, parietals and occipitals concave; canthus strong, *s ch r e i b e r s i i*.

aaa. Teeth on operculare, premaxillary teeth ten (9).

Twenty-nine (four) mandibulars; coronoid without groove below, much nearer angle mandible than symphysis; muzzle long, frontals narrow plane; canthus not strong, *a n g u i n u s*.

I have retained the name of the original species for the last of these species, which Fitzinger has called *P. laurentii*. *Zoisii* is the stoutest in proportion to the length. *P. carrarae* is from Dalmatia, while the others are from Carinthia. A specimen like *P. xanthostictus*, but with nine premaxillary teeth, has been named *freyeri*, and one very near *anguinus*, with twenty-four mandibulars, has been named *heidingerii*.

CADUCIBRANCHIATA.

It is customary to regard this group as presenting two types, one with, and the other without pharyngeal fissures. But this feature is of no greater value than any other, as the very nearly allied genera *Protonopsis* and *Megalobatrachus* differ in this respect.

A. An axial cranial bone (? vomer) in front of orbitosphenoids, and one forming palatal surface in front of parasphenoid. Teeth on the outer anterior margin of palatines. Urohyal and basihyals distinct; two anterior ceratohyals connate.

I. Prefrontals and pterygoids present.

Parietals prolonged laterally, not reaching prefrontals. Orbitosphenoid separated by membrane from proötic. Vestibule wall osseous internally. Premaxillaries consolidated.

Carpus and tarsus cartilaginous.

Vertebræ biconcave.

Neck with a pharyngeal slit.

Occipital condyles on cylindrical pedestal.

Mandible elevated in part by tendon passing over parietal bone, and arising from atlas.

AMPHIUMIDÆ—Two genera, *Amphiuma*, *Murænopsis*.

The occipital condyles and temporo-cervical tendon are quite as in *Desmognathus*; they have not been previously described. In *Amphiuma* means there is a minute, not articulated bone on the suture between the o. o. frontalia and præfrontalia, in the situation of a lachrymal.

There are some approximations to *Cœcilia* in *Amphiumidæ*. It does not appear to have been noticed that the latter possess minute scales; the free margin of the frontal seems to foreshadow the overroofing of the orbit and temporal fossa seen in *Cœcilia*. There is also a very large foramen or canal passing through the o. maxillare from near its middle to the orbit, foreshadowing the *canalis tentaculiferus* of *Cœcilia*: a narrow one occurs in the same situation in *Protonopsis*. Further, the prominent horizontal anterior inferior processes of the vertebral centra are the same in *Amphiuma* and *Cœcilia*.

B. No anterior axial cranial bone; teeth on anterior margin of o. o. palatina.

II. Prefrontals and pterygoids present.

Parietals and prefrontals prolonged, meeting and embracing frontals.

Orbitosphenoid separated from proötic by membranous wall.

Wall of vestibule membranous internally.

Premaxillaries separated.

Carpus and tarsus cartilaginous.

Vertebræ biconcave.

Occipital condyles sessile.

PROTONOPSIDÆ.—Genera *Protonopsis*, *Megalobatrachus*; Nearctic and Palæarctic.

C. No anterior axial bone; palatines not prolonged over parasphenoid bearing teeth on the posterior portion. No postorbital arch.

III. Prefrontals and pterygoids present.

Parietals and prefrontals prolonged, meeting, embracing frontals.

Orbitosphenoid separated from proötic by membranous wall.

Wall of vestibule osseous.

Premaxillaries distinct, usually not embracing a fontanelle.

No dentigerous plates on the parasphenoid.

Carpus and tarsus osseous.

Vertebræ amphicoelian (biconcave.)

Occipital condyles sessile.

AMBLYSTOMIDÆ.—Genera, *Amblystoma*, *Ensatina*, and *Onychodactylus*. North America; one species in Japan.

IV. Prefrontals present, pterygoids wanting.

Prefrontals not prolonged or embracing frontals; parietals slightly embracing.

Orbitosphenoids separated by membrane from proötic.

Vestibule, inner wall osseous.

Premaxillaries always embracing a fontanelle.

Dentigerous plates on the parasphenoid.

Carpus and tarsus cartilaginous.

Vertebræ amphicælian.

Occipital condyles sessile.

PLETHODONTIDÆ.—Genera *Plethodon*, *Hemidactylum*, *Spelerpes*, *Geotriton*, and *Batrachoseps*. North America; seven north neotropical species, one in Siam, one in South Europe.

This family, with that preceding and that following, have been regarded by Dr. Gray as subtypes of one family,—his *Plethodontidæ*. Dr. Hallowell elevated the *Amblystomidæ* to its present rank in 1859, and I have followed him, and can now add several confirmatory characters. Nevertheless, the frontals are not embraced by the parietals and prefrontals in *Onychodactylus*, but are as in *Plethodon*; I do not know the structure of its tarsi and carpi. In *Ensatina* also, the premaxillary embraces a fontanelle, as in the present family. Eschscholtz correctly represents *Batrachoseps attenuatus* as without prefrontals. An elongate process of the frontal occupies only part of its place, forming no suture with the maxillary; this is quite different from *Desmognathus*, where the orbit is completed by the union of frontal and maxillary. In *Batrachoseps quadridigitatus* the prefrontal occupies this depression as an elongate vertical scale.

In *Spelerpes rubra* the quadratum presents a small internal anterior ala, which has a superficial resemblance to a pterygoid. In this species there is apparently an azygus bone behind the premaxillaries; this is, however, only the exposed extremity of their united spines, which are nearly or quite isolated by the approximation of the anterior parts of the nasale. It does not occur in the *S. salmonea*.

All the characters of this family are those of low developement, and approximations to the larval condition, except the loss of the pterygoid; one of the species exhibits a subocular cirrhus, which occurs in some of the *Gymnophidia* (*Cœcilia*) and *Dactylethra* among *Anura*. It is probably the persistence of that long subocular tentacle characteristic of the early larval stage of *Salamandridæ* and *Pleurodelidæ* (*e. g.*, *Salamandra Notophthalmus*), and of a later larval stage of *Dactylethra* (*vid.* Wyman and Gray), where they resemble the appendages of the *Siluridæ*. They have been called crochets by Rusconi, and homologized with the cylindric cephalic processes of the larval *Rana*, with what correctness remains to be proven by observations on other types. In the young larva of *Bufo americanus* they are not developed, but the transverse black line, at whose extremities they appear in *Rana*, instead of vanishing, becomes a fissure, separating two longitudinal lateral lips from an equally prolonged transverse anterior lip, which has much the form of the labrum of an insect, as, *e. g.*, *Locusta*.

When the remains of the intervertebral cartilages are visible, they adhere to the posterior of two vertebræ, except in the single specimen of *Hemidactylum scutum*, which I have examined, where they adhere to the anterior.

V. Prefrontals and pterygoids wanting.

Parietals not embracing frontals.

Orbitosphenoid separated by membrane from proötic.

Vestibule, internal wall osseous.

Premaxillaries embracing a fontanelle.

Dentigerous plates on the parasphenoid.

Carpus and tarsus cartilaginous.

Vertebræ opisthocælian.

Occipital condyles on cylindrical pedestal.

Mandible elevated by tendon, which arises from atlas and moves over o. parietale.

DESMOGNATHIDÆ.—One genus, *Desmognathus*, North America.

This family is now first characterized.

The absence of o. prefrontale does not appear to be the result of its confluence at any late period, with the nasale; its ordinary position is traversed by the frontal suture. The frontal bone is decurved, and closes the preorbital aspect of the superpalatal vacuity, usually open.

D. No anterior axial bone. Palatines in contact, prolonged over parasphenoid, bearing teeth on posterior external margin.

VI. Prefrontals and pterygoids present, well developed.

Frontal not embraced by parietals and prefrontals.

Orbitosphenoid separated by membranous wall from proötic.

No dentigerous plates on the parasphenoid.

Carpus and tarsus?

Vertebræ?

Postfronto-squamosal arch or ligament none.

Occipital condyles sessile.

HYNOBIIDÆ.—Genus *Hynobius*, Japan.

E. No anterior axial bone. Palatines with posterior separate processes extending over the parasphenoid, bearing teeth on their inner margins.

VII. Prefrontals and pterygoids present.

Parietal entirely separated from prefrontals by broad frontals.

Orbitosphenoid confluent with proötic.

No dentigerous plates on the parasphenoid.

No postfronto-squamosal arch or ligament.

Carpus and tarsus osseous.

Vertebræ opisthocælian.

Occipital condyles sessile.

SALAMANDRIDÆ.—Two genera: *Salamandra*, *Triton*, Regio Palæarctica.

This family was characterized by Dr. J. E. Gray, in Proc. Zoological Soc. London, 1858, 142.

VIII. Prefrontals and pterygoids present.

Parietals not embracing the broad frontals.

Orbitosphenoid

No dentigerous plates on the parasphenoid bone.

A postfronto-squamosal arch, sometimes ligamentous.

Carpus and tarsus osseous.

Vertebræ opisthocælian.

Occipital condyles sessile.

PLEURODELIDÆ.—Genera Hemisalamandra, Neurergus, Lissotriton, Lophinus, Euproctus, Cynops, Notophthalmus, Pleurodeles, Glossolega, Siranota. Regio Palæarctica; three species in North America.

These genera form a series measured by the increasing strength and ossification of the post-frontoparietal arch, which has been pointed out by Gray and figured by Gervais, Duméril, and Dugès. It is first bony in Lophinus: in Glossolega it is very stout, and leaves but a small crotaphite foramen, while in Siranota it fills up the foramen, being entirely continuous with the parietal bone. On this ground Dr. Gray has regarded this genus as representing a family,—“Siranotidæ,”—but it does not appear to be more different from Glossolega than the latter is from Neurergus and Hemisalamandra.*

The study of the Mammalia, the Rapacious, Pullastrine, Gallinaceous and Passerine Birds, of the Sauria, Tortoises, Tailless Batrachians† and Malacopterygian Fishes, leads to the conclusion that these portions of the Fauna Neotropica represent much lower stages in their respective series than do the same types in the Regio Palæotropica. In a few types, as Zygodactyl Birds and Ophidia, there is, as far as our present knowledge extends, a seeming equivalency; but in no single group can a superiority be proven for the Fauna Neotropica; the tests of the grade being ever the retention of the characters of the incomplete stages of the extremes of the series, the relations of generalized and specialized structure, or, where we have not yet demonstrated thoroughly, by the affinities with forms whose relations in these respects *are* known. These relations coincide in *kind* with those contrasting the Faunæ of earlier and later geological periods, but not in *degree*, since they refer to the *subordinate* or

* The genera adopted are those arranged by me, Proc. Acad. 1862, 343. The preparations on which the preceding investigations have been made are the collections of Prof. Baird and myself; the former in the Museum of the Smithsonian Institution, Washington.

† This is in opposition to the following proposition of Günther, (Proc. Zool. Soc. Lond., 1858,) the contrary of which, I think, has been abundantly proven. He says: “Such a difference between the animal life of the New World and that of the Old as pertains to other parts of the animal kingdom, is not to be observed in the Batrachians. Dissimilarity and similarity of the Batrachia Fauna depend upon the zones.”

homologous divisions of the classes and subclasses, and not to the classes themselves. Hence the relations between the two Faunæ will be those of differing minor epochs in geological time, through several of which some special forms may range; and we may safely conclude, from data above alluded to, that the Regio Palæotropica is one or more geologic *epochs* in advance of the R. Neotropica.

Between these Faunæ come the Nearctic and Palæarctic, of which Agassiz has said that the former was an epoch behind the latter. The undeveloped condition of our predominant types of Salamanders, our Pleurodont Saurians, our more numerous Clamatores and nine-quilled Oscines, and the comparative fewness of the ten-quilled Oscines, especially the highest, Turdidæ (including *Sylviidæ*), would indicate from an anatomical stand-point that this view is correct, though the balance of difference is small, and the northern regions are nearly identical.

As to the Regio Æthiopica, excepting of course Madagascar, in reptilian features it is almost equivalent to the R. Indica; in several points the southern extremity must be excepted from this comparison.

Of the R. Australis, Prof. Agassiz* has said that none of its animal products present that degree of peculiarity exhibited by the Mammalia. Its inferiority is plain, however, in the points below included; and if we consider any distributions from the centres to have taken place during brief epochs of time, this region will have had every opportunity of acquiring its few high types, as some Acrodont Lacertilia, and numerous birds,† which can be most readily transported; including a few high Oscines from its neighboring Palæotropical area.‡

On the whole, it cannot be said that the evidence for the succession here claimed is as yet much more than fragmentary; yet it appears to be sufficiently indicated, which cannot be said of any other order or succession.

The succession of the great regions and grounds therefore, may then be imperfectly illustrated as follows:

R. A u s t r a l i s.—Inferior in Monotrematous and Marsupial Mammalia, Pullastriform and Struthious Birds, Serpentineform Pleurodont Lacertilia, Arciferous Ba-

* Contrib. I. 44. Prof. A. also gives a table of Scincidæ from Duméril and Bibron, illustrating its distribution, from which it would appear that the greater number of limbless and digitless types are from other regions than the R. Australis. But of the twenty genera, with toes less than 4—4, but *eight* belong to the Scincidæ. Adding to these two from Gray's Catalogue, we have seven of them Australian, one South Æthiopian, one Palæarctic, and one Palæotropical. It possesses in addition the limbless families Pygopodidæ, Lialisidæ, and Aprasiidæ. It must at the same time be remembered that the most elevated Scincidæ belong to the *same* region Cyclodus, Hinulia, etc.

† Much must yet be allowed for the incompleteness of anatomical knowledge of the birds. The only system which, in many features, appears to nearly accord with nature, is that published by Wilh. Lilljeborg, Upsala Transactions, 1862.

‡ Vide articles by A. Wallace on distribution in the Malaysian and Australasian Archipelagos.

- trachia, Pleurodire Tortoises, its Elapid venomous snakes, and the whole Flora, according to Unger.
- R. *Neotropica*.—Marsupial and Edentate Mammalia, Inferior Rodentia and Quadrumana, Pleurodire Tortoises, Pleurodont Lacertilia, Arciferous Batrachia, Clamatorial and Pullastriform Birds, Characin and Erythrinid Malacopterigii.
- R. *Nearctica*.—Lacking most of the inferior types of the preceding, it retains more Arcifera and Bufoniformia, Pleurodont Lacertilia, and Clamatores, than the following; possesses the inferior Urodela, the Aphredoderus and Percopsis, and wants as types of the
- R. *Palæarctica*.—Higher Urodela, Acrodont Lacertilia, higher Gallinæ* and Oscines. This is inferior, however, to the last in Ophidia Solenoglypha.
- R. *Palæotropica* or *Indica*.—Superior in types of Teleostei, Batrachia Anura, Lacertilia Acrodonta, Testudinata,† Gallinaceous and Oscine Aves, Mammalia, including Homo.

If the above succession be marked out in present time, it has no doubt existed throughout a longer or more probably shorter series of recent geologic periods or epochs, and over areas of course only partially coinciding with those of the present Regions. This points to the Regio Palæotropica, faunally and florally most advanced in time, as the seat of first origin of the human species, as already indicated by revelation and tradition. The fact of its being the source of such a majority of the vegetable and animal products most useful to the species, is in harmony with this view; and more so is the known, almost regular departure from the typical symmetry of form and expression of mind by body, in the men of the different Regions. That these areas were occupied by man in this succession, determined by their preparation for maintaining a degree of developmental perfection, sufficient to enable him to take his part in "the struggle for existence," is a natural sequence of the relation in time.

Palæontology is as yet too incomplete to answer the question as to how ancient such a relation may be. Its indications are quite contradictory, and perhaps may not be relevant, prior to Cænozoic time.

Thus the resemblance between existing Australian and American types and tertiary European‡ forms successively, harmonizes with the existent relations between the faunæ here proposed; but the similarity between fresh water shells of the Upper Missouri Lignite and recent Indian forms, between American Eocene and European

* E. g., Phasianus, Tetrao, Lyrurus, Tetraogallus, etc.

† Possesses a greater number of distinct types of Emydidæ and Testudinidæ than the R. *Nearctica*, though not much beyond it.

‡ Among others, the extinct genera *Polysemia Myr.* and *Heliarchou Myr.* exhibit the unossified carpus and tarsus of the recent American *Plethodontidæ*.

Miocene plants, and between American Cretaceous and European Eocene plants, are of exactly contrary significance. Of the same meaning is the appearance of true Crocodiles* in American Cretaceous, equal European Eocene.

As progress is the rule in palæontology, the lapse of time will probably see a later equivalency of some kind between the characters of the products of the inferior Zoological Regions, *e. g.*, Australis, Neotropica, and of those characterizing the highest,—*e. g.*, Palæotropica, at the creation of man,—and *mostly* still remaining.

The ready and rapid naturalization of Palæotropical and Palæarctic plants in the North and South American and Australian regions, is a remarkable feature often noticed.† This will furnish the future palæontologist with the explanation of the modification of flora of a region on the introduction of a new epoch, and that by no course of descent within that region; and constituting a nearer equivalency, as above proposed, with that higher flora established long since in the Regio Palæotropica.

The extent of time during which the regions owe their products to migrations and modifications, may have been limited to periods or epochs only. In respect to terrestrial cold-blooded vertebrata, the following facts in their geographical distribution are patent; they have been observed also in other types:‡

First, the identity of many of the boreal genera throughout the earth; second, the

* With regard to the amphicælian Crocodile genus *Hyposaurus Owen*, of the New Jersey Green Sand, I would state that it differs in one feature from all known extinct Crocodilians. The neural spines of the cervical vertebræ are acuminate, of considerable—finally, of great—height, the anterior standing transversely on the neural arch, the median subtetragonal, the posterior, as usual, longitudinal in section. In an anterior cervical vertebra, length 2 in., the spine is 2 in. 10 l. above the ceiling of the arch, and is acute; it receives a strong lateral wing from each posterior zygapophysis, which does not disappear till near the tip. These enclose a deep groove on each side behind, with a strictly perpendicular posterior median rounded rib; in front a narrow keel extends from the tip to the neural canal; the lateral alæ are curved backwards. On a more posterior cervical, the lateral alæ are very heavy, short and rounded, and enclose no groove with the slightly projecting posterior vertical rib, while the anterior keel has become a strong compressed wing, dividing two shallow anterior grooves; breadth and length equal in section. In a last cervical, length 2 in. 2 l., the longitudinal section (equal about an inch) is longitudinal cuneiform, owing to the projection of the anterior ala. In an anterior dorsal the section is longitudinal (1 in. 5 l.); the lateral ribs remain at the base only, and the posterior carina is strong and sharp; it is acuminate, and was probably subacute, but is broken at tip; if restored would measure 4 in. 6 l. at least.

This creature possessed some kind of elevated dorsal carina, probably dermal, as in some Anolidæ and Iguanidæ, though the spines are not acute and ribbed in the latter. Their appearance in *Hyposaurus* suggests some kind of conic dermal horny sheath as defensive weapons; the vertebral line could not in any case have been covered by flat bony plates, as in ordinary Crocodilia. (See Leidy's Cretaceous Reptiles of the United States, 1865, p. 18.)

† See Dr. J. D. Hooker's article (Linnæan Society) on Naturalization of European Plants in New Zealand, and Prof. A. Gray's Botany of the Northern United States.

‡ A. Murray on Coleoptera, Old Calabar. Trans. Linnæan Soc. Lond., 1863.

occurrence of closely affined forms in the most nearly approximated regions of West Africa and South America; third, the appearance of similar forms in the most adjacent parts of South America and Australia.

Finally, as Guyot* points out that the races of man are inferior as we reach the southern extremities of the continents which are prolonged into the great Water Hemisphere, so it can be shown that these extremities produce the greater number of "degraded" or "undeveloped" genera of Batrachia Anura, as indicated by the condition of their cranial bones, sternum, etc.

* Earth and Man.

EXPLANATION OF PLATE 25.

- Fig. 1. *Thoropa missiesii* Bibr., Rio Janeiro. Anterior part of cranium above.
2. *Chorophilus oculatus* Daud. (*Cystignathus ornatus* Gthr., not *C. oculatus* Holbr.) *a*, premaxillaries; *b*, maxillaries; *c*, prefrontals; *d*, ethmoid; *e*, frontoparietal; *f*, quadratum; *g*, prootic; *h*, exoccipital. From Georgia.
3. *Scytopus venulosus* Daud., Brazil.
4. *Smilisca baudinii* D. & B. Mexico: *g*, anterior and posterior terminal phalanges.
5. *Hyla palmata*, Brazil.
6. *Agalychnis moreletii*, Guatemala.
- 7—8. *Tripurion petasatus* m., Yucatan.
9. *Scaphiopus solitarius*, Georgia.
- 10—11. *Discoglossus pictus*, Greece: *a*, arched cartilage; *b*, acromial; *c*, coracoid; *d*, xiphisternal; *e*, ribs; *f*, coccygeal diapophyses.
12. *Pelobates fuscus*, Austria.
13. *Megalophrys montanus*, Java.
14. *Chiroleptes australis*, New S.
15. *Gnathophysa ocellata*, Surinam.
16. *Pithecopus fuliginosus*, Brazil.
17. *Borborocætes peronii*, Australia.
18. *Hylorhina aenea*, Chili.
19. *Phyllobates bicolor*, Cuba.
20. *Enhydrobius vomerinus*, Rio Janeiro.
21. *Lithodytes oxyrhynchus*, West Indies.
22. *Zaphrissa eurypelis* m., sp. nov. Fossil.

ART. III.—*New Unionidæ, Melanidæ, etc., chiefly of the United States.*

By ISAAC LEA.

(Continued from page 65.)

AMPULLARIA GRACILIS. Pl. 22, fig. 1.

Testa regulariter elliptica, luteo-olivacea, transversim pervittata, subtenui, arcute umbilicata, lævi, nitida; spira emersa; suturis parum impressis; anfractibus instar senis, subconvexis; apertura ovata, intus tenebroso-brunnea et obsolete vittata; labro acuto; umbilico arcute compresso; columella lævi.

Shell regularly elliptical, yellowish olive, transversely and very much banded, rather thin, narrowly umbilicate, smooth and shining; spire raised; sutures slightly impressed; whorls about six, somewhat convex; aperture ovate, dark brown and obscurely banded within; outer lip acute; umbilicus narrowly compressed; columella smooth.

Proc. Acad. Nat. Sci. 1856, p. 110.

Hab.—Siam, S. R. House, M. D., per W. A. Haines.

My cabinet and cabinet of Mr. Haines.

Diam. 1·22,

Length 1·40 inches.

Remarks.—I have two specimens of this beautiful species before me. The bands are very much the same in both of them. The epidermis is very smooth and slightly polished. It is near to *flagellata*, Say, from Cuba and Florida, but is smaller, rather thinner and has a more constricted umbilicus. It differs also in having but little matter deposited on the columella.

AMPULLARIA TURBINIS. Pl. 22, fig. 2.

Testa turbinata, luteo-viridi, transversim vittata, subcrassa, vix perforata, lævi; spira valde depressa; suturis parum impressis; anfractibus instar quinis, valde convexis; apertura pergrandi, elongato-ovata, intus fusca et valde vittata; labro acuto; columella valde incurvata, incrassata. ●

Shell turbinate, yellowish green, transversely banded, rather thick, scarcely perforate, smooth; spire very much depressed; sutures slightly impressed; whorls about five, very convex; aperture very large, elongately ovate, brownish and much banded within; outer lip acute; columella very much incurved and thickened.

Operculum calcareous, thick and solid, subconcentric, with the polar point on the edge half way up.

Proc. Acad. Nat. Sci. 1856, p. 110.

Hab.—Siam, S. R. House, M. D., per W. A. Haines.

My cabinet and cabinet of Mr. Haines.

Diam. 2.36, Length 2.46 inches.

Remarks.—Three specimens are before me, only one of which is adult; the other two are quite young. This species is remarkably flat on the top, the spire being but slightly exerted. It is nearest perhaps to *Celebensis*, Quoy, but is wider in proportion to that species and more turbinate. It is also more banded.

AMPULLARIA TUBÆFORMIS. Pl. 22, fig. 3.

Testa elongato-globosa, tenebroso-fusca, transversim vittata, tenui, pellucida, late umbilicata, lævi; spira emersa; suturis valde profundis; anfractibus instar quinis, valde convexis; apertura magna, subrotunda, dilatata, luteo-albida, intus brunneo-vittata; umbilico magno; columella subcallosa.

Shell elongately globose, dark brown, transversely banded, thin, pellucid, widely umbilicate, smooth; spire raised; sutures very deep; whorls about five, very convex; aperture large, rounded, dilate, yellowish white, with brown bands within; umbilicus very large; columella somewhat callous.

Proc. Acad. Nat. Sci. 1856, p. 110.

Hab.—India, M. Burrough, M. D.

My cabinet.

Diam. 1.05, Length 1.32 inches.

Remarks.—A single specimen, which came with many other shells from India, collected by that indefatigable collector the late Dr. Burrough. It is remarkably large in the aperture and is in outline nearest to *ovata*, Caill., from Egypt, but may easily be distinguished by its larger aperture, its being thinner and in having a wider umbilicus.

AMPULLARIA AUROSTOMA. Pl. 22, fig. 4.

Testa subglobosa, lutea, transversim vittata, crassa, arcte perforata, lævi; spira obtusa; suturis vix profundis; anfractibus instar senis, convexis; apertura rotundo-elliptica, subreflexa, intus aurantea et obsolete vittata; umbilico arcte compresso; columella crassa.

Shell subglobose, yellowish, transversely banded, thick, narrowly perforated, smooth; spire obtuse, sutures scarcely deep; whorls about six, convex; aperture sub-elliptical, somewhat reflexed, golden and obscurely banded within; umbilicus narrowly compressed; columella thick.

Operculum horn color, somewhat transparent, subtriangular.

Proc. Acad. Nat. Sci. 1856, p. 110.

Hab.—Carthagera, Col. Totten, and J. C. Trautwine, Esq.

My cabinet.

Diam. .98,

Length 1.14 inches.

Remarks.—A very pretty little species with a fine golden aperture and rather thickened lips, which are more intense in color than the interior. It is nearly of the same outline as *Pealeiana* (nobis) and *crassa*, Swainson, but differs from both in being thicker than the first and not so thick as the last. It is easily distinguished from both by its golden colored aperture.

PALUDINA ORIENTALIS. Pl. 22, fig. 5.

Testa carinata, pyramidata, rufo-castanea, subcrassa, arcissime umbilicata, striata; spira elevata; suturis impressis; anfractibus septenis, planulatis, in medio carinatis, superne geniculata; apertura subrotunda, incurvata; labro angulato.

Shell carinate, pyramidal, reddish chestnut, rather thick, narrowly umbilicate, striate; spire elevated; sutures impressed; whorls seven, flattened, carinate in the middle, geniculate above; aperture subrotund, incurved; angular on the outer lip.

P. Chinensis,* Lea, Proc. Acad. Nat. Sci., 1860, p. 110.

Hab.—China, W. A. Haines.

My cabinet and cabinet of Mr. Haines.

Diam. .71,

Length 1.20 inch.

Remarks.—This is a very unusual form for a *Paludina*, having a very marked angle on the middle of the body whorl. I have three specimens before me. One of them, kindly loaned to me by Mr. Haines, is a little more than half grown, and presents a very strong carina, on the interior of which there is a corresponding groove. The other two specimens were purchased by me many years since in London, and said then to come from China. On one of these the carina is not so well marked; the other has lost its epidermis, and does not present the fine revolving striæ which may be seen on the others. The angle on the body whorl reminds one of the *P. pyramidata* Phil., (v. 3, t. 1, f. 3 and 4,) but it is not so wide in proportion to its height, nor has it bands.

PALUDINA HAINESIANA. Pl. 22, fig. 6.

Testa ventricoso-conoidea, subglobosa, ponderosa, solida, viridi-palida, arcissime umbilicata, lævi; spira obtusa, ad apicem carnea; suturis valde impressis; anfractibus senis, convexis, ultimo amplo; apertura magna, subrotundata, intus albida; columella alba, crassa, incurvata.

Shell ventricoso-conical, subglobose, ponderous, solid, pale green, narrowly umbili-

* Changed to *orientalis*, *Chinensis* being preoccupied by Dr. Gray.

cate, smooth; spire obtuse, reddish at the tip; sutures much impressed; whorls six, convex, the last one very large; aperture large, nearly round, within white; columella white, thick, incurved.

Proc. Acad. Nat. Sci., 1856, p. 109.

Hab.—Siam, S. R. House, M. D.

My cabinet and cabinet of Mr. Haines.

Diam. .88,

Length 1.27 inch.

Remarks.—This is a remarkably solid globose species. The color is paler than usual with the *Paludinæ*, the darkest being of an apple green, others varying and passing into a pale whitish green. The oldest specimens have dark oblique striae, somewhat like *P. obtusa* Trosch., as figured by Philippi, v. 3, pl. 1, f. 14, but it is a larger species and more globose than that. The upper portion of the whorls is slightly flattened, and the upper part of the columella is thickened. In mature specimens the aperture is bordered by a linear black edge. This species nearly answers to the description of *crassa* Benson, (Journ. Asiatic Soc., v. 5,) but differs in several respects.

I dedicate this fine species to W. A. Haines, Esq., to whom I am indebted for so many fine Siamese fresh water shells.

PALUDINA SWAINSONIANA. Pl. 22, fig. 7.

Testa globosa, subsolida, tenebroso-viridi, arcissime umbilicata, lævi; spira obtusa; suturis valde impressis; anfractibus instar quinis, convexis; apertura rotundata, intus albida.

Shell globose, rather solid, dark green, narrowly umbilicate, smooth; spire obtuse; sutures very much impressed; whorls about five, convex; aperture rounded, within white.

Proc. Acad. Nat. Sci., 1856, p. 110.

Hab.—Siam, T. R. Ingalls, M. D.

My cabinet and cabinet of Dr. Ingalls.

Diam. .84,

Length 1.15 inch.

Remarks.—Three specimens were submitted to me by Dr. Ingalls under the name of *unicolor* Swainson, and I think this is the species figured by that Zoologist in Zool. Journ., 1st ser. v. 2, pl. 98, as *unicolor*; but it is not the same shell described by Olivier as *Cyclostoma unicolor*, coming from Egypt, and which Lamarck has recognized in his Anim. Sans. Vert., *Pal. unicolor*, v. 6, p. 174. I therefore propose Mr. Swainson's name for the species. It does not seem to have been noticed by Philippi. It is near to *obtusa* Trosch. and *Hainesiana*, herein described, but it is not so thick as either of those species, is without the bands and is of a darker green. The half grown specimens are of a lighter green and the apex is brownish.

PALUDINA UMBILICATA. Pl. 22, fig. 8.

Testa carinata, obtuse conoidea, viridi-brunnea, subtenui, umbilicata, nitida; spira obtusa, *babylonica*; suturis linearibus; anfractibus senis, carinatis, superne planulatis, minute et transverse striatis; apertura subrotundata, intus albida; umbilico spiraliter carinato; columella incurvata.

Shell carinate, obtusely conical, greenish brown, rather thin, umbilicate, shining; spire obtuse, tower shaped; sutures linear; whorls six, carinate, flattened above, transversely and minutely striate; aperture nearly round, whitish within; umbilicus spirally carinate; columella incurved.

Proc. Acad. Nat. Sci., 1856, p. 109.

Hab.—Takrong River, Siam, Mr. Haines.

My cabinet and cabinet of Mr. Haines.

Diam. .45,

Length .67 inch.

Remarks.—A single specimen only of this very remarkable species was among the shells received by Mr. Haines from Siam. It is from Takrong River, a tributary to the Cambodia River. This specimen has three distinct revolving carina nearly equidistant. The lower one is the most distinct, and curves spirally round the umbilicus, forming the outer portion of it. The middle one marks the junction of the whorl, and the superior one forms the outside border of the flattened portion of the whorls, which gives the shell somewhat the appearance of the tower of Babylon. Some of the striæ are minutely dotted. I have no knowledge of any *Paludina* that has so marked a carinate border to the umbilical region. The operculum is of a light brown color and semitransparent, with the polar point rather nearer the columellar border than usual.

PALUDINA INGALLSIANA. Pl. 22, fig. 9.

Testa carinata, obtuse conoidea, tenebroso-viridi, tenui, umbilicata, nitida; spira obtusa; suturis linearibus; anfractibus senis, subplanulatis, minutissime et transverse striatis; apertura rotundato-elliptica, inferne subangulata, intus cæruleo-alba.

Shell carinate, obtusely conical, dark green, thin, umbilicate, shining; spire obtuse; sutures linear; whorls six, rather flattened, finely and transversely striate; aperture rotundo-elliptical, subangular below, within bluish white.

Proc. Acad. Nat. Sci., 1856, p. 110.

Hab.—Siam, T. R. Ingalls, M. D.

My cabinet and cabinet of Dr. Ingalls.

Diam. .37,

Length .52 inch.

Remarks.—This species is closely allied to *umbilicata*, herein described, but I think, although I have but a single specimen before me, that it should be separated. It has not that well characterized flattening of the superior portion of the whorl so remarka-

ble in the other, while it really has it slightly. There is also a disposition to a carina round the umbilicus, but by no means so marked, there being only, in that region, a strengthening of four or five of the striæ which border the umbilicus, which is by no means as open as in the other. The aperture in this specimen, which seems to be adult, has a fine black linear border. The body whorl is of a fine green and the apex is reddish brown.

I name this after T. R. Ingalls, M. D., Greenwich, N. Y., to whom I am indebted for many fine species from this distant locality.

RIVULINA MACULATA. Pl. 22, fig. 10.

Testa ovato-conica, virido-lutea, brunneo-maculata, crassa, imperforata, lævi; suturis valde impressis; anfractibus instar quinis, convexis; apertura subrotunda, intus alba; columella per alba, callosa.

Shell ovately conical, greenish yellow, brown spotted, thick, imperforate, smooth; sutures very much impressed; whorls about five, convex; aperture nearly round, within white; columella very white and thickened.

Operculum small, suboval, rather thin and subconcentric.

Paludomus maculata, Lea. Proc. Acad. Nat. Sci. 1856, p. 110.

Hab.—Ahmednugger, India, S. Shurtleff, M. D.

My cabinet and cabinet of Dr. Shurtleff.

Diam. .25,

Length .44 inch.

Remarks.—This little species is well characterized, and belongs to that group which takes the general form of *Paludina*, and for which the generic name of *Rivulina* has been proposed by I. Lea and H. C. Lea, Proc. Zool. Soc. London, 1850, p. 196. *Maculata* is very much like *Melania (Rivulina) Zeylonica* (I. Lea and H. C. Lea) Proc. Zool. Soc. London, 1850, p. 194, but it is a smaller species, not so much spotted and not quite so pointed in the spire. It is also closely allied to *Paludomus (Rivulina?) spiralis*, Reeve, but is much smaller and more pointed in the spire. In the two specimens before me, the maculations are disposed in rows, which leave a vacant space below the middle of the body whorl.

BITHINIA SIAMENSIS. Pl. 22, fig. 11.

Testa ovato-conoidea, palido-olivacea, tenui, diaphana, nitida, lævi, acutissime umbilicata; spira subelevata; suturis linearibus; anfractibus instar senis, convexis; apertura ovato-rotundata, incrassata, superne angulata, intus albida.

Operculo calcarco, extrinsecus striis concentricis, intus granulato.

Shell ovately conical, pale olive, thin, semitransparent, shining, smooth, narrowly umbilicate; spire rather elevated; sutures linear; whorls about six, convex; aperture ovately rounded, thickened, angular above, within whitish.

Operculum calcareous, concentrically striate without, granulate within.

Proc. Acad. Nat. Sci., 1856, p. 110.

Hab.—Takrong River, Siam, S. R. House, M. D.

My cabinet and cabinet of Mr. Haines.

Diam. .19,

Length .32 inch.

Remarks.—Several of this species are before me from Siam. They are well characterized by their hard calcareous operculum fitting exactly into the peritreme. *Bithinia* is a genus no doubt well separated from *Paludina*. I have never seen the soft parts, but the construction of the operculum testifies to its being different. The general form of the shell of this genus is the same with *Paludina*, but I have seen none longer than half an inch, viz., the *B. faculata* Beck, from Denmark.

BITHINIA GLOBULA. Pl. 22, fig. 12.

Testa globosa, palido-olivacea, tenui, diaphana, lævi, imperforata; spira depressa, ad apicem obtusa; suturis impressis; anfractibus quaternis, ventricosus; apertura rotundata, incrassata, subreflexa, superne angulata, intus albida; columella incrassata.

Operculo calcareo, lævi, marginato.

Shell globose, pale olive, thin, semitransparent, smooth, imperforate; spire depressed, obtuse at the apex; sutures impressed; whorls four, inflated; aperture rounded, thickened, slightly reflexed, angular above, within whitish; columella thickened.

Operculum calcareous, smooth, bordered.

Proc. Acad. Nat. Sci., 1856, p. 110.

Hab.—India, W. A. Haines; Tanks, at Calcutta, S. Shurtleff, M. D.

My cabinet and cabinet of Mr. Haines.

Diam. .15,

Length .22 inch.

Remarks.—I have under examination some dozen of this interesting little species, all of which seem to be mature. Its symmetry of form, its round mouth, with a callous border and linear margin, designate a distinct species, and it is much smaller and more globose than the *Siamensis* herein described.

ASSIMINEA CARINATA. Pl. 22, fig. 13.

Testa regulariter conica, lutea, vittata, subcrassa, umbilicata, lævi; spira ad apicem acuta; suturis parum impressis, infra lineatis; anfractibus instar septenis, planulatis; apertura elliptica, subcanaliculata, intus vittata; umbilico spiralter carinato; columella incurvata, ad basim subangulata.

Shell regularly carinate, yellowish, banded, rather thick, umbilicate, smooth; spire pointed at the apex; sutures slightly impressed, with a small line below; whorls

about seven, flattened; aperture elliptical, with a slight channel, banded within; umbilicus spirally carinate; columella incurved and subangular at base.

Proc. Acad. Nat. Sci. 1856, p. 111.

Hab.—Siam, S. R. House, M. D.

Cabinet of Mr. Haines.

Diam. .20,

Length .36 inch.

Remarks.—A single specimen of this well marked *Assimineæ* was submitted to me by Mr. Haines. In form and size it resembles a species I believe described by Dr. Gray, from Bengal, but differs in being wider in the umbilicus, in being carinate, in having a fine revolving line below the suture, in the number of the revolving bands, and in being canaliculate. The whorls are also more flattened. There are four revolving reddish-brown bands on our species, the lower one of which is much darker, and is placed immediately outside of the spiral carina. This carina is very remarkable, producing a corresponding canal within, which makes the aperture slightly effuse at the base. There was no operculum with this specimen. Those which I have of the Bengal species have the operculum exceedingly delicate, thin, horny and transparent, being spiral, nearly like to those of *Melania*. The aperture is about one-half the length of the shell.

PACHYCHILUS PARVUM. Pl. 22, fig. 14.

Testa striata, obtuso-conoidea, crassa, ferruginea; spira curta; suturis impressis; anfractibus senis, convexis, striis transversis, exilissimis impressis; apertura grandi, subrotunda, intus brunnea; labro expanso, valde incrassato, albo; columella alba, incrassata.

Operculo diaphano, elliptico.

Shell striate, obtusely conoidal, thick, rust-red; spire short; sutures impressed; whorls six, convex, with fine transverse impressed striæ; aperture large, rounded, brown within; outer lip white, expanded, very much thickened; columella thickened.

Operculum translucent, elliptical.

Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Siam, S. R. House, M. D.

My cabinet and cabinet of Mr. Haines.

Diam. .16,

Length .33 inch.

Remarks.—Three specimens of this little interesting species were submitted to me, among the fresh water shells from Siam, by Mr. Haines. I recognized it at once as belonging to that group of incrassate light shells which I separated from the *Melaniæ*, under the name of *Pachychilus*. This little species is remarkable for its very thick perimetre, the circumference being very thick and white, and the border having a dark red line around it. The specimens are all covered with the oxide of iron, which, when scraped off, leaves the surface of the shell whitish. The aperture is one-half the length of the shell.

MELANIA BONINENSIS. Pl. 22, fig. 15.

Testa cancellata, conoidea, tenui, tenebroso-cornea; spira subelevata; suturis parum impressis; anfractibus instar septenis, planulatis; apertura parva, pyriformi, superne angulata, intus albida; labro acuto; columella torta.

Shell cancellate, conoidal, thin, dark horn color; spire somewhat elevated; sutures slightly impressed; whorls about seven, flattened; aperture small, pear-shaped, angular above, within whitish; outer lip acute; columella twisted.

Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Bonin Islands, M. Burrough, M. D.

My cabinet.

Diam. .23,

Length .65 inch.

Remarks.—A single specimen only of this species was submitted to me by Dr. Burrough. It was obtained during one of his voyages to the East, and has remained with me many years in hopes of other specimens coming to hand, that I might describe it more accurately. It is finely cancellate all over. Below the suture it is flattened, and this modifies the aperture into a pyriform shape. In outline it is near to *affinis*, herein described, but is not quite so large. The apex being eroded, the number of whorls cannot be ascertained. There are five and a half visible, and there were probably seven or eight.

MELANIA RUBIDA. Pl. 22, fig. 16.

Testa striata, conica, crassa, ferruginea; spira subelevata, acuminata; suturis impressis; anfractibus undenis, planulatis, ultimo superne constrictis, ad apicem carinatis; apertura subgrandi, rotunda, intus rubicundula; labro acuto; columella incrassata.

Shell striate, conical, rust-red; spire rather elevated, acuminate; sutures impressed; whorls eleven, flattened, the last one being constricted above; aperture rather large, rounded, within a little reddish; outer lip acute; columella thickened.

Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Mexico, Hon. J. R. Poinsett.

My cabinet and the cabinet of the American Philosophical Society.

Diam. .57,

Length 1.30 inch.

Remarks.—A number of specimens of this species were brought by Mr. Poinsett many years since from Mexico, and probably from the Table Land. It came with a number of *Unio cuprinus* (nobis.) It is remarkable for its color, its very thin epidermis, and its solidity and stricture on the upper part of the lower whorl. I have but two specimens before me, both of which are equally constricted. In outline it is near to *fæda* (nobis,) but has a much larger and rounder lower whorl. In color they differ entirely. The aperture is rather more than one-third the length of the shell.

MELANIA NEWCOMBII. Pl. 22, fig. 17.

Testa striata, attenuata, tenui, cornea; spira elevata; suturis valde impressis canaliculatisque; anfractibus instar novem, subconvexis; striis transversis, exilissimis impressis; apertura parva, elliptica, intus albida; labro acuto; columella albida.

Operculo tenebroso-fusco.

Shell striate, attenuate, thin, horn color; spire elevated; sutures deeply impressed and channelled; whorls about nine, a little convex, and impressed with fine transverse striæ; aperture small, elliptical, whitish within; outer lip acute; columella whitish.

Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Oahu, Sandwich Islands, W. Newcomb, M. D.

My cabinet and cabinet of Dr. Newcomb.

Diam. .42,

Length 1.32 inch.

Remarks.—A very distinct species, belonging to the form of *fasciolata* Lam., but not plicate like that species, nor has it the flammulate spots. While it has a general resemblance, it differs in another character, which is in having a well impressed channel along the suture. In the impressed channel it closely resembles *canalis* (nobis,) from Guimara, but differs in the striæ as well as the folds on the spire, and is a much smaller species. In size and form it is closely allied to *turriculus* (nobis,) from Luzon, but it is not maculate like that species, and it is thicker. The aperture is less than a third the length of the shell. I dedicate this species to Dr. Newcomb, who has done so much to promote a knowledge of this branch of Zoology at home and abroad.

MELANIA HAINESIANA. Pl. 22, fig. 18.

Testa lævi, pyramidata, subtenui, cornea; spira subelevata; suturis linearibus, impressis; anfractibus planulatis, in medio angulatis; apertura subgrandi, subrhomboidea, ad basim angulata, intus cæruleo-albida; labro acuto, angulato; columella albida tortaue.

Shell smooth, pyramidal, rather thin, horn color; spire somewhat elevated; sutures linear, impressed; whorls flattened, angular in the middle; aperture rather large, subrhomboidal, angular at the base, within bluish white; outer lip acute, angular; columella whitish and twisted.

Proc. Acad. Nat. Sci., 1856, p. 144.

Hab.—India, W. A. Haines, New York.

My cabinet and cabinet of Mr. Haines.

Diam. .47,

Length 1.20 inch.

Remarks.—Among many fine fresh water shells, procured by W. A. Haines, Esq., of New York, from Eastern Asia, was this fine *Melania*, and I dedicate it to him. There are ten specimens before me, but the largest are all more or less injured. The

oldest are dark, and partly covered by the oxide of iron. The young are greenish horn color. The whorls are flat, the lower one having an acute angle at the middle. None of them being perfect at the apex, the number of whorls cannot be ascertained with precision; probably there are about nine. One of the younger specimens has a disposition to indistinct folds towards the apex. In outline it is near to *conulus* (nobis,) from Fernando Po, but it is a larger species, is not striate, and differs in having a well defined angle on the middle of the whorls. Aperture about one-fourth the length of the shell.

MELANIA MAUIENSIS. Pl. 22, fig. 19.

Testa cancellata, inferne transverse striata, conoidea, acuminata, subcrassa, luteo-cornea; spira subelevata; suturis irregulariter impressis; anfractibus densis, planulatis, ad apicem crebri plicatis; apertura grandi, ovata, superne angulata, intus caerulea alba; labro expanso, acuto; columella torta.

Shell cancellate, transversely striate below, conoidal, acuminate, rather thick, yellowish horn color; spire rather elevated; sutures irregularly impressed; whorls ten, flattened, thickly folded at the beaks; aperture large, ovate, angular above, bluish white within; outer lip expanded, acute; columella twisted.

Proc. Acad. Nat. Sci. 1856, p. 145.

Hab.—Maui, Sandwich Islands, W. Newcomb, M. D.

My cabinet and cabinet of Dr. Newcomb.

Diam. .41,

Length 1.7 inch.

Remarks.—It has been supposed that there were no *Melaniæ* in the Sandwich Islands; but Dr. Newcomb, who resided there for five years, during which time he investigated their mollusca more thoroughly than any Zoologist who had preceded him, found two fine species, this and *Newcombii*, herein also described. The *Mauiensis* is a well characterized cancellate species, graceful in its form, and with a large aperture. It is very closely allied to *Mindoriensis* (nobis,) from the Philippine Islands, the form of the aperture being very nearly the same; but it is a much smaller species, not so acuminate, and the outer lip is more expanded; the granulations also are smaller and sharper. It is also allied to *lateritia* (nobis,) from the Philippines, but is more slender, with more delicate granulations, and with a much smaller aperture. It differs also in the color of the interior. In general outline and appearance it resembles the figure of *porcata* Jonas, in Phili. Conch., pl. 4, fig. 19, but is not much more than half the length of that shell, and the aperture is much larger in proportion. Aperture nearly half the length of the shell.

MELANIA NINGPOENSIS. Pl. 22, fig. 20.

Testa perplicata, striis transversis crebris decussata, conoidea, tenui, pallida cornea, subdiaphana; spira subelevata; suturis valde impressis; anfractibus instar novem, subconvexis, inferne transversim costatis; apertura parva, subrotunda, intus alba; columella alba.

Operculo tenui, pallido-corneo.

Shell covered with folds and with close transverse decussating striae, conical, thin, pale horn color, rather pellucid; spire rather elevated; sutures very much impressed; whorls about nine, rather convex, below transversely ribbed; aperture small, rounded, within white; columella white.

Operculum thin, pale horn color.

Proc. Acad. Nat. Sci., 1856, p. 144.

Hab.—Ningpo, China, W. A. Haines.

My cabinet and cabinet of Mr. Haines.

Diam. .35,

Length .91 inch.

Remarks.—This species is remarkable for its numerous and strongly marked folds covering all the whorls but the base, which is furnished with three or four strongly marked equidistant transverse lines or ribs. Both the folds and the lines may be seen from the inside, and are very remarkable. The aperture is more than one-fourth the length of the shell.

MELANIA MYERSIANA. Pl. 22, fig. 21.

Testa plicata, conoidea, tenui, diaphana, rufo-cornea; spira subelevata; suturis impressis; anfractibus instar octo, subconvexis, striis exilissimis impressis; apertura ovata, superne angulata, ad basim unifasciata; labro acuto; columella albida.

Shell plicate, conical, thin, pellucid, reddish horn color; spire rather elevated; sutures impressed; whorls about eight, somewhat convex; striae minutely impressed; aperture ovate, angular above, at the base single banded; outer lip acute; columella whitish.

Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Fejee Islands, W. A. Haines.

My cabinet and cabinet of Mr. Haines.

Diam. .33,

Length .87 inch.

Remarks.—There are three specimens before me, which are, I believe, all Mr. Haines received from Dr. House. They all differ in the strength of the folds. One has strong folds on every whorl; another has numerous rather undefined ones, and the third has them still less defined. In the form of the aperture they are precisely alike, and each has the well defined dark band at the base of the whorl. This band is more conspicuous within. The specimen with the coarse and strong folds is not so

slender as the others, nor has it the brown flammulate spots, but it has the band. When many specimens may be obtained, it may possibly prove to be distinct. The two flammulate specimens closely resemble *fasciolata* Lam., but the whorls are flatter and the substance of the shell is thinner. The markings are very much the same. It is also allied to *inhonesta* Phil. (Conch. v. 2, pl. 4, f. 5.) The aperture is nearly one-third the length of the shell.

MELANIA HOUSEI. Pl. 22, fig. 22.

Testa lævi, subulata, gracili, tenui, cornea, flammis longitudinalibus ferrugineis ornata; spira subelevata, acuminata; suturis impressis canaliculatisque; anfractibus planulatis, instar duodecim; apertura parva, ovata, intus albida; columella alba torta que.

Operculo tenebroso-fusco.

Shell smooth, subulate, graceful, thin, horn color, furnished with longitudinal ferruginous spots; spire rather elevated, acuminate; sutures impressed and channeled; whorls flattened, about twelve; aperture small, ovate, within whitish; columella white and twisted.

Operculum dark brown.

Proc. Acad. Nat. Sci., 1856, p. 144.

Hab.—Korat, Takrong River, Siam, S. R. House, M. D.

My cabinet and cabinet of Mr. Haines.

Diam. .25,

Length .84 inch.

Remarks.—This is a thin, graceful species, with flame-shaped marks something like *figurata* Hinds and *flamigera* and *Tumsi* Dunk., but in outline or size it does not resemble either of them, being much smaller than either. In size it is near to *pyramidata* Hinds. It differs, however, from that species in the spots and in the aperture being more angular below. Aperture about one-fourth the length of the shell.

MELANIA AFFINIS. Pl. 22, fig. 23.

Testa crebri-striata, conoidea, subtenui, tenebroso-fusca; spira subelevata; suturis impressis; anfractibus convexis, ad apicem plicatis; apertura parva, elliptica, intus albida; labro acuto; columella lævi et incurva.

Shell closely striate, conoidal, rather thin, dark brown; spire somewhat elevated; sutures impressed; whorls convex, folded at the top; aperture small, elliptical, within whitish; outer lip acute; columella smooth and incurved.

Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Manilla, W. Newcomb, M. D.

My cabinet and cabinet of Dr. Newcomb.

Diam. .30,

Length .83 inch.

Remarks.—One of the two specimens before me is much more distinctly striate than the other, but they are evidently the same. In form and size this species is near to *Myersiana*, herein described. It is also near to *torquata* Phil., (Conch., vol. 1, pl. 1, f. 18,) and it somewhat resembles *scilicula* Gould, (Expl. Exp., pl. 10, f. 164.) The aperture is about one-third the length of the shell.

MELANIA MANILLAENSIS. Pl. 22, fig. 24.

Testa crebri-plicata, attenuata, tenui, nigricanti; spira elevata; suturis impressis; anfractibus planulatis, superne canaliculatis, transversim lineis impressis; apertura parva, elliptica, superne obtuso-angulata, intus tenebrosa; labro acuto; columella alba torta que.

Shell thickly folded, attenuate, thin, blackish; spire elevated; sutures impressed; whorls flattened, canaliculate above, with transverse impressed lines; aperture small, elliptical, above obtusely angular, dark within; outer lip acute; columella white and twisted.

M. australis.* Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Manilla, W. Newcomb, M. D.

Cabinet of Dr. Newcomb.

Diam. .27,

Length .80 inch.

Remarks.—This well defined species is quite distinct from any which I have before seen. It has about seventeen straight folds, which are deeply decussated by the transverse striæ. The folds do not reach to the sutures, but are suddenly arrested by a channel below the sutures. It is a graceful species, and it is to be regretted that only a single rather imperfect specimen was obtained. There are only three perfect whorls remaining, which is probably not half the perfect number. The aperture is likely to be one-fourth the length of the perfect shell.

MELANIA LYRÆFORMIS. Pl. 22, fig. 25.

Testa plicata, conoidea, subcrassa, tenebroso-fusca; spira curta; suturis irregulariter impressis; anfractibus convexiusculis, superne regulariter costatis, inferne transversim striatis; apertura parva, elliptica, intus albida; labro acuto; columella incurva torta que.

Shell plicate, conoidal, rather thick, dark brown; spire short; sutures irregularly impressed; whorls somewhat convex, above regularly ribbed, below transversely striate; aperture small, elliptical, whitish within, outer lip acute; columella incurved and twisted.

Proc. Acad. Nat. Sci., 1856, p. 145.

Hab.—Manilla, W. Newcomb, M. D.

Cabinet of Dr. Newcomb.

Diam. .32,

Length .75 inch.

**Australis* having been used by myself in the Proc. Zoological Society, in 1850, I change the name to *Manillaensis*.

Remarks.—A single specimen only of this well marked species was procured by Dr. Newcomb. It is remarkable in the folds stopping suddenly on the middle of the whorl, where a well marked transverse stria cuts them off. The folds are smooth and arcuate. It is nearly allied to *Myersiana*, herein described. The aperture is more than one-third the length of the shell.

MELANIA PLANENSIS. Pl. 22, fig. 26.

Testa lævi, subfusiformi, magna, crassa, tenebroso-fusca, obsolete maculata; spira elevata, conoidea; suturis parum impressis; anfractibus instar novem, convexiusculis, striis transversis exilissimis impressis; apertura grandi, ovata, superne angulata, intus fuscata; labro acuto; columella albida, superne inspissata.

Operculo tenebroso-fusco.

Shell smooth, subfusiform, large, thick, dark brown, obscurely spotted; spire raised, conoidal; sutures somewhat impressed; whorls about nine, somewhat convex, with transverse, impressed close striæ; aperture large, ovate, angular above, brownish within; lips sharp; columella whitish, thickened above.

Operculum suboval, with three volutions and the polar point subcentral.

Proc. Acad. Nat. Sci. 1858, p. 118.

Hab.—Plan and Omaso, Valley of Uluá River, Atlantic Slope, Honduras, J. L. LeConte, M. D.

My cabinet and cabinets of Major LeConte and the Academy of Natural Sciences.

Diam. .90,

Length 2.27 inches.

Remarks.—A number of very fine specimens were taken by Dr. LeConte during his late scientific journey through Honduras. It is one of the largest and most robust species which has come under my notice. It is nearly allied to *M. Largillierti* Phil., but is not so slender, is darker, and has not the lines at the base. It is rather larger than *herculea* Gould, and has no appearance of ribs. The aperture is nine-tenths of an inch long, being more than one-third the length of the shell. The young specimens have the revolving striæ beautifully perfect, the dark markings are somewhat flammulate, and a lighter line runs below the suture. The specimens from Plan are covered with a deposit of carbonate of lime. I am indebted to the kindness of Dr. LeConte for this fine species and other *Mollusca* from Honduras.

MELANIA VERREAUXIANA. Pl. 22, fig. 27.

Testa lævi, pyramidata, crassa, tenebroso-castanea; spira valde elevata; suturis linearibus; anfractibus 11—12, planulatis; apertura subgrandi, ovata, intus parum brunnea; columella alba incurvaque.

Shell smooth, pyramidal, thick, dark chestnut colored; spire much elevated; su-

tures linear; whorls 11—12, flattened; aperture rather large, ovate, within pale brown; columella white and incurved.

Proc. Acad. Nat. Sci. 1856, p. 144.

Hab.—Sandwich Islands, E. Verreaux.

My cabinet and cabinet of E. Verreaux, Paris.

Diam. .63,

Length 1.70 inch.

Remarks.—The three specimens before me are large, all well characterized and nearly of the same size. This species is allied to *Largillierti*, Phil., and *varicosa*, Trosch., but more closely to the former, which comes from Central America. It differs in the number of the whorls, having two or three more than *Largillierti*, in being rather more slender, and in the mouth being rather more rounded. The base of the columella is a little more rounded. Aperture about one-third the length of the shell.

I name this species after M. Edward Verreaux, who collected it during one of his long voyages to the Pacific in search of objects in Natural History.

MELANIA FRATERNA. Pl. 22, fig. 28.

Testa plicata, pyramidata, subcrassa, tenebroso-brunnea; spira elevata; suturis irregulariter impressis; anfractibus subplanulatis, transversim lineis impressis regulariter cinctis, costellis verticallibus; apertura parva, subovata, intus albida; labro acuto; columella contorta, superne incrassata, inferne subemarginata.

Shell folded, pyramidal, rather thick, dark brown, spire elevated; sutures irregularly impressed; whorls rather flattened, bound with irregularly impressed transverse lines, and having vertical ribs; aperture small, suboval, within whitish; outer lip acute; columella twisted, thickened above and emarginate below.

Proc. Acad. Nat. Sci., 1856, p. 144.

Hab.—

My cabinet.

Diam. .50,

Length 1.68 inch.

Remarks.—I purchased the specimen before me many years since in Paris, and have never seen a second one since. I am entirely ignorant of what part of the world it came from. The top of this specimen is broken off. The number of whorls remaining is seven, and there probably have been about five more. The ribs are well marked, strong and numerous, being about seventeen. The lower whorl is nearly destitute of them, and it is constricted on the lower half. The transverse lines cover every part of the whorls. The aperture is slightly channelled above and below, thus approaching the genus *Pirena*. It is very near to *M. transversa* (nobis,) but differs in being of a more slender form, more attenuate, and in having a smaller mouth which

is much less transverse. It is also devoid of the spots in the interior of *transversa*. It is near to *atra* Richard and *subimbricata* Philippi. (See Phil. Conchylien, v. 3, pl. 5, f. 2 and 3.) Aperture about one-fifth the length of the shell.

MELANIA BULLATA. Pl. 22, fig. 29.

Testa striata, obtuso-conoidea, valde inflata, crassa, nigra; spira curta, truncata; suturis parum impressis; anfractibus convexis, striis transversis subdistantibus impressis; apertura grandi, subovata, superne angulata et inerassata; intus albida; labro acuto; columella incurva tortaue.

Shell striate, obtusely conoidal, very much inflated, thick and black; spire short, truncate; sutures somewhat impressed; whorls convex, with rather distant transverse impressed striæ; aperture very large, subovate, above angular and thickened, white within; outer lip sharpened; columella incurved and twisted.

Proc. Acad. Nat. Sci., 1856, p 145.

Hab.—Brazil, W. A. Haines.

My cabinet and cabinet of Mr. Haines.

Diam. .73,

Length 1.70 inch.

Remarks.—Two specimens were submitted to me by Mr. Haines. One has but two and a half whorls remaining, the other not quite four and a half. They are both cut off square at the apex. Neither of them have any folds remaining on the lower whorls. When the spire was perfect, very probably there were folds on the upper whorls. This is a very remarkable species. It is most nearly allied to *transversa* (nobis,) but differs in not having folds, in being much more inflated and shorter, and in having a much larger aperture. The transverse striæ are much less impressed, and they are much more distant. The aperture is less than half the length of the shell.

GONIOBASIS ROMLE. Pl. 23, fig. 30.

Testa subcarinata, conoidea, suberassa, tenebroso-cornea, evittata; spira subelevata, aliquanto obtuse elevata; suturis impressis; anfractibus septenis, planulatis, superne carinatis; apertura grandiuscula, ovata, intus albida; labro acuto, subsinuoso; columella tenui et contorta.

Shell slightly carinate, conical, rather thick, dark horn color, without bands; spire somewhat elevated, sometimes obtuse; sutures impressed; whorls seven, flattened, carinate above; aperture rather large, ovate, whitish within; outer lip acute, somewhat sinuous; columella thin and twisted.

Proc. Acad. Nat. Sci., 1864, p. 111.

Hab.—Rome, North Georgia, Rev. G. White.

My cabinet and cabinet of Mr. White.

Diam. .37,

Length .91 inch.

Remarks.—About two dozen of this species were sent to me by Mr. White. They differ in length and carination, some of the specimens being nearly as high in the spire as *Melania* (Goniobasis) *pallescens* (nobis,) which the species resembles much in many respects. Other specimens are obtuse in the spire, and approach to *Melania* (Goniobasis) *rhombica* Anth., but that shell is smaller, and has a greenish epidermis. The surface of the above described species is usually smooth, but sometimes it has the small veins which generally are found on *pallescens*. The aperture is rather more than one-third of the length of the shell.

GONIOBASIS PUPÆFORMIS. Pl. 23, fig. 31.

Testa lævi, pupæformi, crassiuscula, tenebroso-mellea, obsolete quinque vittata; spira obtusa; suturis impressis; inferne tumidis; anfractibus instar senis, convexiusculis; apertura subgrandi, elongato-pyriformi, intus vittata; labro acuto, recto; columella superne incrassata.

Shell smooth, pupæform, somewhat thick, dark honey yellow, obscurely five-banded; spire obtuse; sutures impressed and swollen below; whorls about six, slightly convex; aperture somewhat large, elongately pear-shaped and banded within; outer lip acute and straight; columella thickened above.

Operculum ovate, dark brown, with the polar point well removed from the left side.

Proc. Acad. Nat. Sci., 1864, p. 112.

Hab.—Coosa River, Alabama, E. R. Showalter, M. D.

My cabinet and cabinet of Dr. Showalter.

Diam. .36,

Length .80 inch.

Remarks.—A single specimen only of this species was received from Dr. Showalter, and the apex of this is not quite perfect. It is allied to *Melania* (Goniobasis) *pupoidea* Anth., and at first I thought it belonged to that species. In getting typical specimens of that species, I find it, however, to differ in outline, color, size, and the number of bands, *pupoidea* having but four. It is also allied to *Alabamensis* (nobis,) but differs in having a larger body whorl, a less constricted aperture, and in having one more band, as well as in having a less natural polish. The aperture is nearly one-half the length of the shell.

GONIOBASIS PULLA. Pl. 23, fig. 32.

Testa lævi, exserta, subtenui, tenebroso-fusca, nitida; spira elevata; suturis regulariter impressis; anfractibus instar septenis, curvatis; apertura parviuscula, ovato-rhomboida, intus dilute purpurea; labro acuto, subsinuato; columella tenui, purpurascenti, aliquanto contorta.

Shell smooth, exserted, rather thin, dark brown, bright; spire raised; suturis regularly impressed; whorls about seven, curved; aperture rather small, ovately rhomb-

oidal, dilutely purple within; outer lip acute, rather sinuous; columella thin, purplish, somewhat twisted.

Proc. Acad. Nat. Sci., 1864, p. 112.

Hab.—Cumberland Gap, E. Tenn., Major S. S. Lyon, U. S. Engineers.

My cabinet.

Diam. .32,

Length .82 inch.

Remarks.—A single specimen only was received, with a number of other *Melanidæ*, from Major Lyon. Other specimens may differ. This one is dark brown on the exterior and purplish inside, and without bands. Other specimens may possibly differ in color and have bands. It has irregular small veins over the two last whorls. It is closely allied to *Melania* (*Goniobasis*) *rufescens* (nobis,) but it is wider in proportion, with sutures less impressed, and has a larger aperture. It differs also in not being carinate on the upper whorls, the three specimens of *rufescens* which I have being all carinate. In outline it is very near to *elata* Gould. The aperture is about one-third the length of the shell.

GONIOBASIS QUADRICINCTA. Pl. 23, fig. 33.

Testa lævi vel obsolete plicata, subfusiformi, suberassa, lutea, quadrivittata; spira conoidea; suturis regulariter impressis; anfractibus instar octonis, planulatis, superne angulatis; apertura grandiuscula, ovata, intus quadrivittata; labro acuto, aliquanto sinuoso; columella tenui et aliquanto contorta.

Shell smooth or obscurely folded, somewhat fusiform, somewhat thick, yellow, four-banded; spire conical; suturis regularly impressed; whorls about eight, flattened, angular towards the apex; aperture rather large, ovate and four-banded within; outer lip acute and somewhat sinuous; columella thin and somewhat twisted.

Operculum ovate, rather thin, light brown, with the polar point near the left edge.

Proc. Acad. Nat. Sci., 1864, p. 112.

Hab.—Coosa and Cahaba Rivers, Alabama, Dr. Showalter; East Tennessee and North Georgia, Bishop Elliott.

My cabinet and cabinets of Dr. Showalter and Bishop Elliott.

Diam. .37,

Length .93 inch.

Remarks.—I have about two dozen specimens before me from the different habitats. Those from East Tennessee are shorter and not so well characterized, having less marked bands, some even being without them. The best developed are from the Coosa River. Two specimens from Fannin County, Georgia, have a bright yellow epidermis without bands, and may belong to a distinct species. The four folds are remarkably regular in this species. The two middle ones are near to each other, and the lower of the two is smaller than the upper. It is allied to *grata*, Anth. The aperture is rather more than one-third the length of the shell.

GONIOBASIS SUBRHOMBICA. Pl. 23, fig. 34.

Testa subcarinata, subfusiformi, subtenui, tenebroso-oliva, estriata et evittata; spira obtusa; suturis impressis; anfractibus quinis, planulatis, superne carinatis; apertura grandi, rhomboidea, intus albida; labro acuto, vix sinuoso; columella tenui et aliquanto contorta.

Shell subcarinate, subfusiform, rather thin, dark olive, without striæ or bands; spire obtuse; sutures impressed; whorls five, flattened, carinate above; aperture large, rhomboidal, whitish within; outer lip acute, scarcely sinuous; columella thin and somewhat twisted.

Operculum thin, brown, with the polar point near the left edge towards the base.

Proc. Acad. Nat. Sci., 1864, p. 111.

Hab.—Hog Creek, North Georgia, J. Clark.

My cabinet.

Diam. .26,

Length .60 inch.

Remarks.—I have about thirty specimens before me of this species. It is closely allied to *Melania* (*Goniobasis*) *rhombica*, Anth., and when I first received it I thought it was merely a variety of that species. In getting typical specimens, however, of that species from Mr. Anthony, I became perfectly satisfied that they were distinct. *Rhombica* is decidedly carinate on all the whorls, is sharply so on the upper whorls, is striate, as described by Mr. Anthony, and is of a light green color. *Subrhombica*, on the contrary, is not carinate on the lower whorl, has no striæ, and is of a dark olive green. Two specimens among all those before me have obscure bands inside. The aperture is about one-half the length of the shell.

Rhombica is from Alabama.

GONIOBASIS CUMBERLANDENSIS. Pl. 23, fig. 35.

Testa lævi, acuminato-conoidea, subtenui, rufo-fusca; spira subelevata; suturis regulariter impressis; anfractibus octonis, convexiusculis; apertura parviuscula, subrhomboidea, intus albida vel purpurecente; labro acuto, parum sinuoso; columella albida vel purpurea, inflecta et contorta.

Shell smooth, acuminately conical, rather thin, reddish brown; spire somewhat raised; sutures regularly impressed; whorls eight, somewhat convex; aperture rather small, subrhomboidal, whitish or purplish within; outer lip acute, rather sinuous; columella whitish or purplish, bent in and twisted.

Operculum ovate, dark brown, with the polar point on the left of the basal margin.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Gap Spring, Cumberland Gap and Bull Run, Major Lyon; Knoxville, Tenn., Wm. Spillman, M. D.

My cabinet and cabinets of Capt. Lyon and Dr. Spillman.

Diam. .25,

Length .62 inch.

Remarks.—A number of specimens were sent from both the above named habitats. It is a graceful, well formed little species, with a pointed apex and dark brown, rather shining epidermis. Usually there is a yellowish line below the suture, and sometimes this portion of the whorls is impressed. The aperture is almost universally purple, more or less intense. It is in outline very like *Melania (Goniobasis) tenebrosa* (nobis), but that species has carinæ on the upper whorls which this never has. Several specimens from Florence, Alabama, sent to me by Rev. G. White, are nearly of the same form, and I think may belong to this species. The aperture is about eight-twentieths the length of the shell.

GONIOBASIS LOUISVILLENSIS. Pl. 23, fig. 36.

Testa lævi, fusiformi, tenebroso-cornea, evittata; spira curta; suturis irregulariter impressis; anfractibus instar quinis, subconvexis; apertura subgrandi, longo-elliptica, intus alba; labro acuto, vix sinuoso; columella alba, superne incrassata, aliquanto contorta.

Shell smooth, fusiform, dark horn-color, without bands; spire short; sutures irregularly impressed; whorls about five, somewhat convex; aperture rather large, long-elliptical, white within; outer lip acute, slightly sinuous; columella white, thickened above and somewhat twisted.

Operculum ovate, reddish brown, rather thin, with the polar point on the left near the base.

Proc. Acad. Nat. Sci. 1863, p. 155.

Hab.—Falls of the Ohio at Louisville, Ky., Wm. H. De Camp, M. D.

My cabinet and cabinet of A. O. Currier.

Diam. .25,

Length .56 inch.

Remarks.—Two specimens only were received from Mr. Currier, neither perfect at the apex. It is a simple species, with an unusually thickened columella, approaching indeed to *Lithasia*. It is near to *Spartanbergensis* and *ovoidea*, (nobis,) and is somewhat like *depygis*, Say, but cannot be confounded with this last species, from the same habitat, being much shorter in the spire and having a differently formed aperture. Neither of the two specimens have any appearance of bands, but they may exist on other specimens. The aperture is about one-half the length of the shell.

GONIOBASIS LITHASIOIDES. Pl. 23, fig. 37.

Testa lævi, subfusiformi, cornea, evittata; spira conoidea; suturis impressis; anfractibus senis, subconstrictis, superne planulatis; apertura grandiuscula, rhomboidea, intus albida; labro acuto, parum sinuoso; columella alba, inflecta, parum contorta.

Shell smooth, subfusiform, horn-color, without bands; spire conoidal; sutures im-

pressed; whorls six, somewhat constricted, flattened above; aperture rather large, rhomboidal, white within; outer lip acute, somewhat sinuous; columella white, bent in and somewhat twisted.

Proc. Acad. Nat. Sci., 1863, p. 154.

Hab.—Ohio, J. P. Kirtland, M. D.

My cabinet.

Diam. .28,

Length .65 inch.

Remarks.—A single specimen was received many years since from Dr. Kirtland with *Melania (Goniobasis) depygis*, Say, but while it agrees with it in color and size, it is quite different in the body whorl, and in the form of the aperture. The aperture is very much like *Lithasia*, and it is slightly thickened above on the columella, but there is neither a channel nor callus below. In the whole outline and form of the aperture it is very like *Lithasia Downiei*, (nobis,) but it is a much smaller shell, a much lighter color, has no tubercles, and has no channel at the base. It is among the few species which are impressed on the body whorl, but it is not so much so as *G. informis*, herein described, and is a larger and stouter species. The aperture is not quite half the length of the shell. Dr. Kirtland did not state from what part of Ohio it came.

GONIOBASIS VITTATELLA. Pl. 23, fig. 38.

Testa lævi vel subcarinata, conoidea, tenebroso-fusca, uno-vittata; spira subacuminata; suturis linearibus; anfractibus octonis, planulatis; apertura parva, subrhomboidea, intus tenebrosa; labro acuto, parum sinuoso; columella inflecta et contorta.

Shell smooth or subcarinate, conical, dark brown, single banded; spire somewhat acuminate; sutures linear; whorls eight, flattened; aperture small, subrhomboidal, dark within; outer lip acute, somewhat sinuous; columella bent in and twisted.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Cumberland Gap, East Tennessee, Major S. S. Lyon, U. S. A.

My cabinet and cabinet of Major Lyon.

Diam. .20,

Length .55 inch.

Remarks.—This is a pretty little species when perfect, but most of the specimens sent were imperfect, and covered with vegetable and mineral substances difficult to remove. There is a small light band on the upper part of the whorls immediately below the suture, which is more or less visible on all the specimens before me, some of which have a carina on the upper terminal whorls. In outline and size it is near to *Melania (Goniobasis) glabra*, (nobis,) but it is more slender, and that species has no band. The aperture is about one-tenth the length of the shell.

GONIOBASIS INFANTULA. Pl. 23, fig. 39.

Testa lævi, fusiformi, tenebroso-cornea, valde vittata; spira curta; suturis vix impressis; anfractibus quinque, superne planulatis; apertura subgrandi, ovata, intus vittata; labro acuto, vix sinuoso; columella purpurea, incrassata et contorta.

Shell smooth, fusiform, dark horn-color, much banded; spire short; sutures slightly impressed; whorls five, flattened above; aperture rather large, ovate, banded within; outer lip acute, slightly sinuous; columella purple, thickened and twisted.

Operculum ovate, reddish brown, rather thin, with the polar point near the base on the left edge.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Falls of the Ohio at Louisville, Ky., Wm. H. De Camp, M. D.

My cabinet and cabinet of A. O. Currier.

Diam. .20,

Length .38 inch.

Remarks.—This is a pretty little species, usually with four well-marked, rather broad brown bands. In one of the six specimens before me there are only three indistinct bands. It is closely allied to *Melania (Goniobasis) cognata*, Anth., and near to *Georgiana* (nobis). It differs from *cognata* in being more drawn out in the spire and having less inflation of the body whorl. The aperture is about one-half the length of the shell.

GONIOBASIS MILESII. Pl. 23, fig. 40.

Testa lævi, subfusiformi, subtenui, olivacea, evittata; spira subelevata; suturis irregulariter impressis; anfractibus senis, subinflatis; apertura submagna, subrhomboidea, intus subfusca; labro acuto, vix sinuoso; columella purpurea, parum incurva.

Shell smooth, subfusiform, rather thin, olivaceous, without bands; spire somewhat raised; sutures irregularly impressed; whorls six, somewhat inflated; aperture rather large, subrhomboidal, brownish within; outer lip acute, scarcely sinuous; columella purple, slightly bent in.

Operculum ovate, thin, light brown, with the polar point near to the base on the left.

Proc. Acad. Nat. Sci., 1863, p. 154.

Hab.—Tuscola County, Michigan, M. Miles.

My cabinet and cabinet of Mr. Miles, Lansing, Mich.

Diam. .32,

Length .74 inch.

Remarks.—A number of specimens were sent to me by Mr. Miles, all from the same habitat. It is nearly allied to *Melania (Goniobasis) Niagarensis*, (nobis,) but may be distinguished by its being less fusiform, being thinner and usually of a darker green. The aperture is about six-fifteenths the length of the shell. I name

it after Mr. Miles, State Zoologist of Michigan, who has kindly sent me many fresh water and land shells from his State.

GONIOBASIS INFORMIS. Pl. 23, fig. 41.

Testa lævi, cylindrico-conica, tenebroso-cornea, evittata; spira parum exserta; suturis irregulariter impressis; anfractibus instar septenis, in medio impressis; apertura parviuscula, subovata, intus albida; labro acuto, valde sinuoso; columella alba, et valde contorta.

Shell smooth, cylindrico-conical, dark horn-color, without bands; spire somewhat elevated; sutures irregularly impressed; whorls about seven, impressed in the middle; aperture rather small, nearly ovate, whitish within; outer lips acute, very sinuous; columella white and very much twisted.

Proc. Acad. Nat. Sci. 1863, p. 154.

Hab.—Falls of the Ohio at Louisville, Ky., W. H. De Camp, M. D.

My cabinet and cabinet of A. O. Currier.

Diam. .19,

Length .60 inch.

Remarks.—Only two specimens were sent to me by Mr. Currier, one of which is only about half grown. It is very different from any species I have seen, having the appearance of being deformed by the impressed or constricted middle of the whorl. The bulging of the shoulder immediately below the suture has a corresponding thickening within. The outer lip is very much incurved above the middle of the whorl at the impressed portion of it. The aperture is nearly one-third the length of the shell.

GONIOBASIS ATERINA. Pl. 23, fig. 42.

Testa lævi, subfusiformi, atra vel virido-atra, crassiuscula; spira obtusa; suturis regulariter impressis; anfractibus senis, convexiusculis; apertura subgrandi, subovata, intus purpurea, aliquanto albida; labro acuto, vix sinuoso; columella inflecta, purpurea, incrassata et contorta.

Shell smooth, subfusiform, black or greenish black, rather thick; spire obtuse; sutures regularly impressed; whorls six, somewhat convex; aperture rather large, subovate, purple within, somewhat whitish; outer lip acute, scarcely sinuous; columella bent in, purple, thickened and twisted.

Operculum ovate, reddish brown, thin and delicate, with the polar point near the left edge above the base.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Gap Spring, Cumberland Gap, and Rogers' Spring, west of Fincastle, East Tennessee, Major S. S. Lyon, U. S. A.

My cabinet and cabinet of Major Lyon.

Diam. .25,

Length .51 inch.

Remarks.—This is a pretty little species which is nearly allied to *Melania* (*Goniobasis*) *Nickliniana*, (nobis,) but while being nearly of the same length it is not much inflated. It differs much in the color, *aterina* being of a black or green black color, while *Nickliniana* is lighter and almost rubiginose, and has a larger aperture. While some of the *aterina* are dark bottle green, they are generally black with a dark purple mouth. It is near to *Melania* (*Goniobasis*) *adusta*, Anth., but is a shorter and darker species. The length of the aperture is about one-half the length of the shell.

GONIOBASIS EMERYENSIS.* Pl. 23, fig. 43.

Testa plicata, subfusiformi, subtenui, tenebroso-oliva, evittata; spira obtuse conoidea; suturis irregulariter impressis; anfractibus instar senis, planulatis, superne plicatis; apertura grandiuscula, subovata, intus cæruleo-alba; labro acuto, leviter sinuoso; columella inferne leviter incrassata et contorta.

Shell plicate, subfusiform, rather thin, dark olive, without bands; spire obtusely conical; sutures irregularly impressed; whorls about six, flattened, folded above; aperture rather large, subovate, bluish white within; outer lip sharp, slightly sinuous; columella slightly thickened and twisted below.

Operculum ovate, dark brown, with polar point near to the base.

Proc. Acad. Nat. Sci., 1864, p. 3.

Hab.—Rocky Creek, Head Branch of Emery River, E. Tenn. Major S. S. Lyon, U. S. E.

My cabinet.

Diam. .34,

Length .78 inch.

Remarks.—In outline this species is near to *instabilis* and *Christyi* (nobis). It differs from both in having no bands and in having no folds on the body whorl. In the form and size of the aperture it closely resembles them both. The aperture is nearly half the length of the shell.

GONIOBASIS SMITHSONIANA. Pl. 23, fig. 44.

Testa plicata, fusiformi, tenebroso-cornea, subcrassa, mucronata, evittata; spira obtuso-conica; suturis impressis; anfractibus instar septenis, planulatis, in medio angulatis; apertura subgrandi, ovato-rhomboidea, intus albida; labro acuto, subrecto; columella subcrassa et aliquanto contorta.

Shell plicate, fusiform, dark horn-color, rather thick, sharp at the apex, without bands; spire obtusely conical; sutures impressed; whorls about seven, flattened,

*In my paper on New *Melanidae* of the United States, published in the Proceedings of the Academy in 1861, and more at large in the Journal, Vol. 5, and in my "Observations," Vol. 9, I used the names *blanda* and *Vanuxemii* for two new *Goniobasi*. Having used both names before as *Melania*, which now come under the genus *Goniobasis*, I propose to change *blanda* into *versa*, and *Vanuxemii* into *Prestoniana*, the former *Vanuxemii*, having been found at Col. Preston's Salt Works in Western Virginia.

angular in the middle; aperture rather large, ovately rhomboidal, whitish within; outer lip acute, nearly straight; columella somewhat thick and a little twisted.

Operculum ovate, rather thick, dark brown, with the polar point near the base.

Proc. Acad. Nat. Sci. 1864, p. 112.

Hab.—North Georgia and East Tennessee, Bishop Elliott.

My cabinet and cabinet of Smithsonian Institution.

Diam. .36,

Length .80 inch.

Remarks.—A number of specimens of different ages were sent to me from the Smithsonian Institute, and I name it after the founder of that noble institution. In outline it is near to *Melania* (*Goniobasis*) *obtusa* (nobis), but it is a larger, thicker and more carinate species, and in the folds it differs very much. It is also closely allied in outline and in the apex to *Melania* (*Goniobasis*) *Wardneriana* (nobis), but that is a carinate species, and the apex rather more acuminate. The largest specimens remind one of *Lecontiana* (nobis), but the folds of *Lecontiana* are larger and it is also more fusiform. In *Smithsoniana* the folds are not so close nor well defined; they being shorter, and having their origin in a transverse stria below the suture. It is also more pointed in the apex. The folds are whitish. The aperture is full one-half the length of the shell.

GONIOBASIS DECAMPIL. Pl. 23, fig. 45.

Testa plicata, inferne striata, subcylindrica, valde attenuata, tenui, cornea, evittata; spira subulata; suturis linearibus, impressis; anfractibus instar denis, subconvexis, superne plicis aliquanto flexis; apertura parvissima, subrhomboidea, intus albida; labro acuto, parum sinuoso; columella albida, incurva et contorta.

Shell folded, striate below, subcylindrical, very much drawn out, thin, horn colored, without bands; spire awl-shaped; sutures linear, impressed; whorls about ten, somewhat convex, with slightly bent folds above; aperture very small, subrhomboidal, whitish within; outer lip sharp, somewhat sinuous; columella whitish, incurved and twisted.

Proc. Acad. Nat. Sci., 1863, p. 154.

Hab.—Huntsville, Alab., Wm. H. DeCamp, M. D., Surgeon 1st Michigan Engineers and Mechanics.

My cabinet and cabinet of A. O. Currier.

Diam. .17,

Length .72 inch

Remarks.—This is a very distinct small species which is somewhat allied to *Melania* (*Goniobasis*) *concinna* (nobis), but may easily be distinguished by its having a less number of folds, by the whorls being more convex and by being of a horn color. Although very much the outline of *G. rubellâ* (nobis), it cannot be confounded with that species as it is carinate. On all the specimens before me, about a dozen, there

are three, four, or five striæ below the middle of the whorl, which is slightly carinate. The upper stria is visible on all the whorls about the suture. No folds exist on the three or four last whorls. All the specimens before me except two have the apex broken off. The two young ones show that the perfect shell is sharp pointed. The aperture is about one-sixth the length of the shell. I name this after Dr. DeCamp, who, while professionally accompanying the Federal army, collected several new species, which he presented to Mr. Currier, and to him I am indebted for the privilege of describing them.

GONIOBASIS FRATERNA. Pl. 23, fig. 46.

Testa carinata, fusiformi, subtenui, lutea, evittata vel quadrivittata; spira obtuso-conica; suturis valde impressis; anfractibus instar senis, planulatis, superne acuto carinatis; apertura parviusecula, ovato-rhomboidæa, intus alba; labro acuto, vix sinuoso; columella tenui, inferne contorta.

Shell carinate, fusiform, rather thin, yellow, without bands or with four bands; spire obtusely conical; suturès very much impressed; whorls about six, flat, acutely carinate above; aperture rather small, ovately rhomboidal, white within; outer lip acute, scarcely sinuous; columella thin and twisted below.

Proc. Acad. Nat. Sci., 1864, p. 111.

Hab.—Bibb county and Cahawba river, Alab., E. R. Showalter, M. D.

My cabinet and cabinet of Dr. Showalter and Dr. Hartman.

Diam. .23,

Length .52 inch.

Remarks.—A number of specimens from the two habitats were sent by Dr. Showalter to Dr. Hartman and myself. It is a small species, well characterized, and is near to *paula* (nobis), but is smaller and more *carinate* and of a brighter yellow. Those from Bibb county were all without bands, while those from Cahawba river are generally banded, the two middle bands being approximate. The aperture is not quite half the length, of the shell.

GONIOBASIS PORRECTA. Pl. 23, fig. 47.

Testa striata, attenuata, tenebroso-fusca, uno-vittata; spira attenuata, acuminata; suturis valde impressis; anfractibus novenis, planulatis; apertura parva, ovata, intus albida vel tenebrosa; labro acuto, parum sinuoso; columella inflecta et contorta.

Shell striate, attenuate, dark brown, single banded; spire attenuate, acuminate; sutures very much impressed; whorls nine, flattened; aperture small, ovate, whitish or dark within; outer lip somewhat sinuous; columella bent in and twisted.

Operculum ovate, dark brown, with the polar point near the left edge above the basal margin.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Gap Creek and Spring, Cumberland Gap, E. Tenn., Major S. S. Lyon, U. S. E.

My cabinet and cabinet of Major Lyon.

Diam. .23,

Length .80 inch.

Remarks.—A number of specimens were sent to me by Major Lyon; these were all covered with oxide of iron or carbonate of lime. On removing this the epidermis was found to be a dark brown, and a light band was revealed which follows the whorls immediately under the suture. Some of the specimens have transverse revolving stria on all the whorls; others only on the apical whorls. The strongest stria is in the middle of the whorl, and this is sometimes large enough to make quite a carina. In form and size it is near to *Melania (Goniobasis) strigosa* (nobis), but that species is more acuminate and is of a light horn color without a band. They cannot be confounded. The aperture is about one-fourth the length of the shell.

GONIOBASIS VIRIDISTRIATA. Pl. 23, fig. 48.

Testa virido-striata, fusiformi, subtenui, luteo-olivacea; spira obtuso-conica; suturis irregulariter impressis; anfractibus instar quinis, convexiusculis, superne granulatis, inferne striatis; apertura parviuscula, ovata, intus vittata; labro acuto, vix sinuoso; columella aliquanto inflecta et contorta.

Shell with green striæ, fusiform, rather thin, yellowish olive; spire obtusely conical; sutures irregularly impressed; whorls about five, somewhat convex, granulate above and striate below; aperture rather small, ovate, banded within; outer lip acute, scarcely sinuous; columella somewhat bent in and twisted.

Operculum subrotund, very small, very thin, light brown, with the polar point on the left near the middle.

Proc. Acad. Nat. Sci., 1864, p. 4.

Hab.—Flint River, Geo., Bishop Elliott and Mr. Gesner.

My cabinet and cabinet of Bishop Elliot, Dr. Lewis, and Mr. Gesner.

Diam. .22,

Length .58 inch.

Remarks.—This pretty little species has very much the appearance of some of the young *Melania (Goniobasis) Boykiniana* (nobis), and at first I thought it was such. But although it has the same green striæ, which embellish the whole of the whorls, it differs in being a smaller species, in not being angular, and in being without folds on the lower whorls. It is also closely allied to *Albanyensis*, herein described, but that species is larger, with flatter whorls and much more granulate. The *viridistriata* has usually ten raised, nearly equidistant striæ, which are of a dark green color and are plainly visible through the diaphanous whorl. The aperture is about two-fifths the length of the shell.

GONIOBASIS ALBANYENSIS. Pl. 23, fig. 49.

Testa granulata, conica, subtenui, luteo-olivacea; spira subelevata; suturis irregulariter impressis; anfractibus instar senis, planulatis, superne interdum plicatis, inferne striatis; apertura grandiuscula, ovata, intus albida; labro acuto, vix sinuoso; columella aliquanto inflecta et contorta.

Shell granulate, conical, rather thin, yellowish olive; spire somewhat raised; sutures irregularly impressed; whorls about six, flattened, sometimes folded above, striate below; aperture rather large, ovate, whitish within; outer lip acute, scarcely sinuous; columella somewhat bent in and twisted.

Operculum subrotund, light brown, very thin, polar point on the left near the middle.

Proc. Acad. Nat. Sci., 1864, p. 4.

Hab.—Near Albany and Blue Spring, Baker County, Georgia, Rev. G. White.

My cabinet and cabinet of Mr. White.

Diam. .37,

Length .90 inch.

Remarks.—When I first received this species from Mr. White many years since, I believed it to be a small variety of that proteus species *Melania (Goniobasis) Boykiniana*, (nobis). It differs from it in being less angular on the periphery, in being more granulate, and in having smaller and more closely placed folds on the superior whorls. It is between *Boykiniana* and *viridistriata*, herein described. From the latter it may be easily distinguished by its flatter whorls and more indistinct striæ, which are about the same in number, but which are usually granulate down to the middle of the last whorl. The aperture is about two-thirds the length of the shell.

TRYPANOSTOMA SUBROBUSTUM. Pl. 23, fig. 50.

Testa lævi, pyramidata, tenobroso-cornea, crassa; spira pyramidata, elevata; suturis impressis; anfractibus instar novenis, planulatis; apertura parva, rhomboidea; labro acuto, valde sinuoso; columella incrassata et valde contorta.

Shell smooth, pyramidal, dark horn-color, thick; spire pyramidal and elevated; sutures impressed; whorls about nine, flattened; aperture small, rhomboidal; outer lip sharp and very sinuous; columella thickened and very much twisted.

Operculum ovate, dark brown, with polar point near the base on the left side.

Proc. Acad. Nat. Sci., 1864, p. 4.

Hab.—Holston River at Knoxville, East Tennessee, Major S. S. Lyon, U. S. E.

My cabinet.

Diam. .61,

Length 1.25 inch.

Remarks.—A single specimen only, with an imperfect outer lip and much eroded spire, was received. This is greatly to be regretted, as such a fine large species ought to be well represented. This specimen has no bands, and is without striæ.

It belongs to the group of which *Hartmanii* may be considered the type, but may be distinguished by its being a larger and more robust species, with a much larger body whorl. The aperture is about one-third the length of the shell.

TRYPANOSTOMA CYLINDRACEUM. Pl. 23, fig. 51.

Testa lævi, cylindracea, subcrassa, vittata vel evittata; spira subelevata; suturis irregulariter impressis; anfractibus planulatis, leviter impressis, inferne suturis tumidis; apertura parviuseula, rhomboidea; labro acuto, aliquanto sinuoso; columella incrassata, incurvata et contorta.

Shell smooth, cylindrical, rather thick, banded or without bands; spire rather raised; sutures irregularly impressed; whorls flattened, slightly impressed, swollen below the sutures; aperture rather small, rhomboidal; outer lip acute, somewhat sinuous; columella thickened, incurved and twisted.

Proc. Acad. Nat. Sci. 1864, p. 4.

Hab.—Roane County, East Tennessee, Major S. S. Lyon, U. S. E.

My cabinet.

Diam. .41,

Length 1.4 inch.

Remarks.—I have three specimens of this pupæform species before me. Two of them are of a light horn color; the third has a dark brown band over more than two-thirds of the whorls, above which band along the sutures it is yellow. In this specimen the base of the columella is purple and the interior is purplish. In all the three specimens the body whorl is impressed above the periphery, amounting almost to a channel. It is allied to *parvum* and *moriforme*, (nobis,) but is larger and more cylindrical than the first, and smaller and less pyramidal than the latter. The aperture is about one-third the length of the shell. The apices were too much eroded to ascertain the number of whorls, but there are probably about eight.

TRYPANOSTOMA ROANENSE. Pl. 23, fig. 52.

Testa lævi, obtuso-conica, crassa, vittata vel evittata; spira obtusa; suturis impressis; anfractibus planulatis, inferne suturis tumidis; apertura parviuseula, rhomboidea; labro acuto, sinuoso; columella albida, incrassata et valde contorta.

Shell smooth, obtusely conical, thick, banded or without bands; spire obtuse; sutures impressed; whorls flattened, swollen below the sutures; aperture rather small, rhomboidal; outer lip acute, sinuous; columella whitish, thickened and very much twisted.

Proc. Acad. Nat. Sci., 1864, p. 4.

Hab.—Roane County, East Tennessee, Major S. S. Lyon, U. S. E.

My cabinet.

Diam. .41,

Length .80? inch.

Remarks.—This species is allied to *cylindraceum*, herein described, but differs in being shorter and wider in proportion. It differs also in the form of the bands where they exist. Two of the six specimens before me have a single narrow band below the middle, and one has a second band above the middle. All the specimens have apices so much eroded that the number of whorls cannot be correctly ascertained. There may be six or seven. The aperture is probably more than one-third the length of the shell.

TRYPANOSTOMA CURTATUM. Pl. 23, fig. 53.

Testa lævi, pyramidata, luteola, crassa; spira obtusa; suturis irregulariter impressis; anfractibus instar septenis, planulatis, ultimo impresso; apertura rhombica, intus albida; labro acuto, expanso, valde sinuoso; columella incrassata, inflecta et valde contorta.

Shell smooth, pyramidal, yellowish, thick; spire obtuse; sutures irregularly impressed; whorls seven, flattened, the last one impressed; aperture rhomboidal, whitish within; outer lip acute, expanded, very sinuous; columella thickened, bent in and very much twisted.

Operculum ovate, dark brown, with polar point near the base on the left.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Powell's River, near Cumberland Gap, East Tenn., Maj. S. S. Lyon, U. S. E. My cabinet and cabinet of Major Lyon.

Diam. .41,

Length 1.75 inch.

Remarks.—Quite a number of this species were sent to me by Major Lyon. It is a short thick species, with a well characterized aperture, the columella being much thickened, drawn back and twisted. It is allied to *T. pumilum* and *minor*, (nobis,) but differs from both in having the sides flattened and being angular about the middle of the body whorl. Very few of *curtatum* are banded, while all I have seen of the above two species are banded and the epidermis polished. The aperture is about one-third the length of the shell.

TRYPANOSTOMA NAPOIDEUM. Pl. 23, fig. 54.

Testa lævi, obtuso-conoidea, subcrassa, cornea, evittata; spira curta, mucronata; suturis impressis; anfractibus septenis, superne convexiusculis, ultimo inflato; apertura grandi, subrhomboidea, intus alba; labro acuto, sinuoso; columella inferne incrassata et valde contorta.

Shell smooth, obtusely conical, rather thick, horn-color, without bands; spire short, pointed at the apex; sutures impressed; whorls seven, slightly convex above, the last one very much inflated; aperture large, subrhomboidal, white within; outer lip acute, sinuous; columella thickened below and very much twisted.

Proc. Acad. Nat. Sci., 1864, p. 112.

Hab.—Tennessee, Prof. Troost.

My cabinet.

Diam. .30,

Length .51 inch.

Remarks.—This is one of the many species sent to me long since by my excellent friend the late Prof. Troost. There were but two specimens, and as they had very much the aspect of young *Melania (Trypanostoma) conica*, Say, I refrained from describing them in hopes that others would be received. Feeling satisfied that it is a distinct species, I propose the name from its round short form, somewhat like a turnip. One of the specimens has a purple spot at the base of the columella; the other is devoid of it. The aperture is quite one-half the length of the shell.

TRYPANOSTOMA LYONII. Pl. 23, fig. 55.

Testa lævi, conica, viridi-cornea, evittata; spira subelevata; suturis impressis; anfractibus instar senis, convexis; apertura parviuscula, rhomboidea, intus albida; labro acuto, valde sinuoso; columella alba, inferne incrassata et contorta.

Shell smooth, conical, greenish horn-color, without bands; spire somewhat raised; sutures impressed; whorls about six, convex; aperture rather small, rhomboidal, whitish within; outer lip acute, very sinuous; columella white, thickened below and twisted.

Operculum ovate, very dark brown, with the polar point on the basal margin at the left.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Cumberland River near the Ford, north side of the mountain, and Big Creek, south of mountain at Cumberland Gap, Tenn., Maj. S. S. Lyon, U. S. E.

My cabinet and cabinet of Major Lyon.

Diam. .32,

Length .85 inch.

Remarks.—Quite a number of specimens were sent to me by Major Lyon, from both the above habitats. They are all very much the same in color and size, and none are banded. None were perfect at the apex, but the upper whorls, I think, from indications in a few specimens, will be found to be carinate. It is between *Christyi* and *modestum* (nobis). From the former it differs in having the base of the columella less twisted, in having a smaller aperture, and having the whorls more convex. From the latter it differs in being a smaller species, being darker, and having a less expanded outer lip. The aperture is about one-third the length of the shell. I name this after Major S. S. Lyon, of the Engineer Corps of the U. S. Army, being collected by him during the campaign last year to Cumberland Gap, East Tennessee, where he obtained several new Melanidæ.

TRYPANOSTOMA AFFINE. Pl. 23, fig. 57.

Testa canaliculata, pyramidata, cornea; spira valde elevata; suturis regulariter impressis; anfractibus instar novenis, canaliculatis, supra planulatis; apertura subrhomboidea, intus albida vel vittata; labro acuto, sigmoideo; columella incrassata et valde contorta.

Shell channelled, pyramidal, horn-color; spire very much raised; sutures regularly impressed; whorls about nine, channelled, flattened above; aperture subrhomboidal, whitish or banded within; outer lip acute, sigmoid; columella thickened and very much twisted.

Proc. Acad. Nat. Sci. 1864, p. 4.

Hab.—Smith's Shoals, Cumberland River, East Tennessee, Maj. S. S. Lyon, U. S. E. My cabinet.

Diam. .60,

Length 1.35 inches.

Remarks.—This species is allied to *Thorntonii*, (nobis,) and belongs to the group of which *canaliculatum*, Say, may be considered the type. It differs from that species in having a longer fuse or basal channel, in which character it approaches the genus *Io*. It is closely allied to *moniliferum*, (nobis,) but differs in having a shorter spire; being channelled on the periphery and having no nodules. There is usually a well defined channel above the periphery, the middle of the lower whorl being carinate. Below the carina there is usually a single stria. Two specimens of the four before me have a broad single band on the upper whorls and several bands in the interior. The base of the columella is very much twisted backwards, and the edge of the outer lip is disposed to be thickened. The aperture is rather more than one-third the length of the shell.

TRYPANOSTOMA UNIVITTATUM. Pl. 23, fig. 58.

Testa obtuso-carinata, pyramidata, subcrassa, dilute olivacea, nitida, univittata; spira elevata; suturis impressis; anfractibus planulatis; apertura parviuscula, rhomboidea, intus albida, obsolete univittata; labro acuto, sigmoideo; columella inferne incrassata et valde contorta.

Shell obtusely carinate, pyramidal, somewhat thick, pale olive, shining, with a single band; spire elevated; sutures impressed; whorls flattened; aperture rather small, rhomboidal, whitish within, obscurely single banded; outer lip acute, much curved; columella thickened below and very much twisted.

Proc. Acad. Nat. Sci. 1864, p. 112.

Hab.—Cahawba River, Alab., E. R. Showalter, M. D.

Cabinet of W. D. Hartman, M. D.

Diam. .45,

Length 1.2 inches.

Remarks.—A single specimen was received by Dr. Hartman from Dr. Showalter,

and kindly lent to me for description. It seems to be most nearly allied to *T. Anthonyi* (nobis,) but it is a smaller species, without the striæ and obscure sulcations of that species, and it has a band which I have never observed in *Anthonyi*, and probably a less number of whorls. It also is somewhat allied to *Hartmanii* (nobis,) but not so elevated and it is smaller. When *Hartmanii* is banded it always has, I believe, two. This specimen of *univittatum* has a single band above the periphery which is observable on all the whorls above. The apex being eroded I cannot state the number of whorls, but they seem to be about eight. The aperture is about one-third the length of the shell.

TRYPANOSTOMA LESLEYI. Pl. 23, fig. 59.

Testa tuberculata, pyramidata, tenebroso-cornea; spira elevata; suturis irregulariter impressis; anfractibus instar octonis, subimpressis; apertura parviuscula, rhomboidea, intus albida, interdum vittata; labro acuto, valde sinuoso; columella incrassata.

Shell tuberculate, pyramidal, dark horn color; spire exerted; sutures irregularly impressed; whorls about eight, somewhat impressed; aperture rather small, rhomboidal, white and sometimes banded within; outer lip acute, very sinuous; columella thickened.

Operculum ovate, dark brown, rather thin, with the polar point near the base.

Proc. Acad. Nat. Sci. 1864, p. 4.

Hab.—East Tennessee, Prof. Troost; Smith's Shoals, Cumberland River, East Tennessee, Major S. S. Lyon, U. S. E.; Pulaski County, Kent., Joseph Lesley, C. E.

My cabinet.

Diam. .80,

Length 1.2 inches.

Remarks.—This species is closely allied to *T. undulatum* (*Melania undulata*) Say, but may at once be distinguished by its lower spire and proportionately wider base, where it is flatter. The undulations on Mr. Say's shell are low, while in *Lesleyi* these are replaced by well defined tubercles, which are disposed to be compressed and incline to the left. There is only a single row of these tubercles, but those of the row above cause swellings on the upper part of the whorls. In the young state they differ totally, the *undulatum* being entirely smooth, while the *Lesleyi* has tubercles to the apex, except that on the two or three first whorls they change into folds. In the multiplicity of nodules it resembles *Lithasia* (*Melania*) *pernodosa* (nobis). In the spire it also resembles *Lithasia* (*Melania*) *armigera*, Say, and *Lithasia* (*Melania*) *Jayana* (nobis,) but differs in the aperture being Trypanostamose and of course not belonging to the same genus. I have ten specimens before me. Those from Troost I have had a long time and believed they might be a variety only of *undulatum*, but the young sent by Mr. Lesley and Major Lyon convinced me at once that the species was new and very distinct. The aperture is more square than in *undulatum* and the

fuse is less. The young are striate on the under part of the whorls, which is never the case with *undulatum*. The aperture is about one-third the length of the shell. I have great pleasure in naming this after Mr. Joseph Lesley, Civil Engineer, to whose kindness I am indebted for many Kentucky species.

TRYPANOSTOMA CINCTUM. Pl. 23, fig. 60.

Testa carinata, subfusiformi, subcrassa, tenebroso-cornea; spira subelevata; suturis impressis; anfractibus instar septenis, planulatis; apertura parviuseula, rhomboidea, intus albida; labro acuto, sinuoso; columella inferne incrassata et contorta.

Shell carinate, subfusiform, somewhat thick, dark horn-color; spire somewhat raised; sutures impressed; whorls about seven, flattened; aperture rather small, rhomboidal, whitish within; outer lip acute and sinuous; columella thickened and twisted below.

Proc. Acad. Nat. Sci., 1864, p. 112.

Hab.—North Alabama, Prof. Tuomey.

My cabinet.

Diam. .32,

Length .65 inch.

Remarks.—A single specimen only was received, and it was among several specimens of *Alabamense*, (nobis,) to which it is allied; but it is evidently a smaller species, with a comparatively shorter spire and with a more developed angle on the periphery, which is accompanied by a furrow. The angle on the lower whorl is cord-like, while on the upper whorls it is sharper and has the furrow deeper above. There are no colored bands on this specimen, and I suspect that it will be found to be generally if not always without them. The aperture is rather more than one-third the length of the shell.

TRYPANOSTOMA CURRIERIANUM. Pl. 23, fig. 61.

Testa carinata, valde attenuata, tenebroso fusco-vittata; spira valde exserta; suturis linearibus, vix impressis; anfractibus instar denis, planulatis; apertura parva, rhomboidea, intus vittata; labro acuto, valde sinuoso; columella albida et valde contorta.

Shell carinate, very attenuate, with dark brown bands; spire very much drawn out; sutures linear, scarcely impressed; whorls about ten, flattened; aperture small, rhomboidal, banded within; outer lip acute, very sinuous; columella whitish and very much twisted.

Operculum ovate, reddish-brown, rather thick, with the polar point near the base towards the left margin.

Proc. Acad. Nat. Sci., 1863, p. 155.

Hab.—Florence, Alabama, Wm. H. De Camp, M. D.

My cabinet and cabinet of A. O. Currier.

Diam. .31,

Length 1.26? inch.

Remarks.—I have seven specimens before me for examination, none of which are perfect at the apex, and therefore the number of whorls is somewhat uncertain. It is a well characterized shell, all the specimens being without any variation except in age. There are five dark brown bands, the upper and lower being the broadest. The lower two of the three in the middle are on two revolving striæ. The whorls above the body whorls exhibit two of the five bands all the way to the apex. In old individuals the outer lip is much expanded and slightly thickened inside of the edge. It is allied to *Melania (Trypanostoma) elongata*, (nobis,) but may easily be distinguished by being more attenuate, smaller, thinner, and in having five bands. The aperture is about one-fifth the length of the shell. I name this after Mr. A. O. Currier, to whom I am indebted for it.

TRYPANOSTOMA CARINATUM. Pl. 23, fig. 62.

Testa carinata, acuto conica, rufo-cornea, tenui, diaphana; spira acuto-conica, mucronata; suturis valde impressis; anfractibus instar novenis, carinatis, superne striatis; apertura parviuscula, rhomboidea; labro acuto, sinuoso; columella aliquanto incrassata et contorta.

Shell carinate, acutely conical, reddish horn-color, thin, transparent; spire acutely conical and sharp at the point; sutures very much impressed; whorls about nine, carinate and striate above; aperture rather small and rhomboidal; outer lip acute, sinuous; columella somewhat thickened and twisted.

Proc. Acad. Nat. Sci. 1864, p. 4.

Hab.—Bull Run, Tributary to Clinch River, East Tenn., Major S. S. Lyon, U.S.E. My cabinet.

Diam. .19,

Length .44 inch.

Remarks.—Two specimens only were received, having somewhat the aspect of young shells, but I suspect they are nearly if not quite mature. It is evidently a delicate species. It has rather a wide channel, with the outer lip not much produced. In outline it resembles *Melania (Goniobasis) sculptilis*, (nobis,) but differs from it generically as well as being shorter in the spire and in not having deep striæ over the whole of the whorls. The aperture is more than one-third the length of the shell.

TRYPANOSTOMA CORNEUM. Pl. 23, fig. 63.

Testa striata, exserta, tenui, subdiaphana, dilute cornea; spira elevata; suturis regulariter impressis; anfractibus octonis, subconvexis; apertura elongata, constricto-elliptica, intus albida; labro acuto, valde sinuoso; columella tenui et contorta.

Shell striate, exserted, thin, semi-transparent, pale horn-color; spire raised;

sutures regularly impressed; whorls eight, somewhat convex; aperture elongate, narrow-elliptical, whitish within; outer lip acute and very sinuous; columella thin and twisted.

Proc. Acad. Nat. Sci., 1864, p. 112.

Hab.—Tennessee, Mr. J. G. Anthony.

My cabinet and cabinet of Mr. Anthony.

Diam. .27,

Length .76 inch.

Remarks.—Two specimens were sent to me some years since by Mr. Anthony. I do not know from what part of Tennessee they came. In these two specimens all the whorls but the body whorl have six or ten transverse striae. The base of the body whorl is striate. The base is prolonged almost into a channel, and thus approaches the genus *Io*. In outline and color it is allied to *T. venustum*, herein described, but differs in not being fusiform, in having a larger aperture, and in having striae. The aperture is more than one-third the length of the shell.

SCHIZOSTOMA SHOWALTERII. Pl. 23, fig. 56.

Testa laevi, cylindracea, producta, crassa, mellea, evittata; spira exserta; suturis valde impressis, infra funiculo instructis; anfractibus subplanulatis; fissura parviuscula; apertura parva, elliptica, intus alba; labro acuto, aliquanto sinuoso; columella inferne et superne incrassata.

Shell smooth, cylindrical, elevated, thick, honey-yellow, without bands; spire exserted; sutures very much impressed, furnished below with a cord; whorls flattened; fissure rather small; aperture small, elliptical, white within; outer lip acute, somewhat sinuous; columella thickened above and below.

Operculum elongate, dark brown.

Proc. Acad. Nat. Sci., 1864, p. 112.

Hab.—Coosa River, Alabama, E. R. Showalter, M. D.

My cabinet and cabinet of Dr. Showalter.

Diam. .54,

Length 1.2? inch.

Remarks.—This species, of which I have but a single specimen, is the highest in the spire of any I have seen, and it is to be regretted that it is not more perfect, the three lower whorls only remaining. These, however, indicate a high spire, which is not common in the genus. The lower whorl reminds one of *constrictum*, (nobis,) but that species is short, not so thick, has a larger aperture, and the callus is not so thick on the columella. It also has a constriction round the body whorl which this species has not. It is also devoid of the well marked cord which runs round the sutures of this species, which cord is very remarkable. There are a few iridescent striae on the under part of last whorl in this specimen. Being an imperfect specimen, neither the number of whorls nor the proportion of the aperture can be ascertained. In a former

paper I named a fine *Schizostoma* after Dr. Showalter, which he sent to me as new; but I find that Mr. Anthony had very shortly before described the same shell under the name of *carinifera*. Wishing very much that Dr. Showalter's name should be permanent in a genus to which he has so much contributed in bringing so many new species to light, I dedicate this fine species to him, as an acknowledgement of the debt due to him by all students of *Malacology*.

EURYCÆLON UMBONATUM. Pl. 23, fig. 64.

Testa nodulata, subfusiformi, suberassa, obsolete vittata, tenebroso-oliva; spira valde obtusa; suturis valde impressis; anfractibus irregulariter umbonatis, subsuturis tumidis, ultimo pergrandi; apertura pergrandi, subelliptica; labro acuto, leviter sinuoso; columella superne incrassata, inferne subsinuoso.

Shell nodulous, subfusiform, rather thick, obscurely banded, dark olive; spire very obtuse; sutures very much impressed; whorls with irregular bosses, swollen below the sutures, the last one very large; aperture very large, subelliptical; outer lip acute, slightly sinuous; columella thickened above and somewhat sinuous below.

Goniobasis umbonata, Lea. Proc. Acad. Nat. Sci., 1864, p. 3.

Hab.—Smith's Shoals, Cumberland River, East Tenn., Major S. S. Lyon, U. S. E. My cabinet.

Diam. .48,

Length .80? inch.

Remarks.—I received only two specimens of this interesting species, and neither being perfect at the apex the number of whorls cannot be ascertained; probably there are not more than five. Both these specimens have two small obscure bands on the inside of the upper part of the outer lip. One has dark brown marks inside and is brown at the bottom of the columella. One is much darker on the outside than the other. The large irregular nodes or bosses are three on the body whorl of one specimen and five on the other; they are placed on the shoulder of the whorls. The aperture is nearly two-thirds the length of the shell. This is the fourth species of a natural group which I have described, and which have a large ear-shaped aperture,—viz.: *Melania* (*Goniobasis*) *basalis*, *midas*, *gibberosa*, and now *umbonata*. If they be not entitled to a generic place, they may at least be considered a subgenus, for which I propose the name of *Eurycælon*, from *Eurus amplus* and *Kοιλων* *cavitas*, the aperture being larger than in the *Melanidæ* generally. All the species of *Eurycælon* have a callus on the columella above, but not below, as in *Lithasia*, and the base is more or less angular, which is not the case with *Anculosa*. Those which we have considered varieties of *Anculosa præerosa*, Say, which have an angular base, properly belong, I think, to *Eurycælon*, as well also *Anthonyi*, Redfield, *turbinata* and *tintinnabulum*, (nobis,) and perhaps some others. When the soft parts of the four species mentioned first shall be examined, they will, I think, be found to differ from *Gonio-*

basis, *Trypanostoma* and *Lithasia*, to which genera they seem nearest allied. The operculum of the only one I have seen, *gibberosa*, is the same as *Goniobasis* and the *Melanidæ* generally.

STREPHOBASIS LYONII. Pl. 23, fig. 65.

Testa lævi, subcylindracea, crassa, tenebroso-cornea vel oliva, raro vittata; spira obtuso-conica; suturis impressis; anfractibus octonis, convexiuseulis; apertura subconstricta, rhomboidea, intus albida, raro vittata; labro acuto, aliquanto sinuoso; columella inferne incrassata, ad basim canaliculata et retrorsa.

Shell smooth, subcylindrical, thick, dark horn-color or olive, rarely banded; spire obtusely conical; sutures impressed; whorls eight, somewhat convex; aperture somewhat constricted, rhomboidal, whitish within, rarely banded; outer lip acute, somewhat sinuous; columella thickened below and channelled, and drawn back at the base.

Proc. Acad. Nat. Sci. 1864, p. 5.

Hab.—Holston River at Knoxville, East Tennessee, Major S. S. Lyon, U. S. E.

My cabinet.

Diam. .48,

Length .92 inch.

Remarks.—I have about a dozen, of various ages, of this well characterized species, which is nearly allied to *Spillmanii*, (nobis). It differs in having a shorter aperture, in being rather larger, and in not being so cylindrical. In the young of the two there is a marked difference in outline, *Lyonii* being much more conical. Some of the less cylindrical specimens approach *olivaria*, (nobis,) but that is a smaller species, of a darker color, and almost always having two bands. *Lyonii* is usually without bands. Among the specimens before me two have a single band, one has two bands, one has four bands, and another has five bands. Four have a dark purple mark round the base of the columella. In those before me the color of the epidermis is very variable: several are light horn-color, one young one is almost a cinnamon brown, and three are olivaceous. The old specimens are much eroded at the apex, and this causes a more cylindrical outline. The aperture is about four-tenths the length of the shell.

I have great pleasure in dedicating this fine species to Major Sidney S. Lyon, of the U. S. Engineer Corps, at this time (1864) in the field in East Tennessee. I owe to him the possession of these and other interesting species described in this paper.

TRYPANOSTOMA VENUSTUM. Pl. 23, fig. 66.

Testa lævi, acuminata, luteo-cornea, tenui, mucronata, evittata; spira subelevata; suturis impressis; anfractibus novenis, planulatis; apertura parviusecula, subconstricta, elliptica; labro acuto, subsinuoso; columella tenui, subcontorta.

Shell smooth, acuminate, yellowish horn-color, thin, sharp pointed, without bands;

spire somewhat elevated; sutures impressed; whorls nine, flattened; aperture rather small, somewhat constricted, elliptical; outer lip acute, subsinuous; columella thin and somewhat twisted.

Operculum ovate, very thin, light brown, with polar point near the base on the left side.

Proc. Acad. Nat. Sci. 1864, p. 112.

Hab.—Big Prairie Creek, Alabama, Dr. Showalter.

My cabinet and cabinet of Dr. Showalter.

Diam. .25,

Length .74 inch.

Remarks.—A single specimen of this species was received. It was sent with specimens of what I called *T. mucronatum*, but while it has nearly the same color of epidermis and is nearly of the same outline, it is distinguished by its longer base, its having no carinations except on two or three of its first whorls. It also differs in the base of the columella, which is not so much curved. The aperture is also longer and more constricted. The aperture is rather more than one-third the length of shell.

Genus MESECHIZA.*

Testa fusiformis, imperforata; apertura rhomboidea, inferne canaliculata; labrum expansum, in medio excisum; columella lævis, incurvata.

Operculum corneum, ad spiram pertinens.

Proc. Acad. Nat. Sci., 1864, p. 2.

When I described the genus *Trypanostoma*† I mentioned the importance of eliminating as many species as possible from the enormously extended genus *Melania*. The little shell which I now propose as a new genus has so distinct a character in the incision of the middle of the outer lip, as to mark distinctly its place in the *Melanidæ* of the United States. It differs entirely in the character of the cut from that in *Schizostoma*, which has, in all the many species I have seen, a more or less deep incision immediately under the suture. The living soft parts have not yet been observed. They may when examined prove to have some characteristics quite different from *Schizostoma*.

MESECHIZA GROSVENORII. Pl. 23, fig. 67.

Testa lævi, fusiformi, tenui, obtuse conica, vel purpurea vel vittata; spira obtuse conica; suturis leviter impressis; anfractibus instar septenis, vix convexis; apertura magna, rhomboidea, intus plerumque vittata; labro acuto, in medio leviter exciso; columella leviter incrassata et contorta.

* Μεση σχιζή central fissure.

† Jour. Acad. Nat. Sci., Vol. v. p. 268, and Obs., Vol. ix. p. 90.

Shell smooth, fusiform, thin, obtusely conical, purple or banded; spire obtusely conical; sutures slightly impressed; whorls about seven, scarcely convex; aperture large, rhomboidal, generally banded within; outer lip acute, slightly notched in the middle; columella slightly thickened and twisted.

Operculum ovate, light brown, rather thin, having several volutions, and with the polar point well removed from the left margin.

Proc. Acad. Nat. Sci., 1864, p. 2.

Hab.—Wabash River, Indiana, H. C. Grosvenor.

Diam. .27,

Length .43 inch.

Remarks.—I have thirteen specimens of this remarkable shell. Eight of them have a well defined though delicate notch on the edge, at or near to the periphery of the last whorl. In some this notch is a little above the periphery, and in others a little below. Five of the specimens have no notch, which probably arises in four of them from not being full grown, and in one from having the thin delicate edge broken off. The specimens vary in color, some being light horn-color with few or many bands, others more or less purple and with or without bands; others again have obscure longitudinal thickenings, which being whitish give the specimens the appearance of being folded. In all the specimens there is a light line under the sutures, and some have six or seven brown bands which are distinctly seen on the inside. The channel at the base is small but well defined. In outline this species reminds one of *Goniobasis Vauxiana*, (nobis,) and *Melania (Goniobasis) germana*, Anth. It is a thinner shell than either, and the notch in the lip removes it from that genus. The aperture is about one-half the length of the shell. I have great pleasure in naming this species after Mr. Grosvenor, to whom I am greatly indebted for many of our Western Mollusca.

MEGASYSTROPHA NEWBERRYI. Pl. 23, fig. 68.

Testa pallida-cornea, depresso-turrita, minutissime striata, superne et inferne acuto-carinata, late et profundite umbilicata; anfractibus quinis, superne planulatis; apertura magna, pallido-cornea, subtriangulari.

Shell pale horn-color, slightly turritid, very finely striate, sharply carinate above and below, widely and deeply umbilicate; whorls five, flattened above; aperture large, pale horn-color and subtriangular.

Planorbis Newberryi, Lea. Proc. Acad. Nat. Sci., 1858, p. 41.

Hab.—Klamath Lake and Canoe Creek, California, J. S. Newberry, M. D.

My cabinet and cabinets of the Smithsonian Institution and Dr. Newberry.

Diam. .55,

Length .42 inch.

Remarks.—This is a very remarkable shell, and I have placed it among the *Planorbis* until the soft parts may be observed in a living state; they may be found to differ from the true *Planorbis*.* Some specimens preserved in alcohol have been carefully examined, but the parts are so rigid that it could not be satisfactorily done. The tentacula do not, however, seem to be so long as is usual in the *Planorbis*. The epidermis is very thin on the upper part of the whorls, and the striæ there are backwards in curves, and on the lower part slightly forwards. The upper carina forms an acute angle, the edge being cord-like; the lower one is still more acute. In most of the specimens there are two obscure carinations on the whorls between the acute ones. The umbilical region is very remarkable, the perforation extending to the apex of the slightly elevated spire, the apex itself being frequently wanting, owing to corrosion occasioned by the attacks of some small enemy eating into the substance of the hard part. The upper angle of the whorls is elevated slightly above the plane of the whorls, thus forming a babylonian appearance. This gives the shell the appearance of some forms of the *Trochi*. This very curious and interesting species is among the *Mollusca* brought by J. S. Newberry, M. D., attached to the Pacific Rail Road Survey under the command of Lieut. R. S. Williamson, U. S. A.; and I have great pleasure in dedicating it to Dr. Newberry, who has done so much to elucidate the Natural History of California and Oregon, when on these expeditions so creditable to the Government.

I received in February, 1856, from Dr. John B. Trask, of San Francisco, California, a number of interesting *Molluscs*, some of which are new to me. I propose to give the diagnoses of these, and merely to enumerate the others which are already known, adding what I believe to be their synonymy.

Among the *Unionidæ* I found no new ones, and it may be mentioned that the genera and species of this family are remarkable, first, for their very small number, secondly, for the absence of strongly pronounced characteristics; there being no tuberculate, plicate, spinose or sulcate species yet observed, although many naturalists within the last fifteen or twenty years have well examined the lakes and rivers of the country.

We are not the less surprised at the remarkable paucity as regards also the families *Colimacea*, *Lymnæana*, *Melaniana* and *Peristomata*. This is most strikingly in contrast with the profusion which exists in regard to most of these *Families*, in the waters which drain the eastern flanks of the Rocky Mountains, and the vast valleys and plains intervening between them and the Atlantic Ocean.

* Provisionally it may be called *Megasystropha*, from *Μεγας*, magnus, and *συστροφή*, vortex, the umbilicus being large and vortex-like.

The following species, heretofore described, were part of the *envoi* made by Dr. Trask :

Margaritana margaritifera, *Lea*.

Alas. falcata, Gould.

Alas. Yubaensis, Trask, from Klamath and Yuba Rivers.

I received specimens of this shell from Prof. Nuttall in 1837, brought by him from Columbia River. I thought then, and I still think that there were not characters sufficiently distinct in them to form a new species. The observations published at the time (*Trans. Am. Phil. Soc.* vol. vi. p. 97) are still in accordance with my opinions after having had many specimens from various localities under examination. The purple in the nacre is stronger than any I have seen from other localities, but this with the other differences would not I think warrant its being considered more than a mere variety of *M. margaritifera*.

Anodonta Wahlamatensis, *Lea*, *Tr. Am. Ph. Soc.*, vol. vi. p. 78. = *A. triangulata*, Trask, *A. rotundovata*, Trask.

From Sacramento River.

Anodonta angulata, *Lea*, *Tr. Am. Ph. Soc.*, vol. vi. p. 97. = *A. feminalis*, Gould, *A. Randallii*, Trask.

From Upper San Joaquin.

Helix Oregonensis, *Lea*, *Tr. Am. Ph. Soc.*, vol. vi. p. 100.

Point Cypress, Monterey County.

Helix Nickliniana, *Lea*, *Tr. Am. Ph. Soc.*, vol. vi. p. 100.

Tomales Bay and Deadman's Island.

Helix Californiensis, *Lea*, *Tr. Am. Ph. Soc.*, vol. vi. p. 99.

Point Cypress, Monterey County.

Lymnæa exigua, *Lea*, *Tr. Am. Ph. Soc.*, vol. 9, "Obs." vol. 3.

San Antonio, Arroya.

Lymnæa pallida, *Adams*, *Jour. Boston Nat. Hist. Soc.*, vol. 3.

San Antonio, Arroya.

Physa heterostropha, *Say*, *Nicholson's Ency.*, Am. Edition.

Los Angeles.

Melania occata, *Hinds*, *Voyage of the Sulphur*, pl. 15, fig. 5.

Sacramento River.

Melania seminalis (*Paludina Hinds*), *Voyage of the Sulphur*, pl. 16, fig. 22.

Sacramento River.

Planorbis trivolvis, *Say*, *Nicholson's Ency.*, Am. Edition.

Kern Lake. Slightly varies from the Michigan specimens.

Planorbis ammon, *Gould*, *Proc. Bost. Soc. Nat. Hist.*, vol. v. p. 129.

Lagoons Sacramento Valley.

Family *LYMNEANA*.

Genus POMPHOLYX.*

Testa rotundo-gibbosa, subtus retrorsa, superne planulata, non umbilicata; spira depressa; apertura amplissima, subrotunda, effusa; labro acuto; labio incrassato, planulato; operculum nullum.

Shell gibbosely rounded, drawn back beneath, above flattened, not umbilicate; spire depressed; aperture very large, nearly round, effuse; outer lip acute, inner lip thickened, flattened; no operculum.

Proc. Acad. Nat. Sci., 1856, p. 80.

Remarks.—Among a number of specimens of *Melania seminalis*, Hinds, sent to me by Dr. Trask from Sacramento River, were four specimens of the above described genus, which at a hasty glance might have been easily passed unrecognized. A little comparison, however, would easily show that the constriction of the mouth and the depression of the spire forbid the connection, even with the genus. On a more critical examination it would be observed that the form of the aperture, as well as the spire, would more closely connect it with some of the *Ampullariæ*, particularly *A. neritoides*, D'Orb. It cannot be placed, however, with that genus, having no operculum. It probably belongs to the family of *Lymneana*, but without the advantage of examining the structure of its organs it would be impossible to decide definitely as to the true position of the genus. Three of the four specimens before me had the soft parts remaining dried up in the shell. There was no operculum, and we might expect this from the effuse form of the aperture. The absence of an operculum would suggest its belonging to the *Planorbis*, but the absence of an umbilicus and its not being convolute, forbid that connection. The general form reminds one of the genus *Vitrina*.

POMPHOLYX EFFUSA. Pl. 23, fig. 69.

Testa parva, striata, rotundo-gibbosa, subtenui, effusa, luteo-cornea; anfractibus trinis, superne planulatis, inferne convexis; apertura subrotunda, dilatata, intus albida, maculata.

Shell small, striate, irregularly rounded, rather thin, effuse, yellowish horn-color; whorls three, flattened above, convex below; aperture rounded, dilate, within whitish and spotted.

Proc. Acad. Nat. Sci., 1856, p. 80.

Hab.—Sacramento River, California, Dr. Trask.

My cabinet and cabinet of Dr. Trask.

Diam. .32,

Length .25 inch.

* Πομφόλυξ, bulla.

Remarks.—Among a number of fine fresh-water and land shells which I owe to the kindness of Dr. Trask, were four specimens of this heretofore undescribed species. In the general form of the shell there is a resemblance to *Ampullaria neritoides*, D'Orb. In the form of the *columella* it resembles the genera *Littorina* and *Anculosa*, but the outer lip is very effuse and totally without any thickening or reflexion. The *columella* is indented, and has at each end a maculation of brown, which is the case with some of the *Anculosæ*. It is a very thin shell, and quite diaphanous. The spire is but very little raised above the plane of the whorls, and the apex in each of the specimens is slightly worn off.

PLANORBIS TRASKII. Pl. 23, fig. 70.

Testa magna, tenebroso-cornea, subcylindracea, minute, crebre et regulariter striata, superne late et profundite depressa, inferne magis excavata; anfractibus quinis, superne acute carinata ad periphariam, inferne obtuse carinata; apertura auriculæformis.

Shell large, dark horn-color, nearly cylindrical, minutely, thickly and regularly striate, above widely and deeply umbilicate, below largely excavated; whorls five, above acutely carinate near the periphery, below obtusely carinate; aperture ear-shaped.

Proc. Acad. Nat. Sci., 1856, p. 80.

Hab.—Hern Lake, Tulare County, California, Dr. Trask.

My cabinet and cabinet of Dr. Trask.

Diam. 1·5,

Length ·86 inch.

Remarks.—This is certainly the most remarkable species of *Planorbis* yet observed in the United States. It approaches in general form to *corpulentus*, Say, but is a much larger species, having very much smaller striæ. The depressions above and below are also much greater, and the superior carina is more acute. The striæ of the true *corpulentus* are coarser than I have observed in any other American species, while in this species they are among the finest and closest of the various species.

The form of *Traskii* is very remarkable in being high for the width, being really barrel-shaped. I should call this shell sinistral, but Mr. Say calls the *corpulentus*, which opens on the same side, dextral. Mr. Haldeman calls the spiral side the left side, owing to its position in the animal. A single specimen only was received from Dr. Trask, and this unfortunately having lost part of the lip, renders it impossible to say what might be the form of that important portion. I doubt very much its being very effuse. I name this fine species after Dr. Trask, who has kindly furnished me with all the species described above from California, on pages 154 and 157.

PLANORBIS WHEATLEYI. Pl. 23, fig. 71.

Testa parva, tenebroso-cornea, planulata, obsolete striata, bicarinata, superne depressa, inferne late et profundite umbilicata; anfractibus quinis, superne obtuse carinata, inferne acute carinata; apertura albida, crassa et valde constricta, intus sexdentata.

Shell large, dark horn-colored, flattened, obscurely striate, bicarinate, depressed above, deeply and widely umbilicate below; whorls five, obtusely carinate above and acutely carinate below; aperture whitish, very thick and very much constricted; six-toothed within.

Proc. Acad. Nat. Sci., 1858, p. 41.

Hab.—Cotoma Creek, Montgomery Co., Alab., C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .28 inch.

Remarks.—This belongs to a group of which *P. armigerus*, Say, may be considered the type, and which is so widely distributed over the Eastern and Western States. The principal character of both these species is in the position of the teeth, which are internal and stretching nearly across the cavity of the whorl. *P. Wheatleyi* has a very remarkable cord-like enlargement on the outer lip, which enlargement is whitish, striate and in some specimens slightly undulating. The lip itself is thickened, reflected and white with a dark line along the edge. The inner lip is thickened and dark colored. The umbilical region is wide, sharply carinate on the edge and presents all the whorls to view. The striæ are very fine. On the superior part of the whorls there are, in some specimens, impressions which are of a darker horn-color. The teeth are two on the pillar side and four on the opposite side, placed about one-third of the whorl from the aperture. The largest is placed obliquely on the pillar side, stretching nearly across it, is thin, lamellar and curved. Immediately below it is a very small one. The four opposite teeth are rather small and lamellar. Two of them point inwardly and two (the alternate ones) are across the whorl. The largest one of these four is nearly in the centre, and is slightly curved. In this armature it will be observed that there is a strong resemblance to that of *armigerus*, even in the number of the teeth; for, although Mr. Say states that “the throat is armed with five teeth,” there are in reality, in all perfect specimens of his species, six, the superior one (the fourth on the side of “the labrum”) being distinctly visible even from the outside in some of my specimens. The position of this armature is not so far in the throat of *armigerus*, usually not more than the fourth of a whorl. The general appearance of *Wheatleyi* is very different. It is more like *bicarinatus*, Say, having two very distinct carinæ, while *armigerus* has none, which I have ever seen, although Mr. Say describes it as “obtusely carinate above.” The enlargement, like a cord or collar round the exterior portion of the aperture, is very remarkable, and a somewhat similar enlargement may be observed on the whorls to have taken place when the individual was about half grown.

PLANORBIS BILLINGSII. Pl. 23, fig. 72.

Testa lævi, planulata, superne plano-convexa, subtus lato umbilicata, estriata; anfractibus quaternis; labro acuto; apertura grandiuscula, subrotunda, obliqua.

Shell smooth, flattened, plano-convex above, widely umbilicate below and without striæ; whorls four; outer lip acute; aperture rather large, rounded and oblique.

Proc. Acad. Nat. Sci. 1864, p. 111.

Hab.—Ottawa River, Canada West, E. Billings, Esq.

My cabinet and cabinet of Mr. Billings.

Diam. .18.

Remarks.—Mr. Billings sent me many of this small species some years since. I have never been able to place it with any of the species I know. It is near to *parvus*, Say, but differs in having a wider umbilicus, in having a more oblique aperture and exhibiting one more whorl. Some specimens, received subsequently from Prof. Daniels, Palmyra, Wisconsin, belong to this species. I have great pleasure in naming it after E. Billings, to whom I am indebted for many shells from Canada.

LYMNEA HAYDENII. Pl. 24, fig. 73.

Testa ovato-conica, lævi, tenui, pallido-cornea, imperforatâ; spira breviuscula; anfractibus quinis, convexis; suturis valde impressis; apertura ovata; columella fortiter plicata.

Shell ovately conical, smooth, thin, pale horn-color, imperforate; spire rather short; whorls five, convex; sutures very much impressed; aperture ovate; columella strongly plicate.

Proc. Acad. Nat. Sci., 1858, p. 166.

Hab.—Yellow Stone and Big Sioux Rivers, Dr. Hayden.

My cabinet and cabinets of Dr. Hayden and Smithsonian Institute.

Diam. .40,

Length .87 inch.

Remarks.—This is about the size of and very closely resembles *L. umbrosa*, Say. It may, however, be at once distinguished by the inflation of the upper whorls, which are remarkable, their convexity being very great. The body whorl is not so large in proportion as the *umbrosa*.

There are three specimens before me, and all these have a mark of growth on the back of the last whorl forming a dark and light band.

I am indebted to Dr. Hayden for these and many other species which he brought from Nebraska, &c. All the other *Lymneæ* brought by him were species common to the Valley of the Ohio and of Mississippi. I have great pleasure in naming this after Dr. Hayden, who has done so much for the Natural History and Geology of the far West.

LYMNEA PROXIMA. Pl. 24, fig. 74.

Testa acuto-conica, subtenui, crebre et irregulariter striata, cornea, minute perforata; spira subelevata, ad apicem acuminata; suturis valde impressis; anfractibus septenis, convexis; apertura subinflata, subelliptica, intus fasciata; columella paulo plicata.

Shell acutely conical, rather thin, closely and irregularly striate, horn-colored, slightly perforate; spire rather elevated, pointed at the apex; sutures very much impressed; whorls seven, convex; aperture rather inflated, nearly elliptical, banded within; columella slightly folded.

Proc. Acad. Nat. Sci., 1856, p. 80.

Hab.—Arroya San Antonio, Marin County, California, Dr. Trask.

My cabinet and cabinet of Dr. Trask.

Diam. .30,

Length .76 inch.

Remarks.—This species is near to *Nuttalliana*, Lea, and *reflexa*, Say. It is less inflated than the former and less attenuate than the latter. The brown band within the outer lip is narrower than in *Nuttalliana*, and there is no thickening as in *reflexa*. Nearly all the specimens were covered with a deposit of the peroxide of iron, and therefore are quite black. The lip is not reflexed.

LYMNEA ARCTICA. Pl. 24, fig. 75.

Testa elliptica, subinflata, subcrassa, imperforata, minute striata, dilute cornea; spira obtusa; suturis impressis; anfractibus convexis; apertura lato-elliptica, subgrandi; labro regulariter expanso; columella medio incrassata et magna plica induta.

Shell elliptical, somewhat inflated, rather thick, not umbilicate, minutely striate, pale horn-color; spire obtuse; sutures impressed; whorls convex; aperture broadly elliptical, rather large; outer lip regularly expanded; columella thickened in the middle and furnished with a large fold.

Proc. Acad. Nat. Sci., 1864, p. 113.

Hab.—Moose River, of Hudson's Bay, Arctic America, Smithsonian Institution.

Cabinet of the Smithsonian Institution, Washington.

Diam. .24,

Length .45? inch.

Remarks.—I found a single imperfect specimen among some odd valves of *Uniones* sent to me by the Smithsonian Institution for examination. The apex is broken and only two and a half of the lower whorls are left. It probably had five. It is a very distinct species with very regular oval whorls, and an uncommonly large fold bent round the middle of the columella. The expansion of this fold covers the small umbilicus, rendering it imperforate. It differs from *Pingelii*, Beck, from Greenland, as well also from *palustris* of Northern Europe. It is allied to *caperata*, Say. The aperture is nearly two-thirds the length of the shell.

LYMNÆA SMITHSONIANA. Pl. 24, fig. 76.

Testa fusiformi, subtenui, rufo-fuscescente, subdiaphana, parum perforata, excellissime transverse striata; spira obtusa; suturis impressis; anfractibus senis, convexis; apertura grandiuscula, ovata, submarginem fusca; labro expanso; columella parum incrassata et vix plicata.

Shell fusiform, rather thin, reddish-brown, slightly transparent, slightly umbilicate, very minutely and transversely striate; spire obtuse; sutures impressed; whorls six, convex; aperture rather large, ovate, brown within the margin; outer lip expanded; columella somewhat thickened and scarcely plicate.

Proc. Acad. Nat. Sci., 1864, p. 113.

Hab.—Loup Fork of the Platte River, F. V. Hayden, M. D., Surg. U. S. A.

My cabinet and cabinet of Smithsonian Institution.

Diam. .35,

Length .47 inch.

Remarks.—Several specimens of various ages were sent to me by the Smithsonian Institution, with other shells collected by Dr. Hayden when on the Exploring Expedition to the Upper Missouri and Yellow Stone Rivers, under Lieut. Warren, U. S. A. It is a symmetrical species inflated like *umbilicata*, Adams, but is larger, more inflated and has a broader dark band within the outer margin. It has nearly the same outline as *Haydenii*, (nobis,) from the Yellow Stone River, but is a much smaller species and with a much less plicate columella. It is also allied to *Traskii*, herein described, but is not so elongate nor has it so broad a band within the margin. The aperture is rather more than half the length of the shell. I dedicate this species to the founder of the noble Smithsonian Institution, which has done so much for the advancement of the Science of the country.

LYMNÆA JAMESII. Pl. 24, fig. 77.

Testa subturrita, tenuissima, albida, diaphana, perforata, striis rectis indutis; spira exserta; suturis valde impressis; anfractibus quinis, convexis; apertura grandiuscula, subrotundata; labro expanso; columella aliquanto plicata.

Shell subturritid, very thin, whitish, transparent, umbilicate, furnished with perpendicular striæ; spire drawn out; sutures very much impressed; whorls five, convex; aperture rather large and somewhat rounded; outer lip expanded; columella somewhat plicate.

Proc. Acad. Nat. Sci., 1864, p. 113.

Hab.—Ponds near Cincinnati, Ohio, U. P. James, Esq.; and Lafayette, Walker County, Georgia, Rev. G. White,

My cabinet and cabinet of Mr. James.

Diam. .22,

Length .45 inch.

Remarks.—Mr. James some years since sent me about a dozen specimens. At

first I thought it might be *bulimoides*, (nobis,) but it is nearer perhaps to *exigua* and *plica*, (nobis). It differs from *bulimoides* in being more elongate, and in being whiter and thinner; from *exigua* in being larger, having striæ and a large body whorl, as well as having a more inflated aperture; from *plica*, in being larger, having a more expanded aperture and a very much less fold in the columella, which is remarkable in *plica*. All the specimens before me have numerous very close perpendicular striæ. The aperture is a little more than half the length of the shell. I have pleasure in naming this species after my friend Mr. James, who seems first to have observed it.

LYMNÆA TRYONIANA. Pl. 24, fig. 78.

Testa subfusiformi, tenui, dilute fusca, subdiaphana, parum perforata, minutissime striata, nitida; spira conoidea; suturis impressis; anfractibus quinis, convexiusculis; apertura parviuscula, ovata, submarginem fusca; labro subexpanso; columella incrassata et plicata.

Shell subfusiform, thin, light brown, semi-transparent, slightly umbilicate, very minutely striate, shining; spire conoidal; sutures impressed; whorls five, somewhat convex; aperture rather small, ovate, brown within the margin; outer lip somewhat expanded; columella thickened and plicate.

L. Traskii.* Proc. Acad. Nat. Sci., 1864, p. 113.

Hab.—San Antonio, Arroya, John B. Trask, M. D.

My cabinet and cabinet of Dr. Trask.

Diam. .25,

Length .55 inch.

Remarks.—This pretty little species has been in my possession some years. I supposed it might be *pallidæ*, Adams, but that shell has a larger aperture, a more expanded lip, and is more inflated. On comparison with the description and figure of Mr. Adams in the 3d volume of the Journal of the Boston Society of Natural History, the difference may at once be observed. The aperture is rather less than one-half the length of the shell. It is also allied to *umbilicata*, Adams. I have a single imperfect specimen in my cabinet, simply marked as coming from "Ohio," but I am not positively sure that it is correct. I am indebted to Dr. Trask for this and many other interesting species of *Mollusca* from California.

LYMNÆA LECONTII. Pl. 24, fig. 79.

Testa inflata, subcrassa, perforata, excellissime transverse striata; spira obtusa; suturis valde impressis; anfractibus valde convexis; apertura subrotunda, grandiuscula; labro expanso; columella medio incrassata et impressa.

Shell inflated, somewhat thick, umbilicate, minutely and transversely striate;

* The name of *Traskii* being pre-occupied by Mr. Tryon, I substitute that of Mr. Tryon.

spire obtuse; sutures very much impressed; whorls very convex; aperture nearly round and rather large; outer lip expanded; columella thickened and impressed in the middle.

Proc. Acad. Nat. Sci., 1864, p. 113.

Hab.—Georgia, Major John Le Conte.

My cabinet.

Diam. .19,

Length .30? inch.

Remarks.—A single imperfect specimen was brought from Georgia many years since by my late friend Major John Le Conte, U. S. Engineer Corps. The two or three upper whorls are wanting; there were probably five in all. It was not described at the time it was first brought, with the expectation of more and better specimens being found. I have great pleasure in dedicating it to my late friend, who was unremitting during his life in the promotion of the natural science of this country. This little species is closely allied to *curta*, (nobis,) but it may easily be distinguished by being more inflated, in having a rounder aperture, and being a thicker shell. The aperture reminds one of the genus *Bulimus*, and in this respect resembles *bulimoides*, (nobis). The aperture is about one-half the length of the shell.

PHYSA TRASKII. Pl. 24, fig. 80.

Testa valde inflata, parum obliqua, striata, subdiaphana, tenuissima, pallido-castanea; spira parum producta, apice acuto; suturis impressis; anfractibus senis, ultimo pergrandi et valde inflata; apertura late expanso; labro acuto, subter marginem fusco-vittato; columella medio impressa et magna plica induta.

Shell very much inflated, somewhat oblique, striate, semi-transparent, very thin, pale chestnut color; spire somewhat produced, pointed at the apex; sutures impressed; whorls six, the last one very large and very much inflated; aperture broadly expanded; outer lip acute and within the margin brown banded; columella impressed in the middle and furnished with a large fold.

Proc. Acad. Nat. Sci. 1864, p. 115.

Hab.—Rio Los Angeles, California, J. B. Trask, M. D.

My cabinet and cabinet of Dr. Trask.

Diam. .45,

Length .76 inch.

Remarks.—This species is of a larger size than usual, having somewhat the outline of an inflated *heterostropha*, Say, but differs in being more inflated, in being thinner and more vesicular. The fold in the columella is usually well defined, but is larger in some specimens than in others. It is allied to *fragilis*, Mighels, but differs in color and in having a well defined fold, that species being “without columella fold.” It is also allied to *Warreniana*, herein described, but is not so globose and has a larger and better defined fold. The aperture is about eleven-fifteenths of the length of the shell.

I name this fine species after Dr. Trask, who sent it to me some years since with other interesting species from California.

PHYSA WARRENIANA. Pl. 24, fig. 81.

Testa inflata, tenui, diaphana, nitida, albida; spira obtusa; suturis impressis; anfractibus quinis, ultimo pergrandi et valde inflato; apertura late elliptica; labro acuto, subter marginem fusco et albido-vittata; columella medio impressa et contorta.

Shell inflated, thin, somewhat transparent, shining, whitish; spire obtuse; sutures impressed; whorls five, the last one very large and very much inflated; aperture broadly elliptical; outer lip acute, brown and white banded under the margin; columella impressed and twisted in the middle.

Proc. Acad. Nat. Sci. 1864, p. 115.

Hab.—Loup Fork of the Platte River, F. V. Hayden, M. D.; Milwaukie, Wisconsin, H. C. Grosvenor; Lake near Grand Rapids, Mich., A. O. Currier.

My cabinet and cabinet of the Smithsonian Institution.

Diam. .45,

Length .70 inch.

Remarks.—About a dozen chiefly immature specimens were brought by Dr. Hayden from the Expedition to the Upper Missouri and Yellow Stone, under Lieut. G. K. Warren, T. E. U. S. A., and to that officer I have great pleasure in dedicating this species. In form and size it is allied to *heterostropha*, Say, but may be distinguished by being more inflated, being much thinner and of a finer texture, showing the columella through the walls of the shell. The young are very transparent, and when about one third grown are very like *virginea*, Gould. On the inside the brown bands are strongly marked, while on the outside the white are broader and more prominent. The mature specimens before me have only two bands. The aperture is about three-fourteenths the length of the shell.

PHYSA ALTONENSIS. Pl. 24, fig. 82.

Testa elliptica, subcrassa, læviuscula, pallido-castanea; spira breviuscula; suturis impressis; anfractibus quinis, ultimo grandi; apertura ovata, subgrandi; labro acuto, subter marginem incrassato et crocato-vittata; columella inferne magna plica induta.

Shell elliptical, rather thick, rather smooth, pale chestnut color; spire rather short; sutures impressed; whorls five, the last one large; aperture ovate, rather large; outer lip acute, thickened under the margin and saffron banded; columella furnished below with a large fold.

Proc. Acad. Nat. Sci. 1864, p. 114.

Hab.—Alton, Illinois, Mr. Henry Lea.

My cabinet.

Diam. .35,

Length .55 inches.

Remarks.—A single specimen only was received from my brother some years since. It probably has its full growth, as there are two bands within the aperture. It is a very well marked species, having a larger and more contorted fold on the columella than I have seen in any other species. This fold is so much turned at the base that on looking into the base the interior whorls may be seen, and a bristle may be run through to the apex. In outline it is near to *elliptica* and *Hildrethiana*, (nobis,) but the large fold distinguishes it at once. The aperture is nearly three-fourths the length of the shell. It is very different from the variety of *ancillaria*, Say, which Mr. Haldeman describes and figures as having “a very deep fold.”

PHYSA HALEI. Pl. 24, fig. 83.

Testa late ovata, inflata, diaphana, tenui, albida; spira obtusa; suturis impressis; anfractibus quinis, ultimo grandi; apertura rotundata; labro regulariter expanso, subter marginem albo et incrassato; columella medio incrassata, impressa et plica induta.

Shell broadly oval, inflated, semi-transparent, thin, whitish; spire obtuse; sutures impressed; whorls five, the last large; aperture rounded; outer lip regularly expanded, white and thickened within the margin; columella thickened and impressed in the middle, and furnished with a fold.

Proc. Acad. Nat. Sci. 1864, p. 114.

Hab.—Alexandria, Louisiana, J. Hale, M. D.

My cabinet.

Diam. .33,

Length .55 inches.

Remarks.—About a dozen specimens were sent to me some years since by Dr. Hale. It is a regular symmetrical species, with a small white thickened border, and is rather less in size than *heterostropha*, Say. It need not be confounded with any other species with which I am acquainted. Its whiteness and regular swelling whorl gives it the appearance of a blister. The aperture is about three-tenths the length of the shell. I have pleasure in naming it after Dr. Hale, who has sent me many interesting specimens of fresh-water and land shells.

PHYSA HAWNII. Pl. 24, fig. 84.

Testa fusiformi, subcompressa, crassa, albida; spira exserta, subobtusa; suturis impressis, ultimo inflecto; anfractibus senis, convexis, ultimo grandi; labro parum expanso, subter marginem incrassato et rufescente; columella valde incrassata, vix plicata.

Shell fusiform, somewhat compressed, thick, whitish; spire exserted, rather obtuse; sutures impressed, the last one bent down; whorls six, convex, the last one large; outer lip somewhat expanded, thickened under the margin and reddish brown; columella very much thickened and scarcely folded.

Proc. Acad. Nat. Sci., 1864, p. 115.

Hab.—Verdigris River, Kansas, F. Hawn, Civil Engineer.

My cabinet.

Diam. .33,

Length .67 inch.

Remarks.—This is a well marked species near to *Saffordii*, herein described, and belongs to the group of which *heterostropha*, Say, may be considered the type. It is more straight than *heterostropha*, and not so much inflated as *Saffordii*, nor is it so much polished. The half-dozen specimens before me are mature, but evidently dead shells. There is no polish on them, but this may arise from want of perfection. In all the specimens there is one or two bands of white callus marking the progress of growth, and at each of these the suture above is indented. This is unusual with the *Physæ*. The aperture is about two-thirds the length of the shell. I name the species after Mr. Hawn, who collected it among other fresh-water shells on the Survey through Kansas.

PHYSA DORBIGNIANA. Pl. 24, fig. 85.

Testa late ovata, oblique inflata, late striata, subdiaphana, pertenui, colore columbæ; spira subobtusa; anfractibus quinis, convexiusculis, ultimo pergrandi; apertura magna, late elliptica; labro regulariter expanso, subter marginem parum incrassato et dilute crocato; columella medio impressa, parum incrassata et plica induta.

Shell broadly oval, obliquely inflated, widely striate, semitransparent, very fragile, dove color; spire rather obtuse; whorls five, the last very large; aperture very large, broadly elliptical; outer lip regularly expanded, thickened and pale saffron under the margin; columella impressed and slightly thickened in the middle and furnished with a fold.

P. Striata.* Proc. Acad. Nat. Sci., 1864, p. 115.

Hab.—Salt Lagoon, near Monterey, Cal. J. B. Trask, M. D.

My cabinet and cabinet of Dr. Trask.

Diam. .32,

Length .55 inch.

Remarks.—Dr. Trask sent to me quite a number of this species, interesting from the fact of its inhabiting “water which is quite salt.” I believe this is the first time that the genus *Physa* has been found in other than perfectly fresh water. It is very near in outline to *heterostropha*, Say, but it is a rather smaller, thinner species, not quite so long in proportion, and the longitudinal striæ distinguish it at once. These striæ are rather coarse and distant, and the whole surface of the whorls is covered over with minute parallel striæ. The aperture is about three-tenths the length of the shell.

*The name of *striata* being preoccupied by D'Orbigny (Moll. Cuba, v. 1, p. 192,) I substitute that of Monsieur D'Orbigny.

PHYSA TENUISSIMA. Pl. 24, fig. 86.

Testa subfusiformi, tenuissima, fragilissima, diaphana, nitida, albida; spira producta; suturis vix impressis; anfractibus quaternis convexiusculis, ultimo pergrandi et subcompresso; apertura grandi, elongato-ovata; labro acuto; subexpanso; columella tenui, vix contorta.

Shell subfusiform, exceedingly thin, very fragile, transparent, shining, whitish; spire produced; sutures scarcely impressed; whorls four, slightly convex, the last one very large and somewhat compressed; aperture large, elongately ovate; outer lip slightly expanded; columella thin and slightly twisted.

Proc. Acad. Nat. Sci., 1864, p. 114.

Hab.—Alexandria, Louisiana, J. Hale, M. D.

My cabinet.

Diam. .25,

Length .55 inch.

Remarks.—A single specimen only of this graceful and very delicate species was received from Dr. Hale, and it was so much broken that I had much difficulty in making a correct drawing of it. The form is very unusual with the *Physæ*, having much the appearance of a reversed *Lymnæa* or *Succinea*. The aperture is not quite two-thirds the length of the shell.

PHYSA SAFFORDII. Pl. 24, fig. 87.

Testa subfusiformi, subcompressa, opaca, albida, polita, crassiuscula; spira parum producta, acuminata; suturis impressis; anfractibus quinis, ultimo grandi; apertura ovata, grandiuscula; labro parum expanso, subter marginem incrassato et dilute fusco; columella parum incrassata et vix plicata.

Shell subfusiform, slightly compressed, opaque white, polished, somewhat thick; spire somewhat produced, pointed; sutures impressed; whorls five, the last one large; aperture ovate, somewhat large; outer lip somewhat expanded, thickened and pale brown within the margin; columella slightly thickened and scarcely folded.

Proc. Acad. Nat. Sci., 1864, p. 115.

Hab.—Lebanon, Wilson Co., Tenn., Mr. J. M. Safford; Verdigris River, Kansas, F. Hawn, and Nashville, Prof. Troost.

My cabinet and cabinets of Mr. Safford and Smithsonian Institution.

Diam. .25,

Length .48 inch.

Remarks.—This graceful and symmetrical species was sent to me many years since, and I have great pleasure in now naming it after Mr. Safford, who very kindly sent me many interesting fresh water shells from Tennessee. The substance of the shell is rather thick and opaque white, and being porcelainic reminds one of an immature white *Cypræa* or *Marginella*. Two of the specimens have but a single white band immediately under the margin of the outer lip. One has two and the fourth specimen has four bands. In outline and size they are the same. In this the species is allied

to *microstoma*, Hald., but there is no appearance of "teeth" on the columella. The aperture is about seven-tenths the length of the shell.

PHYSA BLANDII. Pl. 24, fig. 88.

Testa ovato-subfusiformi, subobliqua, inflata, dilute straminea vel albida; spira obtusa; suturis impressis; anfractibus quaternis, ultimo inflato et pergrandi; apertura ovata, subgrandi; labro expanso, subter marginem incrassato et pallido crocato; columella incrassata, impressa, plicata et contorta.

Shell ovately fusiform, somewhat oblique, inflated, pale straw-color or whitish; spire obtuse; sutures impressed; whorls four, the last one inflated and very large; aperture ovate, rather large; outer lip expanded, within the margin thickened and pale salmon; columella thickened, impressed, folded and twisted.

Proc. Acad. Nat. Sci., 1864, p. 116.

Hab.—California, Mr. Thomas Bland.

My cabinet and cabinet of Mr. Bland.

Diam. .30,

Length .48 inch.

Remarks.—Among a number of *heterostropha*, Say, sent to me by Mr. Bland, I found the four specimens before me; and I have great pleasure in naming it after one who has done so much and so well for the terrestrial *Mollusca* of the United States. It is a symmetrical, pretty little species, and nearly allied to *Niagarensis*, herein described. The spire is rather more produced and the substance of the shell is rather thicker. The fold of the columella is not so well pronounced. All four have a single thickened band within the edge of the margin. The texture of the shell is porcelainic. The aperture is about five-sevenths the length of the shell.

PHYSA VENUSTA. Pl. 24, fig. 89.

Testa subcylindracea, tenuissima, diaphana, nitida, alba; spira curta, acuminata; suturis leviter impressis; anfractibus quaternis, convexiusculis, ultimo pergrandi; apertura magna, elongato-ovata, subter marginem fusca; labro acuto et sinuoso, vix expanso; columella parum impressa.

Shell subcylindrical, very thin, transparent, shining, white; spire short, pointed; sutures slightly impressed; whorls four, slightly convex, the last one very large; aperture large, elongately ovate, under the margin brownish; outer lip acute, sinuous and slightly expanded; columella slightly impressed.

Proc. Acad. Nat. Sci. 1864, p. 116.

Hab.—Near Fort Vancouver, Oregon, Sir George Simpson.

My cabinet and cabinet of Lady Catherine Douglas.

Diam. .26,

Length .55 inch.

Remarks.—I have before me three specimens of this graceful, delicate species, which was taken by Sir George Simpson many years since, and kindly sent to me by

Lady Catherine Douglas. It is more cylindrical than any species with which I am acquainted. The brown band near the edge of the lip is of a light color, and more strongly marked outside than in. In outline it is near to *acuta*, Drap., is a little larger and more transparent. Of our indigenous species it is nearest to *virginica*, Gould, but it is straighter, the spire is shorter, and the species is larger. It is very thin, clear white, and shows the columella through the whorls. The aperture is about seven-tenths the length of the shell.

PHYSA CROCATA. Pl. 24, fig. 90.

Testa elliptica, subtenui, nitida, crocata; spira obtusa; suturis impressis; anfractibus quaternis, ultimo grandi et subinflato; apertura elliptica; labro acuto, subter marginem crocato-vittata; columella medio incrassata, impressa et contorta.

Shell elliptical, somewhat thin, shining, light yellow saffron; spire obtuse; sutures impressed; whorls four, the last one large and somewhat inflated; aperture elliptical; outer lip acute, saffron-banded under the margin; columella thickened, impressed and twisted in the middle.

Proc. Acad. Nat. Sci., 1864, p. 114.

Hab.—Lafayette, Walker County, Georgia, Rev. G. White.

My cabinet and cabinet of Mr. White.

Diam. .30,

Length .51 inch.

Remarks.—I have about a dozen of this species, three or four only being mature. It is of a light yellow saffron, with a saffron band somewhat removed from the edge. It is allied to *elliptica*, (nobis,) but is of a different color and has a more inflated outline. In outline it is near to *Troostiana*, (nobis,) but may easily be distinguished by its lighter color as well as by its being much thinner,—*Troostiana* being unusually thick for a *Physa*,—with a dark line immediately on the edge of the outer lip, and a thickened band within the edge. The aperture is about seven-tenths the length of the shell.

PHYSA SMITHSONIANA. Pl. 24, fig. 91.

Testa elliptica, subtenui, subdiaphana, nitida, pallido-fusca, fere olivacea; spira subacuta; suturis impressis; anfractibus quinis, convexiusculis, ultimo grandi et parum constricta; apertura elongato-elliptica; labro parum incrassato, subter marginem tenebroso-fusca; columella impressa et contorta.

Shell elliptical, rather thin, translucent, shining, pale-brown, almost olivaceous; spire rather acute; sutures impressed; whorls five, somewhat convex, the last one large and somewhat constricted; aperture elongately elliptical; outer lip somewhat thickened and dark brown under the margin; columella impressed and twisted.

Proc. Acad. Nat. Sci., 1864, p. 115.

Hab.—Loup Fork of the Platte River, F. V. Hayden, M. D.

My cabinet and cabinet of Smithsonian Institution.

Diam. .45,

Length .47 inch.

Remarks.—Among the *Mollusca* brought by Dr. Hayden from the Expedition to the Upper Missouri and Yellow Stone, under Lieut. Warren, were three specimens of this species, which is remarkable for its graceful symmetry and color which approaches that of the *Melanix*. The two mature individuals have, on the last third of the body whorl, three longitudinal brown bands, bordered with pale yellow, and this may be a permanent character. These bands are more marked outside than in. In outline it closely resembles *elliptica*, (nobis,) but is not quite so oblique, is of a darker color and differs in having several bands. The aperture is about seven-tenths the length of the shell.

I name this species in honor of the founder of the noble Smithsonian Institution, over which Prof. Joseph Henry has presided with so much usefulness to the Science of the country.

PHYSA SHOWALTERII. Pl. 24, fig. 92.

Testa subfusiformi, subinflata, subdiaphana, subtenui, pallido-cornea; spira parum producta, acuminata; suturis valde impressis; anfractibus quinis, convexis, ultimo grandi; apertura magna, elliptica; labro regulariter expanso, subter marginem late incrassato et crocata; columella medio valde impressa, incrassata, contorta et plica induta.

Shell somewhat fusiform, rather inflated, semi-transparent, rather thin, pale horn-color; spire somewhat produced, pointed at the apex; sutures very much impressed; whorls five, convex, the last one large; aperture large, elliptical; outer lip regularly expanded, thickened and saffron color under the margin; columella much impressed and thickened in the middle, twisted and furnished with a fold.

Proc. Acad. Nat. Sci. 1864, p. 115.

Hab.—Uniontown, Ala., E. R. Showalter, M. D.

My cabinet and cabinet of Dr. Showalter.

Diam. .27,

Length .48 inch.

Remarks.—A few years since Dr. Showalter sent to me three specimens of *Physæ* which he had lately observed in a pool of water which had only recently been formed. The largest one was a large sized *gyrina*, Say, but the other two were smaller and evidently distinct. The whorls are more inflated with much deeper sutures. It is more of the outline of *Halei*, herein described, but is a thicker, darker, smaller shell with a more produced spire. The second specimen is more slender, with less inflated whorls, and may indeed be of a different species. The aperture is two-thirds the length of the shell. I have great pleasure to name it after Dr. Showalter, who has labored so successfully to develop the *Mollusca* of Middle Alabama.

PHYSA NUTTALLII. Pl. 24, fig. 93.

Testa inflata, subtenui, subdiaphana, parum nitida, albida; spira obtusa, curta; suturis impressis; anfractibus quaternis, convexis, ultimo pergrandi et inflato; apertura grandi, subrotunda, subter marginem pallido-fusca; labro acuto, valde expanso; columella leviter incrassata et contorta.

Shell inflated, rather thin, semi-transparent, somewhat bright, whitish; spire obtuse, short; sutures impressed; whorls four, convex, the last one large and inflated; aperture large, rounded, pale brown within the margin; outer lip sharp and very much expanded; columella slightly thickened and twisted.

Proc. Acad. Nat. Sci. 1864, p. 116.

Hab.—Lewis' River, Oregon, Prof. Thomas Nuttall.

My cabinet.

Diam. .27,

Length .40 inch.

Remarks.—Among the numerous new land and fresh water shells kindly given to me many years since by the late Prof. Nuttall, were two specimens of *Physa*, which I did not describe then with the others, hoping that other specimens might be brought by future travellers. Neither are not entirely perfect at the tip, and there is a slight difference between them. It differs from all our American species in having a regularly arched outer lip. It approaches Say's *ancillaria*, but it has not the shoulder, and is rather more oblique. It seems to be a quite different species from *concolor*, Hald., also brought by Prof. Nuttall from Oregon. The aperture is about five-eighths the length of the shell. I have great pleasure in dedicating this species to my deceased friend, who spent a long life in most successfully investigating and developing the beauties of nature.

PHYSA ANATINA. Pl. 24, fig. 94.

Testa subfusiformi, subinflata, diaphana, tenui, albida; spira exserta, acuminata; suturis valde impressis; anfractibus senis, convexiusculis, ultimo grandi; apertura parviuscula, subconstricta; labro subexpanso, subter marginem incrassato et crocato; columella medio impressa et contorta.

Shell subfusiform, somewhat inflated, transparent, thin, whitish; spire exserted, pointed; sutures very much impressed; whorls six, somewhat convex, the last one large; aperture rather small and somewhat constricted; outer lip a little expanded, thickened and saffron color under the margin; columella impressed in the middle and twisted.

Proc. Acad. Nat. Sci., 1864, p. 115.

Hab.—Northern Tributary of the Arkansas River, Kansas, F. Hawn, Civil Engineer.

My cabinet.

Diam. .24,

Length .49 inch.

Remarks.—Only two specimens of this graceful and symmetrical species were found among the shells brought by Mr. Hawn. It is a pretty little species belonging to the *heterostropha* group, and nearest to *Showalterii* herein described. It may be distinguished from it by its having one more whorl, the spire being more produced and the body whorl being less inflated, as well as being thinner and lighter colored. The apical point is dark brown and includes the embryonic shell which is here counted as one of the whorls, a practice I always follow when this can be observed. The aperture is nearly two-thirds the length of the shell.

PHYSA FORSHEYI. Pl. 24, fig. 95.

Testa subfusiformi, subcrassa, subopaca, luteo-cornea; spira exserta, acuminata; suturis valde impressis; anfractibus senis, ultimo subgrandi; apertura parviuscula, ovata, subconstricta; labro subter marginem incrassato et fusco-vittato; columella incrassata et medio impressa et contorta.

Shell subfusiform, rather thick, rather opaque, yellowish horn-color; spire exserted, pointed; sutures very much impressed; whorls six, the last one large; aperture rather small, ovate and somewhat constricted; outer lip thickened and brown banded within the margin; columella thickened, impressed in the middle and twisted.

Proc. Acad. Nat. Sci., 1864, p. 114.

Hab.—Near Ruttersville, Texas. Prof. C. G. Forshey.

My cabinet and cabinet of Prof. Forshey.

Diam. .21,

Length .36 inch.

Remarks.—I have before me about a dozen of this little species, two only of which seem to be mature. These two have a remarkably thickened columella and outer lip. The form is very symmetrical and seems to be allied to *Whitei* herein described, and to *virginea*, Gould. It is thicker than either. The aperture is two-thirds the length of the shell. Prof. Forshey sent me these specimens some years since with some *Unionidæ* from his vicinity, and I name it after him.

PHYSA WHITEI. Pl. 24, fig. 96.

Testa subinflata, tenui, subdiaphana, parum nitida, albida; spira subacuta; suturis valde impressis; anfractibus quaternis, convexis, ultimo grandi et parum inflato; apertura elliptica, subter marginem incrassata et pallido-salmonia; labro incrassato, subconstricto; columella impressa et contorta.

Shell somewhat inflated, thin, somewhat transparent, somewhat shining, whitish; spire rather acute; sutures very much impressed; whorls four, convex, the last one large and somewhat inflated; aperture elliptical, thickened and pale salmon within the edge; outer lip thickened and somewhat constricted; columella impressed and twisted.

Proc. Acad. Nat. Sci., 1864, p. 114.

Hab.—Lafayette, Walker Co., Geo., Rev. Geo. White, and Verdigris River, Kansas, F. Hawn, Civil Engineer.

My cabinet and cabinets of Mr. White and Smithsonian Institution.

Diam. .22,

Length .40 inch.

Remarks.—Some years since Mr. White sent to me a few of this small species with many other river shells. It is near to *inflata*, (nobis,) from Central Virginia, but is a smaller species, less inflated, rather more oblique and less transparent. The spire is higher and more acute. It is also very near to *virginea*, Gould, but is rather larger and not quite so elongate. The inner margin is thicker than usual. The aperture is two-thirds the length of the shell. I name this species after the Rev. George White, who has done much for the Natural History of Georgia.

PHYSA NIAGARENSIS. Pl. 24, fig. 97.

Testa suborbiculari, inflata, subdiaphana, nitida, subcrassa, albida; spira obtusa; suturis impressis; anfractibus quaternis, ultimo pergrandi; apertura ovata, grandi; labro expanso, subter marginem albo et incrassato; columella medio valde incrassata, impressa et plica induta.

Shell suborbicular, inflated, semi-transparent, shining, rather thick; spire obtuse; sutures impressed; whorls four, the last very large; aperture ovate and large; outer lip expanded, white and thickened under the margin; columella very much thickened and impressed in the middle, and furnished with a fold.

Proc. Acad. Nat. Sci., 1864, p. 114.

Hab.—Niagara River, New York.

My cabinet.

Diam. .25,

Length .35 inch.

Remarks.—This is a small species which I took many years since. I then thought it might be a small variety of *heterostropha*, Say, but it is a more orbicular, thicker species, and its color and surface differ. It is somewhat porcelainic. The mature shell has two or three white bands near the edge of the aperture, and the columella is broadly callous the whole length. In texture, size and color it is allied to *Whitei*, herein described, but that species is more elongate, has a higher spire, and a less pronounced fold. The aperture is rather more than two-thirds the length of the shell.

PHYSA BREVISPIRA. Pl. 24, fig. 98.

Testa lævi, lato-elliptica, albida, diaphana, inflata; spira brevissima, obtusa, vix exserta; anfractibus ternis, ultimo grandi et inflato; labro acuto, margine intus incrassato; apertura pergrandi et dilatata; columella incrassata, impressa et contorta.

Shell smooth, broad elliptical, whitish, somewhat transparent, inflated; spire very

short, obtuse and scarcely exerted; whorls three, the last one large and inflated; outer lip acute, the inner margin being thickened; aperture very large and dilated; columella thickened, impressed and twisted.

Proc. Acad. Nat. Sci., 1864, p. 116.

Hab.—Ottawa River, Canada West, E. Billings, Esq.

My cabinet and cabinet of Mr. Billings.

Diam. .25,

Length .38? inch.

Remarks.—Three specimens are before me, which were sent by Mr. Billings with other shells some years since. I was in hopes of getting more, and delayed the description. It is allied to the American species *globosa*, Hald., and the European species *fontinalis*, Pfeif., but is more obtuse at the apex than either of them. The aperture is about six-sevenths the length of the shell.

PHYSA FEBIGERII. Pl. 24, fig. 99.

Testa elliptica, pellucida, polita, pallida; spira obtusa, curta; suturis vix impressis; anfractibus quinis, ultimo grandi et subconstricto; apertura ovata, superne angulata; labro acuto, intus incrassato; columella vix impressa.

Shell elliptical, somewhat transparent, polished, pale colored; spire short and obtuse; sutures scarcely impressed; whorls five, the last one large and somewhat constricted; aperture ovate, angular above; outer lip acute, thickened within; columella scarcely impressed.

Proc. Acad. Nat. Sci., 1864, p. 114.

Hab.—Logan County, Ohio, Major G. L. Febiger, U. S. A.

My cabinet.

Diam. .23,

Length .40 inch.

Remarks.—I have had two specimens many years in my cabinet, without being able to place them with any species I know. It is allied to *aurea* and *elliptica*, (nobis,) but more closely to *fontinalis*, Pfeif., a European species. It differs from *aurea* in being less inflated, being of a lighter color, and having a shorter spire and a thinner and lighter colored inner margin; from *elliptica* in having a more obtuse spire, being more inflated, of a lighter color, and having a lighter inner margin. It is a larger and rather thicker shell than *fontinalis*, while being very nearly of the same outline it is rather more inflated, and has a thicker inner margin, *fontinalis* being almost devoid of any thickening.

In most species of *Physa* there is a whitish line immediately below the suture, and it is very observable in this. The tip of the spire is dark brown. The aperture is about two-thirds the length of the shell. I name this species after my nephew, Major Febiger, to whom I owe the possession of it.

PHYSA GROSVENORII. Pl. 24, fig. 100.

Testa ovato-fusiformi, subrecta, subinflata, vel albida vel dilute straminea, polita; spira aliquanto exserta; suturis impressis; anfractibus quinis, ultimo grandiusculo; apertura ovata, subgrandi; labro subexpanso; subter marginem incrassato; columella incrassata, valde impressa, plicata et valde contorta.

Shell ovately fusiform, nearly straight, somewhat inflated, white or pale straw-yellow, polished; spire somewhat exserted; sutures impressed; whorls five, the last one rather large; aperture oval, rather large; outer lip somewhat expanded, thickened under the margin; columella thickened, very much impressed, folded and very much twisted.

Proc. Acad. Nat. Sci. 1864, p. 114.

Hab.—Santa Rita Valley, Kansas? Mr. H. C. Grosvenor.

My cabinet and cabinet of Mr. Grosvenor,

Diam. .18.

Length .30 inch.

Remarks.—I have before me five specimens received from Mr. Grosvenor, after whom I have great pleasure in naming it. Two of the specimens only are matured, and these are only one-fourth of an inch in length. They are transparent, showing the axis through the sides. Both specimens have a broad white band under the margin of the outer lip. It is a symmetrical, graceful little species, and is allied in outline to *Showalterii*, *Niagarensis* and *Blandii*, herein described, but is smaller and less inflated than either of them. It has the same number of whorls with *Showalterii*, but has one more than *Niagarensis* and *Blandii*. The aperture is about two-thirds the length of the shell.

PHYSA NICKLINII. Pl. 24, fig. 101.

Testa elliptica, subcompressa, diaphana, polita, tenuissima, margaritacea; spira obtusa; anfractibus quaternis, subconstrictis, convexiusculis, ultimo magno; apertura elongato-ovata; labro arquato; columella medio parum impressa, contorta et parva plica induta.

Shell elliptical, somewhat compressed, transparent, polished, very thin, pearly white; spire obtuse; whorls four, somewhat constricted, very slightly convex, the last one large; aperture elongately oval; outer lip bowed; columella slightly impressed in the middle, twisted and furnished with a fold.

Proc. Acad. Nat. Sci., 1864, p. 114.

Hab.—Callaghan's, Alleghany County, Va., P. H. Nicklin, Esq.

My cabinet.

Diam. .20,

Length .37 inch.

Remarks.—Many years since two specimens, evidently not mature, were given to me by my late friend Mr. Nicklin, with other fresh water shells. It is a symmetrical, nearly straight species, so transparent that the columnar structure may be observed

through the shell. There is not in either of the two specimens any deposit under the margin, or any marked line of growth. Mature specimens no doubt would exhibit such marks. In outline it is closely allied to *elliptica*, (nobis,) but differs in being smaller, in having a shorter spire, and in being more fragile. The aperture is nearly three-fourths the length of the shell. I have great pleasure in dedicating this to my deceased friend, whose knowledge and love for this branch of natural science was exceeded by few.

PHYSA HORDACEA. Pl. 24, fig. 102.

Testa subcylindracea, pellucida, polita, dilute rufa; spira subelevata, subacuta; suturis subimpressis; anfractibus quinis, ultimo grandi et constricto; labro acuto, margine rufo-lineato; apertura ovata, superne acute angulata; columella aliquanto impressa et incrassata.

Shell subcylindrical, somewhat transparent, polished, pale reddish; spire somewhat raised, rather pointed; sutures somewhat impressed; whorls five, the last large and constricted; outer lip acute, with a reddish line on the margin; aperture ovate, with an acute angle above; columella somewhat impressed and slightly thickened.

Proc. Acad. Nat. Sci., 1864, p. 116.

Hab.—Vancouver Island, Oregon, Sir George Simpson.

My cabinet and cabinet of the Academy of Natural Sciences.

Diam. .13 inch.

Length .27 inch.

Remarks.—A number of specimens of this small species were sent to me many years since by Lady Catherine Douglas. It is allied to *triticea*, (nobis,) from Shasta County, California, but differs in being less inflated, having a higher spire and one more whorl. The color differs in being slightly redder, bordering on the rubiginous, and in the margin of the outer lip the difference is well marked, *triticea* having a pale rufous line *within* the margin, while *hordacea* has a thin dark rufous line *on* the margin. They are nearly of the same size. The aperture is about three-fifths the length of the shell.

PHYSA TRITICEA. Pl. 24, fig. 103.

Testa subfusiformi, pellucida, polita, rufo-castanea; spira brevi, subacuta; suturis subimpressis; anfractibus quaternis, subconstrictis; apertura elongata, intus lineata.

Shell subfusiform, pellucid, shining, reddish-chestnut; spire short, rather pointed; sutures slightly impressed; whorls four, somewhat constricted; aperture elongate, lined within.

Proc. Acad. Nat. Sci., 1856, p. 80.

Hab.—Shasta County, California, Dr. Trask.

My cabinet and cabinet of Dr. Trask.

Diam. .14,

Length .27 inch.

Remarks.—This is a very small species, which appears to be very numerous. It is near to *P. aurea*, described by me from Virginia, and is near to *P. Troostiana*, also described by me from near Nashville, Tenn. It approaches in size and somewhat in form to *P. fontana*, Hald., but is more elongate than either of the species. The aperture is longer in proportion, being nearly three-fourths the length of the shell. It is not thickened at the edge of the lip like the two first, but it has within the edge a brown line which the *fontana* has not.

*
PHYSA PARVA. Pl. 24, fig. 104.

Testa fusiformi, subconstricta, diaphana, polita, pertenui, tenebroso-cornea; spira exserta, acuminata; suturis impressis; anfractibus quaternis, convexiusculis, ultimo grandi; apertura parviuscula, constricta; labro subexpanso, margine acuto; columella impressa, vix plicata.

Shell fusiform, somewhat constricted, transparent, polished, very thin, dark horn-color; spire exserted, pointed; sutures impressed; whorls four, a little convex, the last one large; aperture rather small, constricted; outer lip somewhat expanded, with an acute margin; columella impressed, scarcely folded.

Proc. Acad. Nat. Sci., 1864, p. 115.

Hab.—Verdigris River and Rock Creek, Kansas, F. Hawn, Civil Engineer.

My cabinet.

Diam. .11,

Length .19 inch.

Remarks.—This is a very small species, about the size of *hordacea*, herein described, and nearly the same color. It is, however, very different in form, and has not the colored edge of the outer lip. It might be supposed to be the young of the same described species, but it has the appearance of being mature, having four whorls. There were ten specimens from the two habitats. The aperture is nearly two-thirds the length of the shell.

SUCCINEA WILSONII. Pl. 24, fig. 105.

Testa elongato-obliqua, valde striata, diaphana, peraeura, subnitida, tenui; spira valde exserta; suturis valde impressis; anfractibus quaternis, convexiusculis; apertura grandiuscula, ovata; labro subexpanso; columella tenui, incurva et contorta.

Shell obliquely elongate, very much striate, transparent, deep golden color, and somewhat shining and thin; spire very much exserted; sutures much impressed; whorls four, slightly convex; aperture somewhat large, ovate; outer lip somewhat expanded; columella thin, incurved and twisted.

Proc. Acad. Nat. Sci., 1864, p. 109.

Hab.—Near Darien, Georgia, S. W. Wilson, M. D.

My cabinet and cabinet of Dr. Wilson.

Diam. .30,

Length .66 inch.

Remarks.—A single specimen only was sent to me some years since by Dr. Wilson, after whom I name it. It is a slender, symmetrical, graceful species, and is one of a group which may embrace *Wardiana*, (nobis,) *Concordialis*, Gould, *Haydeni*, N. G. Binny, *vermeta*, Say, and *retusa*, (nobis). It has one more whorl than either of these species, and is quite as oblique as *retusa*. The color is richer than in any of them. The aperture is about seven-twelfths the length of the shell.

SUCCINEA PELLUCIDA. Pl. 24, fig. 106.

Testa elongato-obliqua, lævi, nitida, pellucida, alba, pertenui; spira exserta, acuminata; suturis impressis; anfractibus quaternis, vix convexis; apertura grandiuscula, ovata; labro subexpanso; columella tenui, incurva et contorta.

Shell obliquely elongate, smooth, shining, transparent, white, very thin; spire exerted, pointed; sutures impressed; whorls four, slightly convex; aperture somewhat large, ovate; outer lip somewhat expanded; columella thin, incurved and twisted.

Proc. Acad. Nat. Sci., 1864, p. 110.

Hab.—United States.

My cabinet.

Diam. .30,

Length .55 inch.

Remarks.—About a dozen specimens are before me. The exact habitat I am not acquainted with, but am inclined to believe it to be in some part of the Western States or Territories. It is one of the most fragile of the genus, and has almost the clearness of glass. The columella is plainly visible to the top from the outside. The lines of increment are very feeble. In some of the specimens a portion of a fifth whorl may be seen. Under the microscope very minute revolving striæ are visible. The fold on the columella is exceedingly thin and delicate. The aperture is about seven-tenths the length of the shell. It is greatly to be regretted that the living soft parts of the species should not be observed.

SUCCINEA FORSHEYI. Pl. 24, fig. 107.

Testa elongato-obliqua, lævi, nitida, diaphana, subaurea, pertenui; spira exserta, acuminata; suturis impressis; anfractibus ternis, convexiusculis; apertura grandi, lato-ovata; labro subexpanso; columella tenui, incurva et contorta.

Shell obliquely elongate, smooth, polished, semi-transparent, pale golden color, very thin; spire exerted, pointed; sutures impressed; whorls three, a little convex; aperture large, wide ovate; outer lip somewhat expanded; columella thin, incurved and twisted.

Proc. Acad. Nat. Sci., 1864, p. 109.

Hab.—Rutersville, Texas, Prof. C. G. Forshey.

My cabinet and cabinet of Prof. Forshey.

Diam. .23,

Length .46 inch.

Remarks.—Some fifteen specimens were sent to me a few years since by Professor Forshey, to whom I am indebted for many species of Mollusca, and I propose to give it his name. It is a graceful, symmetrical shell, allied to *Wilsonii*, herein described, but is smaller, brighter, and not quite so slender. It also differs in having one less number of whorls. It is remarkably thin, the columella being very distinguishable from the outside. The aperture is about seven-tenths the length of the shell.

SUCCINEA GROSVENORII. Pl. 24, fig. 108.

Testa obliquo-ovata, striata, subdiaphana, straminea, tenui; spira exserta; suturis valde impressis; anfractibus quaternis, convexis; apertura subrotunda, grandiuscula; labro expanso; columella incurva et contorta.

Shell obliquely ovate, striate, somewhat transparent, straw-yellow and thin; spire exserted; sutures very much impressed; whorls four, convex; aperture nearly round and rather large; outer lip expanded; columella bent in and twisted.

Proc. Acad. Nat. Sci. 1864, p. 109.

Hab.—Santa Rita Valley, Kansas? Mr. H. C. Grosvenor, and Alexandria, Louisiana, J. Hale, M. D.

My cabinet and cabinets of Mr. Grosvenor and Dr. Hale.

Diam. .32,

Length .51 inch.

Remarks.—From the two habitats I have some twenty specimens. Those from Santa Rita are all dead shells and opaque white from partial decomposition. Those from Alexandria are in a perfect state, and present an interesting symmetrical species. While the shell is a fine bright straw color, the surface is not shining, being covered with well marked lines of growth. It is nearly allied to *lineata*, W. G. Binny, from Nebraska Territory, but it is higher in the spire, not so round, and has not the parallel revolving lines described by him. The aperture is about six-tenths the length of the shell. I have great pleasure in naming the species after Mr. Grosvenor, to whom I am indebted for many interesting Mollusca.

SUCCINEA MOORESIANA. Pl. 24, fig. 109.

Testa obliquo-ovata, minute striata, opaca, albida, subtenui; spira exserta; suturis impressis; anfractibus ternis, convexiusculis; apertura subrotunda; labro subexpanso; columella incurva et contorta.

Shell obliquely oval, minutely striate, opaque, whitish, somewhat thin; spire exserted; sutures impressed; whorls three, a little convex; aperture nearly round; outer lip expanded; columella incurved and twisted.

Proc. Acad. Nat. Sci. 1864, p. 109.

Hab.—Court House Rock, on Platte River, California route, H. Moores.

My cabinet and cabinet of Mr. Moores.

Diam. .24,

Length .39 inch.

Remarks.—I am indebted to Mr. Moores for five specimens of this species, and I name it after him. At first I thought it might belong to *luteola*, Gould, or *lineata*, W. G. Binney. But it is more globose than the former, has one whorl less, and is devoid of any yellowness in the interior which so well marks that species. From *lineata* it differs in being without the “revolving lines which distinguish it,” as well also in the form of the aperture as described. It is, however, more like the figure given by Mr. Binney, which disagrees with the description, as that describes the aperture to be half the length of the shell, while the figure represents it as two-thirds the length. *Moorensiana* need not be confounded with *campestris*, Say, that species being more globose, thicker and rougher on the exterior. The aperture is about five-eighths the length of the shell.

SUCCINEA HALEI. Pl. 24, fig. 110.

Testa obliquo-ovata, nitida, subdiaphana, aurea, tenui; spira brevi; suturis impressis; anfractibus ternis, convexis; apertura grandi, lato-ovata; labro regulariter expanso; columella incurva.

Shell obliquely ovate, shining, somewhat transparent, thin, golden color; spire short; sutures impressed; whorls three, convex; aperture large, broadly oval; outer lip regularly expanded; columella incurved.

Proc. Acad. Nat. Sci., 1864, p. 109.

Hab.—Alexandria, Louisiana, J. Hale, M. D.

My cabinet and cabinet of Dr. Hale.

Diam. .17,

Length .23 inch.

Remarks.—This is a pretty little golden-colored species, of which Dr. Hale sent to me about a dozen specimens; and I have great pleasure in naming it after him. It is allied on one side to *Oregonensis*, (nobis,) and on the other to *aurea*, (nobis). It differs from the former in being smooth and shining and having a less exerted spire; from the latter in being rather smaller, being less bright, being rather darker, and less pronounced apical whorls. The aperture is about two-thirds the length of the shell.

Since I published in 1841 a number of new species of *Succinea*, Dr. Binney's *Terrestrial Shells of the United States* has appeared. In Vol. II. pages 65 and 66, he gives eight of my species with the Latin diagnosis, and says he had seen *Wardiana*, *Totteniana*, *Nuttalania* and *aurea*, but had no knowledge of the others except what he derived from descriptions and figures; and further, that “on a careful

examination it appears to us that *S. aperta* and *S. aurea* are well established species; that *Wardiana* is synonymous with *avara*, Say; *Totteniana* with *ovalis*, Say; *Nuttaliana* with *ovalis*, Gould; *inflata* with *campestris*, Say; that *retusa* is probably synonymous with *ovalis*, Gould; and that *Oregonensis* cannot be at present ascertained." All naturalists must regret introducing this kind of confusion in a difficult branch of science, and had Dr. Binney given more time to the subject—my types being always open to his inspection—I cannot doubt but that he would have avoided this attack upon my species. His editor, Dr. Gould, has in part corrected his synonymy, and Mr. W. G. Binney, in the continuation of his father's beautiful work (Vol. iv.), makes further correction of these hasty and erroneous criticisms. Dr. Gould says that *Nuttaliana* "no doubt is a well marked species,"—of course it is not *ovalis*, Gould; that *Oregonensis* is "decidedly a well marked species." *Totteniana*, Dr. Gould says, differs from *ovalis*, Say, that "it is a thinner and more fragile shell, proportionally more ventricose in form, with a shorter spire, a larger aperture," &c. Mr. W. G. Binney says, in Vol. iv. p. 34, that in regard to *inflata* he "is inclined to doubt its specific weight." On a careful examination and comparison of specimens with *campestris*, sent to me as such by Dr. Ravenel from Sullivan's Island, South Carolina, I find these agree with the description of Mr. Say and Dr. Binney, except that the full-grown specimens show a fourth whorl, and not three, as both authors state in their description. This, I think, arises from their mode of counting. If a fourth whorl can be seen on a specimen, even if it be not complete, I always count as four whorls, as fractions cannot conveniently and correctly be enumerated in small shells. My *inflata* has but three whorls, is smoother, more inflated and more obtuse in the spire. With these differences it ought not to be made a synonym until more observations under better circumstances should prove it to be such. As regards *Totteniana*, Mr. W. G. Binney says he "agrees entirely with Mr. Lea and Dr. Gould in separating it from *obliqua*, Say."

After a careful examination of the original specimens, with the addition of subsequent acquisitions, I am perfectly satisfied of the correctness of my first convictions as to their being eight species, which Dr. Binney would reduce to two; and they may be stated as follows:

S. aperta. Dr. Binney allows to be established.

S. aurea. Dr. Binney allows to be established.

S. retusa. Dr. Binney says is probably *ovalis*, Gould. It differs, nevertheless, in being retuse at the base and in being less inflated.

S. Wardiana. Dr. Binney says is synonymous with *avara*, Say. But *Wardiana* is a more slender species, and is more oblique. It is evident that Dr. B. figures two species under this name. Pl. 57, c.

- S. Totteniana*. Dr. Binney says this is synonymous with *ovalis*, Say.* But Dr. Gould properly says it differs in being more fragile, and has a shorter spire. It also differs in color. The interior of all my specimens is iridescent,—a character I have never seen in *ovalis*. Mr. W. G. Binney says (Vol. iv.) he “agrees entirely with Lea and Gould in separating it from *obliqua*, Say.”
- S. Nuttalliana*. Dr. Binney says this is synonymous with *ovalis*, Gould. Dr. Gould, however, says this “no doubt is a well marked species.” It certainly is very different from *ovalis*, Gould, being much more slender, more oblique, and different in color. In fact, I believe that Dr. Gould has described the same shell as *rusticana*, in his volume of “Expedition Shells,” p. 28.
- S. Oregonensis*. Dr. Binney says that this “cannot at present be ascertained.” Dr. Gould says that the specimens furnished by Mr. Lea “leave no doubt of its being decidedly a well marked species.” *Oregonensis* is perhaps nearest to *Wardiana*, but that shell has a smoother surface, is greenish, while *Oregonensis* is yellowish; and in the turns of the spire they differ entirely.
- S. inflata*. Dr. Binney makes this synonymous with *campestris*, Say. Mr. W. G. Binney says he “is inclined to doubt its specific weight.” *Inflata* is smoother, more inflated and more obtuse in the spire, as well as in really having one whorl less. It ought to be retained until more specimens could be examined. This species was founded on a single specimen sent by Dr. Ravenel, who also sent me the true *campestris*.

HELIX CLARKII. Pl. 24, fig. 111.

Testa superne rotundata, inferne plano-convexa, regulariter striata, bruneo-cornea, imperforata, uno-dentata; anfractibus septenis, oblique striatis; apertura lunata, subdilata; labro albido, reflexo, inferne calloso; columella in medio uno-dentata, ad basim impressa.

Shell rounded above, flattened below, regularly striate, brownish horn-color, imperforate, with one tooth; whorls seven, obliquely striate; aperture lunate, somewhat dilate; outer lip white, reflected, below thickened; columella with one tooth in the middle, at the base impressed.

Proc. Acad. Nat. Sci., 1858, p. 41.

Hab.—Tuskee Cove, Cherokee County, North Carolina, Prof. D. Christy; Hamilton, Ohio.

My cabinet and cabinets of Prof. Christy and J. Clark, Cincinnati.

Diam. .51,

Length .37 inch.

Remarks.—This is perhaps nearer to *Pennsylvanica*, Green, than any other species

* At page 72, Vol. ii, Dr. B. says that *Totteniana* is “unquestionably” the same with *obliqua*, Say, considering *obliqua* = *ovalis*, but the figures of the two last species are very different.

with which I am acquainted. The four specimens before me—two being young with unfinished lip—are rather smaller than that species, and are of a darker horn-color. The superior portion is more rounded and the oblique striæ are not decussate, as in *Pennsylvanica*. It also has a single rather large curved tooth on the columella, which Prof. Green's species has not. It has the outer lip more flattened, and the callus on the inferior portion of the lip is more developed and differently formed, being more like that of *palliata*, Say. The young specimens are somewhat carinate on the middle of the whorl, and the striæ are here slightly deflected and diminished in size. Neither of the specimens were alive when they reached me, so that a description of the soft parts cannot be now given. I owe the possession of two specimens to the kindness of Mr. Clark. He received them from Professor Christy, who, while pursuing his geological researches, does not neglect to observe the Mollusca of our country.

HELIX (POLYGYRA) COUCHIANA. Pl. 24, fig. 112.

Testa superne paulisper elevata, subplanulata, inferne subinflata, nitida, albida, longitudinaliter et subtiliter striata, minute perforata; anfractibus quinis; apertura rotundata, quinquidentata; labro subacuto.

Shell slightly raised above, flattish, somewhat inflated below, shining, whitish, longitudinally and finely striate, slightly perforate; whorls five; aperture rounded, five-toothed; lip subacute.

Proc. Acad. Nat. Sci. 1857, p. 102.

Hab.—Tamaulipas, Mexico, Dr. Berlandier.

My cabinet and cabinet of the Smithsonian Institution.

Diam. .41,

Length .15 inch.

Remarks.—This was among the shells brought by Lieut. N. D. Couch, U. S. A., from Tamaulipas, being part of Berlandier's collection purchased by Lieut. Couch, and presented to the Smithsonian Institution. It cannot be confounded with *Troostiana* or *Tamaulipasensis*, though belonging to the same natural group. The four teeth are so placed that each succeeding one becomes more transverse. The umbilicus is remarkable; at the last whorl it is suddenly enlarged by the curve of the whorl changing. I name it after Lieut. Couch, who so liberally presented Dr. Berlandier's collection to the Smithsonian Institution.

HELIX (POLYGYRA) TAMAULIPASENSIS. Pl. 24, fig. 113.

Testa superne paulisper elevata, subplanulata, inferne subinflata, nitida, albida, longitudinaliter et subtiliter striata, minute perforata; anfractibus quinis; apertura lunata, tridentata; labro spissato, reflexo.

Shell slightly raised above, flattish, somewhat inflated below, shining, whitish,

longitudinally and finely striate, minutely perforate; whorls five; aperture lunate, three-toothed; lip thickened and reflected.

Proc. Acad. Nat. Sci., 1857, p. 102.

Hab.—Tamaulipas, Mexico, Dr. Berlandier.

My cabinet and cabinet of the Smithsonian Institution.

Diam. .35,

Length .17 inch.

Remarks.—This is another of the new shells brought by Lieut. N. D. Couch, U.S.A., from Tamaulipas, and presented to the Smithsonian Institution, being of Dr. Berlandier's original collection. It is near to *Troostiana* and *Couchiana*, but still nearer if it be not a variety of *Texasiana*, Moricand. It has one whorl less, and the umbilicus is smaller. The form of the aperture and the teeth seem to be almost exactly the same.

PALUDINA MILESII. Pl. 24, fig. 114.

Testa lævi, subpyramidata, subcrassa, imperforata; spira exserta; suturis valde impressis; anfractibus senis, subinflatis; apertura parviuscula, subovata; labro acuto, parum sinuoso; columella superne et inferne parum incrassata.

Shell smooth, subpyramidal, rather thick, imperforate; spire drawn out; sutures very much impressed; whorls six, somewhat inflated; aperture rather small, subovate; outer lip acute, slightly sinuous; columella slightly thickened above and below.

Proc. Acad. Nat. Sci. 1863, p. 156.

Hab.—Branch Lake, Antrim County, Michigan, M. Miles.

My cabinet and cabinet of Mr. Miles.

Diam. .57,

Length 1.03 inch.

Remarks.—Three specimens were sent by Mr. Miles. This species is more elongate than *integra*, Say, being less inflated in the body whorl, and need not be confounded with *subpurpurea*, Say, on one side, nor *coarctata*, (nobis,) on the other. It seems to be more regularly pyramidal than any other species, if we can judge from three rather imperfect specimens. It is to be regretted that perfect specimens could not be procured, but Mr. Miles informs me that he has not been able to find more than those sent for my inspection. They are all without the epidermis and without the opercula. The aperture is about six-sixteenths the length of the shell. The color of the epidermis therefore remains to be ascertained. I have pleasure in naming this after Mr. Miles, who is the discoverer of the species.

PALUDINA ELLIOTTII. Pl. 24, fig. 115.

Testa subcarinata, pyramidata, subcrassa, viridi-oliva, arcissime umbilicata, lævi; spira elevata, subacuta, ad apicem cornea; suturis excavatis; anfractibus septenis, rotundatis, superne obtuse carinatis, ultimo parviusculo; apertura subrotundata, parva, intus albida.

Shell subcarinate, pyramidal, rather thick, greenish olive, very narrowly perforate, smooth; spire raised, rather sharp, reddish at the beaks; sutures excavate; whorls seven, rounded, obtusely carinate above, the last one rather small; aperture rather rounded, small, white within.

Proc. Acad. Nat. Sci. 1858, p. 166.

Hab.—Othcalooga Creek, Georgia, Bishop Elliott.

My cabinet and cabinet of Bishop Elliott.

Diam. .60,

Length 1.15 inches.

Remarks.—This is a very distinct species, with a very unusually high spire for a *Paludina*, and the aperture is proportionally small, being little more than the third of the whole length. The upper whorls are obtusely carinate on the middle, and they are solid, slightly reddish and semi-transparent in perfect specimens. The sutures are remarkably impressed and constricted. This species is allied to *subcarinatus*, Say, on one side, and *subpurpureus*, Say, on the other. But it cannot be confounded with either. It is larger than the former and smaller than the latter, and it is higher in the spire and more attenuate than either. I have great pleasure in dedicating this species to my friend the Right Reverend Stephen Elliott, of Georgia, who has done so much to develop the Natural History of his State, and to whom I am indebted for many fine specimens.

ANCYLUS NEWBERRYI. Pl. 24, fig. 116.

Testa magna, obtuse pyramidata, opaca, rufo-fusca, ad lateris paulisper compressis; vertice subcentrali; apertura elliptica.

Shell large, obtusely pyramidal, dark, reddish-brown, slightly compressed at the sides; apex subcentral; aperture elliptical.

Proc. Acad. Nat. Sci., 1858, p. 166.

Hab.—Klamath Lake, California, J. S. Newberry, M. D.

My cabinet and cabinets of the Smithsonian Institution and Dr. Newberry.

Length .55,

Height .20,

Breadth .40 inch.

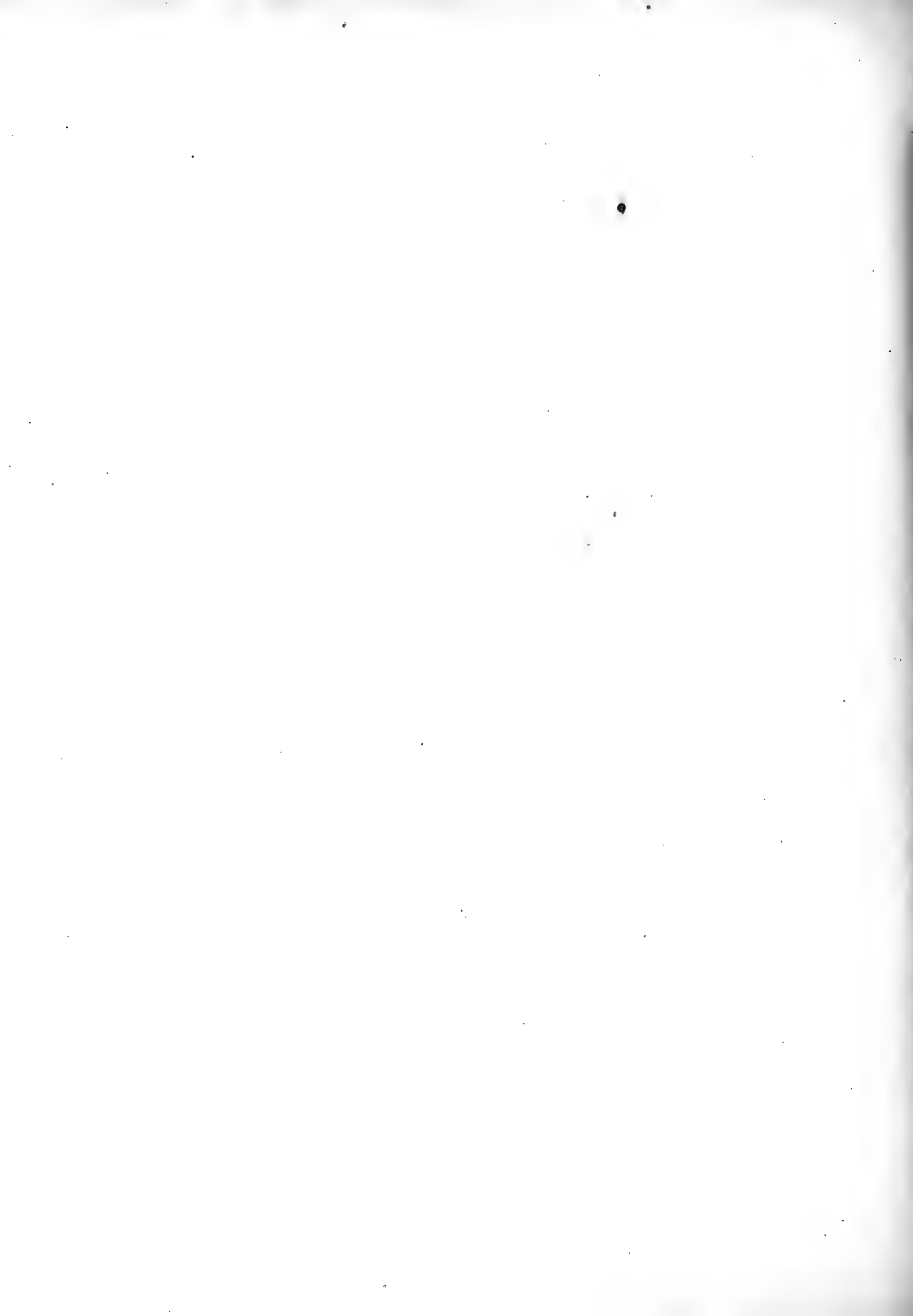
Remarks.—This remarkably fine and large species was brought by Dr. Newberry in his former expedition to California. It differs from *præclarus*, Stimpson, in being much larger, in being dark brown and in not being so high. I have great pleasure in naming this interesting species after the discoverer of it.

ANCYLUS PATELLOIDES. Pl. 24, fig. 117.

Testa magna, crassa, elliptica, maculata, oblique conica; striis crebris, minutis; apice submediali.

Shell large, thick, elliptical, spotted, obliquely conical; striæ small and close; apex nearly medial.

umbilicus. In mature specimens the left of the aperture is nearly straight, and the deposit is so enlarged that it reminds one of the aperture presented in the *Neritinae*. Under the microscope small, oblique, retrorse striæ may be observed over the body whorl. I name this after Mr. Currier, to whom I owe the possession of about a dozen specimens. They were taken in Tennessee by Dr. De Camp, of the U. S. Army.



ART. IV.—*On the Families of the Raniform Anura.*

By E. D. COPE.

It has been already pointed out* that the families of the toothless Anura, or Bufoniformia, are distinguishable into those with the arciferous and those with the raniform types of sternum. To the first were assigned the families Rhinophrynidæ and Bufonidæ, and to the last, the Engystomidæ, Brachymeridæ, and Dendrobatidæ. Continued observation points to the radical nature of this diversity, while the increase of knowledge furnishes us with cases of rudimental dentition, indicating a less significance for the character which has been supposed to characterize the Bufoniformia. Such occurs in the genus *Colostethus* Cope, which seems to be quite identical with *Dendrobates*, except in the possession of teeth. *Microhyla*, a true Engystomatid, is said by Günther to possess teeth, and minute rugosities on the maxillæ of *Callula natatrix* deceived me into the belief at one time that teeth actually existed. Among arciferous genera *Eupemphix* Steindachner is said by him to possess very minute teeth, which in some adults are entirely wanting. I therefore incline to believe that the families of the Bufoniformia must be separated, and referred to the neighborhood of those types of Arcifera or Raniformia to which they are most nearly affined.

In reviewing the structures of the genera with raniform sternum, it appeared that the family of Brachymeridæ did not represent a natural group, embracing genera related by analogy rather than affinity. The opportunity of studying *Phrynomantis* (*Brachymerus*) afforded by the Museum Compar. Zoology, shows that it is a degraded form of those Engystomatoid genera without epicoracoid, and should be referred to the family Engystomidæ. The genera, mostly American, furnished with epicoracoid, represent the family Phryniscidæ. *Chelydobatrachus* should be referred to the Bufonidæ, and *Breviceps* is the type of a peculiar family.

The family Rhinophrynidæ will remain with the Bufonidæ in the Arciferous series, but its characters must be modified by the removal from it of the genus *Hemisis* Gthr. This is as might have been anticipated, and is the result of a different interpretation of the pieces of the scapular arch. In this genus the arch is very

* Nat. Hist. Review, London, 1865. On the Batrachia Salientia.

oblique, the scapula and suprascapula directed forwards, and bordering closely the cranium, the latter element exhibiting the anomaly among the Batrachia, of a ligamentous articulation with the condyloid extremity of the proötic bone. If we compare with Engystomidæ, the clavicle appears to be similarly wanting, and most probably the epicoracoid (*procoracoid* Gegenbauer), while the coracoids are dilated, and abut against each other closely. The xiphisternum is slender, and attached at its posterior extremity to the similar ends of a cylindrical bone which extends posteriorly from the glenoid cavity to meet its fellow on the middle of the abdominal line. This piece might naturally be supposed to be the coracoid, especially in view of the obliquity of the superior limb of the scapular arch. Günther has apparently so identified it, by terming the anterior element the clavicle. This anterior element, however, appears in its origin, form and position, to be truly homologous with that determined heretofore to be the coracoid in the Brevicipitidæ and Engystomidæ, and, as in the latter family, the acromion projects forwards without giving rise to the clavicular, indicating that that element is absent. The posterior osseous element may then be termed the postcoracoid. If this determination be correct, the genus *Hemisis* becomes the type of a tribe (or sub-order) of equal isolation as the *Aglossa*, *Arcifera*, and *Raniformia*, which may be called the *Gastrechmia*, characterized as follows:

Eustachian tubes not roofed by pterygoids, tongue present; coracoids abutting, no arched cartilages; a postcoracoid; suprascapula having a ligamentous articulation with proötic.

Should, however, the two elements to be determined to be epicoracoid and coracoid by the examination of the younger stages of the genus, it may still remain the type of a distinct tribe defined by their divergence and single cartilaginous connection, and the suspension of the scapular arch. It may be said in favor of this view, that the supposed coracoid has a short distal posterior fissure, similar to the groove of the clavicular which usually embraces the epicoracoid.

RANIFORMIA.

Coracoidei abutting; epicoracoidei, when present, continuous transverse, and abutting on coracoidei; not connected with the latter by overlapping longitudinal cartilages.

I. Bufonoid Raniformia.

No teeth on the maxillary or premaxillary bones.

Epicoracoidei present; sacrum with dilated triangular diapophyses,

confluent with coccygeal style. Two lobes of the liver, Brevicipitidæ.

Epicoracoidei wanting; sacrum distinct from coccygeal style, with

dilated triangular diapophyses. Two lobes of the liver, Engystomidæ.

Epicoracoidei present; sacrum distinct from coccygeal style, with

dilated triangular diapophyses. Two or three lobes of the liver, . Phryniscidæ.

Epicoracoidei present; sacrum distinct from coccygeal style, with cylindrical diapophyses. Three lobes of the liver, Dendrobatidæ.

II. Ranoid Raniformia.

Maxillary and premaxillary bones furnished with teeth. Fronto-parietal bones ossified above.

Epicoracoid present; xiphisternum and manubrinum wanting.

Three lobes of the liver, Colostethidæ.

Epicoracoid present; xiphisternum and manubrium present, osseous.

Three lobes of the liver, Ranidæ.

BREVICIPITIDÆ mihi.

I. Prefrontals widely separated; ethmoid arch not ossified.

A fronto-parietal fontanelle; ear perfectly developed; toes free; no parotoid glands; head not distinct from body, BREVICEPS.

BREVICEPS Merrem.

The only genus of the family, embracing three species in South and West Africa.

B. verrucosus Rapp, Erichson's Arch. f. Naturg. 1842, 289, tab.; Smith, Ill. S. Afr.; Gthr. Catal.

Habitat. South Africa.

B. gibbosus Merrem, Tent. 178; Gravenhorst; Dum. Bibr.; Smith; Günther. *Rana gibbosa* Linn. *Systoma breviceps* Wagler.

Habitat. South Africa.

B. mossambicus Peters, in Wieg. Archiv. f. Naturg. 1855, 58.

Well distinguished from the preceding species.

Habitat. Mozambique.

ENGYSTOMIDÆ mihi.

I. Ethmoid arch not ossified; prefrontals widely separated.

A. A fronto-parietal fontanelle; terminal phalanges with transverse limb.

Ear perfectly developed; toes free; no metatarsal shovel, PHRYNOMANTIS.

II. Ethmoid arch ossified; prefrontals fully developed, in contact with each other and fronto-parietals; latter complete.

A. Terminal phalanges with transverse limb, anteriorly at least.

"No tympanum or cavum tympani; eustachian ostia minute." Toes webbed, MICROHYLA.

- Tympanum, cavum tympani and eustachian ostia ; toes with web or its rudiment, CALLULA.
- AA. Terminal phalanges simple.
- Ear fully developed ; head not distinct ; membranum tympani concealed ; toes free to slightly palmate ; metatarsus with insignificant tubercles, ENGYSTOMA.
- Ear developed, membranum tympani concealed ; toes free to partially palmate ; metatarsus with two compressed shovel-like tubercles, SYSTEMA.
- Ear developed, membranum tympani distinct externally ; toes free ; metatarsus with insignificant tubercles, ADENOMERA.

PHRYNOMANTIS Peters.

Brachymerus Smith (name pre-occupied), Zool. S. Africa.

P. bifasciata Smith. South and East Africa to Zanzibar.

P. fusca Peters, Monatsberichte, Berlin, 1867, 35. Amboina.

CALLULA Gray, 1831.

(Spelled erroneously *Kaloula* and *Culohyla*.) *Hylædactylus* Tschudi, 1838. *Plectropus* Dum. Bibr. *Holonectes* Peters, 1863.

The species of this genus in the author's estimation are—

- C. picta* Dum. Bibr. (*Plectropus*.) Philippine Islands.
- C. obscura* Günther, Rept. Brit. India. Ceylon.
- C. pulchra* Gray (*Hylædactylus*), Cantor. Ceylon, Siam, Burmah, China.
- C. baleata* Müller, Günther, Cat. B. M. Java.
- C. sundana* Peters, Monatsberichte Berl. Ac. 1867. Borneo.
- C. conjuncta* Peters (*Holonectes* Pet.), Monatsber. 1863. Steindachner Verh. Bot. Zool. Gess. Wien, 1864. Tab. Philippine Is.
- C. natatrix* Cope, sp. nov. Near Rangoon, Burmah.

This species differs from the preceding in the complete palmation of its toes, the length of its posterior extremities, and the minuteness of the ostia pharyngea, thus approximating the genus *Microhyla*, and entirely confirming the position I assigned the latter in the essay in Nat. Hist. Review (1855).

Head small, muzzle as long as orbit, obtuse, scarcely projecting beyond mouth ; canthus rostralis very obtuse. Fingers slender, free, tips truncate, scarcely dilated, a slight dermal margin. Foot large, one phalange only of longest toe free from web. Metatarsal tubercles minute ; no tarsal fold. When the hind limb is extended, the end of the muzzle falls opposite the middle of the tibia, the whole measuring twice the length of head and body in all, the longest limb among the Anura. Skin everywhere smooth. Tongue oval ; a subgular vesicle in ♂.

Length head and body 18 lines; fore limb 9·75 lines; hind limb 36 lines; foot without tarsus 9·75; tarsus 5·25; tibia 12 lines.

Above an olivaceous clay color, with a broad blackish dorsal band commencing abruptly across the interorbital space, narrowing on the scapular region, and spreading widely over the sacral region, before vanishing; a broad oblique blotch from axilla to near groin. Femora blackish marbled behind, with faint cross-bars above; tibia with some light bordered black spots on hinder margin. Foot, tarsus and forearm black below. Abdomen pale yellow; gular region thickly brown speckled. Numerous specimens in Mus. Compar. Zoology, Cambridge, from W. Theobald, Jr. (No. 630.)

This species, although presenting some peculiar features, cannot be referred to any other genus than the present one. From its structure I should suppose it to be a strong swimmer, and would express the belief that its habits are aquatic and terrestrial, like the *Acris gryllus* among Hylidæ, offering another evidence of the risk of applying physiological characters to the explanation of the system of animal structures. Callula, once held to be a tree-toad, is really more nearly allied to some ground toads, and embraces species both aquatic and terrestrial!

A similar instance occurs in the genus *Bufo*. Duméril and Bibron remark of *B. borbonicus* (*B. cruentatus* Boie) that it might as well be regarded as a tree-frog or frog as a toad. On this species Boie established his genus *Hylaplesia*, according to Prof. Peters, referring it to the tree-frogs. Günther referred this name to the genus *Dendrobates*, it appears erroneously, in consequence of which the writer re-characterized the section under the name *Adenomus*, taking as type *Bufo kelaartii*. Professor Peters still retains the genus, adding a new species, *Bufo brevipes*.* I am, however, convinced, after a most careful study of the internal and external structure of *B. kelaartii*, and in part of *B. borbonicus*, that they do not differ from the genus *Bufo*, and that their external appearance is deceptive.

MICROHYLA Tschudi, Dum. Bibr., Cope.

M. achatina Boie (*Hylaplesia*) Tschudi. Java.

Size small; the only species. •

SYSTOMA Tschudi.

Batrachia (nec. Wagler). Steindachner, Reise d. Novara. *Uperodon* Dum. Bib., Günther, Catal. *Cacopus* Günther, Rept. Brit. Ind.

* Monatsberichte 1857, 55. In the same essay Prof. P. refers *Chelydrobatrachus* to *Brevipes*, erroneously, as the two genera do not enter the same families. His reference of *Myobatrachus paradoxus* to *C. gouldii* I have no doubt is correct, from my own examination of the types of the two species.

This genus is represented by two species of the Palæotropical, and two of the Neotropical region. One of the latter exhibits free toes, and metatarsal tubercles so reduced as to constitute an approximation to *Engystoma*.

a. Toes webbed.

S. marmoratum Cuvier. (*Engystoma*) *Rana systoma* Schneider, Hist. Amphib., Peters, Monatsber. Berl. 1863. *Uperodon* D. B. *Cacopus* Gthr. *Systoma leschenaultii* Tschudi. The Carnatic, India.

S. globulosum, *Cacopus globulosus* Günther, Rept. Brit. India. Madras.

S. variolosum Cope, Proc. Ac. Nat. Sci. 1866. (*Engystoma*.) Costa Rica, Central America.

aa. Toes free.

S. ustum, *Engystoma ustum* Cope, Proc. A. N. S. Phila. 1866. Guadalaxara and Vera Cruz, Mexico.

ENGYSTOMA Fitzinger, Dum. Bibron.

Stenocephalus Tschudi. *Microps* Wagler. "*Oxyrhynchus* (Valenc.) Guérin." *Diplopelma* Gthr., Peters, Steind.

a. Toes webbed.

E. ornatum Dum. Bibr. *Diplopelma* Gthr. Catal. Madras, India.

E. pulchrum Hallowell, Proc. Academy, 1862; Günther, Rept. Brit. India. (*Diplopelma*). China.

E. disciferum Peters, Monatsberichte, 1867 (*Diplopelma*). Java.

aa. Toes free.

E. carolinense Holbrook, N. Am. Herp. Tab. Dum. Bibr. Southern United States.

E. ovale Schneider, Hist. Amph. *Bufo Surinamensis* Dand. *Engystoma* Fitz., Dum. Bibr., Gthr., Steindachner, Verh. K. K. Zool. Bot. Gessel. Wien, 1864. Tab. Surinam, Brazil and Buenos Ayres.

E. microps Dum. Bibr. Steindachner, l. c. Tab. Brazil.

Species of this family have been artificially distributed among various genera and families. *Diplopelma*, supposed to differ in its palmate feet, is connected by species having rudimental webs, with the webbed species. *Systoma* appears to be distinct, so far as known, though the vomerine teeth supposed to characterize it are found by Günther not to exist, while the metatarsal shovels assigned to it occur in the Mexican *S. variolosum* Cope, slightly less developed, and in the *S. ustum* Cope, so reduced as to approach *Engystoma*.

ADENOMERA Fitzinger.

Ausbeute, Rept. Novara. Steindachner, Amphib. Novara.

A. marmorata Fitz., Steind. Tab.*PHRYNSCIDÆ* nobis.

I. Prefrontals fully developed, forming suture with each other and fronto-parietals.

Ear perfectly developed; toes webbed; dorsum covered with a stratum of glands, CALOPHRYNUS.

II. Prefrontals small, widely removed from each other and from the fronto-parietals.

A. Ear perfectly developed.

Two sharp-edged tubercles on metatarsus; toes little webbed; outer toe rudimental; muzzle simple, COPEA.

No tubercles on metatarsus; toes slightly webbed, outer rudimental; muzzle simple. Two lobes of the liver, ATELOPUS.

Tubercles of tarsus rudimental; toes slightly webbed, all well developed; a horizontal dermal process on extremity of muzzle, RHINODERMA.

AA. Ear imperfectly developed.

Toes slightly webbed, outer small; metatarsus simple; muzzle simple; liver with two lobes, PHRYNIDIUM.

Toes slightly webbed, no cutting metatarsal tubercles or dorsal dermal shield. Three lobes of the liver, PHRYNSCUS.

Toes slightly webbed; no cutting tubercles; a broad dorsal osseous dermal shield, confluent with vertebral apophyses, BRACHYCEPHALUS.

CALOPHRYNUS Tschudi.

Batrachia, p. 86.

C. pleurostigma Tsch. Borneo.Var. *Sinensis*, Peters, Monatsber. 1867. China.

COPEA Steindachner.

Verhandl. K. K. Zool. Bot. Gessel. Wien, 1864, 286.

Not having examined the sternal or cranial characters of this genus, I place it here, in accordance with the description and figure of Steindachner.

C. fulva Steind. l. c. Brazil.

ATELOPUS Dum. Bibr.

Erpetologie Générale, viii. 600.

I have only been able to examine the livers of *Phrynidium læve* and *P. varium*; as the *A. flavescens* is very similar in type, its structure is probably identical with the former.

a. Ethmoid plate ossified to extremity of muzzle.

A. flavescens Dum. Bibr. l. c. Cayenne.

PHRYNIDIUM Martens.

Nomenclator Rept. Mus. Berolin, 1853. *Phirix* Schmidt, Denkschr. Wien, 1858, 256.

As proposed by its namer, this genus was not distinguishable from *Phryniscus*, with which it is accordingly united in Günther's Catalogue. The structure of the liver I find to be different, and though I here regard the distribution as generic, I suspect it to have a higher value, and to be of a more radical character than the peculiar atrophy of the auditory apparatus.

aa. Ethmoid plate cartilaginous anteriorly (in *læve* and *varium*).

P. læve *Atelopus* m. in Nat. Hist. Review, Lond. 1865; *Phryniscus lævis*, Gthr. Catal. 43. Tab. Panama to Chili.

P. crucigerum Martens, Gthr. l. c. "*Phirix pachydermus* Schmidt," Gthr. Central America.

P. varium Stannius (*Atelopus*), Martens Nomencl. Reptil. Mus. Berol. Central America.

P. bibroni Schmidt, Denkschr. Acad. Wiss. Wien, 1858, 256. Tab. Puerto Cabello.

? *P. olfersii* Martens, Nomenclator, l. c. Gthr. l. c. Brazil.

RHINODERMA Dum. Bibr.

Erp. Gen. viii. 657.

R. darwinii D. B. l. c. Bell, Voy. Beagle. Chili.

It is to be observed that the *R. signiferum* of Girard* belongs to the family Bufonidæ, having the cranial structure of *Bufo* and *Paludicola*. It must be referred to the latter genus, the supposed dermal lobe of the muzzle being entirely rudimental, and of uncertain character.

PHRYNISCUS Weigmann.

Nova Acta, Ac. Leop. 1834, 264. Dum. Bibron, Günther. *Chaunus* sp. Tschudi. *Hylæomorphus* Fitzinger.

P. nigricans Wiegmann, Dum. Bibr., Gthr., Cope, Pr. A. N. Sci. 1862, 353 (var.) Buenos Ayres.

* Proceed. Academy, 1853, 424.

BRACHYCEPHALUS Fitzinger.

Neue Class. Rept. 1826, Wagler, Tschudi, Dum. Bibr., Gthr. *Ephippifer* Coct. 1835.

B. ephippium Spix (*Bufo*) Fitzinger, Girard. *Ephippifer spixii* Cocteau. Brazil.

DENDROBATIDÆ Gthr.

O. o. prefrontalia widely separated; ethmoid broad, ossified to extremity of muzzle; no parotoid glands or metatarsal shovel; terminal phalanges with two divaricate limbs supporting dilatations; tongue narrow, free and entire behind, DENDROBATES.

DENDROBATES Wagler.

Natürl. Syst. Amphib. 1830, 202, Dum. Bibr. *Hylaplesia* Gthr. Catal. (not of Boie.)

D. tinctorius Schneider (*Calamita*). *Rana* Shaw. *Hyla* Latreille, Daudin, Cuvier. *Hylaplesia* Boie? *Phyllobates auratus* Girard, U. S. Astron. Exp. Chili hinc *Hylaplesia aurata* Cope, fide Steindachner. Brazil, Columbia, Cayenne.

D. nigerrimus Spix (*Hyla*) *Dendrobates* Wagl. *Hylaplesia picta* Tschudi, Günther et *Dendr. obscurus* Guichenot, in Casteln. Anim. nov. Amer. Sud. Tab., fide Steindachner Verhandlungen K. K. Zool. Bot. Gess, 1864, 257. Brazil.

D. truncatus Cope, *Phyllobates* et *Hylaplesia* Cope. Proceed. Acad. 1863, 49. Central America.

D. speciosus Schmidt, Denkschr. Acad. Wiss. Wien. 249. Tab. Günther Catal. Andes of New Grenada, six thousand feet (Schmidt.)

D. pumilio Schmidt, l. c. Same habitat.

D. lateralis Gay, Chili, ii. p. 120, tab. 5, f. 2. *Hylaplesia* Günther, l. c. Chile.

COLOSTETHIDÆ mihi.

Cranium fully developed; ethmoid plate broadly ossified to end muzzle, separating the narrow prefrontals. Terminal phalanges with transverse limb supporting digital dilatations; no vomerine teeth or metatarsal tubercles; tongue cylindric, free behind, COLOSTETHUS.

COLOSTETHUS Cope.

Proc. Acad. Nat. Sci. Phil. 1866, 130.

C. latinus Cope, l. c. *Phyllobates latinus* l. c. 1863, 48. New Grenada.

It is not at all certain that *Phyllobates melanorhinus* Berthold does not belong to this genus.

RANIDÆ mihi.

For a synopsis of the genera of this extensive family the student is referred to the Essay in Natural History Review above mentioned.

STAUROIS ACRIDOIDES Cope, sp. nov.

The species of *Staurois* are the present with *S. nator* Gthr., and *S. guttatus* Gthr. *Hyperolius plicatus* Gthr., referred here by me on a former occasion, pertains to *Heteroglossa* Hallowell, being the second known species. (Mus. Academy, from Ashantee.)

This species ranges in size and proportions much as *Acris gryllus* of North America. Palmation of foot not full, leaving three phalanges of the fourth toe free; terminal dilatations small. Sole with two small tubercles, a third tubercle below its middle on the inner side. Profile of front convex; canthus rostralis obtuse, straight; muzzle narrowed, rounded, slightly prominent. Diameter bony orbit equal from same to end muzzle; nostril behind end muzzle. Membranum tympani half orbit; eustachian tubes larger than the very small choanæ. Heel to middle orbit. Skin with weak tubercles above, and two plicæ convergent from orbits, then divergent and terminating behind scapulæ.

Above dark grayish olive, with frequently a narrow vertebral band; this with the plicæ and warts often black margined. A dark band on side, on front and hind face of femur, the latter with a pale one above it. Lip with three broad blackish bars, one from canthus rostralis and orbit, and two below orbit. Throat and breast brown white, punctate; abdomen white. Limbs cross-barred.

| | | | |
|-----------------------|---------|-----------------------|--------|
| Length head and body, | 13 lin. | Length tarsus, | 3 lin. |
| “ hind limb, | 19·5 | Width cranium behind, | 4·5 |
| “ foot, | 9 | | |

Habitat. Zanzibar, apparently very abundant; brought to the Mus. Comp. Zoology by C. Cooke, who has explored that region. (Nos. 457, 459.)

GASTRECHMIA.

Maxillæ edentulous; epicoracoid and clavicle wanting; vertebræ proœlian; sacrum with dilated diapophyses, attached by condyles to simple coccygeal style, *Hemisidæ.*

HEMISIDÆ.

Auditory apparatus wanting; tongue posteriorly retractile into a sheath; frontoparietal and prefrontal bones fully developed, in contact, the latter separated to end of muzzle by ossified ethmoid septum; toes webbed, no cuneiform shovel; no parotoid glands; manubrium present, *HEMISUS.*

HEMISUS.

Günther, Catal. Brit. Mus. 1858. *Cacophrynus* Steindachner.

This genus shows its nearest affines to be *Callula* and allied genera of the *Engystomidae* in the wide separation of the lobes of the liver for the accommodation of the pericardial sac and its contents, and by the posterior position of the heart. In the latter point it exceeds all other genera; the heart is of relatively large size, and occupies nearly the median portion of the abdominal region. It would appear to be for the protection of this important organ that the postcoracoids are extended backwards. The cavity anterior to the heart is occupied by longitudinal muscles and the large larynx. The lobes of the liver extend each to the groin, a position even more posterior than in those genera of *Raniformia* which are characterized by the posterior position of that organ, and by the disappearance of its median lobe, and the wide separation of its lateral lobes for the accommodation of the heart. The genera in which this relation exists, as determined by numerous examinations, are *Breviceps*, *Engystoma*, *Systema*, *Callula*, *Phrynomantis*, *Atelopus* and *Pipa*.

This genus exhibits also an external corpus adiposum, which I have not found in *Callula*, *Engystoma*, or any other genus of *Batrachia*. Each one is subtriangular, the apex resting near the extremity of the postcoracoid, the body lying between the strata of the external and internal oblique muscles, along the anterior margin of the lobe of the liver on each side.

H. guttatum Günther, Catal. *Engystoma guttatum* Rapp, Erichson's Archiv. 1842, 290, tab.

Habitat. Natal, (Mus. Academy.)

This species possesses the posterior cartilaginous cups observed by Steindachner on the tongue of *H. sudanense*. They are probably insertions of the flabelliform retractor muscle which withdraws the extremity of the tongue into the slit behind it. The heart of this species is of unusual size.

H. sudanense Steind., Verh. Bot. Zool. Gess. Wien. 1864, 284. *H. guineense* Cope, Nat. Hist. Review, Lond. 1865, (no description.) *Cacophrynus sudanense* Steind., Sitzungsber. k. Acad. Wiss. Wien. vol. xlviii.

Habitat. Equatorial Africa.

ARCIFERA.

Supplementary to the preceding, some important characteristics of the structure of the metacarpals and phalanges of certain Arciferous genera, *e. g.* *Hylidae*, may be noticed.

The genus *Hyla*, as defined by the writer in "Genera of Arciferous Anura" (*Journal of the Academy*, 1866), embraces a number of groups readily recognized by

their physiognomy, but not distinguished hitherto by any essential characters. Some of these have received names and been regarded as genera, without any valid characters being adduced, and having in many cases a very inaccurate coincidence with the trenchant series of nature. In this catalogue come *Hypsiboas*, *Auletis*, *Hyas* of Wagler; *Lophopus* Tschudi; *Litoria* Dumeril, Bibron; *Pelodyas* Günther; and *Centrotelma* and *Hylomedusa* Burmeister, with others.

The species of *Hyla*, as above defined, appear to be referable to five genera, as follows :

I. Pollex a simple metacarpus.

Tongue short, entirely attached; inferior palpebra latticed with fibres; vomerine teeth in series posteriorly longitudinal, anteriorly incurved, CENTROTELMA.

Tongue attached, to one-third free; inferior palpebra transparent; vomerine teeth in fasciculi, or short series, which are transverse or convergent posteriorly, HYLA.

II. Pollex a metacarpus with supplementary phalanges.

Phalanges of pollex forming a solid elongate claw; vomerine teeth in series longitudinal posteriorly, anteriorly incurved; feet palmate; lower palpebra opaque with fibres, CINCLIDIUM.

Phalanges of pollex forming a solid curved elongate claw; vomerine teeth in series longitudinal posteriorly, incurved anteriorly; feet largely palmate; palpebra transparent, HYPYSIBOAS.

Phalanges of pollex two, distinct, short, obtuse, longitudinal; vomerine teeth in short transverse series; toes largely palmate; palpebra transparent, CALAMITA.

The genus *Hyla*, as above defined, still includes *Litoria* D. B. and of other authors, as no character has yet been discovered distinguishing it trenchantly, and its species are, for the writer, only indicative of a modification within the genus toward which several other species tend. The character of the opposition of the inner digit to the others is, as Steindachner well observes, of little value, and seldom of more than specific value.

The species referable to the above genera are as follows :

| | |
|--|--|
| <i>Cinclidium granulatum</i> Cope, sp. nov. Probably | <i>Hypsiboas pardalis</i> Spix. Brazil. |
| <i>Hyla langsdorffii</i> Burmeister, Erläut. Naturg. Bras. Surinam. (H. langsdorffii is an <i>Osteocephalus</i> Fitz.) | <i>palmatus</i> Latr. Brazil. |
| | <i>lundii</i> Burm. Brazil. |
| | <i>pugnax</i> Schm. Costa Rica. |
| <i>Hypsiboas albomarginatus</i> Spix. Brazil. | <i>calcaratus</i> Trosch. Ecuador, Guiana. |
| <i>levaillantii</i> D. B. Cayenne. | <i>spectrum</i> Reinhardt. Brazil. |
| <i>leprieurii</i> D. B. Cayenne. | <i>circumdatum</i> Cope, sp. n. Brazil. |
| <i>xerophyllum</i> D. B. Cayenne. | <i>cinerascens</i> Spix. Brazil. |

| | |
|---|---|
| Hypsiboas <i>indris</i> Cope, sp. nov. Surinam. | Calamita <i>cyanea</i> Daudin. Australia, New Guinea. |
| <i>doumercii</i> D. B. Surinam. | <i>dolichopsis</i> Cope, sp. nov. Amboina. |
| <i>punctatus</i> Daud. Brazil, Surinam. | Centrotelma <i>geographicum</i> Spix. Brazil, Sur. |
| <i>crepitans</i> Wied. Brazil. | <i>cryptomelan</i> Cope, sp. nov. Brazil. |
| <i>boans</i> Daud. Brazil, Surinam. | Hyla, species cognita, 76. |
| <i>albipunctatus</i> Spix. Brazil. | |

The names adopted for the above genera are, with one exception, those employed by certain authors for species now embraced in the latter. As they were employed without discrimination of the natural genera, their re-employment is rather with the view of avoiding multiplication of names, than as a measure of justice.

It may be added that a batrachian, apparently referable to the Hylidæ, has recently been described by Dr. Steindachner (*Reise du Novara* 65) under the name *Ololygon abbreviatus*, supposing it to be the *Hyla abbreviata* Spix. The latter is, however, very different, being a Cystignathid of the genus *Enhydrobius* Wagl. *Ololygon* appears to be very near *Thoropa* Cope, if not the same. *Pohlia*, of the same author and work, is probably *Ranula* Peters, as defined by me, *Proc. Acad.* 1866, 129.

Among many new and interesting forms of Anura, mostly very well figured, the same author describes a new species of *Neobatrachus* Peters, giving it, however, another generic name, *i. e.*, the *Opisthodon frauenfeldti*; his *Helicrana* (nomen hybridum!) *grayi* is the *Platyplectrum dumerilii* Peters, too briefly described by the latter author. Another example of the vox hybrida is the name *Cyclorana*, of an interesting novelty, which with the practice of forming personal generic names, for the first time introduced to any extent into the history of the cold-blooded vertebrates, is to be condemned.

CRINIA STOLATA Cope, sp. nov.

The writer is acquainted with nine species of this genus, of which *C. stolata* and *C. georgiana* attain the largest size. Several of the species lack vomerine teeth and were on this account separated by Girard under the name *Ranidella*; the same type has since been named, by Sütken, *Pterophrynus*, and later, *Camariolius*, by Peters.

Prefrontals well separated; sides and all under surfaces areolate; back without warts, but with a strong dermal fold from each supercilium approaching the other at scapulæ and following length of ilium; two other folds on each side, two converging on parietal regions and one on middle line of muzzle; two metatarsal tubercles; from end muzzle to vent between folds black; a broad dorsolateral pink brown band, and darker lateral; groin and femora carmine; below white.

In this species the posterior dorsal and sacral region is strikingly concave, owing to the elevation of the diapophyses. Tympanum not invisible, one-third orbit; nostrils as near lip as orbit. End of fore-arm measures between orbit and nostril; heel to

tympanum and end of muzzle to middle of outer metatarsus. The femora and tibiae are rugose above; a tarsal fold; soles rugulose; digits rather long, margined.

The beautiful carmine of the femur is continued on the under side of the tibia; it appears also on the outer side, and at the origin of the tarsus. Lips with a few brown spots; a pale pinkish band from orbit to shoulder. In the three preceding species, and in the *verrucosa*, there is an aggregation of minute glands at the angle of the mouth; in the *ignita* there is a similar aggregation over the scapula, which is, however, so thin as not to invalidate the distinction between this and the genus *Hyperalia*, which rests on the swollen parotoids of the latter. This and the *C. ignita* and *picta* are among the most elegantly colored of the *Salientia*.

Hab. West Australia; *Daniel*. Mus. Academy.

CRINIA STICTIVENTRIS Cope, sp. nov.

Pterophrynus varius "Peters," males, Steindachner, *Voy. Novara Amphib.* 33.

This species approaches nearest the *C. signifera* Girard and *C. affinis* Günther; it differs from the former in its very small dorsal tubercles in place of plicæ, and in coloration, especially in the lack of lateral bands; from the latter in not being smooth above, in its margined toes, and peculiar coloration above and below.

No vomerine teeth, canthus rostralis straight, obtuse. Skin areolate below, nearly smooth above, except a pair of suprascapular ridges, which are concave towards each other. A tarsal fold and two minute tubercles; sole broad, toes margined; distal extremity of tarsus to beyond nostril; sole and palm granular.

Olive gray above, with two pair brown, pale margined dorsal spots, a similar one on coccygeal region, and another concave backwards between eyes. Lip spotted; no lateral band, but a vertical spot like the others, above axilla. Below white, forming a ragged suture with the dark color of the sides; a series of black spots, forming longitudinal bars on each side the median line. Limbs cross-banded.

| | | | |
|------------------------|-------------|----------------------|-------------|
| Length head and body, | 11.3 lines. | Foot without tarsus, | 5.75 lines. |
| Hind limb from coccyx, | 17 " | Vent to knee, | 4.25 " |

Habitat. Australia, region not specified. No. 672 Mus. Compar. Zoology; male and female.

This species is perhaps identical with, as a variety of, the species described and figured by Steindachner in the *Voyage of the Novara*, as *Pterophrynus varius* Peters, males. The *C. varia* Pet. differs in being without areolation of the abdominal surface, and so allied to *C. lævis* Gthr. Steindachner regards this as a sexual feature, erroneously in our opinion. *C. signifera* is the species subsequently named *Camariolius pictus* Peters and *Pterophrynus fasciatus* Steindachner.

CINCLIDIUM GRANULATUM Cope, sp. nov.

Three outer fingers entirely webbed; skin minutely granular on upper surfaces;

head large, with acuminate muzzle and concave loreal region; a weak dermal fold on outside of fore-arm and spur on heel; reddish brown, closely marbled with lighter above; sometimes a median dorsal brown line; sides with numerous vertical brown bars; external surfaces of limbs with broad brown cross-bands; lip spotted. Large.

This species is at once noticeable for its subacuminate muzzle, concave front, and extensive palmation. The canthus rostrales are strongly marked and concave, approximated and nearly parallel for a short portion of their anterior extremity. The top of the cranium is concave. Tympanum oval, two-thirds orbit; eyes prominent, of moderate size, long diameter of fissure twice in distance from anterior border of same to end of muzzle. Skin shagreened above, with broad flat areolæ below; palmation before and behind leaving palettes only free; one-fourth of a web inside of inner finger. Incurved limb of series of vomerine teeth short, nearly approaching each other; choanæ very large, oblique, the inner fissure eight to ten times larger than ostia pharyngea. Tongue longitudinally oval. Heel to end of muzzle; longest finger to groin. No subanal flap.

| | Inches. | Lines. |
|---|---------|--------|
| Length head and body, | 3 | 11 |
| " to posterior margin tympanum, | 1 | 3·25 |
| Width head at posterior angle jaws, | 1 | 4·75 |
| " sacral diapophyses | | 10 |
| Length fore-limb, | 2 | 1·25 |
| " carpus and longest finger, | | 12·5 |
| " hind limb, | 6 | 5 |
| " tarsus | 1 | 2·5 |
| " rest of foot, | 1 | 6 |

Coloration.—This consists of brown marblings on a pale ground. Two irregular bands converge from the orbits posteriorly, forming an interscapular patch, which is followed by numerous connected blotches to the extremity of the body; an irregular interocular band and the top of the muzzle also brown. Flanks with numerous narrow vertical brown bands between groin and axilla, which are confluent above, and surmounted by a series of broader ones. Limbs with broad brown cross-bands; the femur with four, which are split behind; the tibia with four, tarsus with two, metatarsus and toe four. A narrow vertebral brown line from end of muzzle to sacrum; below unspotted. Subanal region white, without black spot above.

Habitat. Surinam. One female specimen sent to the Academy Natural Sciences by Dr. Charles Hering.

This species possesses some points of resemblance to *Centrotelma geographicum*, and I suspect it has been confounded with the *Osteocephalus langsdorffii* by Burmeister. In the mouth of this species, of *Phyllomedusa scleroderma*, and

of *Hypsiboas crepitans*, I have found feathers of birds, some of brilliant colors, which the animals had mistaken for insects. Both the nareal meatus of the last named contained feathers, and one projected from each nostril, probably forced through them by the usual upward motion of the tongue in endeavoring to expel them.

The generic name is from *αγκλις*, a lattice.

CALAMITA DOLICHOPSIS Cope, sp. nov.

This species may be contrasted with the Australian *C. cyanea*, as follows:

Head short, truncate, covered with thickened derm; mandible not yellow margined; hind limbs shorter, heel to orbit, *cyanea*.
 Head elongate, oval, covered with thin skin; mandible with a yellow, below brown edged, margin; limbs longer, heel to end of muzzle and beyond, *dolichopsis*.

Habitat. Amboina.

This large species much resembles its congener in color and differs chiefly as above. The following measurements of two specimens of equal length of body will indicate this:

| | <i>C. dolichopsis</i> . | | <i>C. cyaneus</i> . | |
|---|-------------------------|--------|---------------------|--------|
| | Inches. | Lines. | Inches. | Lines. |
| Length from muzzle to end coccyx, | 3 | 10 | 3 | 7.5 |
| “ “ to opposite tympanum | | 13 | | 10.5 |
| Width opposite posterior margin tympana, | 1 | 2.5 | 1 | 5.25 |
| Opposite anterior canthus eye to end of muzzle, | | 5.75 | | 3.3 |
| Arm and fore-arm, above, | 1 | 3.5 | 1 | 2.5 |
| Carpus and longest finger, | 1 | 3 | 1 | 1 |
| Total hind limb, from end coccyx, | 6 | 8 | 5 | 6 |
| Foot (exclusive tarsus), | 1 | 6.75 | 1 | 5 |
| Tibia, | 2 | 1.5 | 1 | 7 |

The glandular folds about the rictus oris are less marked in the present species than the *C. cyanea*, and the yellow mandibular margin is prolonged to over the brachium. Tympanum half orbit; tongue oval; crests of the vomer supporting teeth little elevated, less so than in *C. cyanea*. Breast derm not areolate; areolæ of sides and behind axillæ many (ten) times larger than those of abdomen. Outer web of fingers opposite end first phalanges of penultimate digit (middle, *C. cyanea*). Green color on outer metatarsus and toe only.

Museum Academy Natural Sciences, Philadelphia.

CENTROTELMA CRYPTOMELAN Cope, sp. nov.

Three outer fingers, half webbed; skin smooth; head broad, loreal region concave;

orbit equal length muzzle, twice tympanum; sacral diapophysis scarcely dilated; hind limb long, foot short. Above brownish-red, closely black punctate; anterior and posterior faces femur, tibia below, and band from mouth to groin, black.

This species is distinguished from the *C. geographicum* not only by its more ovate muzzle, and the singular distribution of its colors, but by the extraordinary slenderness of its extremities, and breadth and depression of its head; the diapophyses of the sacral vertebra are also less dilated than in the species of this genus and *Hypsiboas*.

The heel extends to the nares, and the tarsus is equal in length to the metatarsus and longest toe. Tibia one-half the length from end coccyx to end muzzle, two-thirds longer than coccyx. Web of foot to base penultimate phalange of fourth toe; of hand to same point of longest finger. The thumb phalange is remarkably flat and prominent laterally. Tympanum two-thirds orbit, elliptic, erect. Canthus rostralis concave, muzzle rather angulate, truncate in profile. Skin of upper surfaces and of breast entirely smooth. The extremities are colored like the back, the femur most narrowly, none cross-banded, the tibia punctate above. No dark band on loreal region. White below, belly yellow or red; both lips light margined, the mandible with a brown line within the margin.

| | Inches. | Lines. |
|---|---------|--------|
| Length head and body, | 1 | 4.5 |
| “ hind limb, | 2 | 2 |
| “ femur, | | 8 |
| Width cranium at tympanum, | | 6.75 |
| Length “ posterior margin tympanum, | | 5.5 |
| “ fore-limb, | | 9.5 |

One spec. No. 320, Mus. Comp. Zoology, Cambridge, from Bahia; *Antonio de Lacerda*, donor.

Allied to the *Hylidæ* by the form of the diapophyses of the sacrum, but conforming in technical features mostly with the *Pelodytidæ* is the genus.

GRYPISCŪS m.

Mandible with a series of caducous pleurodont teeth, and a permanent elevated tooth on each side the symphysis. Prefrontal bones fully developed, in contact with each other throughout, and with fronto-parietals. Auditory apparatus well developed; tongue broad, entire, little free. Vomerine teeth; no parotoid glands.

The mandibular teeth are obtuse, and scarcely project above the alveolar margin; their attachment appears to be to the mucous membrane only, on which account they are readily scraped away.

The affinities of this genus are as yet obscure; the mandibular teeth and general

form would refer it to the Hemiphractidæ, but the form of the sacrum separates it. The form of the cranium, with its broad outline and narrow brain-case, and of the body in general, are nearest to Pithecopsis and Cyclorhamphus, though the form of the sacrum separates it again. If referred to the Pelodytidæ, it will be the type of a group in the family characterized as follows:

Fronto-parietal bones fully developed; xiphisternum an emarginate cartilaginous shield; coccygeal style attached to two condyles; toes webbed.

GRYPISCUS UMBRINUS Cope, sp. nov.

General form that of *Scaphiopus holbrookii*. It bears also some resemblance to *Pithecopsis fuliginosus*, but has the vomerine chevron directed in the opposite direction, the hind limb, especially the foot, shorter, no inguinal glands, and a different coloration.

Tympanum quite small, and entirely concealed by the derm; ostia pharyngea half size of choanæ. Vomerine teeth in two arched series, which are directed backwards from the inner hinder margin of choanæ, leaving considerable interval between. Heel of extended leg to back of orbit. Width of cranium at jaws two and one-third in length head and body, twice from end muzzle to posterior third orbit, greater than length of foot without tarsus. Canthus rostralis not marked; end of muzzle oblique. Skin generally smooth, verrucose on top head, especially eye-brows. Two large tubercles on palm; large ones at digital joints, which are, with the tips of all the toes, defended by a corneous cap. A narrow cuneiform tubercle, and small external one. Toes rather short, with dermal margins, outer metatarsi bound; web well developed, three phalanges of fourth digit free. A weak tarsal fold.

General color brown, very dark on head, where there are a lighter cross-band between eyes, a light band from back part of orbit to lip, one from the front, and one from below nostril. The deep color of the head is prolonged on scapular region, also as a band on dorsal, which forks, and sends oblique band to side; dark cross-band on coccygeal region, two across tibia, and one across fore-arm. Below, and hind and front face of femur dark brown, with yellow punctæ.

Length head and body 1 in. 10.5 lines; width cranium 10 l., of interorbital region 2.75 lines; length fore-limb 11.25 l., of hind-limb 2 in. 4 l.; of foot 13.5 l., of which the tarsus forms 5 l.

A female specimen of this species was brought among the rich collections of the Thayer Expedition to Brazil, and is preserved in the Museum Compar. Zoology, Cambridge (No. 408). Rio de Janeiro.

ART. V.—*On the Distribution of Fresh-water Fishes in the Allegheny Region of South-western Virginia.*

By E. D. COPE, A. M.

Sect. I.—*Preliminary.*

The distribution of fresh-water fishes is of especial importance to the questions of the origin and existence of species in connection with the physical conditions of the waters and of the land. This is of course owing to the restricted nature of their habitat, and the impossibility of their making extended migrations. With the submergence of land beneath the sea, fresh-water fish are destroyed in proportion to the extent of the invasion of salt water, while terrestrial vertebrata can retreat before it. Hence every inland fish fauna dates from the last total submergence of the country.

Prior to the elevation of a given mountain chain, the courses of the rivers may generally have been entirely different from their later ones. Subsequent to such a period, they can only have undergone partial modifications. As subsequent submergences can rarely have extended to the highlands where such streams originate, the fishes of such rivers have only been destroyed so far as they were unable to reach those elevated regions, and preserve themselves from destruction from salt water by sheltering themselves in the mountain streams. On the other hand, the occurrence of a period of elevation of the land, and of consequent greater cold, would congeal the waters, and cover their courses with glaciers. The fishes would be driven to the neighborhood of the coast, though no doubt in more southern latitudes a sufficient extent of uncongealed fresh waters would flow by a short course into the ocean, to preserve from destruction many forms of fresh-water fishes.

Thus, through many vicissitudes, the fauna of a given system of rivers has had opportunity of uninterrupted descent from the time of elevation of the mountain range in which it has its sources.

In order to prove an earlier origin for such fauna, it is necessary to assume that fresh-water fishes can gradually accustom themselves to respiration in salt water, and a change of food of the same degree, and vice versa; phenomena which have not been observed in any types now characteristic of either habitat. It will not do to

assume, however, that the predecessors of our present Cyprinidæ, Esocidæ, etc., may not have been capable of such change.

As regards the distinction of species in the disconnected basins of different rivers, which have been separated from an early geologic period, if species occur which are common to any two or more of them, the supporter of the theory of distinct creations must suppose that such species have been twice created, once for each hydrographic basin, or that waters flowing into the one basin have been transferred to another. The developmentalist, on the other hand, will accept the last proposition, or suppose that time has seen an identical process and similar result of modification in these distinct regions.

Facts of distribution in the eastern district of North America, are these. Several species of fresh-water fishes occur at the same time in many Atlantic basins, from the Merrimac or from the Hudson to the James, and throughout the Mississippi Valley, and in the tributaries of the great Lakes. On the other hand, the species of each river may be regarded as pertaining to four classes, whose distribution has direct reference to the character of the water and the food it offers. First those of the tide waters, of the river channels, bayous and sluggish waters near them, or in the flat lands near the coast; second, those of the river channels of its upper course, where the currents are more distinct; third, those of the creeks of the hill country; fourth, those of the elevated mountain streams which are subject to falls and rapids.

Agassiz has already alluded in "Lake Superior" to the differences between the lower, middle, and upper waters of rivers in this respect.

To Class I belong :*

| | |
|-------------------|------------------------|
| Perca, | Cyprinodontidæ (many), |
| Lepomis, many sp. | Esocidæ, |
| Enneacanthus, | Umbridæ, |
| Acantharchus, | Stilbe, |
| Hololepis, sp., | Hybopsis, sp., |
| Gasterosteidæ, | Moxostoma, |
| Aphrodedirus. | |

To Class IV :

| | |
|------------|---------------------|
| Boleosoma, | Poecilichthys, sp., |
| Hyostoma, | |
| Uranidea, | Chrosomus, |
| Argyreus, | Salmo fontinalis. |

The majority of the species belong to Class III.

* Vid. Pr. A. N. Sci. 1865, 274.

The following pages furnish the results of an examination into the fish-faunæ of the head waters of four rivers, with reference to the above propositions. These rivers are the James, the Roanoke, the Kanawha, and the Tennessee. The first two rise in Montgomery and Giles counties, Virginia; the James, by its important tributary, Craig's Creek. Both of these approach usually on opposite side of mountain ranges, the tributaries of the Kanawha; the Roanoke to Strouble's and Tom's Creeks, and the James to Sinking and Stony Creeks. Those that head in the same valley descend to the north-east and south-west, being separated by well-marked elevated tracts, in some cases by exceedingly high ones. None of the tributaries examined had their rise in a common swamp.

The Tennessee rises by its longest tributary, the north fork of the Holston, in Bland county, flowing from the most elevated portion of the Rich valley on the north side of Walker's (or Gap) mountain; while a strong tributary of the Kanawha, Walker's Creek, descends from the same point to the north-east. A dry, elevated portion of the valley separates their sources. A straight line connecting the sources of Craig's Creek and the north fork of the Holston would not exceed fifty-five miles in length.

These streams were fished many times by the writer during a residence of nearly four months in that region. It was done with a fine seine, and for some miles at a time, and it is believed the results form a tolerably close approximation to the true character of the fish fauna of the streams in question. The means employed certainly furnished as reliable data for the relative abundance of species as could well be, since at each draw of the net the number taken was large, often reaching one to two hundred specimens. When the same results were thus expressed over some extent of space and time, and in every variety of situation, they might be accepted as reliable for the stream in general. The fishes of the Roanoke were taken in the seventh month, those of the James and Kanawha in the eighth and ninth, and those of the Holston* in the tenth, 1867.

The observation of fishes in their native haunts brings much of beauty, as well as of interest, to the eye of the naturalist. In the spring of the year, after the Catostomi of the head of the Roanoke had deposited their eggs beneath their accustomed piles of stones, the smaller species of Cyprinidæ gathered themselves to try and rob the nests, so far as lay in their power. Refulgent shoals of *Clinostomus affinis* and *Hypsilepis ardens* would lie close to the heaps down the stream, and when startled by the approach of a stranger, would disappear like the passage of a stream

* I must here record the obligations under which I have been placed by the kindness of my friend William Alex. Stuart, of Saltville, Va., one of the proprietors of the salt wells and furnaces at that place. Through his aid I was enabled to procure a remarkably good series of the fishes of the north fork of the Holston.

of blood in the current; or the inquisitive *Chrosomus oreas*, in his harlequin hues, and the graceful *Argyreus atronasmus*, would try to force away the pebbles and reach the coveted store, while pairs of a scarlet *Hypsilepis cornutus (cerasinus)* would chase each other in and out, and by their superior size and activity keep up perpetual commotion among the industrious party. The *Campostoma*, too, of pale tints, and painted fins, swimming in pairs on the bottom, would gather with ease whatever the stream carried from the burrowing *Chrosomus*.

It is believed that a full examination of the fish fauna of these streams will furnish a good standard for the general estimation of the relations of the species of rivers within the same zoological district, heading in a common elevated region, whose embouchures are most distant. In consequence of the latter condition, the greatest probable diversity of species is to be anticipated, while the proximity of the head waters furnishes the most probable opportunity for the commingling of the faunæ, if such ever can take place.

A synopsis of the species follows, after which their relations to the topography of the country, and to the general fauna, will be examined.

Sect. II.—*Catalogue.*

PERCIDÆ.

The genera allied to *Boleosoma* are represented by numerous species in the United States. Prof. Agassiz has given (*Amer. Jour. Sci. Arts*, xvii, 305) a synopsis of the genera. All of these I have not been able to distinguish as yet, and include them under the following:

I. Second dorsal equal to anal fin; vomerine teeth.

A series of caducous ventral shields, *ETHEOSTOMA*.
 No ventral shields; body scaled, *COTTOGASTER*.
 Muzzle obtuse conic; osseous anal radii; scales only in a few rows
 on the sides, *PLEUROLEPIS*.

II. Second dorsal much larger than anal fin; vomerine teeth.

Muzzle conic truncate; body entirely scaled; two osseous anal radii, *PERCINA*.
 Muzzle obtuse conic or decurved; two bony anal radii; body scaled, *POECILICHTHYS*.
 Muzzle obtuse conic; one bony anal ray; body scaled, *BOLEOSOMA*.

III. Second dorsal much larger than anal fin; vomerine teeth wanting.

Muzzle obtuse; two osseous anal radii; body scaly, *HYOSTOMA*.

The genus *Alvarius* Girard enters probably Section II, but the vomerine teeth are not described. It is characterized by an elongate slender head, and lower jaw longer than the upper.

ETHEOSTOMA Rafinesque, Agassiz, Cope, emend.

Etheostoma et Hadropterus Agass. *Alvordius* Girard; *Aplesion et Diplesion* Raf.

ETHEOSTOMA BLENNIOIDES Raf.

Not rare in the tributaries of the Kanawha, and head waters of the James. Those from the former present two varieties:—

β. Scales 8-11—11-13. D. xiv. 11. A. ii. 8-9; the back with square blotches and many smaller spots. Three specimens, Walker's Creek.

γ. Scales 7-6—11. D. xiii. 13 A. ii. 10; back scarcely marked. Two specimens, Sinking Creek.

COTTOGASTER Putnam.

Bull. Mus. Comp. Zool. i, 1863, p. 4.

Dorsal fins distinct; lateral line present; muzzle obtuse.

COTTOGASTER AURANTIACUS Cope, sp. nov.

Form elongate, caudal peduncles slightly contracted. Caudal fin even. Orbit smaller than length of muzzle, contained four times in length of head, excluding opercular spine. Mandible shorter than muzzle. Cheek and operculum covered with small scales. Head 4.25 in length to basis caudal; depth at middle first dorsal six times in the same. Scales very small, 15—25, covering the ventral line; gular region smooth. Radii D. xv. 15, A. ii. 11. Third dorsal ray longest, fin outline rapidly descending posteriorly; first anal below first of second dorsal.

Total length 2 in. 6.75 lines; to first dorsal ray 8.25 lines; to last anal 20 lin.; least depth caudal peduncle 2.25 lines.

Colors: golden brown above, with a series of small round brown spots nearer the basis of the dorsal fin than the lateral line; latter traversed by a broad black band, which passes on sides of head round muzzle; below bright citron-yellow. Fins unspotted.

PERCINA Haldeman.

PERCINA CAPRODES Putnam e Raf.

One specimen of a marked variety from the Holston.

POECILICHTHYS Agass. emend.

Catonotus et Poecilichthys Agass., l. c.

The species of this genus are numerous; the following partial synopsis is given to aid in the identification of the species below described:

I. Branchiostegal membranes broadly connected across the pectoral region.

α. Operculum and cheeks scaled.

Form more slender; depth one-fifth length; head elongate, muzzle gradually decurved; dorsal spines eleven. A dorsal series of black spots, which are continued on a green ground on the sides, and connected by a band on the lateral line, then continued as narrower bands round the belly; second dorsal with small red spots, pectoral fin spotted, ZONALIS.

$\beta\beta$. Dorsal with eight spines; cheeks, operculum and dorsal region naked.

Scales 8-10-14; anal ii. 8; mandible slightly longer than muzzle; some adults with clavate dorsal spines. General form elongate, head a little more than one-fourth the length. Olive, with vertical black bars on the sides, and a black scapular spot; second dorsal and caudal spotted, FLABELLATUS.

II. Branchiostegal membranes distinct throughout their length.

a. Dorsal radii ten; cheeks, operculum and dorsal regions naked.

Form elevated compressed; head elongate, mouth terminal; head one-fourth of length. Second dorsal rays 13; scales 6 | 9; first dorsal red at base, a blackish-blue bar through the middle; sides vertically banded with greenish-blue and red; belly and lower fins red, CÆRULEUS.

POECILICHTHYS ZONALIS Cope, sp. nov.

A species attaining about double the size of *P. cæruleus*, and characterized among other features by the small size of its head. Scales 11-52-12, covering evenly the abdominal and dorsal surfaces, but few irregular ones on the pectoral. Head one-fifth length; muzzle obtuse, projecting beyond mandible, extremity of maxillary reaching line of orbit. Orbit round equal muzzle, and one-fourth head including opercular spine.* First dorsal well developed, separated from the second; not quite as high as the second, but longer, its third ray as far from the occiput as is the end of the muzzle; rays xi. 12; anal commencing opposite or a little before second dorsal, ii. 6 1 | 1; caudal slightly lunate; P. 15. Total length 3 in. 1 lin.; length of caudal fin 5 lines; to base of anal 18 lin.; to basis ventrals 8.25 lin. Longest dorsal spine 3.6 lines; depth at R. 1 of second dorsal 6 l., at contraction of peduncle 3.5 lin.

Bright olivaceous above, golden below; six dark brown quadrate dorsal spots, which connect by alternating spots with a broad brown lateral band, from which eight narrower bands more or less completely encircle the belly. Paired, anal and caudal fins golden, brown-spotted; middle half first dorsal crimson; a series of round crimson spots near basis of second dorsal; occiput, a band on side of muzzle and one below eye black; a black spot on operculum, and one on base of pectoral.

*This spine is otherwise always omitted in measurements of the head.

Three specimens from the Holston River, Va.; it does not appear to be common, and keeps in the main stream. A fourth specimen in Museum Academy, from the Miami River in Indiana, is not to be distinguished from it, except in the lack of the bands which pass round the belly.

POECILICHTHYS FLABELLATUS m. e. Raf.

Etheostoma Rafinesque, *Catonotus* Putnam.

Many of the adults of this species are characterized by the obclavate or obspatulate form of the dorsal spines as indicated by Agassiz, but others equally mature do not possess the peculiarity. As this defined the genus *Catonotus* Agass., I do not regard the latter as different from *Poecilichthys*, to the species of which the *C. flabellatus* is otherwise nearly allied.

This species is abundant in all the streams examined from the James to the Holston. There are three varieties of coloration, as follows:

I. Cross-bars more or less indistinct, but the centre of each scale with a dark line, forming together numerous longitudinal striae; several large sp. from Walker's Creek.

II. Dark vertical cross-bars; the usual form.

III. A series of quadrate dorsal, and lateral spots connected by numerous brown shades and spots. Body shorter and more elevated. This marked variety seems to pass into the common one in all respects. Most abundant in Sinking Creek; also from Austinville. Specimens all small.

No specimen of the *P. cœruleus*, so abundant in the western States, was seen.

BOLEOSOMA De Kay emend.

This genus differs from *Poecilichthys* Ag. only in the possession of one anal spine in place of two.

I. Branchiostegal membranes connected across pectoral region; dorsal fins distinct.

iii. Dorsal radii 9; cheeks and operculum scaly.

Rays of dorsal fins elongate, 14 radii in second; caudal fin truncate; muzzle more or less abruptly descending; head 4* to 4.5† times in length; scales 5 | 9; a series of dorsal and one of lateral spots, connected by specks; superior fins and pectorals speckled, OLMSTEDI.

BOLEOSOMA OLMSTEDI Storer, Agass.

Boleosoma tessellatum De Kay.

Of this species, so abundant in Pennsylvania, but two specimens were taken, and

* In spec. from Crosswicks, N. J.

† In spec. from the Potomac.

those from the Holston River. There is more than one strongly marked variety of this species, which, with variations attributable to age, has given rise to several synonyms.

Var. I. *nigromaculata* Girard (*Estrella*).

Head 4.5 times in length; dorsal and thoracic regions scaled; 14 rays in second dorsal; a black spot at basis of first dorsal, and black bar below orbit. Potomac River.

Var. II. *olmstedii*.

Head four times in length of body; second dorsal radii 14; no black spot on first dorsal and bar below orbit.

Many specimens of this variety from many eastern localities. Of forty specimens from Crosswicks, N. J., but one, the largest, has scales on the dorsal and thoracic regions; it is otherwise identical.

Var. III. *brevipinnis*.

Only 12 rays in the second dorsal fin; head four times in length; dorsal blotches reduced to punctæ, and the lateral to zig-zags, back punctate between; no spot at base dorsal.

a. A black bar below eye; two specimens from the Holston; they have the dorsal region scaly and the thoracic smooth.

aa. No black bar below orbit; 18—20 specimens from the Kiskiminitas, Penn. All have the dorsal and thoracic regions smooth.

HYOSTOMA Agass. emend.

The characters assigned to this genus by Agassiz have not seemed to the writer to distinguish it sufficiently from *Poecilichthys* of the same author. Its physiognomy is, however, somewhat peculiar, and on examination I find it to be distinct in the absence of vomerine teeth.

I. Branchiostegals broadly connected across the pectoral region.

a. Operculum and cheeks scaled.

β. Dorsal spines fourteen to twelve.

Body elongate; head abruptly obtuse, mouth slightly inferior; dorsal rays xiv. 13; scales $\frac{10}{12}$; a series of brown U-shaped marks below lateral line; dorsal fin red in the middle, and a black spot before and behind, BLENNIOPERCA.

Body elongate; head abruptly obtuse, mouth slightly inferior; dorsal rays xii (I). 13; scales $\frac{7-8}{12}$; scaled in front of dorsal fin; brown U-shaped marks below the lateral line, and numerous zig-zag lines above it, CYMATOGRAMMUM.

$\beta\beta$. Dorsal with 10 spines; scaled anterior to dorsal fin, and on cheeks and operculum.

Dorsal outline elevated, depth one-fourth length; head exceedingly short and obtuse, orbit oblique; dorsal spines ten. A dorsal and lateral series of quadrate black-green blotches; dorso-lateral region red-spotted; belly saffron, unspotted; pectoral fin unspotted, second dorsal with membrane red, SIMOTERUM.

HYOSTOMA BLENNIOPERCA Cope, sp. nov.

This species bears considerable resemblance to the *H. cymatogrammum* Abb., but constantly differs as given in the table, and grows to a considerably larger size. Specimens of the latter from different localities have been under the eye of the writer; among others, several from the Miami River. These differ from Abbott's type in having 13 dorsal rays instead of 12, one more row of scales above the lateral line, and the U-shaped marks much more distinct; in all these points approaching *H. blennioperca*.

Common in the tributaries of the Kanawha and Holston. Adults reach 4.25 inches in length.

HYOSTOMA SIMOTERUM Cope, sp. nov.

This is a shorter and more elevated fish than the last, with a notably smaller head, and very obtuse muzzle. Its physiognomy carries to an extreme the Blennius-like expression of many of the North American allied species.

Muzzle truncate in profile, mouth small inferior, maxillary bone not reaching orbit. Orbit with its longest diameter directed downwards and forwards, equal (in straight line) the muzzle; enters the head (without spine) 3.75 times, and is .66 more than interorbital width. Head one-fifth length. Scales 10—52—12; pectoral region smooth. Dorsal fin x. 11, well separated, the second much higher than the first; anal opposite first ray of second ii. 7. P. elongate, 13. Caudal slightly lunate, peduncle little contracted. The first dorsal is orange-red margined, spotted behind the first and penultimate rays; a row of oval red spots extends also across the middle of the fin. The blood-red of the second dorsal is truncated below by a yellowish area, which rises anteriorly. Spot on occiput and operculum, and line on side of muzzle and below eye, black. Caudal fin brown-barred.

No black scapular spot. Total length 3 in.; to basis second dorsal 3 in. 6 lin. Longest dorsal spine 4 l., longest articulate ray 5 l., width of parietal region 2.25 l.

This handsome and peculiar species is one of the most abundant in the Holston River and its tributaries. It occurs in the main river as well as subordinate streams. Its movements are like its congener, and our *Boleosoma olmstedii*; lying quiescent on the bottom, or moving from place to place by sudden and forcible darts.

CENTRARCHIDÆ.

For convenience of reference, and illustration of the present essay, the following comparative table of genera allied to the *Pomotis* is given :

- I. Dorsal fin longer than anal.
- a.* Operculum with two posterior points.
- β.* Dorsal fins deeply divided, approaching separation.
- Palatine teeth; spinous dorsal radii x; caudal emarginate, MICROPTERUS.
- ββ.* Dorsals continuous.
- Palatine teeth; dorsal spines x; scales ctenoid, caudal emarginate. A. v, vi, AMBLOPLITES.
- Palatine teeth; dorsal spines x; scales cycloid; caudal convex.
- A. v, vi, ACANTHARCHUS.
- Palatine teeth; D. ix. A. iii; caudal convex, ENNEACANTHUS.
- Palatine teeth; D. viii. A. iv; caudal convex, HEMIOPLITES.
- Palatine teeth; D. x. A. iii; caudal convex, MESOGONISTIUS.
- aa.* Operculum with an entire convex process; D. x. A. iii.
- Palatine teeth; present or absent; inferior pharyngeals conic; caudal emarginate, LEPOMIS.
- No palatines; inferior pharyngeals paved; caudal emarginate, POMOTIS.
- II. Dorsal fin of equal basis and extent with the anal. Palatine teeth.
- Spinous dorsal longer than cartilaginous, forming an angle with it, CENTRARCHUS.
- Spinous dorsal shorter than articulated, continuous with it. D. vii—viii, HYPERISTIUS.
- Dorsal as in last, except with vi rays, POMOXYS.

MICROPTERUS Lac. Gill.

Grystes Cuv., *Dioplites* Rafinesque.

MICROPTERUS FASCIATUS Gill.

Proc. A. N. Sci. 1865, 83. *Cichla* Leseur, *Grystes* Agass.

This species is abundant in the Holston River; individuals are identical with others from the Miami R., Indiana, the Wabash, the Kiskiminitas, from Michigan and Lake George, N. Y. It grows to a considerable size and is much valued as food.

The Academy possesses specimens of *M. nigricans* or a nearly allied species from the lower part of James River, Va.

The absence or rarity of this species and the *Ambloplites rupestris* in the Kanawha River, in Giles county, and above is remarkable. During a residence of over six weeks on its banks I never caught or saw a specimen of either, and they were not clearly known to the fishermen.

AMBLOPLITES Raf. Agass. Emend.

Am. Journ. Sci. Arts, xvii, 299.

Dorsal radii xi; short, longest, .66 depth the head at front of orbit; cheek scaled; front convex; orbit 3.75 in length head; with brown longitudinal striæ, RUPESTRIS.

Dorsal radii x; elongate, longest, equal depth of head at front margin orbit; cheek with very few scales; front concave, muzzle projecting; orbit large, 3 in head; scales with brown shades at base, CAVIFRONS.

AMBLOPLITES RUPESTRIS Raf. Gill.

Proc. Acad. 1860, 20, *Bodianus rupestris* Raf. Amer. Month. Mag. 1817, 120, *Cichla œnea* Leseuer. *Centrarchus œneus* auct.

This species, so common everywhere in the West, is common in the Holston River; it occurs rarely in the Kanawha.

AMBLOPLITES CAVIFRONS Cope.

This new species has more the physiognomy of the true *Centrarchus* than the last. The mouth is very oblique and large, the maxillary attaining the line behind the middle of the pupil; the chin quite prominent; the outline of the cranium concave, a little over three-fourths the diameter of the orbit. Dorsal line from cranium to dorsal ray straight; bony dorsal as elongate as soft. General form elongate, deepest at middle of body 2.5 times in length (exclus. chin and caudal fin) caudal emarginate. Radii D. x. 12; A. vi. 11, Scales of operculum much less than those of body; those of cheek very few, minute. Mucous cavities large, a crest on middle of front. Silvery, below of body 7—38—13. Mucous cavities large, a crest on body with a narrow, vertical, dark shade on head dusted with black points; scales of dorsal); spinous dorsal shaded, a small operculum at base; soft fins all dusky (except pectoral); regular black spot. Total length 3 in.; of head 11.5 lines; from chin to first dorsal ray 13.25 lines; basis of dorsal 12.75 lines. Length of caudal fin 6.75 l.

Habitat.—The head waters of the Roanoke River, Montgomery Co., Va.

HEMIOPLITES Cope gen. nov.

This genus is intermediate between *Enneacanthus* and *Centrarchus*. Its characters are: operculum with two posterior points and dermal flap; palatine teeth; eight dorsal, and four anal spines; caudal fin rounded.

Name, ἡμι and ὄπλον, half armature, faded. dorsal, and all being of a type half *Centrarchus* from that of the anal being half that of the *Centrarchus* and half *Pomotis*.

HEMIOPLITES SPULANS Cope sp. nov.

This species resembles, in coloration and general proportions, the *Enneacanthus guttatus* (*Pomotis* Morris) so closely, that at the description of the latter will apply to it with some exceptions.

Char.—With a strong black band within the spines of the ventrals, and the dusky of the sides predominating behind, and reducing the olive to pale spots. There is a distinct supraoccipital mucous cavity in this species not seen in the *E. guttatus*, and the orbit is smaller, measuring 3.25 times in the length of the head, exceeding the muzzle and measuring 1.15 times in interorbital width. Operculum with purple reflections. Head 2.75 in the length.

Descr.—Scales 4—30—11, three rows on cheek. Fifth dorsal spine longest, equal from end muzzle to near posterior margin orbit; third anal equal from same point to posterior margin pupil. End maxillary reaching half-way between edge of orbit and pupil. Soft anal terminating at commencement caudal radii or fulcra. Ventrals and pectorals extending to the third anal spine. Eye large, 2.75 times to edge bony operculum, greater than muzzle, 1.6 times interorbital width; no supraoccipital mucous cavity; supraorbitals more than their diameter apart. End of maxillare not quite to pupil. Greatest depth 2.3 in length. Caudal elongate, rounded. Total length 2 in. 4 lin., of which the caudal fin measures 6.5. From end muzzle to basis first dorsal spine 9.2 lines (obliquely.) Radii D. viii, 11; A. iv, 10; V. i, 5; P. 11. Color: bright olivaceous, with dusky longitudinal stripes crossing sutures of scales. A small black spot on posterior margin operculum. Anal, caudal and second dorsal fins dusky, the first and last with large, oval transparent spots on the membrane. Anal strongly reddish; two dark bars below orbit. Sides and opercula with purple reflections.

Habitat.—Abundant in the slow waters of Tuckahoe Creek, which enters the James River above Richmond, Virginia.

ENNEACANTHUS Gill.

Sill. Am. Journ. Sci. Arts, 1864.

Besides the nine spines assigned as the character of this genus by Prof. Gill, it is characterized by having two acute angles to the operculum, as in *Micropterus*, etc.*

* In order to complete the comparison with the species of *Lepomis* group *Bryttus*, the following description of the species of *Mesogonistius* is introduced:

MESOGONISTIUS Gill.

Group I.

Palatine teeth; dorsal spines quite elongate, decreasing in height towards the elevated soft dorsal; mucous cavities small.

Lateral line gradually descending; scales in three row on the cheek; on the body 4 | 28 | 10; eye large, .33 of head, maxillary to margin orbit. Longest spine equal from end muzzle to near preoperculum. Compressed, much elevated; dirt straw color, with four vertical blackish bars; front rays of dorsal and ventral fins black, margined with pink before, *chaetodon*.

Mesogonistius chaetodon Gill (*Bryttus chaetodon* Eird) is common in sluggish waters in the lowlands along the Delaware, and in the pine woods of New Jersey. It is the most beautiful species of the family found near Philadelphia, and is much caught for aquaria.

ENNEACANTHUS GUTTATUS.

Pomotis guttatus Morris, Proc. A. N. Sci. Philada 1859, p. 3.

From Tuckahoe Creek, near Richmond, Va.

This species may be distinct from the *E. obesus* of Baird, and is readily distinguished in life. It is abundant in all the ditches near Philadelphia.

LEPOMIS Rafinesque, Cope emend.

This most extensive genus of North American Percidæ presents a considerable variety in details of structure among its species. The presence or absence of palatine teeth has been thought by Cuvier and Valenciennes and other authors to indicate distinctness of genus, hence the names *Bryttus*, *Calliurus* and *Chænobryttus* have been proposed for certain species. I have been induced, after study of numerous species, not to regard this peculiarity as a constant factor. The series is very short, for instance, on the anterior parts of the ossa palatina in *L. ardesiacus* Cope, and it is not unfrequently found as well developed in the *Lepomis appendix*, which is one of the types of the genus described heretofore as without them. The form of *L. auritus* Raf. allies it nearly to species of the *Bryttus* section, yet it is without palatines. I do not, however, lay much stress on the latter fact, since truly generic features may separate species otherwise nearly allied; as, e. g., *Hemioplites simulans* from *Enneacanthus guttatus*; *Oporornis agilis* from *Geothlypis tephrocotis*; *Centrotelma geographicum* from *Cinclidium granulatum*.

However, there are no other characters to substantiate the supposed genus *Bryttus*, and it therefore must fall to the ground.

Most of the species with palatine teeth have larger mucous cavities of the cranium than those without; but such species as *L. nephelus* and *L. ardesiacus* are quite identical with the latter class in this respect.

The mucous ducts open into distinct superficial pits, which are rather fissure-like, in the adipose integuments of the top of the vertex and face, in the *L. mincepas*; in the species of the first section of the genus, these openings are much less visible in life.

Before reviewing the species, I must express regret at not being able to identify the two species described by Dr. J. P. Kirtland in his fishes of Ohio, *L. macrochira* Raf. and *L. nitida* Kirtl. Specimens much resembling the latter, from the Wabash, I have referred as a small variety of the *L. megalotis*; but perhaps it is distinct.

I.

Palatine teeth wanting (with a few exceptions); dorsal spines usually elongate, nearly continuous in outline with the soft rays; mucous caverns small. (*Lepomis*, *Ichthelis* Raf., Holbrook.)

A. Scales of the cheek small in eight or more series.

End maxillary to anter. part pupil; scales 6·7—45—15, pectoral do. minute; form oval; depth 2·33 in length; eye large, 3·3 in head to superior fissure, equal muzzle and interorbital width; opercular flap long, black, not light bordered; unspotted olive to golden, . APPENDIX.

AA. Cheek scales in 4—6 rows.

α. Long dorsal radii equal muzzle and orbit.

Compressed, dorsal line elevated; spinous dorsal higher than soft; anal spines very long; scales 6·7—14·16; mouth small, maxillary to anterior line of pupil; orbit large; pectoral fin to beyond anal; steel-gray, with short concentric opercular spot; fins blackish, with spot on edge second dorsal, LONGISPINIS.*

αα. Long dorsal radii equal from end muzzle to posterior margin pupil.

Form elevated, depth 2·1 to 2·2 in length; opercular appendage }
long, black; scales 6·7—12·14. } MEGALOTIS.
α. A black spot on hinder edge second dorsal; pectoral scales large.
β. No spot on dorsal; pectoral scales small.

Form more elongate; depth 2·5 in length; orbit 3·5 in head to upper fissure, less than interorbital width; maxillary scarcely to line of

* *Lepomis longispinis* Cope, Proc. Acad. N. Sci. 1865, 83.

Three older specimens of this species from near Leavenworth, Kansas, sent by Saml. H. Edge, exhibit a more discoid form than the smaller first described; the depth enters the length 2·33 times (originally given 2·66, which ought to be rather 2·5), and the head three times. There are indistinct dusky cross-bars on the sides in all the specimens. The spines, compressed form and coloration readily distinguish this fish.

Lepomis megalotis m. *Ichthelis* do. Rafinesque, Ichthyol. Ohiensis, 1820, 29. *L. incisor* Cope, Proc. Acad. Nat. Sci. 1865, 83.

This is probably *Pomotis incisor* of Cuv. Val., but if so, Rafinesque's name must take precedence. It is abundant in the west: var. α from the Kiskiminitas (A. H. Guss) and from Michigan, and var. β from the Upper Wabash. Kirtland's *Pomotis nitida* must, from figure and description, resemble it closely. In both, the sides of the head are beautifully banded with blue.

Lepomis auritus m. *Ichthelis auritus* Rafinesque, l. c. 29.

A single specimen of this handsome species, from the Miami River, agrees so closely with Rafinesque's description as to be safely identified with it, but for one peculiarity: our specimen has but 2 dorsal spines, which, by their regularity and lengths, appear to be normal. I suspect it to be not so, however, and look for future specimens with X radii.

The general form of the fish is that of the *Lepomis microlophus*, a resemblance increased by the short dorsal spines; of these the first is quite short, and the last two equal.

End of maxillary attains anterior margin of pupil; head to superior margin opercular flap 2·32 in length. Jaws equal. Caudal rather rounded, strongly emarginate. Radii E3, neither it nor the ventrals quite attaining anal. Scales 5—41—14. Colors light rufous to golden, without spots; no spots on fins. Total length 4 in. 3 lin.; depth at I dorsal 18 lin.; at I articulated ray the same from end muzzle to first dorsal ray the same; basis dorsal. 19 lines. Front rather steep, and at the same time elongate.

pupil; radii D. x. 11; A. iii. 9; pectoral scales not small; those of body 6—14; front flat, with ridge on each side; pectorals not reaching anal. Olive, head and sides of body with blue bands; ear spot and flap large, with narrow blue edge, INSCRIPTUS.

aaa. Dorsal radii shorter than muzzle.

Form oval; depth 2·3 in length; head rather broad; radii ix. 11; A. iii. 9. Orbit equal muzzle, 3·5 to upper branchial fissure, equal interorbital width; long black unmarginated ear-flaps; orange below; blue stripes on the head, AURITUS.

II. (*Bryttus* Cuv. Val.)

Palatine teeth. Dorsal spines elongate; (longer than from lip to orbit.) Size smaller.

α. Lateral line suddenly descending posteriorly, usually with more or less interruption.

Scales 5—32—11·12; eye smaller, less than interorbital width, 5 or nearly in length to end bony operculum; operculum little prolonged; flap long, light-edged; caudal peduncle and fin one-third length; mucous caverns moderate; not red-spotted, OCULATUS.

Scales 5—33—11; eye equal muzzle, large, 4·2 in head; operculum prolonged; flap long; caudal peduncle and fin more than one-third length; mucous caverns very large; belly and fins below red; sides red-spotted, ANAGALLINUS.*

* *Lepomis anagallinus* Cope, sp. nov.

A species distinguished by the large size of its mucous cavities and its bright coloration.

Scales 5—33—11, those of the pectoral region rather smaller than those of the ventral; five rows of small cheek scales. Supraorbital and mandibular mucous cavities nearly touching; a large supraoccipital cavity. Orbit equal interorbital width and length of muzzle, 3·5 times to upper extremity branchial fissure. Opercular flap elongate. Greatest depth 2·25 in length (exclus. caud.); form declive from front of dorsal fin. Dorsal spines elongate, fifth longest, ninth equal tenth; second dorsal little more elevated, like the caudal, free from small scales. Caudal forked. Longest anal spine equal fourth dorsal, equal from end muzzle to posterior margin pupil. Ventrals reaching anal, pectorals extend to second ray of same. Radii D. X. 11. A. III. 8. V. 1: 5. P. 11.

Ground color bluish, darker about the head; opercular flap black, with bright colored edge. Second dorsal and caudal dark, former with black spot at base posteriorly. Belly and anal fin bright salmon red; ventral fins similar, with black external margin; large salmon red spots scattered over the sides of the head and body.

Total length 2 in. 9 lin.; length of head to end of opercular flap, 1 in.

From near Leavenworth, Kansas; one of several interesting ichthyological discoveries made near that place by Samuel H. Edge, late of Leavenworth,

Lepomis microps. *Calliurus microps* Girard, U. S. Pac. R. R. Exped. x, p. 17. *Bryttus longulus* "Girard,"

Cope, Proc. A. N. Sci. 1865, p. c. (not of Girard.) Platte River.

To the same group as this and the preceding species belongs apparently *Bryttus diaphanus* (*Calliurus*) of Girard's report above quoted.

Lepomis oculatus Cope, Pr. A. N. Sci. 1865, 83.

Allied to the last named, but smaller, with longer caudal fin and peduncle, larger scales, and much longer ear-flap. Lake Whittlesey, Minnesota.

Scales 7—44—15; eye larger, equal interorbital width, 4·33 in head; operculum not prolonged, flap quite short, light-edged; caudal peduncle and fin 3·3 in length; mucous caverns moderate; not red-spotted, MICRIPS.

aa. Lateral line descending gradually to caudal peduncle.

β. Five or six series of scales on the cheek.

γ. Supraoccipital mucous cavity large; a deep groove along vertex of cranium.

Eye large; scales of operculum small; maxillary to beyond middle pupil; longest dorsal spine equal muzzle nearly to posterior edge orbit. Light olive, a mere trace of opercular spot; four dusky bars from orbit backwards, GILLII

γγ. Supraoccipital mucous cavity small; no groove on vertex.

Eye moderate, one-fourth of head; form elongate compressed; scales of operculum large; longest dorsal spine equal muzzle and orbit; maxillary to front edge pupil; bluish, without markings except black spot on second dorsal, and same on very short opercular flap, ARDESIACUS.*

Eye moderate, four times in head; † opercular scales large; longest dorsal spine equal from end muzzle to middle pupil, end of maxillary reaching latter point; blue-grey, closely spotted with dark brown; second dorsal, caudal and anal marbled with same; no bands on head; black ear-flap short, NEPHELUS.‡

* *Lepomis ardesiacus* Cope, sp. nov.

This species is characterized by its compressed ovate form, small scales, long spines and small ear-flap. Scales 6—45—17, those of the pectoral region considerably larger than those of the cheek. Depth 2·33 in length, head 3·1 in same. Eye four times in head, barely equal muzzle; 1·1 in interorbital width. Mucous cavities small, front rather flat. Mandible longer than premaxillary; maxillary extending to between lines of orbit and pupil. Ventral and pectoral fins attaining anal; third anal spine equal from end muzzle to posterior margin pupil. Fourth and fifth dorsal spines longer than soft portion, ninth and tenth equal.

Total length 3 in. 11 lin.; from end muzzle to first dorsal ray 16·2 l.; basis of first anal 2 in.; depth at first dorsal 15·75; at fifth soft dorsal 11·75 l. Radii D. X. 11. A. III. 11. P. 13.

Color steel-blue in spirits, without markings; a small opercular black spot without pale margin, which is prolonged in a faint brown streak to the preoperculum. An indistinct spot at posterior margin second dorsal.

Habitat.—Kiskiminitas River, Western Pennsylvania; discovered by Addison R. Guss.

This species resembles the *Lepomis longispinis* Cope. I had thought it once the *Ichthelis cyanella* Rafinesque, *Ichthyologia* Oh. 28; but that must be a slender species, as he says "diameter one-fifth;" "anal rays 12, whereof 3 are spiny;" "pectoral fins very short;" all which features are not to be seen in this species.

† To origin opercular flap.

‡ *Lepomis nephelus* Cope, sp. nov.

This is a symmetrical elongate species, with quite a peculiar coloration.

Depth 2·4 in length; head 2·82 in same; eye equal muzzle, 4·2 in head, 1·2 in interorbital width; mucous cavities small; five rows scales on cheek; pectoral scales larger than the latter. Scales 6—42—15. Opercular

Eye moderate, equal muzzle, less than interorbital space, 4·5 or ·6 in head; form broad ovate; longest dorsal spine equal from end muzzle to hinder edge pupil; maxillary to latter point or farther; scales large; mucous caverns small. No spot on dorsal; sides vertically banded, GULOSUS.

♂♂. Eight to ten series of scales on the cheeks; no frontal groove.

Eye large; form elongate; scales of operculum large; maxillary short of middle pupil; longest dorsal spine little longer than length of muzzle; light olive, without markings, except black opercular spot on a short flap, OPHTHALMICUS.

End maxillary extending to middle pupil; eye nearly four times in side head; head three times in length; longest dorsal spine equal from muzzle to middle orbit; opercular flap short; unicolor except black spot on posterior margin second dorsal and opercular flap, . . . HUMILIS.

“End maxillary to rim orbit; eye four times in head; latter 3·5 times in length; colors as above,” ALBULUS.

III (*Chaenobryttus* Gill).

Palatine teeth. Dorsal spines short, less than muzzle in advance of orbit. Size larger.

Maxillary extending to middle of pupil; cheek scales minute, in nine rows; greatest width of mouth ·66 length of top of head and muzzle; no frontal ridges; eye 1½ times frontal width; opercular spot broadly light bordered, MINEOPAS.

lobe short. Soft dorsal higher than spinous; 9th and 10th spines of latter equal; anal spines long and strong; caudal emargination shallow. Pectoral fins reach anal. Mandible a little longer than muzzle.

Total length 4 in. 8·5 lin.; caudal fin 10·75 lin.; end muzzle to first dorsal ray 19 lin.; basis dorsal 20·5 lin. Depth at first dorsal spine 19 l., at fifth soft dorsal 14·25. Radii D. X. 12. A. 3. 10. P. 11. Color bluish-gray, closely spotted with bronze-brown; black ear-spot margined with silvery below; soft fins marbled with brown.

From the Kiskiminitas River, West Pennsylvania. Mus. Academy, from A. H. Guss.

Lepomis melanops m. *Ichthelis melanops* Raf., Ichthy. Ohiensis, 28. *Chaenobryttus melanops* Gill, Cope, Pr. A. N. Sci. Phila. 1865, 84; not *Calliurus melanops* Girard.

This species has been referred to a distinct genus, called by Agassiz *Calliurus*, after Rafinesque, but more correctly *Chaenobryttus* by Gill. As it appears to me to be but a section of *Bryttus*, I do not adopt it here, and, as above remarked, the separation of the latter from *Lepomis* is as yet not practicable.

Dorsal radii X. 11. Reddish-brown, two series of blue spots on cheek below orbit. Anal black, second dorsal with black spot behind.

As this species is quite distinct from that named *melanops* by Girard, I call the latter *L. charybdis* in the synopsis above. It is from various streams in Texas.

Greatest width mouth equal top of head and muzzle; two divergent frontal ridges; eye 1.5 times frontal width; black opercular spot small; dorsal and anal rays very short, MELANOPS.
 Maxillary extending to beyond orbit; cheek scales large as those of operculum; dorsal and anal spines longer; centres of the scales dark-spotted, CHARYBDIS.

LEPOMIS OPHTHALMICUS Cope, sp. nov.

In general this species resembles the *L. gillii*, that is in its elongate form and pale coloration, but is characterized as much by its short dorsal spines as the latter is by its long ones, as also by its much smaller mucous cavities, and many other features.

The depth enters the length 2.66 times; the dorsal outline descends gradually posteriorly, but is full and abrupt anteriorly. Eye unusually large, 3.3 in length of head, longer than muzzle, and 1.4 times interorbital width. Head 2.85 in length. Mandible not longer than premaxillary. Ear flap very short. Pectoral scales much smaller than lateral; those of cheek in seven straight, eight obliquely counted. Scales 7—41—13. R radii x. 10. A. iii. 10. V. i. 5. P. 14. Neither pectorals nor ventrals reaching anal fin. Caudal emargination not deep.

Total length 3 in. 7.5 lines. Depth at first dorsal ray 13 lin.; at fifth ray second dorsal 9.5 lines.

General color light olive, with prominent black opercular patch which has no light margin; caudal fin dusky; otherwise the specimen before me has no markings.

One specimen taken in the head of the Roanoke River.

LEPOMIS MINEOPAS Cope.

Proc. Acad. Nat. Sci. 1864, p. 84, *Bryttus*.

Two specimens from tributaries of the Kanawha river, one from Giles, another from Wythe county, Va. The coloration in life was as follows:

Dark brown, with some blue bands across the head, and indistinct transverse dusky bars on the sides. Second dorsal, caudal, and anal fins orange-margined. This fish is widely distributed. The Academy Museum has it from the Miami River (Elijah Coffin coll.) and from the tributaries of the Missouri near Leavenworth, Kansas (Samuel Edge coll.); the original locality is Lake Whittlesey, Minn.

This fish answers quite well to Girard's description of his *Calliurus formosus* (from which *C. longulus* is not distinguishable as figured and described), but differs much from his figure, in the much shorter spinous radii in dorsal and anal fins.

LEPOMIS APPENDIX Mitch.

A nearly yellow variety of this fish from John's Creek, one of the head waters of the James.

LEPOMIS INSCRIPTUS m. ex Agass.

Pomotis, Amer. Jour. Sci. Arts, 1854, 302.

This handsome species, one of seven recorded by Agassiz from the Bend of the Tennessee River, is not uncommon in the Holston River, Va.

LEPOMIS GILLII Cope, sp. nov.

An elongated species, peculiar in appearance and characters, resembling the species of *Ambloplites*. It is defined from a single specimen, which is probably not fully grown.

Fourth and fifth dorsal spines longest, exceeding any of the soft rays; first ray not small; ninth and tenth nearly equal. Basis of dorsal equal from its first ray to nares. Caudal fin moderately notched; anal spines elongate. Pectorals reaching anal, ventrals not. Radii D. x. 10. A. iii. 9. V. i. 5. P. 13. This fish is gradually acuminate in outline to the end of the muzzle. The head enters length 2.6 times, and the depth, which is greatest at first dorsal ray, is equal. The eye's diameter is longer than muzzle, and enters the head three times, and 1.5 times the interorbital width. Scales 7—45—12, larger than those of operculum; those of pectoral region smaller than latter. The mandible projects beyond premaxillary border. The spines of the latter bone form a prominence in front of the orbit. The mucous cavities are large, especially on the preoperculum; those of the vertex nearly margining the broad fronto-parietal groove.

Total length 2 in. 7 lin.; to base of first dorsal ray 9.75 lin.; to do. of anal 15 lin.

Light green, slightly silvery below; several indistinct dark cross-bars above the lateral line and across caudal peduncle; punctulated with black below; dorsal, caudal and anal clouded with the same.

This very distinct species was taken in a branch of Tuckahoe Creek, in the bottoms of James River, twelve miles above Richmond. It is very distinct from those previously described, and is named in honor of my friend, Prof. T. Gill, of the Smithsonian Institution.

TRIGLIDÆ.

URANIDEA De Kay, Putn. emend.

Cottus Girard; Heckel u. Kner.

URANIDEA CAROLINÆ m.

Potamocottus carolinæ Gill, Proceed. Bost. Soc. Nat. Hist. 1861, 41.

In this species the preoperculum possesses three spines, as in *U. meridionalis* Girard. It differs from that species in its more slender form, the depth being one-fifth instead of one-fourth the length to caudal; in the more numerous 16—17 rays of the pectoral, and the double furcation of the caudal rays, which Girard denies the *U.*

meridionalis, though his figure represents it. It is leather-colored in life, with three broad cross-bars under second dorsal and just behind it. All the fin rays barred with dusky. There is no red about this species in life. Largest specimen six inches long. It abounds in cold springs, such as often issue in great volume from subterranean channels in the limestones of the central and southern Allegheny regions.

A similar habit characterizes the *U. viscosa* in Pennsylvania. This is the species called by Abbot* *C. copei*.

CYPRINIDÆ.

CERATICHTHYS Baird.

Of this genus three species were obtained: *C. biguttatus* Kirtland, and the two below described for the first time. The first mentioned is abundant in all the water basins examined; the larger specimens occur in the river channels almost entirely. The new species should be associated with *C. dissimilis* Kirt. and *C. cataractæ* Cuv. Val. in my Section II of the genus, but its characters must be altered to include them, as follows:

Sect. II. Mouth more or less inferior, small; teeth 4—4 or 1·4—4·1; size small.

Scales large, 5—39—3; eye oval, three times in head; latter one-fourth length; depth 4·75 in do.; silver, a leaden band on side; fins unspotted, *C. HYALINUS.*

Scales small, 8—56—4; eye round, 4·2 times in head; latter $\frac{1}{4}$ total length, flat above, with long muzzle; depth 5·2—5 in length; uniform silver below, dorsal fin black behind, *C. MONACHUS.*

CERATICHTHYS HYALINUS Cope, sp. nov.

This is the smallest species of the genus, and approaches nearest the *C. dissimilis*. It is shorter than the latter, has a larger eye and larger scales.

Muzzle elongate, profilé obtuse, projecting beyond lips. Eye large, equal muzzle, two-fifths longer than interorbital width. Extremity of maxillary opposite its anterior nine barbels well developed. Operculum considerably deeper than long. Inferior fins short, not reaching each other. Radii, D. i. 8. C. +18+. A. i. 8. V. 8. P. 15. Total length 3 in. 4·5 lines; end muzzle to origin dorsal 16·5 lines; from latter to basis caudal 17·25 lin. Depth at orbit 3·75 lin.; do. at last anal ray 3·75 l. Pharyngeal teeth 1·4—4·1.

In life translucent above; sides and below silvery, a plumbeous lateral band more distinct posteriorly, where it sometimes ends in a spot. Top of head and streak through eye blackish; no vertebral band. Fins immaculate.

* Proc. Acad. 1860, 326.

This species is abundant in the tributaries of the Holston; it neither prefers the cold and rapid streams, nor the river channels, but is found at the mouths of creeks, and in still stretches near the river.

CERATICHTHYS MONACUS Cope, sp. nov.

This species resembles those belonging to *Phenacobius* Cope, in some degree, but has much thinner lips, and a maxillary barbel. No other *Ceratichthys* at present known resembles it; the marking of its dorsal fin is similar to that in *Photogenis spilopterus*, *Hypsilepis analostanus*, and *Lepomis megalotis*. The barbels are very small; teeth 4—4.

Eye small, 1.5 in the projecting muzzle; the end of the latter and the upper lip are rugulose or punctate. Isthmus moderately wide. Mouth more inferior than in any other *Ceratichthys*, small, end of maxillary opposite the posterior nares. Operculum much deeper than long; lateral line descending for thirteen scales. Dorsal outline slightly elevated, caudal peduncle contracted. Inferior fins falling far short of each other. Twenty-four scales in front of dorsal.

Total length 4 inches, lacking .5 of a line. Caudal deeply forked, the inferior lobe a little longer than the superior in three specimens; length 8 lines; basis of do. to first dorsal ray 20 lines. From latter to end muzzle 18.8 lines. Depth at orbit 4 lin.; at dorsal fin 8 lin.; at last anal ray 4.25 lin. Upper surface to a line from operculum to base of caudal, light olive, with a rufous vertebral band, which has a metallic lustre in life, but is readily obscured in spirits. Below the above line, uniform silvery; no lateral band, a black spot at basis caudal; muzzle blackish. Basis of dorsal white, posterior portion black.

This fish is rather rare, and occurs singly or in pairs in the channel of the Holston River, in Washington County, Va., with the *Phenacobius uranops* Cope; the habits of the two fishes are probably nearly identical. Its solitary habits and isolated characters have induced me to name it *C. monacus*.

RIINICHTHYS Agass.

RIINICHTHYS NASUTUS (Ayres) Agass.

This species was found in the tributaries of the Kanawha River, Sinking Creek, Walker's Creek, and near Austinville. As elsewhere, it haunts rapids, and its motions are swift and powerful. Color in life dark green, all the fins red; a broad silver band on the caudal peduncle in several specimens. The species has a partially free fatty lobe in the pectoral axillæ, not before noticed. The specimens from the Kanawha have a few more longitudinal series of scales than those from Pennsylvania, —viz., 15—66—10; fourteen series on the caudal peduncle. Largest specimen 4 inches 6 lines.

RHINICHTHYS LUNATUS Cope.

Proc. Academy 1864, 278.

This species is very abundant in the tributaries of the Kanawha and Holston; it follows the smallest streams to their sources, having a power of leaping falls far beyond that of any other of our Cyprinidæ, except perhaps the *R. nasutus*. The only other species I have found in company with it is the *Catnotus flabellatus* Rafinesque.

Size larger than those seen from Michigan; total length of a Holston specimen 4 inches. End muzzle to base dorsal 1 in. 10 lin.; from latter to basis caudal 18.25 lines. A fatty lobe behind ventrals and pectorals; anal radii i. 7. Scales 14—61—8. Orbit from 5 to 5.5 times in length of head, 4.2 in length to origin caudal.

Brownish-olive above, with many scattered brown scales; latter accumulated on the lateral line at basis caudal; belly golden or silvery, deepest near lateral line and on suborbital region.

RHINICHTHYS ATRONASUS (Mitch.) Agass.

Found only in the Roanoke River and in John's Creek, one of the heads of the James.

PHENACOBIUS Cope.

The lips of this genus are defended by a cartilaginous sheath on their opposing edges.

PHENACOBIUS TERETULUS Cope.

Proc. Acad. Nat. Sci. Philada. 1867, 96.

The lips of this species have weak transverse plicæ.

From the main channel and mouths of tributaries of the Kanawha.

PHENACOBIUS URANOPS Cope.

L. c. 1867, 96.

The lips of this species are tuberculate behind.

From the main channel of the Holston River near Saltville, Va.

CLINOSTOMUS Girard.

CLINOSTOMUS AFFINIS Girard.

The numerous specimens of this species all differ from those of the *C. funduloides* Girard in the following points: The orbit enters the head 3.5 times (3 times in the latter); the head the body 3.6 times (not 4.25 times). Caudal peduncle deeper, shorter, twice longest anal ray, to basis latter; dorsal fin short, longest ray 2.75 times to end muzzle. Scales 9(10)—53—5. No distinct brown lateral band;

sides and below deep crimson; fins orange. Above blackish, scales dark-edged. Dermal tubercles on top of head only in the breeding season.

Abundant in the head-waters of the James and Roanoke Rivers.

HYPHILEPIS Baird.

See a revision of this genus in Proceedings Acad. Nat. Sciences, 1867, 158.

HYPHILEPIS CORNUTUS Mitch. Girard.

Common in all the streams examined; the varieties *cerasinus* in the Roanoke, and *frontalis* Agass. in the Holston.

HYPHILEPIS COCCOGENIS Cope.

Loc. cit.

From the streams of the Holston, where it is one of the most abundant species.

HYPHILEPIS GALACTURUS Cope.

Loc. cit.

With the last, and equally abundant.

HYPHILEPIS ANALOSTANUS Girard, Cope.

From the head-waters of the James, but especially abundant in the main stream of the Kanawha.

HYPHILEPIS ARDENS Cope.

Loc. cit.

This delicate and brilliant species was only seen in the Roanoke.

PHOTOGENIS Cope.

For an essay on this genus see Proceedings Acad. Nat. Sci. 1867, 163.

PHOTOGENIS LEUCOPS Cope.

Abundant in tributaries of the Kanawha.

PHOTOGENIS TELESCOPUS Cope.

Loc. sup. cit.

Common in the tributaries of the Holston.

PHOTOGENIS LEUCIODUS Cope.

From the Holston River near Saltville.

PHOTOGENIS SCABRICEPS Cope.

Not scarce in Sinking Creek, Walker's Creek, and other tributaries of the Kanawha, in whose channels it also occurs.

Undoubted specimens of this species in the British Museum are included by Dr. Günther in the vii vol, Catalogue Fishes Brit. Museum, as individuals of *Ceratichthys biguttatus*. It is not difficult to perceive how this error has occurred, as the external technical features of the two are alike in many respects. The resemblance is, however, superficial, for the two belong to different groups of genera,—*Ceratichthys* being allied to *Gobio*, and *Photogenis scabriceps* to *Leuciscus*. The latter is a small species, the former a large one; they differ in osteological characters, as the form of the preorbital bone, etc. No one who has seen the two living in the same streams can ever confound them, as their coloration is totally distinct. The one species is widely distributed, the other, so far as known, is confined to the Kanawha.

HYBOPSIS Agass.

Four species are added to this genus; one from the Roanoke and James Rivers, and three from the Holston. Two of them belong to division B (Synopsis Cyprinidae Pennsylvania), or the type of *H. procne*, where the teeth are 4—4, and the mouth horizontal and slightly inferior; two belong to division D, or the type of *H. chalybæus*, where the teeth are 2·4—4·2, and the mouth oblique and the mandible more elongate.

Division B.

a. Pectoral fins not attaining the ventrals.

Form elongate, depth 5 times, head 4·25 or 4·5 in length. Eye equal muzzle, 3·5 (in young 3·25) in head, equal præorbital width; scales 5—33—2, 14 before dorsal fin. Anal rays 7, . *H. LONGICEPS.*

Form elongate, head larger, broad and rather flat, 4 times in length; depth 5·5 to 6 times in same. Eye large, diameter greater than length muzzle, three times in head, less than præorbital width; scales 5(4)—37—3: 15 rows anterior to dorsal; anal radii 9, *H. SPECTRUNCULUS.*

Division D.

Preorbital bone longer than deep; operculum posterior margin shorter than inferior; eye equal length muzzle, 3·5, 3·75 in head; latter, 3·75, 4 times, depth 4·75—5 times in length; scales 7—38—3; anal radii 9, *H. RUBRICROCEUS.*

Preorbital deeper than long; posterior margin operculum longer than inferior; chin projecting beyond muzzle, maxillary not reaching line orbit. Eye 3·25 in head, equal muzzle; head broad, 4 times in length; scales large, 5 above lateral line, . *H. LACERTOSUS.*

HYBOPSIS LONGICEPS Cope, sp. nov.

Form elongate, caudal peduncle not contracted; profile flat to nares, then obliquely descending; vertex gently convex; orbit $\cdot 25$ greater than frontal width, longer than deep. Preorbital bone much longer than deep; maxillary not attaining line of orbit. Dorsal fin mostly nearer end of muzzle than basis of caudal, in small specimens equidistant. Inferior fins short, none reaching the following. Fourteen rows scales anterior to dorsal fin. Operculum considerably larger than posterior margin.

Total length 2 in. 4 lin.; do. to basis dorsal 13.5 lin.; depth at first anal ray 4.6 l.

Color in life translucent, with a well-marked lateral silver band, which is marked by a black speck at the origin of each tube of the lateral line.

This species is moderately abundant in the head-waters of the Roanoke in Montgomery, and of the James in Giles County, Va.

HYBOPSIS SPECTRUNCULUS Cope, sp. nov.

This species can be recognized by its broad head, remarkably thick muzzle, large eye, and olivaceous colors.

Mouth slightly oblique, maxillary attaining line of orbit; preorbital bone longer than high. Head nearly broad as deep; depth at posterior margin orbit equal length from end muzzle to posterior margin pupil. Dorsal nearer caudal than end of muzzle, former distance measuring to anterior to orbit in latter.

Total length 2 in. 6.75 lines; depth at dorsal 4 lin.; at last anal ray 2.5; width of parietal region 3 lines.

Color olivaceous, below silvery white; a leaden band along the sides, and conspicuous black spot at base of caudal. Head above, and margins of scales above the lateral line, with bases of dorsal and anal fins, blackish. Edges of pectorals, centres of ventrals and anal orange; dorsal membrane red-orange.

Inhabits in abundance Bear Creek, a tributary of the middle fork of the Holston River, in Smyth Co., Va., also probably the adjacent tributaries of the same stream, the Hungrymother and Chilohoway Creeks.

HYBOPSIS RUBRICROCEUS Cope, sp. nov.

This species has the general form of *Hypsilepis cornutus*, having a less depressed form than the species of the preceding sections of the genus. The lateral line is distinctly decurved. The colors are most brilliant, presenting a marked contrast to those of other species, excepting the *H. chalybæus mihi*, type of the section. The latter fish I found last spring in great abundance in the dam of Brown's Mills, in middle New Jersey. The females were filled with ova, which they were about to deposit. The largest specimens did not attain more than $\cdot 25$ inch above the

measurement I gave in Monogr. Cyprinidæ Pennsylvania. The colors were brownish orange above and below, with a burnished black lateral band.

In the *H. rubricroceus* the combination of colors is very fine, and would render it a great ornament to aquaria. A bluish-leadene band extends from the superior angle of the operculum to the middle of the caudal, above which the color is brownish-orange; below it a narrow golden band is sometimes present, and the length of the lateral line vermillion. The same color extends over the chin, both lips, and the ends of the muzzle; in highly colored specimens over the pectoral region also; lower regions generally rich yellow. Iris and preorbital bone pearly blue.

The dorsal fin is nearer the basis of the caudal than to the end of the muzzle; the caudal peduncle contracted behind anal. Muzzle a little compressed, end of maxillary attaining line of orbit. Operculum long as its anterior margin. The pectoral fins barely attain the ventrals, and the latter reach the vent. The concentric lines on the scales of this fish are stronger than the radii; there are 19 rows anterior to the dorsal fin. The isthmus is not of the narrowest type.

Length 3 inches; depth head at middle orbit 3.5 lines; of body at dorsal 6 lines; at last anal ray 3.1 lines.

This fish is abundant in the same localities as the last, and several small specimens were taken near the mouth of Tumbling Creek, which rises in the Clinch Mountain, and flows into the north fork of the Holston. Many specimens are infested with the *Achlya*.

HYBOPSIS LACERTOSUS Cope, sp. nov.

This is one of the largest species of the genus, and, though taken at the same time as the last, displayed none of its bright colors. It is particularly characterized by its broad and deep head, and large scales. The mouth is wide, measured from canthus to canthus longer than from same to end of symphysis of mandible. The interorbital width is equal to the longitudinal diameter of the large eye, which latter exceeds the vertical diameter. The pectoral fins do not reach the ventrals. The concentric striæ of the scales are much more delicate than in the *H. rubricroceus*, and are interrupted by the strong radial grooves.

Total length 4 in. 4 lin.; length of head 10.5 lin.; depth of do. posteriorly 7.5; depth at last anal ray 4 lin.

Silvery, dorsal region and top of head dusky.

Habitat.—Four specimens from Bear Creek, middle fork of Holston River, Va.

ALBURNELLUS Girard.

ALBURNELLUS JACULUS Cope.

Trans. Amer. Philos. Soc. 1866, 387.

This species abounds in the Kanawha River and its principal tributaries, seeking

the main channels, seldom the small streams, as observed also in Michigan. Our specimens exhibit seven scales above the lateral line as frequently as six. Largest specimen 3 in. 1.5 lines.

In life pale olive above, with a dorso-lateral concealed golden line; sides and below silvery, often rose-colored.

ALBURNELLUS MICROPTERYX Cope, sp. nov.

This species approaches the *A. jaculus*, and differs in the smaller size and more backward position of the dorsal, the smaller ventrals and other fins, the shorter head, and the larger scales. The latter are (5)6—39—2; the head 4.5 times to basis caudal instead of 4 times. The ventrals cease below the fifth dorsal ray, instead of the last. Height of dorsal six times from origin dorsal to front of orbit; five times in *A. jaculus*. It originates opposite the posterior third of the ventral; in *A. jaculus* opposite the anterior fourth or third.

Orbit equal length of muzzle; lateral line considerably decurved; greatest depth in length (exclus. caudal) 5.5 to 5.75 times. Total length 2 in. 8 lin.

Habitat.—The Holston River. Two specimens of this species were compared with one hundred of the preceding.

CHROSOMUS Rafin. Agass.

CHROSOMUS OREAS Cope, sp. nov.

This species is probably the most varied and brilliant in coloration of the known species of our fresh-water fishes. It is nearly allied to the *Chr. eos* Cope, from which it may be known by the few following structural features:

C. eos: The preorbital bone is deeper than long, and reaches the extremity of the maxillary, which latter does not reach the line of the orbit; the supero-posterior margin of the operculum is strongly concave; the parietal branch of the mucous tubes is not developed.

C. oreas: The præorbital bone is longer than deep, falling considerably short of the extremity of the longer maxillary, which attains the line of the orbit; supero-posterior margin of the operculum straight or convex; parietal mucous tube well developed.

As features less likely to prove constant, the *C. oreas* are all deeper and stouter, the depth entering the length 4.5 times; in the *C. eos* 5 times. The lateral line is distinct often to opposite the dorsal fin in *C. oreas*, in *C. eos* a trace visible on one side in one of four specimens. I have elsewhere stated the line to be absent, but the character is not constant in that species or in *C. erythrogastrer*.

The pattern of coloration in the two fishes is different. In *C. eos* a black band extends from the end of the muzzle to the origin of caudal fin, uniting on the peduncle

with a superior dark line; in *C. oreas*, a broad black band extends from the end of the muzzle to the middle of the basis of the anal fin; another distinct band originates on the middle of the side above the anal, and terminates at the origin of the caudal. If a superior dark line be present, it extends to the basis of the caudal without union with the median band.

Teeth 5—5. Orbit 3·5 in head, equal muzzle in adults, less in young. Head four times in length (basis caudal). Parietal region convex, even in largest specimens, end of muzzle obtuse. Anal rays elongate, in males a little shorter than dorsal, in females notably longer. Scales, longitudinal series 27—8, transverse 67—9; forty rows anterior to dorsal fin. Radii, D. i. 8. C. 19. A. i. 8. V. very short, 8. P. short, 12. Total length largest specimen 2 in. 11 lin. End muzzle to origin dorsal 16 lin.; from latter to basis caudal 13·25 lin.

A silver lateral band extends to the basis of caudal above the black ones; dorsal region above this olive-green, with black cross-bars, which are most distinct laterally. Below the black bands bright crimson, also on operculum and end of muzzle, but silver on suborbital region. Anterior to pectoral fins, including edge of upper jaw, deep black. All the fins deep yellow, the anal red at the base, dorsal same, with black edging above.

Habitat.—The mountain streams forming the head of the Roanoke, in Montgomery Co., Va. The females, which are larger than males, and less brilliant, deposit their eggs towards the end of the seventh month.

HYBORIYNCHUS Agass.

HYBORIYNCHUS SUPERCILIOSUS Cope, spec. nov.

Char.—The head at the orbits wider above than below; least interorbital width 1·5 length of head and muzzle above, preorbital width greater. A short barbel at the oral canthus. Vertex, front and mouth black; sides slate.

Descr.—Form elongate, with deep caudal peduncle and short caudal fin. Muzzle excessively obtuse, with three transverse series of tubercles, the inferior of seven, median of five, and superior of two. Mouth very small, inferior, with a distinct dermal appendage at the angle. Supranareal crests strongly developed; vertex rugose through the projection of the ossified tubes of the mucous system; interopercular bone similarly furnished. Orbit half interorbital width, four times in length of head. Four specimens are of rather more elongate form than the others; in them the length of the head enters the length 4·5 times, in the others 4 times; in the first the depth of the body enters the length 5·25 times, in the others 5 times. Scales 6—41·3—4(3). Fins all small, the dorsal longer than high; in large

specimens, the third ray much longer than the second and first articulated. Raddi D. i. 8. C. +18+. A. i. 7. V. i. 8. P. 15.

Total length 3 in. 9 lin.; from end of muzzle to origin of dorsal 1 in. 7 lin.; from do. to origin of caudal 1.5.

General color above and on the sides slate-blue; top of head and end of muzzle with lips leaden-black. Dorsal and caudal fins black, the former pale at base and margin. Anal with a posterior black spot.

Although the physiognomy of this species is marked, its distinguishing characters above given, as compared with the variable *H. notatus*, are not many. The cranium is much more rugose in adults, and the form of the dorsal fin peculiar; the latter is quite similar to that of *H. notatus* in younger specimens.

This fish occurs rather rarely in the tributaries of the Kanawha River, where the latter passes the highest ranges of the Alleghenies.

HYBORHYNCHUS NOTATUS (Raf.) Agass.

Abundant in muddy portions of all the tributaries of the Kanawha.

CAMPOSTOMA Agassiz.

CAMPOSTOMA ANOMALUM (Raf.) Agass.

This species abounds in the tributaries of the Roanoke, Kanawha, and Holston. All present the dentition given by Agassiz, 1.4—4.0; occasionally the outer tooth is present on the right side also. The *C. dubium* does not differ otherwise, and the *C. callipteryx* must be regarded as synonymous, being founded on a male of shortened form and elevated front; some similar specimens occur from Sinking Creek. Specimens vary in having the head enter the length from 4.5 to 5 times. The species of the genus are then four, viz.: *C. anomalum* Raf., *C. mormyrus* Cope, *C. gobioninum* Cope, and *C. hippops* Cope.

TERETULUS Rafin., Cope emend.

Ptychostomus Agass., Amer. Journ. Sci. Arts, xix, 88.

The essential character of this genus is the division of the natatory bladder into three chambers, while *Catostomus*, and all *Cyprinidæ*, exhibit but two. This feature is accompanied by plicate lips, as Agassiz has indicated, and nine radii to the ventral fin, already pointed out by Rafinesque. The species are the largest scaled of the typical suckers. Leseur and Valenciennes have pointed out the generic features in the *P. macrolepidotus*; Prof. Baird informs me that it occurs in *Pt. florealis* Bd., and I find it in *Pt. cervinus* and *Pt. duquesnei*. It no doubt exists also in the *Pt. aureolus*. Other species described by Baird and Girard from the south-west probably possess it.

It is difficult to assign a name to this genus. Rafinesque proposes it upon untenable characters, and includes with it species of *Moxostoma* and *Catostomus*. Agassiz purified it of these elements, but did not express its essential character, apparently relying on the plicate lips. I have taken the older name, leaving for others the final decision.

TERETULUS CERVINUS Cope.

This is the smallest species of the genus, if, as is probable, my specimens are adult. The longest is 6 in 9 lin. in length. The colors are rich, but not showy.

Form elongate slender, depth very little longer than length of head; $\cdot 2$ the length.

Scales everywhere equal, 5—43—5, 15 anterior to dorsal fin. Head elongate, depth at orbit $\cdot 5$ length, nearly equal parietal width. Eye five times in head (four times in spec. of $\cdot 4$ in.), twice in interorbital width. Muzzle projecting beyond mouth; lips narrow, strongly plicate. Dorsal fin scarcely longer than high; anal reaching to basis of caudal; pectoral to below dorsal. Radii, D. i. 11. A. i. 7. V. 10. P. 14. Caudal half length forked.

Color: above brown, commissures of scales shaded dark chestnut, giving rise to stripes to below the lateral line; belly yellow; fins shaded with red and yellow.

Length of head 13.5 lin.; to basis dorsal 32.6 lin.; to basis anal 4 in. 4.5 lin.; to basis caudal 5 in. 7.75 lin.

The young have a broad brown lateral band, which, as they grow older, breaks into quadrate spots before disappearing.

Abundant in the head-waters of the Roanoke and James Rivers, Va., preferring rapids.

TERETULUS DUQUESNEI Les.

Catostomus Les. *Ptychostomus* Agass. .

Abundant, with fry in the Holston River in the ninth month.

CATOSTOMUS Leseur.

Agassiz. *Decactylus* Raf. sp. *Hylomyzon* Agass.

CATOSTOMUS NIGRICANS Les.

Hylomyzon Agass., l. c.

In the characters of its mouth and natatory bladder this species is evidently a *Catostomus*; it has, however, the nine rays of the *Teretuli*, instead of ten. I am not disposed to attach much importance to this fact.

Abundant in the Roanoke, Kanawha and Holston.

CATOSTOMUS COMMUNIS Les.

Abundant in the Roanoke, James, Kanawha and Holston. Also from the Miami, Indiana.

SILURIDÆ.

Silurids are not abundant in the part of the Holston examined.

NOTURUS Rafinesque.

Three species of this genus are in the museum of the Academy, and may be thus distinguished :

- A band of palatine teeth ; head more than four times in length to basis caudal ; dorsal longer than high ; maxillary barbels short, not reaching pectoral ; yellowish, fins yellow-edged, FLAVUS.*
- No palatine teeth ; head four times to basis caudal ; dorsal higher than long ; maxillary barbels reaching beyond basis pectoral ; brownish, fins black-edged, MARGINATUS.
- No palatine teeth ; head elongate, flat ; a little over three times in length to basis caudal ; maxillary barbels reaching to beyond base of pectoral ; brownish, caudal fin yellow-edged, GYRINUS.

NOTURUS MARGINATUS Baird.

One specimen from Sinking Creek of the Kanawha, and one from the head of James River ; similar specimens from the Susquehanna.

HOPLADELUS Raf. Gill, emend.

HOPLADELUS OLIVARIS Raf.

This fish is abundant in the Kanawha, and is valued as food. It attains a weight of fifty pounds ; one weighing thirty came under my observation. The fry only are found in the creeks. They are very dark, the caudal and some other fins white-edged. When older they are olive, banded with black ; they grow lighter with age, the large individuals being greenish-yellow ; the white fin margins disappear early.

ICHTHÆLURUS Raf. Gill, emend.

ICHTHÆLURUS CÆRULESCENS Raf.

This species abounds in the Kanawha, but is not known above the falls of more than twenty-five pounds weight. It is deservedly valued as a table-fish, and is an important source of supply to the poorer people in the neighborhood of the stream. Confined to the river channels.

* Many specimens in Mus. Academy from the Miami Riv., Indiana, from Elijah Coffin ; also from Michigau, and from the Kiskiminitas, West Pennsylvania.

Noturus gyrinus, *Silurus gyrinus* Mitchell.

Two specimens in Mus. Academy ; one from the Delaware Water Gap, Pa.

CYPRINODONTIDÆ.

FUNDULUS Lac.

FUNDULUS CATENATUS Storer.

Günther, Catal. Brit. Mus. vi, 322.

This species is abundant in some tributaries of the Holston, and reaches a length of five inches. In life it is of a light steel-blue, each scale with a longitudinal ochraceous band; fins spotted with ochre.

ESOCIDÆ.

ESOX Linn.

Species of this genus occur in the head-waters of the Roanoke and James, but the fishermen did not know them from either the Kanawha or Holston.

SALMONIDÆ.

SALMO Linn.

SALMO FONTINALIS Mitchell.

The trout occurs only in the mountain streams that flow from the high ranges of the back-bone of the Allegheny,—the Salt Pond, Big, and Peters Mountains, where it is quite abundant. I did not hear of it in the more eastern range of the Poplar Camp Mountain, nor elsewhere northward of the Tennessee line. It is here not uncommon in the streams that flow from the White Top, on the point of junction of North Carolina, and from the adjacent Balsam Mountain. These I did not see, but they were so described as to render it probable that they are of this species, but of small size. This point is no doubt near the southern extreme of its range.

ANGUILLIDÆ.

ANGUILLA L.

A species of this genus occurs in the Kanawha, but not commonly. Some skins seen. None in the Holston.

My friend O. H. Bryan informs me that, on the approach of winter, the eels bury themselves in the mud in great numbers, at a depth of about a foot. In suitable localities in the Potomac, fifteen miles below Washington, they may be procured during this season in numbers, with gigs.

LEPIDOSTEIDÆ.

LEPIDOSTEUS HURONENSIS Richardson.

A head of a gar from the Holston, at Saltville, is identical with that of this

common species of the Lakes and Ohio. Neither this nor any other bony gar is known to the fishermen on the Kanawha above the falls, near the mouth of the Greenbriar, although the species is common in the Allegheny and its tributaries.

PETROMYZONTIDÆ.

PETROMYZON Linn.

A species of this genus inhabits the upper waters of the Holston. The landlord at Glade Springs, Mr. Thompson, informed me that he had observed one attached to the side of a black bass (*Micropterus*), from which it had torn the scales, and nearly penetrated the abdominal cavity. He also mentioned seeing a black sucker (*C. nigricans*) violently excited, and making great exertions in the water, and unable to pursue a direct course. It became at last so exhausted as to be taken from the water by the hand, when a *Petromyzon* was found attached to one side. Oliver N. Bryan, who resides opposite Mount Vernon, on the Potomac, informs me that it is not uncommon to find them attached to the shad, and that they destroy them by their continued suction.

Sect. III.—*Conclusions.*

Before drawing any general conclusions, I will quote from Agassiz his statement of some of the propositions in distribution; we will see later what approach to their solution can be made:

“I would remark that there is still another very interesting problem respecting the geographical distribution of our fresh-water animals, which may be solved by the further investigation of the fishes of the Tennessee River. This water-course, taking the Powells, Clinch and Holston Rivers as its head-waters, arises from the mountains of Virginia in latitude 37° ; it then flows south-west to latitude $34^{\circ} 25'$, when it turns west and north-west, and finally empties into the Ohio under the same latitude as its sources in 37° .

“The question now is this: Are the fishes of this water system the same throughout its extent? in which case we should infer that water communication is the chief condition of the geographical distribution of our fresh-water fishes; or do they differ in different stations along its course? and if so, are the differences mainly controlled by the elevation of the river above the level of the sea, or determined by climatic influences corresponding to differences of latitude? We should assume that the first alternative were true if the fishes of the upper course of the river differed from those of the middle and lower course, in the same manner as in the Danube, from its source to Pesth, where this stream flows nearly for its whole length under the same parallel. We would, on the contrary, suppose the second alternative to be well

founded, if marked differences were observed between the fish of such tracks of the river as do not materially differ in their elevation above the sea, but flow under different latitudes.”*

Whether different portions of the course of a river differ in their fish-fauna, has been already indicated, and will be further. The question of the importance of water communication, and, to a slight degree, that of latitude, is also to a great extent considered below.

The following table presents at one view the differences and resemblances in the fish-faunæ of the four rivers. They may be in part summed up as follows :

| | No. of species. |
|--|-----------------|
| Common to four rivers, | 5 |
| Common to the Roanoke and James only, | 4 |
| Common to the James and Kanawha only, | 4 |
| Common to the Kanawha and Holston only, | 2 |
| Common to James, Roanoke and Kanawha only, | 1 |
| Total number of species, | 56 |

| ROANOKE. | JAMES. | KANAWHA. | HOLSTON. |
|------------------------------------|------------------------------------|--------------------------------|----------------------------------|
| <i>Poecilichthys flabellatus</i> , | <i>P. flabellatus</i> , | <i>P. flabellatus</i> , | <i>P. flabellatus</i> . |
| | <i>Boleosoma olmstedii</i> , var., | <i>B. olmstedii</i> , var., | <i>Poecilichthys zonalis</i> . |
| | <i>Hystoma blennioperca</i> , | <i>H. blennioperca</i> , | <i>H. blennioperca</i> . |
| | | | <i>H. simoterum</i> . |
| | <i>Etheostoma blennioides</i> , | <i>E. blennioides</i> , | <i>Cottogaster aurantiacus</i> . |
| | | | <i>Percina caprodes</i> . |
| | | | <i>Micropterus fasciatus</i> . |
| | | | <i>Ambloplites rupestris</i> . |
| | | | <i>A. cavifrons</i> . |
| <i>Lepomis ophthalmicus</i> , | <i>Lepomis appendix</i> , | <i>Lepomis microchloa</i> , | <i>Lepomis inscriptus</i> . |
| | | <i>Uranidea carolinæ</i> , | <i>U. carolinæ</i> . |
| <i>Ceratichthys biguttatus</i> , | <i>C. biguttatus</i> , | <i>C. biguttatus</i> , | <i>C. biguttatus</i> . |
| | | | <i>C. hyalinus</i> . |
| | | | <i>C. monachus</i> . |
| | <i>Semotilus corporalis</i> , | <i>S. corporalis</i> , | <i>S. corporalis</i> . |
| | <i>S. rhotheus</i> , | | |
| <i>Argyreus atronasmus</i> , | <i>A. atronasmus</i> , | <i>A. lunatus</i> , | <i>A. lunatus</i> . |
| | | <i>A. nasutus</i> , | |
| | | <i>Phenacobius teretulus</i> , | <i>P. uranops</i> . |
| <i>Clinostomus affinis</i> , | <i>Clinostomus affinis</i> , | | |
| <i>Hypsilepis cornutus</i> , | <i>H. cornutus</i> , | <i>H. cornutus</i> , | <i>H. cornutus</i> . |
| | <i>H. analostanus</i> , | <i>H. analostanus</i> , | <i>H. galacturus</i> . |
| <i>H. ardens</i> , | | | <i>H. coccogenis</i> . |

* On the Fishes from the bend of the Tennessee River, Amer. Jour. Sci. Arts, 1854, 363.

| ROANOKE. | JAMES. | KANAWHA. | HOLSTON. |
|--------------------------------|--------------------------------|----------------------------------|--------------------------------|
| | | <i>Photogenis leucops,</i> | <i>Ph. telescopus.</i> |
| | | Ph. scabriceps, | Ph. leuciodus. |
| Hybopsis longiceps, | Hybopsis longiceps, | | H. spectrunculus. |
| | | | H. rubricroceus. |
| | | | H. lacertosus. |
| <i>Chrosomus oreas,</i> | | <i>Alburnellus jaculus,</i> | Alb. micropteryx. |
| | | | Chrosomus erythrogaster. |
| | | <i>Hyborhynchus notatus,</i> | |
| | | H. superciliosus, | |
| <i>Campostoma anomalum,</i> | | <i>C. anomalum,</i> | <i>C. anomalum.</i> |
| <i>Teretulus cervinus,</i> | <i>Teretulus cervinus,</i> | | <i>Teretulus duquesnei.</i> |
| <i>Catostomus nigricans,</i> | <i>C. nigricans,</i> | <i>C. nigricans,</i> | <i>C. nigricans.</i> |
| <i>C. communis,</i> | <i>C. communis,</i> | <i>C. communis,</i> | <i>C. communis.</i> |
| <i>Exoglossum maxillingua,</i> | <i>Exoglossum maxillingua,</i> | <i>Exoglossum maxillingua,</i> | |
| | | | <i>Fundulus catenatus,</i> |
| | Noturus marginatus, | Noturus marginatus, | |
| | | Hopladelus olivaris, | |
| | | <i>Ichthæurus cærulescens,</i> | |
| Salmo fontinalis, | Salmo fontinalis, | Salmo fontinalis, | Salmo fontinalis. |
| | | ? <i>Lepidosteus huronensis,</i> | <i>Lepidosteus huronensis.</i> |
| <i>Fourteen species.</i> | <i>Nineteen species.</i> | <i>Twenty-seven species.</i> | <i>Thirty-four species.</i> |

In this list, the most abundant species are in italics.

Excluding from consideration the following seven, probably universally distributed species:—

| | |
|--------------------------|-----------------------|
| Boleosoma olmstedii, | Catostomus nigricans, |
| Ceratichthys biguttatus, | “ communis, |
| Semotilus corporalis, | Salmo fontinalis, |
| Hypsilepis cornutus. | |

| | | | | Species. |
|---|---|---|---|----------|
| There are common to the Kanawha and Allegheny,* | . | . | . | 8 |
| “ “ Holston | “ | . | . | 8 |
| “ “ Kanawha and Susquehanna,* | . | . | . | 8 |
| “ “ Roanoke | “ | . | . | 2 |
| “ “ Holston | “ | . | . | 0 |

These comparisons have reference to species of Classes III and IV, since those of I and II do not enter the region examined. Compare, however, the following list from Class II, embracing the most abundant species from the lower part of the James River (near Tuckahoe Creek), with the mountain list:

*For lists of the Cyprinidæ of these rivers, see "The Cyprinidæ of Pennsylvania," Trans. Amer. Philos. Soc. 1866, 356.

| | |
|---|------------------------------|
| Pomoxys sp., | <i>Umbra annulata</i> , |
| <i>Ambloplites rupestris</i> , | <i>Esox</i> , 2 sp., |
| <i>Hemioplites simulans</i> , | <i>Semotilus rhotheus</i> , |
| <i>Enneacanthus guttatus</i> , | “ <i>corporalis</i> , |
| <i>Pomotis maculatus</i> , | <i>Hypsilepis cornutus</i> , |
| <i>Micropterus nigricans</i> , v. aff., | <i>Catostomus communis</i> , |
| <i>Haplochilus</i> sp., | <i>Amiurus</i> sp., |
| | <i>Anguilla</i> sp. |

From the above enumerations two points are evident:

I. That species not generally distributed exist in waters on different sides of the great water shed;

II. That the distribution of the species is not governed by the outlet of the rivers, streams having similar discharges (Holston and Kanawha, Roanoke and Susquehanna) having less in common than others having different outlets (Kanawha and Susquehanna, or James).

In view of the first proposition, and the question of the origin of species, the possibility of any original or subsequent mingling of the fresh waters suggests itself as more probable than that of distinct origin in the different basins.

Two questions arise: I. Has any destruction of the river faunæ taken place since the first elevation of the Alleghenies, when the same species were thrown into waters flowing in opposite directions? II. If so, has any means of communication existed, at any time, but especially since the last submergence, by which the transfer of species might occur?

The Allegheny region is believed to have been elevated at the close of the palæozoic ages, accompanied south and west of the Kanawha River by faulting on an immense scale. At that time the valleys through which the larger of the present water courses flow were established. Had the valleys been elevated above the ocean level at that time, the sources of the streams would have been more widely removed than now, at least as respects their habitability by fishes, since the mountains would have been much more elevated than at present. As faults of eight thousand feet are found, according to Rogers, in this region, the mountains themselves would have risen beyond the snow line. The most elevated points of the same chain in this region are now the Balsam Mountain, 5500 feet, and the Salt Pond Mountain, 5300 feet, indicating the great denudation which has followed.

It is quite possible, indeed, that nothing more than the summits of the mountains rose above the ocean for a considerable period subsequent to their first elevation, and that the enormous denudation which they have undergone was produced by the Atlantic waves beating on them for a considerable period, as the continent slowly

rose.* Thus the inhabitants of the fresh waters on either side could have had no descent from a common fresh-water ancestry, but must have been supplied by independent creations or migrations, or descent from marine types. There has been no doubt a later submergence of the Allegheny region both before and subsequent to postpliocene times, as indicated by the remains of the Eocene at Brandon, Vermont, and of the same at Monte Alto, Pennsylvania, by the great number of smaller and larger boulders containing fossils from the Silurian and Carboniferous rocks scattered over the Miocene regions of Eastern Maryland and Virginia. The destruction of the greater part of a ridge by denudation, in Wythe Co., Va., near the Kanawha River, left remains of the floor and galleries of a cavern or caverns along a line of eight miles, which contain a limestone breccia of postpliocene age, containing remains of *Tapirus*, *Dicotyles*, *Equus*, *Castor*, *Lepus*, and modern Pulmonates. There was, then, one submergence to deposit the early tertiaries, and another to denude postpliocene deposits; no doubt the same that has stratified the drift. The latter occurrence has been also connected with local phenomena, dependent on the condition of the Kanawha (new) River, which, near the ridge in question, has brought down *from the south* huge boulders of chlorite and Silurian conglomerate, to a point below its passage through both the Poplar Camp Mountains above, and the ridges in question. The great streams of immense, somewhat rounded sandstone rocks which occur in many places on the slopes of the mountains of the back-bone in this region, might readily have been gathered into submarine ravines and gorges, as they were undermined by the wave action at the surface of the ocean. A species of local drift, however, occurs. On the hills from a quarter to a half mile from the right bank of the Kanawha (new) River, at Eggleston's Springs (which is at the eastern base of the main Allegheny back-bone, but separated from the valley by three mountains), at an elevation of from 250 to 400 feet, a bed of coarse and fine gravel, in red clay, forms the crest of a hill of three miles in extent. On the opposite side of the river, four miles lower down, opposite Pearisburg, there is a ridge covered with very coarse gravel; the stones several inches in diameter, and of white semi-transparent quartz, which I did not find in the sandstones of the adjacent mountains. A similar coarse, local drift is seen on the bank of the Roanoke about 200 feet above the level of the water, near Salem, Roanoke County, where the railroad cuts it. Similar deposits have not been observed away from the neighborhood of these rivers. This distribution of these deposits would indicate the action of streams flowing at a level of, at the most, 350 feet higher than now, perhaps owing to the opposition of remains of fractured mountain barriers which cross both streams shortly below these points. These have so far yielded to the action of the water, as to be indicated now by nothing more than

* This view is expressed by Rogers, *Geology Pennsylvania*, ii, p. 924.

rapids. It is probable that such obstructions to the east and westward flowing rivers may have existed for a long time where they pass the Allegheny ridges, but the breaches which they selected could only have been results of the greatest of the denuding agencies which have existed in that region.

Such an elevation of waters would not, however, have caused a communication of the head streams of the Holston and Kanawha, nor indeed of any of the four rivers, especially as it is probable that at that time they were separated by elevations somewhat greater than now.

Of the three submergences here indicated, it is not possible that of the modified drift should have been so deep as to have reduced mountains of 10,000 and 20,000 feet to their present elevation; otherwise its deposit over the country would have been more extensive. The submergence during which the tertiaries of Brandon and Monte Alto were deposited could not have been profound enough for this result, otherwise these beds would not contain fruits and other remains of shore plants so abundantly. As we have no indications of any other submergences, the period of denudation may most probably have been that during which the Alleghenies slowly rose from the bed of the carboniferous ocean; for deposits made at such a period have at least had time for removal and reappearance in our extensive cretaceous and neocomian beds of the east.

Hence no destruction of the fishes since that period can be asserted to have been caused by submergences.

The destruction of the river fauna cannot be accounted for on the supposition of the poisoning of the waters by sulphhyric acid, vitriol, alum, or other waters. The thermal and mineral springs of Virginia have, in former periods of greater activity, no doubt, poisoned many streams, but not probably all those of any one basin at one time. Therefore it is improbable that any one species of fish could have been destroyed in this way. The occurrence of greater cold, and more extensive deposits of ice and snow during the glacial epoch of the north, could only have driven fishes to lower waters. So an opportunity seems to have offered for a continuous "descent with modification," as has been already suggested in the first section.

We may then turn to another means of communication. The subcarboniferous and Devonian limestones, which form the beds of the valleys in this region and portions of the bases of the mountains, are everywhere penetrated by caverns, and in many places traversed by faults. Now it appears quite possible that the waters of one stream, in some elevated part of their course, might occasionally have sunk into a fault, or penetrated the limestone on one side of a monoclinal mountain, and so have found its way into the opposite valley of a stream of another hydrographic basin, carrying with it several species of fishes. That the upper waters were chiefly concerned in this commingling is indicated by the fishes which are common to any two

rivers. These are of the genera *Salmo*, *Poeciliichthys*, *Rhinichthys*, *Clinostomus* and *Exoglossum*, which seek the highest streamlets. This is especially the case with the *Rhinichthyes*, which are particularly numerous above falls of eighteen and twenty feet. There is also *Uranidea*, the species of which abound in the cold waters of the great springs which burst from subterranean courses in many places in this region. I never saw them in the subterranean portions of such waters, though I have had but few such streams to examine. These species I have enumerated in Class IV.

It appears to the writer that the occurrence of species not universally distributed, in the heads of these adjacent but distinct basins, may be best accounted for in this manner, after an examination of the ground. No attempt is made to account for the distribution of the seven cosmopolite species in this way.

Prop. II, that the fish fauna of rivers of the same geographical district have but a slight relation to their points of discharge, may be further illustrated by comparing the faunæ of two adjacent tributaries of the Kanawha, Strouble's and Sinking Creeks. Their mouths are fifteen miles apart.

One species, *Rhinichthys lunatus* Cope, was found very abundant in both; if anything, *Semotilus corporalis* Mich. and *Exoglossum maxillingua* Hald. were more common in Strouble's Creek. Of these two the *Exoglossum* was very rare, and the *Semotilus* absent, in Sinking Creek. The most common species of the latter were *Photogenis leucops* and *P. scabriceps* Cope, neither found in Strouble's Creek. No *Hypsilepis* or *Ceratichthys* in Strouble's Creek, neither uncommon in Sinking Creek; the same may be said of *Uranidea* and *Hyostoma* Agass. Species of *Campostoma*, *Hyborhynchus*, *Catostomus* and *Poeciliichthys* abounded in both. Individuals were equally abundant in the two streams, which flow alike through limestone valleys. They differ in important particulars, however; Sinking Creek, as its name indicates, is not permanent throughout its course, sinking every summer for three miles from its mouth. Strouble's Creek is permanent, and passes for part of its course through the coal region of Price's Mountain, thus receiving streams containing copperas, etc., in solution, and carrying down coal dust, which experience has shown to be very fatal to fishes.

In the case of Bear Creek, a tributary of the middle fork of the Holston, there were taken nine species, of which five were not found, after much examination, in the streams of the north fork. These were *Semotilus corporalis*, *Hybopsis lucertus*, *H. rubricroceus*, *H. spectrunculus*, and *Chrosomus erythrogaster*. And in another branch of the middle fork, twenty miles below, all the north fork species were found, and but one or two individuals of one species of the five of Bear Creek, *i. e.*, *Hybopsis spectrunculus* Cope. At the time I visited these streams the last mentioned was strong and full, while Bear Creek was reduced to a chain of pools. The difference of fauna is no doubt connected with this fact.

It is known that the Rocky Mountains, elevated at the commencement of Cænozoic time, divide fish faunæ which are in many respects very different, though numerous genera exist on both sides the range.

It would appear, from the previous considerations, that the distribution of fresh-water fishes is governed by laws similar to those controlling terrestrial vertebrates, and other animals, in spite of the seemingly confined nature of their habitat. With this general principle in view, we may revert briefly to this distribution over the eastern district of the nearctic region.

That this is a single though large zoological district, is indicated by the distribution of several species over its entire area, or nearly so, so far as yet examined: those of *Semotilus*, *Ceratichthys*, *Hypsilepis*, *Catostomus*, etc., or by the universal recurrence of the same in suitable situations; and by the representation of these and other genera, by nearly allied species, in its different portions. The fauna of the tributaries of the Mississippi constitutes, it might be said, that of our district; while the slight variations presented by the Atlantic coast streams might be regarded as exceptional. The fauna of the great lakes combines the peculiarities of both, possessing as a special peculiarity (I) which belongs to the lake region, which, in the district, commences at latitude 42°, and extends to the arctic regions, the range of the genus *Coregonus*.

The peculiarity of the Atlantic subdistrict (II) may be said to be the abundance of *Esox*, *Salmo* and *Anguilla*, and the absence of *Haploidonotus*. The first two are abundant in the lake region, while *Anguilla* has but a partial distribution there, and *Haploidonotus* does not occur. In (III) the Mississippi basin *Esox* is represented by but few species, and remarkably few individuals. *Salmo* occurs abundantly in the upper parts of the Missouri tributaries, exists in the western mountain streams of the Alleghenies, becoming rare in those of the Kanawha, and only occurring near the highest summits in those of the Tennessee, south to the line of North Carolina. The gradation from the Mississippi grouping of species to the Atlantic is very gradual, and takes place in successional order from those emptying into the Gulf of Mexico towards the east and north-east, until we reach the rivers of Massachusetts and Maine, where the greatest modification of the fauna exists. The latter fact has been pointed out by Agassiz, who calls this region a "zoological island," and enumerates* the characteristic nearctic genera which are wanting there. I give now a list, showing the points at which Mississippi genera cease as we follow the rivers of the Gulf and Atlantic coasts, so far as our present knowledge extends:

Gulf rivers. *Haploidonotus* has not yet been indicated from eastward of these.

Roanoke. *Cumpostoma* ceases here.

* Amer. Journ. Sci. Arts, xvii, 363, 1854.

James. *Micropterus*,* *Ambloplites* and *Pomoxys* cease.

Potomac. *Percopsis*, according to Prof. Baird (verb. com.), ceases here.

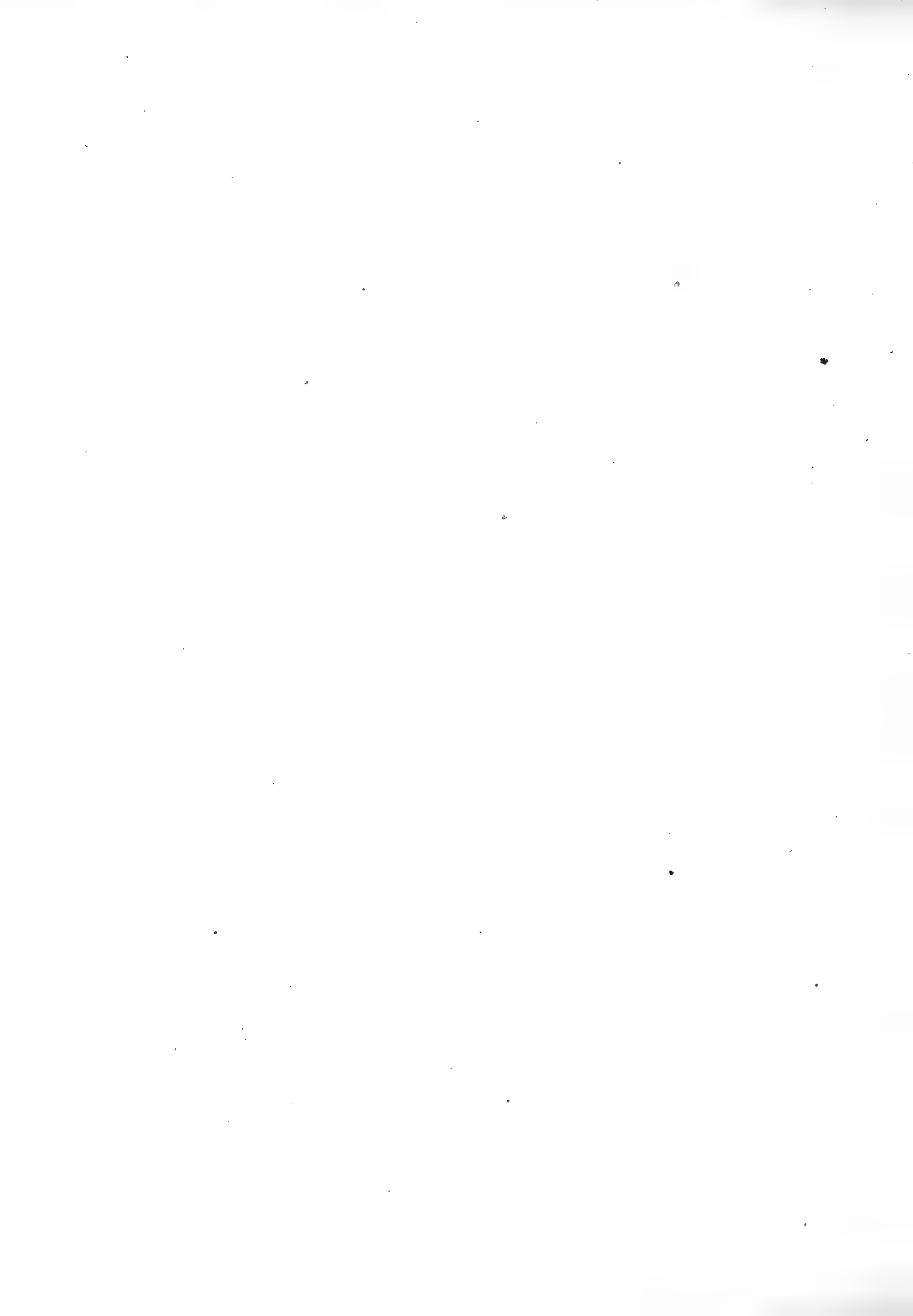
Susquehanna. *Ceratichthys*, *Exoglossum*, *Chrosomus* and *Carpiodes* cease.

Delaware. *Clinostomus*, *Hypsilepis analostanus*, *Enneacanthus* and *Lepidosteus* cease.

Hudson. *Semotilus corporalis*, according to F. W. Putnam (verb. comm.), ceases.

The Atlantic types remaining in the New England district (IV) are first, then, *Salmo*, *Esox*, *Anguilla*, *Perca*; and, secondly, the general types *Semotilus*, *Hypsilepis*, *Stilbe*, *Hybopsis (bifrenatus)*, *Fundulus*, *Amiurus*, and by the Lake types *Lota* and *Coregonus*.

* It appears from statements made to me by J. Delaplaine, of Wheeling, and Prof. J. B. Davis, of Roanoke College, Va., that the *Micropterus fasciatus* was introduced from sixteen to twenty years ago into the head waters of the Potomac, from the Ohio, and that they have greatly increased since that time. They are now said to be very abundant in the Shenandoah. By subsequent reference to the Smithsonian Report for 1854 (p. 290), I find that this fact has been recorded there by John Eoff, of Wheeling, who states that this transfer, which has been so successful in its results, was made by William Shriver, of the same place.



ART. VI.—*New Unionidæ, Melanidæ, etc., chiefly of the United States.*

BY ISAAC LEA.

UNIO HOMSENSIS. Pl. 29, fig. 63.

Testa plicata, suboblonga, inæquilaterali, ad latere planulata, postice angulata; valvulis crassis, antice crassioribus; natibus prominulis, ad apices valde corrugatis; epidermide tenebroso-fusca, micanti; dentibus cardinalibus crassis, erectis crenulatisque; lateralibus longis, crassis subrectisque; margarita vel purpurea vel salmonea et iridescente.

Shell plicate, somewhat oblong, inequilateral, flattened at the sides, angular behind; valves thick, thicker before; beaks rather prominent, much corrugated at the tips; epidermis dark brown and shining; cardinal teeth thick, erect and crenulate; lateral teeth long, thick and nearly straight; nacre purple or salmon colored and iridescent.

Proc. Acad. Nat. Sci. 1864, p. 285.

Hab.—Lake Homs, (ancient Emesa,) River Orontes, North Syria, C. M. Wheatley. My cabinet and cabinet of Mr. Wheatley.

Diam. .8, Length 1.4, Breadth 2.5 inches.

Shell plicate, somewhat oblong, inequilateral, flattened at the sides, angular behind; substance of the shell thick, thicker before; beaks rather prominent, much corrugated at the tips; ligament large and long; epidermis dark brown, shining, with six to eight nearly equidistant marks of growth; umbonial slope rounded; posterior slope compressed and filled with small folds; cardinal teeth thick, erect and crenulate, single in the right and double in the left valve; lateral teeth long, thick and nearly straight; anterior cicatrices distinct, deeply impressed and corrugate; posterior cicatrices distinct, large and well impressed; dorsal cicatrices placed on the upper part of the cavity of the beaks; cavity of the shell rather shallow; cavity of the beaks rather deep and angular; nacre purple or salmon colored and iridescent.

Remarks.—Two fine specimens and two odd valves were received; one is beautifully perfect and corrugate for some distance from the tips. The epidermis is without rays, is smooth and shining, and the marks of growth very regular. The folds on the most perfect specimen are numerous and very regular. This species is so much like some of the very thick *U. fluviatilis*, which have been found in the interior of Pennsylvania and some from Virginia, that one might be mistaken for the other, but

for the folds and corrugations. The beaks of *Homsensis* are higher and their folds are very different. The anterior part of the shell is also thicker. This is among the many *Unionidæ* which Mr. Wheatley has been able to procure from Western Asia through his friend the Rev. Mr. Beadle.

UNIO ORPHAENSIS. Pl. 29, fig. 64.

Testa lævi, oblonga, inæquilaterali, antice rotundata, postice obtuse subbiangulata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, ad apices crebre et minute undulatis; epidermide olivacea, virido-radiata; dentibus cardinalibus parvis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus longis subrectisque; margarita vel alba vel aurea et valde iridescente.

Shell smooth, oblong, inequilateral, rounded before, obtusely biangular behind; valves somewhat thick, thicker before; beaks somewhat prominent, closely and minutely undulate at the tips; epidermis olivaceous, with green rays; cardinal teeth small, compressed, crenulated and double in both valves; lateral teeth long and nearly straight; nacre white or golden and very iridescent.

Proc. Acad. Nat. Sci. 1864, p. 285.

Hab.—Tigris River, near Mardin, Pashalic of Orpha, Asiatic Turkey, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. 1,

Length 1·4,

Breadth 2·7 inches.

Shell smooth, oblong, inequilateral, rounded before, obtusely biangular behind; substance of the shell somewhat thick, thicker before; beaks somewhat prominent, closely and minutely undulate at the tips; ligament large and deep brown; epidermis olivaceous, with green rays on the posterior part and with distant, well defined marks of growth; umbonial slope rounded; posterior slope narrow-elliptical; cardinal teeth small, compressed, crenulate, corrugate and double in both valves; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks rather deep and angular; nacre white or golden and very iridescent.

Remarks.—Quite a number of specimens of different ages were kindly sent to me by Mr. Wheatley for my inspection. In outline it is very near to some varieties of *complanatus*, but it is more inflated and differs in the teeth. None of the specimens were purplish, nor will it be found, I presume, to possess that color. Generally the nacre is golden, but sometimes white. Some of the specimens have fine green rays on the posterior half. The full grown individuals have four or five broad marks of growth. The first growth, forming the beautifully undulate tips, are in all the speci-

mens before me almost white, some of them quite so. The anterior portion of the valves are quite sulcate in some specimens, but it does not pervade enough to put this species in the sulcate division.

UNIO KULLETHENSIS. Pl. 29, fig. 65.

Testa lævi, oblonga, valde inæquilaterali, ad latere planulata, antice subtruncata, postice obtuse angulata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide luteola, postice radiata et tenebroso-viridi; dentibus cardinalibus parvis, acuminatis crenulatisque; lateralibus longis subrectisque; margarita vel alba vel aurea et valde iridescente.

Shell smooth, oblong, very inequilateral, flattened at the sides, subtruncate before and obtusely angular behind; valves thick, thicker before; beaks slightly prominent; epidermis yellowish, radiate and dark green behind; cardinal teeth small, pointed and crenulate; lateral teeth long and nearly straight; nacre white or golden and very iridescent.

Proc. Acad. Nat. Sci. 1864, p. 285.

Hab.—Near Mardin, in a stream from Kulleth falling into the Tigris River, Asia.
C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .8,

Length 1.2,

Breadth 2.1 inches.

Shell smooth, oblong, very inequilateral, flattened at the sides, subtruncate before and obtusely angular behind; substance of the shell thick, thicker before; beaks slightly prominent; ligament rather short and light brown; epidermis yellowish, radiate and dark green behind, with rather approximate lines of growth; umbonial slope rounded; posterior slope rather depressed and covered with green rays; cardinal teeth small, pointed, double in the left and treble in the right valve; lateral teeth long, nearly straight and rather thick; anterior cicatrices distinct and deeply impressed; posterior cicatrices distinct and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks subangular; nacre white or golden and very iridescent.

Remarks.—I am indebted to Mr. Wheatley for several specimens of this species, with other very interesting ones from the fresh waters of Asia Minor, which seem to have escaped the attention of Naturalists who have travelled through this part of Asia. *Kullethensis* is nearly allied to *Mardinensis*, herein described, but it is a thicker shell and is more inequivalve. In outline it is nearest, of the American species, to *Whiteianus*, (nobis) but in most of its characters very different. The beaks of all the specimens before me are eroded so much as to prevent the character of them being well ascertained, but an appearance of undulation remains sufficiently to designate that they possessed such corrugated wrinkles as most of the species of Western Asia.

UNIO MARDINENSIS. Pl. 30, fig. 66.

Testa lævi, suboblōnga, inæquilaterali, antice rotundata, postice obtuse angulata; valvulis subtenuibus, antice crassioribus; natibus prominulis, ad apices crebre et minute undulatis; epidermide luteola, valde radiata; dentibus cardinalibus parvis, acuminatis crenulatisque; lateralibus sublongis subrectisque; margarita aurea et valde iridescente.

Shell smooth, suboblong, inequilateral, rounded before, obtusely angular behind; valves rather thin, thicker before; beaks slightly prominent, closely and minutely undulate at the tips; epidermis yellowish and much rayed; cardinal teeth small, acuminate and crenulate; lateral teeth rather long and nearly straight; nacre golden and very iridescent.

Proc. Acad. Nat. Sci. 1864, p. 286.

Hab.—Tigris River near Mardin, Asiatic Turkey, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .8, Length 1.2, Breadth 1.9 inch.

Shell smooth, suboblong, inequilateral, rounded before, obtusely angular behind; substance of the shell rather thin, thicker before; beaks slightly prominent, closely and minutely undulate at the tips; ligament rather short and light brown; epidermis yellowish and much rayed on the posterior portion, with rather distant lines of growth; umbonial slope rounded; posterior slope raised and usually dark green; cardinal teeth small, acuminate and crenulate; lateral teeth rather long and nearly straight; anterior cicatrices distinct and well impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks subangular; nacre golden and very iridescent.

Remarks.—Quite a number of specimens of different ages are before me. The younger ones are perfect in the beaks, which display a number of irregular wrinkles, which vary somewhat in different specimens. The cardinal tooth is double in the left and treble in the right valve. The nacre is rich, being usually golden and satin like. In nearly all the specimens the posterior portion is covered with dark green rays. It is nearly allied to *Kullethensis*, herein described, but that shell is more inequilateral, has a less elevated posterior slope and is a thicker shell.

MONOCONDYLÆA MARDINENSIS. Pl. 30, fig. 67.

Testa lævi, arcuata, valde inæquilaterali, ad latere compressa, antice et postice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, recurvis, ad apices minute undulatis; epidermide tenebroso-fusca; dentibus cardinalibus parvis, erectis compressisque; margarita cæruleo-alba et iridescente.

Shell smooth, arcuate, very inequilateral, compressed at the sides, rounded before and behind; valves rather thick, thicker before; beaks a little prominent, recurved

and minutely undulate at the tips; epidermis dark brown, cardinal teeth small, erect and compressed; nacre bluish-white and iridescent.

Proc. Acad. Nat. Sci. 1864, p. 286.

Hab.—Near Mardin, in a stream falling into the Tigris River, Asia, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .9, Length 1.6, Breadth 3.1 inches.

Shell smooth, arcuate, very inequilateral, compressed at the sides, rounded before and behind; substance of the shell thick, thicker before; beaks a little prominent, recurved and minutely undulate at the tips; ligament large, long and dark brown, with rather distant marks of growth; umbonial slope rounded; posterior slope narrow, slightly raised, with two slightly impressed lines in each valve from the tips to the posterior margin; cardinal teeth small, erect, compressed, inclining to be double in the left valve, the cleft being angular and deep; anterior cicatrices confluent, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed in a row in and above the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather shallow and rounded; nacre bluish-white and iridescent.

Soft Parts.—These were not in alcohol, and were so dried as to present no perfectly developed characters, except that the anal opening was without any papillæ. The *branchial opening* is large, and has large colored papillæ. The palpi seem to be large and subtriangular. No ova or embryos were found in the specimens sent to me by Mr. Wheatley. The mantle is very thin, with a broad margin.

Remarks.—Among a number of interesting shells from Asia I am indebted for this to Mr. Wheatley, who is untiring in efforts to procure from Western Asia the fresh-water shells of that little known country to science. This species has a resemblance to *M. Wheatleyi* (nobis), but that species is not arcuate, and the nacre is brighter and more disposed to be golden, nor does the nacre thicken before. There is also a difference in the color of the epidermis, the *Wheatleyi* being of a light straw color, and having the lines of growth more distant and better defined. The *Mardinensis* has very minute granulations in the cavity of the shell, which along the margin are usually replaced by beautiful minute striæ. Among the species described by M. Bourguignat in De Souley's "Voyage Autour de la Mer Morte," that which comes nearest to this species is *Unio Souleyi*, which is evidently a *Monocondylæa*. It differs from that species in being arcuate, in having larger teeth, in the lines of growth, and other minor characters. The habitat of these shells is thus described in a letter to me from Mr. Wheatley: "These shells are from a stream which flows from Kulleth, joins another from Lore, and together reach the Tigris north of Telshehen. Kulleth is twenty-one miles north, thirty-three east from Mardin, and about fifteen or eighteen miles south of the Tigris."

UNIO EMESAENSIS. Pl. 30, fig. 68.

Testa lævi, subrotunda, inæquilaterali, ad umbones subtumida, antice rotundata, postice obtuse subbiangulata; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominentibus, ad apices valde corrugatis; epidermide rufo-fusca et obsolete radiata; dentibus cardinalibus subcrassis et crenulatis; lateralibus brevibus subrectisque; margarita vel purpurea vel alba vel aurea et valde iridescente.

Shell smooth, subrotund, inequilateral, swollen at the beaks, rounded before and obtusely biangular behind; valves somewhat thick, a little thicker before; beaks prominent and very corrugate at the tips; epidermis reddish-brown and obscurely rayed; cardinal teeth rather thick and crenulate; lateral teeth short and nearly straight; nacre purple, white or golden, and very iridescent.

Proc. Acad. Nat. Sci. 1864, p. 286.

Hab.—Lake Homs, River Orontes, North Syria (ancient Emesa), C. M. Wheatley. My cabinet and cabinet of Mr. Wheatley.

Diam. .8,

Length 1.2,

Breadth 1.7 inch.

Shell smooth, subrotund, inequilateral, swollen at the beaks, rounded before and obtusely angular behind; substance of the shell somewhat thick, a little thicker before; beaks prominent and very corrugate at the tips; ligament short, rather thick and light brown; epidermis reddish-brown, obscurely rayed, with distant marks of growth above and close below; umbonial slope rounded; posterior slope elliptical, slightly raised, with two green rays from the tips to the posterior margin; cardinal teeth rather thick, crenulate, single in the right and double in the left valve; lateral teeth short, rather thick and nearly straight; anterior cicatrices distinct and well impressed; posterior cicatrices distinct, rather large and well impressed; dorsal cicatrices placed nearly in the centre of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks rather deep and angular; nacre white, purple or golden and very iridescent.

Remarks.—I have seven specimens of this species from Mr. Wheatley, collected for him by the Rev. Mr. Beadle. Six of these are marked "Lake Homs, North Syria;" and one "Northern Egypt." There is no doubt of their being the same species, and I cannot doubt but that all are from Lake Homs. The oldest specimen is much eroded, with little epidermis remaining, and the nacre destroyed on the surface of the cavity. The others are younger, and show corrugated wrinkles to the tips of the beaks. This species approaches in outline and other characters to that of *semirugatus*, Lam., which I had, in my "Synopsis," considered a variety of *litoralis*, Lam., but which I am now satisfied is distinct, although very closely allied in many of its characters. The *semirugatus* differs from our shell in being more rounded in outline, and the undulations of the beaks differ. It is also redder in the epidermis. In the

specimen of *semirugatus* before me,—an authentic specimen from Bagdad,—given to me at the “Museum” in Paris,* there are two sets of undulations, which meet and make acute angles pointing to the tip of the beaks; in the *Emesaensis* there are three sets, and these make two sets of angles which point towards the basal margin.

UNIO MARGINIS. Pl. 31, fig. 69.

Testa lævi, elliptica, inflata, valde inæquilaterali, postice et antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide striata, tenebroso-oliva, marginata, obsolete radiata; dentibus cardinalibus parviusculis, valde sulcatis et crenulatis; lateralibus subcurtis rectisque; margarita alba et valde iridescente.

Shell smooth, elliptical, inflated, very inequilateral, rounded before and behind; valves somewhat thick, thicker before; beaks somewhat prominent; epidermis striate, dark olive, margined, obscurely rayed; cardinal teeth rather small, very much sulcate and crenulate; lateral teeth rather short and straight; nacre white and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 89.

Hab.—Blue Springs, Dougherty Co., Georgia, Bishop Elliott.

My cabinet and cabinet of Bishop Elliott.

Diam. .5,

Length 1,

Breadth 1.1 inch.

Shell smooth, elliptical, inflated, very inequilateral, rounded before and behind; substance of the shell somewhat thick, thicker before; beaks somewhat prominent; ligament very small, thin and light brown; epidermis finely striate, dark olive, obscurely rayed, with a well-marked greenish-yellow margin; umbonial slope rounded; posterior slope narrow and slightly carinate; cardinal teeth rather small, very much sulcate and crenulate; lateral teeth rather short and straight; anterior cicatrices confluent, rather small and deeply impressed; posterior cicatrices confluent, rather small and slightly impressed; dorsal cicatrices placed in the centre of the cavity of the shell; cavity of the shell rather shallow; cavity of the beaks shallow and rounded; nacre white and very iridescent.

Remarks.—Only two specimens were received from Bishop Elliott. It belongs to the group of *parvus*, Barnes, but may easily be distinguished by its epidermis and yellowish margin. It is not quite so transverse as *parvus*. The nacre of both specimens is beautifully white and richly iridescent. Neither of the specimens are perfect enough to show the undulations of the tips. When young, there may be rays exhibited on the upper portions, but with these mature ones the yellow border only slightly presents obscure green rays.

* Baron Ferussac at the same time (1832) gave me a specimen from Bagdad under the same name, but which evidently is distinct. It is oval, has irregularly corrugate beaks, epidermis olive, cardinal teeth compressed, double in both valves, and has a white nacre. I have great pleasure in proposing the name *U. Ferussacianus* for it, after the distinguished naturalist.

UNIO PROPRIUS. Pl. 31, fig. 70.

Testa lævi, oblonga, subinflata, micanti, inæquilaterali, postice obtuse angulata; antice rotunda; valvulis subtenuibus, antice crassioribus; natibus prominulis, ad apices undulatis; epidermide lutea, eradiata; dentibus cardinalibus parvis, acuminatis, erectis, compressis; lateralibus sublongis subcurvisque; margarita vel purpurea vel salmonis colore tineta et iridescente.

Shell smooth, oblong, somewhat inflated, shining, inequilateral, obtusely angular behind, round before; valves rather thin, thicker before; beaks a little prominent, undulate at the tips; epidermis yellow, eradiate; cardinal teeth small, pointed, erect, compressed; lateral teeth rather long and somewhat curved; nacre purple or salmon and iridescent.

Proc. Acad. Nat. Sci. 1865, p. 89.

Hab.—Lafayette, Georgia, Rev. G. White.

My cabinet and cabinet of Mr. White.

Diam. .6, Length .9, Breadth 1.5 inch.

Shell smooth, oblong, somewhat inflated, inequilateral, shining, obtusely angular behind and round before; substance of the shell rather thin, thicker before; beaks a little prominent, undulate at the tips; ligament short, thin and pale brown; epidermis yellow, eradiate, with distant marks of growth; umbonial slope slightly raised and very obtusely angular; posterior slope narrow elliptical and somewhat carinate; cardinal teeth small, pointed, erect, compressed; lateral teeth rather long, lamellate and somewhat curved; anterior cicatrices distinct, rather large and moderately well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks rather shallow and obtusely angular; nacre purplish and pale salmon in the cavity, and whitish on the border.

Remarks.—Several specimens are before me. It is a small species, and rather less and thinner than *nitens* (nobis). All these specimens have the nacre white on the margin, with a salmon cavity increasing in tint to a purplish color in the cavity of the beaks. In outline it is very near to *merus* (nobis), but it is not rayed, and it is rather more compressed. It differs in color inside and out. In having a salmon and purplish nacre, it resembles *nitens*. It also reminds us of *buxeus* (nobis). None of the beaks were perfect, but the tips presented three or four rather coarse undulations.

UNIO PROTENSUS. Pl. 31, fig. 71.

Testa lævi, late elliptica, subcompressa, valde inæquilaterali, postice subbiangulata, antice rotunda; valvulis subtenuibus, antice aliquanto crassioribus; natibus prominulis; epidermide tenebrososusca, obsolete radiata; dentibus cardinalibus minimis, obliquis striatisque; lateralibus prelongis subcurvisque; margarita vel cæruleo-alba vel salmonea et iridescente.

Shell smooth, widely elliptical, rather compressed, very inequilateral, subbiangular behind, round before; valves rather thin, somewhat thicker before; beaks a little prominent; epidermis dark brown, obscurely rayed; cardinal teeth very small, oblique and striate; lateral teeth very long and slightly curved; nacre bluish white or salmon and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 88.

Hab.—North Carolina, Prof. E. Emmons.

My cabinet and cabinet of Prof. Emmons.

Diam. .4, Length .8, Breadth 1.6 inch.

Shell smooth, widely elliptical, somewhat compressed, very inequilateral, subbiangular behind, round before; substance of the shell rather thin, somewhat thicker before; beaks a little prominent; ligament rather long and thin; epidermis dark brown, obscurely rayed and with distant marks of growth; umbonial slope slightly raised and obtusely angular; posterior slope very narrow, elliptical and slightly carinate; cardinal teeth very small, oblique and striate; lateral teeth very long and slightly curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, rather small and slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell very shallow and wide; cavity of the beaks very shallow and obtusely angular; nacre bluish white or salmon and very iridescent.

Remarks.—This is a small species nearly allied to *aquilus* (nobis) in outline, but is very much smaller. In the color of the epidermis and in the small obscure rays they are very much alike. None of the five specimens before me have beaks perfect enough to ascertain the class of undulations of the tips. *Aquilus*, which this species closely resembles, is from Flint River, Georgia. This is one of the many new species collected by my friend, the late Professor Emmons, to whom I am so much indebted for this and other favors.

UNIO AMABILIS. Pl. 31, fig. 72.

Testa lævi, triangulari, micanti, subinflata, inequilaterali, postice angulata, antice rotunda; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, ad apices undulatis; epidermide vel luteola vel fuscescente, obsolete radiata; dentibus cardinalibus parvis, obliquis, subcompressis; lateralibus sublongis, obliquis corrugatisque; margarita vel alba vel dilute salmonea et valde iridescente.

Shell smooth, triangular, shining, rather inflated, inequilateral, angular behind, round before; valves somewhat thick, thicker before; beaks somewhat prominent, undulate at the tips; epidermis yellowish or brownish, obscurely radiate; cardinal teeth small, oblique, somewhat compressed; lateral teeth rather long, oblique and corrugate; nacre white or pale salmon and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 89.

Hab.—Butler, Taylor Co., Georgia, Dr. H. M. Neisler.

My cabinet and cabinet of Mr. Neisler.

Diam. .6,

Length 1,

Breadth 1.4 inch.

Shell smooth, triangular, shining, rather inflated, inequilateral, angular behind, round before; substance of the shell somewhat thick; thicker before; beaks somewhat prominent, undulate at the tips; ligament very short and light brown; epidermis yellowish or brownish, obscurely rayed and with distant marks of growth on the younger and more closely on the older portion; umbonial slope somewhat raised and obtusely angular; posterior slope rather narrow, slightly carinate, with two darkish lines on each valve from the beaks to the posterior margin; cardinal teeth small, oblique, somewhat compressed; lateral teeth rather long, oblique and corrugate; anterior cicatrices distinct, rather small and well impressed; posterior cicatrices confluent, rather small and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather shallow; cavity of the beaks shallow and obtusely angular; nacre white or pale salmon and very iridescent.

Remarks.—Seven specimens were sent by Dr. Neisler, among others, from Taylor County. It is so nearly allied to *striatulus* (nobis) that at first I supposed it to be a strong variety. On a more careful examination, I have no longer any doubt but that it differs. It is more oblique, has not the transverse striæ and differs in the undulations of the beaks, which are more developed. The color of the epidermis is also of a brighter yellow in the young. The nacre of *amabilis* is disposed to be of a dilute yellowish salmon color. The older specimens have quite a dark brown epidermis, while the younger are yellowish and brighter. After the third line of growth these lines become much closer. The older specimens are much eroded at the beaks and then they take, in a measure, the outlines of *pyriformis* (nobis). The younger ones remind us of *favosus* (nobis), but this species differs in many respects from that, particularly in the rays, which in *amabilis* are scarcely observable, even on the young specimens; while on *favosus* they are strong and very beautiful. One of the specimens of *amabilis* has perfect beaks, which show five subconcentric folds on the first growth.

UNIO CROMWELLII. Pl. 31, fig. 73.

Testa lævi, elliptica, subinflata, valde inæquilaterali, postice rotundata, antice rotunda; valvulis subtenuibus, antice crassiusculis; natibus subprominentibus, ad apices concentricè plicatis; epidermide minute striata, fusca vel virenti, radiata; dentibus cardinalibus parvis, compressis, corrugatis, in utroque valvulo duplicibus; lateralibus sublongis subcurvisque; margarita purpurecente et valde iridescente.

Shell smooth, elliptical, somewhat inflated, very inequilateral, rounded before and round behind; valves rather thin, thicker before; beaks somewhat prominent,

concentrically folded at the tips; epidermis minutely striate, brownish or greenish, radiate; cardinal teeth small, compressed, corrugate, double in both valves; lateral teeth rather long and somewhat curved; nacre pale purple and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 89.

Hab.—Kiokee Creek, near Albany, Dougherty Co., Ga., B. M. Cromwell, M.D

My cabinet and cabinets of Dr. Cromwell and Mr. Hallenbeck.

Diam. .4, Length .7, Breadth 1.1 inch.

Shell smooth, elliptical, somewhat inflated, very inequilateral, rounded before and round behind; substance of the shell thin, thicker before; beaks somewhat prominent, concentrically folded at the tips; ligament small, thin and rather light brown; epidermis minutely striate, brownish or greenish, with a few broad green rays, with distant broad marks of growth; umbonial slope rounded; posterior slope regularly elliptical, carinate, with two broad yellowish rays on each valve; cardinal teeth small, compressed, corrugate, double in both valves; lateral teeth rather long and somewhat curved; anterior cicatrices scarcely distinct, rather large and well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks small and obtusely angular; nacre pale purple and very iridescent.

Remarks.—Mr. Hallenbeck sent me a suite of fine specimens of this pretty little species. At first I thought it might be a variety more perfect than usual of *paulus* (nobis), although closely allied to that species. The two yellow rays on the posterior slope of each valve are larger and more distinct, and the carina is higher. It also differs in the undulations of the beaks, and is rather thinner. The nacre in all the five specimens is purple, which is not the case with the *paulus*. In the nacre and in the outline it is allied to *glans* (nobis), but in the epidermis and beaks it is entirely different, as well as being a thinner shell. It belongs to that group of which *parvus* (Barnes) may be considered the type, but differs in the epidermis, the nacre and the undulations of the beaks. I name it after Dr. Cromwell, who found it and gave it to Mr. Hallenbeck.

UNIO LYONII. Pl. 32, fig. 74.

Testa lævi, subrotunda, subcompressa, inæquilaterali; valvulis subcrassis, antice crassioribus; natibus prominentibus; epidermide rufo-fusca, late radiata; dentibus cardinalibus subgrandibus, subcompressis corrugatisque; lateralibus crassis, obliquis subcurvisque; margarita dilute salmonæa et valde iridescente.

Shell smooth, subrotund, somewhat compressed, inequilateral; valves rather thick, thicker before; beaks prominent; epidermis reddish-brown, with broad rays;

cardinal teeth rather large, somewhat compressed and corrugate; lateral teeth thick, oblique and somewhat curved; nacre pale salmon and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 89.

Hab.—East Tennessee, Major S. S. Lyon, U. S. E.

My cabinet.

Diam. .8, Length 1.5, Breadth 1.8 inch.

Shell smooth, subrotund, somewhat compressed, inequilateral; substance of the shell somewhat thick, thicker before; beaks prominent; ligament rather short, thick and light brown; epidermis reddish-brown, with dark broad rays over the middle of the valves and with distant marks of growth; umbonial slope flattish; posterior slope narrow and very slightly carinate; cardinal teeth rather large, somewhat compressed and corrugate; lateral teeth thick, oblique, somewhat curved and corrugate; anterior cicatrices confluent, rather large and well impressed; posterior cicatrices confluent, rather small and impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks shallow and obtusely angular; nacre pale salmon and very iridescent.

Remarks.—A single specimen only was received from Major Lyon. The exact habitat not mentioned, but I presume it came from near Cumberland Gap. In outline it is near to *Leseuerianus* (nobis), but it is not quite so rotund. It is a more compressed species, differs in color of the epidermis and in the rays. It also resembles *pubicus* (nobis), but that shell in a perfect state is triangular and thinner. The rays are somewhat like those of *Holstonensis* (nobis). The nacre of the specimen before me is very fine, and the salmon tint very agreeable. It is likely that specimens may be found to be white. I have great pleasure in dedicating the species to Major Lyon, late of the Engineer Corps U. S. Army, to whom I am indebted for many species of molluscs from the western waters.

UNIO DOLIARIS. Pl. 32, fig. 75.

Testa lævi, elliptica, valde inflata, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subtenuibus, antice crassioribus; natibus prominentibus, valde inflatus; epidermide viridi-lutea, radiis undique indutis; dentibus cardinalibus erectis, acuminatis, compresso-conicis crenulatisque; lateralibus sublongis, curvatis, lamellatis corrugatisque; margarita alba et valde iridescente.

Shell smooth, elliptical, very much inflated, inequilateral, obtusely angular behind, rounded before; valves rather thin, thicker before; beaks prominent, very much inflated; epidermis greenish-yellow, covered all over with rays; cardinal teeth erect, pointed, compressed conical and crenulate; lateral teeth rather long, lamellar, curved and corrugate; nacre white and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 89.

Hab.—Etowah River, Georgia, Rev. G. White.

My cabinet and cabinet of Mr. White.

Diam. 1·1, Length 1·6, Breadth 2·3 inches.

Shell smooth, elliptical, very much inflated, inequilateral, obtusely angular behind and rounded before; substance of the shell rather thin, thicker before; beaks prominent, very much inflated; epidermis greenish-yellow, with distant marks of growth, covered all over with thin, rather distant rays; ligament rather short, thick and dark brown; umbonial slope much raised and very obtusely angular; posterior slope broad, slightly carinate, subcordate; cardinal teeth erect, pointed, compressed conical and crenulate; lateral teeth rather long, lamellar, curved and corrugate; anterior cicatrices confluent, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed on the upper part of the centre of the cavity of the beaks; cavity of the shell deep and rounded; cavity of the beaks deep and obtusely angular; nacre white and very iridescent.

Remarks.—This species belongs to the group which embraces *multiradiatus* (nobis), *perovalis*, Con., *Spillmanii* (nobis) and *perradiatus* (nobis). It is a much thinner shell than *Spillmanii*, and is rather more inflated. It is very like *perradiatus*, but differs in being more elliptical, that shell being subtriangular, the valves somewhat thicker, and the rays broader and closer together. There is a disposition in nearly all the specimens before me to be slightly tinged with salmon color in the cavity of the beaks. In some of the specimens the green rays, which generally diverge over the whole disk, are well marked and nearly equidistant.

UNIO PUNCTATUS. Pl. 32, fig. 76.

Testa lævi, elliptica, ad latere planulata, valde inæquilaterali, postice et antice rotundata; valvulis crassis, antice aliquanto crassioribus; natibus vix prominentibus; epidermide olivacea, radiis punctatis undique indutis; dentibus cardinalibus parvis, compresso-conicis crenulatisque; lateralibus longis, crassis subcurvisque; margarita argentea et iridescente.

Shell smooth, elliptical, flattened at the sides, very inequilateral, rounded before and behind; valves thick, somewhat thicker before; beaks scarcely prominent; epidermis olivaceous, covered with interrupted rays; cardinal teeth small, compressed conical and crenulate; lateral teeth long, thick and somewhat curved; nacre silvery white and iridescent.

Proc. Acad. Nat. Sci. 1865, p. 89.

Hab.—Caney Fork, Tenn., Dr. Edgar; and Tuscumbia, Ala., B. Pybas.

My cabinet and cabinet of Mr. Pybas.

Diam. ·8, Length 1·4, Breadth 2·2 inches.

Shell smooth, elliptical, flattened on the sides, very inequilateral, rounded before

and behind; substance of the shell thick, somewhat thicker before; beaks scarcely prominent; ligament short, thick and dark brown; epidermis olivaceous, inclining to yellow, covered with interrupted rays which produce elongated subquadrate spots, with rather distant marks of growth; umbonial slope raised and rounded; posterior slope narrow elliptical, subcarinate and slightly impressed; cardinal teeth small, compressed conical and crenulate; lateral teeth long, thick, somewhat curved and corrugate; anterior cicatrices distinct, rather small and well impressed; posterior cicatrices confluent, large and moderately well impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell very shallow; cavity of the beaks very shallow and obtusely angular; nacre silvery white and iridescent.

Remarks.—I have seven specimens of this species from Dr. Edgar and Mr. Pybas; a single specimen from Dr. Edgar a long time since. It is very nearly allied to *Lindsleyi* (nobis), but is a smaller species, not so bright in the epidermis, nor are the spots so distant and square. *Punctatus* is thicker, more lenticular, and has smaller cardinal teeth. It belongs to that group of which *interruptus* (nobis) may be considered the type. None of the specimens had beaks perfect enough to designate the kind of undulations of the tips, but the whole group seem to be very much alike in this respect.

UNIO PARCUS. Pl. 33, fig. 77.

Testa lævi, late elliptica, subinflata, valde inæquilaterali, postice subrotundata, antice rotunda; valvulis subtenuibus, antice aliquanto crassioribus; natibus prominulis, ad apices divaricate undulatis; epidermide polita, tenebroso-oliva, eradiata; dentibus cardinalibus parviusculis, obliquis lamellatisque; lateralibus longis, lamellatis subrectisque; margarita cæruleo-alba et iridescente.

Shell smooth, widely elliptical, rather inflated, very inequilateral, rounded behind and round before; valves rather thin, somewhat thicker before; beaks a little prominent, with divergent folds at the tips; epidermis polished, dark olive, without rays; cardinal teeth rather small, oblique and lamellar; lateral teeth long, lamellar and nearly straight; nacre bluish-white and iridescent.

Proc. Acad. Nat. Sci. 1866, p. 34.

Hab.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Diam. .5,

Length .7,

Breadth 1.4 inch.

Shell smooth, widely elliptical, rather inflated, very inequilateral, rounded behind and round before; substance of the shell rather thin, somewhat thicker before; beaks a little prominent, with divergent folds at the tips; ligament thin and light brown; epidermis polished, dark olive, without rays, with distant marks of growth; umbonial slope rounded; posterior slope narrow, rather depressed, roughish; cardinal teeth

small, oblique, lamellar, single in the left and double in the right valve; lateral teeth long, lamellar and nearly straight; anterior cicatrices confluent and slightly impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell wide and somewhat deep; cavity of the beaks shallow and subangular; nacre bluish-white and iridescent.

Soft Parts.—A single dried specimen only was received. It was so poor that I was only enabled to make out the ova in the ovarium and in the branchial uterus. These ova were not sufficiently advanced to make out the embryonic form perfectly, but they were enough so as to show that it was pouch-shape. The branchial opening was mutilated as well as the palpi and the papillæ.

Remarks.—A single specimen only is before me. It is a small species, and this individual is about an inch wide. It probably is not quite grown. In outline it is near to *ellipticum*, Spix, but is more nearly allied to *inornatus* (nobis). It cannot be confounded with either. The epidermis is of a brilliant polish, and the single band of growth is distinctly marked by a dark and yellow line. The cardinal tooth, being double in the right and single in the left valve, is of an unusual character.

UNIO APPRIMUS. Pl. 33, fig. 78.

Testa lævi, elliptica, inflata, inæquilaterali, postice emarginata, obtuse angulata, antice rotundata; valvulis percrassis, antice crassioribus; natibus subprominentibus, ad apices divaricate undulatis; epidermide castanea, micanti, substriata, obsolete radiata; dentibus cardinalibus grandibus et valde partitis; lateralibus prælongis, lamellatis, curvatis et decore granulatis; margarita argentea et iridescente.

Shell smooth, elliptical, inflated, inequilateral, obtusely angular and emarginate behind and rounded before; valves very thick, thicker before; beaks rather prominent, with divergent folds at the tips; epidermis chestnut-brown, shining, somewhat striate and obscurely rayed; cardinal teeth large and very much divided; lateral teeth very long, lamellar, curved and beautifully granulate; nacre silver-white and very iridescent.

Proc. Acad. Nat. Sci. 1866, p. 34.

Hab.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Diam. 1·7,

Length 2·6,

Breadth 3·9 inches.

Shell smooth, elliptical, inflated, inequilateral, obtusely angular and emarginate behind and rounded before; substance of the shell very thick, thicker before; beaks rather prominent, with divergent folds at the tips; ligament large and light brown; epidermis chestnut-brown, shining, somewhat striate, obscurely rayed, with dis-

tant marks of growth; umbonial slope rounded and inflated; posterior slope rather wide, elliptical, with an indistinct furrow on each valve; cardinal teeth large and very much divided in each valve; lateral teeth very long, lamellar, curved and beautifully granulate; anterior cicatrices confluent, very large and very deeply impressed; posterior cicatrices confluent and well impressed; dorsal cicatrices placed across the centre of the cavity of the beaks; cavity of the shell rather deep and very wide; cavity of the beaks shallow and rounded; nacre beautifully silver-white and iridescent.

Remarks.—It is much to be regretted that a single specimen only of this fine species, and without the soft parts, should have been procured. In some respects it resembles some of our North American species, but that unerring characteristic of divergent folds of the tips emphatically places it as an inhabitant of the fresh waters of South America. In outline it approaches *Weldonensis* (nobis) and *Charlottensis* (nobis), as well as some varieties of *complanatus* (Solander), but it is not so wide. In the cardinal teeth it differs entirely from these. In outline it also approaches *Uruguayensis* (nobis), but it differs much from that species in outline as well in the cardinal and lateral teeth. The regular ellipse, the smooth polished umbos and the much divided large cardinal teeth well characterize this species. In each valve the cardinal tooth is divided into six compressed corrugate parts, larger or smaller, and the lamellar teeth are beautifully granular and iridized. Although the substance of the shell is very thick, and the anterior cicatrices deeply impressed, the two lower ones are confluent, while the third,—the upper one not usually noted,—is deeply impressed and distinct from the great one beneath. In the lateral tooth of the left valve the upper division is exceedingly small in this specimen, and it may be a general character of the species.

UNIO LOCELLUS. Pl. 33, fig. 79.

Testa lævi, elliptica, valde inflata, inæquilaterali, postice subrotundata, antice subtruncata; valvulis tenuibus; natibus subprominentibus, tumidis, ad apices divaricate undulatis; epidermide tenebroso-fusca, obsolete radiata, antice striata; dentibus cardinalibus parvis, valde compressis, valde obliquis, in utroque valvulo duplicibus; lateralibus parviusculis, lamellatis; margarita cæruleo-alba et iridescente.

Shell smooth, elliptical, very much inflated, inequilateral, somewhat rounded behind, subtruncate before; valves thin; beaks rather prominent, swollen, with divergent folds at the tips; epidermis dark brown, obscurely rayed, striate before; cardinal teeth small, very much compressed, very oblique and double in both valves; lateral teeth rather small and lamellar; nacre bluish white and iridescent.

Hab.—Buenos Ayres, South America, Don Patricio M. Paz.

My cabinet and cabinet of Don. P. M. Paz.

Diam. .8, Length 1.2, Breadth 1.8 inch.

Shell smooth, elliptical, very much inflated, inequilateral, somewhat rounded behind and subtruncate before; substance of the shell thin; beaks rather prominent, swollen, with divergent folds at the tips; ligament very small and light brown; epidermis dark brown, obscurely rayed, with distant marks of growth, striate on the anterior half; umbonial slope rounded and very much inflated; posterior slope elliptical, rather wide, with an indistinct furrow in each valve; cardinal teeth small, very much compressed, very oblique and double in both valves; lateral teeth rather small, nearly straight, thin and lamellar; anterior cicatrices confluent and slightly impressed; posterior cicatrices confluent and scarcely visible; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell deep and wide; cavity of the beaks very shallow and rounded; nacre bluish white and iridescent.

Remarks.—Of this well characterised little species there was only a single specimen received. In outline it is near to *Bengalensis* (nobis), but it is more inflated, has larger teeth and a thicker and white nacre. It differs from *ampullaceus*, herein described, in being elliptical, more inflated over the umbones, and being a much lighter shell. The beaks well display the divergent folds at the tips, a character so well denoting its South American origin.

UNIO PECULIARIS. Pl. 34, fig. 80.

Testa lævi, quadrata, compressiuscula, inæquilaterali, postice obtuse angulata, antice rotunda; valvulis crassiusculis, antice aliquanto crassioribus; natibus subprominentibus, ad apices divaricate undulatis; epidermide viridi-fusca, eradiata; dentibus cardinalibus parviusculis, compressis, obliquis, in utroque valvulo duplicibus; lateralibus longis, lamellatis curvisque; margarita cæruleo-alba et iridescente.

Shell smooth, quadrate, somewhat compressed, inequilateral, obtusely angular behind, round before; valves a little thick, somewhat thicker before; beaks a little prominent, with divergent folds at the tips; epidermis greenish-brown, without rays; cardinal teeth rather small, compressed, oblique and double in both valves; lateral teeth long, lamellar and curved; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. 1866, p. 33.

Hab.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don. P. M. Paz.

Diam. .9, Length 1.3, Breadth 2 inches.

Shell smooth, quadrate, somewhat compressed at the sides and inflated on the umbonial slope; inequilateral, obtusely angular behind, round before; substance of the shell somewhat thick, slightly thicker before; beaks a little prominent, slightly in-

flated, with divergent folds at the tips; ligament small and very dark; epidermis greenish-brown, without rays and with very indistinct marks of growth; umbonial slope inflated and rounded; posterior slope narrow, elliptical, with an indistinct impressed line in each valve; anterior cicatrices confluent, rather small and slightly impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices in a row across the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks very shallow and rounded; nacre bluish white and iridescent.

Soft parts.—*Branchial uterus* occupies nearly the whole width of the inner branchiæ, the ovisacks being long, closely approximate and filled with nearly mature embryonic shells; ova were found in the ovaries also. *Branchiæ* rather large, rounded below, inner ones much the larger, united the whole length of abdominal sack. *Palpi* rather small, somewhat thin, oblique, rounded below and united a small distance on the posterior superior edges. *Mantle* thin, slightly thickened at the edges. *Branchial opening* rather small, with numerous small, brownish papillæ. *Anal opening* small, without papillæ and entirely separated from the branchial opening. Has no *super-anal opening*; color of the mass dirty white.

Embryonic shell subtriangular, light brown; dorsal line rather long and straight; side margins irregular and unequal; one being a segment of a circle, the other an irregular curved line, forming an obtuse angle at the base; basal margin obtusely angular and furnished with hooks; granulate over the whole surface. Plate 34, fig. 80.

Remarks.—There were two only of this species, both in alcohol; male and female. The female fortunately had the embryonic shell nearly matured, and that presents to us a unique and very peculiar form in having unequal lateral margins, as described above. It therefore has the appearance of being abnormal and lapsed. No irregularity approaching to this has been observed by me in the numerous North American species which I have examined.

In outline *peculiaris* is near to *Bengalensis* (nobis), but in other respects it is very different, having divergent folds on the beaks, a white and thicker nacre, etc. Of all the South American species with which I am acquainted, it most nearly resembles *Wymanii* (nobis), but may easily be distinguished by its darker epidermis, its greater inflation and in being a smaller species. There is a slight indication of triplication of the cardinal tooth of the left valve in both the specimens.

UNIO RUGOSOSULCATUS. Pl. 34, fig. 81.

Testa sulcata, triangulari, subinflata, subæquilaterali, postice biangulata, antice oblique rotundata; valvulis percrassis, antice crassioribus; natibus prominentibus; epidermide olivacea, rugoso-sulcata, obsolete radiata; dentibus cardinalibus crassis, rugosis, elevatis; lateralibus sublongis, subcrassis, lamellatis subcurvisque; margarita argentea et iridescente.

Shell sulcate, triangular, somewhat inflated, nearly equilateral, biangular behind and obliquely rounded before; valves very thick, thicker before; beaks prominent; epidermis olive color, roughly sulcate, obscurely rayed; cardinal teeth thick, rugose and raised; lateral teeth rather long, rather thick, lamellar and slightly curved; nacre silvery white and iridescent.

Proc. Acad. Nat. Sci. 1866, p. 33.

Hub.—Central America, Don. Patricio M. Paz.

My cabinet and cabinet of Don. P. M. Paz.

Diam. 1·4,

Length 2·2,

Breadth 3 inches.

Shell sulcate, triangular, somewhat inflated, nearly equilateral, biangular behind and obliquely rounded before; substance of the shell very thick, thicker before, with a broad and thickened border; beaks prominent, rather pointed; ligament rather large and light brown; epidermis olive color, darker on the umbones and posterior slope, with distant, indistinct marks of growth; umbonial slope angular; posterior slope narrow elliptical, with an indistinct furrow on each valve; cardinal teeth large, thick, rugose, raised and obtusely pointed; lateral teeth rather long, rather thick, lamellar and slightly curved; anterior cicatrices distinct, very large and well impressed; posterior cicatrices confluent, very large and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks obtusely angular and somewhat deep; nacre silvery white and iridescent.

Remarks.—There were two specimens, nearly of the same size, sent to me by Don P. M. Paz. The species is very distinct, and belongs to that sulcate group which generally prevails with the Central American species. The specimens were marked as coming from the United States, but I have no hesitation in saying that this must be an error; the species having all the analogous characteristics of the Central American species. It has some resemblance to *U. Estabrookianus* (nobis), but is much thicker, higher in the beaks; more sulcate and darker colored. It is allied to *Newcombianus* (nobis), from Lake Nicaragua, and might be taken for the old of that species, but it is very much larger, very much heavier, more inflated, has a much more corrugate surface and is not so lenticular. In the *rugosulcatus* the nacre is of a remarkably pure pearly white, and on the umbones and beaks the olive color is nearly replaced by a greenish brown color.

UNIO FIRMUS. Pl. 34, fig. 82.

Testa lævi, elliptica, subinflata, valde inæquilaterali, postice et antice rotundata; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominulis; epidermide viridi-fusca, eradiata; dentibus cardinalibus subcrassis, compressis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subcurvisque; margarita argentea et valde iridescente.

Shell smooth, elliptical, somewhat inflated, very inequilateral, rounded before and behind; valves rather thick, thicker before; beaks slightly prominent; epidermis greenish brown, without rays; cardinal teeth somewhat thick, compressed and double in both valves; lateral teeth long, lamellar and somewhat curved; nacre silver white and very iridescent.

Proc. Acad. Nat. Sci. 1866, p. 33.

Hab.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Diam. 1,

Length 1.4,

Breadth 2.4 inches.

Shell smooth, elliptical, somewhat inflated, very inequilateral, rounded before and behind; substance of the shell rather thick, thicker before; beaks slightly prominent; ligament rather long and light brown; epidermis greenish brown, without rays, with distant marks of growth; umbonial slope rounded and inflated; posterior slope narrow, elliptical, and very slightly carinate, with indistinct impressed lines in each valve; cardinal teeth somewhat thick, compressed and double in both valves; lateral teeth long, lamellar and somewhat curved; anterior cicatrices confluent, rather small and deeply impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed in a row across the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks shallow and rounded; nacre silver white and very iridescent.

Soft parts.—*Branchial uterus* occupies nearly the whole width of the inner branchiæ, the ovisacks being long, closely approximate and filled with nearly mature embryonic shells. Ova were found still in the ovaries. *Branchiæ* rather large, outer ones much rounded, inner ones larger and nearly straight at the basal edge, united the whole length of the abdominal sack. *Palpi* rather small, rather thick, obliquely rounded below and united a short distance on the posterior edges. *Mantle* thin, much thickened at the posterior edges. *Branchial opening* rather small, dark brown, with regular, rather small papillæ. *Anal opening* very small, without papillæ and entirely disunited from the branchial opening below. No super-anal opening. Color of the mass dirty white.

Embryonic shell subtriangular, light brown; dorsal line rather long and straight; side margins slightly curved outward, forming an obtuse angle at the base; basal margin obtusely angular and furnished with hooks; granulate over the whole surface. Pl. 34, fig. 82.

Remarks.—Four specimens of this species were brought by Don P. M. Paz, two of them, a male and female, in alcohol, and from which the above descriptions were made. In connection with the description of the embryonic shell it may be mentioned that it is, I believe, the first time this has been done in regard to South American species. In outline *firmus* is closely allied to *caliginosus* (nobis), but it is a heavier

species, with a brighter nacre and a less dark epidermis. In the specimens before me the nacre is much worn and the substance of the shell eroded. The beaks are so much eroded that there are no remains of divergent folds with which they were no doubt once clothed. It is nearly allied to *Puraguayensis*, herein described, but differs much in the elliptical outline.

UNIO AMPULLACEUS. Pl. 35, fig. 83.

Testa lævi, suboblonga, valde inflata, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, inflatis; epidermide tenebroso-fusca, rugoso-striata, eradiata; dentibus cardinalibus parvis, obliquis, lamellatis, in utroque valvulo duplicibus; lateralibus longis, subrectis, lamellatis corrugatisque; margarita alba et iridescente.

Shell smooth, oblong, very much inflated, inequilateral, obtusely angular behind and rounded before; valves somewhat thick, thicker before; beaks prominent and inflated; epidermis dark brown, rugosely striate and without rays; cardinal teeth small, oblique, lamellar and double in both valves; lateral teeth long, nearly straight, lamellar and corrugate; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1866, p. 34.

Hub.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Diam. 1.1,

Length 1.5,

Breadth 2.5 inches.

Shell smooth, oblong, very much inflated, inequilateral, obtusely angular behind and rounded before; substance of the shell somewhat thick, thicker before; beaks prominent and inflated; ligament rather small and dark brown; epidermis dark brown, rugosely striate, without rays and with rather distant marks of growth; umbonial slope rounded and much inflated; posterior slope elliptical, somewhat carinate, rather wide, very dark brown and with an impressed line in each valve; cardinal teeth small, oblique, lamellar and double in both valves; lateral teeth long, nearly straight, lamellar and corrugate; anterior cicatrices confluent, rather large and well impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed across the cavity of the beaks; cavity of the shell deep and rounded; cavity of the beaks very shallow and rounded; nacre white and iridescent.

Remarks.—A single specimen only of this species was received. The beaks are much eroded, but still an indistinct indication remains of the divergent character of the tips. In outline it is closely allied to *Mexicanus*, Phil., but differs entirely in the teeth and the color of the nacre. It is also very near to *Charruanus*, D'Orb., but is more inflated and not so wide. It reminds one of *Blandingianus* (nobis), but is more quadrate than that shell and less oblique. In the specimen before me there are slightly impressed lines running from the beaks to the anterior half of the margin

which give the surface a rugose character. There is also a slight emargination at the posterior basal margin which may not pertain to all other specimens.

UNIO ACUTIROSTRIS. Pl. 35, fig. 84.

Testa lævi, oblonga, ad latere compressa, valde inæquilaterali, postice obtuse angulata, antice truncata; valvulis crassiusculis, antice crassioribus; natibus prominulis; epidermide tenebroso-fusca, nigrescente, eradiata; dentibus cardinalibus parviusculis, in utroque valvulo sulcato-divergente; lateralibus prælongis, aliquanto curvatis granulatisque; margarita alba et valde iridescente.

Shell smooth, oblong, compressed at the sides, very inequilateral, obtusely angular behind and truncate before; valves somewhat thick, thicker before; beaks somewhat prominent; epidermis dark brown, nearly black, without rays; cardinal teeth rather small, in both valves sulcate and divergent; lateral teeth very long, curved and granulate; nacre white and very iridescent.

Proc. Acad. Nat. Sci. 1866, p. 34.

Hab.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Diam. 1,

Length 1·6,

Breadth 2·4 inches.

Shell smooth, oblong, compressed at the sides, very inequilateral, obtusely angular behind and truncate before; substance of the shell somewhat thick, thicker before; beaks somewhat prominent; ligament long, thin and very dark brown; epidermis dark brown, nearly black, somewhat striate, with distant marks of growth; umbonial slope long and obtusely angular; posterior slope long, compressed at the sides and somewhat carinate; cardinal teeth rather small, in both valves sulcate and divergent; lateral teeth very long, curved and granulate; anterior cicatrices confluent, rather small and well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed across the centre of the cavity of the beaks; cavity of the shell shallow and very wide; cavity of the beaks very shallow; nacre white and very iridescent.

Soft Parts.—*Branchial uterus* occupies nearly the whole width of the inner branchia, the ovisacks being somewhat long, closely approximate and filled with ova which appear to be elliptical and not matured. Ova were also found in the ovaries. *Branchiæ* very long, the outer one curved, the inner nearly straight at the basal margin and much the larger, united the whole length of the abdominal sack. *Pulpi* large, rather thick, round below and united only at the upper edges. *Mantle* thin, slightly thickened at the edges. *Anal opening* rather large, without papillæ and entirely separated from the branchial opening. No *super-anal opening*. Color of the mass dirty white.

Remarks.—This was a single female specimen of a species interesting from its unusual outline. The ova were not sufficiently advanced to give one an idea of the

form the embryonic shell would take. The *palpi* or mouth-lips have that peculiar round form which I have elsewhere described, and which seems peculiar to South American species.* It is to be regretted that this species, with so peculiar an outline, should not have had the embryonic form to examine, as it would probably present a very distinct form. In the specimen before me the posterior basal margin is slightly arcuate, but this character may not strictly pertain to the species, as the lines of growth above do not present this inward curve. The beaks are very much eroded, so much so as to obliterate the usual diverging folds which they no doubt once possessed. The perpendicular truncation of the anterior margin and the beak-like posterior margin are very characteristic of the species. The cardinal teeth are also quite peculiar in their form, being sub-divided into about a dozen sections (denticles) diverging from a point immediately under the tip of the beaks. In outline it is allied to that rare South American species which I described under the name of *parallelopipedon*, from Rio Parana and Rio Plata; but it is a larger species, not quite so transverse, and differs in the color of the epidermis as well as the form of the cardinal teeth.

UNIO PARAGUAYENSIS. Pl. 35, fig. 85.

Testa lævi, elliptica, inflata, sublenticulari, valde inæquilaterali, postice et antice rotundata; valvulis subcrassis, antice crassioribus; natibus vix prominentibus; epidermide viridi-fusca, obsolete radiata; dentibus cardinalibus crassiusculis, obliquis, compressis, in utroque valvulo duplicibus; lateralibus sublongis, lamellatis curvisque; margarita argentea et valde iridescente.

Shell smooth, elliptical, inflated, sublenticular, very inequilateral, rounded before and behind; valves somewhat thick, thicker before; beaks scarcely prominent; epidermis greenish-brown, obscurely rayed; cardinal teeth a little thick, oblique, compressed, double in both valves; lateral teeth rather long, lamellar and curved; nacre silvery-white and very iridescent.

Proc. Acad. Nat. Sci. 1866, p. 34.

Hab.—Paraguay, South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Diam. 1·2,

Length 1·7,

Breadth 2·5 inches.

Shell smooth, regularly elliptical, inflated, somewhat lenticular, very inequilateral, rounded before and behind; substance of the shell somewhat thick, thicker before; beaks inflated, scarcely prominent; ligament rather small and dark brown; epidermis greenish-brown, obscurely rayed; umbonial slope rounded and inflated; posterior slope elliptical, somewhat carinate, with two slightly impressed lines in each valve; cardinal teeth somewhat thick, oblique, compressed, double in the right and disposed to be treble in the left valve; lateral teeth long, lamellar and slightly

*Trans. Acad. Nat. Sci., vol. 5, p. 391. Observations, vol. 10, p. 27.

Remarks.—A single specimen only was received, and that without the soft parts. It differs from all the South American species described by D'Orbigny and Moricand in being of almost a perfect lenticular form. It is about the size of *Franciscana*, Mori., but cannot be confounded with that species, which is lighter and thinner in the substance of the shell and much more inflated and higher in the carina. The specimen before me has the greatest transverse axis about the middle of the disks, and the enlarged or thickened nacre towards the base is unusually great. The greenish-blue of the tips of the beaks arises from epidermal deposit on the interior, which in this specimen is quite remarkable. The tooth of the right valve shuts in behind that of the left valve, which is usual with South American species.

MONOCONDYLÆA PAZII. Pl. 36, fig. 88.

Testa lævi, obovata, inflata, valde inæquilaterali, postice rotundata, antice curta rotundaque; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominentibus, tumidis, retusis; epidermide tenebroso-oliva, striata, eradiata; dentibus cardinalibus subcrassis, compresso-tuberculatis, subelevatis; margarita alba et valde iridescente.

Shell smooth, obovate, inflated, very inequilateral, rounded behind, short and round before; valves somewhat thick, slightly thicker before; beaks prominent, swollen, retuse; epidermis dark olive, striate, without rays; cardinal teeth rather thick, compressed tuberculate and somewhat raised; nacre pearly-white and iridescent.

Proc. Acad. Nat. Sci. 1866, p. 34.

Hab.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Diam. 1,

Length 1.5,

Breadth 2.2 inches.

Shell smooth, obovate, inflated, slightly flattened on the umbones, very inequilateral, rounded behind, round and short before; substance of the shell somewhat thick, slightly thicker before; beaks prominent, swollen and drawn backwards; ligament rather small and dark brown; epidermis dark olive, rather coarsely striate and without rays; umbonial slope rounded and very much inflated; posterior slope subcordate, subcarinate, with two indistinct lines on each valve from the beaks to the posterior margin; cardinal teeth rather thick, compressed tuberculate and somewhat raised; anterior cicatrices confluent, rather large and moderately well impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices concealed within the cavity of the beaks; cavity of the shell very deep and rounded; cavity of the beaks rather deep and angular; nacre pearly white and very iridescent.

Soft parts.—*Branchial uterus* occupies nearly the whole width of the inner branchiæ, the ovisacks being closely approximate and filled with very minute round ova, not sufficiently advanced to give any idea of the form of the embryonic shell.

Ova were also found in the ovaries. *Branchiæ* very large and curved below, the inner ones being very much the larger, united the whole length of the abdominal sack. *Palpi* rather small, thick, rounded below and united only at the upper part. *Mantle* rather thick, much thickened at the edges, having only a few papillæ below the branchial opening. *Branchial opening* large, brownish, with numerous, regular very small papillæ on the inner edges, the papillæ in this alcoholic specimen having more the appearance of closely-placed knobs, which decrease in size below. *Anal opening* very long, without any papillæ and entirely disunited from the branchial opening below, while the anal tube and vent nearly protrude beyond the edges of the mantle. Has no *super-anal opening*. The anterior and posterior adductor muscles are remarkably large, and the abdominal mass is large, compressed and rounded behind. Color of the mass dirty white.

Remarks.—Two specimens only were received; one, a female, in alcohol, from which a careful description of the soft parts is made. Mr. D'Orbigny, in describing his genus *Monocondylæa*, says the soft parts are the same with the *Unio*, but this is not exactly the case. I have seen no *Unio*, or other genus of this family, with the same kind of knob-like papillæ, nor with an anal opening exactly like that described above. In the outline of the hard parts, or outward covering of this species, it is nearest to *Paraguayana*, D'Orb., but may be distinguished from it by its darker color of epidermis and its flatness over the umbones, *Paraguayana* being more inflated there than usual in the genus. Mr. D'Orbigny does not mention that any of the species which he described had undulations of any kind. Nearly all the specimens of the genus which I have seen are eroded at the beaks, except three young ones which I have of two different species, *Parchappii*, D'Orb., and *Franciscana*, Mori. These exhibit no appearance of undulations, while all the numerous species of *Unio* which I have seen from South America have divergent folds at the tips. The border without pearly nacre is very broad in this species. I have great pleasure in naming this interesting species after Don Patricio Maria Paz y Membiela, Commodore in the Royal Spanish Navy, who has aided me greatly in developing the South American *Unionidæ*.

ANODONTA PAZII. Pl. 36, fig. 87.

Testa lævi, subrotunda, valde inflata, inæquilaterali, postice et antice rotundata; valvulis crassiusculis; natibus subprominentibus, acuminatis; epidermide tenebroso-rufo-fusca, eradiata, striata; margarita punicea formosissime iridescente.

Shell smooth, subrotund, very much inflated, inequilateral, rounded before and behind; valves somewhat thick; beaks rather prominent, acuminate; epidermis dark reddish-brown, striate; nacre deep red and most beautifully iridescent.

Proc. Acad. Nat. Sci. 1866, p. 35.

Hub.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz and C. M. Wheatley.

Diam. 1·1, Length 1·7, Breadth 2·3 inches.

Shell smooth, nearly round, very much inflated, inequilateral, rounded before and behind; substance of the shell somewhat thick; beaks somewhat prominent and pointed at the tips; ligament very small and dark brown; epidermis dark reddish-brown, rather roughly striate, with distant marks of growth and without rays; umbonal slope rounded and rather inflated; posterior slope elliptical, very slightly carinate, with an obscure slightly impressed line from the beaks to the posterior margin; anterior cicatrices confluent, rather large and slightly impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices imperceptible; cavity of the shell deep and rounded; cavity of the beaks shallow and subangular; nacre very deep red and most beautifully iridescent.

Soft Parts.—Two males. *Branchia* rather large, rounded below, inner one somewhat the larger, united the whole length of the abdominal sack. *Pulpi* rather large, round and united only at the upper part. *Mantle* thin, much thickened at the edges, with numerous small papillæ below the branchial opening. *Branchial opening* rather small, with a few small dark brown papillæ on the inner edges. *Anal opening* dark brown, corrugated on the edges and very long, entirely disunited from the branchial opening below. Has no super-anal opening. Color of the mass dirty-white.

Remarks.—This very beautiful species has the most intensely red color of the nacre of any species which I have seen. It is almost of a beet-red, and on the broad border this is so intense that in some specimens it is almost black. The border is nearly as large as that of *lato-marginata*, and along the line of junction with the pearly nacre the color is deepened. In outline it is between *rubicunda* and *lato-marginata* (nobis), but is not *obovate* like the latter, nor so round or carinate as the former, and in color much more deeply colored than any I have seen of either of them. In thickness it stands between them. The high wing-like carina of *rubicunda* at once distinguishes that species, and the broad thick margin of *lato-marginata* cannot be confounded with this species.

MYCETOPUS PYGMÆUS = *Anodonta pygmaea*, Spix. Test. Braz. pl. 23, fig. 3 and 4.

Soft Parts.—A male. *Branchia* very wide, slightly curved below, inner ones much the larger, united the whole length of abdominal sack. *Pulpi* large, round below and united only at the upper part. *Mantle* very thin, slightly thickened at the edges, having no papillæ below the branchial opening. *Branchial opening* rather large, with rather large dark papillæ on the inner edges. *Anal opening* corrugated on the inner edges, very long, entirely disunited from the branchial opening below. Has no

super-anal opening. Color of the mass pale salmon. The foot has very much the appearance of that of *Mycetopus*, described and figured by D'Orbigny in his *Voy. Am. Merid.*, but the muscular fibre in the single specimen before me is very much contracted by the alcohol.

Hab.—South America, Don Patricio M. Paz.

My cabinet and cabinet of Don P. M. Paz.

Remarks.—A single specimen with the soft parts was received. The outer or hard parts measure $4\frac{1}{2}$ inches in width. Specimens which I have had a long time in my cabinet from Central America are three inches wide. That figured in Spix's *Test. Braz.* measures 1.6 inches, of course quite a young specimen. This has created some confusion, and induced Dr. Wagner to consider that *Anodonta siliquosa*, Spix, and *An. pygmæa*, Spix, were the same. But I am now satisfied that they are distinct species, and both belong to D'Orbigny's genus *Mycetopus*, which he describes as perforating the earth like *Pholades*, below the water, and which corresponds with the habits of our *Margaritana dehiscens*, Say, = *M. oriens*, Lea, being rarely found except in such holes.

It is to be regretted that the only specimen received should have proved to be a male, as the form of the branchial uterus, as well as that of the embryonic shell, would have been of great interest. M. D'Orbigny does not seem to have observed these forms, as he does not mention them in his description of *Mycetopus*, which does not differ much from *Unio*.

UNIO JEWETTI. Pl. 37, fig. 89.

Testa lævi, oblonga, subinflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subtenuibus; natibus prominulis, ad apices concentrico-undulatis; epidermide fusca; dentibus cardinalibus parvis, obliquis, compressis; lateralibus prælongis lamellatisque; margarita alba et iridescente.

Shell smooth, oblong, rather inflated, very inequilateral, obtusely angular behind, rounded before; valves rather thin; beaks a little prominent, concentrically undulate at the tips; epidermis brownish; cardinal teeth small, oblique and compressed; lateral teeth very long and lamellar; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1867, p. 81.

Hab.—Sink of Noonan's Lake, Florida, Col. E. Jewett.

My cabinet and cabinets of Col. Jewett and Dr. Lewis.

Diam. .7,

Length 1.1,

Breadth 1.9 inch.

Shell smooth, oblong, somewhat inflated, inequilateral, obtusely angular behind, rounded before; substance of the shell rather thin; beaks a little prominent, concentrically undulate at the tips; ligament long and thin; epidermis brownish,

obscurely rayed and with distant marks of growth; umbonial slope flattened; posterior slope carinate, with two impressed lines in each valve; cardinal teeth small, oblique and compressed, single in the right and double in the left valve; lateral teeth very long, lamellar and slightly curved; anterior cicatrices confluent, large and slightly impressed; posterior cicatrices confluent, very large and very slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell wide and shallow; cavity of the beaks shallow and wide; nacre white and iridescent.

Remarks.—Two rather young specimens of this species were sent to me by Dr. Lewis, of Mohawk, N. Y., to whom they were given by Col. Jewett, of Utica, N. Y., who collected them in Florida. The species is nearly allied to *obesus* (nobis). It seems to be distinct, from the fact of its being wider in proportion and in being more compressed. The beaks of these specimens are eroded, but there is enough of the undulations visible to assure us of the group to which the species belongs.

UNIO BISSELIANUS. Pl. 37, fig. 90.

Testa lævi, oblonga, sublenticulari, inæquilaterali, postice obtuso-angulata, antice rotunda; valvulis subcrassis, antice aliquanto crassioribus; natibus prominulis, ad apices concentrico-undulatis; epidermide tenebroso-oliva, obsolete radiata; dentibus cardinalibus crassiusculis, compressis, subelevatis crenulatisque; lateralibus sublongis, lamellatis subcurvisque; margarita carnea et valde iridescente.

Shell smooth, oblong, sublenticular, inequivalve, obtusely angular behind, round before; valves rather thick, somewhat thicker before; beaks a little prominent, concentrically undulate at the tips; epidermis dark olive, obscurely radiate; cardinal teeth oblique, compressed, somewhat raised; lateral teeth rather long, lamellar and somewhat curved; nacre flesh color and very iridescent.

Proc. Acad. Nat. Sci. 1867, p. 81.

Hab.—Bissel's Pond, Charlotte, N. C., C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .9,

Length 1.6,

Breadth 2.7 inches.

Shell smooth, oblong, sublenticular, inequivalve, obtusely angular behind, round before; substance of the shell thick, somewhat thicker before; beaks a little prominent, concentrically undulate at the tips; ligament rather long and thin; epidermis dark olive, obscurely radiate, with rather close marks of growth; umbonial slope flattish and somewhat darkened; posterior slope carinate and furnished with two impressed lines in each valve; cardinal teeth oblique, compressed, somewhat raised, single in the right and double in the left valve; lateral teeth rather long, lamellar and somewhat curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed across the cavity of the beaks; cavity of the shell wide and somewhat deep; nacre flesh color and very iridescent.

Remarks.—This species belongs to the *obesus* group, and has nearly the same outline as *obesus* and it has the same concentric folds at the beaks. The epidermis is of the same color. All the specimens I have seen have the same color of nacre, whitish in the cavity and a lively flesh or pinkish color towards the margin. The umbonial slope has usually a dark, broad, greenish ray and the posterior slope has usually two smaller ones. I am under obligations to Mr. Wheatley for a very beautiful suite.

UNIO CLINCHENSIS. Pl. 37, fig. 91.

Testa lævi, triangulari, ad latere planulata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassis, antice crassioribus; natibus prominentibus; epidermide luteola, ad latere radiata; dentibus cardinalibus crassis, subcompressis corrugatisque; lateralibus percrassis, curtis obliquisque; margarita alba et iridescente.

Shell smooth, triangular, flattened at the sides, very inequilateral, obtusely angular behind, rounded before; valves thick, thicker before; beaks prominent; epidermis yellowish, radiated on the sides; cardinal teeth thick, rather compressed and corrugate; lateral teeth very thick, short and oblique; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1867, p. 81.

Hab.—Clinch River, Tenn., Pres. Estabrook; French Broad River and Holston River, Tenn., Dr. Edgar.

My cabinet.

Diam. .8,

Length 1.5,

Breadth 1.8 inch.

Shell smooth, triangular, flattened at the sides, very inequilateral, obtusely angular behind, rounded before; substance of the shell thick, thicker before; beaks prominent; ligament short and rather thick; epidermis yellowish, with interrupted rays on the sides and with close marks of growth; umbonial slope slightly angular; posterior slope elliptical and slightly raised, usually without rays; cardinal teeth thick, rather compressed, corrugate and double in both valves; lateral teeth very thick, short and oblique; anterior cicatrices distinct, rather small and well impressed; posterior cicatrices distinct and well impressed; dorsal cicatrices placed on the under side of the plate, within the cavity of the beaks; cavity of the shell rather deep and rounded; cavity of the beaks rather deep and subangular; nacre white and iridescent.

Remarks.—I have six specimens before me, all of which are from the upper tributaries of the Tennessee River. In outline it is near to *cuneolus* (nobis), but it is more oblique than that species. There is very little difference in the form of these six specimens. All of them are more or less rayed on the sides. These rays are all interrupted by the lines of growth and are much larger before the umbonial slope, the smaller ones reaching but a short distance from the beaks.

UNIO EVITATUS. Pl. 38, fig. 92.

Testa lævi, elliptica, valde inæquilaterali, postice subbiangulata, antice rotundata; valvulis subtenuibus, antice parum crassioribus; natibus prominulis, ad apices divaricate undulatis; epidermide olivacea, obsolete radiata; dentibus cardinalibus parviusculis, compressis, in utroque valvulo duplicibus; lateralibus sublongis, subrectis lamellatisque; margarita alba et iridescente.

Shell smooth, elliptical, very inequilateral, subbiangular behind, rounded before; valves rather thin, slightly thicker before; beaks a little prominent, divaricately folded at the tips; epidermis olivaceous, obscurely rayed; cardinal teeth rather small, compressed and double in both valves; lateral teeth rather long, nearly straight and lamellar; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1866, p. 133.

Hab.—Bengal, W. A. Haines.

My cabinet and cabinet of W. A. Haines.

Diam. .5, Length .8, Breadth 1.5 inch.

Shell smooth, elliptical, very inequilateral, subbiangular behind and rounded before; substance of the shell rather thin, slightly thicker before; beaks a little prominent, divaricately folded at the tips; ligament thin and light brown; epidermis olivaceous, darker behind and obscurely rayed; umbonial slope slightly raised and obtusely angular; posterior slope narrow elliptical, very slightly carinate, with three green rays in each valve; cardinal teeth small, compressed and double in both valves; lateral teeth rather long, nearly straight, lamellar, single in the right and double in the left valve; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, large and very indistinct; dorsal cicatrices placed immediately over the centre of the cavity of the beaks; cavity of the shell rather shallow; cavity of the beaks small and subangular; nacre white and iridescent.

Remarks.—Two specimens are before me, one of which is smoother than the other, and differs slightly in outline. It belongs to the group of which *cæruleus* (nobis) may be considered the type, and stands between that species and *pilatus*, herein described.

It differs from *cæruleus* in being smaller, in not having a bluish epidermis and in the cardinal teeth being stouter. From *pilatus* it differs in being thinner, flatter and less green. In the lateral teeth they are entirely different, *pilatus* being disposed to be *treble in both valves*, while *evitatus* is single in the right and double in the left valve. These two last mentioned shells have been in my possession several years, and I have avoided describing them in the hope of getting others more closely to compare them.

UNIO SIAMENSIS. Pl. 38, fig. 93.

Testa lævi, transversa, subcylindracea, ad basim emarginata, valde inæquilaterali, subcompressa, ad latere planulata, postice truncata, antice rotundata; valvulis tenuissimis, diaphinis; natibus prominulis; epidermide luteo-oliva; dentibus cardinalibus acicularis, sublongis, obliquis; lateralibus longis, lamellatis subrectisque; margarita alba et iridescente.

Shell smooth, transverse, subcylindrical, emarginate at the base, very inequilateral, somewhat compressed, flattened at the sides, truncate behind, rounded before; valves very thin, semitransparent; beaks a little prominent; epidermis yellowish olive; cardinal teeth acicular, rather long and oblique; lateral teeth long, lamellar and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1866, p. 133.

Hab.—Siam, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .5,

Length 1.1,

Breadth 2.3 inches.

Shell smooth, transverse, subcylindrical, emarginate at the base, very inequilateral, somewhat compressed, flattened at the sides, truncate behind, rounded before; substance of the shell very thin, semitranslucent; beaks small, somewhat pointed and a little prominent; ligament very thin and light brown; epidermis yellowish olive, without rays or obscurely rayed and with distant marks of growth; umbonial slope slightly raised and rounded; posterior slope narrow elliptical, with a rather high carina; cardinal teeth acicular, rather long and oblique; lateral teeth long, lamellar and nearly straight; anterior cicatrices confluent and very slightly impressed; posterior cicatrices confluent and scarcely perceptible; dorsal cicatrices placed directly over the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks very shallow; nacre white, inclining to yellow and very iridescent.

Remarks.—Mr. Wheatley kindly sent me his three specimens for examination and description. The largest, $2\frac{1}{4}$ inches wide, is evidently mature—the other two are younger. It is a very thin, delicate species, with very remarkably thin, slender, cardinal teeth. The lateral teeth are also thin and long, and in the left valve there is a disposition to have a triple termination. In outline this species is almost identical with *Poeyanus* (nobis) from Mexico, but that is a much thicker shell and has very different cardinal teeth. In the youngest specimen before me the elevated carina is greenish and has a few obscure rays. In outline it is quite different from *Peguensis*, Anth., being much more transverse.

UNIO ASPERULUS. Pl. 38, fig. 94.

Testa plicata, elliptica, inæquilaterali, postice subbiangulata, antice rotundata; valvulis subtenuibus; natibus subprominentibus, ad apices undulatis; epidermide viridi-oliva, obsolete radiata; dentibus cardinalibus lamellatis, parum obliquis, in dextro duplicibus; lateralibus sublongis, lamellatis subcurvisque; margarita cæruleo et valde iridescente.

Shell plicate, elliptical, inequilateral, subbiangular behind, rounded before; valves rather thin; beaks a little prominent, folded at the tips; epidermis olive-green, obscurely rayed; cardinal teeth lamellar, somewhat oblique, double in the right

valve; lateral teeth rather long, lamellar and somewhat curved; nacre bluish and very iridescent.

Proc. Acad. Nat. Sci. 1866, p. 133.

Hab.—Siam, Thomas R. Ingalls, M.D.

My cabinet.

Diam. .7,

Length .9,

Breadth 1.6 inch.

Shell plicate, elliptical, inequilateral, somewhat biangular behind, rounded before; substance of the shell rather thin; beaks a little prominent, folded at the tips; ligament short, thin and light brown; epidermis olive-green, shining, obscurely rayed and with rather distant marks of growth; umbonial slope obtusely angular; posterior slope narrow elliptical, with a slight carina and three green rays on each valve, the upper one being obscure; cardinal teeth lamellar, somewhat oblique, double in the right and single in the left valve; lateral teeth rather long, lamellar and somewhat curved; anterior cicatrices confluent, rather large and very slightly impressed; posterior cicatrices confluent, large and scarcely perceptible; dorsal cicatrices placed immediately over the centre of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks rather deep and angular; nacre bluish and very iridescent.

Remarks.—This is a small species which the late Dr. Ingalls sent me some years since. In outline it stands between *caeruleus* and *contradens* (nobis), but is rather shorter and stouter than either. The three specimens before me have a few irregular undulations on the sides and some rather obscure ones on the posterior slope, which distinguish it at once from the two above-mentioned species. In two of the species the undulations are apparent on the inside. Other specimens very probably will be found to be more plicate. Like the two cited species above, the cardinal teeth are *double* in the right valve and single in the left. It is evident that the tips of the beaks are furnished with folds, but they are too much eroded to make them out satisfactorily. It cannot be confounded with *Shurtleffianus* (nobis), which is much wider, more cylindrical, more plicate and very much rougher.

UNIO PILATUS. Pl. 38, fig. 95.

Testa lævi, elliptica, valde inequilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, ad apices minute undulatis; epidermide luteo-viridi, micanti, obsolete radiata; dentibus cardinalibus subcrassis, curtis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus sublongis, subrectis-lamellatisque; margarita alba et valde iridescente.

Shell smooth, elliptical, very inequilateral, obtusely angular behind, rounded before; valves somewhat thick, thicker before; beaks rather prominent, minutely undulate at the tips; epidermis yellowish-green, shining, obscurely rayed; cardinal

teeth somewhat thick, short, compressed, crenulate, double in both valves; lateral teeth rather long, nearly straight and lamellar; nacre white and very iridescent,

Proc. Acad. Nat. Sci. 1866, p. 133.

Hab.—Siam, Thomas R. Ingalls, M.D.

My cabinet.

Diam. .5,

Length .8,

Breadth 1.4 inch.

Shell smooth, elliptical, very inequilateral, obtusely angular behind, rounded before; substance of the shell somewhat thick, thicker before; beaks rather prominent, minutely undulate at the tips; ligament short, thin and light brown; epidermis yellowish-green, green prevailing on the posterior half, shining, obscurely rayed, with broad distant marks of growth; umbonial slope obtusely angular and somewhat raised; posterior slope narrow elliptical, with two green rays on each valve; cardinal teeth somewhat thick, short, compressed, crenulate, double in both valves; lateral teeth rather long, nearly straight, lamellar, disposed to be *treble in both valves*; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, slightly impressed and large; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather deep and angular; nacre pearly-white and very iridescent.

Remarks.—A single specimen only was received from the late Dr. Ingalls. In outline it is near to *cœruleus* (nobis), but differs in being a smaller and thicker species, as well as in having a smoother and greener epidermis. The cardinal teeth are also thicker and shorter. In the lateral teeth they are entirely different, the specimen before me having three nearly perfect ones in both valves. Whether this be a constant character can only be proved by the examination of other specimens. This specimen came with *asperulus*, herein described, and is about the size and has somewhat the same appearance; but that shell is more elliptical, has lamellar cardinal teeth, and is furnished with obscure folds, while *pilatus* is perfectly smooth. The tips of the beaks of this specimen are eroded, but the small closely-placed folds are visible all around the eroded parts, and indicate that they commenced at the very point.

UNIO RUFOFUSCUS. Pl. 39, fig. 96.

Testa plicata, subquadrata, subsulcata, sublenticulari, inæquilaterali, postice rotundata, antice rotunda; valvulis crassiusculis, antice crassioribus; natibus prominulis, crebre et minute plicatis; epidermide rufo-fusca, eradiata, micanti; dentibus cardinalibus subcompressis, obliquis, crenulatis, in utroque valvulo subduplicibus; lateralibus longis subcurvisque; margarita alba et iridescente.

Shell plicate, subquadrate, slightly sulcate, sublenticular, inequilateral, rounded behind and round before; valves somewhat thick, thicker before; beaks slightly

prominent, minutely and closely plicate; epidermis reddish-brown, without rays, shining; cardinal teeth somewhat compressed, oblique, crenulate, slightly double in both valves; lateral teeth long and somewhat curved; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1865, p. 76.

Hab.— Don Patricio Maria Paz.

Cabinet of Don P. M. Paz, Madrid.

Diam. .7, Length 1.2, Breadth 1.7 inch.

Shell plicate, subquadrate, slightly sulcate, sublenticular, inequilateral, rounded behind and round before; substance of the shell somewhat thick, thicker before; beaks slightly prominent, minutely and closely plicate, almost granulate; ligament long, thin and dark brown; epidermis reddish-brown, without rays, shining, with distant marks of growth; umbonial slope very slightly raised and rounded; posterior slope carinate, almost alate; cardinal teeth somewhat compressed, crenulate, double in the right and slightly double in the left valve; lateral teeth long, somewhat curved and corrugate; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks very shallow and rounded; nacre white and iridescent.

Remarks.—A single specimen only is before me. Its habitat is unknown, but it is probably from South America. The epidermis and minute folds are very much like *ellipticus* (nobis) from Brazil. While in these characters it closely resembles *ellipticus*, the outline of the shell is entirely different, being quadrate, more inflated and having a carina almost amounting to a wing. While *rufofuscus* belongs to the quadrate division, *ellipticus* belongs to the wide group. The beaks of the specimen being eroded for some distance, their character cannot be described, but I suspect that the small folds, which reach one-third down the side, will be found in perfect specimens to decrease to the apex.

UNIO WRIGHTII.* Pl. 39, fig. 97.

Testa plicata, lata, ad umbones inflata, valde inæquilaterali, postice acuto-angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus et crebre plicatis; epider-

*“In a paper on ‘Chinese Shells,’ by Dr. Baird and Mr. H. Adams, published in the Proceedings of the Zoological Society of London, May 9th, 1867, there are some remarks and claims which call upon me for correction.

“1st, ‘*Unio Douglasiæ*.’ It is stated that ‘in 1833 Dr. Gray shortly described and accurately figured in the 12th volume of Griffith’s edition of Cuvier a species of *Unio*, which he called *U. Douglasiæ*,’ &c. Further, that ‘Mr. Lea, some years afterwards, from not knowing the shell as figured in Griffith, described and figured a species from China, which he named *U. Murchisonianus*, but which there is no doubt is the same as *U. Douglasiæ* of Gray.’ In the above statements there are several to which I beg leave to demur. It is

mide tenebroso-fusca, eradiata, marginata; dentibus cardinalibus sublongis, subobliquis, crenulatis, lamellatis, in utroque valvulo duplicibus; lateralibus prælongis, obliquis, lamellatis corrugatisque; margarita alba et valde iridescente.

Shell plicate, wide, inflated towards the beaks, very inequilateral, acutely angular behind and rounded before; valves rather thick, thicker before; beaks rather prominent and slightly plicate; epidermis dark brown, without rays, bordered; cardinal teeth rather long, somewhat oblique, crenulate, lamellar and double in both valves;

suggested by these gentlemen that, 'perhaps from not knowing the shell (*Douglasia*) as figured in Griffith,' I had 'described and figured *Murchisonianus*, which there is no doubt is the *Douglasia* of Gray.' In answer to this I would ask how I could, when I read my paper on the 16th March, 1832, before the American Philosophical Society, know of a description in Griffith's Cuvier dated 1834 (not in 1833, as incorrectly cited)? *Douglasia* therefore cannot have precedence 'of some years,' as claimed for it, but it must remain a synonym to *Murchisonianus*, where I placed it in my *Synopsis*, first, second, and third editions, since 1836.

"As regards the claim in the same paragraph for *U. Shanghaiensis*, Lea, being also a synonym to *Douglasia*, I am constrained to differ in opinion. *Shanghaiensis* is not the same with *Douglasia*, as affirmed, but it is the same with *U. Osbeckii*, Philippi, the description of which I had not seen. 'Conchylien, vol. 3d.' Some years since I placed it as a synonym to *Osbeckii* in the manuscript copy of my *Synopsis*, 4th edition, preparing for the press.

"2d. *Anodonta tenuis*, Gray,—also called *Unio tenuis*, Gray, in Griffith's Cuvier,—is considered to be, by Messrs. Baird and Adams, an *Anodonta*, and it is said to be little known. This shell does not belong to either of these genera. It is a true *Dipsas* of Leach, and if Dr. Gray had had a perfect specimen before him when describing *Anodonta tenuis*, he never would have placed it in that genus. The *Dipsasian* character was evidently obliterated by age in the specimen from which he made his diagnosis. The young specimens, and the mature perfect ones, always have the tooth (so to call it) of the genus *Dipsas*. I described this species in the Transactions of the American Philosophical Society, March 15th, 1833, under the name of *Symphynota discoidea*, with a figure perfectly representing the characteristic tooth, which consists of a single raised, slightly curved line under the dorsal margin. In my 'Synopsis,' in the first edition in 1836, as well as in the second and third editions, I gave Dr. Gray's *tenuis* as a synonym to this shell, which I there placed in the genus *Dipsas*, where it properly belongs. It must therefore stand as *Dipsas discoidea*, Lea, with the synonym of *Anodonta tenuis*, Gray; my date being 1833, and Dr. Gray's 1834.

"In this paper of Messrs. Baird and Adams, they have described a supposed new species from Shanghai, under the name of *Unio* (*Lampsilis*) *subtortus*. I previously published a description of a species which I believe will prove the same, under the name of *tortuosus*, in the Proc. Acad. Nat. Sci. April 18, 1865. Since then I have found in the 'Journal de Conchiliologie,' July, 1863,—which work for that year was not accessible to me,—that Messrs. Crosse and Debeaux had given a description and an excellent figure of a *Unio* of the same twisted character, under the name of *Tientsinensis*, which, if the figure be entirely correct, differs in the form of the posterior slope, and in the undulations of that part.

"I may be permitted to express my surprise that neither the French nor the English authors should have observed the very remarkable character of these Chinese species, which were before them, in being *inequivalve*! The figure in the *Journal de Conchiliologie* seems to be very correctly delineated by the artist, having represented the *inequivalve* condition of the right and left valves.

"Messrs. Baird and Adams refer to *Tientsinensis*, but consider it to differ in some respects from their *subtortus*, which I think very likely. If *Tientsinensis* prove to be the same as *tortuosus* and *subtortus*, then the two last must be synonyms. If not, then there will be two species, viz.: *Tientsinensis*, Grosse and Debeaux, and *tortuosus* (nobis),—*subtortus*, B. and A., being a synonym to *tortuosus*."—(*Proc. Acad. Nat. Sci. April*, 1868)

lateral teeth very long, oblique, lamellar and corrugate; nacre white and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 75.

Hab.—China, A. R. Wright, M. D.

My cabinet and cabinet of Buffalo Society of Natural History, New York.

Diam. .9, Length 1.3, Breadth 2.5 inches.

Shell plicate, wide, inflated towards the beaks, very inequilateral, acutely angular behind and rounded before; substance of the shell rather thick, thicker before; beaks rather prominent, furnished with small corrugate folds, some of which assume an angular form; ligament rather long, rather thick and light brown; epidermis dark brown, without rays, with distant marks of growth and with a narrow border of lighter brown; umbonial slope obtusely angular; posterior slope narrow-elliptic, with a few imperfect undulations; cardinal teeth rather long, somewhat oblique, crenulate, lamellar and double in both valves; lateral teeth very long, oblique, lamellar and corrugate; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell wide and rather deep; cavity of the beaks rather deep and subangular; nacre white and very iridescent.

Remarks.—Two specimens of this species were sent for my examination by the Buffalo Society of Natural History, New York. It belongs to the group of which *Murchisonianus* (nobis) may be considered the type. It is more inflated, rather larger and has a less number of undulations. It differs from *Osbeckii*, Phil. = *Shanghaiensis* (nobis) in being more oblique, and not being cylindrical. It reminds one of *U. Pazzi* (nobis), also from China, but that shell is not plicate and is more oblique. It is, in outline, near to *Dunkerii* (nobis) from New Granada, but that is a thinner and more transverse shell, with the South American character of radiating folds, which no Asiatic or North American species has, to my knowledge. In outline it is certainly very nearly the same as *U. tumidus*, Retz., common to most parts of Europe. The description is made from a very perfect specimen. The second one is quite imperfect, being so much eroded as to be devoid of folds. It does not seem to possess the light-colored epidermal margin, and this character may not be permanent. I name it after Dr. Wright, who has deposited, in the cabinet of the Buffalo Society of Natural History, a number of fine shells from the fresh waters of China, among which is a gigantic specimen of *U. Cumingii* (nobis), being much larger than I supposed it ever occurred. It has the following dimensions: Diameter 2 inches, length 5½ inches and width 9¼ inches. The wing is entirely gone and the undulations towards the beaks are nearly obliterated.

UNIO TORTUOSUS. Pl. 39, fig. 98.

Testa inequivalva, contorta, plicata, valde obliqua, inflata, postice obtuse angulata, antice oblique curvata; valvulis percrassis, antice crassioribus; natibus prominentibus, crassis terminalibusque; epidermide tenebroso-oliva, obsolete radiata; dentibus cardinalibus permagnis, crassis, rectis corrugatisque; lateralibus sublongis, subrectis, striis perpendicularis instructis; margarita argentea et valde iridescente.

Shell inequivalve, twisted, plicate, inflated, very oblique, obtusely angular behind and obliquely curved before; valves very thick, thicker before; beaks prominent, thick and terminal; epidermis dark olive, obscurely rayed; cardinal teeth very large, thick, straight and corrugate; lateral teeth rather long, nearly straight and furnished with perpendicular striæ; nacre silver white and very iridescent.

Proc. Acad. Nat. Sci. 1865, p. 76.

Hab.—China, A. R. Wright, M. D.

Cabinet of the Buffalo Society of Natural History, New York.

Diam. 1·1,

Length 1·5,

Breadth 2·1 inches.

Shell inequivalve, twisted, plicate, very oblique, inflated, obtusely angular behind, obliquely curved before; substance of the shell very thick, thicker before; beaks prominent, thick and terminal; ligament rather short and thin; epidermis dark olive, obscurely rayed and with distant marks of growth; umbonial slope slightly raised and rounded; posterior slope with unequal sides and nearly covered with oblique folds; cardinal teeth very large, thick, straight and corrugate; lateral teeth rather long, nearly straight and furnished with perpendicular, parallel striæ on the upper half; anterior cicatrices distinct and deeply impressed; posterior cicatrices distinct and slightly impressed; dorsal cicatrices placed under the posterior part of the cardinal tooth; cavity of the shell rather deep and rounded; cavity of the beaks very deep and obtusely angular; nacre silver white and very iridescent.

Remarks.—This very remarkable shell was, among other shells from China, sent to me for examination by the Buffalo Society of Natural History. It was accompanied by the gigantic specimen of *U. Cumingii* (nobis) mentioned above. This is the first *Unio* which has been found possessing an irregular plane of the margin and being inequivalve. When looking on the anterior end, with the ligament above, the line of the opening of the valves curves to the right. The beak of the left valve is higher than that of the right and projects anteriorly. The left valve, therefore, is larger than that of the right, and the weight differs—the left being 257 grains and the right 242 grains. In the specimen before me the marks of growth are but two and they are distant. The cardinal teeth are large and nearly in a line with the lateral teeth. The very remarkable perpendicular striæ on the lateral teeth of this specimen, if always present in other individuals, will demand its being placed in the genus *Prisodon*,

Schum. = *Castalia*, Lam. These striæ are not so strong and well developed as in *Prisodon ambigua*, Schum., but they are moderately developed and, probably, entirely normal to the species. The apex of the beaks is not perfect in this species, and whether it has undulations or not cannot be ascertained from this specimen, but the oblique undulations on the posterior slope are probably well developed to the points. The epidermis is smooth and glossy, and of so dark an olive as to be nearly bottle-green. In the outline and general appearance one is reminded of *Unio ellipsis* (nobis). Before *Triquetra contorta*, from China, was described by me, none of us could have expected to see a member of the *Unionidæ* to be curved like *Arca tortuosa*, Lin.; but now we have a second member of the family totally unlike the other, except having a curved plane of the shell. Since the above was written I have had two specimens from Hong Kong referred to me by Mr. J. G. Anthony. They have both the same inequivalve character, but they differ in having tubercles on the disks as well as in having folds. The striæ of the lateral teeth are much stronger, thus presenting the character of *Prisodon*. This character, with the tubercles, suggests that this species may be identical with Wood's *Mya nodulosa*, which I have placed in the genus *Prisodon*.

NOTE.—Since the above description was published in the *Proc. Acad. Nat. Sci.*, April 18th, 1865, I have seen the description of a species by Messrs. Crosse and Debeaux, under the name of *U. Tientsinensis*, in the *Journal de Conch.*, July, 1863. (See note page 285.)

ANODONTA YOUKANENSIS. Pl. 40, fig. 99.

Testa lævi, elliptica, valde inflata, valde inæquilaterali, postice subbiangulata, antice rotundata; valvulis subcrassis; natibus prominulis, ad apices aliquanto undulatis; epidermide tenebroso-fusca, eradiata; margarita albida.

Shell smooth, elliptical, very much inflated, very inequilateral, somewhat biangular behind, rounded before; valves somewhat thick; beaks a little prominent, somewhat undulate at the tips; epidermis dark brown, without rays; nacre whitish.

Proc. Acad. Nat. Sci. 1867, p. 81.

Hab.—Upper Youkan River, Arctic America.

My cabinet and cabinet of Smithsonian Institution.

Diam. 1·7,

Length 2·5,

Breadth 4·9 inches.

Shell smooth, elliptical, very much inflated, very inequilateral, somewhat biangular behind and rounded before; substance of the shell somewhat thick, rather thicker before; beaks a little prominent, somewhat undulate at the tips; ligament very long and narrow; epidermis dark brown, without rays and with very close marks of growth; umbonial slope flattish; posterior slope long ovate and slightly carinate; anterior cicatrices confluent, large and well impressed; posterior cicatrices

confluent, large and very slightly impressed; dorsal cicatrices placed across the cavity of the beaks; cavity of the shell deep and wide; cavity of the beaks shallow and wide; nacre whitish.

Remarks.—I am indebted to Prof. Henry, Secretary of the Smithsonian Institution, for the advantage of seeing and describing this shell, which is the first that has been received from the great river Youkan, of the new territory *Alaska*, recently acquired from Russia in Arctic America. It is greatly to be regretted that other species of the *Unionidæ* have not been found, as they no doubt exist where these were found. I have several specimens before me, all of uniform character.

In outline this species is near to *Anodonta ovata* (nobis), but it is more inequivalve and more inflated, of a darker color in the epidermis and has closer marks of growth. All the specimens received were dead and much injured. I am not aware by whom they were taken and brought here.

ANODONTA GRANADENSIS.* Pl. 41, fig. 100.

Testa lævi, elliptica, subinflata, *inequivalva*, inæquilaterali, postice obtuse angulata, antice rotunda; valvulis subtenuibus; natibus prominulis; epidermide vel lutea vel virido-radiata; margarita cæruleo-alba et valde iridescente.

Shell smooth, elliptical, somewhat inflated, *inequivalve*, inequilateral, obtusely

*“In the ‘Proceedings of the Acad. of Nat. Sci.,’ April, 1856, I described a new species of *Triqueta* (*Hyria*, Lam.), which I called *lanceolata*. It was made from a single valve in a collection from China. In the diagnosis made in the ‘Proceedings’ it was not mentioned that this valve was somewhat twisted, being fearful that the curved condition arose from accidental circumstances, and not from a normal condition like *Arca tortuosa*, Lin. Subsequently, in the ‘Journal of the Academy,’ vol. iii, and in ‘Observations on the Genus Unio,’ vol. vi, I published a full account of this peculiarly interesting species, having received perfect specimens, one of which was well figured. In this paper I thought that, as the original name of *lanceolata*, made from a single imperfect valve, did not apply to the perfect shell, science would be subserved by a descriptive name. I proposed to call it *contorta*, and redescribed it under that name with full remarks and observations. At that time it was the only member of the family *Unionidæ* which was known not to be *equivalve*. Subsequently, in describing a species of *Spatha* under the name of *Natalensis*, I mentioned that it was ‘slightly inequivalve.’ ‘Journal Acad. Nat. Sci.,’ vol. vi, and in ‘Observations on the Genus Unio,’ vol. xi.

“In 1865 I published in the ‘Proceedings of the Academy’ the diagnosis of a new *Unio* from China, which is *inequivalve* and twisted. This I named *tortuosus*. The full description and figure, with remarks, is in a paper which I have prepared for the Journal of the Academy. These constitute all the *inequivalve* species of the family which I have seen until recently.

“The collection made by the late Mr. Thomas Bridges, botanist, who, during his travels in Central America, visited Lake Nicaragua, has been kindly placed in my possession, part by Col. E. Jewett, and part by Mr. W. M. Gabb, Palæontologist of the California Geological Survey. Very much to my surprise and satisfaction I found that several species of *Unio* and *Anodonta* had this *inequivalve* character.

“It may be here remarked that there seems to be a predisposition, in the *Unionidæ* of Central America, to this very unusual character in the *Unionidæ*, while in Mexico, United States and Canada, where so many species have been described, there has not been a single one observed. These observations and the follow-

angular behind, round before; valves rather thin; beaks slightly prominent; epidermis yellowish or green rayed; nacre bluish-white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 96.

Hab.—Lake Nicaragua, Central America, Col. E. Jewett.

My cabinet and cabinets of Col. Jewett and Academy of Natural Sciences.

Diam. .6, Length .9, Breadth 1.4 inch.

Shell smooth, elliptical, somewhat inflated, *inequivalve*, inequilateral, obtusely angular behind, round before; substance of the shell rather thin; beaks slightly prominent; ligament thin and short; epidermis yellowish or green rayed; umbonial slope rounded; posterior slope carinate, elongate elliptical; anterior cicatrices confluent and but little impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed in the upper part of the cavity of the beaks; cavity of the shell shallow; cavity of the beaks very shallow; nacre bluish-white and very iridescent.

Remarks.—This species is allied to *lenticularis* and *inæquivalva*, herein described, but may be distinguished by being more transverse than either. The three are very closely allied, but I think they cannot belong to one species. I have been impressed by the fact that, in the *Unionidæ* of Lake Nicaragua, the specific differences are so small that one cannot, with entire satisfaction, seize well defined and characteristic differences, while it is evident they exist.

ANODONTA JEWETTII Pl. 41, fig. 101.

Testa lævi, suboblonga, valde inflata, parum inæquilaterali, postice rotundata, antice oblique rotundata; valvulis tenuibus; natibus prominentibus, inflatis; epidermide olivacea, transverse striata, fere sulcata, obsolete radiata; margarita argentea et valde iridescente.

Shell smooth, suboblong, very much inflated, somewhat inequilateral, rounded behind and obliquely rounded before; valves thin; beaks prominent, inflated; epidermis olivaceous, transversely striate, almost sulcate and obscurely radiate; nacre silver-white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

ing list will, I hope, induce more attention to the investigation, by students of Fresh-water *Molluscs*, of this interesting branch of inquiry:

List of inequivalve Unionidæ.

| | |
|-------------------------------------|--|
| Triquetra contorta, China. | Unio encarpus, Central America. |
| Spatha Natalensis, Africa. | Unio Nicaraguensis, Central America. |
| Unio tortuosus, China. | Anodonta inæquivalva, Central America. |
| Unio Newcombianus, Central America. | Anodonta Granadensis, Central America. |
| Unio Gabbianus, Central America. | Anodonta lenticularis, Central America." |

Pro. Acad. Nat. Sci., March, 1868.

Hab.—Lake Nicaragua, Central America, Col. E. Jewett.

My cabinet.

Diam. 1·9,

Length 2·5,

Breadth 4·3 inches.

Shell smooth, suboblong, very much inflated, somewhat inequilateral, rounded behind and obliquely rounded before; substance of the shell thin; beaks prominent, large and very much inflated; ligament rather short, thick and dark brown; epidermis olivaceous, with a single mark of growth, transversely striate, almost sulcate and obscurely radiate; umbonial slope raised and rounded; posterior slope wide, elliptical and dark green; anterior cicatrices distinct, rather large and very slightly impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed within the cavity of the beaks; cavity of the shell deep and rather wide; cavity of the beaks rather deep and rounded; nacre silver-white, pinkish in the cavity of the beaks and very iridescent

Remarks.—A single specimen was sent to me by Col. Jewett, of Utica, N. Y. It was obtained by him as coming from Lake Nicaragua. The remarks as to habitat mentioned in regard to *An. Bridgesiana*, herein described, may apply to this. In outline and inflation it has a close resemblance to *An. doliaris* (nobis), from North Carolina, but it is more quadrate, has a different epidermis and is much more brilliant in the nacre. The transverse striæ are close and well defined, almost forming furrows. On the posterior slope there are a few broad, greenish rays. The nacre is brilliant, but not nearly so much so as in *Bridgesiana*. The interior, towards the beaks in this specimen, is pinkish. A single mark of growth is prominent towards the margin in this specimen. It cannot be confounded with *Bridgesiana*, from same habitat, that species being more transverse, of a thinner substance and much more brilliant in the nacre, and the dorsal line is not so straight. It differs from *trapezialis*, Lam., in not being oblique, and from *Forbesiana* (nobis) in not being obovate and in not being so solid. I name this fine species after Col. Jewett, who kindly sent it to me.

ANODONTA LENTICULARIS. Pl. 41, fig. 102.

Testa lævi, subrotunda, compressa, *inæquivalva*, inæquilaterali, antice et postice rotundata; valvulis subtenuibus; natibus prominulis; epidermide transverse striata, tenebroso-viridi, redundanter radiata; margarita cæruleo-alba et valde iridescente.

Shell smooth, subrotund, compressed, *inequivalve*, inequilateral, rounded before and behind; valves rather thin; beaks a little prominent; epidermis transversely striate, dark green and very much radiated; nacre bluish-white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

Hab.—Lake Nicaragua, Central America, W. M. Gabb.

My cabinet.

Diam. .6, Length 1, Breadth 1.4 inch.

Shell smooth, subrotund, compressed, *inequivalve*, inequilateral, rounded before and behind; substance of the shell rather thin; beaks a little prominent; ligament small and pale brown; epidermis transversely striate, dark green and very much radiated; umbonial slope depressed and rounded; posterior slope subcarinate, narrow elliptical; anterior cicatrices confluent and somewhat impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed on the upper side of the cavity of the beaks; cavity of the beaks shallow and rounded; cavity of the shell very shallow and subangular; nacre bluish-white and very iridescent.

Remarks.—A single specimen only of this species was received. It is closely allied to *inæquivalva*, herein described, in most of its characters, and especially in being *inequivalve*. It may be distinguished in being more rounded, in being lenticular and in having dark green rays over the whole disk, except on the posterior slope, which is yellow, while the anterior slope is covered with dark green. The nacre is remarkably brilliant. The beaks are eroded and do not seem to possess any undulations.

ANODONTA BRIDGESII. Pl. 42, fig. 104.

Testa lævi, oblonga, inflata, inæquilaterali, antice et postice rotundata; valvulis pertenuibus; natibus prominulis; epidermide lævissima, micante, olivacea, obsolete radiata; margarita elegantissime iridescente.

Shell smooth, oblong, inflated, inequilateral, rounded before and behind; valves very thin; beaks a little prominent; epidermis very smooth, shining, olivaceous and obscurely radiated; nacre elegantly iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

Hab.—Lake Nicaragua, Central America, Mr. Th. Bridges.

My cabinet and cabinet of the Academy of Natural Sciences.

Diam. 1.7, Length 2.5, Breadth 4.7 inches.

Shell smooth, oblong, inflated, inequilateral, rounded before and behind; dorsal and basal margins nearly parallel; substance of the shell very thin; beaks a little prominent; ligament long, thin and light brown; epidermis very smooth, shining, olivaceous, with very distant marks of growth and obscurely radiate; umbonial slope rounded; posterior slope raised almost into a keel, the whole being dark green; anterior cicatrices distinct, very large and very slightly impressed; posterior cicatrices very large and very indistinct; dorsal cicatrices placed within the cavity of the beaks; cavity of the shell large and wide; cavity of the beaks rather shallow; nacre remarkably brilliant and iridescent.

Remarks.—This species of *Anodonta* was among the shells taken by Mr. Bridges, in Nicaragua. Like the other *Unionidæ* brought to this country by some collectors from California, there remains a possibility of error in the habitat. Unfortunately this industrious botanist did not live to bring his collections home, and the *Unionidæ* were sent to San Francisco and there distributed as coming from Lake Nicaragua. Several known species of this collection inhabit Lake Nicaragua, but there are two species of *Micetopus* which heretofore have only been found in South America. This fact, and this only, throws some doubt as to the exact habitat of the species of *Unionidæ*, which have not before been observed. All the *Uniones* received have that peculiar sulcation over the whole disk which characterise all the species I have seen from Lake Nicaragua; and they are by no means rare in our cabinets. But heretofore I have not seen an *Anodonta* from this Lake, while in this collection there are several. All this doubt must be taken into consideration as to the habitat of the species described in this paper said to have come from Lake Nicaragua. The species above described is somewhat like *trapezialis*, Lam., but differs in being more rectangular and having the dorsal and basal lines nearly parallel. There is a disposition in all the specimens before me to be slightly compressed in the middle, from the beaks to the base, which causes a slight arcuation on the basal margin, and on this space there is usually a broad line of slightly darker color. The posterior slope is of a dark green color. The nacre is of most extraordinary brilliancy, radiant with all the colors of the spectrum, being opalescent over the whole interior. I have peculiar gratification in dedicating this fine species to the memory of the distinguished botanist, who, after many years of successful examination of tropical vegetation, was unfortunately unable to return to his family, having died at sea of tropical fever, on his way from Panama to San Francisco. His friend, Dr. Hooker, has honored him by naming a genus of plants after him, calling it *Bridgesia*.

ANODONTA INÆQUIVALVA. Pl. 43, fig. 108.

Testa lævi, obovata, compressa, *inæquivalva*, inæquilaterali, antice et postice rotundata; valvulis subtenuibus; natibus subprominentibus; epidermide vel tenebroso-viridi vel luteo-viridi, obsolete radiata; margarita cæruleo-alba et valde iridescente.

Shell smooth, obovate, compressed, *inequivalve*, inequilateral, rounded before and behind; valves rather thin; beaks somewhat prominent; epidermis dark green or yellowish-green and obscurely radiated; nacre bluish-white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

Hab.—Lake Nicaragua, Central America, Mr. W. M. Gabb.

My cabinet and cabinet of Academy of Natural Sciences.

Diam. .7,

Length 1.1,

Breadth 1.6 inch.

Shell smooth, obovate, compressed, *inequivalve*, inequilateral, rounded before and behind; substance of the shell rather thin; beaks somewhat prominent; ligament short, thin and dark brown; epidermis dark green or yellowish-green and obscurely radiated; umbonial slope rather depressed and rounded; posterior slope narrow elliptical and carinate; anterior cicatrices confluent, large and very slightly impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices scarcely perceptible; cavity of the shell rather shallow and wide; cavity of the beaks shallow and obtusely angular; nacre bluish-white and very iridescent.

Remarks.—Several specimens of this remarkable *Anodonta* are before me. They are all slightly *inequivalve*, having the beak of the left valve a little higher than that of the right, and having a slight flexure on the superior anterior margin. In this unusual character of being *inequivalve*, it resembles *Spatha Natalensis* (nobis), from South Africa, described in my eleventh volume of "Observations on the Genus *Unio*." I have not before observed this character on any of our American *Anodonta*, but we have a *Unio* and a *Triquetra*, it will be remembered, from Northern China, published by me, which are so. To these may now be added several new *Uniones* from Lake Nicaragua, described herein. [See remarks on *U. Nicaraguensis*.] In outline it is near to *luteola* (nobis), but it is a smaller species, thinner and more inflated. Several specimens which accompanied the four before me are nearly of the same size and thinness, but they differ in outline and constitute, I think, different species, and will be described herewith. The epidermis on most of the small *Anodontæ* of this collection is worn and bleached. The one figured has a dark green epidermis, with a broad border. The other three are pale yellow, with obsolete green rays well marked on the posterior slope, with three distinct ones on each valve.

UNIO GRANADENSIS. Pl. 42, fig. 103.

Testa sulca, elliptica, subinflata, inæquilaterali, postice subangulari, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide tenebroso-fusca, nigricante, eradiata; dentibus cardinalibus parviusculis, compressis, erectis crenulatisque; lateralibus obliquis; margarita alba et iridescente.

Shell sulcate, elliptical, somewhat inflated, inequilateral, subangular behind, rounded before; valves somewhat thick, thicker before; beaks somewhat prominent; epidermis dark brown, blackish, without rays; cardinal teeth rather small, compressed, erect and crenulate; lateral teeth oblique; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

Hab.—Lake Nicaragua, Central America, Col. E. Jewett and Mr. Gabb.

My cabinet and cabinets of Acad. Nat. Sci. and Col. Jewett.

Diam. .6,

Length .9,

Breadth 1.4 inch.

Shell sulcate, elliptical, somewhat inflated, inequilateral, subangular behind, rounded before; substance of the shell rather thick, thicker before; beaks somewhat prominent; ligament very short and dark brown; epidermis dark brown, blackish and without rays; umbonial slope obtusely angular; posterior slope narrow and very slightly raised; cardinal teeth rather small, compressed, erect and crenulate; lateral teeth oblique and slightly curved; anterior cicatrices small, distinct and well impressed; posterior cicatrices distinct and moderately well impressed; dorsal cicatrices small, placed on the upper part of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks rather deep and subangular; nacre white and iridescent.

Remarks.—Nearly a dozen of this small dark-colored species are before me. It is easily distinguished from all the other species from Lake Nicaragua by its nearly black epidermis, which is thin and easily rubbed off. None of the specimens having it to remain on the beaks, and but little on the sides. In some of the specimens there is a disposition to salmon color in the cavity of the beaks. In outline it is nearly the same with *fabalis* (nobis) and *germanus* (nobis). It is also near to *Rowellii* (nobis), from Charges River, and, like it, it is sulcate. It may easily be distinguished from it, however, by the blackish epidermis, the *Rowellii* being of a dark olive. It is also more oblique, and not so large a species.

UNIO ENCARPUS. Pl. 42, fig. 105.

Testa sulcata, subtriangulari, subinflata, aliquanto *inequivalva*, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subcrassis, antice crassioribus; natibus prominentibus; epidermide tenebroso-olivacea, encarpiformi, eradiata; dentibus cardinalibus compressis, erectis, crenulatis, in valvulo dextro subtripartitibus; lateralibus obliquis rectisque; margarita albida et iridescente.

Shell sulcate, subtriangular, somewhat inflated, slightly *inequivalve*, inequilateral, obtusely angular behind, rounded before; valves rather thick, thicker before; beaks rather prominent; epidermis dark olivaceous, festoon-like, without rays; cardinal teeth compressed, erect, crenulate, somewhat tripartite in the right valve; lateral teeth oblique and straight; nacre whitish and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

Hab.—Lake Nicaragua, Central America, Mr. W. M. Gabb.

My cabinet and cabinet of Acad. Nat. Sci.

Diam. .7,

Length .1,

Breadth 1.4 inch.

Shell sulcate, subtriangular, somewhat inflated, slightly *inequivalve*, inequilateral, obtusely angular behind, rounded before; substance of the shell rather thick, thicker before; beaks rather prominent; ligament short and thin; epidermis dark olivaceous, the sulcations being festoon-like, without rays; umbonial slope obtusely angular; pos-

terior slope sulcate, but nearly free from festoons; cardinal teeth compressed, erect, crenulate, somewhat tripartite in the right and double in the left valve; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather deep and angular; nacre whitish and iridescent.

Remarks.—Two specimens only were received, both of the same size, color and form. This species is nearly of the same outline with *U. cyrenoides*, Phil., but differs in not being granulate nor solid, nor quite so deltoid. It cannot be confounded with *Newcombi* (nobis), for that shell is rotund, solid and more compressed. But like the latter it has transverse furrows, which are slightly interrupted by minute and irregular festoon-like curves in the epidermis, and which give the surface a somewhat roughened crinkled aspect. I have given the name *encarpus* to this species from these festoon-like striæ which pervade the disk. The posterior slope has two impressed lines on each valve, and the area within these lines is striate, not sulcate.

UNIO GABBIANUS. Pl. 43, fig. 106.

Testa sulcata, triangulata, subinflata, aliquanto *inequivalva*, inæquilaterali, postice acute angulari, antice oblique truncata; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominentibus, ad apices retusis; epidermide tenebroso-olivacea, obsolete radiata; dentibus cardinalibus erectis, compressis et valde crenulatis; lateralibus curtis, obliquis striatisque; margarita argentea et iridescente.

Shell sulcate, triangular, somewhat inflated, slightly *inequivalve*, inequilateral, acutely angular behind, obliquely truncate before; valves rather thick, somewhat thicker before; beaks prominent, drawn back at the tips; epidermis dark olive, obscurely radiate; cardinal teeth erect, compressed, and very much crenulate; lateral teeth short, oblique and striate; nacre silver-white and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

Hab.—Lake Nicaragua, Central America, Col. E. Jewett and Mr. W. M. Gabb.

My cabinet and cabinets of Acad. Nat. Sci. and Col. Jewett.

Diam. .7,

Length 1,

Breadth 1.3 inch.

Shell sulcate, triangular, somewhat inflated, slightly *inequivalve*, inequilateral, acutely angular behind, obliquely truncate before; substance of the shell rather thick, somewhat thicker before; beaks prominent, drawn back and pointed at the tips; ligament short, thin and light brown; epidermis dark olive, obscurely radiate; umbonial slope obtusely angular; posterior slope very slightly raised, regularly elliptical; cardinal teeth erect, compressed and very much crenulate; lateral teeth short, oblique and striate; anterior cicatrices distinct and well impressed; posterior cicatrices distinct and moderately impressed; dorsal cicatrices placed under the

cardinal tooth within the cavity of the beaks; cavity of the shell rather deep and rounded; cavity of the beaks deep and angular; nacre silver-white and iridescent.

Remarks.—There are nine specimens before me from Col. Jewett and Mr. Gabb. They are very perfect, having beaks without erosion, but not exhibiting any undulations at the tips, while minute green rays are very apparent. In all the specimens perfect enough the disks exhibit very obscure rays, which are capillary at the apex, and these are beautifully distinct. The furrows are extremely regular and beautiful, and are without festoons as in *encarpus*, herein described. In outline it is near to *cyrenoides*, Phil., but it is a smaller and less solid shell, and the teeth are not massive, but thin, delicate and compressed. I have pleasure in dedicating this pretty little species to Mr. W. M. Gabb, who, while devoting his time to his palæontological duties as one of the geologists of the California Survey, has brought here a number of new species, which were collected by the late botanist Th. Bridges in Lake Nicaragua.

UNIO NICARAGUENSIS. Pl. 43, fig. 107.

Testa sulcata, triangulari, compressa, aliquanto *inequivalva*, inæquilaterali, postice obtuse angulata, antice oblique truncata; valvulis crassiusculis; natibus prominentibus, subacutis; epidermide olivacea, crebris sulcatis indutis, radiata; dentibus cardinalibus erectis, compressis, crenulatis et in valvulo dextro subtripartitibus; lateralibus brevibus fornicatisque; margarita argentea et iridescente.

Shell sulcate, triangular, compressed, slightly *inequivalve*, inequilateral, obtusely angular behind, obliquely truncate before; valves rather thick; beaks prominent, rather pointed; epidermis olivaceous, covered with close furrows, without rays; cardinal teeth erect, compressed, crenulate, and in the right valve somewhat tripartite; lateral teeth short and arched; nacre silver-white and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 95.

Hab.—Lake Nicaragua, Central America, Mr. W. M. Gabb.

My cabinet and cabinet of Acad. Nat. Sci.

Diam. .7,

Length 1.1,

Breadth 1.5 inch.

Shell sulcate, triangular, compressed, slightly *inequivalve*, inequilateral, obtusely angular behind, obliquely truncate before; substance of the shell rather thick; beaks prominent, pointed at the tips; ligament short, thin and light brown; epidermis olivaceous, covered with transverse close furrows and without rays; umbonial slope angular and placed near the posterior margin; posterior slope very narrow elliptical, depressed, with a small elevated line in each valve from the beaks to the posterior margin; cardinal teeth erect, compressed, crenulate, and in the right valve somewhat tripartite; lateral teeth short, lamellar and arched; anterior cicatrices distinct and well impressed; posterior cicatrices distinct and well impressed; dorsal cicatrices placed

in the upper part of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks rather deep and obtusely angular; nacre silver-white and iridescent.

Remarks.—One only of the four specimens before me appears to be adult. This is the most perfect one. The others are apparently only half-grown. This species may be distinguished from *Newcombianus* (nobis) by being less solid, being more compressed, and in having smaller and compressed cardinal teeth. It belongs to the deltoid form of the sulcate group, which group has so many representatives in the Central American *Uniones*. It is somewhat allied in color and sulcation to *Caldwellii* (nobis), but that species is elliptical and the sulcations are not so regular. In the youngest specimen the beaks are nearly perfect. There is no sign of undulations, but there are capillary green rays from the tips. The tripartite character of the cardinal tooth of the right valve is more or less developed in most of these Nicaraguan *Uniones*; some are very slightly so. It is a very remarkable feature of some of the small *Unionidae* of Lake Nicaragua to be *inequivalve*. Three species described herein are so, plainly showing one beak to be higher than the other, and the plane of the valves may easily be observed to be slightly curved. Having received several perfect specimens of *U. Newcombianus*, I was surprised to find in every case that the *inequivalve* character was also possessed by it.

UNIO BEAVERENSIS. Pl. 44, fig. 109.

Testa lævi, oblonga, compressa, ad latere planulata, inæquilaterali, postice obtuso-biangulari, antice rotunda; valvulis subcrassis, antice parum crassioribus; natibus subprominentibus; epidermide vel rubiginosa vel luteola, micanti, radiata; dentibus cardinalibus crassis sulcatisque; lateralibus longis, crassis, lamellatis subrectisque; margarita vel alba vel purpurea et valde iridescente.

Shell smooth, oblong, compressed, flattened at the sides, inequilateral, obtusely biangular behind, round before; valves rather thick, slightly thicker before; beaks somewhat prominent; epidermis rubiginose or yellowish, shining and obscurely radiate; cardinal teeth thick and sulcate; lateral teeth long, thick, lamellar and nearly straight; nacre white or purple and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 161.

Hab.—Beaver Creek and Long Creek, N. C., C. M. Wheatley, and Carter's Creek, Geo., J. Postell.

My cabinet and cabinet of Mr. Wheatley.

Diam. .8, Length 1.6, Breadth 2.8 inches.

Shell smooth, oblong, compressed, flattened at the sides, inequilateral, obtusely biangular behind, round before; substance of the shell rather thick, slightly thicker before; beaks somewhat prominent; ligament rather short and dark brown;

epidermis reddish-brown or yellowish, shining, radiated, with very distant lines of growth; umbonial slope low and slightly angular; posterior slope very narrow elliptical and raised into a sharp carina, made dark green with rays; cardinal teeth thick, sulcate and slightly crenulate; lateral teeth long, thick, lamellar and nearly straight; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell very shallow and wide; cavity of the beaks very shallow and obtusely angular; nacre white or purple and very iridescent.

Remarks.—Among the *Unionidæ* procured by Mr. Wheatley from North Carolina were several of this species, which belongs to the *complanatus* group. It is allied to *humerosus*, herein described, but is a thicker shell and a little more transverse. The specimen from Carter's Creek, Geo., has a white nacre and may possibly be a different species. The older specimens are dark, reddish-brown and some are without rays. The younger and more perfect specimens are yellowish, and the one figured is covered with fine rays.

UNIO NUBILUS. Pl. 44, fig. 110.

Testa lævi, oblonga, subcompressa, inæquilaterali, postice biangulari, antice rotundata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus crassis, sulcatis corrugatisque; lateralibus crassis, longis, corrugatis lamellatisque; margarita nubila, salmonea et purpurea, iridescente.

Shell smooth, oblong, subcompressed, inequilateral, biangular behind and rounded before; valves thick, thicker before; beaks a little prominent; epidermis dark brown, radiate; cardinal teeth thick, sulcate and corrugate; lateral teeth thick, long, corrugate and lamellar; nacre cloudy, salmon colored and purple, iridescent.

Proc. Acad. Nat. Sci. 1868, p. 161.

Hab.—Paw Creek, Mecklenburg Co., N. C., C. M. Wheatley.

Diam. .9,

Length 1.8,

Breadth 3.2 inches.

Shell smooth, oblong, subcompressed, inequilateral, biangular behind and rounded before; substance of the shell thick, thicker before; beaks a little prominent; ligament long, thick and very dark brown; epidermis very dark brown, without rays and with rather close lines of growth; umbonial slope somewhat raised and obtusely angular; posterior slope narrow elliptical, somewhat raised, with rather a wide furrow on each valve from the beaks to the posterior margin; cardinal teeth thick, sulcate and corrugate; lateral teeth thick, long, corrugate and lamellar; anterior cicatrices distinct, very large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks shallow and obtusely angular; nacre cloudy, salmon-color and purple, iridescent.

Remarks.—There are four specimens before me, all of which have a mixture of color, salmon, purple and greenish epidermal matter, which gives a singular clouded aspect to the nacre of the interior. Hence the name. The salmon color prevails and is very intense and beautiful in several of the specimens. In outline this species is near to *Weldonensis* and *Mecklenbergensis* (nobis). It is more quadrate than either and differs entirely in the color of the nacre.

UNIO DATUS. Pl. 44, fig. 111.

Testa lævi, lato-elliptica, valde compressa, inæquilaterali, postice obtuse angulari, antice rotundata; valvulis subcrassis, antice parum crassioribus; natibus prominulis; epidermide rufo-fusca, micanti, obsolete radiata; dentibus cardinalibus parviusculis, sulcatis erectisque; lateralibus prelongis, subcurvis, lamellatis corrugatisque; margarita nubila, salmonea et purpurea, et valde iridescente.

Shell smooth, broadly elliptical, very much compressed, inequilateral, obtusely angular behind, rounded before; valves somewhat thick, a little thicker before; beaks slightly prominent; epidermis reddish-brown, shining and obscurely radiated; cardinal teeth rather small, sulcate and erect; lateral teeth very long, somewhat curved, lamellar and corrugate; nacre cloudy, salmon-color and purple, and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 161.

Hab.—Paw Creek, Beaver Co., and Long Creek, N. C., C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .8, Length 1.7, Breadth 3.2 inches.

Shell smooth, broadly elliptical, very much compressed, inequilateral, obtusely angular behind and rounded before; substance of the shell somewhat thick, a little thicker before; beaks slightly prominent; ligament long, narrow and dark; epidermis reddish-brown, shining, obscurely radiated, with distant distinct lines of growth; umbonial slope flattened; posterior slope slightly carinate; cardinal teeth rather small, sulcate and erect; lateral teeth very long, somewhat curved, lamellar and corrugate; anterior cicatrices distinct, large and well impressed; posterior cicatrices distinct and moderately well impressed; dorsal cicatrices nearly in the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks very shallow; nacre cloudy, salmon-color and purple, and very iridescent.

Remarks.—Three specimens are before me and they are all of the same regular ellipse. In outline it is very close to *subellipsis* (nobis), and also to some varieties of *radiatus*, Lam., but these totally differ in radiations and color of epidermis. The nacre in all has a predominance of salmon color, but it is mixed with purple and

the deposit of epidermal matter, so that the whole interior of the disk becomes cloudy. The lines of growth in each of the three specimens are four, and they are at nearly equal distances and very strongly marked.

UNIO DORSATUS. Pl. 45, fig. 112.

Testa laevi, triangulari, ad latere planulata, inæquilaterali, postice subbiangulari, antice rotundata; valvulis subtenuibus, antice crassiusculis; natibus prominentibus; epidermide rufo-fusca, subsquamosa, obsolete radiata; dentibus cardinalibus parvis corrugatisque; lateralibus longis, lamellatis subcurvisque; margarita vel alba vel purpurea vel salmonea et valde iridescente.

Shell smooth, triangular, flattened at the sides, inequilateral, subbiangular behind and rounded before; valves rather thin, thicker before; beaks prominent; epidermis reddish-brown, subsquamosa, obtusely radiated; cardinal teeth small and corrugate; lateral teeth long, lamellar and somewhat curved; nacre white, purple or salmon color and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 160.

Hab.—Catawba River, N. C., C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .9,

Length 1.5,

Breadth 2.2 inches.

Shell smooth, triangular, flattened at the sides, inequilateral, subbiangular behind, rounded before; substance of the shell rather thin, thicker before; beaks prominent; ligament short, thick and dark brown; epidermis reddish-brown, somewhat squamosa, obscurely radiate, with distant lines of growth; umbonial slope raised and obtusely angular; posterior slope raised into a carina; cardinal teeth small and corrugate; lateral teeth long, lamellar and somewhat curved; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and moderately impressed; dorsal cicatrices placed above the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather deep and subangular; nacre white, purple or salmon color and very iridescent.

Remarks.—Several specimens are before me which differ slightly. They have all more or less color of purple; some are mixed with salmon color. One is clouded with purple and white. In outline it is nearest to *ovatus*, Say, but it differs very much in size, inflation, color of the nacre, epidermis, and flatness of the posterior slope. The epidermis in *ovatus* is yellowish, smooth and polished. In this species it is rubiginose and squamosa. The beaks, as usual in nearly all the specimens sent from this part of North Carolina, are eroded, and therefore the apical undulations are unknown. Some of the specimens are wrinkled on the posterior slope.

UNIO HUMEROSUS. Pl. 45, fig. 113.

Testa lævi, elliptico-oblonga, compressa, ad latere planulata, inæquilaterali, postice obtuse biangulari, antice rotunda; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide rufofusca, obsolete radiata; dentibus cardinalibus grandibus, sulcatis, partitis; lateralibus prælongis, lamellatis corrugatisque; margarita salmonis colore tincta et valde iridescente.

Shell smooth, elliptical oblong, compressed, flattened at the side, inequilateral, obtusely biangular behind and round before; valves rather thick, thicker before; epidermis reddish-brown, obsoletely radiated; cardinal teeth large, sulcate and divided; lateral teeth very long, lamellar and corrugate; nacre salmon color and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 161.

Hab.—Charlotte, Mecklenberg Co., N. C., C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. 1.1, Length 2.1, Breadth 3.5 inches.

Shell smooth, elliptical oblong, compressed, flattened at the side, inequilateral, obtusely biangular behind and round before; substance of the shell thick, thicker before; ligament long, large and dark brown; epidermis reddish-brown, obscurely radiated, with somewhat distant marks of growth; umbonial slope flattened and rounded; posterior slope narrow-elliptical, carinate, dark brown, with two impressed lines in each valve; cardinal teeth large, sulcate and divided; lateral teeth very long, lamellar and corrugate; anterior cicatrices distinct, very large and very much impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed above the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks very shallow and rounded; nacre salmon colored and very iridescent.

Remarks.—In outline this species is very nearly the same as *Charlottensis* (nobis), but that is a thinner shell, with very different cardinal and lateral teeth, which are very small, while in *humerosus* they are thick and almost massive. The cavity of the shell in the latter is also much more shallow. The color of the nacre is also different. The cardinal teeth of *humerosus* are remarkably sulcate, and disposed to be divided into three parts in each valve. The lateral teeth are large and stout. The whole of the posterior slope is dark, and there are a few thin rays before the umbonial slope. In a younger specimen the rays are over the whole disk. In some respects this species reminds one of *Weldonensis* (nobis), but *humerosus* is more quadrate, has larger teeth, and the color is salmon.

UNIO PAWENSIS. Pl. 45, fig. 114.

Testa lævi, suboblonga, inflata, valde inæquilaterali, postice subbiangulari, antice rotundata; valvulis subcrassis; natibus subprominentibus, subtumidis; epidermide tenebroso-fusca, squamosa, eradiata; dentibus cardinalibus parvis, corrugatis, subconicis; lateralibus longis, lamellatis subcurvisque; margarita vel alba vel purpureascente et iridescente.

Shell smooth, suboblong inflated, very inequilateral, subbiangular behind and rounded before; valves rather thick; beaks somewhat prominent and rather swollen; epidermis dark brown, squamose, without rays; cardinal teeth small, corrugate, somewhat conical; lateral teeth lamellar and somewhat curved; nacre white or purplish and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 161.

Hab.—Paw Creek, Beaver Co., and Catawba Run, N. C., C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. 1·2,

Length 1·6,

Breadth 2·9 inches.

Shell smooth, suboblong, inflated, very inequilateral, subbiangular behind and rounded before; substance of the shell rather thick; beaks somewhat prominent and rather swollen; ligament rather short, thin and dark brown; epidermis dark brown, squamose, without rays, with rather distant lines of growth; umbonial slope very much raised and obtusely angular; posterior slope wide, somewhat carinate, with an impressed line from the beaks to the posterior margin; cardinal teeth small, corrugate and somewhat conical; lateral teeth lamellar and somewhat curved; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed above the cavity of the beaks; cavity of the shell deep and wide; cavity of the beaks rather deep and wide; nacre white or purplish and iridescent.

Remarks.—Quite a number of specimens were submitted to me by Mr. Wheatley, none of which were perfect enough at the beaks to show any undulations, and all were more or less eroded on the sides. In outline it is allied to *squalidus* (nobis), and is nearest in general characters to that species. It also reminds one of *obesus* (nobis), but it is not so ventricose, and it differs in the epidermis, as well as the teeth.

of Major Downie, of Georgia, I am in possession of five more. All the specimens I have differ so little, that I am able to satisfy myself of the distinctness of the species. It is most closely allied to *mundus* (nobis), but may be distinguished by being more inflated, being more curved at the basal margin, and in having green bands along the marks of growth, *mundus* having maculate or interrupted rays. It also has the teeth more solid than *mundus*.

UNIO UHARÉENSIS. Pl. 46, fig. 116.

Testa lævi, oblonga, ad latere planulata, inæquilaterali, postice biangulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, subsquamea, eradiata; dentibus cardinalibus parvis, striatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subcurvisque; margarita vel alba vel salmonis colore tincta.

Shell smooth, oblong, flattened at the sides, inequilateral, biangular behind and rounded before; valves somewhat thick, thicker before; beaks slightly prominent; epidermis reddish-brown, somewhat squamose, without rays; cardinal teeth small, striate, in both valves double; lateral teeth long, lamellar and somewhat curved; nacre white or salmon color.

Proc. Acad. Nat. Sci. 1868, p. 145.

Hab.—Uharee River, Montgomery Co., N. C., F. A. Genth, M.D.

My cabinet and cabinets of Academy of Natural Sciences and Dr. Genth.

Diam. .8,

Length 1.3,

Breadth 2.3 inches.

Shell smooth, oblong, flattened at the sides, biangular behind, rounded before, inequilateral; substance of the shell somewhat thick, thicker before; beaks a little prominent; ligament rather long, dark brown; epidermis reddish-brown, with rather distant marks of growth, without rays, squamose on the anterior and basal margins; umbonial slope obtusely angular; posterior slope slightly carinate; cardinal teeth small, striate, double in both valves, slightly raised and nearly perpendicular; lateral teeth long, lamellar, somewhat thick and slightly curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices distinct, large and well impressed; dorsal cicatrices small, and placed above the centre of the cavity of the beaks; cavity of the shell shallow; cavity of the beaks very shallow; nacre white, generally tinted with salmon-color in the cavity of the beaks, iridescent.

Remarks.—Dr. Genth very kindly submitted a number of specimens to my examination. They were of very different ages, but none, even the very young, had beaks perfect enough to observe undulations. It is allied to *salebrosus* (nobis), from Georgia, but none of the specimens I have are so large as those of *salebrosus*. The epidermis is rougher, more rubiginose, more squamose, and has none of the greenish rays which that shell has. It is not so inequilateral; the teeth are very much the same.

UNIO GENUINUS. Pl. 46, fig. 117.

Testa lævi, elliptica, subinflata, inæquilaterali, postice subbiangulata, antice rotundata; valvulis subtenuibus, antice crassioribus; natibus subprominentibus; epidermide luteola, valde radiata; dentibus cardinalibus erectis, pyramidatis; lateralibus longis, subcurvis lamellatisque; margarita alba et iridescente.

Shell smooth, elliptical, somewhat inflated, inequilateral, subbiangular behind, rounded before; valves rather thin, thicker before; beaks somewhat prominent; epidermis yellowish, very much radiated; cardinal teeth erect, pyramidal; lateral teeth long, somewhat curved and lamellar; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 161.

Hab.—Bissel's Pond, Charlotte, N. C., C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. .8,

Length 1.2,

Breadth 2 inches.

Shell smooth, elliptical, somewhat inflated, inequilateral, subbiangular behind, rounded before; substance of the shell rather thin, thicker before; beaks somewhat prominent; ligament rather long, chestnut-brown color; epidermis yellowish, with numerous green capillary rays on the posterior half, with distant marks of growth; umbonial slope rounded; posterior slope narrow elliptical and slightly carinate; cardinal teeth erect, pyramidal and double in the right and disposed to be treble in the left valve; lateral teeth long, somewhat curved and lamellar; anterior cicatrices confluent, rather small and moderately impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather deep and rounded; nacre white and iridescent.

Remarks.—Mr. Wheatley submitted three specimens of this shell to me. It is so closely allied to *intercedens* and *fallax* (nobis) that I was not disposed to consider it different, until I gave it a complete examination and comparison. It is rather more compressed than either, and is more enlarged over the umbonial slope, where the rays are also more capillary. In all the three specimens the nacre is white, while in the other two species mentioned above it is usually salmon and purple. The beaks are too much eroded to distinguish the undulations.

UNIO FASSINANS. Pl. 47, fig. 118.

Testa lævi, elliptica, subcompressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide tenebroso-rufo-fusca, cradiata; dentibus cardinalibus crassiusculis, compressis, obliquis; lateralibus sublongis, crassis, obliquis corrugatisque; margarita salmonis colore tincta, splendens et iridescente.

Shell smooth, elliptical, subcompressed, inequilateral, obtusely angular behind, rounded before; valves somewhat thick, thicker before; beaks somewhat prominent; epidermis dark reddish-brown, without rays; cardinal teeth somewhat thick,

compressed, oblique; lateral teeth rather long, thick, oblique and corrugate; nacre salmon-colored, splendid and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 143.

Hab.—Head-waters of Holston River, Washington Co., Va., Prof. E. D. Cope.

My cabinet and cabinet of Acad. Nat. Sci.

Diam. .9, Length 1.5, Breadth 2.3 inches.

Shell smooth, elliptical, somewhat compressed, inequilateral, obtusely angular behind and rounded before; substance of the shell thick, thicker before; beaks somewhat prominent; ligament large and dark brown; epidermis dark reddish-brown, without rays, and with rather close marks of growth; umbonal slope depressed and rounded; posterior slope narrow-elliptical, subcarinate; cardinal teeth somewhat thick, compressed, and oblique; lateral teeth rather long, thick, oblique and corrugate; anterior cicatrices distinct, rather large and deeply impressed; posterior cicatrices distinct, rather large and well impressed; dorsal cicatrices placed on the upper side of the cavity of the shell; cavity of the shell rather shallow and wide; cavity of the beaks rather shallow and obtusely angular; nacre salmon-colored, splendid and iridescent.

Remarks.—I found a single specimen only among the large number of *Unionidæ* brought by Prof. Cope. At first I thought it to be a salmon-colored variety of *Copei*, but while the outline is closely alike, the epidermis and interior are quite different. The cardinal teeth differ in *fassinans*, being more robust and not so compressed; in the lateral teeth being thicker, more solid, and in having that of the right valve disposed to be double. In the nacre all the four specimens of *Copei* are alike in having a very dark purple color, while in *fassinans* the nacre is of a remarkably soft satin-like salmon color. The cavity of *fassinans* is not so deep as that of *Copei*. The beaks of this specimen are eroded, and therefore their character cannot be ascertained.

UNIO SPARUS. Pl. 47, fig. 119.

Testa lævi, lato-elliptica, subinflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis subtenuibus, antice crassioribus; natibus prominentibus, ad apices minute undulatis; epidermide subcrocea, valde radiata; dentibus cardinalibus parvis, erectis, conicis; lateralibus longis subcurvisque; margarita salmonis colore tincta et valde iridescente.

Shell smooth, broadly elliptical, somewhat inflated, very inequilateral, obtusely angular behind, rounded before; valves rather thin, thicker before; beaks a little prominent, minutely undulate at tip; epidermis reddish-yellow, very much radiated; cardinal teeth small, erect and conical; lateral teeth long and somewhat curved; nacre salmon-color and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 143.

Hab.—Swamp Creek, Whitfield Co., Georgia, Major T. C. Downie.

My cabinet and cabinets of Maj. Downie, Mr. Wheatley and Dr. Lewis.

Diam. .7, Length 1.1, Breadth 1.8 inch.

Shell smooth, broadly elliptical, somewhat inflated, very inequilateral, obtusely angular behind and rounded before; substance of the shell rather thin, thicker before; beaks a little prominent, minutely undulate at the tips; ligament short, thin and dark brown; epidermis reddish-yellow, very much radiated, with moderately distant marks of growth; umbonial slope low and rounded; posterior slope narrow elliptical; cardinal teeth small, erect and conical; lateral teeth long, lamellar and somewhat curved; anterior cicatrices distinct, rather small and moderately well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed across the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks shallow and obtusely angular; nacre salmon color and very iridescent.

Remarks.—A number of specimens of nearly all ages were sent to me by Major Downie. In the color of the epidermis, as well as in the nacre, this species is nearly allied to *subangulatus* (nobis). In outline it is nearly the same, but *sparus* is rather more transverse, and differs in not having a subangular umbonial slope. It also differs in having smaller rays more closely set, and those more prevalent on the posterior half of the disk. The nacre of *sparus* is perhaps more brilliant. *Sparus* cannot be confounded with *scitulus* (nobis), although the two species are very nearly of the same outline. *Scitulus* is rather heavier and larger, and has a yellow epidermis with green rays, which are generally interrupted by the marks of growth. The nacre of *scitulus* is usually white, with a slight tint of salmon in the cavity of the beaks, while *sparus* is almost always dark salmon in the greater part of the cavity of the shell.

UNIO COPEI. Pl. 47, fig. 120.

Testa lævi, elliptica, subcompressa, inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice crassioribus; natibus prominulis, ad apices undulatis; epidermide tenebroso-fuscata, ad marginem squamosa, eradiata; dentibus cardinalibus subcrassis, elevatis, compressis, corrugatis, in utroque valvulo duplicibus; lateralibus longis, lamellatis subcurvatisque; margarita purpurea et valde iridescente.

Shell smooth, elliptical, somewhat compressed, inequilateral, rounded before and behind; valves somewhat thick, thicker before; beaks slightly prominent, undulate at the tips; epidermis dark brown, squamose towards the margin, eradiate; cardinal teeth rather thick, raised, compressed, corrugate and double in both valves; lateral teeth long, lamellar and somewhat curved; nacre purple and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 144.

Hab.—Head-waters of the north branch of the Holston River, Smyth County, Va., Prof. E. D. Cope.

My cabinet and cabinet of the Academy of Natural Sciences.

Diam. .9,

Length 1.6,

Breadth 2.3 inches.

Shell smooth, elliptical, somewhat compressed, inequilateral, rounded before and behind; substance of the shell somewhat thick, thicker before; beaks slightly prominent, undulate at the tips; ligament short, thick and dark brown; epidermis dark brown, squamose towards the margin, without rays and with somewhat distant marks of growth; umbonial slope flat and rounded; posterior slope narrow elliptical, slightly carinate, with two slightly impressed lines in each valve from the beaks to the posterior margin; cardinal teeth rather thick, raised, compressed, corrugate and double in both valves; lateral teeth long, lamellar and somewhat curved; anterior cicatrices distinct, rather large and well impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks shallow and obtusely angular; nacre purple and very iridescent.

Remarks.—This species is closely allied to *Pybasii* (nobis), but may be distinguished by being larger and of a more regular ellipse. Among the specimens before me two are adults, one of which is figured. They all have a deep purple nacre in the cavity of the shell, the anterior and basal margins near to the edge being white. One of the specimens has a tinge of salmon color towards the basal margin. There are no rays on either of these specimens, except quite a young one, which has obsolete rays; and the tips of the beaks present minute undulations. The inferior posterior cicatrix is larger than usual in proportion to the superior one. It is with great pleasure I name this species after Prof. Cope, who, while exploring the headwaters of the Holston, New and Catawba Rivers for ichthyological purposes, extended his researches to the *Molluscs* of these little-frequented districts, among the mountains of Virginia, North Carolina and Tennessee.

UNIO CYLINDRELLUS. Pl. 48, fig. 121.

Testa lævi, late elliptica, cylindræca, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide luteola, eradiata; dentibus cardinalibus parvis, subconicis corrugatisque; lateralibus longis subcurvisque; margarita intus purpurea et valde iridescente.

Shell smooth, widely elliptical, somewhat cylindrical, very inequilateral, rounded before and behind; valves somewhat thick, thicker before; beaks slightly prominent; epidermis yellowish, without rays; cardinal teeth small, subconical, corrugate; lateral teeth long and somewhat curved; nacre purple within and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 144.

Hab.—Duck Creek, Tenn., Swamp Creek, Whitfield Co., Geo., Major Downie, and North Alabama, Prof. Tuomey.

My cabinet.

Diam. .7,

Length .8,

Breadth 1.5 inches.

Shell smooth, widely elliptical, somewhat cylindrical, very inequilateral, rounded before and behind; substance of the shell thick, thicker before; beaks slightly prominent; ligament rather long and thin; epidermis yellowish, without rays, with rather distant marks of growth; umbonial slope rather high and rounded; posterior slope elliptical, low, with a line from the tip to the posterior margin in both valves; cardinal teeth small, subconical and corrugate; lateral teeth long and somewhat curved; anterior cicatrices distinct, small and well impressed; posterior cicatrices distinct, rather small and slightly impressed; dorsal cicatrices placed in the centre of the cavity of the shell; cavity of the shell rather deep and wide; cavity of the beaks rather deep and subangular; nacre purple within the cavity and very iridescent.

Remarks.—I have two specimens and an odd valve of this interesting species before me. These are adults. The thickened margin of the nacre below the palleal impression is white in three specimens. Neither of the specimens have any rays. In outline it is nearly allied to *granulatus* (nobis), and *parvus*, Barnes, but is not easily confounded with either, being more cylindrical than either, being more solid, and in having a yellowish epidermis, while the others are dark greenish.

UNIO BRAZOSENSIS. Pl. 48, fig. 122.

Testa plicata, subrotunda, ventricosa, valde inæquilaterali, antice et postice rotundata; valvulis percrassis, antice crassioribus; natibus prominentibus, tumidis, incurvis, ad apices minute undulatis; epidermide tenebroso-rufo-fusca, eradiata; dentibus cardinalibus percrassis, solidis, erectis corrugatisque; lateralibus longis subcrassis et obliquis; margarita argentea et valde iridescente.

Shell folded, subrotund, ventricose, very inequilateral, rounded before and behind; valves very thick, thicker before; beaks prominent, swollen, incurved and minutely undulate at the tips; epidermis dark reddish-brown, without rays; cardinal teeth very thick, solid, erect and crenulate; lateral teeth long, rather thick and oblique; nacre silver-white and beautifully iridescent.

Proc. Acad. Nat. Sci. 1868, p. 144.

Hab.—Dallas Co., Texas, Prof. Forshey; Brazos River, Dr. Lincecum.

My cabinet and cabinet of Smithsonian Institution.

Diam. 1·5,

Length 2·1,

Breadth 2·7 inches.

Shell plicate, subrotund, ventricose, very inequilateral, rounded before and behind; substance of the shell very thick, thicker before; beaks prominent, swollen, incurved and minutely undulate at the tips; ligament very large and light brown; epidermis dark reddish-brown, without rays, with distant broad marks of growth; umbonial slope raised, rounded, with two irregular raised lines from the tips to posterior margin; posterior slope cordate and carinate; cardinal teeth very thick, solid, erect

and crenulate; lateral teeth long, rather thick and oblique; anterior cicatrices distinct, rather large, corrugate and well impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices placed over the cavity of the beaks; cavity of the shell deep and rounded; cavity of the beaks deep and angular; nacre silver-white, with a narrow reddish border beautifully iridescent.

Remarks.—I have nine specimens of this species before me, the youngest of which is about one-fourth grown. Four are from the Brazos River, sent by Dr. Lincecum to the Smithsonian Institution; the others many years since were sent to me by Prof. Forshey. Until I received those collected by Dr. Lincecum, I was not entirely satisfied as to their not being a variety of *plicatus*, Lesueur, to which this species is closely allied. There are, however, several points which distinguish them. *Brazosensis* is a more rounded shell, and is more tumid at the beaks. The color of the epidermis is also very different, being disposed to be of a dark rubiginose color, and where the epidermis is removed, particularly on the beaks, the color is a tint of salmon. The marginal line beyond the nacre is reddish, which is not the case with *plicatus*. The species herein described under the name of *Lincecumii*, which came with it, cannot be confounded with it, for *Lincecumii* is globose and usually has five or six folds, while *Brazosensis* has a few very irregular ones. The marks of growth of *Brazosensis* are few, distant and well-marked, usually being impressed, and thus on the first growth giving it a tumid appearance. On the umbonial and posterior slope there are usually three irregular raised lines, one of which cuts diagonally the folds. The undulations of the tips are few, very small and subconcentric.

UNIO CORVINUS. Pl. 48, fig. 123.

Testa lævi, elliptica, inflata, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice crassioribus; natibus vix prominentibus; epidermide nigra, subsquamea, eradiata; dentibus cardinalibus parvissimis decussatisque; lateralibus longis subrectisque; margarita alba et valde iridescente.

Shell smooth, elliptical, inflated, very inequilateral, rounded before and behind; valves somewhat thick, thicker before; beaks scarcely prominent; epidermis black, subsquamose, without rays; cardinal teeth very small and decussate; lateral teeth long and somewhat straight; nacre white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 144.

Hab.—Flint River, Geo., J. C. Plant and Dr. Neisler; Darien? J. H. Couper; Neuse River, Raleigh, N. C., Prof. Emmons.

My cabinet.

Diam. .7,

Length .8,

Breadth 1.3 inch.

Shell smooth, elliptical, inflated, very inequilateral, rounded before and behind; substance of the shell somewhat thick, thicker before; beaks scarcely prominent;

ligament short, thin and very dark brown; epidermis black, subsquamose, without rays, with close marks of growth; umbonial slope rounded, sometimes with a raised line; posterior slope elliptical, with a slight furrow on each valve from the beaks to the posterior margin; cardinal teeth very small and decussate; lateral teeth long and somewhat straight; anterior cicatrices distinct, small and well impressed; posterior cicatrices confluent, very slightly impressed; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks shallow and obtusely angular; nacre white and iridescent.

Remarks.—I have had most of the four specimens of this little black species, now before me, for many years, always doubtful as to whether they might belong to *parvus*, Bar., or to *paulus* (nobis). Now, after a thorough examination and comparison, I am convinced that it cannot belong to either of these two species, and therefore must be considered to be a new one. The group of little shells of which this is a member are all very much alike, while there exists a difference which the practised eye easily analyzes. This species has a well-pronounced angle on the umbonial slope, which is absent on the other species. The epidermis is more rough and blacker than the others. All the four specimens have a pure white nacre, and the beaks of these are all eroded, so that we must remain ignorant if there be any undulations, until perfect specimens are found.

UNIO DIFFICILIS. Pl. 49, fig. 124.

Testa lævi, elliptica, inflata, valde inæquilaterali, postice obtuse angulata, antice rotundata; valvulis tenuibus, antice crassioribus; natibus prominulis; epidermide luteola, valde radiata; dentibus cardinalibus parviusculis, conicis crenulatisque; lateralibus sublongis rectisque; margarita alba et valde iridescente.

Shell smooth, elliptical, inflated, very inequilateral, obtusely angular behind, rounded before; valves thin, thicker before; beaks a little prominent; epidermis yellowish, very much radiated; cardinal teeth rather small, conical and crenulate; lateral teeth rather long and straight; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 144.

Hab.—Swamp Creek, Whitfield Co., Geo., Maj. Downie, and head-waters of the Holston, Washington Co., Va., Prof. Cope.

My cabinet and cabinet of Academy of Natural Sciences.

Diam. .6,

Length .9,

Breadth 1.5 inch.

Shell smooth, elliptical, inflated, very inequilateral, obtusely angular behind, rounded before; substance of the shell thin, thicker before; beaks a little prominent; ligament short and dark brown; epidermis yellowish, very much radiated, with distant marks of growth; umbonial slope raised and rounded; posterior slope ellip-

tical, carinate, with two impressed lines from the beaks to posterior margin; cardinal teeth rather small, conical and crenulate; lateral teeth rather long and straight; anterior cicatrices distinct, small and deeply impressed; posterior cicatrices confluent, rather large and slightly impressed; dorsal cicatrices placed over the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks rather deep and angular; nacre white and iridescent.

Remarks.—Four specimens before me, sent from Swamp Creek, Georgia, by Major Downie, are not, perhaps, either of them full-grown. The largest is nearly one and a half inches wide,—a male, which is figured. A single specimen—a female—was brought by Prof. Cope from the head-waters of the Holston. This is two inches wide, and no doubt mature. This species is allied to *radians* (nobis), and so near to that species that I have doubted until recently whether it was not a variety only. But it differs in being less wide, less yellow in the epidermis, and in having higher beaks.

UNIO LINCECUMII. Pl. 49, fig. 125.

Testa plicata, rotundata, subglobosa, valde inæquilaterali; valvulis percrassis, antice crassioribus; natibus prominentibus, tumidis, incurvis, ad apices minute undulatis; epidermide tenebroso-fusca, nigricante, eradiata; dentibus cardinalibus percrassis, solidis, erectis corrugatisque; lateralibus longis, subcrassis et obliquis; margarita argentea et valde iridescente.

Shell plicate, rounded, subglobose, very inequilateral; valves very thick, thicker before; beaks prominent, swollen, incurved, minutely undulate at the tips; epidermis dark brown, blackish, without rays; cardinal teeth very thick, solid, erect and corrugate; lateral teeth rather thick and oblique; nacre silver-white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 144.

Hab.—Dallas Co., Texas, Prof. Forshey; Brazos River, Central Texas, Dr. Gideon Lincecum.

My cabinet and cabinet of Smithsonian Institution.

Diam. 1.5,

Length 1.9,

Breadth 2.4 inch.

Shell plicate, rounded, subglobose, very inequilateral, rounded before and behind; substance of the shell very thick, thicker before; beaks prominent, swollen, incurved, minutely undulate at the tips; ligament rather short, very thick and chestnut-brown; epidermis dark brown, blackish, polished towards the beaks, without rays, with rather close marks of growth; umbonial slope raised and rounded; posterior slope cordate, slightly raised; cardinal teeth large, very thick, solid, erect, corrugate and crenulate; lateral teeth rather thick, slightly curved and oblique; anterior cicatrices distinct, rather small, corrugate and deeply impressed; posterior cicatrices confluent and very slightly impressed; dorsal cicatrices placed above the cavity of the beaks;

growth; umbonial slope slightly raised and rounded; posterior slope very narrow and slightly raised; cardinal teeth erect, compressed and crenulate; lateral teeth long and straight; anterior cicatrices distinct and moderately well impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices placed in a row across the centre of the cavity of the beaks; cavity of the shell rather deep and very wide; cavity of the beaks rather shallow and rounded; nacre bluish-white and very iridescent.

Remarks.—Nearly a dozen specimens of this shell, of various ages and different habitats, are before me. For many years I have had several, but its close resemblance to *nasutus*, Say, on one side, and to *Ruttersvillensis* and *Bairdianus* (nobis) on the other, made me hesitate. More recently I have better specimens from other habitats in Kansas and Nebraska, which no longer leave any doubt. In outline it is not so transverse as *nasutus*, and the undulations differ. In *Topekaensis* the tips of the beaks are embellished with two series of undulations, which meet in the middle and form somewhat acute angles pointing to the vertex. *Bairdianus* is a much smaller species, less transverse, and has concentric undulations on the beaks. Like *nasutus*, this species has, in perfect specimens, green rays over nearly the whole disk, and the enlargement of the female in the vicinity of the branchial uterus is very much the same. In the character of the undulations of the beaks it is the same as *Ruttersvillensis*, but that shell is not so transverse, and the female is more inflated.

UNIO CORVUNCULUS. Pl. 50, fig. 127.

Testa lævi, elliptica, subinflata, valde inæquilaterali, antice et postice rotundata; valvulis crassiusculis, antice crassioribus; natibus prominulis, ad apices subconcentrico-undulatis; epidermide nigricante, eradiata; dentibus cardinalibus parvis, erectis, subcompressis crenulatisque; lateralibus sublongis et subcurvatis; margarita purpurea et iridescente.

Shell smooth, elliptical, somewhat inflated, very inequilateral, rounded before and behind; valves a little thick, thicker before; beaks a little prominent, concentrically undulate at the tips; epidermis blackish, without rays; cardinal teeth small, erect, somewhat compressed and crenulate; lateral teeth long and slightly curved; nacre purple and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 144.

Hab.—Swamp Creek, Whitfield Co., Georgia, Major T. C. Downie.

My cabinet and cabinets of Academy of Natural Sciences and Mr. C. M. Wheatley.

Diam. .5,

Length .7,

Breadth 1.2 inch.

Shell smooth, elliptical, somewhat inflated, very inequilateral, rounded before and behind; substance of the shell a little thick, thicker before; beaks a little prominent, concentrically undulate at the tips; ligament short, thin and brown;

epidermis blackish, without rays, with rather distant marks of growth; umbonial slope raised and rounded; posterior slope narrow elliptical, slightly carinate; cardinal teeth small, erect, somewhat compressed and crenulate; lateral teeth rather long and slightly curved; anterior cicatrices distinct, small and well impressed; dorsal cicatrices placed across the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks shallow and obtusely angular; nacre purple and iridescent.

Remarks.—Quite a number of this little purple-nacred species, with its black epidermis, was sent to me by Major Downie. It belongs to the group of which *parvus*, Barnes, may be considered the type. It more closely resembles *glans* (nobis) on one side and *paulus* on the other. The epidermis is black, like *paulus*, but it may be distinguished by being less transverse and in not having a white nacre. From *glans* it may be distinguished by being less solid, less ventricose, and having a deeper purple nacre. Every one of the specimens before me has the disk entirely of a deep purple, except the anterior basal margin, which is not quite white, being along the edge of a pale purple.

UNIO VALLATUS. Pl. 50, fig. 128.

Testa nodulosa, rotundata, lenticulari, subinflata, inæquilaterali; valvulis crassis, antice crassioribus; natibus subprominentibus; epidermide luteo-fusca, eradiata; dentibus cardinalibus pergrandibus, elevatis granulatisque; lateralibus crassis, curtis et obliquis; margarita argentea et iridescente.

Shell nodulous, rounded, lenticular, somewhat inflated, inequilateral; valves thick, thicker before; beaks somewhat prominent; epidermis yellowish-brown, without rays; cardinal teeth very large, raised and granulate; lateral teeth thick, short and oblique; nacre silver-white and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 145.

Hab.—Alabama River, Dr. Showalter.

My cabinet and cabinet of Dr. Showalter.

Diam. 1·2,

Length 2·1,

Breadth 2·3 inches.

Shell nodulous, rounded, lenticular, somewhat inflated, inequilateral; substance of the shell thick, thicker before; beaks somewhat prominent; ligament short, thick and light brown; epidermis yellowish-brown, without rays, with rather close lines of growth; umbonial slope raised and rounded; posterior slope subcordate, slightly carinate, furnished with curved rows of nodules; cardinal teeth very large, raised and granulate; lateral teeth thick, short and oblique; anterior cicatrices distinct, large and deeply impressed; posterior cicatrices distinct, large and well impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell rather deep and wide; cavity of the beaks very deep and angular; nacre silver-white and iridescent.

Remarks.—A single specimen only was sent by Dr. Showalter to Dr. Lewis, who kindly sent it to me. It does not seem to have been before observed. It cannot well be confounded with any other species. It is much more lenticular than any other nodulous *Unio* with which I am acquainted. It is allied to *pustulosus* and *turgidus* (nobis), but differs much from them both. The specimen before me is nearly in the form of a thick lens, and covered with nodules except on the anterior and anterior-basal portions. The nodules on the posterior slope run into lines towards the margin. It is not high in the beaks as *pustulosus*, nor has it the broad green rays which that and *turgidus* have. The teeth are remarkably robust.

UNIO PLANIOR. Pl. 50, fig. 129.

Testa subsulcata, subtriangulari, ad latere planulata, inæquilaterali; valvulis crassiusculis, antice crassioribus; natibus subprominentibus; epidermide vel lutea vel ochracea, radiata; dentibus cardinalibus parvis, compressis striatisque; lateralibus longis, crassiusculis et obliquis; margarita alba et iridescente.

Shell subsulcate, subtriangular, flattened at the sides, inequilateral; valves a little thick, thicker before; beaks somewhat prominent; epidermis yellow, or ochraceous and radiate; cardinal teeth small, compressed and striate; lateral teeth long, somewhat thick and oblique; nacre white and iridescent.

Proc. Acad. Nat. Sci. 1868, p. 145.

Hab.—Tennessee, Mr. H. Moores; head-waters of Holston River, Washington County, Va., Prof. Cope.

My cabinet and cabinets of the Academy of Natural Sciences and Mr. Moores.

Diam. .8,

Length 1.5,

Breadth 2.3 inches.

Shell somewhat sulcate, subtriangular, flattened at the sides, inequilateral, subbiangular behind and rounded before; substance of the shell a little thick, thicker before; beaks somewhat prominent; ligament rather thick, short and light brown; epidermis yellow or ochraceous, with broad maculate rays and with rather distant marks of growth; umbonial slope slightly raised and flattened; posterior slope narrow elliptical, carinate, with an impressed line from the beaks to the posterior margin; cardinal teeth small, compressed and striate; lateral teeth long, somewhat thick and oblique; anterior cicatrices distinct, large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed above the centre of the cavity of the beaks; cavity of the shell shallow and wide; cavity of the beaks somewhat deep and angular; nacre white and iridescent.

Remarks.—The specimen from Mr. Moores has been in my possession for some time; from what river it came is not known. Recently Prof. Cope has brought the same species from the head-waters of the Holston, which, although dead and imper-

fect specimens, leaves no doubt of the identity of the species. It belongs to the same group with *negatus* and *Estabrookii* (nobis), but cannot be mistaken for either. It is not so stout nor so triangular as *negatus*, nor is it as triangular as *Estabrookii*, or as much sulcate. The furrows are very small, and in the worn specimens are not very observable. The posterior portion of the nacre of two specimens is of that peculiar golden color—satin-like—which some of the *Uniones* exhibit. The rays are on the flattened sides before the umbonial slope, and are maculate, being interrupted by the marks of growth.

UNIO REFULGENS. Pl. 51, fig. 130.

Testa nodulosa, rotundata, lenticulari, inæquilaterali; valvulis subcrassis, antice crassioribus; natibus prominulis; epidermide rufo-castanea, aliquanto polita; dentibus cardinalibus subgrandibus, eleganter corrugatis crenulatisque; lateralibus longiusculis, obliquis, minute corrugatis; margarita albida, ad marginem purpurecente et elegantissime iridescente.

Shell nodulous, rounded, lenticular, inequilateral; valves somewhat thick, thicker before; beaks slightly prominent; epidermis reddish-chestnut color, somewhat polished; cardinal teeth rather large, beautifully corrugate and crenulate; lateral teeth rather long, oblique and minutely corrugate; nacre whitish, purplish at the margin and beautifully iridescent.

Proc. Acad. Nat. Sci. 1868, p. 145.

Hab.—Oktibbeha River, Lauderdale Co., Mississippi, W. Spillman, M.D.

My cabinet and cabinets of Academy of Natural Sciences and Dr. Spillman.

Diam. 1, Length 1·6, Breadth 1·9 inch.

Shell nodulous, rounded, lenticular, inequilateral, disposed to be very obtusely angular at the posterior basal margin; substance of the shell somewhat thick, thicker before; beaks a little prominent; ligament rather short and light brown; epidermis reddish chestnut-brown, somewhat polished, with rather distant marks of growth, with two indistinct rays on the posterior slope on each valve; umbonial slope slightly raised into an obtuse angle; posterior slope raised almost to a wing, and furnished with a few nodules; cardinal teeth rather large, double in the left and treble in the right valve, beautifully corrugate and crenulate; lateral teeth somewhat thick and long, oblique, minutely and beautifully corrugate; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and large; dorsal cicatrices placed on the plate above the cavity of the beaks; cavity of the shell rather shallow; cavity of the beaks deep and angular; nacre pearly-white in the cavity, beautifully purple towards the margin and refulgently iridescent.

Remarks.—Among a number of *Unionida* sent to me from the State of Mississippi by Dr. Spillman were three specimens of this species, which I have not heretofore seen. It has some resemblance to *verrucosus*, Bar., from Tennessee, in outline, but

differs entirely from that species in being lenticular and not having the beaks much raised. It differs also in the color of the epidermis, *refulgens* being of a very dark chestnut-brown. The beaks will, I think, be found to differ. The specimens before me have neither of the beaks perfect enough to display any undulations, which are so marked and so beautiful in the *verrucosus*. The prominent characteristics of *refulgens* are the lenticular form and the very remarkable nacre. In all the specimens before me the inner portion of the nacre is pearly white, while the outer or border portions are of a rich purple, the posterior part exhibiting an iridescence so refulgent as to surpass any other species, in this respect, which I know. The younger specimen has a broader purple border. The nodules in the specimens before me are placed on the medial third of the disk, and are separate, unusually obtusely angular, and pointing downward. On the posterior slope there are a few nodules.

UNIO STREBELII. Pl. 51, fig. 131.

Testa lævi, oblonga, ad latere compressa, inæquilaterali, postice obtuse biangulata, antice rotundata; valvulis subcrassis, antice aliquanto crassioribus; natibus prominulis; epidermide luteo-fusca, radiata; dentibus cardinalibus subcrassis, elevatis, crenulatis, in utroque valvulo duplicibus; lateralibus sublongis, subcrassis, subcurvatis corrugatisque; margarita vel purpurea vel salmonea et valde iridescente.

Shell smooth, oblong, flattened at the sides, inequilateral, obtusely biangular behind and rounded before; valves rather thick and somewhat thicker before; beaks a little prominent; epidermis yellowish brown, radiate; cardinal teeth rather thick, raised, crenulate and double in both valves; lateral teeth rather long, rather thick, somewhat curved and corrugate; nacre purple or salmon colored and very iridescent.

Proc. Acad. Nat. Sci. 1866, p. 133.

Hab.—Vera Cruz, Mexico, G. Strebel, M. D.

My cabinet and cabinet of Smithsonian Institution.

Diam. 1,

Length 1·6,

Breadth 2·9 inches.

Shell smooth, oblong, flattened at the sides, inequilateral, obtusely biangular behind and rounded before; substance of the shell rather thick, somewhat thicker before; beaks a little prominent; ligament large, rather short and dark brown; epidermis yellowish brown, radiate and with distant marks of growth; umbonial slope slightly raised and rounded; posterior slope narrow elliptical, slightly carinate; cardinal teeth rather thick, raised, crenulate and double in both valves; lateral teeth rather long, somewhat thick, somewhat curved and corrugate; anterior cicatrices distinct, somewhat large and well impressed; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed in a row near to the centre of the cavity of the beaks; cavity of the shell rather shallow and wide; cavity of the beaks shallow and obtusely angular; nacre purple or salmon color and very iridescent.

Soft parts.—Three young specimens, not half grown, were received. None had ova in the ovarium or embryos in the branchial uterus. *Branchiæ* rather small and rounded, the inner ones the larger, united the whole length of abdominal sack. *Palpi* small, ovate, united at the upper posterior edges. *Mantle* very thin, thicker on the edges. *Branchial opening* rather large, with small dark papillæ. *Anal opening* very small, with numerous, very small papillæ on the inner edges. *Super-anal opening* rather large and edged with black. Color of the mass whitish.

Remarks.—This species belongs to the *complanatus* group. It is closely allied to those of that portion of it which is disposed to be biangular behind. It differs in being less carinate, having rather thicker teeth, and it differs also somewhat in the rays. Of the two specimens before me, one has a deep purple nacre throughout, the other is salmon color in the cavity, but towards the margin it is white. I have no doubt that specimens will be found of a full salmon color and others entirely white. These two specimens were sent to the Smithsonian Institution by Dr. Strebel, of Vera Cruz, and to him I dedicate the species.

UNIO SPHÆRICUS. Pl. 51, fig. 132.

Testa nodulosa, subrotunda, valde inflata, subglobosa, fere æquilaterali; valvulis crassis, antice crassioribus; natibus elevatis; epidermide rufo-castanea, eradiata; dentibus cardinalibus pergrandibus, corrugatis crenulatisque; lateralibus curtis, crassis, corrugatis, obliquis subcurvisque; margarita argentea et valde iridescente.

Shell nodulous, rotund, very much inflated, subglobose, nearly equilateral; valves thick, thicker before; beaks raised; epidermis reddish chestnut color, without rays; cardinal teeth very large, corrugate and crenulate; lateral teeth short, thick, corrugate, oblique and somewhat curved; nacre silver white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 145.

Hab.—Pearl River, at Jackson, Mississippi, C. M. Wheatley.

My cabinet and cabinet of Mr. Wheatley.

Diam. 1·3,

Length 1·8,

Breadth 1·9 inch.

Shell nodulous, rounded, very much inflated, subglobose, nearly equilateral; substance of the shell thick, thicker before; beaks raised and recurved; ligament short, thick and dark brown; epidermis reddish-chestnut color, with rather distant marks of growth; umbonial slope raised and obtusely angular; posterior slope cordate and slightly raised into a carina; cardinal teeth very large, corrugate and crenulate; lateral teeth short, thick, corrugate, oblique and somewhat curved; anterior cicatrices distinct, rather small and very deeply impressed; posterior cicatrices confluent, large and well impressed; dorsal cicatrices placed on the base of the cardinal teeth; cavity of the shell deep and rounded; cavity of the beaks deep and obtusely angular; nacre silver white and iridescent.

Remarks.—Mr. Wheatley presented me with two specimens of this species which I had not before seen. One seems to be full grown, the other about one-third grown. It is nearly allied to *U. pustulosus* (nobis), and in outline is nearly the same, but *sphæricus* is more carinate on the posterior slope and is there obtusely angular. It differs also in the form and number of the nodules, *sphæricus* having few, and those small and not well pronounced. The specimens of *pustulatus* from the same habitat have higher beaks and more well characterised nodules. There is also a difference in the marks of growth, which are very much further apart in *sphæricus*. The color of the epidermis is also different, in being of a dark chestnut-brown, which causes the marginal edge to be a reddish line under the nacre. The nacre of the adult specimen is beautifully white, with a disposition to a pinkish tinge. The young specimen has a purplish nacre. It cannot be confounded with *refulgens*, herein described, although it has nearly the same colored epidermis and nodules, resembling, in a measure, that species, the nacre of which is brighter and purple. In regard to inflation they are very different, *refulgens* being lenticular, while *sphæricus* is globose. *Sphæricus* has a wide, shallow groove immediately before the umbonial slope.

UNIO VERACRUZENSIS. Pl. 52, fig. 133.

Testa lævi, elliptica, subcompressa, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis tenuibus; natibus prominulis; epidermide tenebroso-fusca, radiata politaque; dentibus cardinalibus parvis, compressis, crenulatis, in utroque valvulo duplicibus; lateralibus longis, rectis lamellatisque; margarita cærulea et valde iridescente.

Shell smooth, elliptical, somewhat compressed, inequilateral; obtusely angular behind, rounded before; valves thin; beaks slightly prominent; epidermis dark brown, radiated and polished; cardinal teeth small, compressed, crenulate and double in both valves; lateral teeth long, straight and lamellar; nacre bluish and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 150.

Hab.—Vera Cruz, G. Strebel, M. D.

Cabinet of Smithsonian Institution.

Diam. .4,

Length .7,

Breadth 1.2 inch.

Shell smooth, elliptical, somewhat compressed, inequilateral, obtusely angular behind, rounded before; substance of the shell thin; beaks a little prominent, very slightly inflated; ligament very short, thin and light brown; epidermis dark brown, radiated all over and polished; umbonial slope low and rounded; posterior slope slightly raised and has two impressed lines in each valve; cardinal teeth small, compressed, crenulate and double in both valves; lateral teeth long, straight and double in both valves; anterior cicatrices distinct, small and slightly impressed; posterior

cicatrices confluent and very slightly impressed; dorsal cicatrices placed in the cavity and on the under side of the plate; cavity of the shell shallow; cavity of the beaks very shallow and subangular; nacre bluish, passing into pink at the teeth.

Soft parts.—Probably a young male; a single specimen. *Branchiæ* small and very thin, inner one much the larger, rounded below and united the whole length of abdominal sack. *Palpi* small, elongate, oval and united only above. *Mantle* very thin, slightly thickened at the edges. *Branchial opening* rather large, with numerous, small papillæ on the inner edges, which are nearly black. *Anal opening* very small, with numerous, very small papillæ on the inner edges. *Super-anal opening* rather large and united below. Color of the mass white.

Remarks.—A single specimen, in alcohol, only was received, in the “envoi” of Dr. Strebel, and this probably only half grown. In outline it is near to *Medellinus* (nobis), from Mexico, but still nearer to *subangulatus* (nobis), of Georgia. The specimen before me has rays over the whole disk, but they are indistinct, and this may arise from its being a long time in alcohol. It is probable that old specimens would be without rays. The teeth of this specimen are pinkish and old specimens, if the nacre be thick, are likely to have the whole interior more or less pink or purplish. The beaks are eroded and do not present any undulations, which may exist at the tips.

UNIO ORTONII. Pl. 52, fig. 134.

Testa plicata, lato-elliptica, compressa, valde inæquilaterali, postice angulata, antice rotundata; valvulis crassis, antice crassioribus; natibus prominulis; epidermide rufo-fusca, eradiata; dentibus cardinalibus multipartitis, flexuosis curtisque; lateralibus prelongis, curvatis corrugatisque; margarita albida et valde iridescente.

Shell folded, widely elliptical, compressed, very inequilateral, angular behind and rounded before; valves thick, thicker before; beaks slightly prominent; epidermis reddish-brown, without rays; cardinal teeth much divided, bent and short; lateral teeth very long, curved and roughened; nacre whitish and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 161.

Hab.—River Napo, Ecuador, Prof. Orton.

Cabinet of Smithsonian Institution.

Diam. 1·6, Length 3·1, Breadth 5·3 inches.

Shell folded, widely elliptical, compressed, very inequilateral, angular behind and rounded before; substance of the shell thick, thicker before; beaks slightly prominent; ligament long and thick; epidermis reddish-brown, without rays; umbonial slope raised and furnished with five or six rather distant irregular folds; posterior slope raised into a sharp carina; cardinal teeth much divided into eight or nine curved denticles, the anterior one being much the larger; lateral teeth very long,

lamellar, curved and roughened; anterior cicatrices distinct, large, well impressed and divided into three rounded impressions; posterior cicatrices confluent, large and slightly impressed; dorsal cicatrices placed in a row across the centre of the cavity of the beaks; cavity of the shell shallow, very wide and with a broad furrow from the beaks to the posterior basal margin; cavity of the beaks very shallow and scarcely perceptible; nacre whitish and very iridescent.

Remarks.—A single valve only—the right one—is before me. This is a matter of great regret, because this is a very remarkable shell, entirely new, and we have the advantage of seeing only an imperfect valve, for this has been ground on the margins so that I cannot determine whether it does not belong to the *alate* division and come near to *U. Myersianus* (nobis), from Siam. The outline is nearly the same, and perfect specimens may be alate if not bialate. The cardinal teeth of the young may also be quite different, as in *Myersianus*. There is a very marked difference in *Ortonii* from any species of the *Unionidæ* I have seen. There are two wide ridges from the beaks to the posterior margin, and these enlarge as they are projected towards the margin. On the posterior ridge, which really forms the umbonial slope, there are six folds of low elevation. The nacre is remarkably beautiful, being satin-like. The epidermis is unusually thin and very nearly all lost from the specimen. I have great pleasure in naming this shell after Prof. Orton, who brought it from the River Napo. The lateral tooth is long and lamellar, like any wide *Unio*, but the cardinal tooth is divided more like *Iridina*, and in this it is somewhat like an old *Unio Myersianus* (nobis), the teeth of which differ very much from the young.

ANODONTA STREBELII. Pl. 52, fig. 135.

Testa lævi, elliptica, inæquilaterali, postice obtuse angulata, antice rotundata; valvulis pertenuis; natibus prominulis; epidermide tenebroso-viridi, radiis capillaris indutis; margarita cærulea et valde iridescente.

Shell smooth, elliptical, inequilateral, obtusely angular behind, rounded before; valves very thin; beaks a little prominent; epidermis dark green, covered with capillary rays; nacre bluish and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 150.

Hab.—Vera Cruz, Mexico, G. Strebel, M. D.

Cabinet of the Smithsonian Institution.

Diam. .6

Length .9

Breadth 1.5 inch.

Shell smooth, elliptical, inequilateral, obtusely angular behind and rounded before; substance of the shell very thin, not thickened before, translucent, so as to show the rays; beaks a little prominent and slightly inflated; ligament rather long, thin and nearly concealed; epidermis dark green, with very numerous, close capillary rays,

which cover the whole disk; umbonial slope low and rounded; posterior slope raised into a carina; anterior cicatrices confluent, large and very slightly impressed; posterior cicatrices confluent, large and very slightly impressed; dorsal cicatrices invisible; cavity of the shell rather shallow; cavity of the beaks shallow and obtusely angular; nacre blue, very thin. The dorsal edge thickened and slightly curved upward at the anterior end.

Soft Parts.—A single female, and probably not half-grown. Ova were found in the ovarium, but none in the branchial uterus. *Branchiæ* small, inner ones much the larger, rounded below, united the whole length of abdominal sack. *Palpi* small, rounded below and subangular posteriorly, united only above. *Mantle* very thin, thickened and colored at the edges. *Branchial opening* rather small, dark on the edges, with rather coarse papillæ. *Anal opening* very small, with a few small papillæ, the edges being united below. *Super-anal opening* rather large, the edges being open below with the anal opening. Color of the mass whitish.

Remarks.—A single specimen only of this species was received in alcohol by the Smithsonian Institution from Dr. Strebel. I am kindly permitted by Prof. Henry, Secretary of that admirable Institution, to describe this and *Unio Veracruzensis*, and it gives me great pleasure to call it after Dr. Strebel, who took it from the fresh waters near Vera Cruz. In outline it is nearly allied to *An. undulata*, Say, but differs in being a thinner species, in not having any callus under the hinge, and being covered with beautiful capillary rays over the whole disk. The beaks are not perfect enough to display any undulations, if there be any belonging to the species.

UNIO PRUNOIDES. Pl. 53, fig. 136.

Testa lævi, elliptica, valde ventricosa, inæquilaterali, antice et postice rotundata; valvulis subcrassis, antice aliquanto crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus compressis, obliquis et valde crenulatis; lateralibus longis, lamellatis corrugatisque; margarita argentea.

Shell smooth, elliptical, very ventricose, inequilateral, rounded before and behind; valves rather thick, somewhat thicker before; beaks somewhat prominent; epidermis dark brown, without rays; cardinal teeth compressed, oblique and very much crenulated; lateral teeth long, lamellar and corrugate; nacre silver-white.

Proc. Acad. Nat. Sci. 1868, p. 150.

Hab.—South America?

Cabinet of the Academy of Natural Sciences.

Diam. 1.1,

Length 1.3,

Breadth 2 inches.

Shell smooth, elliptical, very ventricose, inequilateral, rounded before and behind;

substance of the shell rather thick, somewhat thicker before; beaks somewhat prominent; ligament rather short and thin; epidermis dark brown, without rays; umbonial slope raised and rounded; posterior slope wide and cordate; cardinal teeth compressed, oblique and very much crenulate, double in the right and disposed to be treble in the left valve; lateral teeth long, lamellar and corrugate; anterior cicatrices confluent, rather small and well impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices placed nearly in the centre of the cavity of the beaks; cavity of the shell very deep and rounded; cavity of the beaks deep and rounded; nacre silver-white.

Remarks.—A single specimen, which was found among several of *U. corrugata*, Lam., in the collection of the Academy of Natural Sciences. I have little doubt but that it is a native of some of the rivers of South America. The beaks are very much eroded. If they were perfect in the specimen their character would, I think, prove the truth of this suggestion. The character of the cardinal teeth is similar to some of the South American species. In the left valve it is treble, the anterior division being very small, the middle one the largest. In the right valve the cardinal tooth is double. The anterior cicatrices are so confluent as to show no disposition to be separated. There is no appearance of this specimen ever having had rays, but it is very far from being a perfect individual, and young and perfect ones may be rayed.

ANODONTA NAPOENSIS. Pl. 53, fig. 137.

Testa lævi, oblongo-elliptica, subcompressa, valde inæquilaterali, antice et postice rotundata; valvulis subcrassis; natibus prominulis; epidermide tenebroso-fusca, encarpiformi, flexuosa, obsolete radiata; margarita pallido-viridi, non iridescente.

Shell smooth, oblong-elliptical, rather compressed, very inequilateral, rounded before and behind; valves rather thick; beaks a little prominent; epidermis dark brown, festooned, flexuous, obscurely radiate; nacre pale green and not iridescent.

Proc. Acad. Nat. Sci. 1868, p. 162.

Hab.—River Napo, Equador, South America, Prof. Orton.

My cabinet and cabinet of the Smithsonian Institution.

Diam. .7, Length 1.3, Breadth 2.4 inches.

Shell smooth, oblong-elliptical, somewhat compressed, very inequilateral, rounded before and behind; substance of the shell rather thick; beaks a little prominent; ligament long, rather thick and dark; epidermis dark brown, festooned, flexuous, obscurely radiate; umbonial slope rounded, with an elevated line from the beaks to posterior margin; posterior slope slightly raised into a carina; anterior cicatrices distinct, the larger one being very large and well impressed, the smaller one being very small and not much impressed; posterior cicatrices confluent, large and slightly

impressed; dorsal cicatrices indistinct; cavity of the shell shallow and wide; cavity of the beaks very shallow; nacre pale green and not iridescent.

Remarks.—Two odd valves—a right and left—were sent to me by the Smithsonian Institution. The larger and more perfect one is figured, but that is not perfect on the dorsal margin, while the epidermis is nearly perfect. Both the specimens have the epidermis covered with the wrinkled festoon-like character. In outline it is near to *Schræteriana* (nobis), but it is of a more perfect ellipse and is a thicker shell. Like *crispata*, Lam., it is covered with wrinkles, but it is more likely to be confounded with *tenebricosa* (nobis) from the dark color of the nacre and thickness of the shell. It may, however, be easily distinguished by its being elliptical, while the other is oblong, having a higher elevation of the posterior slope.

UNIO CHINENSIS. Pl. 53, fig. 138.

Testa nodulosa, subelliptica, inflata, fere æquilaterali, postice obtuse angulata, antice rotundata; valvulis crassiusculis, antice crassioribus; natibus subprominentibus, ad apices corrugatis; epidermide virido-lutea, radiis viridis undique indutis; dentibus cardinalibus erectis, compressis, striatis, crenulatis et in utroque valvulo subduplicibus; lateralibus sublongis subrectisque; margarita argentea et valde iridescente.

Shell nodulous, subelliptical, inflated, nearly equilateral, obtusely angular behind, rounded before; valves somewhat thick, thicker before; beaks somewhat prominent, corrugate at the tips; epidermis greenish-yellow, covered all over with green rays; cardinal teeth erect, compressed, striate, crenulate, and in both valves subduplicate; lateral teeth rather long and nearly straight; nacre silver-white and very iridescent.

Proc. Acad. Nat. Sci. 1868, p. 150.

Hab.—Hong Kong, China.

Cabinet of Yale College, New Haven, Conn.

Diam. .9,

Length 1.1,

Breadth 1.7 inch.

Shell nodulous, subelliptical, inflated, nearly equilateral, obtusely angular behind, rounded before; substance of the shell somewhat thick, thicker before; beaks somewhat prominent, corrugate at the tips; ligament very short and narrow; epidermis greenish-yellow, covered all over with beautiful green rays, with very distant lines of growth; umbonial slope raised and sharply angular; posterior slope flattened, cordate, with two lines from beaks to posterior margin on each valve; cardinal teeth erect, compressed, striate, crenulate, disposed to be double in both valves; lateral teeth rather long and nearly straight; anterior cicatrices distinct and well impressed; posterior cicatrices confluent and slightly impressed; dorsal cicatrices set deeply within the cavity of the beaks; cavity of the shell deep; cavity of the beaks deep and angular; nacre silver-white and very iridescent.

Remarks.—A single specimen of this beautiful and interesting species was submitted to me by Mr. Anthony as the property of Yale College, with permission to describe it if new. It is remarkable for the beauty of its epidermis, which is covered with green rays over nearly the entire disk, the posterior slope having two rather thin rays on each valve. There are but two marks of growth on this specimen, being unusually distant. The corrugations come down one-third the distance from the tips of the beaks. There is no species which I know of which can be confounded with this, unless it be *U. Lampreyanus*, Baird and Adams, which species I have not seen. But it is evident from their description and figures (Zool. Journ., part 2, 1867) that the species are distinct. *Lampreyanus* is described and figured as being much plicated, compressed and solid, as well as being subtriangular, neither of which characters apply to *Chinensis*. The specimen under view came from Hong Kong, but I suspect it has been taken there from the north of China. If it had been a native of the province of Quang-Tong, the commerce of Canton would certainly have furnished it among the immense number of shells which it has supplied Europe and America within the last century.

In vol. 4 of the Journal of the Academy of Natural Sciences (Observations on the Genus *Unio*, etc., vol. 6) I published descriptions of the soft parts and embryonic forms, with figures, of many of the species of the *Unionidæ*. In subsequent volumes I continued to describe these forms whenever I had been able to obtain them. Through the kindness of Professor Henry I have before me the soft parts of several known species, and some which are new, from Vera Cruz, Mexico, which were sent by Dr. Strebel to the Smithsonian Institution. It is greatly to be regretted that these seem to have been taken at a period of the year when the ovarium was empty of ova, and the branchial uteri without embryos. To these descriptions I add others of the soft parts of some species from Alabama, which were kindly sent to me in alcohol by Dr. Showalter, of which species the hard parts, or outward covering only, have been described.

Unio pliciferus, Lea. Vera Cruz.—Among a large number none had ova in the ovarium, nor embryonic shells in the branchial uterus. *Branchiæ* large and rounded below, inner one much the larger, free the whole length of abdominal sack. *Palpi* small, elliptical, united above. *Mantle* thin, thicker on the edges. *Branchial opening* large, with numerous small papillæ on the inner edges, which are of a dark brown color. *Anal opening* rather large, with very numerous small papillæ on the inner edges. *Super-anal opening* rather small, united below and colored on the edges. Color of the mass white.

Unio umbrosus, Lea. Vera Cruz.—Among a number, none of these, like *pliciferus*,

had ova in the ovarium, nor embryonic shells in the branchial uterus. *Branchiæ* very large and rounded below, inner one being the larger; united the whole length of abdominal sack. *Palpi* large, elliptical, open on posterior side to the top. *Mantle* very large, thin, with a broad thickened border. *Branchial opening* rather large, with rather large coarse papillæ. *Anal opening* large, with numerous very minute colored papillæ on the inner edges. *Super-anal opening* rather small, colored on the edges and united below. Color of the mass whitish. All the specimens, old and young, had pearly granulations on the middle of the cavity of the valves.

Unio granulatus, Lea. Coosa River, Alabama, Dr. Showalter.—Six specimens were received. None had charged branchial uteri, but ova were found in the ovarium. *Branchiæ* small, rounded below, the outer one shorter and extending, posteriorly, beyond the inner one, free nearly the whole length of abdominal sack. *Palpi* very small, very thin and subelliptical. *Mantle* very thin. *Branchial opening* small, with a few papillæ, terminating with a *caruncle* as in *parvus*, Bar. The four *males* have no *caruncle*. *Anal opening* rather large and apparently without papillæ. Seems to have no *super-anal opening*. Color of the mass white.

Unio consanguineus, Lea. Coosa River, Alabama, Dr. Showalter.—Four females and one male. None had charged branchial uteri, but ova were found in the ovarium. *Branchiæ* rather small, inner one much the larger and rounded. Free nearly the whole length of abdominal sack. *Palpi* very small, thin and subtriangular. *Mantle* very thin, dark along the edges. *Branchial opening* rather large, with papillæ on the inner edges. *Anal opening* rather large, with very minute papillæ. *Super-anal opening* long, and colored on the edges. Color of the mass whitish.

Unio Lewisii, Lea. Coosa River, Alabama, Dr. Showalter.—None of the specimens received had ova in the ovarium, nor embryonic shells in the branchial uterus. *Branchiæ* large and rounded below, inner one much the larger, free nearly the whole length of abdominal sack. *Palpi* very small, subtriangular, united above. *Mantle* large, thin, thicker and colored on the margin. *Branchial opening* large, with numerous papillæ on the inner edges, which are dark. *Anal opening* small, with very minute papillæ on the inner edges. *Super-anal opening* long, and slightly colored on the edges. Color of the mass whitish.

Margaritana Holstonia, Lea. Coosa River, Alabama, Dr. Showalter.—Two specimens only, both females, were received. One had ova in the ovarium, but there were no embryos in the branchial uterus. The other had the *branchial uteri* filled with embryonic shells matured in the branchial uteri. These were in form closely allied to those of *Anodonta undulata*, Say. *Branchial uteri* extend the whole width of the *branchiæ*. *Branchiæ* large, inner one the larger, free the whole length of

abdominal sack. *Palpi* very small and subtriangular. *Mantle* very thin, thicker at the edges. *Branchial opening* large, dark colored, with papillæ on the inner edges. *Anal opening* rather small, with very indistinct papillæ. *Super-anal opening* very small, with dark edges. Color of the mass whitish.

GONIOBASIS WHEATLEYI. Pl. 54, fig. 1.

Testa striata, subfusiformi, subinflata, subcrassa, ochracea, vel vittata vel evittata; spira conoidea, ad apicem aliquanto plicata; suturis irregulariter impressis; anfractibus instar senis, fere planulatis; apertura subconstricta, ovata, intus ochracea; labro acuto, parum sinuoso; columella inflexa, reflexa et tortuosa.

Shell striate, subfusiform, subinflated, somewhat thick, ochraceous, banded or without bands; spire conoidal, sometimes folded at the tip; sutures irregularly impressed; whorls about six, nearly flat; aperture ovate, somewhat constricted; ochraceous within; outer lip acute, somewhat sinuous; columella inflected, reflected and twisted.

Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—Coosa River, Alabama, Dr. Showalter.

My cabinet and cabinets of Dr. Showalter, Mr. Wheatley and Dr. Hartman.

Diam. .54,

Length 1.17 inch.

Remarks.—Four specimens of this fine large species were received from Dr. Showalter, one of which has four indistinct bands. It is among the larger ones from the Coosa, and is somewhat like a large rough *Bridgesiana* than any other species I know. The banded specimen is inclined to be of an olive-green color. The transverse striæ cut the longitudinal marks of growth, and on the upper part of the whorls cause that part to be corrugate. Dr. Showalter mentions that this shell was found in November of 1867 for the first time. The aperture is nearly one-half the length of the shell. I have great pleasure in dedicating this fine species to my friend, C. M. Wheatley, who is so unwearied in his efforts to promote a knowledge of our fresh-water *Molluscs*.

GONIOBASIS SIMILIS. Pl. 54, fig. 2.

Testa striata, subfusiformi, subtenui, luteo-cornea; spira brevi, ad apicem plicata; suturis impressis; anfractibus instar senis, vix convexis; apertura subgrandi, ovata, intus luteo-alba; labro acuto; columella inflexa et tortuosa.

Shell striate, subfusiform, rather thin, yellowish-horn color; spire short, folded at the tip; sutures impressed; whorls about six, scarcely convex; aperture rather large, ovate, within yellowish-white; outer lip acute; columella inflected and twisted.

Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie.

My cabinet.

Diam. .40,

Length .74 inch.

Remarks.—This species is allied to *Mel. (Gon.) harpa* (nobis), but differs in having a larger aperture, and in having more and closer striæ. It is also more yellow. In outline it is very nearly the same with *granatoides*, herein described, but it has not, like that species, any granules, and the two differ in the lower part of the aperture. The aperture is about one-half the length of the shell.

GONIOBASIS SULCATA. Pl. 54, fig. 3.

Testa striata, conica, subcrassa, mellea, evittata; spira obtusa; suturis irregulariter impressis; anfractibus instar septenis, planulatis, ad apicem plicatis; apertura parviuscula, rhomboidea, intus alba; labro acuto, sinuoso; columella inflexa, incrassata.

Shell striate, conical, somewhat thick, honey-yellow, without bands; spire obtuse; sutures irregularly impressed; whorls about seven, flattened, folded at the tip; aperture rather small, rhomboidal, white within; outer lip acute, sinuous; columella inflected and thickened.

Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—Cahawba River, Alabama, Dr. Showalter.

My cabinet and cabinet of Dr. Showalter.

Diam. .32,

Length .67 inch.

Remarks.—One of the four specimens before me is more slender than the other three, and may belong to another species. It is of the same honey-yellow color and the striæ are very much the same. The number of the striæ differs, varying from six to eight in the specimens before me, the middle ones being the largest. The aperture is more than one-third the length of the shell.

GONIOBASIS ARATA. Pl. 54, fig. 4.

Testa valde striata, conoidea, subtenui, cornea, vel vittata vel evittata; spira elevata; suturis impressis; anfractibus septenis, planulatis, ad apicem carinatis et plicatis; apertura parva, ovata, intus albida; labro aliquanto crenulato; columella inflexa, ad basim retrorsa.

Shell very much striate, conoidal, rather thin, horn color, banded or without bands; spire raised; sutures impressed; whorls seven, flattened, carinate and plicate at the tip; aperture small, ovate, whitish within; outer lip somewhat crenulate; columella inflected, drawn back at the base.

Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie.

My cabinet.

Diam. .35,

Length .75 inch.

Remarks.—Four specimens were received from Major Downie, one of which is darker and has five well developed bands, which are of a brown color and distinctly marked. In outline it is closely allied to *ornata*, herein described, but need not be confounded with that species, which differs in the aperture and other characters. The reflected base at the aperture separates it from its allied species. The aperture is about one-third the length of the shell.

GONIOBASIS GESNERII. Pl. 54, fig. 5.

Testa striata, fusiformi, tenui, tenebroso-oliva, evittata; spira subbrevis; suturis impressis; anfractibus instar septenis, planulatis; apertura grandi, late ovata, intus lugubri; labro acuto, parum sinuoso; columella purpurescente et valde contorta.

Shell striate, fusiform, thin, dark olive, without bands; spire rather short; sutures impressed; whorls about seven, flattened; aperture large, widely ovate, dark within; outer lip acute, somewhat sinuous; columella purplish and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—Uchee River, Alabama, Mr. Wm. Gesner.

My cabinet.

Diam. .37,

Length .80 inch.

Remarks.—A single specimen only was found among the shells sent by Mr. Gesner to Dr. Lewis. It is closely allied to *G. Gerhardtii* (nobis) in being about the size and of nearly the same outline. It is, however, without bands, is rather more flattened on the whorls and more rounded at the base of the columella. On the lower whorl of this specimen there are seven indistinct, rather distant striæ. The aperture is nearly one-half the length of the shell.

I name this after Mr. Wm. Gesner, of Milledgeville, Geo., who has sent a number of interesting species from Georgia.

GONIOBASIS WHITFIELDENSIS.* Pl. 54, fig. 6.

Testa valde striata, subfusiformi, subcrassa, tenebrosa; spira brevi; suturis irregulariter impressis; anfractibus instar quinque, vix convexis; apertura grandi, ovata, intus tenebroso-purpurea; labro subcrenulato; columella inflexa et parum contorta.

Shell much striate, subfusiform, somewhat thick, dark; spire short; sutures irregularly impressed; whorls about five, scarcely convex; aperture large, ovate, within dark purple; outer lip subcrenulate; columella inflected and somewhat twisted.

G. tenebrosa. Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie.

My cabinet.

Diam. .40,

Length .80 inch.

* Changed from *tenebrosa*, which name is preoccupied.

Remarks.—This species belongs to a group of which *flavescens* (nobis) may be considered the type. It differs in being a smaller species, having a less elevated spire, having a less recurved columella at base, in having finer and closer transverse striæ and in having an aperture of purple within, with an edging of white. The striæ on the specimen before me are fifteen in number, and being strongly developed, form rather deep intermediate grooves. The aperture is about one-half the length of the shell.

GONIOBASIS BIFASCIATA. Pl. 54, fig. 7.

Testa plicata, aliquando striata, subcrassa, luteola, bifasciata; spira obtusa, valde plicata; suturis irregulariter impressis; anfractibus instar senis, planulatis; apertura parviuscula, subrotunda, intus albida; labro acuto, parum sinuoso; columella albida et contorta.

Shell plicate, sometimes striate, somewhat thick, yellowish, double banded; spire obtuse, much plicate; sutures irregularly impressed; whorls about six, flattened; aperture rather small, subrotund, whitish within; outer lip acute, somewhat sinuous; columella whitish and twisted.

Proc. Acad. Nat. Sci., 1868, p. 151.

Hab.—Jackson County, Alabama, Dr. Spillman.

My cabinet and cabinet of Dr. Spillman.

Diam. .25,

Length .54 inch.

Remarks.—This pretty little species, if we may judge of the three specimens before me, is very persistent in its characters. The two wide bands and the yellow epidermis, with the strong folds, seem to distinguish it well from other species. There are about eleven rather strong ribs on each whorl. It is somewhat like *formosa*, Con., but it differs from the figure and description in not "having two proximate, prominent lines on the summit of each whorl." He does not mention the bands, but his figure gives one. The aperture is full one-fourth the length of the shell.

GONIOBASIS CLATHRATA. Pl. 54, fig. 8.

Testa plicata et striata, pyramidata, tenui, dilute cornea, efasciata; spira exserta, acuminata; suturis impressis; anfractibus octonis, convexiusculis; apertura parviuscula, rhomboidea, intus vel albida vel purpurea; labro crenulato, subsinuoso; columella valde contorta.

Shell plicate and striate, pyramidal, thin, pale horn color, without bands; spire exserted, pointed; sutures impressed; whorls eight, a little convex; aperture rather small, rhomboidal, purple or white within; outer lip crenulate, subsinuoso; columella very much twisted.

Proc. Acad. Nat. Sci., 1868, p. 151.

Hab.—Jackson County, Alabama, Dr. Spillman.

My cabinet and cabinet of Dr. Spillman.

Diam. .38,

Length 1.5 inch.

Remarks.—Out of seven specimens before me only one is full grown, being over an inch in length. The stria are close and numerous, covering the whole of the whorls. The ribs, which are numerous, are curved and decussate the striae. These ribs come down to the last stria and there terminate, not reaching the suture. Between the striae the surface is disposed to be crimped. Three out of the seven specimens are purplish inside. It is very like *glauca*, Anth., but is not so large, and the ribs and striae cover the whole of the whorls, which is not the case with *glauca*. The aperture is not quite one-third the length of the shell.

GONIOBASIS GOULDIANA.* Pl. 54, fig. 9.

Testa plicata, subturrita, subtenui, rufo-cornea, vittata; spira elevata; suturis irregulariter impressis; anfractibus instar novenis, convexiusculis; apertura parviuscula, ovata, intus albida; labro acuto; columella inflexa et tortuosa.

Shell plicate, subturrited, rather thin, reddish-horn color, banded; spire raised; sutures irregularly impressed; whorls about nine, a little convex; aperture rather small, ovate, whitish within; outer lip acute; columella inflected and twisted.

G. pulchella. Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—North Alabama, Dr. Spillman.

My cabinet.

Diam. .24,

Length .64 inch.

Remarks.—This pretty little species unfortunately came represented by two imperfect specimens. The aperture of both is broken, but the remaining parts are very perfect. The ribs are strongly marked and consist of nine on each whorl. There are four bands well defined and are stronger outside than in, which is unusual. On the upper part of the whorl there is a light band immediately under the suture, which contrasts with the reddish-horn color of the other parts. The aperture is rather less than one-third the length of the shell.

GONIOBASIS LUTEOCELLA. Pl. 54, fig. 10.

Testa plicata et striata, fusiformi, subcrassa, ochracea, vittata vel evittata; spira brevi; suturis irregulariter impressis; anfractibus quinis, convexiusculis; apertura grandi, ovata, intus luteo-alba; labro acuto; columella superne incrassata et valde contorta.

Shell plicate and striate, fusiform, somewhat thick, ochraceous, banded or without bands; spire short; sutures irregularly impressed; whorls five, somewhat convex;

* Having unintentionally used Dr. Gould's name, *pulchella*, I change it to *Gouldiana*, in honor of my friend.

aperture large, ovate, within yellowish-white; outer lip acute; columella thickened above and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 151.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie, and Oconee River, Rev. G. White.

My cabinet and cabinets of Dr. Hartman, Academy of Natural Sciences and Mr. Wheatley.

Diam. .35,

Length .67 inch.

Remarks.—Quite a number of this species were sent to me by Major Downie. It belongs to the group of which *flavescens* is the type, but it is shorter and has a larger aperture. It cannot be confounded with *tenebrosa*, herein described, although it is nearly of the same outline. That species is striate all over, has a larger aperture, a less curved columella and is purple within, while *luteocella* has usually four bands, or is entirely without bands. In outline it is somewhat like *Mel. (Gon.) auriculiformis* (nobis), but that is a smaller species, with a shorter spire and smooth. They cannot be mistaken for each other. Some of the specimens are more striate than others, and some are darker from having purple bands, which are well defined inside. The aperture is nearly two-thirds the length of the shell.

GONIOBASIS CONNESAUGAENSIS. Pl. 54, fig. 11.

Testa plicata, inferne striata, subfusiformi, subtenui, vel mellea vel ochracea vel tenebroso-fusca, nitida; spira conoidea; suturis impressis; anfractibus septenis, planulatis; apertura subconstricta, rhomboidea, intus luteola vel tenebroso-fusca; labro acuto; columella inflexa et tortuosa.

Shell plicate, striate below, subfusiform, rather thin, honey-yellow, either ochraceous or dark brown, shining; spire conical; sutures impressed; whorls seven, flattened; aperture somewhat constricted, rhomboidal, yellowish within or dark brown; outer lip acute; columella inflected and twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie.

My cabinet.

Diam. .38,

Length .72 inch.

Remarks.—The three specimens before me are all of different colors, while the outline, folds and striæ are exactly the same. The dark one has its color from the dark bands, which run together and thus make the whole a very dark brown. The folds are low and distant, and occupy the upper half of all the whorls, and the transverse striæ occupy, with great regularity, the lower half. The lower whorl has about seven folds, which are here merely slight irregular risings of the surface. It is remarkable that one specimen should be covered with confluent bands and the other two be bandless. The outline of this species is very nearly the same as that of

Bridgesiana (nobis), but it differs entirely in having folds and striæ, which are peculiar. The aperture is more than one-third the length of the shell.

GONIOBASIS CONTIGUA. Pl. 54, fig. 12.

Testa lævi, subfusiformi, tenui, tenebroso-oliva, evittata; spira subelevata; suturis impressis; anfractibus instar quinis, convexiuseulis; apertura grandi, subrhombica, intus albida; labro acuto, sinuoso; columella vix incrassata et valde contorta.

Shell smooth, subfusiform, thin, dark olive, without bands; spire somewhat raised; sutures impressed; whorls about five, somewhat convex; aperture large, subrhomboidal, whitish within; outer lip acute, sinuous; columella scarcely thickened and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie.

My cabinet.

Diam. .37,

Length .80 inch.

Remarks.—Unfortunately only a single specimen was received, and that imperfect in the upper whorls. It is in outline nearest to *Christyi* (nobis), but differs in not being plicate or granose and is a thinner shell, with a sharp angle at the base. There are a few obscure striæ on the middle and lower part of the last whorl. The aperture is about half the length of the shell.

GONIOBASIS MURRAYENSIS. Pl. 54, fig. 13.

Testa lævi, fusiformi, inflata, subtenui, tenebroso-cornea, evittata; spira conoidea, ad apicem plicata; suturis aliquanto impressis; anfractibus instar senis, subplanulatis; apertura magna, subrhomboida, intus luteola; labro acuto, parum sinuoso; columella inflexa et tortuosa.

Shell smooth, fusiform, inflated, rather thin, dark horn color, without bands; spire conoidal, folded at the tip; sutures somewhat impressed; whorls about six, rather flattened; aperture large, subrhomboidal, yellowish within; outer lip acute, somewhat sinuous; columella inflected and twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Swamp Creek, Whitfield County, Georgia, Major T. C. Downie.

My cabinet and cabinets of Academy of Natural Sciences, Mr. Wheatley and Dr. Hartman.

Diam. .48,

Length .95 inch.

Remarks.—Quite a number of this species were sent to me by Major Downie. Some of them are darker in the epidermis than others. In regard to the folds which appear on nearly all the specimens in the younger stage, they are in some of them quite well pronounced as low as the third or fourth whorl. This species has a strong

resemblance to *Bridgesiana* (nobis), but may be distinguished by its longer spire, its darker color and being less fusiform. The color of the interior also differs, the *Murrayensis* being of a yellowish tint. The aperture is rather more than one-third the length of the shell.

GONIOBASIS GRANATOIDES. Pl. 54, fig. 14.

Testa granulata, inferne striata, subfusiformi, subtenui, cornea; spira conoidea, ad apicem plicata; suturis impressis; anfractibus instar senis, vix convexis; apertura subgrandi, ovata; intus luteo-alba; labro acuto; columella tortuosa.

Shell granulate, striate below, subfusiform, somewhat thin, horn color; spire conoidal, plicate at the tips; sutures impressed; whorls about six, scarcely convex; aperture rather large, ovate, yellowish-white within; outer lip acute; columella twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie.

My cabinet and cabinets of Dr. Hartman, C. M. Wheatley and Academy of Natural Sciences.

Diam. .45,

Length .85 inch.

Remarks.—This species is nearly the same in outline with *granata* (nobis), but differs in being a larger species, more horn colored and being without bands. In the aperture it is wider at the base, the fuse being larger. Like *Tryoniana* (nobis), it has numerous though not so many granules, and it differs in the aperture. The young specimens have well formed folds on the upper whorls. The aperture is about one-half the length of the shell.

GONIOBASIS CLAVULA. Pl. 54, fig. 15.

Testa carinata, aliquando plicata, tenui, tenebroso-castanea, efasciata; spira exserta, acuminata; suturis regulariter impressis; anfractibus instar octonis, planulatis; apertura parvissima, ovata, intus castanea; labro acuto; columella alba et contorta.

Shell carinate, sometimes plicate, thin, dark chestnut-brown, without bands; spire exserted, acuminate; sutures regularly impressed; whorls about eight, flattened; aperture, very small, ovate, within chestnut color; outer lip acute; columella white and twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Jackson Co., Alabama, Dr. Spillman.

My cabinet and cabinets of the Academy of Natural Sciences and Mr. Wheatley.

Diam. .17,

Length .52 inch.

Remarks.—A number of specimens were received, all nearly of the same size. It

is a very small species, and somewhat like *Clarkii* (nobis), but it is rather more cylindrical. Some specimens have scarcely the rudiments of folds, while others have them down to the last whorl. Some have striæ on the lower part of the whorl. The aperture is about one-fourth the length of the shell.

GONIOBASIS COCHLIARIS. Pl. 54, fig. 16.

Testa carinata et striata, cylindracea, tenui, tenebroso-fusca, evittata; spira attenuata; suturis valde impressis; anfractibus instar novenis, ad apicem valde carinatis, inferne striatis; apertura parvissima, late elliptica, intus tenebrosa; labro subcrenato; columella inflexa, ad basim incrassata.

Shell carinate and striate, cylindrical, thin, dark brown and without bands; spire attenuate; sutures very much impressed; whorls about nine, very much carinate at the beaks, striate below; aperture very small, widely elliptical, dark within; outer lip subcrenate; columella inflected, thickened at the base.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Shelby Co., Alabama, Major T. C. Downie.

My cabinet and cabinet of the Academy of Natural Sciences.

Diam. .14,

Length .59 inch.

Remarks.—This little cylindrical species is near to *rubella* (nobis), but may at once be distinguished by its gimlet-like form, which is very remarkable, being almost exactly the same with the point of that instrument. There are usually five well-defined striæ on each specimen, and that on the middle of the whorls is so large as to make the shell carinate. Above this carina on the upper whorls there is a chain of bead-like nodes. The basal striæ inside are disposed to be purplish. The aperture is about the fifth of the length of the shell.

GONIOBASIS VENUSTA. Pl. 54, fig. 17.

Testa subcarinata, conoidea, subtenui, mellea, evittata; spira elevata; suturis regulariter impressis; anfractibus planulatis, instar septenis; apertura parva, rhomboidea, intus albida; labro acuto; columella inflexa et valde contorta.

Shell subcarinate, conoidal, rather thin, honey-yellow, without bands; spire elevated; sutures regularly impressed; whorls flattened, about seven; aperture small, rhomboidal, whitish within; outer lip acute; columella inflected and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Coosa River, Alabama, Dr. Showalter.

My cabinet.

Diam. .32,

Length .75 inch.

Remarks.—A single specimen only is before me, and it appears not to be entirely mature. It has some resemblance to a young *robusta* (nobis), but it is a more slender shell and has a small carina above the middle of the whorl. Below this carina there are two or three rather indistinct striæ. It has a very graceful form and polished surface. The aperture is not quite one-third the length of the shell.

GONIOBASIS ORNATA. Pl. 54, fig. 18.

Testa carinata, subturrita, tenui, olivacea, valde vittata; spira elevata, superne plicata; suturis valde impressis; anfractibus septenis, planulatis; apertura parviuscula, subrhomboidea, intus vittata; labro acuto, aliquanto sinuoso; columella vix incrassata et valde contorta..

Shell carinate, somewhat turritid, thin, olivaceous, very much banded; spire elevated, plicate above; sutures very much impressed; whorls seven, flattened; aperture rather small, subrhomboidal, banded within; outer lip acute, somewhat sinuous; columella scarcely thickened and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Connesauga Creek, Whitfield Co., Geo., Major T. C. Downie.

My cabinet.

Diam. .36,

Length .84 inch.

Remarks.—Five specimens are before me, only one being mature. It is a pretty species, with a varying number of bands, which are very distinct within the aperture, there being four, five or six in those before me. The upper whorls are indistinctly plicate. It belongs to the group of which *Gerhardtii* (nobis) may be considered to be the type. It differs from it in being less robust, in being carinate and being a smaller species. It has some resemblance to *mutabilis* (nobis), which is sometimes carinate and plicate, but it differs much in the aperture of that shell. The aperture is quite one-third the length of the shell.

TRYPANOSTOMA NUCIFORME. Pl. 54, fig. 19.

Testa lævi, obtuse conica, inflata, crassiuscula, castanea; spira brevi, obtusa; suturis regulariter impressis; anfractibus instar quinis, convexiusculis; apertura magna, rhomboidea; labro acuto, expanso, sinuoso; columella inflexa et valde tortuosa.

Shell smooth, obtusely conical, inflated, slightly thickened, chestnut-colored; spire short, obtuse; sutures regularly impressed; whorls about five, a little convex; aperture large, rhomboidal; outer lip acute, expanded and sinuous; columella inflected and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Connesauga Creek, Whitfield Co., Geo., Major T. C. Downie.

My cabinet.

Diam. .34,

Length .59 inch.

Remarks.—A single specimen only was among the shells kindly sent to me from the north of Georgia by Major Downie. It is very nearly the size, form and color of the fruit of the Chincapin (*Castanea pumila*). While it is closely allied to *Tennesse-ense* (nobis), it may be distinguished by its lighter color, its longer fuse, and its less indented outer lip. The lower part of the outer lip is much less prolonged. The aperture is quite half the length of the shell.

TRYPANOSTOMA CASTANEUM. Pl. 54, fig. 20.

Testa lævi, pyramidata, subtenui, castanea, obsolete fasciata; spira exserta, acuminata; suturis impressis; anfractibus instar novenis, planulatis; apertura parviuscula, rhomboidea, intus dilute purpurea; labro acuto, sigmoideo; columella parum incrassata et valde contorta.

Shell smooth, pyramidal, rather thin, chestnut-brown, obscurely banded; spire exserted, acuminate; sutures impressed; whorls about nine, flattened; aperture rather small, rhomboidal, pale purple within; outer lip acute, sigmoid; columella somewhat thickened and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 152.

Hab.—Coosa River, Alabama, Dr. Showalter.

My cabinet and cabinet of Dr. Showalter.

Diam, .35,

Length .99 inch.

Remarks.—There were five specimens received from Dr. Showalter, differing very little in size or color. The purplish color of the aperture is caused by irregular subcapillary bands, which pervade the whole interior surface. The apices of all the specimens are eroded, and therefore I am unable to say whether the upper whorls might be striate or not; but there is no appearance of striation. In outline this species is very near to *Christyi* (nobis) and *Whitei* (nobis), but may easily be distinguished by the color inside and out. The channel is rather narrower and more tortuous than in either. The aperture is about three-tenths the length of the shell.

TRYPANOSTOMA WHEATLEYI. Pl. 54, fig. 21.

Testa lævi, pyramidata, tenui, dilute rubiginosa, vel fasciata vel efasciata; spira exserta, acuminata; suturis regulariter impressis; anfractibus instar denis, planulatis, ad apicem carinatis; apertura parviuscula, rhomboidea, intus albida; labro acuto, sigmoideo; columella ad basim parum incrassata et valde contorta.

Shell smooth, pyramidal, thin, pale rubiginose, banded or without bands; spire exserted, acuminate; sutures regularly impressed; whorls about ten, flattened, carinate at the tip; aperture rather small, rhomboidal, whitish within; outer lip acute, sigmoid; columella slightly thickened at the base and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 153.

Hab.—Coosa River, Alabama, Dr. Showalter.

My cabinet and cabinets of Dr. Showalter and Mr. Wheatley.

Diam. .32,

Length .83 inch.

Remarks.—Mr. Wheatley received three specimens from Dr. Showalter, which he kindly sent to me. In outline it is almost identical with *mucronatum* (nobis), but differs in the form of the channel, being not quite so much recurved at the base. It also differs entirely in color, being rubiginose, while *mucronatum* is of a pale horn color. The upper whorls are sharply carinate and the lower whorl is obtusely angular on the middle. One of the three specimens before me has two obscure bands, the others are without bands. The aperture is not quite one-third the length of the shell. I have great pleasure in naming this after my friend C. M. Wheatley, Esq., who has done so much for this branch of Natural History, and to whom I am indebted for the specimens.

TRYPANOSTOMA TEREBRALE. Pl. 54, fig. 22.

Testa lævi, pyramidata, tenui, olivacea, vel vittata vel evittata; spira valde exserta; suturis valde impressis; anfractibus instar duodenis, planulatis, ad apicem carinatis; apertura parviuscula, rhomboidea, intus albida vel vittata; labro acuto, sinuoso; columella impressa et valde contorta.

Shell smooth, pyramidal, thin, olivaceous, banded or not banded; spire very much exserted; sutures very much impressed; whorls about twelve, flattened, carinate at the tip; aperture rather small, rhomboidal, whitish within or banded; outer lip acute, sinuous; columella impressed and very much twisted.

Proc. Acad. Nat. Sci. 1868, p. 153.

Hab.—Jackson County, Alabama, W. Spillman.

My cabinet.

Diam. .44,

Length 1.40 inch.

Remarks.—One adult and four younger specimens were received from Dr. Spillman. All the specimens are thin and light. Two are without bands, the other three have five to seven bands, which are strong in color in the inside. These fine specimens differ very much in appearance, some being more carinate than others and some being without bands. The channel at the base is remarkably wide. In outline it is allied to *M. (Try.) elongata* (nobis), but more closely to *M. (Try.) Brumbyi* (nobis). It is not so solid and smooth as the former, nor is it striate and dark colored like the latter. Only one has the apex whole, but this shows that the number of whorls must be at least twelve. The angle of the body whorl on one specimen is quite sharp. The aperture is not quite one-fourth the length of the shell.

LITHASIA PURPUREA. Pl. 54, fig. 23.

Testa lævi, curta, subcylindracea, suberassa, tenebroso-purpurea; spira brevissima; suturis valde impressis; anfractibus instar quinis, convexiusculis; apertura grandi, rhomboidea, intus saturale purpurea; labro acuto, vix sinuoso; columella impressa, superne incrassata.

Shell smooth, short, subcylindrical, somewhat thick, dark purple; spire very short; sutures very much impressed; whorls about five, somewhat convex; aperture large, rhomboidal, pale purple within; outer lip acute, slightly sinuous; columella impressed, thickened above.

Proc. Acad. Nat. Sci. 1868, p. 153.

Hab.—Cahawba River, at Centreville, Bibb County, Alabama, Dr. Showalter.

My cabinet and cabinets of Dr. Showalter, Mr. Wheatley and Dr. Hartman.

Diam. .47,

Length .70 inch.

Remarks.—Dr. Showalter sent me at two different times, many years since, two specimens of this shell. I then thought it might be a variety of *Showalterii* (nobis). Recently I have received from him two other specimens, larger and older, which satisfy me that he was right in supposing the species to be new. The largest specimen before me has little more than the last whorl perfect. The youngest has the spire nearly perfect. The throat of the shell is intensely purple. This species having no thickening at the base of the columella allies it closely to the genus *Anculosa*, but it is not rounded at the base as that genus is and it is not so oblique. The aperture is about two-thirds the length of the shell.

LITHASIA CURTA. Pl. 54, fig. 24.

Testa granulata, curta, solida, luteo-olivacea, plerumque bifasciata; spira brevi; suturis irregulariter impressis; anfractibus instar quinis, planulatis; apertura subgrandi, rhomboidea, intus albida; labro acuto, subsinuoso; columella inferne et superne incrassata.

Shell granulate, short, solid, yellowish-olive, usually double banded; spire short; sutures irregularly impressed; whorls about five, flattened; aperture rather large, rhomboidal, whitish within; outer lip acute, somewhat sinuous; columella thickened above and below.

Proc. Acad. Nat. Sci. 1868, p. 153.

Hab.—North Alabama, Prof. Tuomey and Dr. Spillman, and Tuscumbia, B. Pybas.

My cabinet and cabinets of the Academy of Natural Sciences and Mr. Wheatley.

Diam. .40,

Length .60 inch.

Remarks.—This is a rather small species, which has been confounded with *semigranulata*, Desh.; but it is a smaller species, has fewer granules, is not so elevated in the spire and is usually more regularly banded. The specimens from Prof. Tuomey have been in my collection many years as a variety of *semigranulata*, but specimens recently received from Dr. Spillman satisfy me that the species is distinct. *Curta*

has usually two bands, well defined inside and out. On the upper band there is usually a complete row of granules, and just below this row a less well developed row of granules above the lower band. In some specimens there is a disposition to three rows and sometimes there are only a few small granules. The aperture is usually more than one-half the length of the shell.

LITHASIA WHEATLEYI. Pl. 54, fig. 25.

Testa lævi, subcylindræa, luteo-virente, vittata; spira elevata; suturis irregulariter impressis; anfractibus planulatis, ultimo subgrandi; apertura subconstricta, rhomboidea, intus vittata; labro acuto, sinuoso; columella alba et valde sinuosa.

Shell smooth, subcylindrical, greenish-yellow, banded; spire elevated; sutures irregularly impressed; whorls flattened, the last one rather large; aperture rather constricted, rhomboidal, banded within; outer lip sharp, sinuous; columella white and very sinuous.

Proc. Acad. Nat. Sci. 1866, p. 133.

Hab.—Cahawba River, Alabama, E. R. Showalter, M. D.

My cabinet and cabinets of Dr. Showalter and Mr. Wheatley.

Diam. .40,

Length .85 inch.

Remarks.—This fine species is allied to *Downiei* (nobis) but differs in being smaller, being less cylindrical and in not possessing any tubercles. In the columella *Wheatleyi* is more incurved and has a more decided turn at the base, which nearly amounts to a fold, and the channel is more pronounced. The two specimens of *Wheatleyi* before me have each four well defined bands. In the three specimens of *Downiei* one has six, another has five and the third has no bands. The spire being imperfect the number of whorls is not ascertained. I dedicate this fine species to Mr. C. M. Wheatley, at the request of Dr. Showalter, with great pleasure.

LITHASIA CYLINDRICA. Pl. 54, fig. 26.

Testa striata, cylindræa, flavescente, vittata vel evittata; spira subelevata; suturis irregulariter impressis; anfractibus constrictis, ultimo grandi; apertura subconstricta, rhomboidea; labro acuto, sinuoso; columella alba et valde sinuosa.

Shell striate, cylindrical, yellowish, banded or without bands; spire somewhat raised; sutures irregularly impressed; whorls constricted, the last one large; aperture rather constricted, rhomboidal; outer lip sharp, sinuous; columella white and very much sinuate.

Proc. Acad. Nat. Sci. 1866, p. 133.

Hab.—Coosa River, Alabama, E. R. Showalter, M. D.

My cabinet and cabinets of Dr. Showalter and C. M. Wheatley.

Diam. .40,

Length .80 inch.

Remarks.—This species, of which there are four specimens before me, is nearly allied to *Wheatleyi* (nobis), herein described. It differs in being more yellow, in being striate and being more cylindrical. The bands are not so well pronounced inside or out. Three of the specimens are four-banded; the fourth entirely without bands on the inside. There is a slight disposition to yellowishness in the interior. All the specimens being eroded at the tips the number of the whorls cannot be ascertained.

SCHIZOSTOMA WHEATLEYI. Pl. 54, fig. 27.

Testa striata, subfusiformi, subtenui, luteola, imperforata, vittata; spira obtuso-conoidea; suturis irregulariter impressis; anfractibus instar senis, ultimo grandi; fissura obliqua brevique; apertura parviuscula, ovata, intus alba et vittata; labro subcrenulato; columella alba incrassata et contorta.

Shell striate, subfusiform, rather thin, yellowish, imperforate, banded; spire obtusely conoidal; sutures irregularly impressed; whorls about six, the last large; fissure oblique and short; aperture rather small, ovate, white and banded within; outer lip somewhat crenulate; columella white, thickened and twisted.

Proc. Acad. Nat. Sci. 1868, p. 153.

Hab.—Coosa River, Dr. Showalter.

My cabinet and cabinet of Dr. Showalter.

Diam. .35,

Length .70 inch.

Remarks.—A single specimen only was received from Dr. Showalter, to whom I have been indebted for so many species of this genus. In outline it is very close to *S. excisa* (nobis), as well as in color, bands and striæ; but it differs entirely in the fissure, which in *Wheatleyi* is shallow and oblique, while in *excisa* it is deep and direct. There are four bands on this specimen, which show distinctly on the inside. The aperture is not half the length of the shell.

I name this species after my friend Mr. C. M. Wheatley, who has greatly promoted the knowledge of our fresh-water *Mollusca*.

ANCULOSA DOWNIÆ. Pl. 54, fig. 28.

Testa plicata, et obsolete striata, subglobosa, crassa, tenebroso-oliva, maculata; spira vix prominulis, plicatis; suturis impressis; anfractibus vix ternis, ultimo grandi et ventricoso; apertura grandi, subrotunda, intus fusco-maculata; labro acuto; columella impressa et incrassata.

Shell plicate and obscurely striate, subglobose, thick, dark olive, spotted; spire very little prominent, folded; sutures impressed; whorls scarcely three, the last large and ventricose; aperture large and subrotund, within brown spotted; outer lip acute; columella impressed and thickened.

Proc. Acad. Nat. Sci. 1868, p. 153.

Hab.—Connesauga Creek, Whitfield County, Georgia, Major T. C. Downie, and Coosa River, Alabama, Dr. Showalter.

My cabinet and cabinets of Dr. Showalter, Dr. Hartman and Mr. Wheatley.

Diam. .45,

Length .51 inch.

Remarks.—Quite a number of specimens were sent to me by Major Downie, and one from the Coosa River by Dr. Showalter. This species seems to be more uniform than usual among *Anculosæ*. Among nearly one hundred specimens scarcely any are found to differ essentially. There are eight or ten short low folds on the upper part of the whorls, and obscure transverse revolving striæ, which cover the whole of the body whorl. The brown spots, which are really interrupted bands, cover the whorls inside and out. It is allied in form to *picta* and *gibbosa* (nobis), but need not be confounded with either. I have pleasure in dedicating this species to Major T. C. Downie, who has brought to our knowledge so many interesting *Mollusca* from Georgia.

PALUDINA SPILLMANII. Pl. 54, fig. 29.

Testa transverse et exillissime striata, obtuse carinata, subelliptica, subtenui, imperforata; spirali quanto exserta; suturis impressis; anfractibus quinis, subinflatis; apertura parviuscula, ovata, intus cæruleo-alba; labro acuto, parum sinuoso; columella parum incrassata.

Shell transversely and closely striate, obtusely carinate, subelliptical, rather thin, imperforate; spire somewhat raised; sutures impressed; whorls five, somewhat inflated; aperture rather small, ovate, bluish-white within; outer lip acute, somewhat sinuous; columella somewhat thickened.

Proc. Acad. Nat. Sci. 1867, p. 81.

Hab.—Jackson County, Alabama, W. Spillman, M. D.

My cabinet and cabinet of Dr. Spillman.

Diam. .51,

Length 1.3 inch.

Remarks.—Four specimens were sent to me by Dr. Spillman, all of different ages. In general characters this species is most like *subcarinata*, Say. It has nearly the same carination on the upper whorls, which carination is obsolete on the last whorl. On all these specimens there are transverse striæ on the upper part of the whorls. It differs from *subcarinata* in being longer and more fusiform, and the mouth is rather more expanded. I am glad to call it after Dr. Spillman, to whom I owe the possession of this and many other new shells from the State of Mississippi.

ART. VIII.—*An Attempt to ascertain the Average Weight of the Brain in the different Races of Mankind.*

By JOSEPH BARNARD DAVIS, M. D., F. R. S.,

Corresponding Member of the Academy of Natural Sciences of Philadelphia, etc.

It would be quite needless to point out the importance of further observations to elucidate this great subject to the members of the Academy of Natural Sciences of Philadelphia, over which the late Dr. S. G. Morton, at one time, presided with so much distinction. The tables prepared by him with such vast pains and elaboration, and presented to the Academy on the 25th of April, 1848, have hitherto afforded the most substantial and complete evidence upon the question yet collected. The work of Prof. Tiedemann, in which he received the assistance of so many other anatomists, preceded Morton's. Unfortunately, it was in some measure produced under the erroneous assumption that the brain, being an organ so essential to life and the intellectual faculties, would be of nearly equal size in all the different races of men, and, if it had been so, possessed of a remarkable exceptional character, we may safely say. He says this is not an hypothesis, but had previously in the same page slightly modified his position by stating that the cavity of the skull and the brain show in all races of man a like mean, *within certain limits of fluctuating dimensions*.* Whatever were the deductions produced under this singular postulate, its incompatibility with truth was sufficiently demonstrated by Morton.

Many other investigations have been undertaken since Morton's day to determine the weight of the brain, although not extended over many races, as those of Dr. T. B. Peacock, in continuance of the observations of Prof. Reid. These were made upon patients of the Royal Infirmary, Edinburgh, and refer to the Scotch. A second series of observations by Dr. Peacock refer to English subjects.† The most extensive series of investigations to ascertain the weight of English brains are those by Dr. Robert Boyd, recorded in the "Philosophical Transactions" for 1861. They extend over no less than 2,614 cases, 2,086 of which occurred in the St. Marylebone

* Das Hirn des Negers mit dem des Europäers und Orang-Outangs verglichen, von Dr. F. Tiedemann, 1837, S. 47.

† Tables of the Weights of the Brain and of some other Organs of the Human Body. By Thomas B. Peacock, M.D., 1861.

Parochial Infirmary, in London, and 528 were patients dying in the Somerset County Lunatic Asylum.* These refer to English brains solely, and so do the 470 cases of Dr. Thurman.† A considerable number of French skulls belonging to different periods were gauged by Dr. Paul Broca.‡

The actual testing of the weight of the brain by manipulation and the balances has hitherto been almost wholly confined to Europeans. Observations on exotic brains have been very few, and probably may not be much increased for some time to come. We are therefore under the necessity to revert to Tiedemann's and Morton's proceeding,—that of gauging the capacity of the cranium,—in order to ascertain the volume of the brain in the numerous races of mankind, where their skulls can be procured. Morton's large collection afforded him materials for his valuable tables. A still more numerous collection, and equally diversified in the races they represent, except in the case of aboriginal American races, having been formed by myself, has offered me the opportunity of calculating the weights of the brains in a considerable number of cases. One object I have kept in view has been to endeavor to distinguish the sexes separately, which Morton did not attempt. In a great many instances this could only be effected by observing the peculiarities of the crania themselves, and referring them to the male or female sex, according to the indications they present. As there are no infallible rules by which to distinguish the skulls of men from those of women, there is no doubt cases must have intervened in which mistakes have occurred. Still, in the vast majority of cases there is not the slightest reason to question that the two sexes have been indicated with correctness. The few doubtful ones cannot be of any importance. This will render our tables and results somewhat more accurate than those of Morton, who, provided they had reached the age of sixteen years, included all skulls in one and the same category, without marking males or females. The lesser volume and weight of the brains of women of all races are constant and specific.

But it is in the next point to which I shall advert that a greater accuracy has been aimed at than can be perceived in the tables of Morton. It is noteworthy that his experiments were confined to gauging the capacities of the skulls of his fine collection, now permanently possessed by the Academy, and reducing them to cubic inches. And when he had obtained this cubic capacity, he appears to have considered it to be, and actually designated it as, "the size of the brain," although no one was better acquainted with the actual contents of the cranium. His words are, after describing his method: "I thus obtain the absolute capacity of the cranium, or *bulk*

* Tables of the Weights of the Human Body and Internal Organs in the Sane and Insane of both Sexes at various ages. By Robert Boyd, M.D.

† On the Weight of the Brain, and on the Circumstances affecting it. By John Thurman, M.D.

‡ Sur la capacité des crânes parisiennes des diverses époques. Bull. de Soc. d'Anthropol., t. iii, p. 102.

of the brain, in cubic inches." It is superfluous to point out that the brain, or the mass of cerebral matter designated by anatomists the *encephalon*, which embraces the *cerebrum*, the *cerebellum*, the *pons varolii* and the *medulla oblongata*, and which is contained in the cranial cavity, does not absolutely fill that cavity. This is far from being the case. There are also the membranes which cover these organs, one of them, the *dura mater*, being thick and tolerably bulky; the blood contained in the vessels of these membranes; and, especially, the serous fluid which is in connection with the membranes and in the ventricles. It is obvious that the volume or the weight of the two former must vary considerably, and in the case of the latter great diversity of amount prevails. The serosity must be regarded as a necessary compensatory fluid which fills up the cavity of the cranium perfectly, however much the cerebral mass may change in size. In the early periods of life the brain is rich in serosity; as maturity is approached it becomes more firm and dense, and is freest from serous fluid. But as soon as this meridian period of life is passed, and decline commences, the watery fluid in and about the brain again increases, and goes on doing so until extreme old age. Besides these normal changes in the amount of serous and other fluids contained in the cavity of the skull, this amount will also vary according to the disease which terminates life, whether it be an acute or chronic disease. Hence it will be at once apparent that the serosity itself is so variable as not easily to be reduced to any rule, and that no rule for its estimation can be established which can be absolutely applicable, or apply to each individual case. To meet these difficulties it has been proposed, as the best practical expedient, to make a deduction, allowance, or tare, for membranes and fluids, which shall bear a definite proportion to the size of the cranial cavity,—be larger where this is capacious, and gradually diminish as it decreases, so as to become decidedly less when this cavity and the organs contained in it are small. For this purpose an average percentage allowance has been fixed upon. At first fifteen per cent. was regarded as the proper allowance to be made, but further investigation has led me to fix upon seventeen per cent. as *the most generally applicable rule* where the mode of gauging to be immediately mentioned is followed, and approaching most closely to the result of actual metrological experiments. In the tables of the weights of the brains, calculated from internal capacities of skulls, which are to follow, an allowance or tare of seventeen per cent. has always been deducted, as a compensation for the membranes and fluids. By this means, if we do not strictly regain the absolute weight of brain of the individual in each case, we shall approach so nearly to it on an average that for all practical purposes the results may be regarded as correct,—undoubtedly much more so than any that have preceded them upon any comprehensive scale.

By the great politeness of a most industrious and able working anatomist and craniologist in Austria, Dr. A. Weisbach, I have been favored with the results of his

experiments in 115 cases, in which he has both weighed the brain, and, subsequently, gauged the skull in which it was contained. This large number of cases, which embrace persons of all ages from ten to ninety years, affords the most valuable materials for testing the difference between the cubic capacity of the cranium and the volume of the encephala, and thus estimating the proper allowance to be made for the abstraction of membranes and fluids. And, in order to place these results in as striking a light as possible, I have constructed the following table :

The internal capacities of 115 skulls, the actual weights of the brains contained in them, their estimated weights, and the differences between the two, with the percentage allowance to be made for membranes and fluids to make the two agree.

| Number of skulls. | Sexes. | Ages. | Capacity of skulls in cubic centimetres. | Actual weight | With addition | Estimated | Excess, +, | Percentage |
|-------------------|--------|---------------|--|--|---|--|--|--|
| | | | | of brains without membranes, fluids and medulla oblongata, in Grammes. | of 14 grammes to compensate for medulla oblongata. Grammes. | w'ght of brains 17 p.c. having been allowed for membranes and fluids. Grammes. | or deficiency, — of estimat'd weight, when compared with real weight. Grammes. | allowancerequired to be made to bring estim'd w'ght nearest to real weight. Grammes. |
| 5 | ♂ | 10 to 19 y'rs | 1436.62 | 1209.85 | 1223.85 | 1243.33 | + 19.48 | 18 p. c. |
| 75 | ♂ | 20 to 29 y'rs | 1535.52 | 1327.43 | 1341.43 | 1324.72 | — 16.71 | 16 p. c. |
| 9 | ♂ | 30 to 59 y'rs | 1556.96 | 1316.12 | 1330.12 | 1347.18 | + 17.06 | 18 p. c. |
| 11 | ♂ | 60 to 90 y'rs | 1550.43 | 1227.21 | 1241.21 | 1321.91 | + 80.70 | 23 p. c. |
| 100 | ♂ | 10 to 90 y'rs | 1533.11 | 1310.06 | 1324.06 | 1324.72 | + .66 | 17 p. c. |
| 15 | ♀ | | 1318.30 | 1159.65 | 1173.65 | 1142.29 | — 31.36 | 14 p. c. |
| 115 | ♀ & ♂ | | 1505.09 | 1290.44 | 1304.44 | 1302.27 | — 2.17 | 17 p. c. |

After the capacity of the skulls, as observed by Dr. Weisbach, and also the actual weights of the brains, exclusive of membranes, fluids, and *medulla oblongata*, according to his method of procedure, I have added a column in which fourteen grammes, or about half an ounce avoirdupois, is restored to make up for the absence of the latter structure, which is really contained in the cranial cavity, and therefore is required to be added to the weight of the brain. Dr. Robert Boyd informs us, as the result of his extensive researches, that “the average weight of the pons varolii and medulla varied in the males from 1.15 oz. to 1.02 oz., and from 1.05 to .95 oz. in the females.”* The mean of these weights is 1.04 oz., and the observations of Dr. Reid, as quoted by Professors Quain and Sharpey,† that the two structures weigh conjointly in men fifteen and three-fourths drams av., and in women one ounce and one-fourth of a dram, coincide closely with Dr. Boyd’s results. I have therefore regarded the two structures to be of nearly equal weights, and made the uniform addition of half an ounce, or fourteen grammes in every case to Dr. Weisbach’s amounts, this being as nearly correct on an average as may be. The next column of the table gives the

* Op. cit., p. 261.

† Elements of Anatomy, 5th ed., 1848, vol. ii, p. 672.

weight of the brain estimated from the cubic capacity of the skull, allowance of seventeen per cent. being made for membranes and fluids. The following column shows how much this estimated weight differs from the real weight of the brain, either exceeding it, +, or falling short of it, —. And the last column points out which percentage deduction would bring the estimated weight nearest to the real weight in the large series of examples examined by Dr. Weisbach. These last percentages are very instructive. They vary from fourteen per cent. to twenty-three per cent., and show that although sixteen per cent. is the proper deduction in the vigor of life in men,—that is, from twenty to thirty years of age,—and even fourteen per cent. in women, in both of whom the serosity of the brain is small in quantity; yet that seventeen per cent. is the nearest general average, as it prevails in the one hundred males of all ages from ten to ninety years, as well as in the entire series of one hundred and fifteen cases of males and females. Indeed, it appears to approach remarkably close to actual observation. Whilst in the five growing males below twenty years of age, and in the nine males between thirty and sixty years of age, when the brain has reached the period of incipient decline; in both these cases the fluids of the brain are a little more abundant, and require an allowance of eighteen per cent. for them and the membranes. But the most striking fact brought to light in this table is that after sixty years of age the fluids of the brain in men go on increasing rapidly to extreme old age, demanding a deduction of no less than twenty-three per cent.

It should here be mentioned that the internal capacity of the skulls embraced in the following tables has been obtained not exactly in the mode pursued by Morton, by filling them with white mustard seed, or with shot, but, as uniformly as possible, with dry Calais sand of a known specific weight of 1425, water being 1000. The brain-weights have been obtained by the conversion of the ounces of sand into ounces of cerebral substance, of the specific gravity of 1040.*

Whilst writing these lines, I learn that a very accurate observer and able anatomist has carefully tested the properties of different substances in their application to this purpose of gauging the capacity of skulls, and finds them to vary materially.† He has accomplished this by filling *the same skull* “with a given material, which was *well shaken down*, and compressed until no more could be received,” eight separate times, so as to compare the result of each experiment; the whole made clear by a table. The contents were then poured into a measure, and the measurements noted in cubic centimetres, each time. Seven different matters were employed, namely, peas, shot, beans, rice, flaxseed, coarse sand, and fine sand. The purpose was to try the uniformity of result by these different media, and the conclusions came out nearly

* See *Crania Britannica*, p. 222.

† *Observations on Crania*. By Jeffries Wyman, M.D. Boston, 1868.

in the order in which they have been here placed,—the only change being that shot came before peas; that is to say, that the range of variation among the eight measurements with shot was only five cubic centimetres, with peas only eight c.c., but with the other substances, in an ascending degree until it amounted to sixty c.c., with fine sand. This might, at first view, be supposed to prove that there is considerably more difficulty in gauging skulls with sand in a *uniform manner* than with any of the other substances named. But it must not be overlooked that in the *measurements* of the different substances employed, subsequently to the gaugings, Dr. Wyman poured them into his measure at a uniform rate, but *without* shaking or pressing them down. The shot, and even the peas, would gravitate at once nearly to their definite volume. The coarse sand, but especially the fine sand, would envelope and carry down much air, and would, from the irregularity of size and form of their particles, absolutely *require* to be shaken down well, in order to regain the same volume they occupied in the cranium. Prof. Wyman does not maintain that observations made with dry Calais sand are vitiated by the results of his experiments, only that the use of a substance the particles of which are definitely spherical, and of the same size and weight, is to be preferred for gauging skulls. He candidly admits that, “with proper care, correct measurements can of course be made with either of the materials mentioned in the table, and, in practice, no one would omit to shake down and compress the material in the measure to the same degree that he would in the skull.” It may reasonably be concluded that where the capacity is obtained by the same hands, with the same sand, and by a uniform method of manipulation, the chances of variation are much lessened; and the data upon which the following tables are constructed may be regarded as sufficiently accurate and trustworthy.

There is, however, another point, which seems as if proved by Dr. Wyman's experiments, that may deserve to receive our attention. The average capacities obtained by the seven different matters were very different, or, at least, appeared to be very different. This is what might have been expected to be the consequence of the fineness or coarseness of the particles influencing their penetrability, which would also be modified by the weight of the substance employed. The measures of the different substances used rise gradually from the peas to the fine sand, in the order in which they are given above; and the increase itself ascends from peas 1193 c.c. to fine sand 1313 c.c., apparently showing that the latter fills the cranial cavity more thoroughly than any of the other substances, and approaches in this respect to water in being adapted to gauging this cavity. Water, which has been used by some for this purpose,—by Prof. John Marshall, for instance,—it is said by Prof. Wyman “would unquestionably be the best.” The fact that on an average 1313 c.c. of fine sand can be got into a skull which is usually filled with 1193 c.c. of peas, or 120 c.c. less, independently of its influence upon the question of which is the best material for use in

gauging the capacity of skulls,—Dr. Wyman considering that this substance “is still a desideratum,”—shows this also, that a larger tare or allowance might be required in this mode of procedure than in some others where less penetrating matters are employed. But again, this peculiarity of sand does not tend in any important degree to lessen our confidence in the following tables, firstly, because the sand in Dr. Wyman’s experiments was shaken down in the skulls and was not shaken down in the measure, and because this source of error in our proceedings was wholly avoided, for the sand was not at all measured, but weighed. It is reasonable to conclude that the result of Dr. Wyman’s experiments would have been very different had he, like us, weighed the substances with which he gauged the skulls, instead of pouring them into a measure, “care being taken that this should be done in each case at a uniform rate, but *without* being afterwards shaken or pressed down.”

By the procedures before mentioned, and the observance of the rules above laid down, it is believed that a large mass of reliable data has been obtained, which it is hoped will prove useful to other observers, who may probably be able to contribute to render it still more accurate. In some cases these data confirm the conclusions deduced by Morton from his observations, and in other instances they probably tend to invalidate them. Particularly they lead to a doubt whether the volume of the brain simply can be taken so absolutely as Morton seemed to think, and those who have followed him, as a just measure of intellectual power. Still, nothing is by this remark implied to call in question the general fact that a large volume of brain is an index of great mental capacity; only it should not in all cases be taken as so perfect and simple an index. The special organization of the brain must be taken fully into account in any estimate of its highest faculties.

Another point to be remarked upon here may probably lead to a key which is applicable to the whole subject, in a degree not hitherto admitted. It has been usual to compare together the size of the brain and the stature of the race to which it belongs, and to regard the diminutive Bushman, for example, as equally endowed with cerebral structure as the much taller European; that is to say, that the Bushman is as richly endowed as the European, stature for stature. It is not proposed to call in question this general law, that the size of the brain bears a proportion to the size of the race, but there are many facts which tend to prove that each race has a special endowment of cerebral development belonging to itself, which view is not in agreement with the opinion of Tiedemann, that, so far as the few established investigations reach, there appears to obtain a difference in the size of the brain *in relation* to that of the body. If our position be true, then the size of the brain is not to be compared so directly with the average stature of the race, in order to gain a correct estimate of the intellectual power of any race, but, in fact, that each race must be studied separately, as each race has a specific stature, volume of brain, and intellectual power.

This, no doubt, is greatly at variance with doctrines which have lately received much attention and have been extensively discussed, especially with developmentalism in all its forms. Still, an examination of the entire subject of the volume of the brain in the various races of mankind lends considerable support to the view of the specific endowments of these races. In the first place, the following tables will prove that the European races have the heaviest brains among mankind; and they will also show that this superior cerebral magnitude is not so exclusively confined to the "Teutonic Family" of Morton,—*i. e.*, to Swedes, Germans, English, and Anglo-Americans, as he considered it to be. They will prove that the ancient Britons, the Italians, the Russians, Poles, Magyars, Finns and other peoples must be reckoned among the large-brained races. They will indicate that European races are distinguished from those of all other great divisions by having fewer of the small-brained peoples among them, and that these are less distinctly marked. They will next of all show that, although the Asiatic races in the whole exhibit a slightly lower general average of brain weight, they also may be distinguished into two classes, one of naturally larger-brained people, and the other of smaller-brained people. Among the former are to be placed the Siamese, Burmese, Chinese, and the different tribes inhabiting the southern slope of the Himalayas. Among the latter are the innumerable races of India, the Afghans (?) and the Veddahs of Ceylon. I am not aware of any substantial reason for calling in question the position that both the large-brained and the small-brained peoples here distinguished, upon this ground, are not equally to be regarded as aboriginal peoples. They differ materially in the essential point of volume of brain, which defies all the ingenuity of philologers to explain away. Indeed, the great Indo-Germanic, or, to call it by a later name, Aryan hypothesis, when tested by the weight of the brain, which neither climatic nor other secondary influences can modify, is seen to have every appearance of being a baseless vision.

Again, if we pass over to the other great divisions of mankind, the same arrangement is seen to prevail. Among the African races there are two great classes of large-brained and small-brained peoples, and the average weight of the whole falls below that of the European races, which we are not at all disposed to doubt may be taken as some evidence of the mental superiority of these European races. The Kafirs and Zulus stand first, the Negroes of the western coast following close after them, and the various diminutive races which are scattered over a large portion of the continent without having any connection with each other, designated by us Bushmen merely because they live wholly in the wild, segregated in families rather than tribes, and separated from all the various tribes by which they are surrounded, constitute a well marked division of small-brained peoples. Again, that these are all aboriginal peoples, each standing upon an independent basis, is unquestionable. The

futile efforts to derive some of them from China and from the Indian Archipelago are too imaginary and baseless to deserve attention.

The Mortonian collection is rich in the skulls of ancient Egyptians, and the curious remarks of Morton on the size of the brain of these people, as demonstrated by his investigations, must not be passed over. They tend powerfully to give support to the position already hinted at, that size of brain in general is not to be looked upon as directly in proportion to mental power, but rather that both are the special endowments in different degrees of different races. He says, in his fourth conclusion: "The ancient Egyptians, whose civilization antedates that of all other people, and whose country has been justly called 'the cradle of the arts and sciences,' have the least-sized brain of any Caucasian nation, excepting the Hindoos." Here Morton was led astray by the term Caucasian and his hypothetical notions. It has yet to be proved that there is any connection between the ancient Egyptians, Hindoos, and Caucasians or Europeans. In his fifth conclusion he adds: "The Negro brain is nine cubic inches less than the Teutonic, and three cubic inches larger than the ancient Egyptians."* If these facts should receive further confirmation from the examination of the large number of ancient Egyptian skulls which have recently been added to the Museums of Paris,—and there is every reason to expect that they will be so confirmed,—they present us with the relics of the most ancient civilized people on the face of the earth, who may most probably be regarded as a civilized race, using the term in the sense of a naturally highly endowed race, from their earliest appearance; and yet these renowned people had a smaller cerebral development than the most famous uncivilizable race known in all ages,—the Negro races. Surely the qualities of the brain are not to be estimated solely by the balances. Surely development is not the only and true key to the secrets nature has hidden in organized beings.

When we next of all approach American races in the mass, in which races the Mortonian collection, although insignificant in the amount of its specimens when we regard the numerous races which have perished under the influence of the great tyrant,—the highly civilized European,—is and ever will remain far richer than any other, we find exactly the same phenomena as among the peoples of Africa. There are, as pointed out by Morton, two great classes: the large-brained and the small-brained peoples. The former he designates the "Barbarous Tribes" of America, and in his third conclusion tells us that they possessed "a much larger brain than the demi-civilized Peruvians or Mexicans." This is a noteworthy conclusion, where the uncivilized races have the larger brains. It is almost needless to add that American races in the aggregate fall below the average brain-weight of European races. They closely agree with the Asiatic races in their average brain-weight.

* It would appear somewhat singular that Morton did not further apply this conclusion to the opinion that volume of brain is equivalent to intellectual power.

In the fifth great division of mankind, which we have made to embrace the races of the great Australian continent and the closely situated Tasmanians, so little is known by an accurate investigation and comparison of tribes that it is hardly safe to draw any conclusions. The "highly civilized" European has here discovered and invaded the territory to possess everything it contains, regardless of the wholesale destruction which has followed in his train, and without considering the original proprietors of the soil worth being studied. Both sections of this division have small brains, but the smaller appertains to the continental tribes, as far as our materials enable us to discover. The more robust Tasmanians have the larger brains. And regarding the division as a whole, it presents the smallest average brain-weight among the six geographical sections to which we have referred all human races.

In the sixth and last very comprehensive division of Oceanic Races, we find the same phenomena repeated. There is a large section composed of many races, which, without any clear understanding, have gone under the common name of Negritos, composed, I believe, wholly of small peoples who have brains of small weights; and another section of races, which are very numerous and very varied, who have large brains; and, it must be added, some of these latter rivalling those of European races, and generally standing at but a few grammes of brain-weight below Europeans. But, notwithstanding the comparatively large size of their brains, these races of the Indian Archipelago have never developed a civilization resembling that of Europeans.

That there is good reason for doubting that stature and size of brain should be regarded as standing in any intermediate and direct relation to each other, may be shown by pointing to many different races of men. The Lapps afford a good instance on one side of short stature and large brain. The Lapp brain is a decidedly large one. The average in the table is 1283 grammes, or 45·27 oz., but the Lapp people are of low stature. Some were measured for me by Mr. A. G. Nordoi, of Mortensnees, in Finnmark, Norway, and gave these results: Of eight Lapp men the tallest measured 5 ft. 2·6 in. Eng., the shortest 4 ft. 9·5 in., the mean being 5 ft. 0·3 in. Of three Lapp women the tallest was 4 ft. 10·1 in., the shortest 4 ft. 7·1 in., the mean being 4 ft. 8·7 in. The average stature of the whole eleven Lapps, men and women, 4 ft. 11·3 in., or 1505 millimetres.* These measurements correspond very closely with those taken by other observers. Mr. J. F. Campbell measured twelve Lapps,—ten men and two women. The tallest man was 5 ft. 4·5 in., the shortest 4 ft. 8 in., the mean of the ten being 5 ft. 1 in. The taller woman was 4 ft. 6 in., the shorter 4 ft. 5·5 in., the mean being 4 ft. 5·75 in. The average stature of the men and women is 4 ft. 11·8 in., or 1513 mm.† Dr. Weisbach, on the authority of Tenon, attributes a

* *Thesaurus Craniorum*. By J. Barnard Davis, M.D., p. 100.

† *Transactions of the Ethnological Society of London*, vol. v, p. 2.

stature of only 1380 mm. to the Lapps, which is evidently not to be relied upon.* Accurate and authentic observations on the stature of the different races of men are almost wholly wanting. Those of the Novara Expedition itself are probably the most reliable that have been taken on any extensive scale.

If we take a converse example, and turn to the brain of the Australian races, this is decidedly small,† yet the people themselves are not short. It must be allowed that general designations, such as "Australians," are misleading, and our ignorance of the tribes or races of Australia great. The average brain-weight of the seventeen males of our table is 1174 grammes, that of the seven females 1101 grammes, giving a mean of 1137 grammes. The stature of Australians, according to Flinders, was 1714 mm.; according to Scherzer and Schwarz, 1617 mm.; according to Gaimard, 1600 mm.; and according to the American Exploring Expedition, 1574·8 mm; thus showing a difference between the highest and the lowest estimate of 139·7 mm., which may probably arise in some measure from the stature of different tribes having been taken by different observers. Reducing the terms to English measure, they range from 5 ft. 7·6 in. to 5 ft. 2·1 in., leaving a difference between the highest and lowest of 5·5 in. The two Australian men of Victoria, measured by the late Dr. Ludwig Becker, were respectively 5 ft. 7·5 in. and 5 ft. 2 in., as nearly as possible the same as the extremes mentioned. The few reliable replies obtained by the Select Committee of the Legislative Council in Victoria, where the data were acquired by the actual measurement of thirteen men, inclusive of Dr. Becker's two, show a range of from 5 ft. 9·75 in. to 5 ft. 2 in., affording a mean of 5 ft. 5·8 inches, or 1645 mm., which is most likely a fair estimate of the mean stature of male Australians.‡ The size of the brain bears a low proportion to this stature, and both are no doubt special attributes of this most peculiar and distinct people.

This specific relation of the weight of the brain of man to the race to which he belongs is a thing of the same kind as the specific development of the brain in the animal series. Every species of animal has its own particular cerebral development. There is no such general law as was formerly presumed, that the development of the brain in proportion to the rest of the animal tissues is increased as we ascend in this series, and that man has decidedly a larger brain in proportion to the size of his body than any other animal. This is as incorrect as the notion that man's brain is positively larger than any other animal's.§ Some small animals have brains larger in

* Reise der Novara um die Erde. Anthropologischer Theil. Körpermessungen, S. 216.

† Professor Lucae distinctly affirms that the brain of Europeans is more than 300 grammes heavier than that of Australians.—*Zur Morphologie der Rassen-Schädel*. 1861, S. 34.

‡ Report of the Select Committee of the Legislative Council on the Aborigines. Victoria, 1858-9.

§ Lawrence appears to have scarcely given up all confidence in the general truth of this view, when he wrote his *Lectures on Man*. His words are: "It has been asserted from remote times that the brain of man is larger than that of any animal; and I know no exception to this assertion of Aristotle and Pliny besides the Elephant, unless the larger cetacea should be as well supplied with brains in proportion to their size as the smaller." p. 187-8.

relation to the bulk of their bodies than that of man. According to Cuvier, the brain of the seal is larger in proportion to the body than in man, and the same is the case in some of the American monkeys, as well as in some small birds. The fact of this smaller proportionate size of the brain in man has been well ascertained, although it is not of much moment; and that of the absolute lesser magnitude of his brain is now notorious. For instance, the brain of a sperm whale of fair average size is about 900 cubic inches in magnitude; so that it is seen that the weight of the brain in each species of animal is strictly proper to it, although it may and must nevertheless bear some relation to the size of the animal. And such is also the case in the different races of man. Each race has its own proper size of brain, influenced, it may possibly be, by the stature of the race, but certainly not necessarily controlled by it.

In looking into the older writers of only forty or fifty years ago, it is at once seen how little was accurately known respecting the weight of the brain and other allied subjects. The great anatomist Von Sœmmerring, at an earlier period, considered that the brain did not increase in size after the third year. The Wenzels deferred the period of full development to the seventh year, which was considered to be confirmed by Sir Wm. Hamilton's researches. Gall and Spurzheim put off this period to about the fourteenth year. Now it is known that the brain goes on increasing in volume till adult age, and until the full maturity of the organization is attained. It has also been demonstrated that the weight of the brain decreases materially in old age, which was formerly regarded as very doubtful.* The fourth series in our table, embracing eleven males of from sixty to ninety years of age, proves a remarkable diminution of weight, possibly of specific gravity also.

It is not requisite in this place to enter into the consideration of the immense advances made in the anatomy and physiology of the brain, upon other points; a subject which would demand a volume that could alone be produced by an accomplished anatomist. Enough has been said to prove that the general views respecting the growth and magnitude of the brain have been rendered much more worthy of confidence by modern researches, to justify the importance of the inquiry to which this memoir is devoted, and to confirm the view here maintained, that brain-weight must not be regarded otherwise than as a special endowment proper to each distinct race of man. The present communication is not of such value as it might have been had the data fallen into abler hands; still, it is hoped that it may be of some use in aiding the advancement of knowledge respecting the encephalon now in progress.

The inquiry itself is of much moment in its bearings upon an hypothesis which is

* Tiedemann expresses these doubts, although he does not participate in them. His words are to this effect: Whether the weight of the brain diminishes in old age is a point upon which anatomists are divided in opinion. The brothers Wenzel did not observe any remarkable diminution. Hamilton, likewise, holds it in doubt. Desmoulins, on the contrary, found that in old people, after the fiftieth year, the brain not only exhibits a smaller absolute weight, but it is also specifically lighter.

exercising the utmost influence upon ethnological doctrines at this time. I allude to the now notorious Indo-European, or Aryan hypothesis, which has been elaborated by the learned labors of three generations of scholars, and has grown so much in the favor of the scientific world that it is almost perilous to dare to call it in question. Still, although the building up of the structure of this hypothesis has been regarded to be the work of the philologist and grammarian, these ingenious inquirers cannot quite emancipate themselves from the much less inviting studies of the anatomist. If it be true that the size of the brain of man is really specific and fixed in the race to which he appertains, and especially if all his race-peculiarities are determined by the development of the brain belonging to that special race,—and such positions appear to us to be correct,—then to overlook the specific volume of the brain in the different races of man would be fatal to any hypothesis which is seen to be at variance with these positions. The Aryan hypothesis supposes the existence of an ancient fine Aryan race, of high powers, in some region of central Asia; the particular region has not been very definitely fixed by the supporters of the Aryan hypothesis. As there is danger of misconception when we speak of these hypothetical matters, it is preferable to quote the statements of the initiated. One of the latest authorities, Mr. Justice Campbell, in his memoir on “The Ethnology of India,” says the Afghans or Pathans are “physically among the very finest people on earth.” Whenever language of this kind is used, it may be confidently assumed that we are treading upon the heels of the mythic “Aryan.” The Justice seems to hesitate whether to take the Afghans as the type, or “the Khatrees and Khasas and more aboriginal Caucasians,” who held Afghanistan before them. But he has no doubt that this country is the seat of the original Aryan race, for his next section is “On the Aboriginal Aryans of the Indian Caucasus.” These “pure Aryan aborigines,” he says, are “altogether such a people as we might expect to give birth to Khasas and early Brahminical Hindoos.” p. 146.* Dr. Nicolucci, in his elegant *Anthropology of Greece*, defines the primeval seat of the Aryans to be somewhat the same,—the region

* It should not be omitted that of all countries Mr. Campbell claims Kashmere for the seat of this primeval stock more particularly than any other. “Kashmere is a Brahmin country,” and apparently the source of all the Brahmins. “The Kashmir Bramins are quite High-Aryan in the type of their features, very fair and handsome, with high chiselled features, and no trace of intermixture of the blood of any lower race.” Page 57. Yet, he says, “the institutions of the people have nothing of the democratic character,” which seems to be quite at variance with the Judge’s principles.

Mr. Campbell deserves credit for his energetic efforts to elucidate the subject on which he treats. His essay is remarkable, as it is in some measure an application of his professional knowledge to the ethnology of the Indian races. He has studied the spirit of their laws and institutions, and often determines the Indo-European alliances of tribes who have an independent spirit and democratic institutions. The philosophy of the Judge is pretty much the same upon these points as upon the physical features. A sentence will show this: “It may be asserted of all these Caucasian tribes that, while they are physically as handsome and fine as possible, they are not so democratic and sturdy as the Afghans.” p. 146.

of Bactriana, between the Indus on the south, Bokharia on the north, Belurtag on the east, and the territories of Merva and Herat on the west,—a very extensive mountainous region.* Others have referred the primeval Aryans to Persia and other countries.

In proof of the high powers of this primitive race of people, it is affirmed that they spoke a pristine language from which the Sanscrit language, which has been designated by competent authorities as the finest language ever spoken by man, was derived, as well as numerous other allied tongues. Parallel to this derivation of languages from the primeval Aryans, is also deduced a succession of races of man, who, most strange to say, are spread over the world from the farthest confines of India to western Europe. After the mere enunciation of this hypothesis, which is so much at variance with the doctrines of anthropology, our faith in it must be shaken by the inquiry which clearly proves that the Indo-European races, although they may speak languages between which resemblances, real or fancied, whether of construction or vocabulary, may be found, embrace among themselves peoples, some of whom have the largest brain-weights of any among mankind, and other peoples, as the races of India, who are equally distinguished for their small brain-weights. It is believed that this fact, although not congenial to the learned in the vast field of philology, is quite adequate of itself to decide the real value of the Indo-European hypothesis.

Nature has irrevocably fixed the cerebral diversities of the European races and of the races of India, both so-called Aryan and Aboriginal. Upon these cerebral diversities all their other diversities rest, and it is quite vain to plead that there are resemblances in their languages which prove that these two essentially different peoples are derived from the same stock. The philological resemblances are utterly impotent to overcome such diversities of organization as have been proved. If the resemblances exist and are valid, they must be explained upon credible grounds. It is quite useless to attempt to explain them by assumptions that are contradicted by the laws of anthropology. The Indo-European, or Aryan hypothesis, entirely breaks down under an examination of the brain-weights of the peoples of Europe and the peoples of India.

Difficulties have long been encountered in the details of the hypothesis itself. We have been told that there are tribes in India of the purest Aryan blood, particularly alluding to the people of Brahminical caste, and that there are many also unequivocally non-Aryan, or aboriginal races of Hill people, who have never mingled their blood with the high Aryan races. When I first directed my attention to these inquiries, I expected to find that the Aryan hypothesis would be easily proved upon these grounds. If we found the Aryan peoples to have a development of brain organization resembling that of European peoples (recollect the term "Indo-

* *Antropologia della Grecia*, p. 24. 1866.

European”), and the aboriginal or non-Aryan peoples evincing a much lower cerebral organization, then the facts would admit of explanation by the hypothesis, because they would agree with it. But the truth appears to be very different from this. The people of India, with respect to their brain development, are tolerably uniform, as far as the subject has been investigated. They are all,—Brahmins, Hindoo races and Hill tribes,—tolerably uniform in having small brains, as far as the subject has been investigated. It has always been openly declared by the writer that the investigation of this and other questions relating to physical organization must go first and foremost in studying the ethnology of India. Whether some of those who now seem to be in a measure engrossing the materials for this investigation will accomplish much, since they are well known to be setting out with the purpose to develop and complete the Aryan hypothesis, remains yet to be seen. It does not at present appear whether they perceive that the materials now being collected are fully adequate to establish the basis of a true ethnology of India, in the hands of those free from hypotheses.

It is also very questionable whether the full investigation of brain-weights in different races of man will prove at all more congenial to the romantic doctrine of developmentalism. A few years ago its disciples rejoiced in the discovery of a portion of an exceedingly ancient human cranium in a cave in Germany,—the celebrated Neanderthal skull,—which was thought to supply in some measure “the missing link” between man and the anthropomorphous apes, or, more properly, to give a shadow and semblance of probability to the fancy that such missing link had ever existed. Although this fragment of a skull does not admit of measurement so as to enable any one to determine its internal capacity, and this can only be arrived at by an approximation, the dimensions which may be recorded justify our regarding the original skull as not in any way deficient in room for brain.* Hence the developmentalism vanishes, for there appears to be no room for development. This most ancient man had about as much brain as many modern men. In the calvarium figured and described in the “Memoirs of the Anthropological Society,” which is probably the most Neanderthaloid modern example known, so far from a small imperfectly developed brain, this organ was unquestionably of unusual magnitude.†

The last section (VI) of Prof. Wyman’s recent “Observations on Crania” is devoted to the Neanderthal skull. The remarks of so accurate an observer, which are expressed in such a right spirit, demand attention. Prof. Wyman says: “There is one fact which we have not seen noticed in the discussion of the question at issue, though it has doubtless been observed, and in which the Neanderthal differs from common

* Prof. Schaafhausen, who first and carefully described the Neanderthal skull, says distinctly: “The cranium is of unusual size, and of a long-elliptical form.” *Nat. Hist. Rev.* 1861, p. 156.

† *Mem. Anthropol. Soc. of London*, vol. i, p. 288.

synostotic skulls. From what has been stated on page 32, it appears that in all of the latter, there described, the increased length of the head is chiefly due to the extension of the parietal bones from before backwards, the frontal and occipital being but slightly angulated. In the Neanderthal skull the length of the parietals is only 115 mm.,* 9 mm. *below* the average, while in the synostotic crania it is 142 mm., or 18 mm. *above* the average. How far this has any real bearing on the nature of the deformity of the Neanderthal cranium will depend upon the extent to which, when large collections are examined, the extension of the parietals and consequent lengthening of the sagittal suture is found to be a *constant* attendant on synostosis." p. 34.

In the words here quoted Prof. Wyman seems to have employed the term synostotic in the sense as if there were but one kind of synostosis,—that of the parietals,—and as if the dolichocephalic and scaphocephalic deformation were the only or the chief deformation resulting from synostosis. Synostoses are various, as they are the results of the premature ossification of all the different sutures between all the different bones of the cranium. Hence it will appear that neither dolichocephalism nor scaphocephalism can be regarded as the general results of synostosis. Brachycephalism is a regular and constant result of synostosis, just as well as dolichocephalism. When transverse sutures are ossified, such as the coronal, lambdoidal, and the speno-occipital synchondrosis, *brachycephalism* is the necessary and immediate consequence. Still, it is synostosis of the parietals which has probably attracted most attention. The third section in Prof. Lucae's classification of synostotic crania is *Brachycephali*, of which he defines different species. Prof. Virchow had previously formed a section of *Brachycephali*. So that it is scarcely sufficient to use the term synostosis as if there were but interparietal synostosis. Explanation and definition should be appended to make the meaning of the writer obvious. The next point deserving attention is that synostosis, in the restricted sense to which Prof. Wyman seems to apply it, is usually attended with an elongation of the parietal bones. This entered into Prof. Lucae's definition of it. His words are: "IV. *Stenocephali*, Narrow-heads. *Macrocephali* (*Dolichocephali*), Long-heads. Synostosis of the sagittal suture, with compensatory development of the parietals, in length."† Prof. Wyman shows that in the very curious skulls he has described and depicted the parietal bones are beyond the normal length. It is most probable that in all scaphocephalic

* There is no room to question Dr. Wyman's correctness, yet the misrepresentations of this skull are general, and it is almost necessary to say what figure or cast is made use of. The coronal suture, one of the points for this measurement, is quite obvious in many of the engravings of this skull. It has been added. See Prof. Carl Vogt's figures, Prof. Busk's figures, Prof. Huxley's figures, Prof. Wm. King's figures. In the figure given from the photograph of the fragment itself, by Prof. Landzert (*Archiv. für Anthropologia*, Band ii, S. 13), the coronal suture is totally absent, and Dr. Fuhlrott's statement respecting the original is, that it is only obscurely perceptible.

† On Synostotic Crania among Aboriginal Races of Man. By J. Barnard Davis, 1865, p. 8.

skulls this is the case. Whether this has any bearing upon the Neanderthal cranium depends, as Prof. Wyman with much judgment says, upon whether this is a constant attendant upon synostosis,—*i. e.*, interparietal synostosis. Prof. Huxley had previously discovered a skull with perfect obliteration of the sagittal suture, which manifested no elongation of the parietal bones. Taking the same view of synostosis as Prof. Wyman has been disposed to do,—that ossification of the sagittal suture, especially when premature, leads to a lengthening of the parietals and thus must necessarily produce elongation of the cranium,—this case of the Tartar skull was at first not easily understood by Prof. Huxley. But after an elaborate and complete examination of it, he says: “It is therefore clear that extreme brachycephaly is consistent with comparatively early synostosis of the parietal bones; or in other words, that synostosis of those bones may take place comparatively early, and yet have no discernible effect upon the form of the skull.”* This is an ample reply to Professor Wyman’s implied query. It would thus appear that even in comparatively early synostosis of the parietals, that form which lengthens the cranium in some cases so enormously, the parietal bones may not be at all elongated. In my Pokomame skull, No. 377, there is not the slightest trace of sagittal suture, and where the synostosis of the parietals can hardly have occurred later than foetal life, the length of the parietals is only 110 mm., or 12 mm. below the average.† This is, I believe, the most brachycephalic skull in the entire collection. In my Kanaka skull, No. 645, in which the faintest remnant of neither coronal nor sagittal suture can be perceived, the length of the arc of the frontal and uniparietal combined is only 228 mm., which brings the latter much within the average. This skull has been lithographed.‡ The skull of an Esquimaux (No. 568*, p. 219 of my “Thesaurus Craniorum”) may be adduced in this argument, premising that Esquimaux crania are naturally both dolichocephalic and scaphocephalic. This example is actually scapholoid, but brachycephalic. The length of the parietals is nevertheless normal.

* On two widely contrasted forms of the Human Cranium. By Thos. H. Huxley, F.R.S.; read at the Nottingham Meeting of the British Association, 1866, and published in the *Journal of Comparative Anatomy and Physiology*, late in 1866. I am indebted to the politeness of the author for this memoir. The cranium with which Prof. Huxley contrasted the very brachycephalic Tartar skull is one of those singular crania to which I have applied the term *Hypsi-stenocephali*. They have a specific form, are unmistakable, and are peculiar to the Islanders of the New Hebrides and the surrounding groups of the Western Pacific. They are the narrowest of all normal crania, and were first described and figured by myself: *On the Peculiar Crania of the Inhabitants of certain Groups of Islands of the Western Pacific*. By J. Barnard Davis. 1866. Qto., with three plates. My first paper, in which I gave an account of these hypsi-stenocephali, was entitled, “The Skulls of the Inhabitants of the Caroline Islands,” and appeared in the “*Anthropological Review*,” No. 12, January, 1866, page 47.

† *Thesaurus Craniorum*. Catalogue of the Skulls of the various Races of Man in the Collection of J. Barnard Davis, M.D., 1867, p. 235.

‡ On Synostotic Crania among Aboriginal Races. Plate viii.

The argument sustained by myself respecting the Neanderthal fragment was that it is of abnormal form, not a race-skull at all, and that this abnormality is the consequence of premature synostosis of the cranial bones. That its parietal bones are not so long as is usual among synostotic, or intra-parietal synostotic skulls, does not invalidate this argument. Although the Neanderthal fragment is long, its extreme length, according to Prof. Huxley, is eight inches. Still the most striking peculiarity it exhibits is the extreme depression across the frontal behind its enormously thick superciliary ridges, which Prof. Schaaffhausen regarded as "unquestionably a typical race-character," and which led Prof. Huxley to speak of it as "the most pithecoïd of human crania yet discovered."* What led me to write anything upon this Neanderthal skull was the *fact* that I found in my own collection a remarkable English skull, which comes the nearest in its form to the Neanderthal of any cranium yet known, and which owes its peculiarities to premature synostosis of its bones. The method I pursued was somewhat of the empirical kind,—merely to apply the explanation which was applicable to the one to the other. That the premature ossification of the sutures surrounding the alisphenoids, and of the coronal suture, gave rise to much of the peculiar form of the permanent frontal bone of the Neanderthal, the remainder being occasioned by individual expansion of the frontal sinuses, still seems to me to be satisfactory and conclusive.

NOTE.—The craniological collection which has afforded the extensive data for the following tables is described in an octavo volume just issued, entitled: *THESAURUS CRANIORUM: Catalogue of the Skulls of the various Races of Man, in the Collection of Joseph Barnard Davis, M.D., F.S.A., etc.* London, 1867. This work supplies a great amount of information respecting the origin of the skulls, their authenticity, and a great variety of other points of interest and importance bearing reference to this inquiry.

* Professor Vogt goes further, and speaks of the Neanderthal as having "more of the Simian type than any other known race-skull."—*Lectures on Man*, p. 194. This is assuming the race-character of the skull, which there is not the slightest perceptible ground for assuming.

TABLES OF THE COMPUTED WEIGHTS OF THE BRAINS CONTAINED IN SKULLS OF PEOPLE OF DIFFERENT RACES.
(Expressed in ounces avoirdupois and in grammes, with internal capacities of skulls in cubic inches.)

TABLE I.—EUROPEAN RACES.

| RACES. | BRAIN-WEIGHTS OF THE SKULLS OF MEN. | | | | BRAIN-WEIGHTS OF THE SKULLS OF WOMEN. | | | | Mean of Sexes | | Mean Intern'l Capacities. Cubic Inches. | |
|----------------------------------|-------------------------------------|-----------|-----------|----------|---------------------------------------|-----------|-----------|----------|---------------|---------|--|-------|
| | No. | Heaviest. | Lightest. | Average. | No. | Heaviest. | Lightest. | Average. | Oz. av. | Gramm's | | |
| | | Oz. av. | Gramm's | Oz. av. | Gramm's | Oz. av. | Gramm's | Oz. av. | Gramm's | Oz. av. | Gramm's | |
| 1. Ancient Britons..... | 56 | 55-93 | 1585 | 40-14 | 1137 | 51-13 | 1460 | 42-41 | 1202 | 44-92 | 1274 | 89-8 |
| 2. Ancient Scottish | 3 | 47-20 | 1338 | 38-05 | 1078 | 42-44 | 1203 | 42-56 | 1216 | 42-56 | 1216 | 85-1 |
| 3. Ancient Romano-Britons..... | 44 | 62-23 | 1760 | 38-91 | 1103 | 46-85 | 1228 | 40-63 | 1152 | 43-73 | 1239 | 90-1 |
| 4. Anglo-Saxons..... | 39 | 53-50 | 1517 | 40-15 | 1137 | 46-13 | 1308 | 40-84 | 1158 | 44-70 | 1268 | 89-1 |
| 5. English | 21 | 56-29 | 1596 | 43-20 | 1225 | 49-28 | 1397 | 42-27 | 1198 | 46-55 | 1320 | 93-1 |
| 6. Irish | 12 | 61-79 | 1723 | 38-70 | 1097 | 48-63 | 1378 | 43-63 | 1236 | 45-77 | 1297 | 91-5 |
| 7. Merovingian Franks..... | 4 | 50-68 | 1442 | 47-78 | 1355 | 49-28 | 1397 | 41-69 | 1182 | 49-28 | 1397 | 98-5 |
| 8. French..... | 9 | 50-70 | 1448 | 41-34 | 1172 | 46-27 | 1312 | 41-69 | 1182 | 44-27 | 1235 | 80-4 |
| 9. Spaniards and Portuguese..... | 7 | 49-35 | 1399 | 44-77 | 1270 | 47-35 | 1342 | 41-69 | 1182 | 47-35 | 1342 | 94-7 |
| 10. Ancient Romans of Italy..... | 8 | 53-29 | 1511 | 41-13 | 1167 | 46-20 | 1310 | 41-69 | 1182 | 46-20 | 1310 | 92-4 |
| 11. Italians..... | 13 | 51-06 | 1448 | 41-34 | 1172 | 47-28 | 1340 | 41-70 | 1182 | 44-49 | 1261 | 93-3 |
| 12. Lapps..... | 5 | 52-20 | 1500 | 44-77 | 1270 | 46-70 | 1323 | 43-70 | 1239 | 45-22 | 1282 | 90-5 |
| 13. Swedes..... | 9 | 50-29 | 1433 | 46-20 | 1310 | 48-13 | 1365 | 43-34 | 1228 | 45-73 | 1296 | 94 |
| 14. Frisians..... | 3 | 52-20 | 1500 | 44-49 | 1261 | 47-63 | 1350 | 41-13 | 1168 | 47-63 | 1350 | 95-3 |
| 15. Dutch..... | 18 | 52-20 | 1500 | 38-91 | 1103 | 48-56 | 1376 | 40-14 | 1135 | 44-84 | 1271 | 92-8 |
| 16. Germans..... | 13 | 54-72 | 1551 | 46-20 | 1300 | 51-78 | 1470 | 40-14 | 1137 | 45-95 | 1303 | 98-5 |
| 17. Russiak..... | 1 | 51-71 | 1466 | 46-20 | 1300 | 46-20 | 1300 | 39-55 | 1121 | 51-71 | 1466 | 103-4 |
| 18. Poles..... | 2 | 46-20 | 1300 | 46-20 | 1300 | 46-20 | 1300 | 40-14 | 1137 | 46-20 | 1300 | 92-4 |
| 19. Czechs..... | 2 | 51-71 | 1466 | 40-77 | 1156 | 46-20 | 1300 | 40-14 | 1137 | 46-20 | 1300 | 92-4 |
| 20. Magyar..... | 1 | 44-13 | 1251 | 45-63 | 1293 | 47-35 | 1342 | 42-91 | 1217 | 44-13 | 1251 | 88-5 |
| 21. Slovak..... | 1 | 42-91 | 1217 | 45-63 | 1293 | 47-35 | 1342 | 42-91 | 1217 | 47-35 | 1342 | 94-7 |
| 22. Finns..... | 7 | 49-85 | 1413 | 43-77 | 1241 | 49-28 | 1397 | 42-91 | 1217 | 49-28 | 1397 | 98-5 |
| 23. Russians..... | 10 | 55-93 | 1581 | 43-77 | 1241 | 49-28 | 1397 | 46-63 | 1322 | 46-63 | 1322 | 93-3 |
| 24. Turks..... | 3 | 49-28 | 1397 | 44-99 | 1275 | 46-63 | 1322 | 45-07 | 1277 | 45-07 | 1277 | 90-1 |
| 25. Rumanys..... | 6 | 51-19 | 1451 | 43-77 | 1241 | 45-06 | 1277 | 42-34 | 1200 | 42-34 | 1200 | 85-1 |
| 26. Gipsies..... | 2 | 44-12 | 1251 | 41-99 | 1190 | 43-06 | 1221 | 42-34 | 1200 | 42-34 | 1200 | 85-1 |
| Numbers and averages..... | 299 | 51-63 | 1364 | 42-74 | 1212 | 47-29 | 1340 | 41-65 | 1180 | 44-82 | 1271 | 92-3 |

TABLE III.—AFRICAN RACES,—Continued.

| RACES. | BRAIN-WEIGHTS OF THE SKULLS OF MEN. | | | | BRAIN-WEIGHTS OF THE SKULLS OF WOMEN. | | | | Mean of Sexes Oz. av. Gram's | Mean of Series Oz. av. Gram's | Mean Intern'l Capacities. Cubic Inches. |
|---------------------------|-------------------------------------|----------------|----------------|----------------|---------------------------------------|----------------|----------------|----------------|---------------------------------|----------------------------------|---|
| | No. | Heaviest. | Lightest. | Average. | No. | Heaviest. | Lightest. | Average. | | | |
| | | Oz. av. Gram's | Oz. av. Gram's | Oz. av. Gram's | | Oz. av. Gram's | Oz. av. Gram's | Oz. av. Gram's | | | |
| 12. Yorubans..... | 1 | 43.20 1295 | 47.43 1344 | 49.57 1405 | 4 | 48.06 1363 | 39.55 1121 | 44.56 1263 | 44.56 1263 | 89.1 | |
| 13. Akassa..... | 2 | 51.26 1466 | 47.43 1344 | 49.57 1405 | 5 | 50.03 1423 | 40.14 1137 | 45.16 1280 | 43.20 1225 | 86.4 | |
| 14. Bakaes..... | 1 | 47.20 1338 | 47.43 1344 | 49.57 1405 | 5 | 44.42 1259 | 35.05 1053 | 36.83 1024 | 45.49 1289 | 91 | |
| 15. Osyekanis..... | 1 | 45.63 1293 | 47.43 1344 | 49.57 1405 | 1 | 33.47 949 | | | 41.07 1104 | 82.1 | |
| 16. M'Pongwe..... | 1 | 44.99 1274 | 47.43 1344 | 49.57 1405 | 3 | 44.99 1274 | 41.34 1172 | 42.98 1219 | 45.63 1293 | 91.2 | |
| 17. Asango..... | 2 | 39.55 1121 | 38.40 1088 | 38.97 1105 | 3 | 41.99 1192 | 38.90 1103 | 41.03 1164 | 34.47 949 | 66.9 | |
| 18. M'Fans..... | 1 | 51.26 1466 | 47.43 1344 | 49.57 1405 | 3 | 41.99 1192 | 38.90 1103 | 41.03 1164 | 44.99 1274 | 90 | |
| 19. M'Fans..... | 1 | 51.26 1466 | 47.43 1344 | 49.57 1405 | 3 | 41.99 1192 | 38.90 1103 | 41.03 1164 | 42.98 1219 | 85.9 | |
| 20. Congos..... | 7 | 51.74 1482 | 38.91 1108 | 48.06 1363 | 1 | 40.80 1156 | | | 38.97 1105 | 77.9 | |
| 21. Momgomja..... | 4 | 49.28 1396 | 43.64 1237 | 45.63 1293 | 3 | 39.97 1133 | 36.48 1034 | 38.70 1097 | 51.26 1466 | 103.4 | |
| 22. Hottentots..... | 1 | 39.55 1121 | 41.10 1165 | 44.72 1268 | 60 | 43.04 1220 | 38.80 1100 | 41.89 1187 | 41.03 1164 | 82 | |
| 23. Kafirs..... | 1 | 39.55 1121 | 41.10 1165 | 44.72 1268 | 3 | 39.97 1133 | 36.48 1034 | 38.70 1097 | 47.20 1338 | 94.4 | |
| 24. Zulus..... | 1 | 39.55 1121 | 41.10 1165 | 44.72 1268 | 3 | 39.97 1133 | 36.48 1034 | 38.70 1097 | 45.63 1293 | 91.2 | |
| 25. Bushmans..... | 1 | 39.55 1121 | 41.10 1165 | 44.72 1268 | 3 | 39.97 1133 | 36.48 1034 | 38.70 1097 | 45.63 1293 | 77.8 | |
| Numbers and averages..... | 53 | 46.43 1316 | 41.10 1165 | 44.72 1268 | 60 | 43.04 1220 | 38.80 1100 | 41.89 1187 | 42.79 1213 | 86 | |

TABLE IV.—AMERICAN RACES.

| RACES. | BRAIN-WEIGHTS OF THE SKULLS OF MEN. | | | | BRAIN-WEIGHTS OF THE SKULLS OF WOMEN. | | | | Mean of Sexes Oz. av. Gram's | Mean of Series Oz. av. Gram's | Mean Intern'l Capacities. Cubic Inches. |
|--------------------------------|-------------------------------------|----------------|----------------|----------------|---------------------------------------|----------------|----------------|----------------|---------------------------------|----------------------------------|---|
| | No. | Heaviest. | Lightest. | Average. | No. | Heaviest. | Lightest. | Average. | | | |
| | | Oz. av. Gram's | Oz. av. Gram's | Oz. av. Gram's | | Oz. av. Gram's | Oz. av. Gram's | Oz. av. Gram's | | | |
| 1. Esquimaux of Greenland..... | 5 | 56.57 1604 | 46.20 1310 | 48.27 1369 | 5 | 48.05 1363 | 36.48 1034 | 43.12 1221 | 45.69 1295 | 91.24 | |
| 2. Esquimaux, Eastern..... | 4 | 48.63 1378 | 42.00 1190 | 45.31 1284 | 1 | 46.20 1310 | | | 45.75 1297 | 90 | |
| 3. Esquimaux, Western..... | 4 | 46.20 1310 | 43.27 1226 | 44.49 1259 | 2 | 45.56 1206 | 40.48 1047 | 41.52 1176 | 43.00 1219 | 87.5 | |
| 4. Iroquois..... | 1 | 44.99 1275 | 43.27 1226 | 44.49 1259 | 1 | 43.77 1261 | | | 44.99 1275 | 86.4 | |
| 5. Mississaga..... | 1 | 44.99 1275 | 43.27 1226 | 44.49 1259 | 1 | 43.20 1225 | | | 43.20 1225 | 86.4 | |
| 6. Athabasca..... | 1 | 49.52 1404 | 40.77 1056 | 45.31 1284 | 1 | 45.99 1304 | | | 47.75 1355 | 95.5 | |
| 7. Shushwaps..... | 2 | 49.85 1413 | 40.77 1056 | 45.31 1284 | 1 | 41.63 1184 | | | 45.31 1284 | 90.6 | |
| 8. Chesnyans..... | 1 | 43.20 1225 | 40.77 1056 | 45.31 1284 | 1 | 46.20 1300 | 37.70 1069 | 41.95 1189 | 43.20 1225 | 86.4 | |
| 9. Selipsh..... | 1 | 50.49 1431 | 40.77 1056 | 45.31 1284 | 2 | 46.20 1300 | 37.70 1069 | 41.95 1189 | 44.79 1270 | 89.6 | |
| 10. Quatsimas..... | 1 | 43.76 1240 | 46.20 1310 | 46.70 1323 | 2 | 46.20 1300 | 37.70 1069 | 41.95 1189 | 43.76 1240 | 87.5 | |
| 11. Songass..... | 2 | 47.20 1338 | 46.20 1310 | 46.70 1323 | 1 | 46.85 1328 | | | 46.70 1323 | 93.4 | |
| 12. Bilhoolas..... | 1 | 46.85 1328 | 46.20 1310 | 46.70 1323 | 1 | 47.78 1355 | | | 46.85 1328 | 93.8 | |
| 13. Lenni Lenape..... | 1 | 46.85 1328 | 46.20 1310 | 46.70 1323 | 1 | 47.78 1355 | | | 47.78 1355 | 95.5 | |
| 14. Illinois..... | 1 | 47.78 1355 | 46.20 1310 | 46.70 1323 | 1 | 47.78 1355 | | | 47.78 1355 | 95.5 | |

TABLE IV.—AMERICAN RACES,—Continued.

| RACES. | BRAIN-WEIGHTS OF THE SKULLS OF MEN. | | | | BRAIN-WEIGHTS OF THE SKULLS OF WOMEN. | | | | Mean Intern'l Capacities. Cubic Inches. | | | |
|----------------------------|-------------------------------------|-----------------------------|-----------------------------|----------------------------|---------------------------------------|-----------------------------|-----------------------------|----------------------------|--|---------------------------------|----------------------------------|------|
| | No. | Heaviest. Oz. av. Gram's | Lightest. Oz. av. Gram's | Average. Oz. av. Gram's | No. | Heaviest. Oz. av. Gram's | Lightest. Oz. av. Gram's | Average. Oz. av. Gram's | | Mean of Sexes Oz. av. Gram's | | |
| | | | | | | | | | | | Mean of Series Oz. av. Gram's | |
| 15. Comanche..... | 1 | 42.56 | 1206 | | | | | | 42.56 | 1266 | 85.1 | |
| 16. Caribs..... | 2 | 43.92 | 1245 | 41.34 | 1172 | 42.63 | 1208 | 40.73 | 1155 | 41.48 | 1176 | 82.9 |
| 17. Muizcas..... | 8 | 50.49 | 1431 | 38.91 | 1103 | 43.99 | 1247 | 40.13 | 1137 | 42.99 | 1219 | 88 |
| 18. Yunca..... | 3 | 44.12 | 1251 | 42.56 | 1206 | 43.27 | 1226 | 40.13 | 1137 | 43.76 | 1240 | 87.5 |
| 19. Quichuas..... | 2 | 40.77 | 1156 | | | | | 33.70 | 979 | 41.25 | 1170 | 83.4 |
| 20. Chanca..... | 1 | 41.99 | 1190 | | | | | 40.03 | 1114 | 41.99 | 1190 | 84 |
| 21. Aymaras..... | 5 | 49.85 | 1413 | 43.20 | 1225 | 46.28 | 1312 | | | 46.28 | 1312 | 92.5 |
| 22. Colla..... | 2 | 43.77 | 1241 | 42.56 | 1206 | 43.20 | 1225 | 37.12 | 1052 | 37.12 | 1052 | 74.2 |
| 23. Charcas..... | 5 | 57.79 | 1638 | 41.99 | 1190 | 48.35 | 1371 | 40.77 | 1156 | 41.99 | 1190 | 84.7 |
| 24. Araucanians..... | 1 | 40.63 | 1152 | | | | | 40.77 | 1156 | 44.56 | 1263 | 94.1 |
| 25. Paraguay Indian..... | 1 | 50.49 | 1431 | | | | | | | 40.63 | 1152 | 81.2 |
| 26. Gran Chaco Indian..... | 1 | 40.77 | 1156 | | | | | | | 50.49 | 1431 | 101 |
| 27. Arawack..... | 1 | 40.77 | 1156 | | | | | | | 40.77 | 1156 | 81.5 |
| 28. Caribi..... | 1 | 36.48 | 1034 | | | | | | | 36.48 | 1034 | 72.9 |
| 29. Tarumas..... | 2 | 42.00 | 1190 | | | | | 35.90 | 1018 | 38.92 | 1103 | 77.8 |
| 30. Macusi..... | 1 | 46.85 | 1328 | | | | | | | 46.85 | 1328 | 93.8 |
| 31. Wapisiána..... | 1 | 40.48 | 1147 | | | | | | | 40.48 | 1147 | 80.9 |
| 32. Orinoco Indian..... | 1 | 46.85 | 1328 | | | | | | | 46.85 | 1328 | 93.8 |
| Numbers and averages..... | 52 | 47.20 | 1338 | 42.63 | 1209 | 45.25 | 1282 | 38.35 | 1087 | 44.03 | 1248 | 87.5 |

TABLE V.—AUSTRALIAN RACES.

| RACES. | BRAIN-WEIGHTS OF THE SKULLS OF MEN. | | | | BRAIN-WEIGHTS OF THE SKULLS OF WOMEN. | | | | Mean Intern'l Capacities. Cubic Inches. | | | | | |
|---------------------------|-------------------------------------|-----------------------------|-----------------------------|----------------------------|---------------------------------------|-----------------------------|-----------------------------|----------------------------|--|---------------------------------|----------------------------------|-------|------|------|
| | No. | Heaviest. Oz. av. Gram's | Lightest. Oz. av. Gram's | Average. Oz. av. Gram's | No. | Heaviest. Oz. av. Gram's | Lightest. Oz. av. Gram's | Average. Oz. av. Gram's | | Mean of Sexes Oz. av. Gram's | | | | |
| | | | | | | | | | | | Mean of Series Oz. av. Gram's | | | |
| 1. Australians..... | 17 | 52.29 | 1482 | 35.98 | 1020 | 41.41 | 1174 | 33.47 | 949 | 40.12 | 1037 | 40.56 | 1150 | 81.1 |
| 2. Tasmanians..... | 7 | 47.42 | 1344 | 36.48 | 1034 | 42.56 | 1206 | 34.69 | 983 | 40.30 | 1142 | 41.41 | 1174 | 82.8 |
| Numbers and averages..... | 24 | 49.85 | 1413 | 36.19 | 1027 | 41.98 | 1190 | 34.08 | 966 | 40.20 | 1139 | 40.98 | 1162 | 81.9 |

TABLE VI.—OCEANIC RACES.

| RACES. | BRAIN-WEIGHTS OF THE SKULLS OF MEN. | | | | BRAIN-WEIGHTS OF THE SKULLS OF WOMEN. | | | | Mean Intern'l Capacities. Cubic Inches. | | | |
|------------------------------|-------------------------------------|-----------|-----------|----------|---------------------------------------|-----------|-----------|----------|---|--------|------|-------|
| | No. | Heaviest. | Lightest. | Average. | No. | Heaviest. | Lightest. | Average. | | | | |
| | | Oz. av. | Gram's | Oz. av. | Gram's | Oz. av. | Gram's | Oz. av. | | Gram's | | |
| 1. Nicobarian..... | 1 | 39.55 | 1121 | 37.47 | 1062 | 40.51 | 1148 | 43.77 | 1241 | 39.55 | 1121 | 79.1 |
| 2. Nians | 2 | 43.56 | 1234 | 40.87 | 1156 | 44.90 | 1275 | 42.61 | 1208 | 42.14 | 1194 | 85.2 |
| 3. Sumatrans..... | 7 | 50.49 | 1431 | 44.42 | 1287 | 49.13 | 1393 | 37.70 | 1069 | 44.90 | 1275 | 89.8 |
| 4. Malays..... | 6 | 52.98 | 1500 | 52.29 | 1482 | 52.30 | 1482 | 37.70 | 1069 | 46.13 | 1225 | 92.3 |
| 5. Bankans..... | 2 | 52.31 | 1483 | 40.13 | 1137 | 46.67 | 1312 | 44.99 | 1275 | 43.45 | 1231 | 104.6 |
| 6. Javans..... | 30 | 53.50 | 1517 | 40.13 | 1137 | 46.67 | 1312 | 44.99 | 1275 | 43.45 | 1231 | 87.5 |
| 7. Madurans..... | 10 | 55.36 | 1569 | 40.13 | 1137 | 46.67 | 1312 | 44.99 | 1275 | 43.45 | 1231 | 99.5 |
| 8. Balinese..... | 3 | 49.85 | 1413 | 40.13 | 1137 | 43.56 | 1234 | 41.34 | 1172 | 43.56 | 1234 | 87.1 |
| 9. Bimanese..... | 1 | 48.63 | 1378 | 45.09 | 1274 | 47.42 | 1344 | 36.83 | 1044 | 48.63 | 1378 | 97.3 |
| 10. Timorese..... | 1 | 46.20 | 1310 | 46.88 | 1328 | 49.28 | 1397 | 43.77 | 1241 | 43.77 | 1241 | 87.5 |
| 11. Amboynese..... | 4 | 52.29 | 1482 | 44.13 | 1251 | 45.13 | 1279 | 42.13 | 1194 | 42.13 | 1194 | 90.5 |
| 12. Tidorese..... | 2 | 51.71 | 1466 | 40.77 | 1156 | 45.06 | 1277 | 49.28 | 1397 | 49.28 | 1397 | 98.5 |
| 13. Alifurans..... | 2 | 46.20 | 1310 | 40.77 | 1156 | 45.06 | 1277 | 43.20 | 1225 | 44.16 | 1252 | 89 |
| 14. Celebeans..... | 8 | 50.49 | 1431 | 40.77 | 1156 | 45.06 | 1277 | 45.46 | 1288 | 45.25 | 1282 | 91.2 |
| 15. Dayaks..... | 12 | 49.28 | 1397 | 42.56 | 1206 | 43.91 | 1245 | 40.98 | 1162 | 42.44 | 1203 | 86.4 |
| 16. Bisayans..... | 5 | 47.42 | 1344 | 42.56 | 1206 | 43.84 | 1243 | 41.34 | 1172 | 43.09 | 1222 | 86.4 |
| 17. Negritos..... | 2 | 42.34 | 1200 | 37.12 | 1052 | 39.72 | 1127 | 41.34 | 1172 | 39.72 | 1127 | 79.4 |
| 18. Oitean | 1 | 41.29 | 1171 | 44.02 | 1259 | 45.85 | 1300 | 41.29 | 1171 | 41.29 | 1171 | 82.6 |
| 19. Papuans..... | 3 | 48.64 | 1382 | 40.48 | 1147 | 43.21 | 1226 | 43.20 | 1225 | 44.85 | 1272 | 89.7 |
| 20. Saloman Islanders..... | 3 | 44.30 | 1156 | 44.42 | 1259 | 46.20 | 1310 | 39.55 | 1129 | 43.23 | 1225 | 86.5 |
| 21. New Caledonians..... | 4 | 48.63 | 1378 | 44.42 | 1259 | 46.20 | 1310 | 49.85 | 1413 | 42.87 | 1216 | 90.1 |
| 22. Loyally Islanders..... | 1 | 44.77 | 1270 | 40.13 | 1137 | 43.77 | 1241 | 42.56 | 1206 | 45.49 | 1289 | 91.4 |
| 23. New Hebrideans..... | 9 | 48.06 | 1363 | 40.13 | 1137 | 43.77 | 1241 | 41.99 | 1190 | 43.49 | 1232 | 86.1 |
| 24. Pejecans..... | 5 | 47.43 | 1344 | 41.34 | 1172 | 44.29 | 1256 | 41.99 | 1190 | 41.23 | 1169 | 82.4 |
| 25. Maoris..... | 1 | 46.20 | 1310 | 41.34 | 1172 | 44.29 | 1256 | 44.29 | 1256 | 44.29 | 1256 | 88.6 |
| 26. Emcoan..... | 1 | 44.99 | 1275 | 45.63 | 1283 | 45.63 | 1283 | 46.20 | 1310 | 46.20 | 1310 | 92.4 |
| 27. Bolabolan..... | 1 | 45.63 | 1283 | 53.50 | 1517 | 45.63 | 1283 | 44.99 | 1275 | 44.99 | 1275 | 90 |
| 28. Gambier Islander..... | 1 | 45.63 | 1283 | 37.12 | 1052 | 40.94 | 1330 | 45.63 | 1283 | 45.63 | 1283 | 91.3 |
| 29. Marquesan Islanders..... | 16 | 53.50 | 1517 | 48.06 | 1363 | 48.06 | 1363 | 51.71 | 1466 | 44.59 | 1264 | 91.3 |
| 30. Kanakas..... | 67 | 54.50 | 1545 | 48.27 | 1369 | 42.05 | 1192 | 43.72 | 1239 | 44.92 | 1277 | 90.1 |
| Numbers and averages..... | 210 | 48.27 | 1369 | 42.05 | 1192 | 45.61 | 1293 | 43.72 | 1239 | 43.63 | 1247 | 89.4 |

SUMMARY OF THE PRECEDING SIX TABLES.

| RACES. | BRAIN-WEIGHTS OF THE SKULLS OF MEN. | | | | BRAIN-WEIGHTS OF THE SKULLS OF WOMEN. | | | | Mean Intern'l Capacities. Cubic Inches. | | | |
|---------------------------|-------------------------------------|-----------|-----------|----------|---------------------------------------|-----------|-----------|----------|---|--------|------|------|
| | No. | Heaviest. | Lightest. | Average. | No. | Heaviest. | Lightest. | Average. | | | | |
| | | Oz. av. | Gram's | Oz. av. | Gram's | Oz. av. | Gram's | Oz. av. | | Gram's | | |
| I. European Races..... | 299 | 51.63 | 1364 | 42.74 | 1212 | 47.29 | 1340 | 41.65 | 1180 | 44.82 | 1271 | 92.3 |
| II. Asiatic Races..... | 124 | 49.27 | 1397 | 40.75 | 1155 | 45.08 | 1278 | 41.29 | 1171 | 43.07 | 1221 | 87.1 |
| III. African Races..... | 53 | 46.43 | 1316 | 41.10 | 1165 | 44.72 | 1268 | 41.89 | 1187 | 42.79 | 1213 | 86 |
| IV. American Races..... | 52 | 47.20 | 1338 | 42.63 | 1209 | 45.25 | 1282 | 41.06 | 1164 | 44.03 | 1248 | 87.5 |
| V. Australian Races..... | 24 | 49.85 | 1414 | 36.19 | 1027 | 41.98 | 1190 | 38.44 | 1089 | 40.20 | 1139 | 81.9 |
| VI. Oceanic Races..... | 210 | 48.27 | 1369 | 42.05 | 1192 | 45.61 | 1293 | 42.14 | 1185 | 43.63 | 1247 | 89.4 |
| Numbers and averages..... | 762 | 48.87 | 1382 | 40.91 | 1160 | 44.99 | 1275 | 41.08 | 1165 | 43.09 | 1222 | 87.3 |



ART. IX.—*On Brevoortia.*

Description of Plate 55, designed to illustrate Prof. A. Wood's Monograph of the Liliacæ of our Pacific States, published in the Proceedings of the Philadelphia Academy of Natural Sciences, June, 1868; and also his Memoir of the new genus *Brevoortia*, in Proceedings, June, 1867.

A. Portrait of *Brevoortia Ida-Maia*,* two-thirds of the natural size. *ov.* The ovary, with style and stigma. *b.* The perianth split and laid open, showing the three sessile, cordate-lanceolate anthers, and the three broad, short, rectangular lobes or leaves of the yellow, membranous corona, alternating with the anthers. The dotted lines represent the segments of the perianth as if *erect*.

C, D, E. The Flowers of the genus *Dichelostemma*, Kunth, introduced for comparison. *C.* *Dichelostemma congesta*, Kth., a single flower (blue), life size. *c.* Perianth laid open, showing the three anthers split at each end, and the peculiarly winged filaments.

* BREVOORTIA, nov. gen.

Perianthium corallæcum (coccineum), tubuliforme, supernè ventricosum fauce remissè contractâ, regulare, persistens; limbo 6-partito, laciniis ovatis, obtusis, arcuè revolutis sexies tubo brevioribus. Corona (flava) brevis, erecta, tribus squamis truncatis integris, bis latioribus quam longis, constituta. Stamina 3, squamas excedentia. Filamenta per totam longitudinem tubo adnata, interioribus laciniis opposita, ac cum squamis alternantia. Antheræ liberæ oblongo-lineares, extrorsæ, apice obtusæ, basi profundè bifidæ ibique insertæ. Ovarium liberum, ovatum, triloculare. Ovula in loculis 3—5, uniseriata. Stylus continuus, erectus, longitudine perianthii. Stigma capitatum, trilobatum. Capsula?

Herba glabra, scapigera (bulbosa?). Folia 5—7, linearia, canaliculata, obtusa. Scapus teres, erectus, rigidus, 2—4 pedalis, longitudine foliorum. Flores 8—12, in apice scapi umbellati, unciales, nutantes, spathâ 4-valvi suffulti; pedicellis 1—2 pollicaribus diffusis; bracteis ovato-lanceolatis, purpureis.

B. *IDA-MAIA*. Grows in deep rich soil on high hills of the Trinity Mt. Range, Shasta county, California, near the stage-road from Shasta City to Yreka. I saw it here in full bloom about the first of June, 1866, occupying a space of several acres. The leaves are very long and narrow, and recurved. The scape, although slender, is rigidly erect, of three, or even four feet high, round, smooth, wavy, and bearing at the top an umbel of about twelve scarlet or bright red flowers, nodding on their slender, recurved, unequal foot-stalks. The form of the perianth is between cylindric and pyriform, about one inch in length, with the limb very short, of six valvate lobes. Before opening, these lobes are chrome-green in color, making a peculiar contrast. After opening, they are yellow. The three leaves (scales) constituting the corona are yellow, one line in length by two or three lines in breadth, occupying the place of, but in no wise resembling, abortive stamens. Unfortunately I found no specimen in fruit; neither did I secure a bulb, so deeply buried were they, and so impatient of delay were my fellow passengers. The whole plant possesses singular grace and beauty, and few are better worthy of a place in the flower garden.

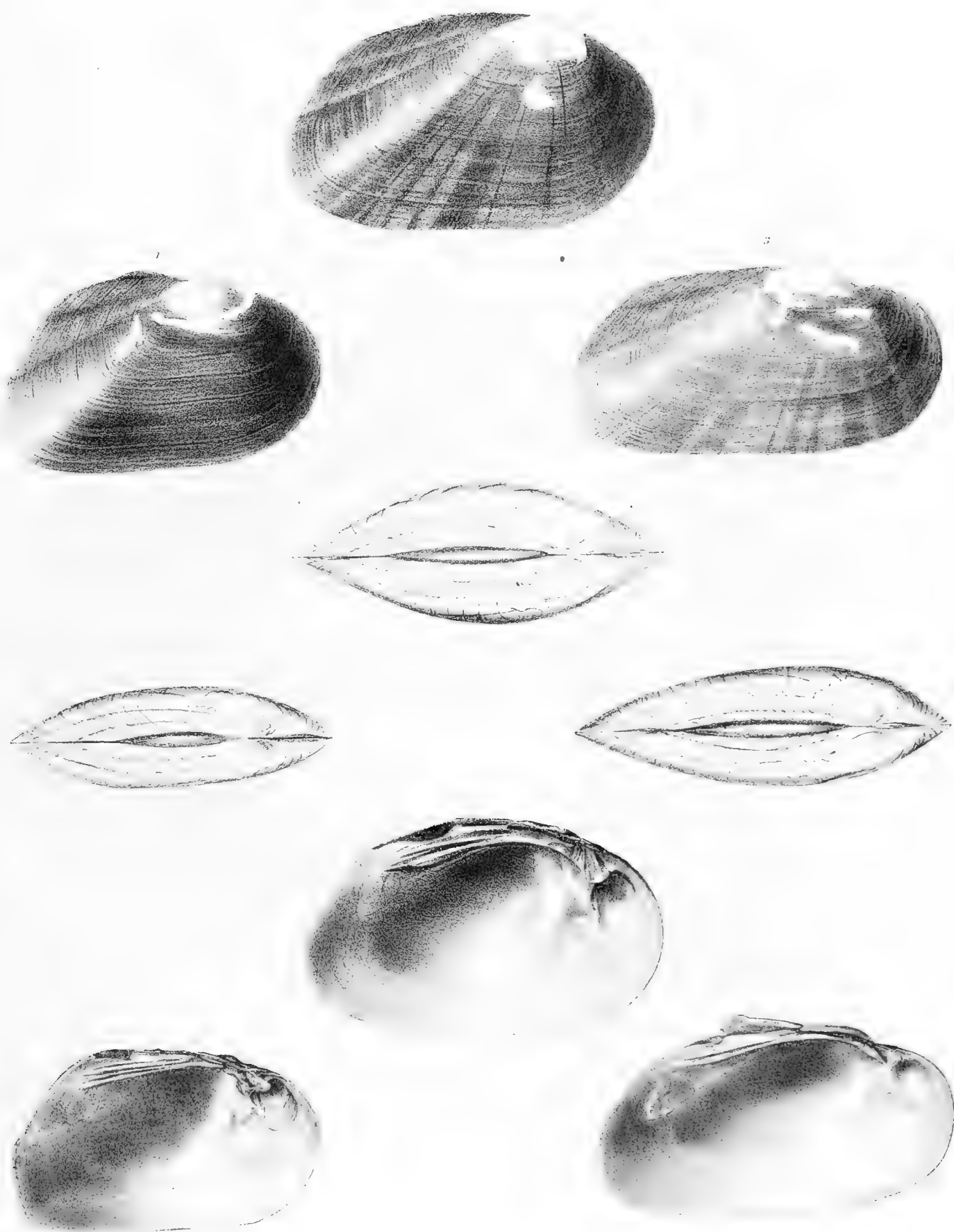
D. *Dichelostemma capitata*, Bentham, a flower (blue-purple), life size (four of its segments), showing the six unequal anthers with the winged filaments of the three larger.

E. *Dichelostemma Californica* (*Stropholirion*), Torrey, a flower (rose-purple), life size. *e.* The perianth displayed, showing the six anthers with their winged filaments.

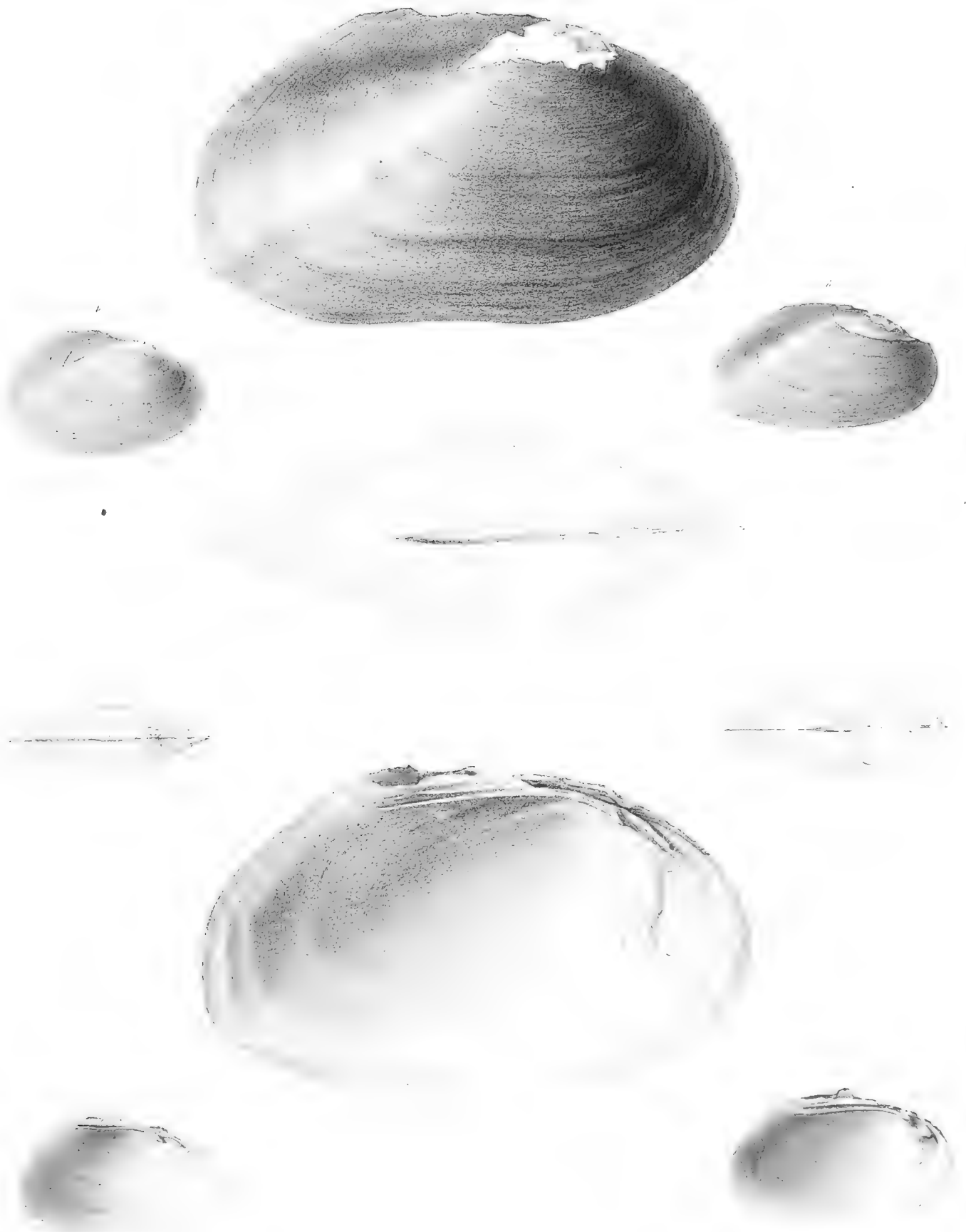
F. Flower of *Brodicea grandiflora*, Sm., introduced also for comparison; flower (blue) life size. *f.* The interior of the perianth displayed, showing the three perfect stamens, and the three abortive anthers similar in form.

The claims of *Brevoortia* to the rank of a genus will be inferred from these illustrations. If we transfer it to *Brodicea* (as Prof. A. Gray proposes in Proceedings Am. Acad. Sci., July, 1868), we must at the same time abandon all those generic characters which have been heretofore recognized as valid in the *Liliaceae*. It will then be impossible to maintain either *Dichelostemma*, or *Calliproa*, or *Subertia*—genera far more closely allied to *Brodicea* than is *Brevoortia*; all must be absorbed in *Brodicea*! Moreover, if this principle be adopted in the reformation of the genera, *Lilium* must absorb *Tritillaria*, *Erithronium* and even *Tulipa*. Indeed, scarcely any genus would be safe from the avarice of its senior neighbors. Let us be impartial and consistent.

* * * *Correction*.—In the Monograph above alluded to, page 2, line 23, the reader is requested to insert *Kellogg* in place of “n. sp.,” after *L. (Lilium) Washingtonianum*. This species had been already published by Dr. Kellogg, under this same name, in the Proceedings Cal. Acad. Sci.

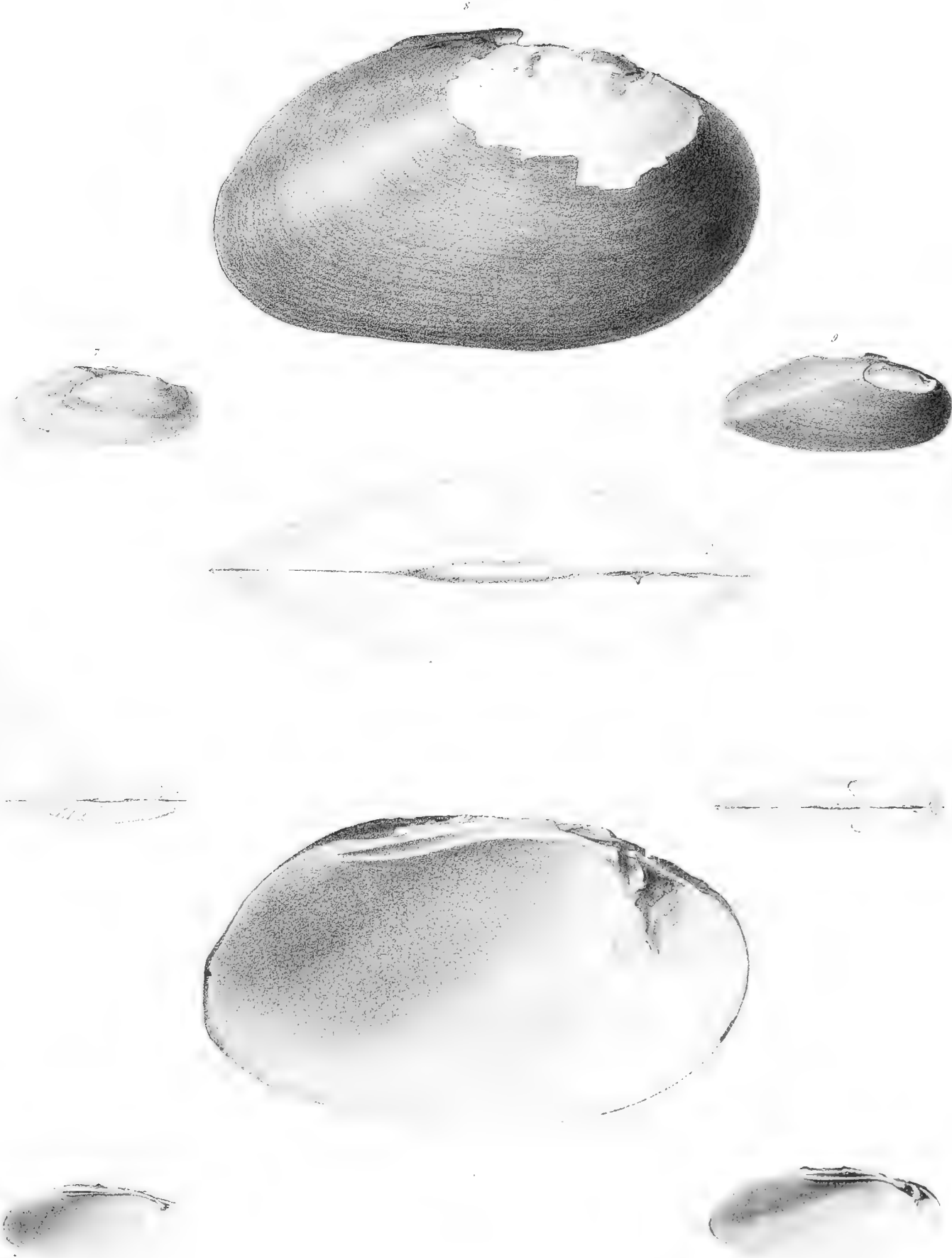


1 *Uros quadrilaterus*
2 *Uros Raleighensis*
3 *Uros aberrans*



1. *Unio pertenuis*
2. *Unio Charlottensis*
3. *Unio lucidus*

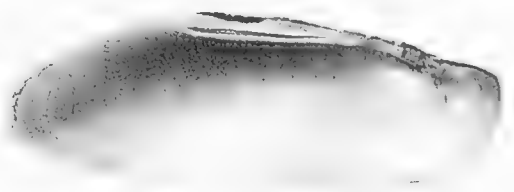
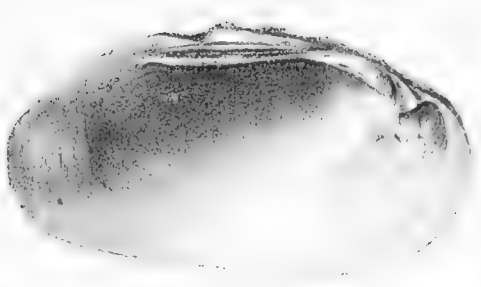
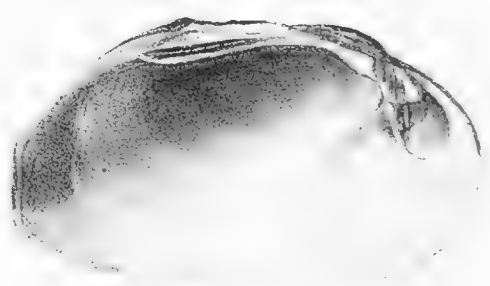
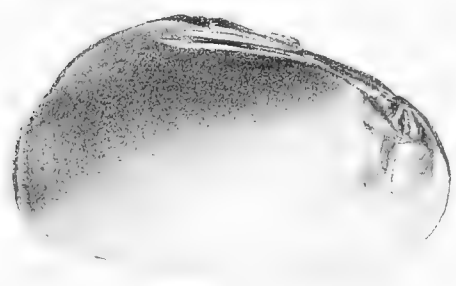
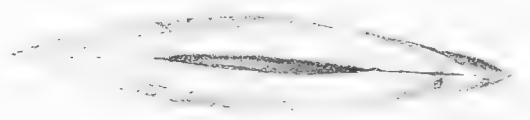
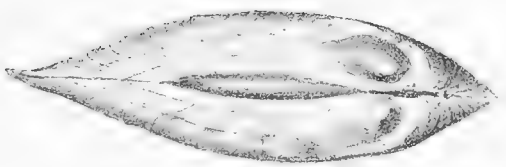
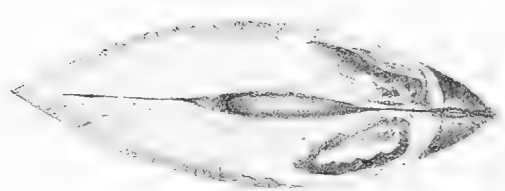
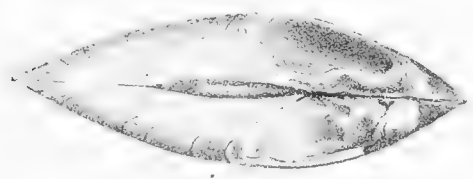
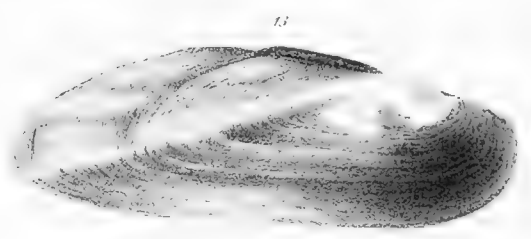
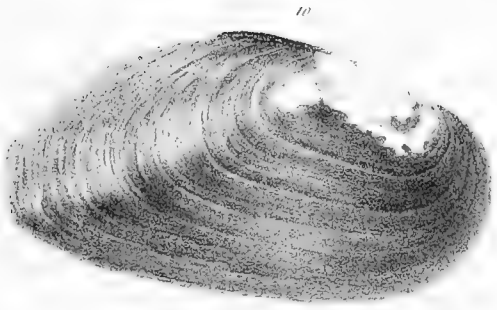
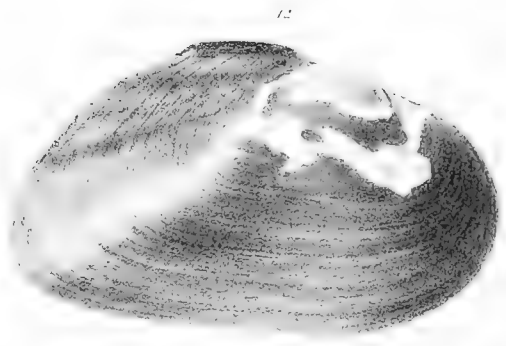
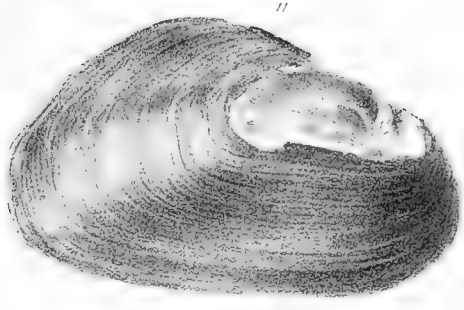
T. Sinclair's lith. Fair*



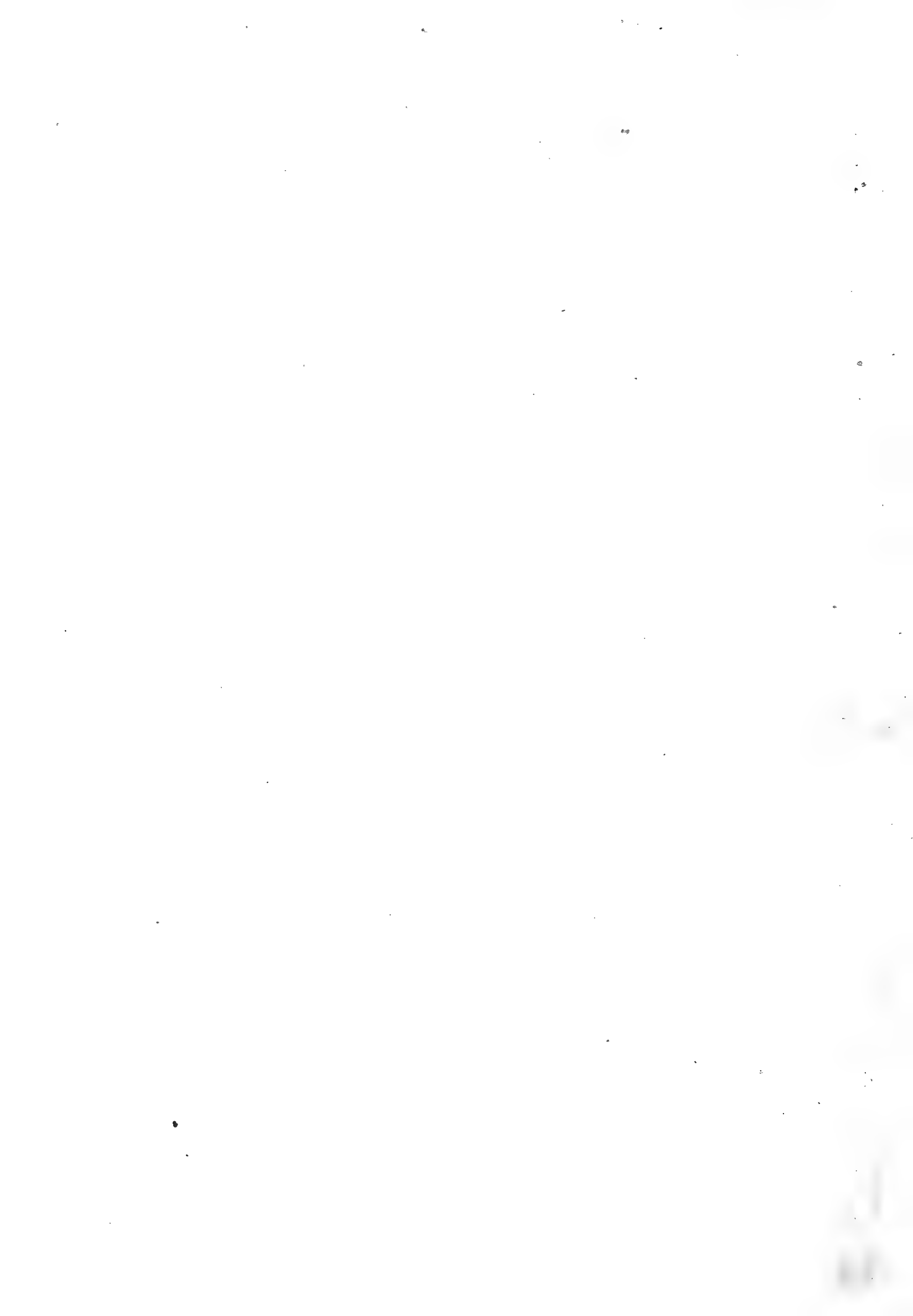
8 *Uro Willouensis*
 9 *Uro nasutulus*

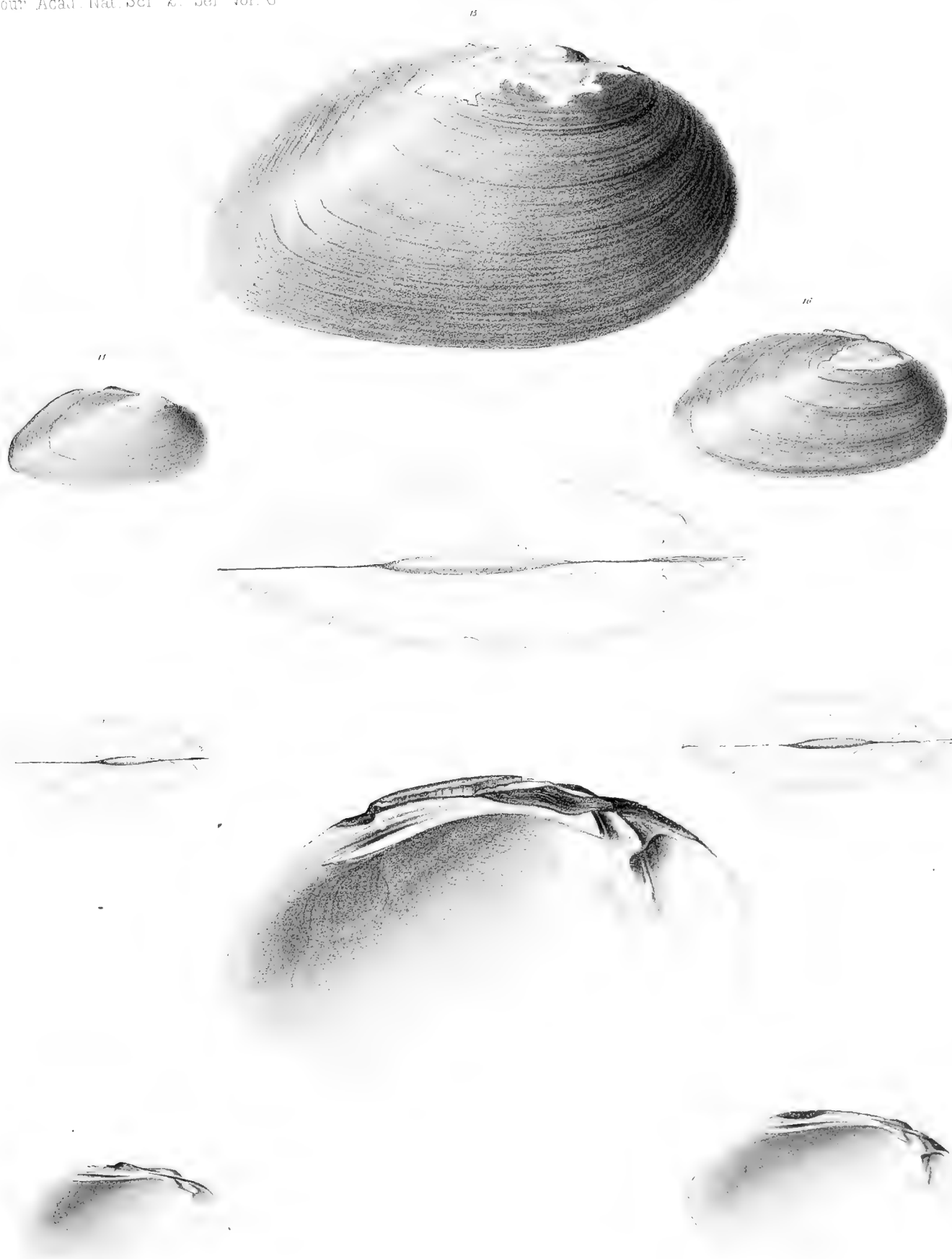
T Sinclair's lith. Phil^a



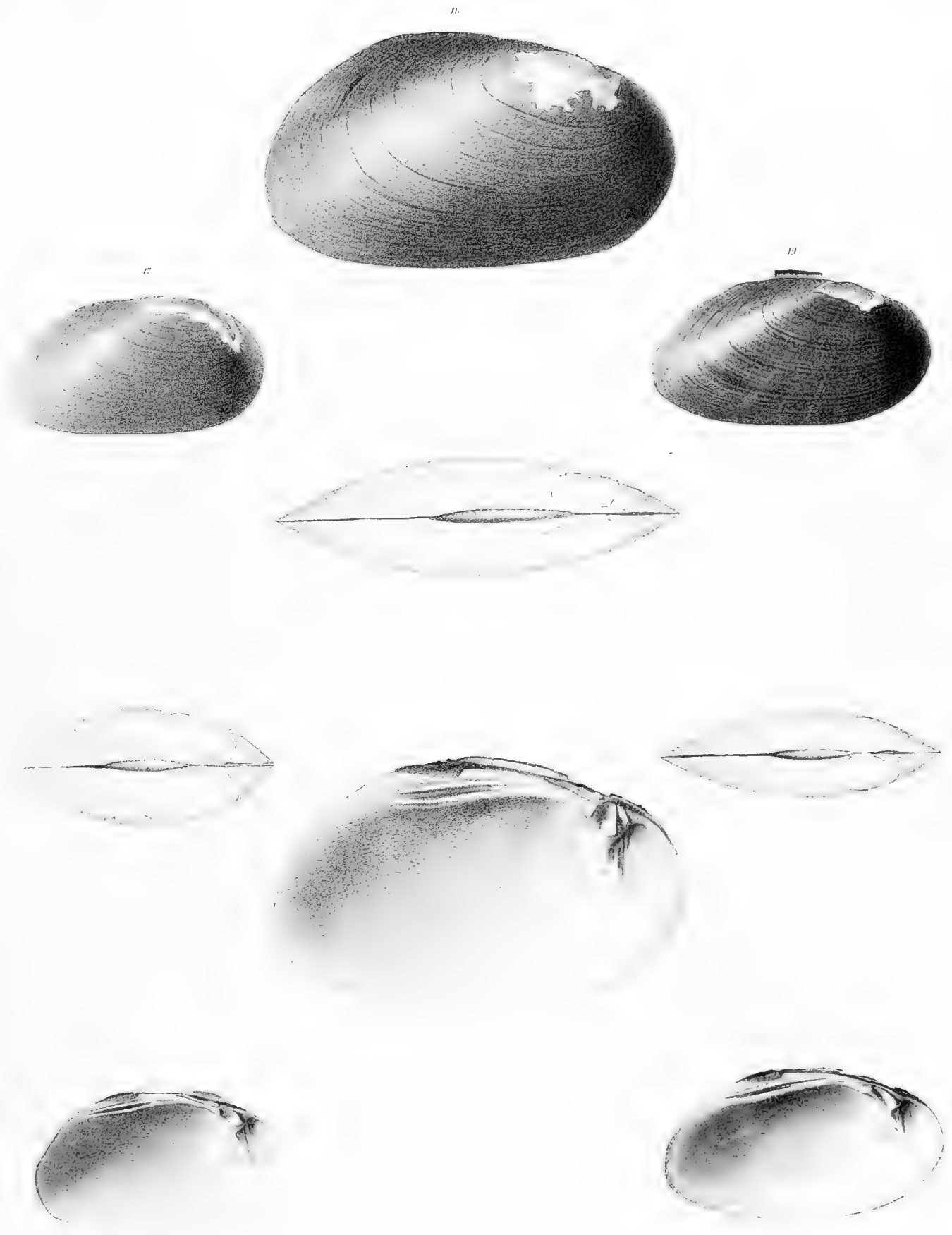


- 10. *Uta oblatas*
- 11. *Uta luvigstonensis*
- 12. *Uta indohinus*
- 13. *Uta perlatus*



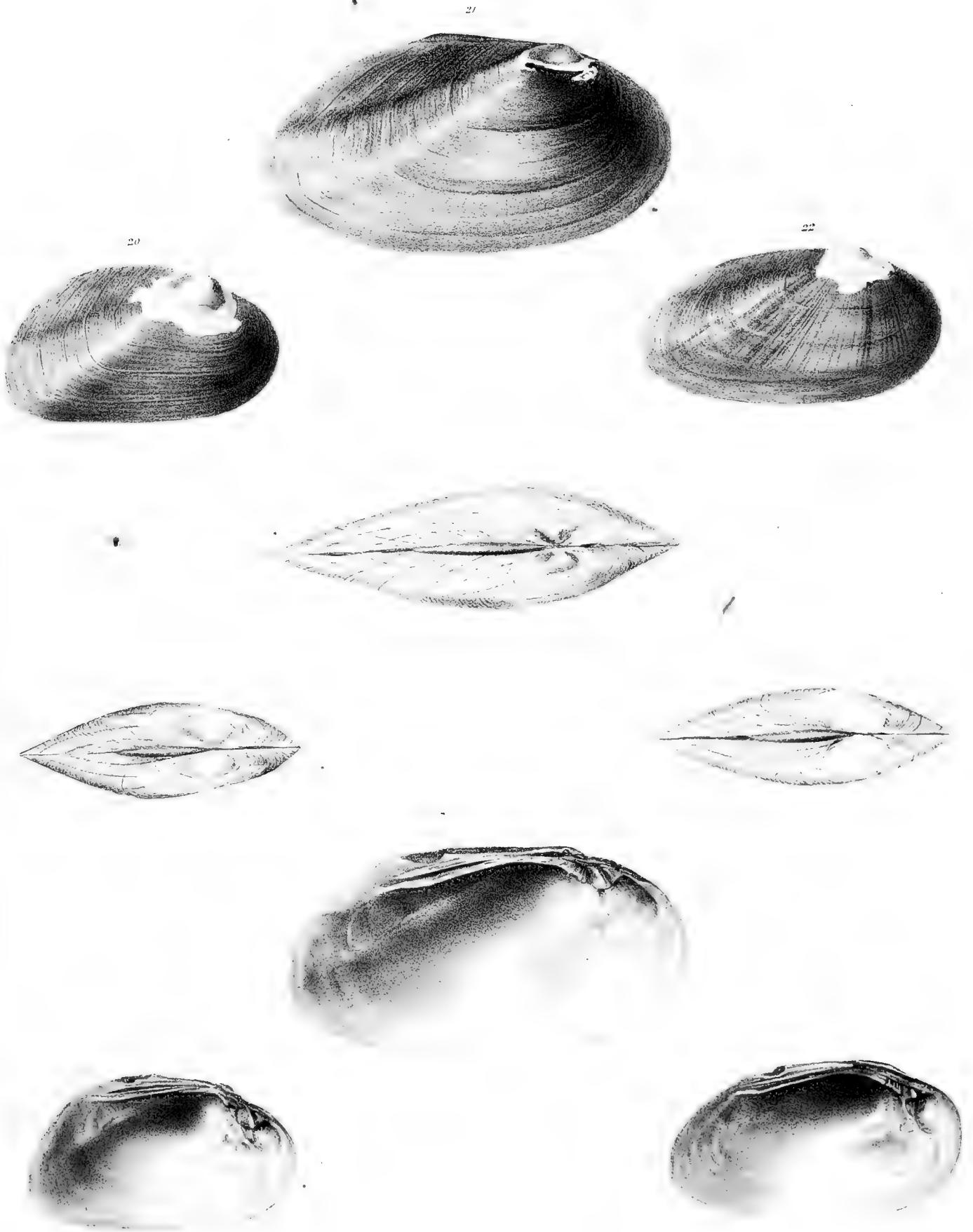


11. *Ure Waccinaensis*
15. *Ure Medtlibergensis*
16. *Ure perlucens*

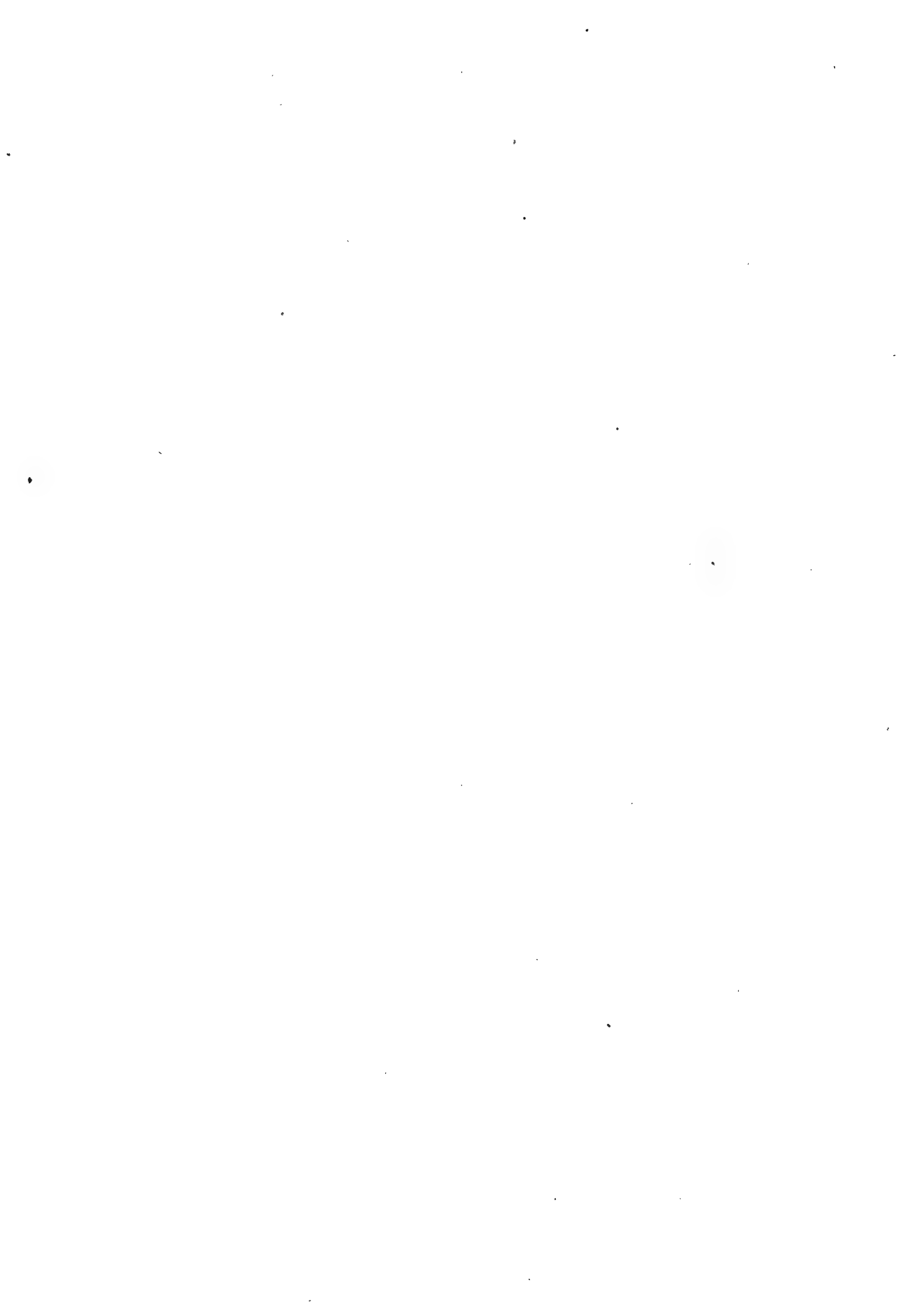


17 *Uvicostrea Verreauxi*
 18 *Uvicostrea Gastromensis*
 19 *Uvicostrea Chathamensis*

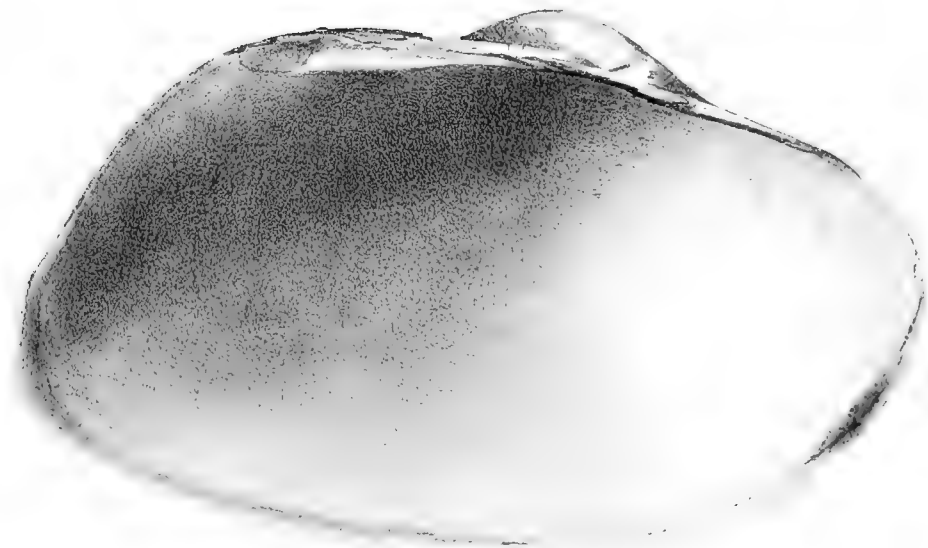
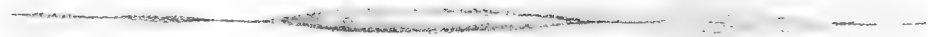
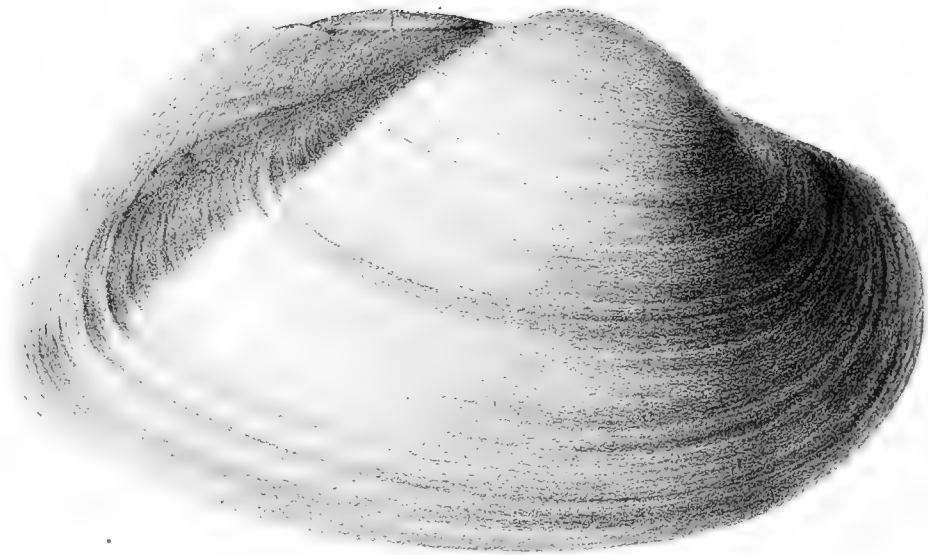


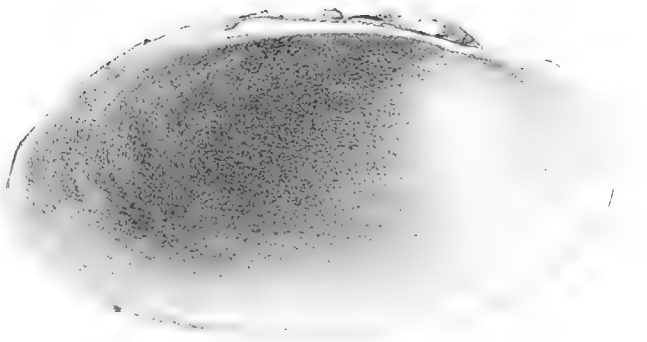
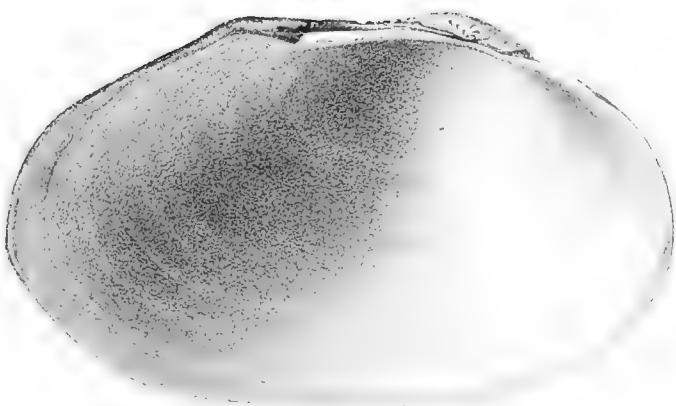
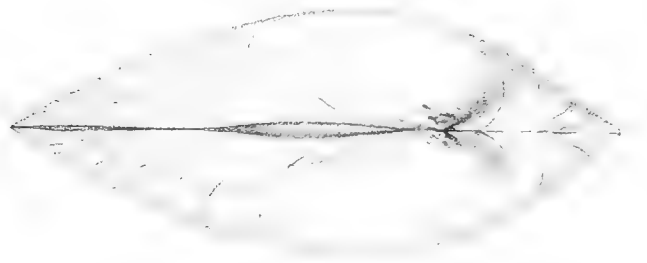
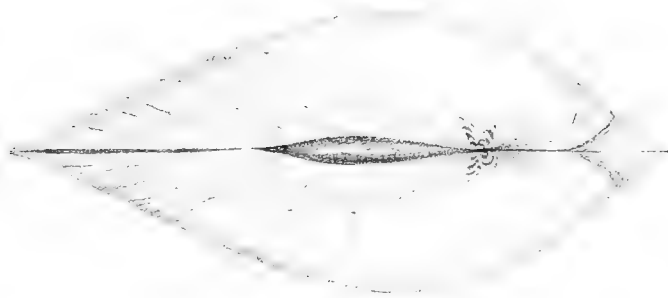
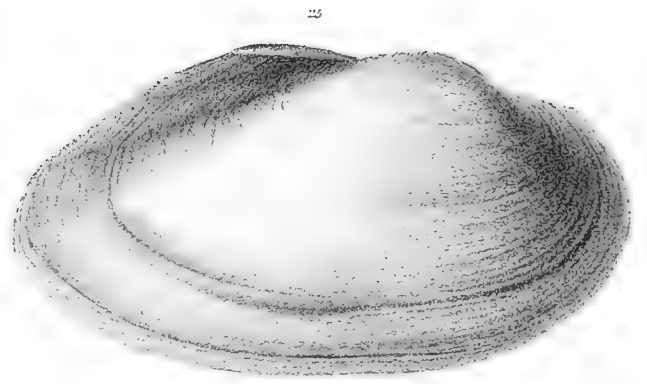
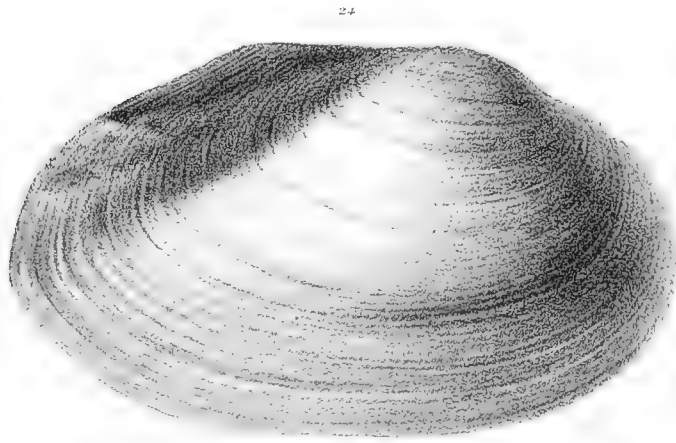


20 *Unio squalidus*
21 *Unio curatus*
22 *Unio medioeris*

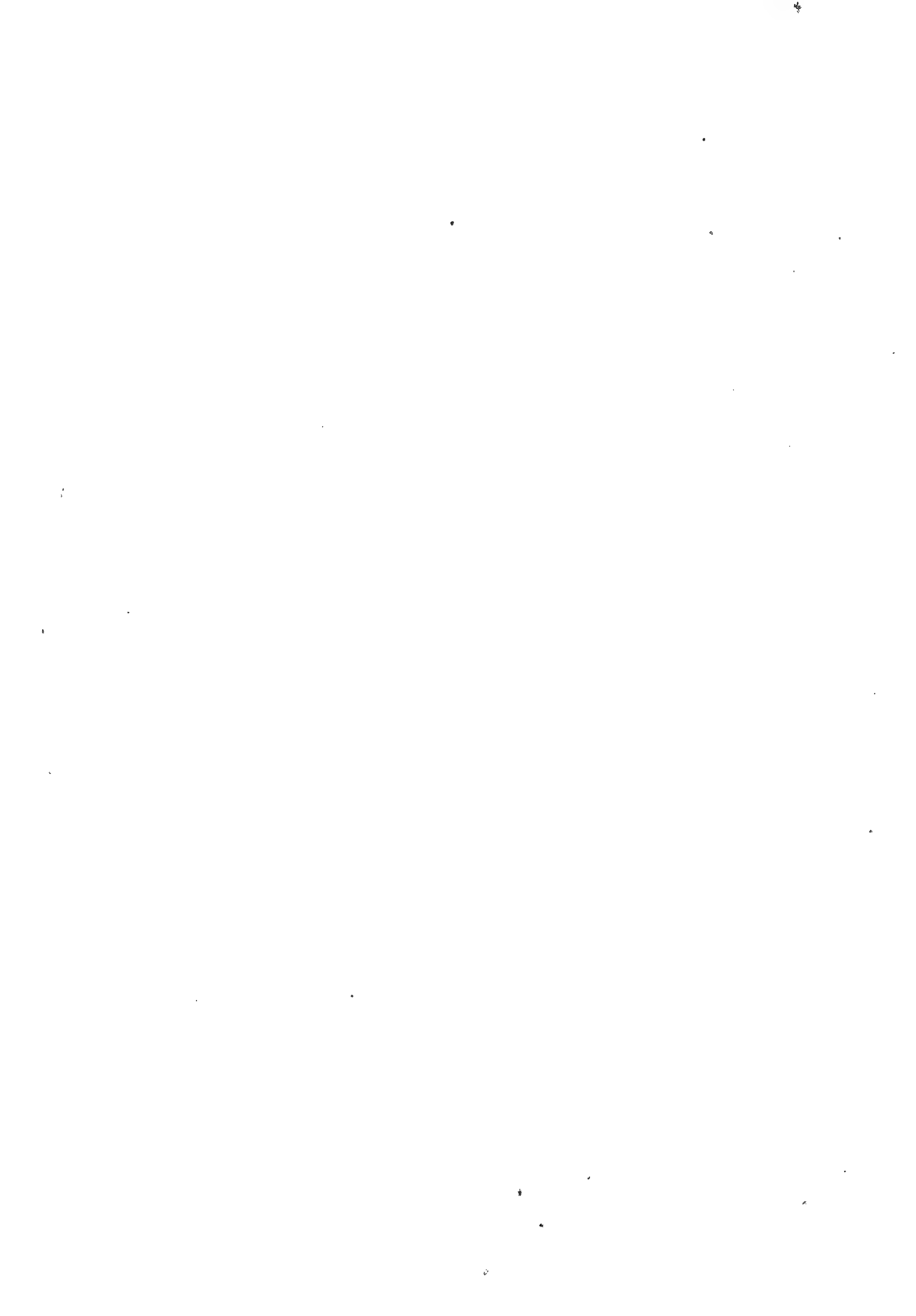


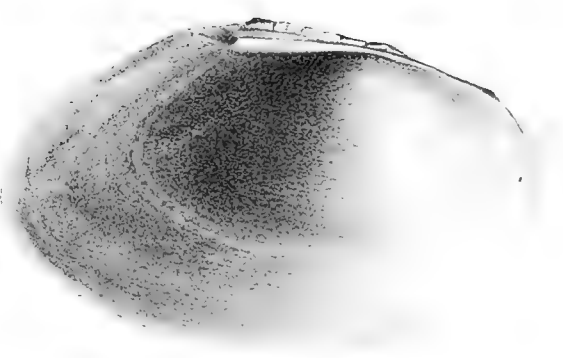
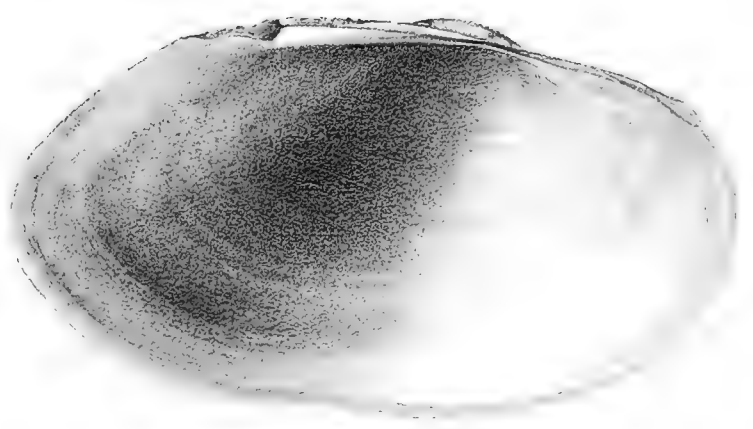
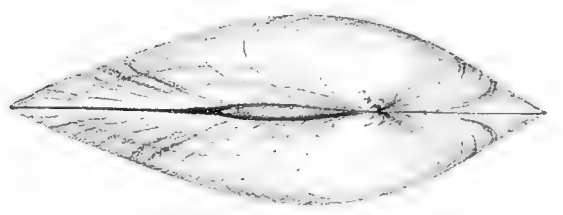
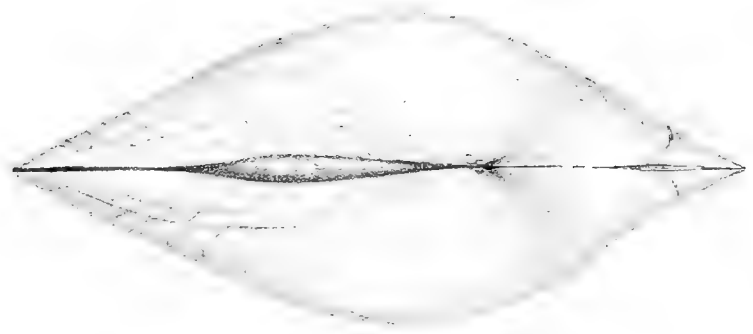
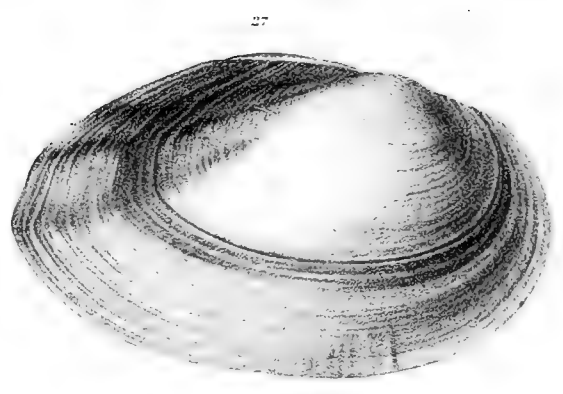
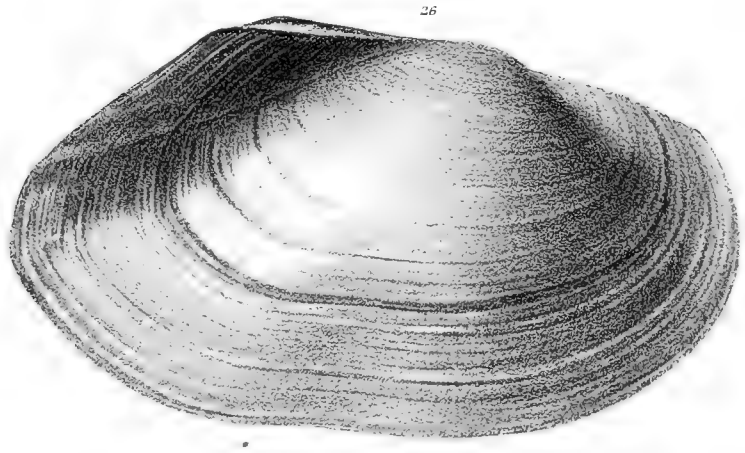
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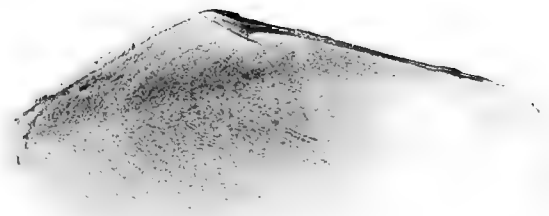
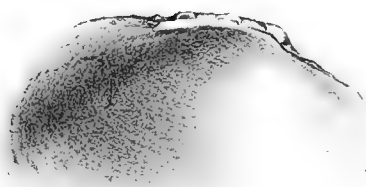
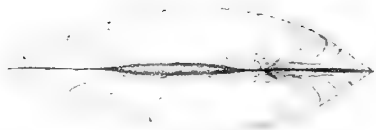
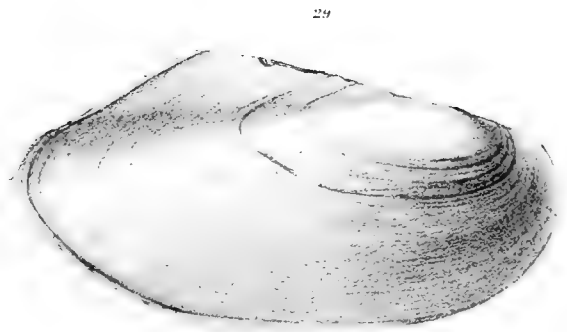
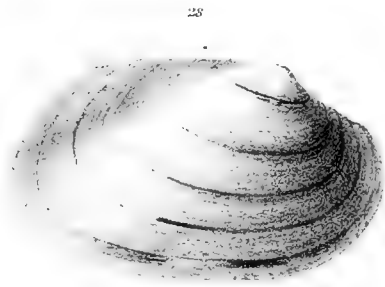


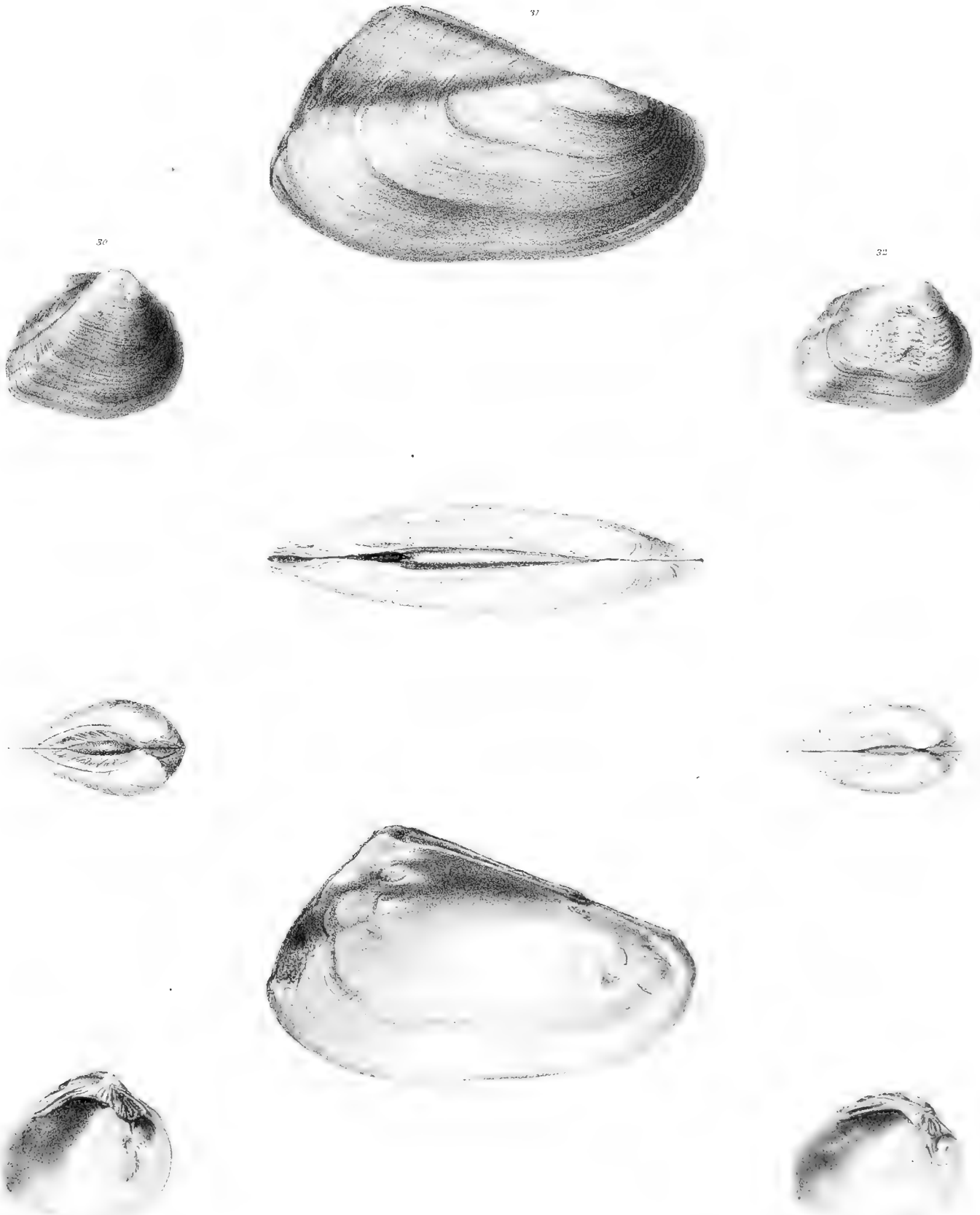


24 *Anodonta Lewicensis*
25 *Anodonta Bealei*



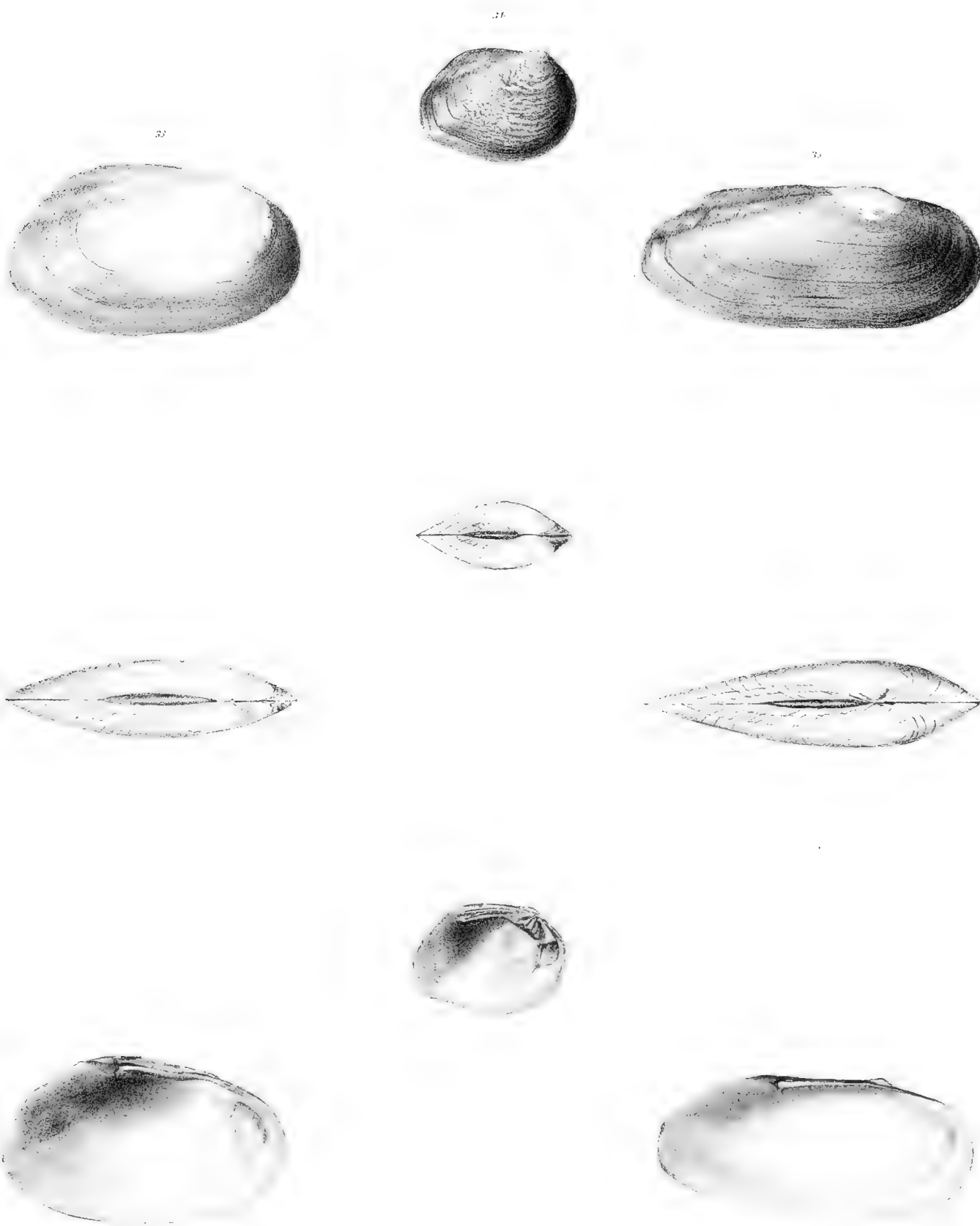




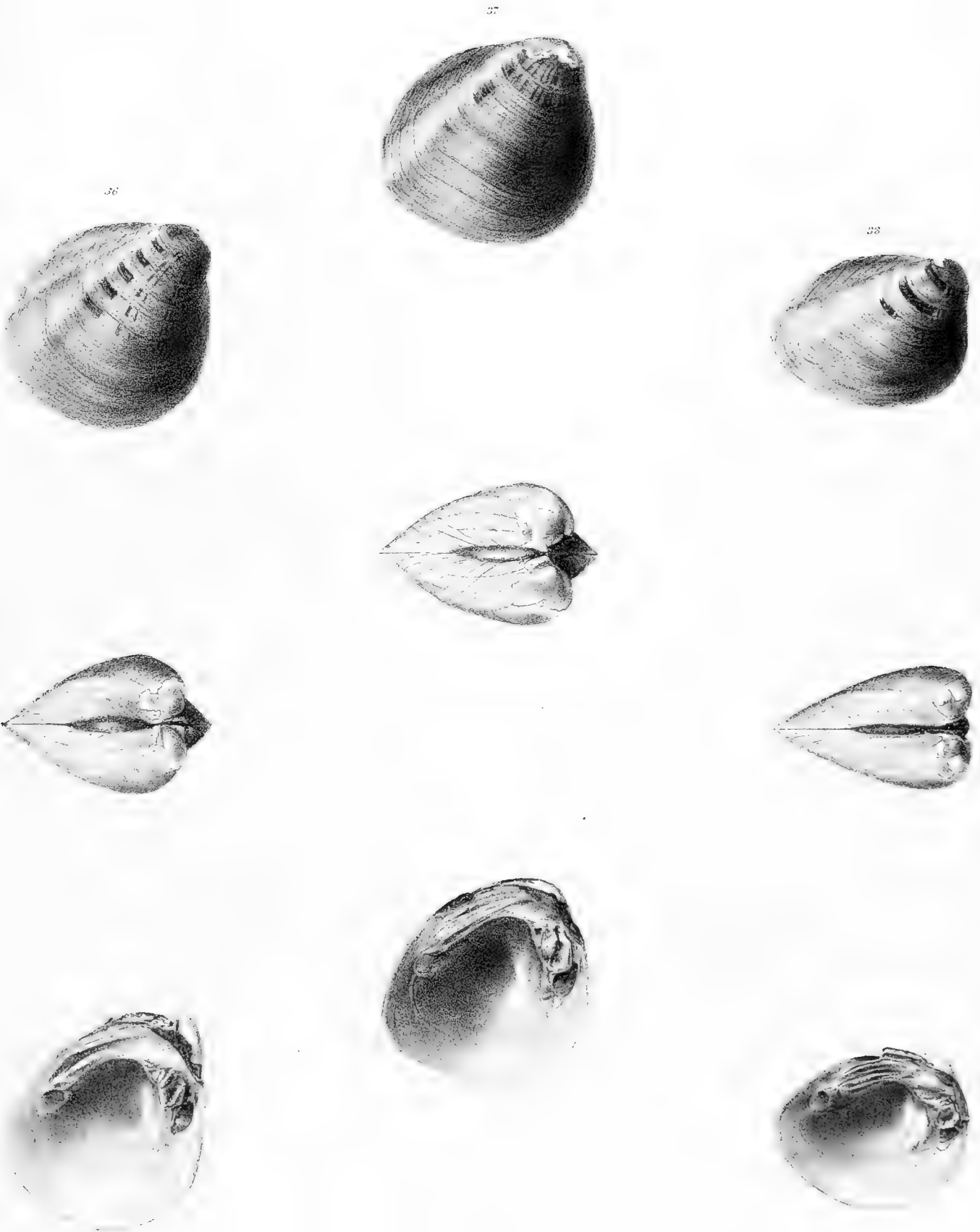


30 *Urio kirku*
31 *Spatha alata*
32 *Urio ayassensis*

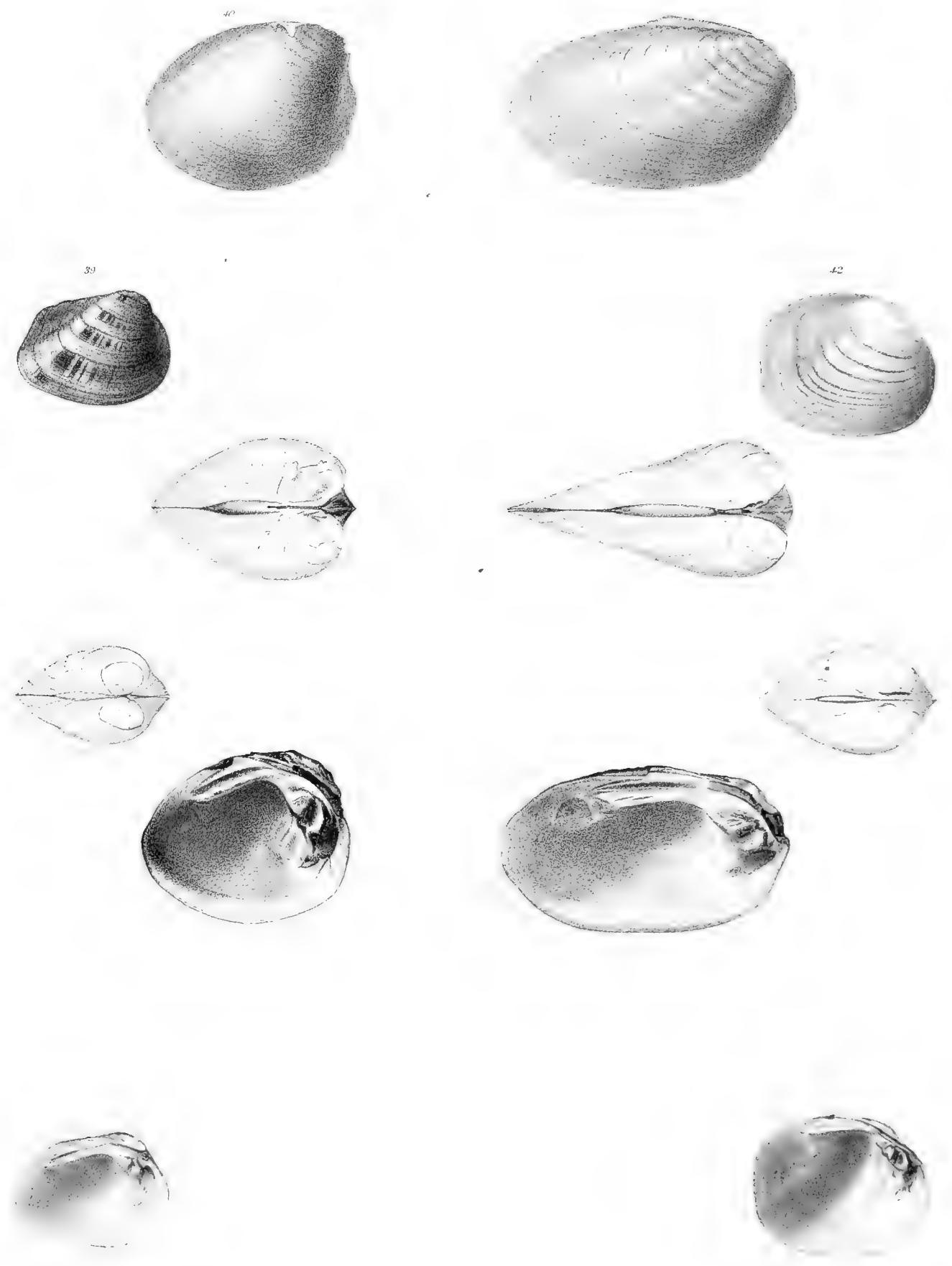
T. Savelans lith. Fide



33 *Spatha Nyassarensis*
34 *Unio Alerulus*
35 *Spatha modesta*

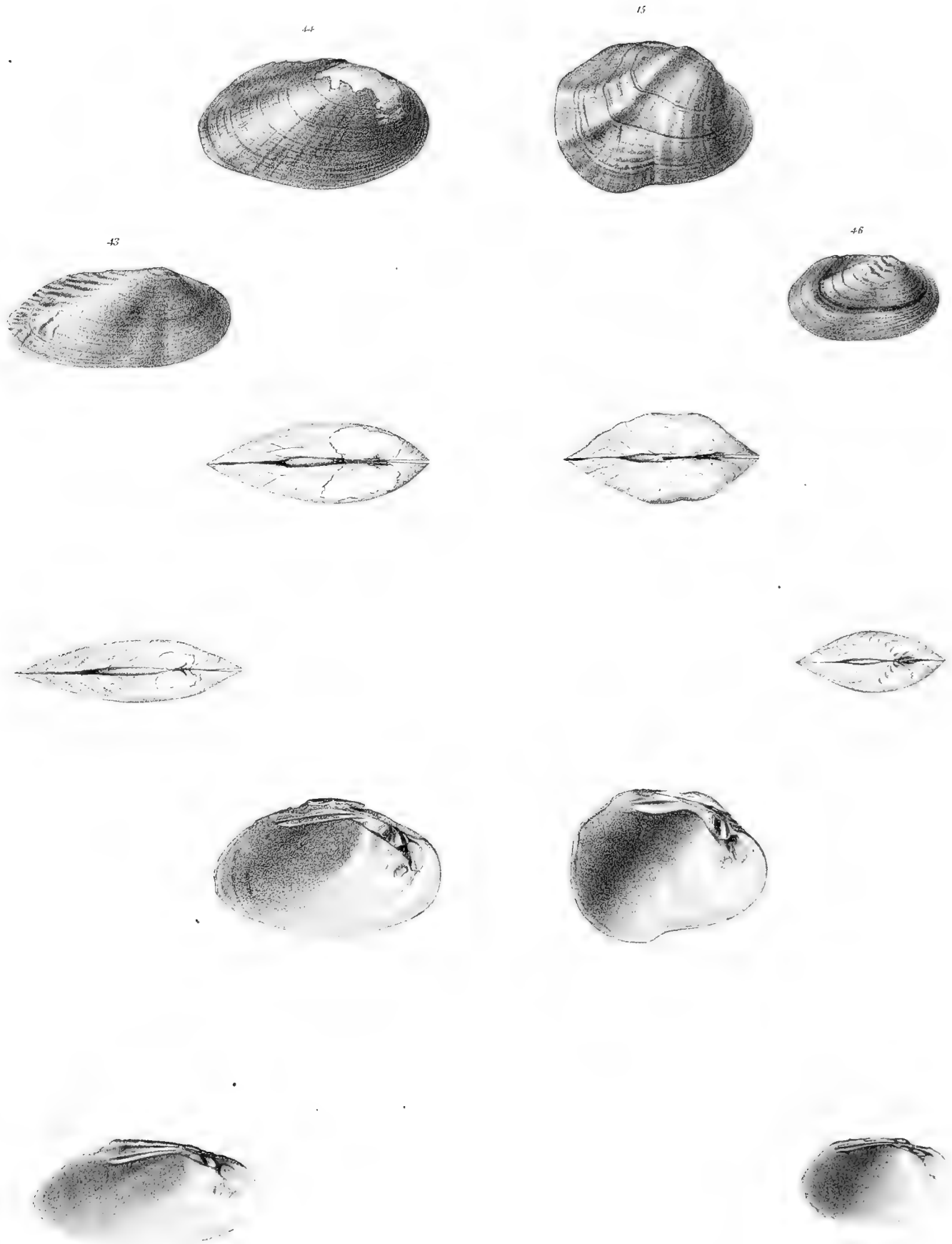


36 *Uva Thorntonii*
37 *Uva Moorestonii*
38 *Uva mundus*



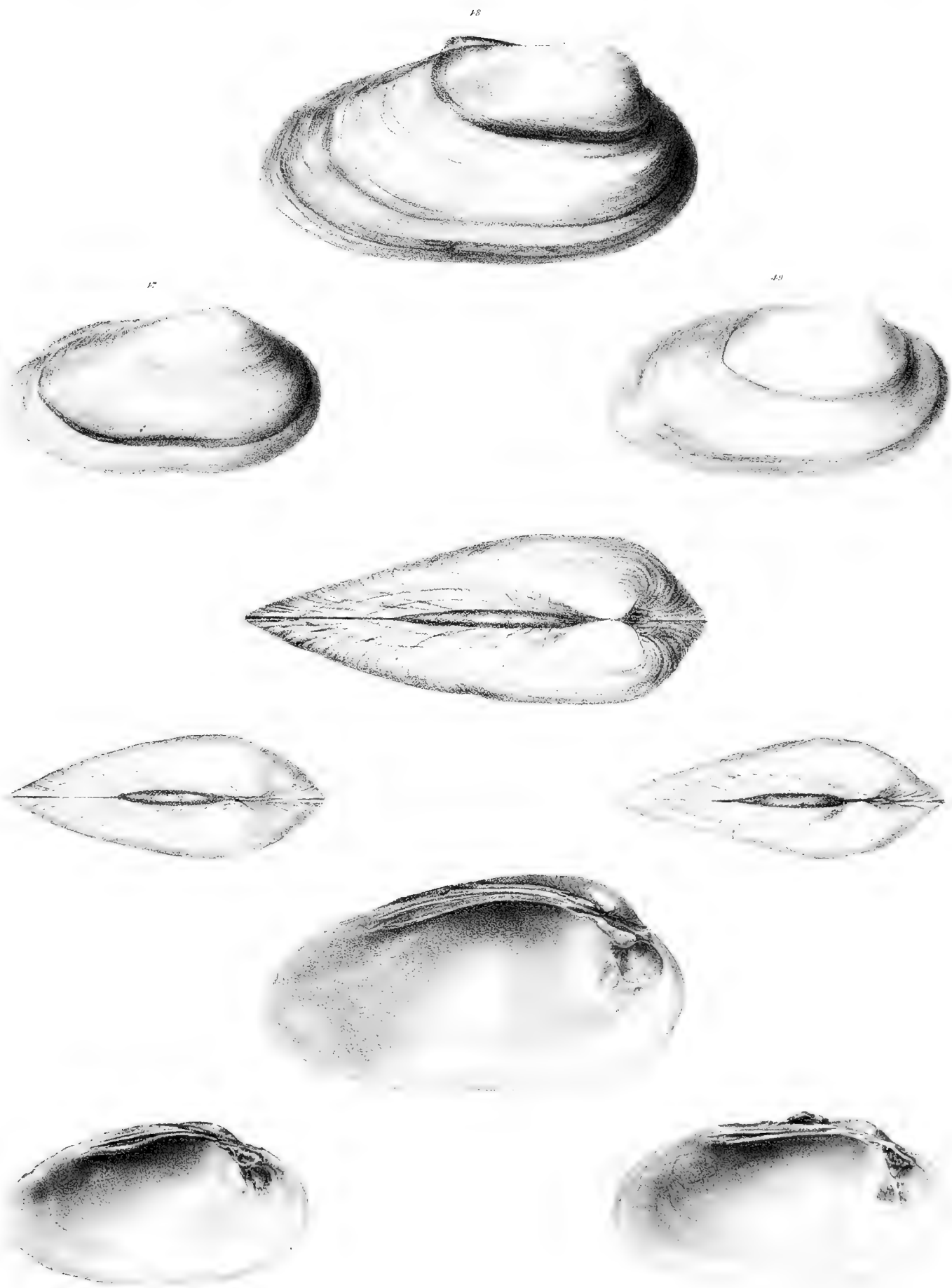
39 *Unio tessellatus*
40 *Unio crapulus*
41 *Unio cerebrulatus*
42 *Unio Leibii*





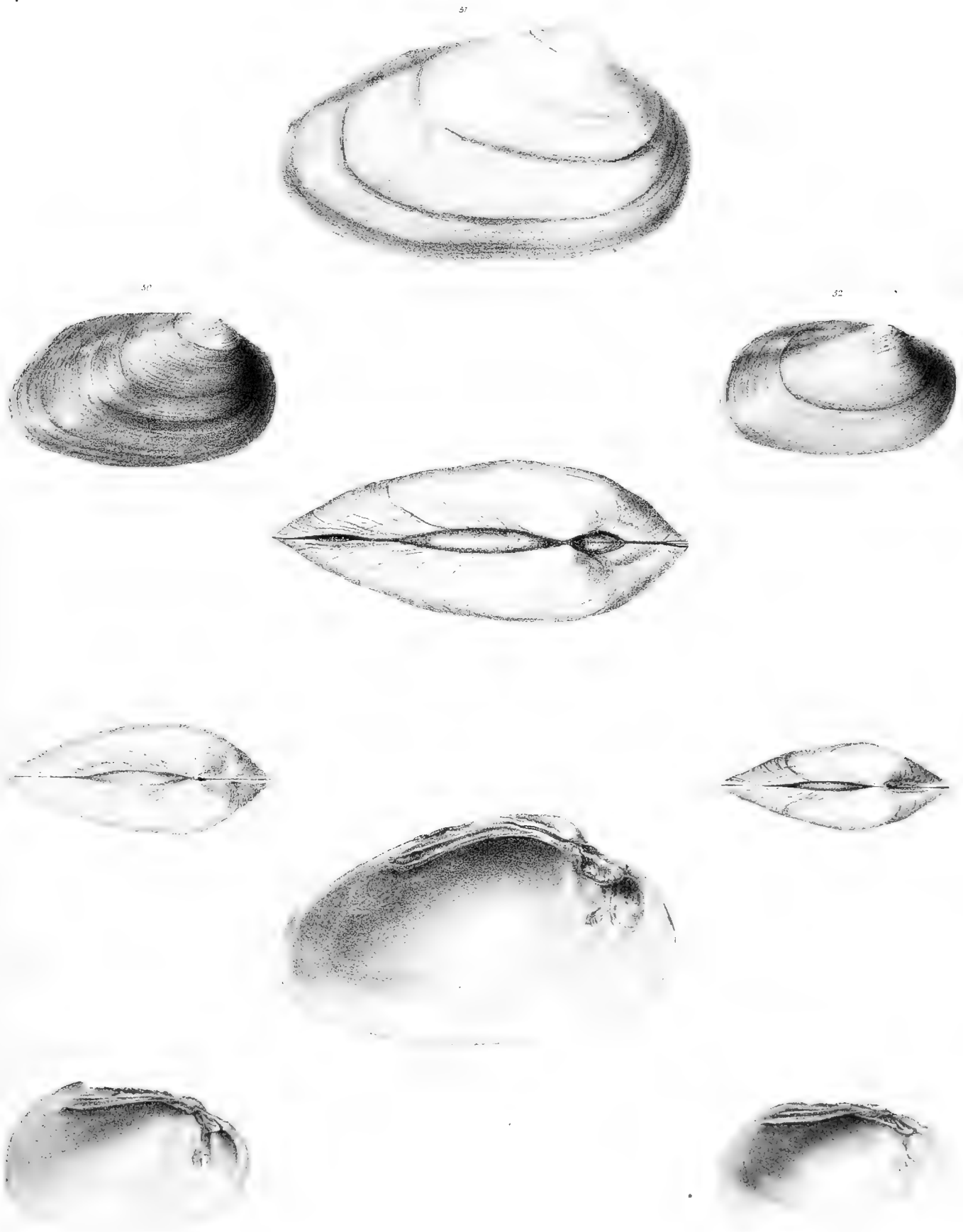
43 *Urio parvulus*
44 *Urio perpurpureus*
45 *Urio bimariginatus*
46 *Urio granulatus*

T. Guérin et H. Phil.



47 *Unio rarus*
48 *Unio dignatus*
49 *Unio Mosulensis*





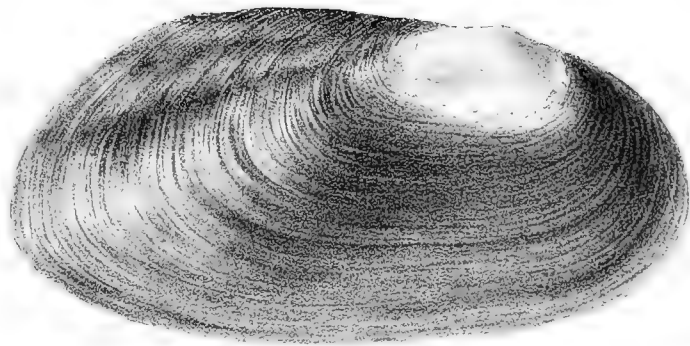
50 *Unio Orontensis*
51 *Unio Bourguignatianus*
52 *Unio Damascensis*



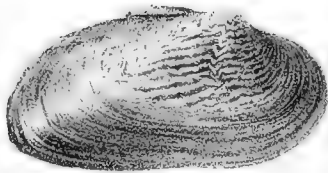
33 *Urosalpinx*
34 *Urosalpinx*
35 *Urosalpinx*
36 *Urosalpinx*



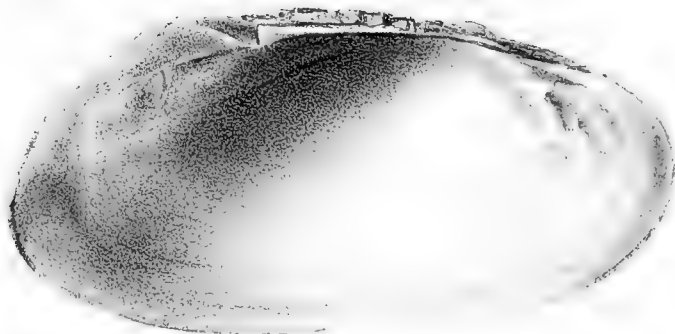
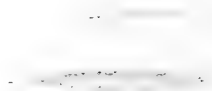
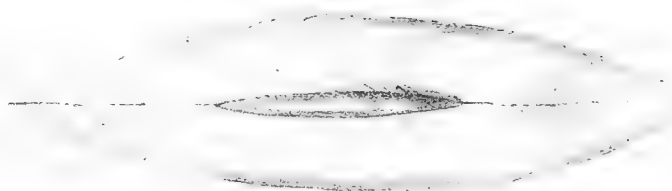
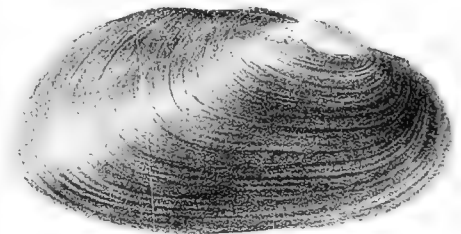
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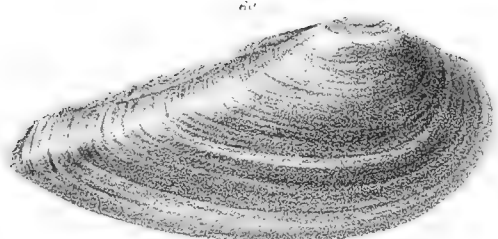


37 *Unio Natalensis*
38 *Spatha Natalensis*
39 *Unio Paramattensis*

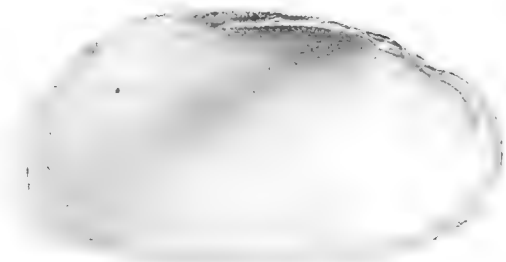
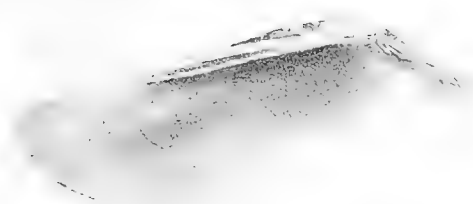
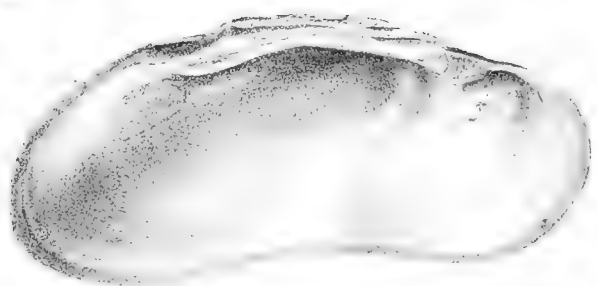
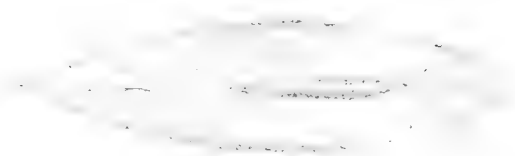
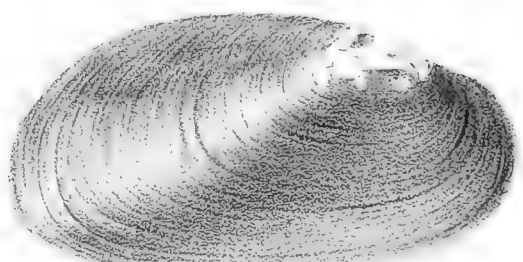
61.



61a



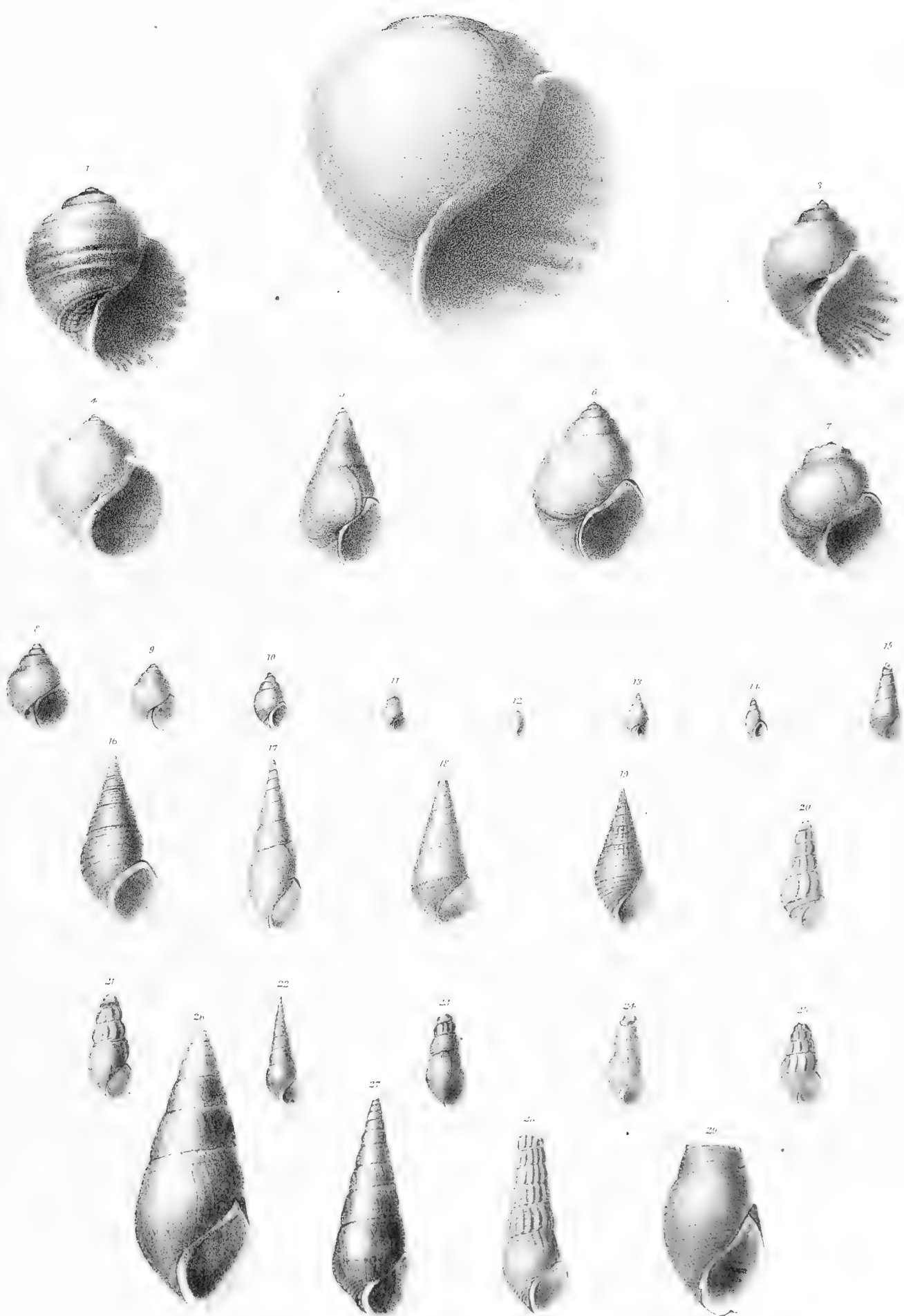
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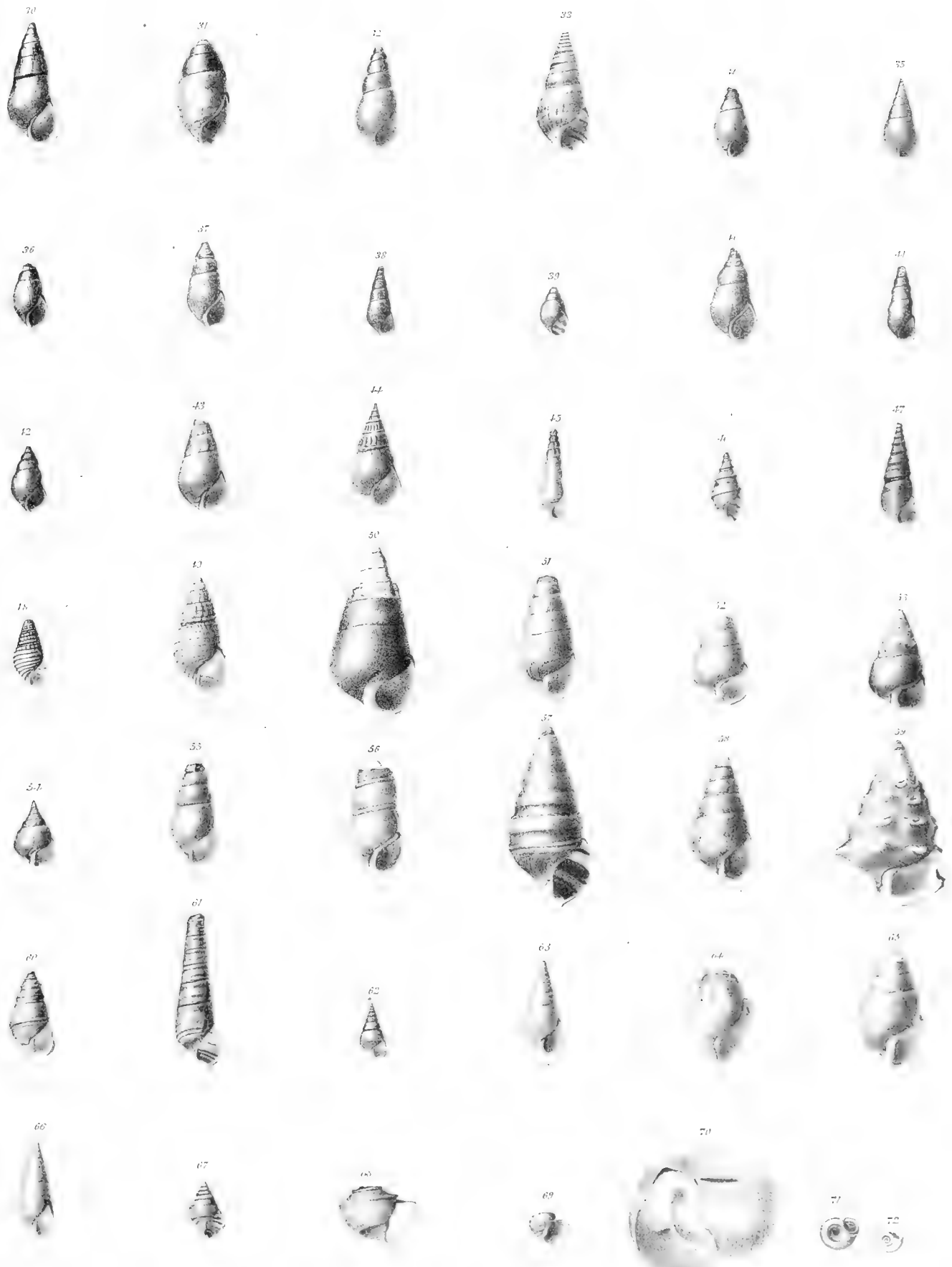
60 *Unio Parvi*
61 *Unio Laosensis*
62 *Mucronulana Mouloutrana*

T Sinclair's lith, Phila

2

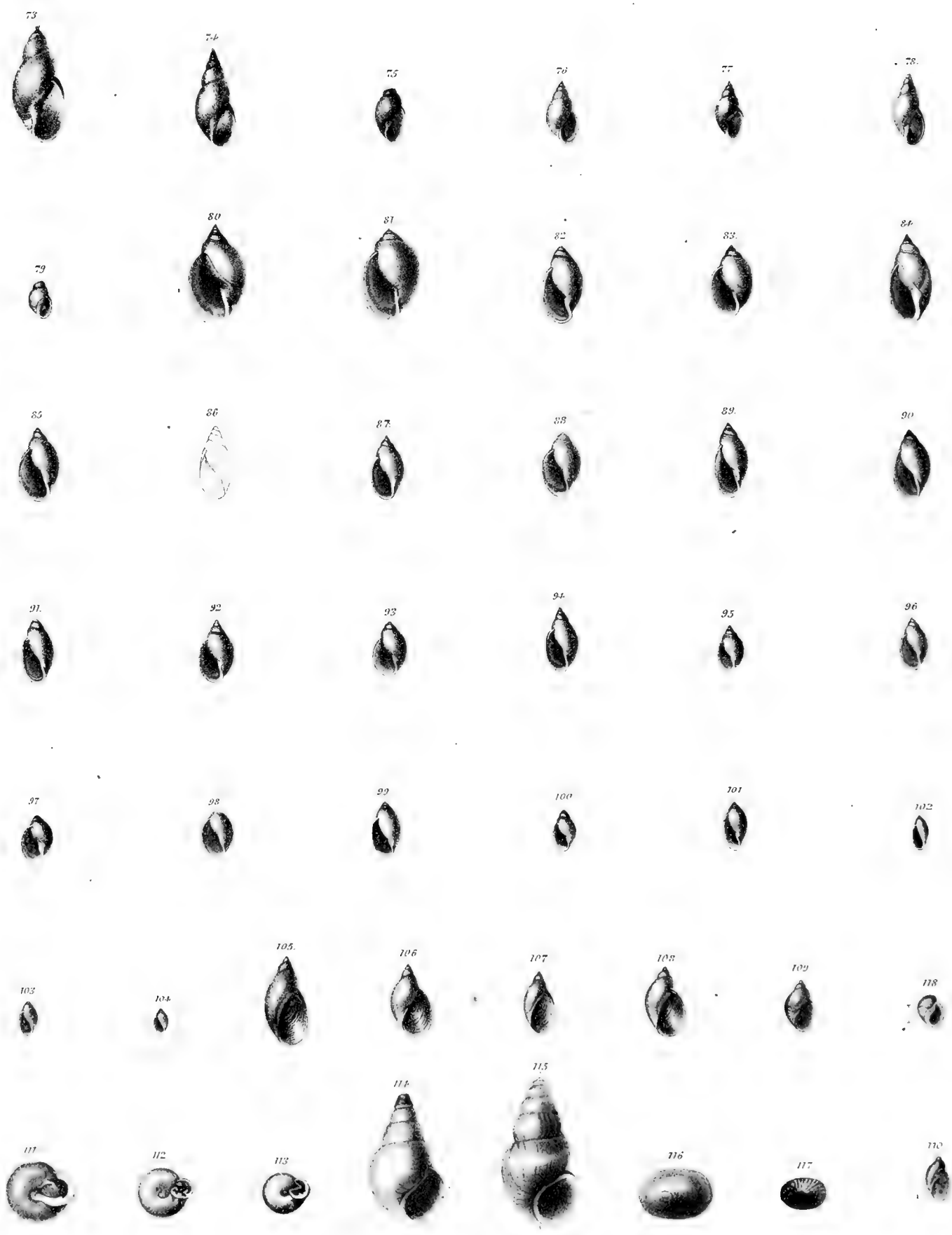


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|---|----------------------------|----|----------------------------|----|---------------------------|----|------------------------|
| 1 | <i>Amphipatia gracilis</i> | 8 | <i>Paludina umbilicata</i> | 17 | <i>Melania Boninensis</i> | 22 | <i>Melania Bonsei</i> |
| 2 | do <i>urbana</i> | 9 | do <i>Angulostoma</i> | 18 | do <i>rubula</i> | 23 | do <i>affinis</i> |
| 3 | do <i>fulvifrons</i> | 10 | <i>Rivulina maculata</i> | 19 | do <i>Newmanii</i> | 24 | do <i>Mandacensis</i> |
| 4 | do <i>aureostoma</i> | 11 | <i>Bithynia Stamenis</i> | 20 | do <i>Ilvastrata</i> | 25 | do <i>Aspinensis</i> |
| 5 | <i>Paludina orientalis</i> | 12 | do <i>globula</i> | 21 | do <i>Mutensis</i> | 26 | do <i>Planensis</i> |
| 6 | do <i>Hancostoma</i> | 13 | <i>Assiminea carinata</i> | 22 | do <i>Nagpoensis</i> | 27 | do <i>Verreauxiana</i> |
| 7 | do <i>Swainsoniana</i> | 14 | <i>Pachychilus parvum</i> | 23 | do <i>Myersiana</i> | 28 | do <i>lincolni</i> |
| | | | | | | | do <i>bullata</i> |



| | | | | | | | | | | | |
|----|------------------|-----------------|----|------------------|--------------|----|---------------------|--------------|----|---------------------|------------|
| 30 | <i>Gomobasis</i> | Roma | 30 | <i>Gomobasis</i> | Mileti | 50 | <i>Trypanostoma</i> | subrobustum | 60 | <i>Trypanostoma</i> | inclinatum |
| 31 | do | pupatornis | 41 | do | infernis | 51 | do | cylindraceum | 61 | do | curvatum |
| 32 | do | pulla | 42 | do | aterna | 52 | do | Roanensi | 62 | do | variosum |
| 33 | do | quadricincta | 43 | do | Emerynsis | 53 | do | artatum | 63 | do | cornutum |
| 34 | do | subhombica | 44 | do | Smithsoniana | 54 | do | napoicum | 64 | Euryalen | unilobatum |
| 35 | do | Cumberlandensis | 45 | do | Decampi | 55 | do | Lyoni | 65 | <i>Strophobasis</i> | Lyoni |
| 36 | do | Louisvillensis | 46 | do | italerna | 56 | <i>Schizostoma</i> | Showalteri | 66 | <i>Trypanostoma</i> | venustum |
| 37 | do | lithasoides | 47 | do | perrecta | 57 | <i>Trypanostoma</i> | affine | 67 | Miscchizi | erosyneria |
| 38 | do | vittatella | 48 | do | viridistrata | 58 | do | nervillatum | 68 | <i>Megasyroptia</i> | Newberryi |
| 39 | do | influitula | 49 | do | Albanyensis | 59 | do | Lesleyi | 69 | <i>Pimpla</i> | affisa |
| | | | 70 | <i>Planorbis</i> | Traski | | | | 71 | <i>Planorbis</i> | Whitelyi |
| | | | | | | | | | 72 | <i>Planorbis</i> | Billausti |





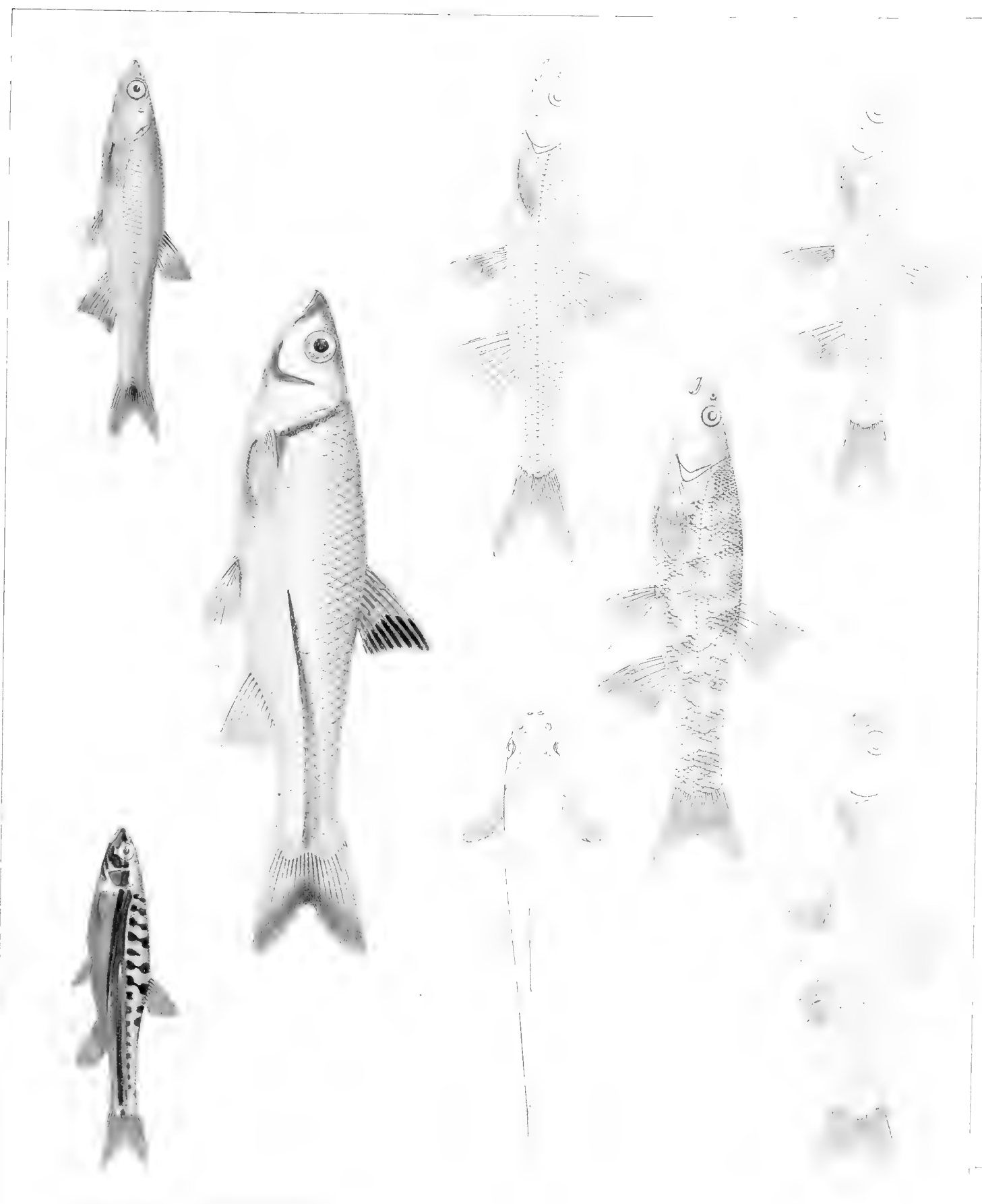
- | | | | |
|----------------------------|---------------------------------|---------------------------------|-------------------------------|
| 73 <i>Lymnaea Haydenii</i> | 84 <i>Physa Hawaii</i> | 95 <i>Physa Forsheyi</i> | 106 <i>Succinea pellucida</i> |
| 74 <i>do proxima</i> | 85 <i>do Dorbigniana</i> | 96 <i>do Whitei</i> | 107 <i>do Forsheyi</i> |
| 75 <i>do arctica</i> | 86 <i>do tenuissima</i> | 97 <i>do Niagaracensis</i> | 108 <i>do Grosvenori</i> |
| 76 <i>do Smithsoniana</i> | 87 <i>do Saffordii</i> | 98 <i>do brevispira</i> | 109 <i>do Moorestana</i> |
| 77 <i>do Jamesii</i> | 88 <i>do Blandii</i> | 99 <i>do Fedigerii</i> | 110 <i>do Halei</i> |
| 78 <i>do Trymani</i> | 89 <i>do venusta</i> | 100 <i>do Grosvenori</i> | 111 <i>Helix Clarkii</i> |
| 79 <i>do Leontii</i> | 90 <i>do crotata</i> | 101 <i>do Nichtlani</i> | 112 <i>do Couchiana</i> |
| 80 <i>Physa Traskii</i> | 91 <i>do Smithsoniana</i> | 102 <i>do hordacea</i> | 113 <i>do Tamaukpacensis</i> |
| 81 <i>do Warreniana</i> | 92 <i>do Showalterii</i> | 103 <i>do triticea</i> | 114 <i>Ral Milesii</i> |
| 82 <i>do Altonensis</i> | 93 <i>do Nuttalli</i> | 104 <i>do parva</i> | 115 <i>do Elliotti</i> |
| 83 <i>do Halei</i> | 94 <i>do anatana</i> | 105 <i>Succinea Wilsonii</i> | 116 <i>Ancylus Newberryi</i> |
| | 117 <i>Ancylus pattelloides</i> | | |
| | | 118 <i>Amnicola Currieriana</i> | |



BATRACHIA.

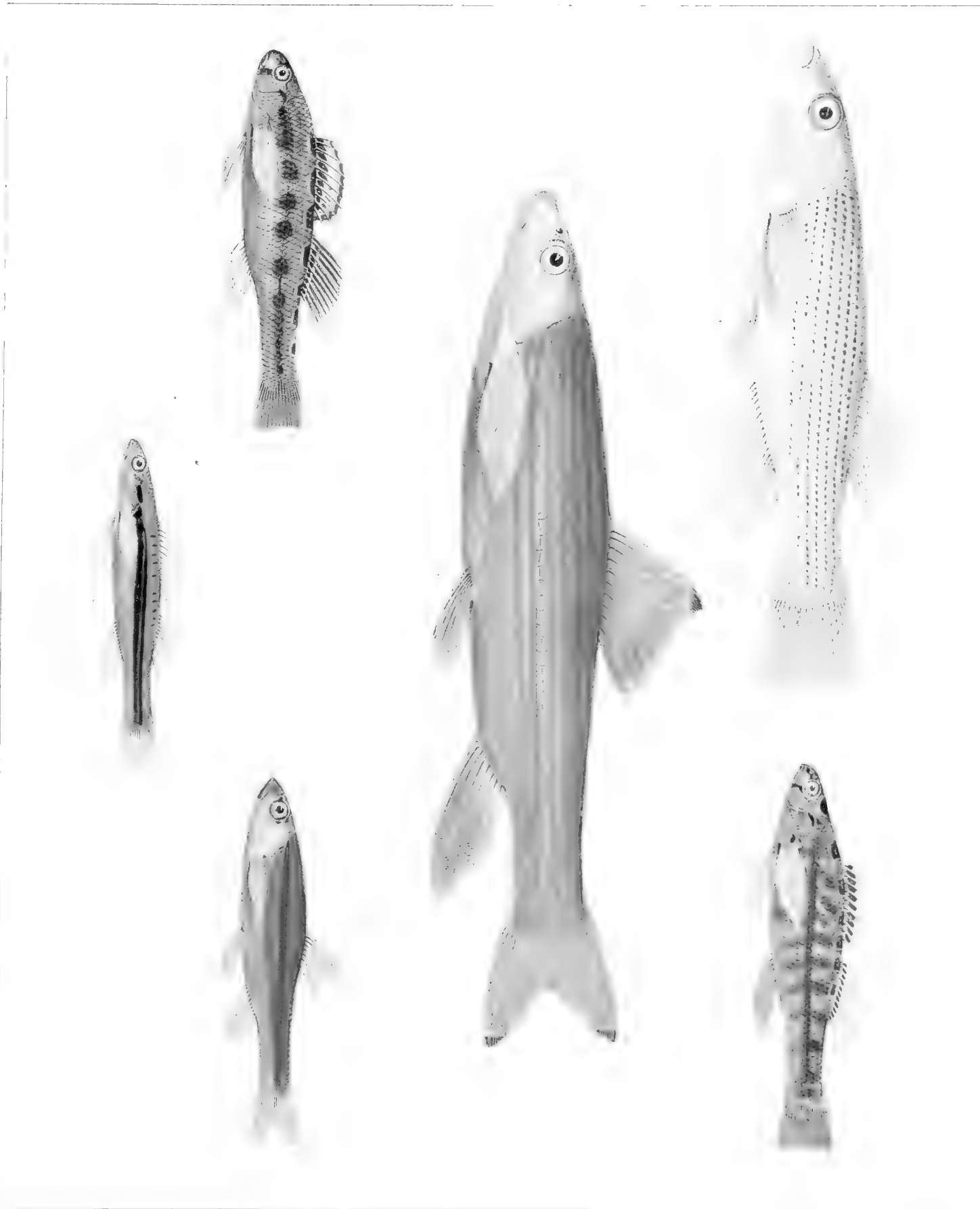


1 Phoradendron torulatum 2 Ph. truncatum 3 Hypoxis spectabilis 4 Hypoxis glandulosa 5 Phlox pilularis 6 Ph. pilularis 7 Menyanthes trifoliata



1 *Ceratichthys hyalinus*. 2 *Cer. monacanthus*. 3 *Rhinichthys limatus*. 4 *Hyphorhynchus superciliosus*. 5 *Ilypsilepis coccogemis*. 6 *Ilypsardens*. 7 *Chrosomus oreas*.

T. S. Silliman del. J. H. Silliman sculp.

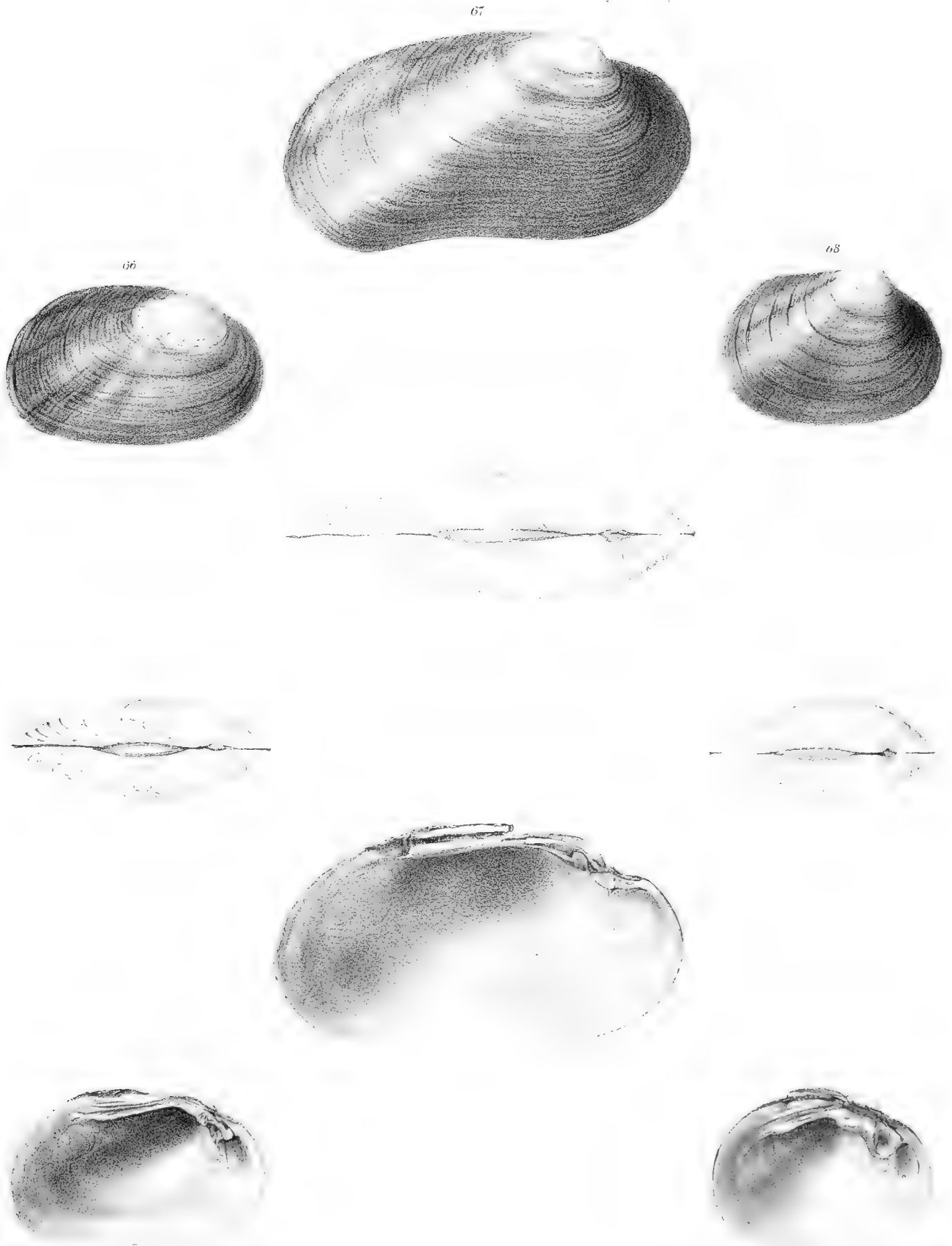


1 *Poecilichthys zonalis*, 2 *Fundulus catenatus*, 3 *Trochilus cervinus*, 4 *Epiplatys tinkerococcus*, 5 *Apostoma siniferum*, 6 *Cottogaster aurantiacus*.

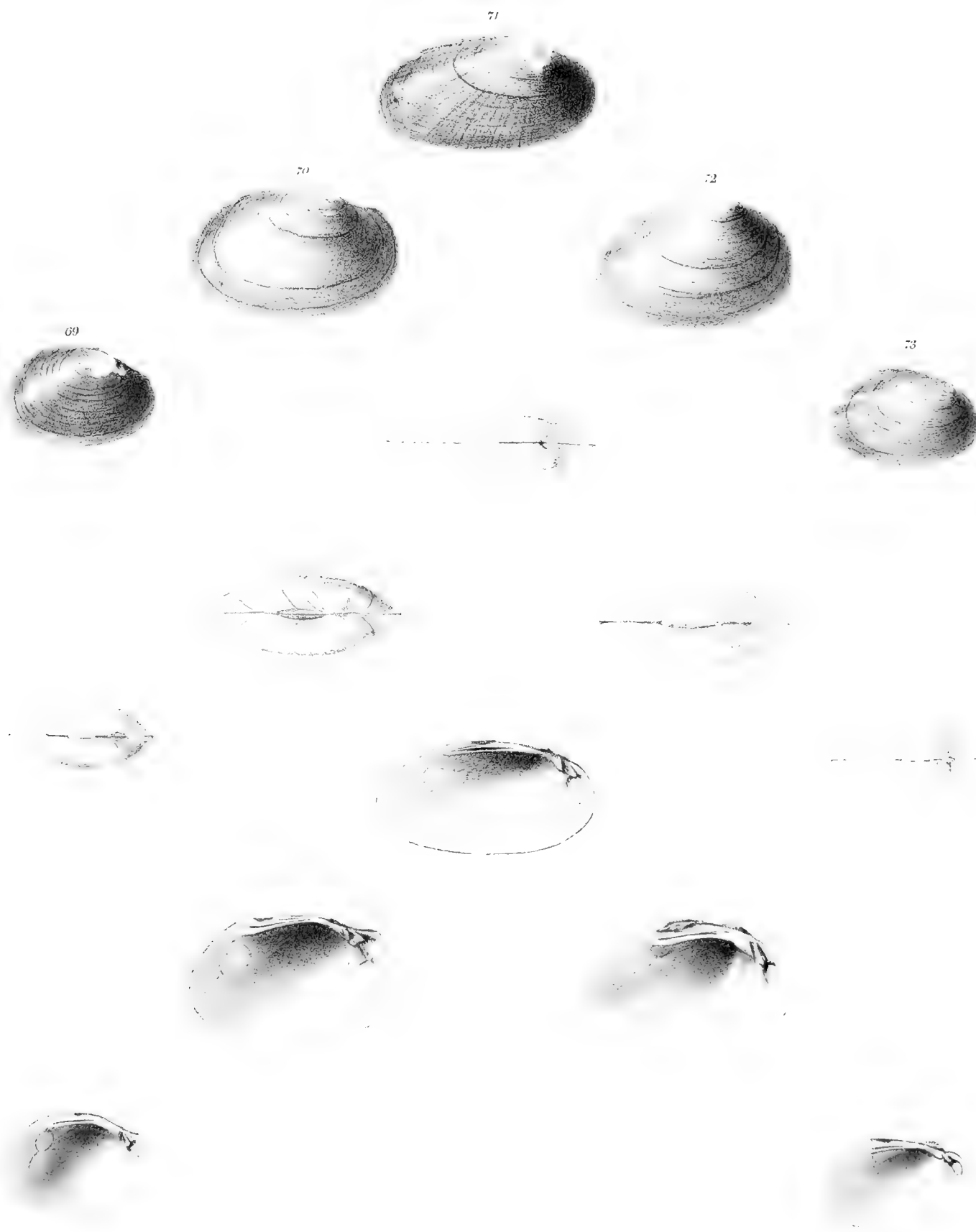
W. S. Silliman, Ill. Phil. Acad.



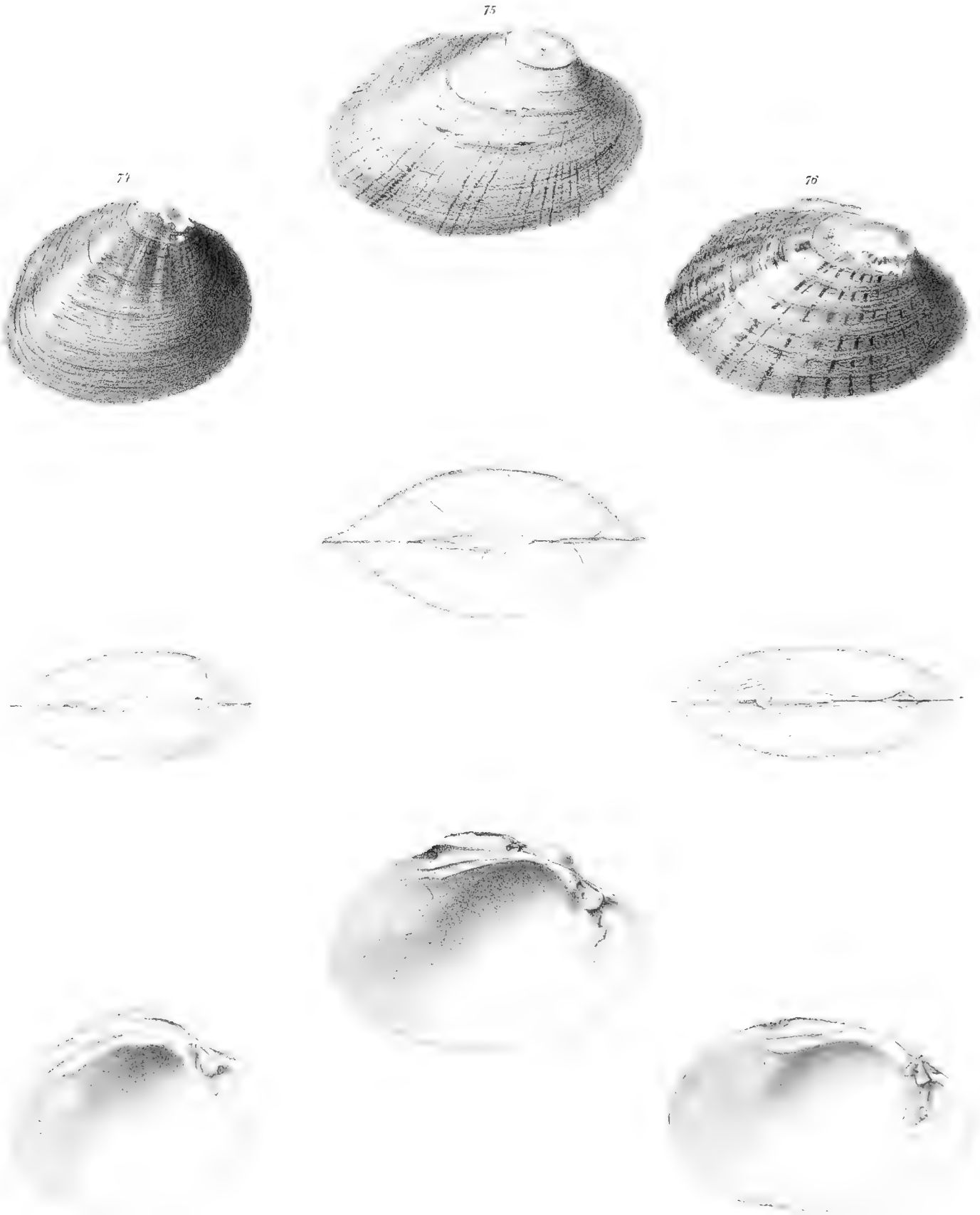
63 *Uta Herriani*
64 *Uta Siphacensis*
65 *Uta Fidei*



66. *Umo Mardinensis*.
 67. *Monocondylaea Mardinensis*.
 68. *Umo Enesacensis*



69 *Unio marginis*
 70 *Unio proprius*
 71 *Unio protensus*
 72 *Unio amabilis*
 73 *Unio Cromwellii*



74 *Unio Lyoni*
75 *Unio dolcaris*
76 *Unio punctatus*

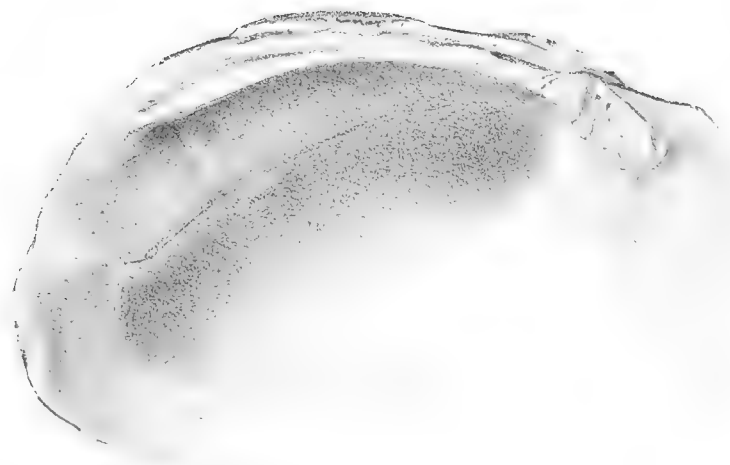
T Sinclair's lith, Phil



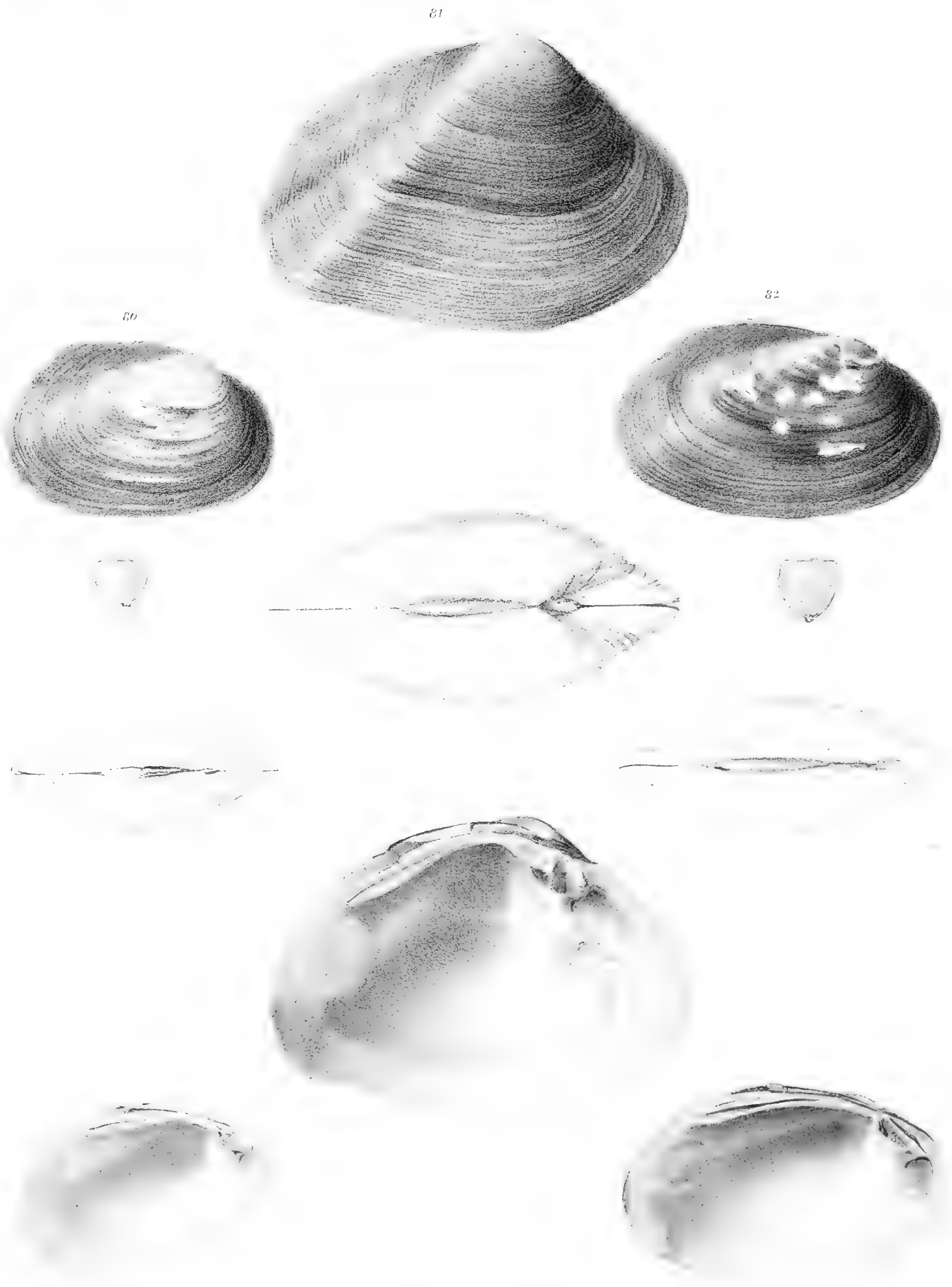
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77

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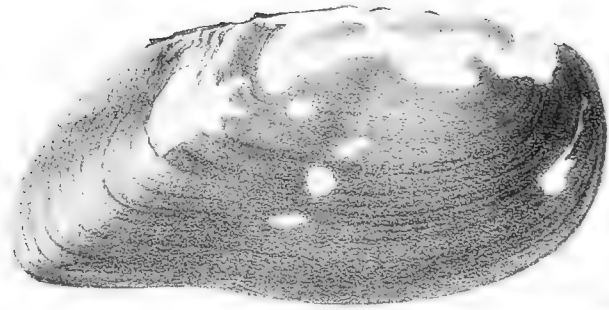
- 77 *Unio parvus*
- 78 *Unio apprimus*
- 79 *Unio locellus*



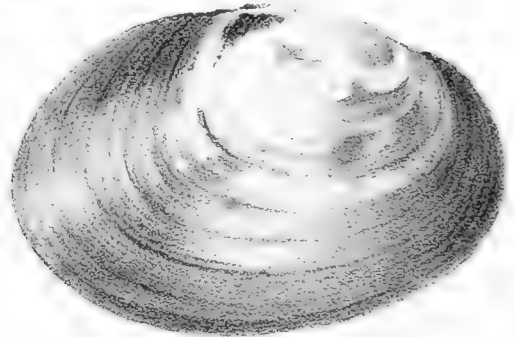
80 *Unio peculiaris*
81 *Unio rugosusulcatus*
82 *Unio firmus*.

T. Wilson's lith. Co.

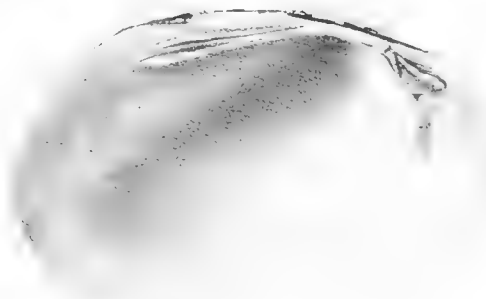
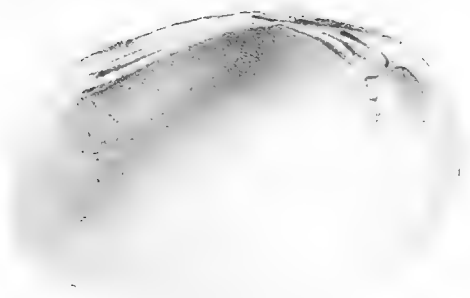
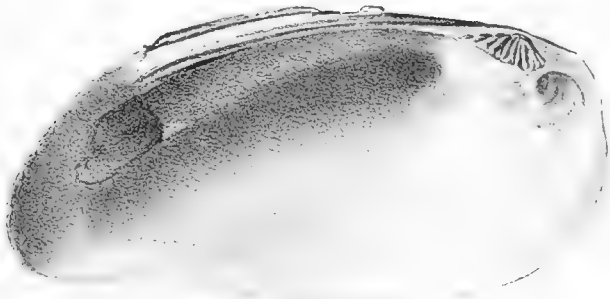
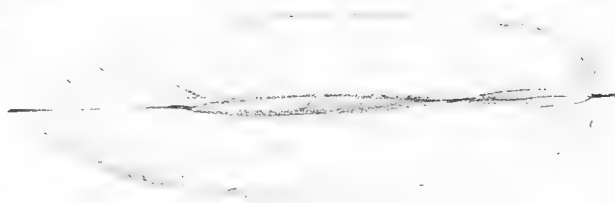
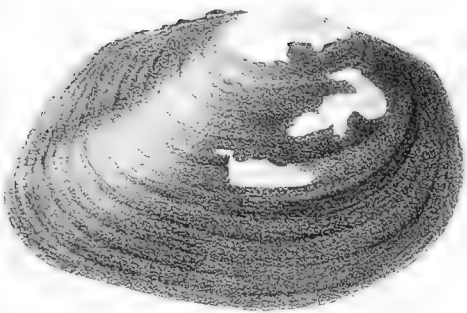
84.



85.

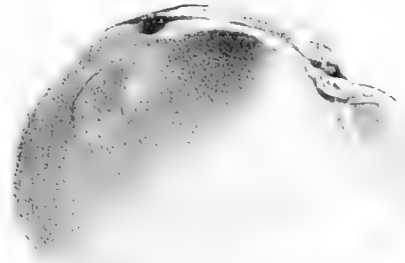
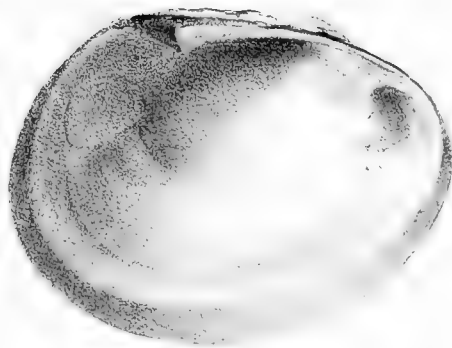
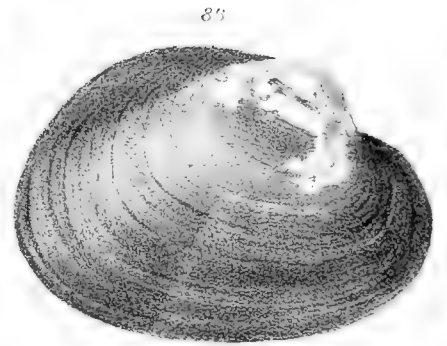
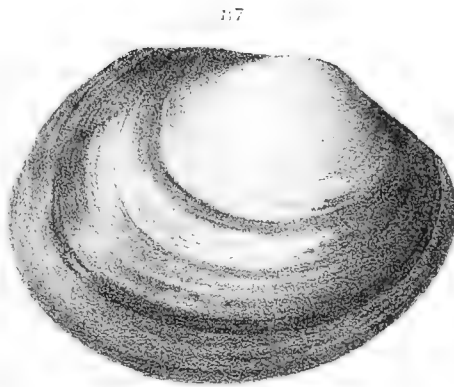
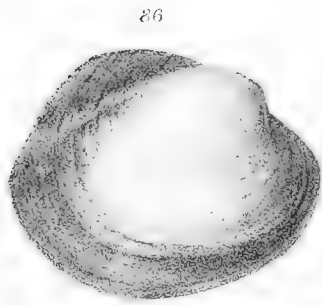


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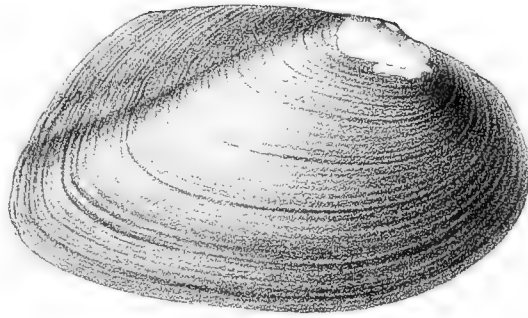
- 83. *Unio ampullaceus*
- 84. *Unio acutirostris*
- 85. *Unio Paraguayensis*



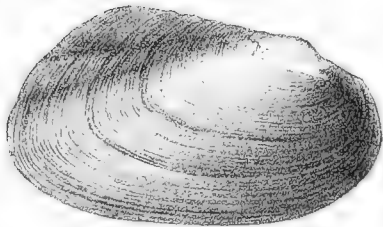


86 *Monocondylea lentiformis*.
87 *Anodonta Puzzi*.
88 *Monocondylea Puzzi*.

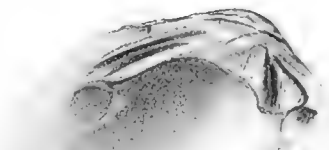
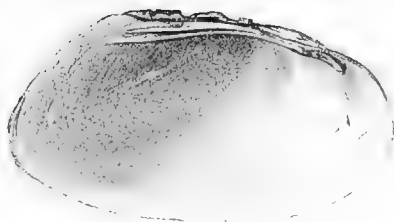
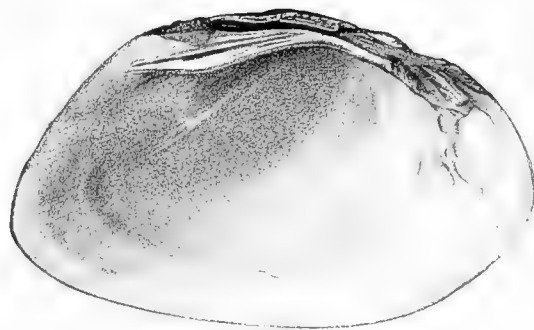
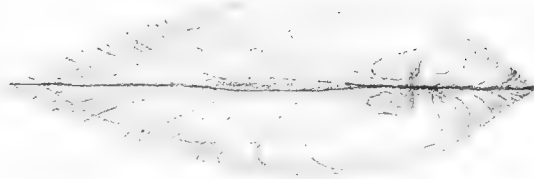
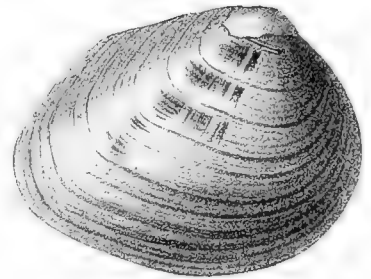
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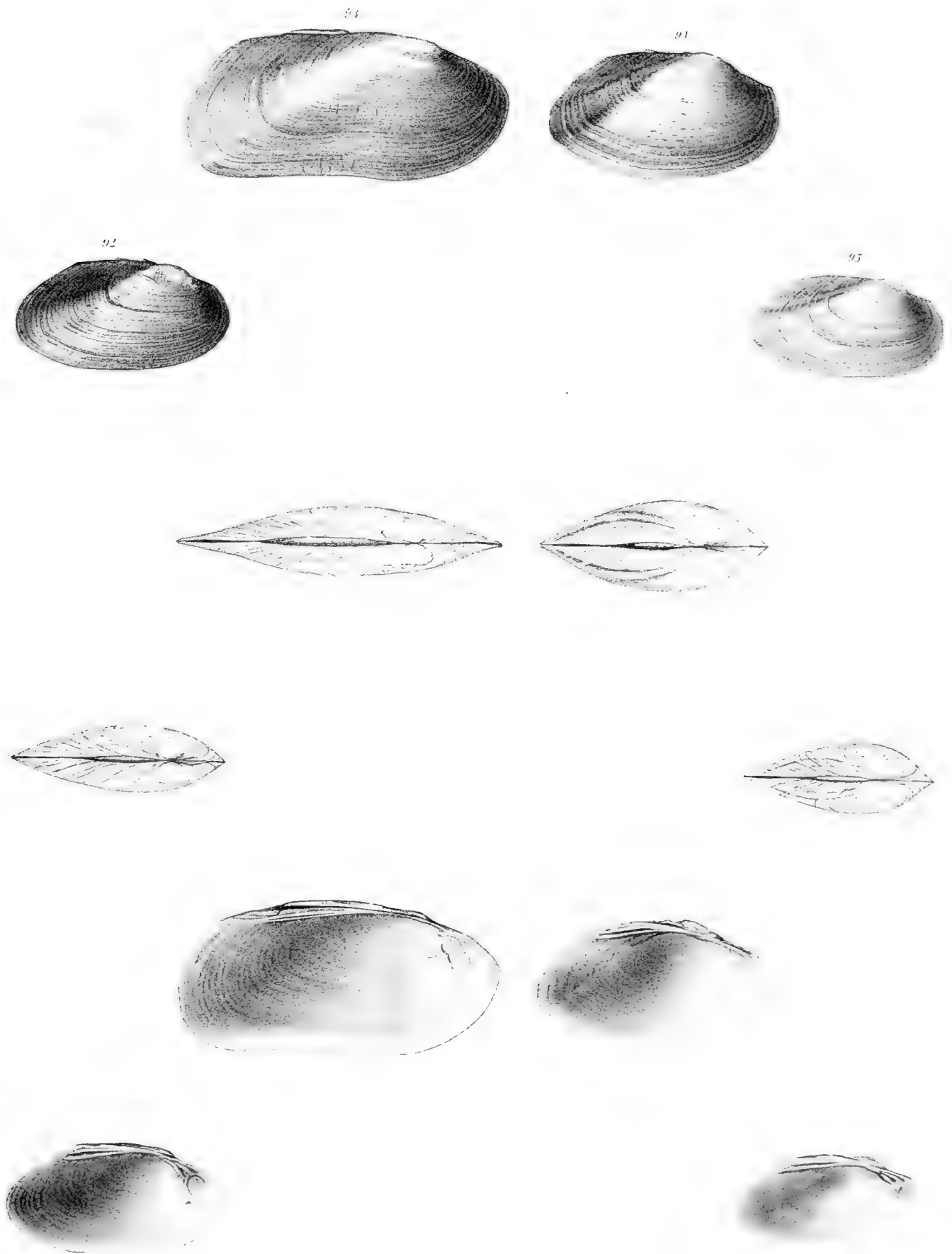
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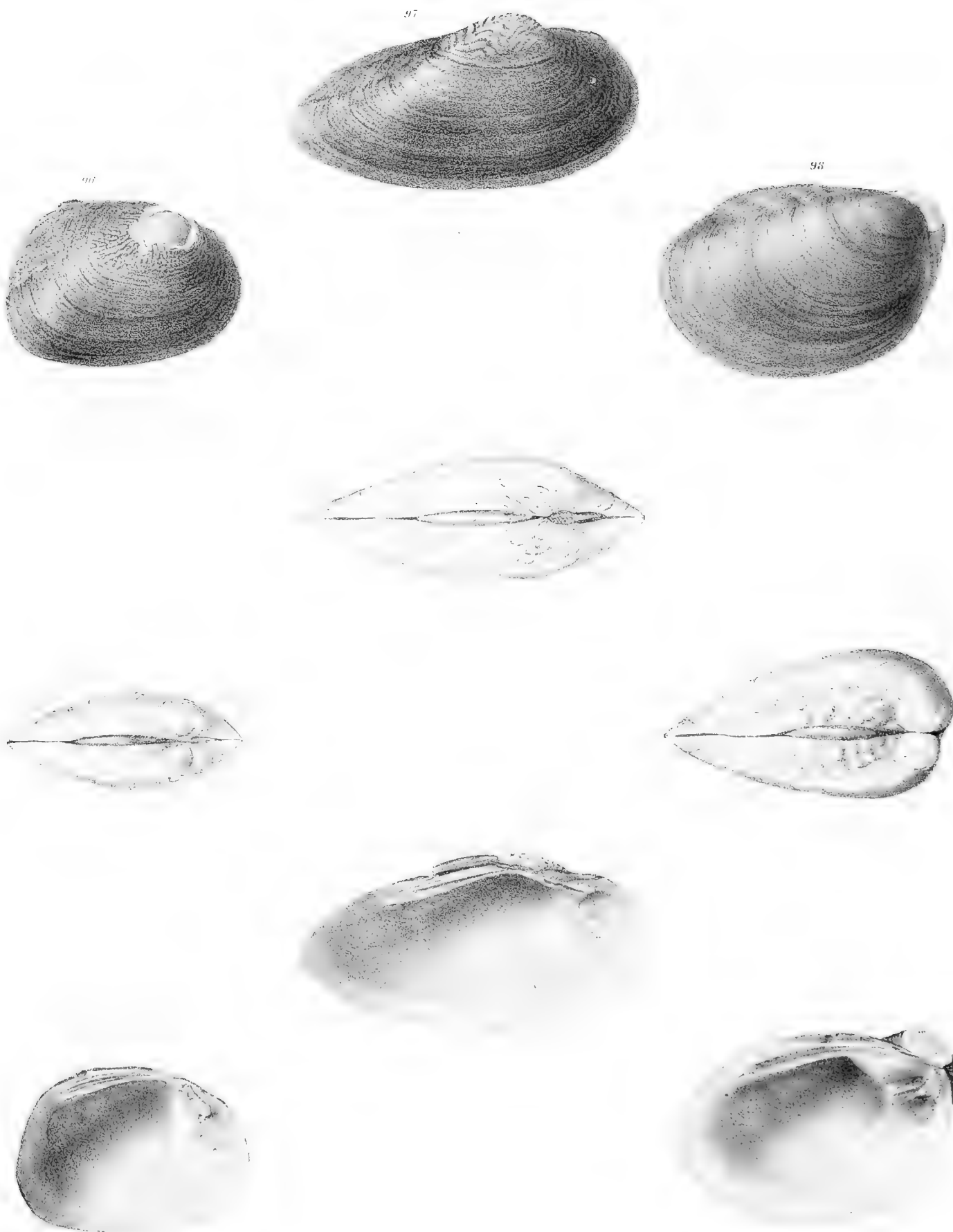
91



89. *Unio Jewellii*
90. *Unio Bissellianus*
91. *Unio Clinchensis*.

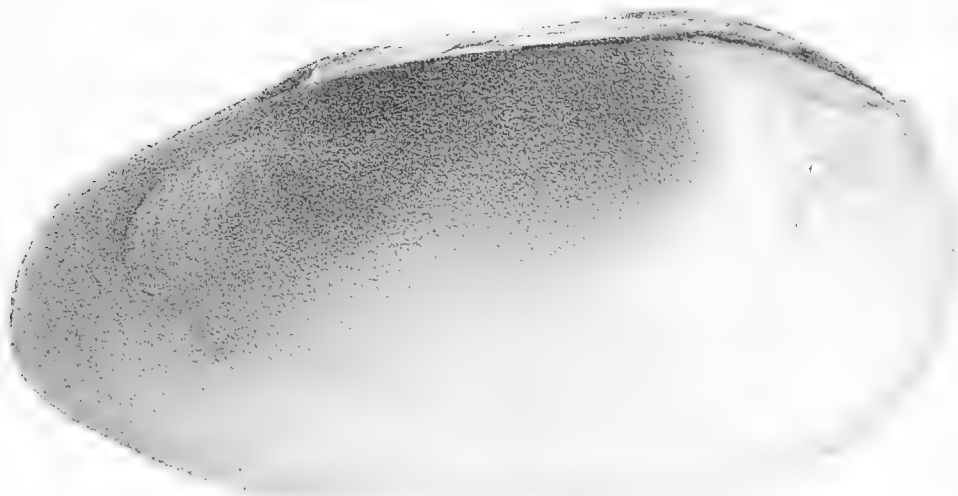
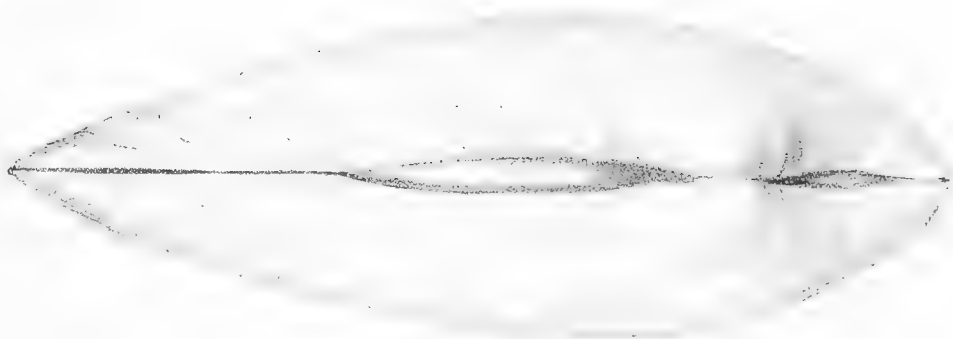
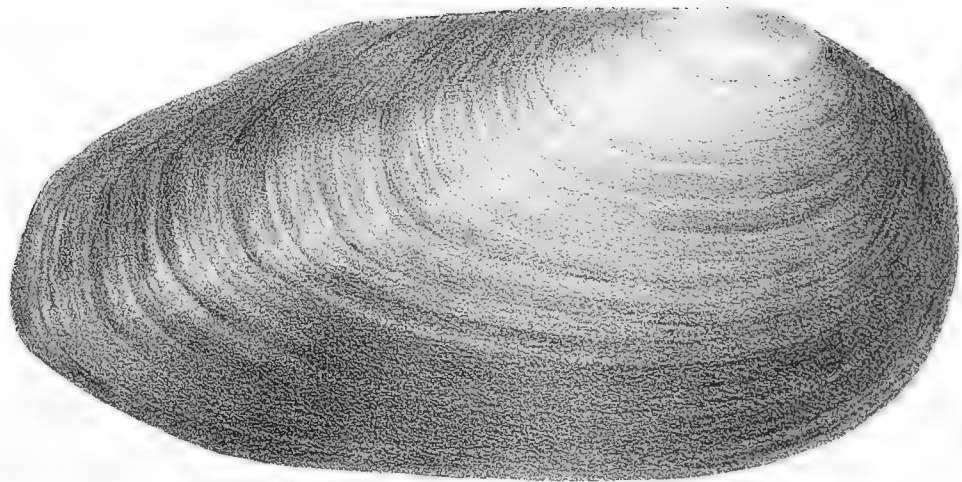


91. *Unio exilatus*. 93. *Unio asperulus*
92. *Unio Siamensis*. 95. *Unio pilatus*

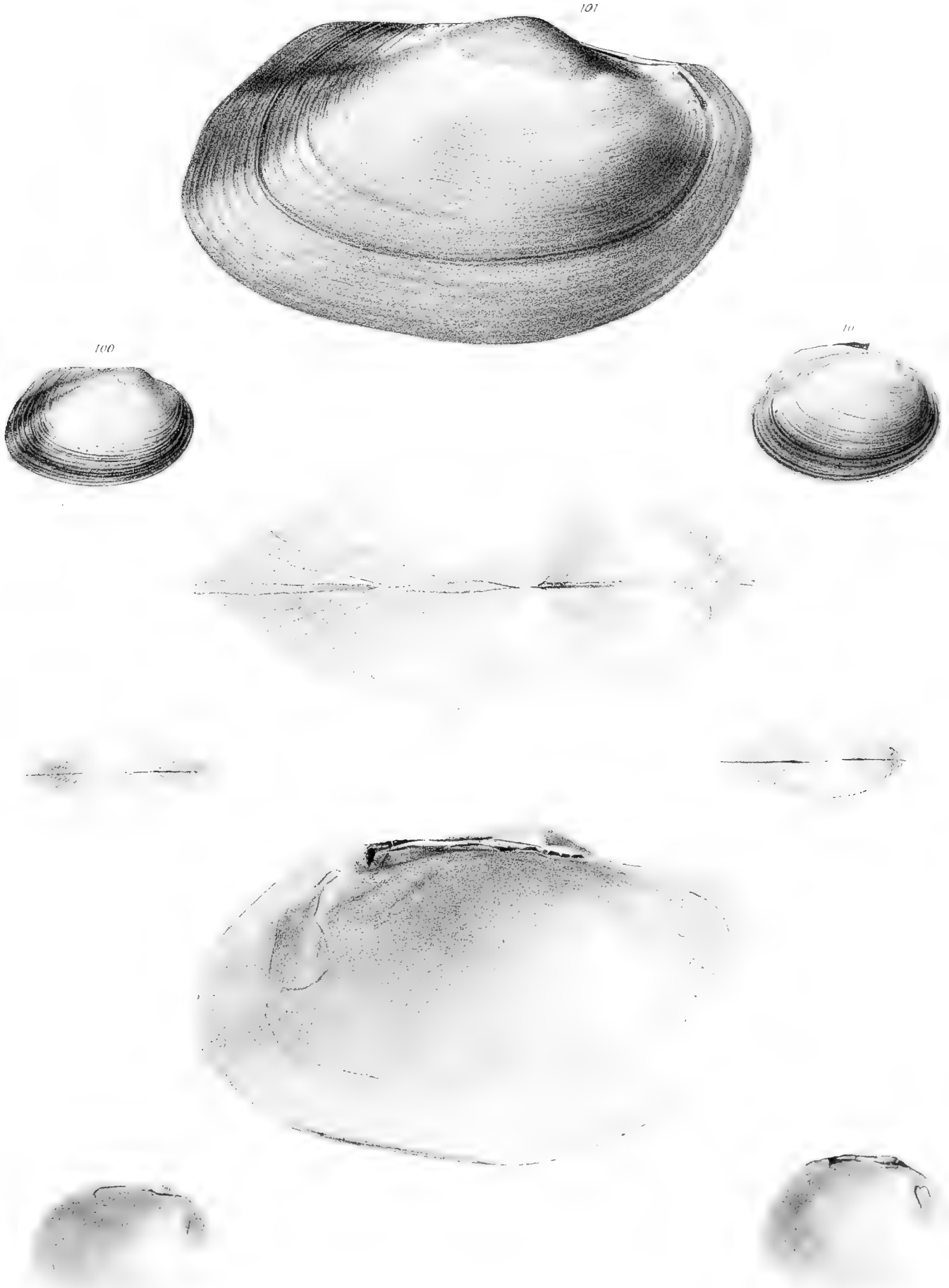


96. *Unio rufosus*.
97. *Unio Wrightii*
98. *Unio tortuosus*

· dnr lth. Plala

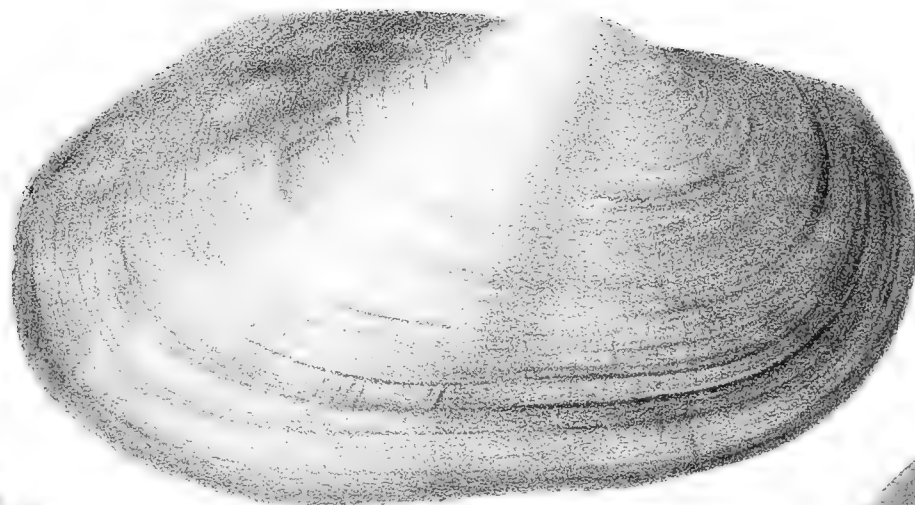


99 *Anodonta Youkanensis*

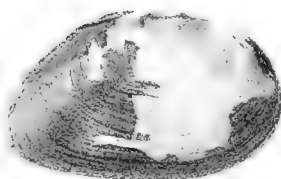


100. *Anodonta Granadensis*.
101. *Anodonta Sewellii*
102. *Anodonta lenticularis*

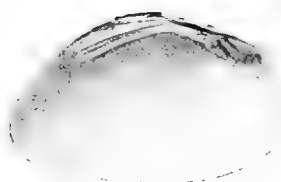
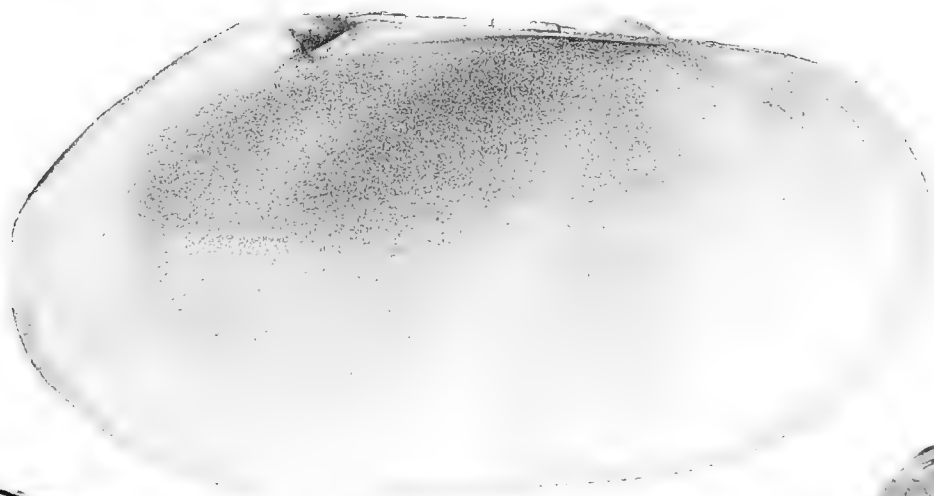
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103

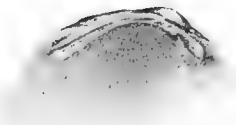
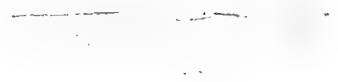
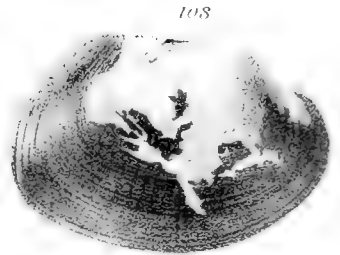
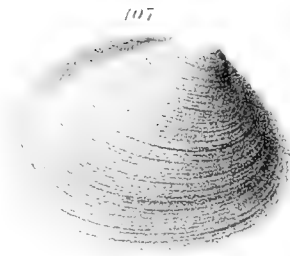
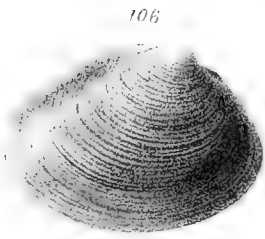


105



T. Sinclair lith. Philada

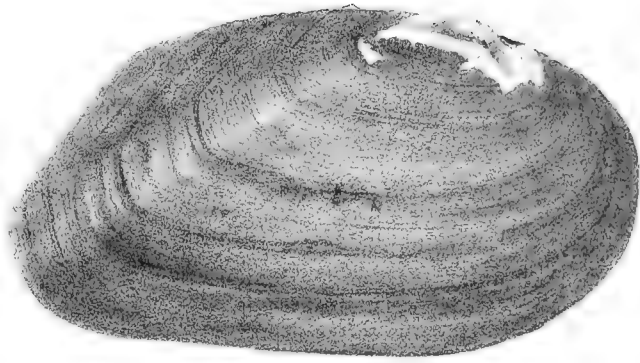
- 103 *Unio Granadensis.*
- 104 *Anodonta Bridgesii.*
- 105 *Unio encarpus.*



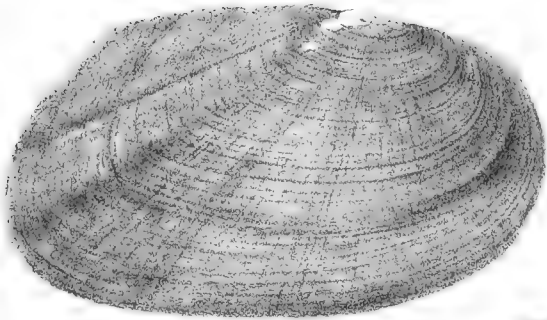
106. *Unio Gabbianus*
 107. *Unio Nicaraguensis*
 108. *Anodonta inaequalva*

T. J. Van der Ploeg, Florida

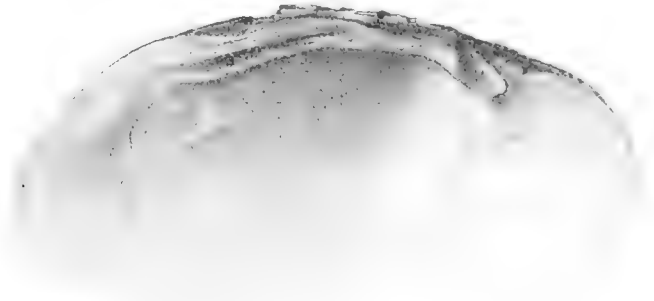
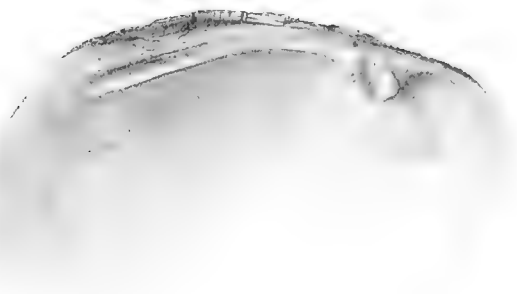
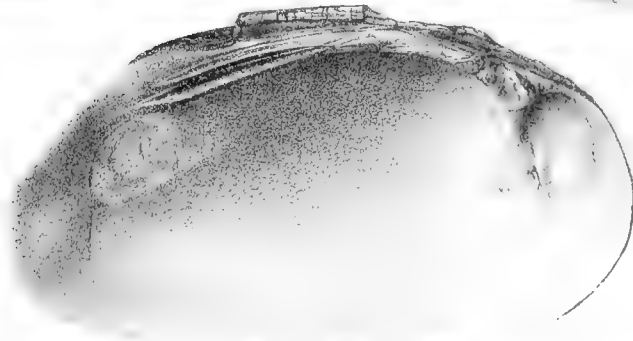
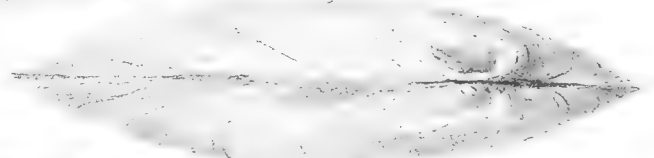
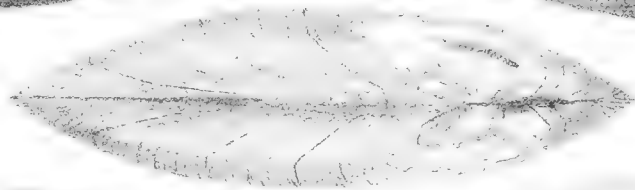
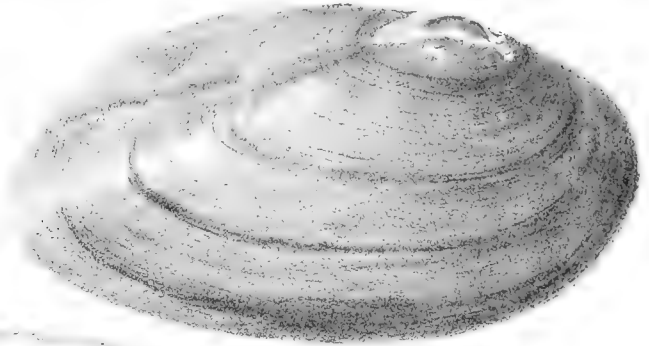
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109

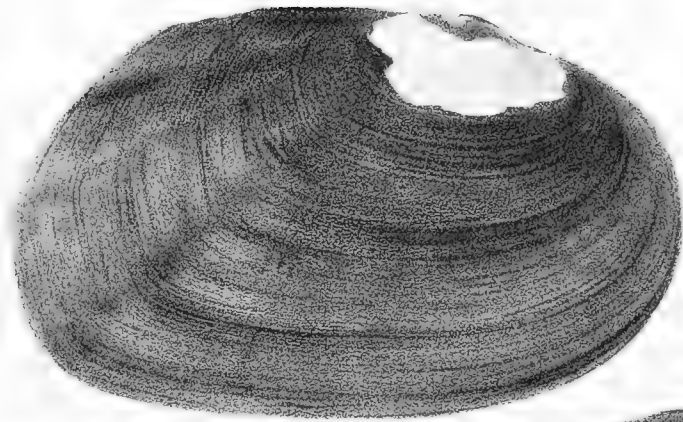


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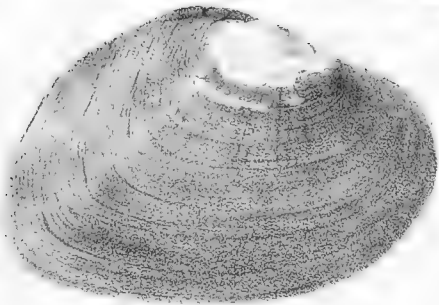


109. *Unio beaverensis*
110. *Unio numbus*
111. *Unio datus*

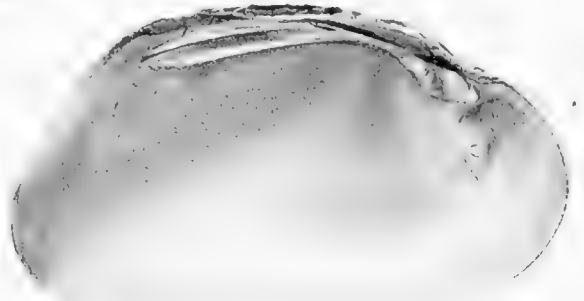
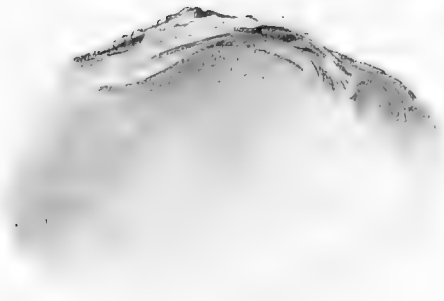
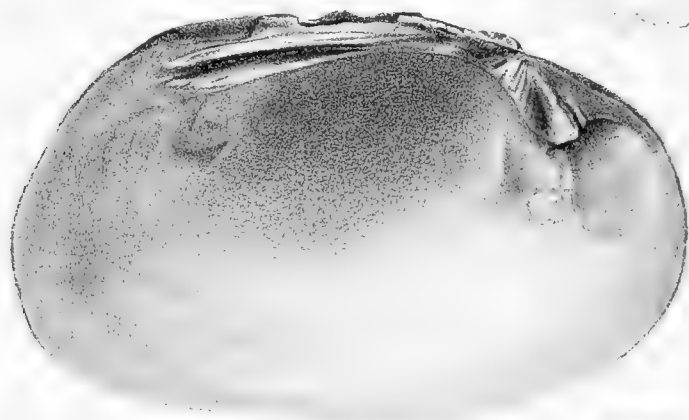
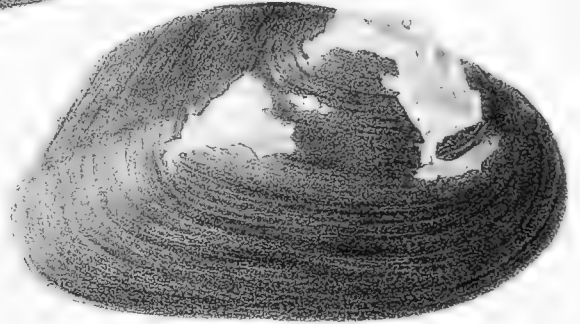
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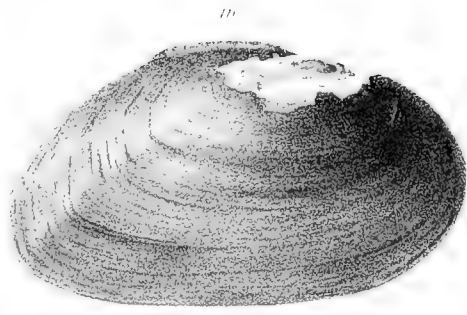
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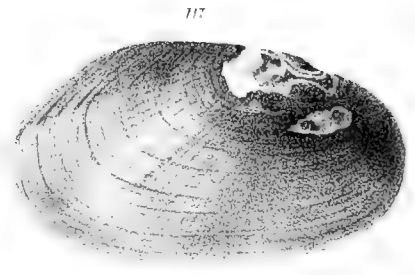
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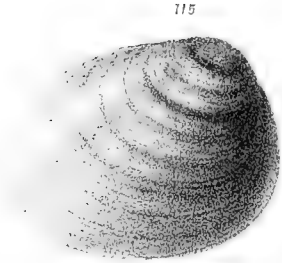
- 112. *Unio dorsatus*
- 113. *Unio humerosus*
- 114. *Unio Powensis*



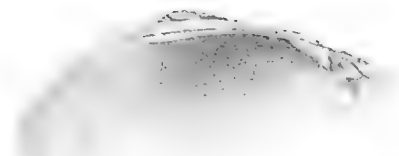
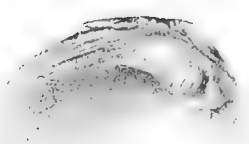
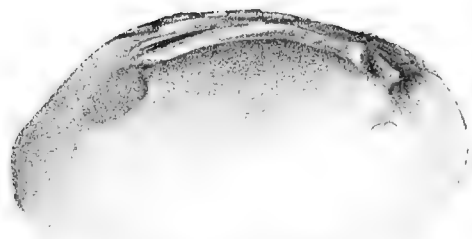
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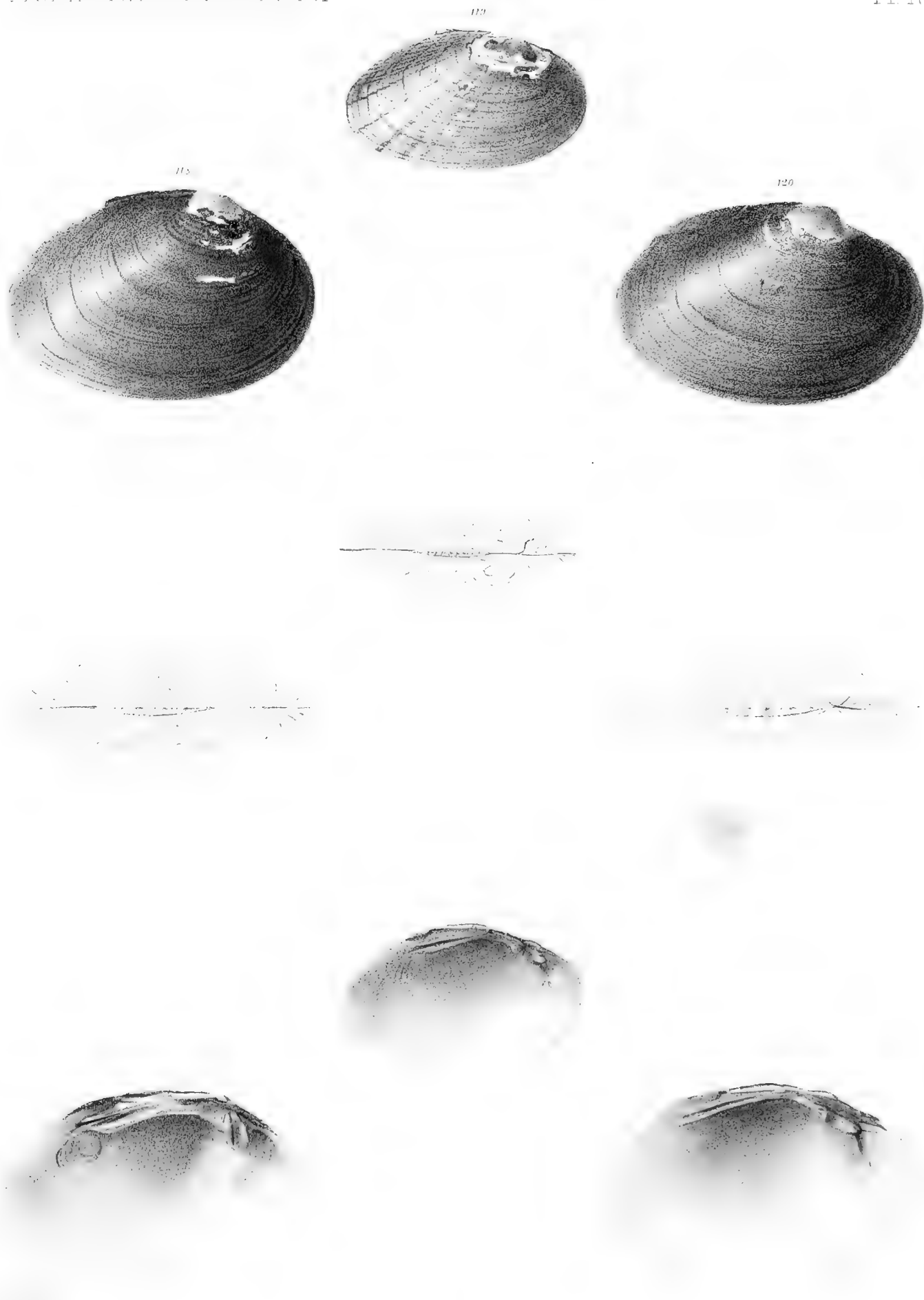
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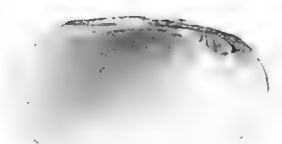
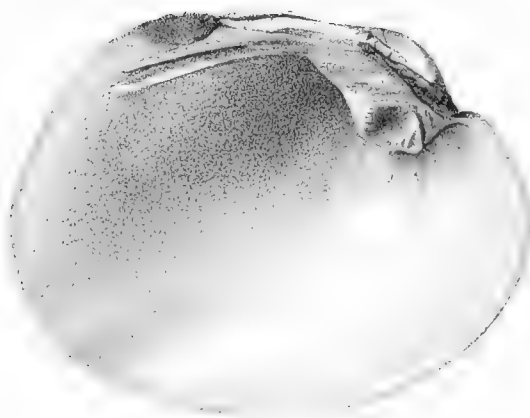
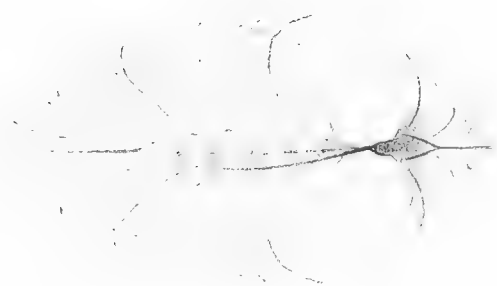
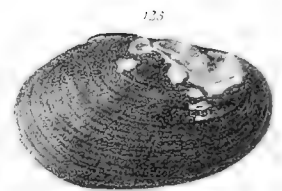
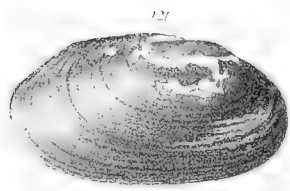
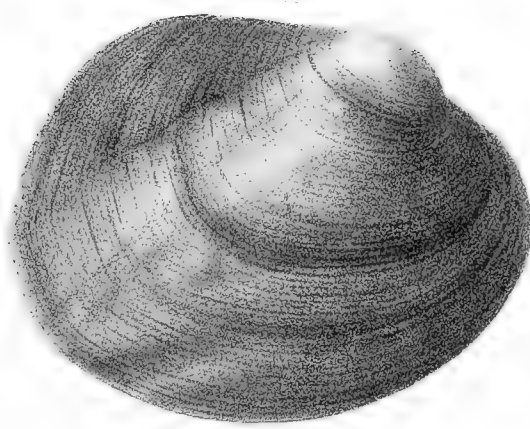


- 115 *Uro Murrayensis*
- 116 *Uro Pharensis*
- 117 *Uro geminatus*

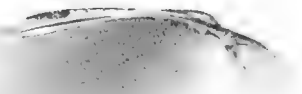
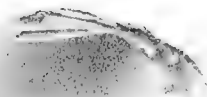
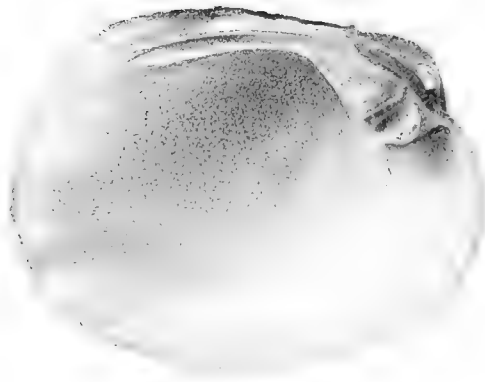
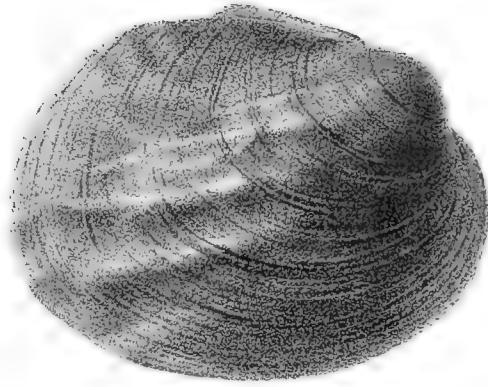


118. *Unio fascians*
 119. *Unio sparus*
 120. *Unio Copei*

F. Steyerl. del. H. J. G. f.

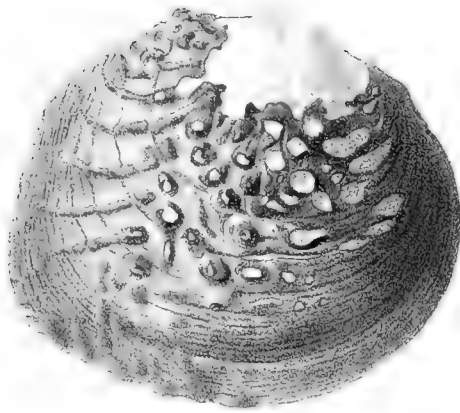


121 *Unio cylindrellus*
122 *Unio Brazosensis*
123 *Unio corvinus*



21 *Urio difficilis*
 25 *Urio lincicum*
 26 *Urio topkatusis*

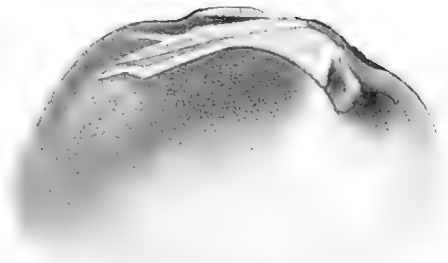
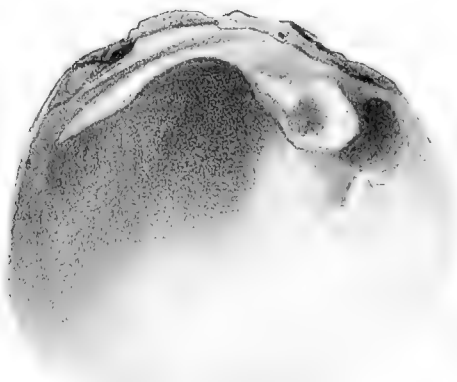
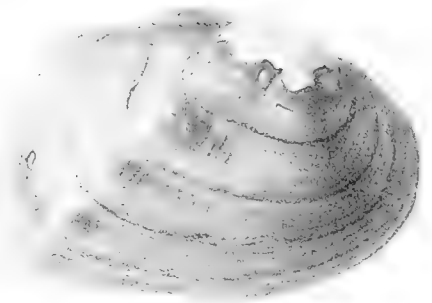
128



127

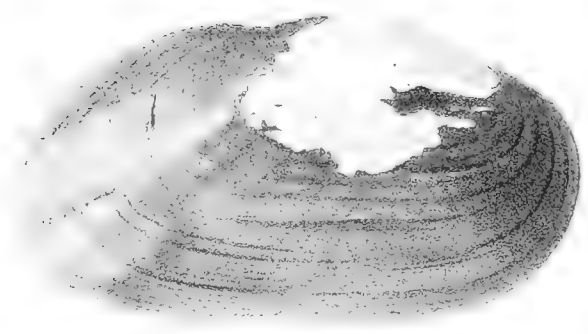


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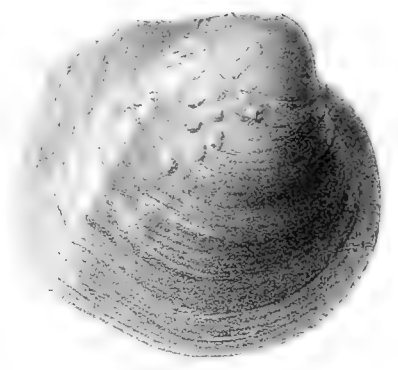


127 *Unio corvunculus*
128 *Unio vallatus*
129. *Unio planior*

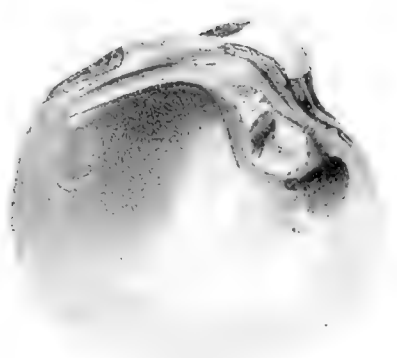
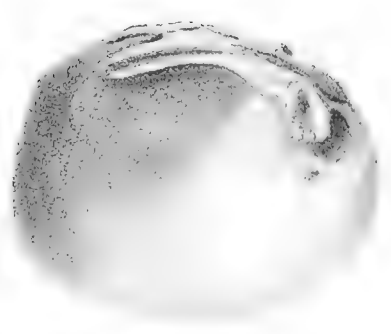
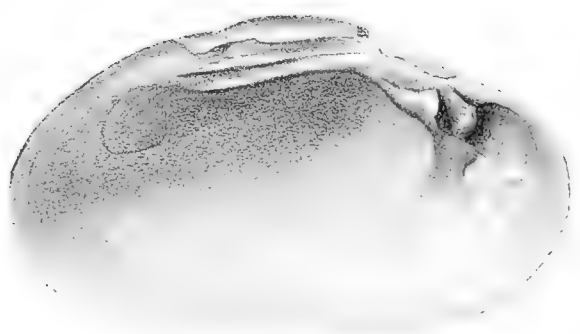
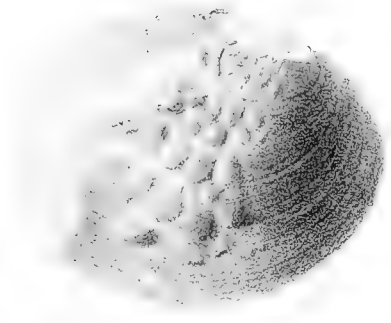
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132

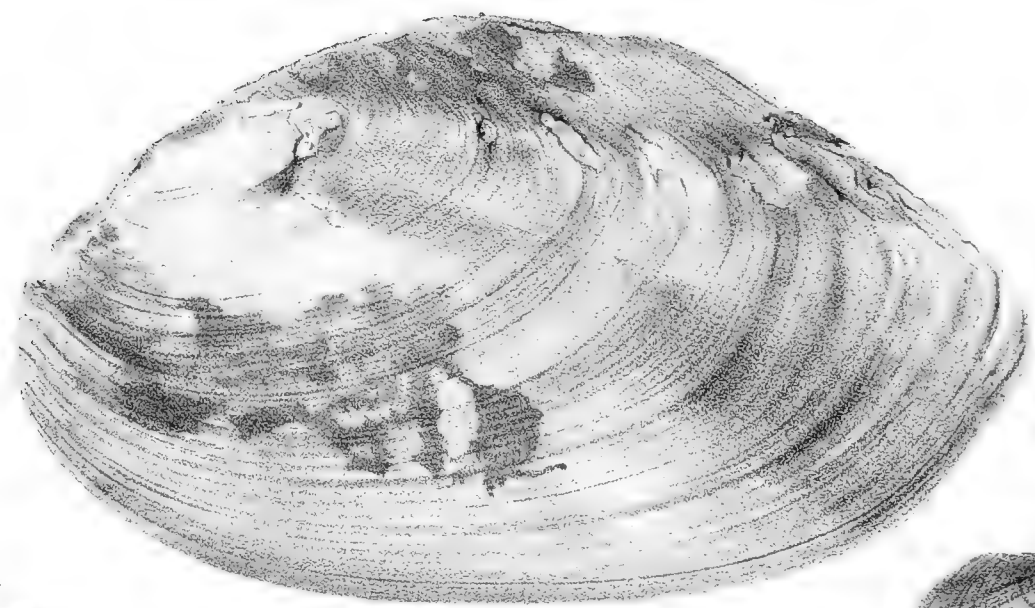


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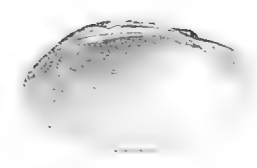
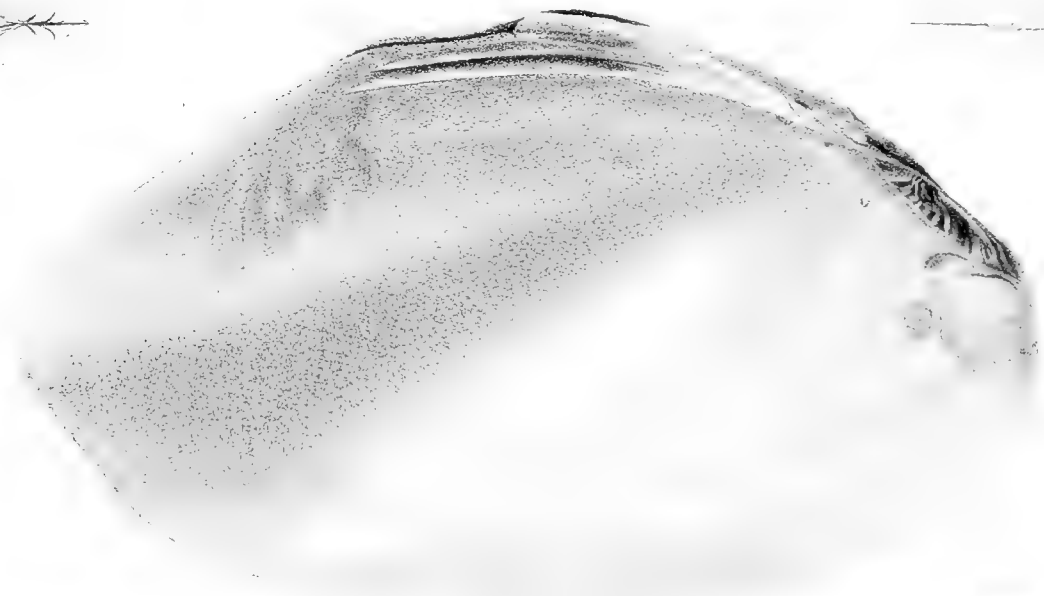
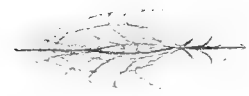
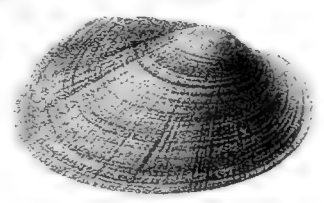
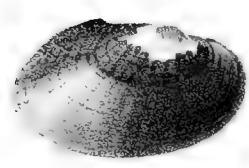


130 *Urio refulgens*
131 *Urio Streblii*
132 *Urio sphaericus*

131



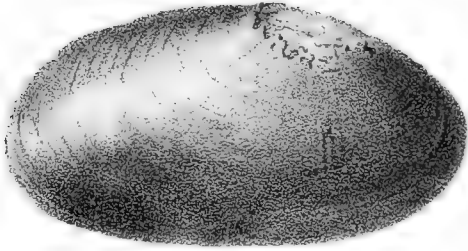
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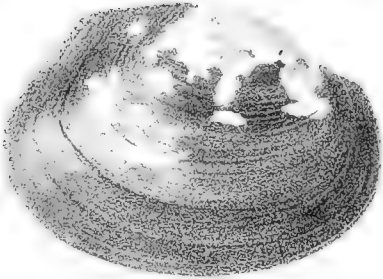
133 *Unio Veracruzensis*
134 *Unio Ortonii*
135 *Anodonta Strebelii*

132

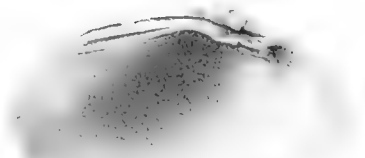
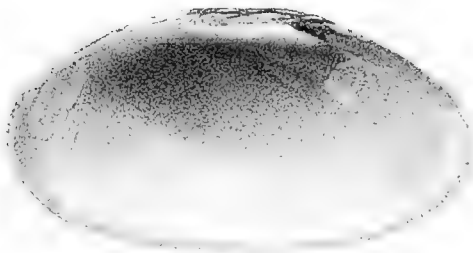
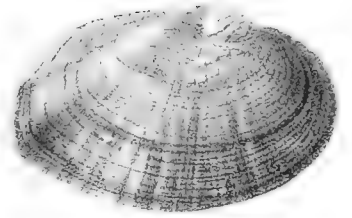
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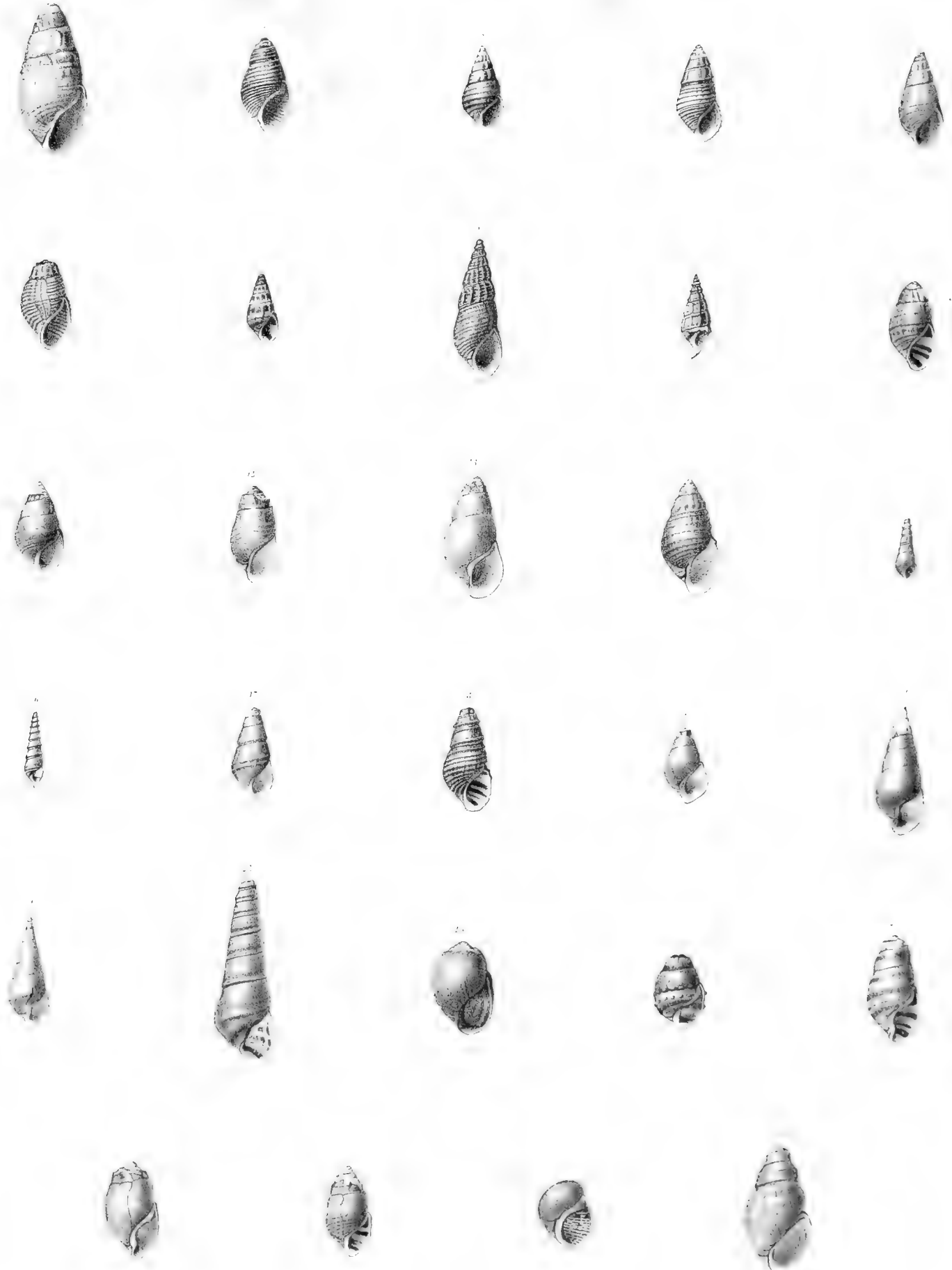
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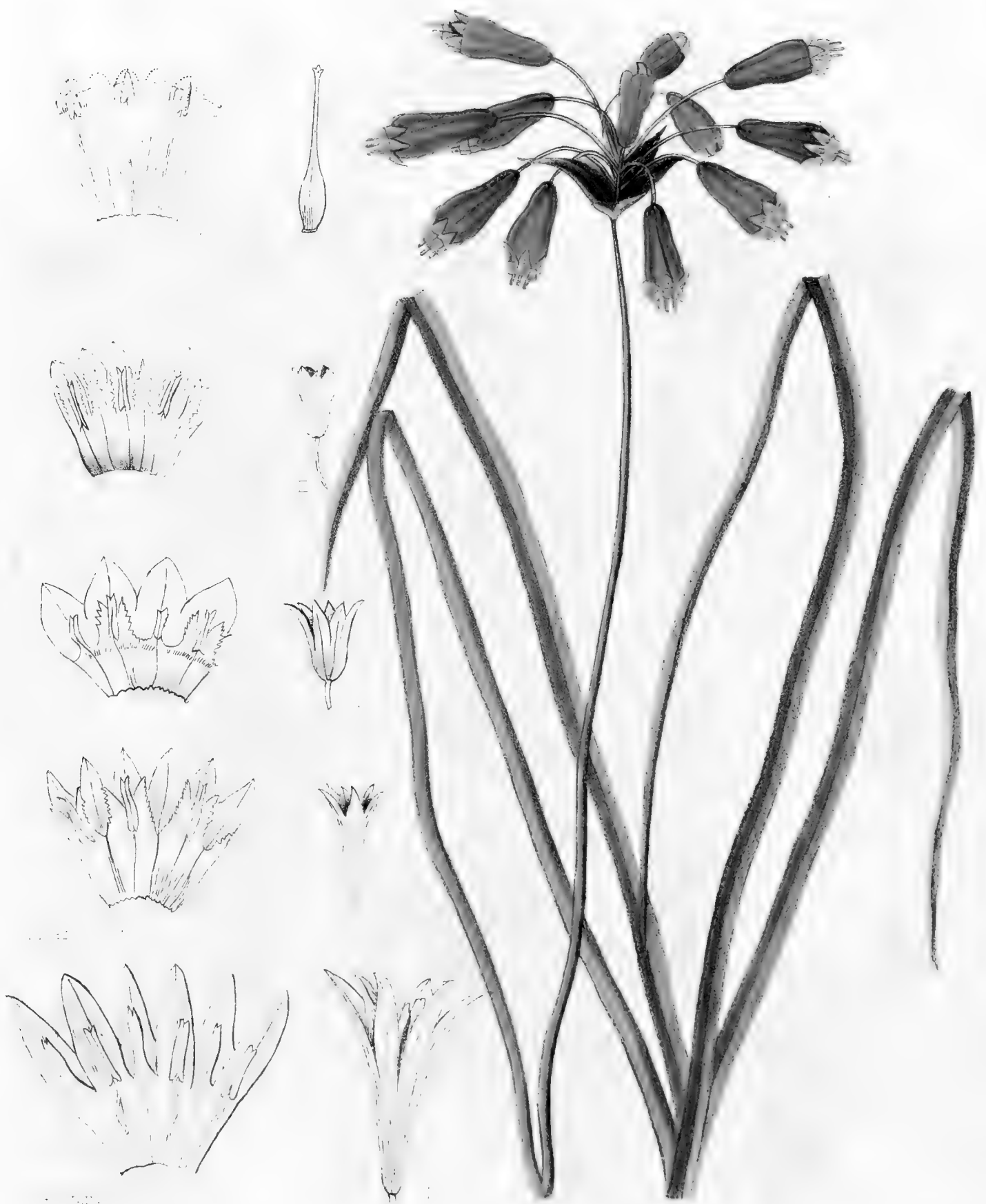
138



136. *Unio prunoides*.
137. *Anodonta Xapoensis*.
138. *Unio Chinensis*.



| | | | | | | | | |
|---|-------------------|-----------------------|----|---------------------|----------------------|----|---------------------|-------------------|
| 1 | <i>Goniobasis</i> | <i>Wheatleyi</i> | 10 | <i>Goniobasis</i> | <i>Lutcorella</i> | 20 | <i>Trypanostoma</i> | <i>castaneum</i> |
| 2 | " | <i>similis</i> | 11 | " | <i>Comesaugarsis</i> | 21 | " | <i>Wheatleyi</i> |
| 3 | " | <i>sulcata</i> | 12 | " | <i>contigua</i> | 22 | " | <i>terebilis</i> |
| 4 | " | <i>urata</i> | 13 | " | <i>Murrayensis</i> | 23 | <i>Lithasta</i> | <i>purpurra</i> |
| 5 | " | <i>Giesneri</i> | 14 | " | <i>granuloides</i> | 24 | " | <i>curta</i> |
| 6 | " | <i>Whitfieldensis</i> | 15 | " | <i>clavula</i> | 25 | " | <i>Wheatleyi</i> |
| 7 | " | <i>bifasciata</i> | 16 | " | <i>cochliaris</i> | 26 | " | <i>cylindrica</i> |
| 8 | " | <i>clathrata</i> | 17 | " | <i>venusta</i> | 27 | <i>Schuzestoma</i> | <i>Wheatleyi</i> |
| 9 | " | <i>Gouldiana</i> | 18 | " | <i>ornata</i> | 28 | <i>Arculosa</i> | <i>Downii</i> |
| | | | 19 | <i>Trypanostoma</i> | <i>uvulaforme</i> | 29 | <i>Paludina</i> | <i>Spillmanni</i> |







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