ANNALS

OF THE

LYCEUM OF NATURAL HISTORY.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY

OF

NEW YORK.

VOLUME XI.

New York:

1876.

GREGORY BROS.,
Printers, 34 Carmine Street,
NEW YORK.

OFFICERS OF THE LYCEUM.

1876.

President.

JOHN S. NEWBERRY.

Vice-Presidents.

T. EGLESTON. BENJ. N. MARTIN.

Corresponding Secretary.

H. CARRINGTON BOLTON.

Recording Secretary.

OLIVER P. HUBBARD.

Treasurer

JOHN H. HINTON.

Librarian.

LOUIS ELSBERG.

Committee of Publication

DANIEL S. MARTIN. JOHN S. NEWBERRY.
GEO. N. LAWRENCE. HENRY MORTON.
H. CARRINGTON BOLTON.

CONTENTS

OF THE

ELEVENTH VOLUME.

BY S. T. BARRETT.

BY W. G. BINNEY.

BY W. G. BINNEY AND THOMAS BLAND.

BY THOMAS BLAND.

BY H. CARRINGTON BOLTON.

BY WILLIAM BREWSTER.

BY M. C. COOKE.

BY AUGUSTUS R. GROTE.

LIST OF PLATES, VOL. XI.

Plate IV.

For details, see page 45 of text.

Plate V.

Plate VI.

For details, see page 45 of text.

Plate VII.

Plate VIII.

Plate IX.

Plate X.

Plate XI.

Ceraurus pleurexanthemus, Green. (enlarged).
A. Transverse section of thorax at 4th segment.
B. Interior of dorsal shell.
C. Longitudinal section at median line.
D. Longitudinal section of single segment.

For details, see page 162 of text.

Plate XII.

Fig. 1. *Bulimulus pallidior*, Sowb. Genitalia.
2. *Helix aspera*, Fér. "
3. " *spinosa*, Lea. "
4. *Limax montanus*, Ing. "
5. *Helix arrosa*, Gould. "
6. " *septemvolva*, Say. "
7. *Ariolimax Hemphilli*, Binney. "
8. *Helix crispata*, Fér. "
9. *Ariolimax Andersoni*, Cooper. "

Plate XIII.

Fig. A. *Helix ruficincta*, Newc. Genitalia.
B. *Zonites cerinoideus*, Anth. Dentition.
C. *Amphibulima Rawsonis*, Bland. Genitalia.
D. *Cæcilianella Gundlachi*, Pfr. Jaw.
E. *Orthalicus undatus*, Brug. (var.) Dentition.
F. *Helix Jamaicensis*, Chemn. Genitalia.
G. Same as D, enlarged.
H. Same, dentition, in part.
I. " " "
J. *Strophia incana*, Binn. Dentition.
K. *Helix Carpenteriana*, Bland. "

Plate XIV.

Fig. A. *Helix fringilla*, Pfr. * Dentition.
B. " *Jamaicensis*, Chemn. "
C. " *Studeriana*, Fér. "
D. *Achatinella venusta*, Mighels. "
E. *Amphibulima Rawsonis*, Bland. "
F. *Glandina truncata*, Say. "
G. *Achatinella textilis*, Fér. "
H. " *obesa*, Newc. " in part.

* See Plate XV, fig. A.

Plate XV.

* See Plate XIV, fig. A.

Plate XVI.

Plate XVII.

PLATE XVIII.

For details of Plates XII to XVIII, see pages 195 and 196 of text.

PLATE XIX.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY.

I.—*An Annotated List of the Birds of Utah.*

BY H. W. HENSHAW.

Read April 6, 1874.

THE following list is based largely upon material collected during the field season of 1872, while with the exploring and surveying party, in charge of Lieut. G. M. Wheeler, of the U. S. Engineers. In it are enumerated all the birds thus far known to have been taken or observed within the limits of the territory. To give it additional value as a formal list, those known to breed, whether from actual observations in the field, or from their known breeding range, are indicated.* Notes are also given respecting their relative abundance or scarcity. Of the 214 species given, 160 were either actually taken or noted by Dr. Yarrow and myself during the season. Of the remaining species, 25 not met with by us are contained in Mr. Allen's list of birds, collected in vicinity of Ogden, from September 1st to October 8th. I am also indebted to Mr. Ridgway for a list of the birds noted by him during his collecting trip in this locality, including many not contained in either Mr. Allen's paper or our own report, and also for assistance in the preparation of the list. It may be here stated that no collections have ever been made in Utah during the spring months, and thus many

---

* A star is prefixed to the names of those known to breed.

of the spring migrants have entirely escaped notice. This will account for the comparatively small number of species mentioned. An entire season's connected observations would doubtless add many to the number.

TURDIDÆ. The Thrushes.

*1. *Turdus fuscescens* Steph. Tawny Thrush. Summer resident. Common on Provo River in summer of 1869. (Ridgway.)

*2. *Turdus Swainsonii* Cab. Olive-backed Thrush. Very common. Inhabits the thickets of the mountain streams. (Ridgway.)

*3. *Turdus Pallasii* Cab., var. *Audubonii* Baird. Rocky Mountain Hermit Thrush. Less common than the preceding. Inhabits the pine region (Ridgway.) Ogden, September. (Allen.)

*4. *Turdus migratorius* L. Robin. Very common. Permanent resident.

*5. *Oreoscoptes montanus* (Towns.). Mountain Mocking Bird. An inhabitant of the valleys and plains. Most abundant in the neighborhood of settlements.

*6. *Harporhynchus crissalis* Henry. Red vented Thrush. Resident? Found breeding, and nest and eggs obtained by Dr. Palmer at St. George. Seen by me in same locality.

*7. *Galeoscoptes Carolinensis* (L.). Cat Bird. Very abundant. Inhabits the thickets.

CINCLIDÆ. The Water Ouzels.

*8. *Cinclus Mexicanus* Swains. Water Ouzel; Dipper. Very abundant. Inhabiting the rapid mountain streams. Permanent resident.

SAXICOLIDÆ. The Stone Chats.

*9. *Sialia Arctica* Swains. Rocky Mountain Blue Bird. Resident. Very abundant. "Found breeding at Salt Lake City and Antelope Island in May and June." (Ridgway.)

SYLVIIDÆ. The Sylvias.

*10. *Regulus calendula* (L.). Ruby-crowned Kinglet. Common resident. Found breeding high up in the mountains by Mr. Ridgway. Winters in the valleys.

PARIDÆ. The Titmice.

*11. *Lophophanes inornatus* (Gamb.). Very abundant. Resident. Breeds in mountains. Wintering in the cedars of the valleys.

*12. *Parus montanus* Gamb. Mountain Chickadee. Abundant. Resident in the mountains.

*13. *Parus atricapillus* (L.), var. *septentrionalis* Harris. Long-tailed Chickadee. Abundant and resident in vicinity of Provo. Apparently not very generally distributed. Not found in mountains.

* 14. *Psaltriparus plumbeus* Baird. Lead-colored Tit. Abundant, moving in large companies. Breeds in the mountains, and winters in the valleys.

SITTIDÆ. The Nuthatches.

* 15. *Sitta Carolinensis* (Gm.), var. *aculeata* Cassin. Slender billed Nuthatch. Apparently not common in the mountains. Met with on but one occasion by us. Resident.

* 16. *Sitta pygmæa* Vig. Pigmy Nuthatch. Same as preceding.

CERTHIIDÆ. The Creepers.

* 17. *Certhia familiaris* L., var. *Americana* Bonap. Brown Creeper. Rare in the pines of mountains in June. Probably breeds. (Ridgway.)

TROGLODYTIDÆ. The Wrens.

* 18. *Campylorhynchus brunneicapillus* (Lafr.). Cactus Wren. Rare in southern parts of state. Several individuals seen in vicinity of St. George, Oct. 27. Possibly breeds.

* 19. *Salpinctes obsoletus* (Say). Rock Wren. Exceedingly abundant in rocky localities.

* 20. *Catherpes Mexicanus* (Sw.), var. *conspersus* Ridgway. White-throated Rock Wren. Rather rare, but generally distributed. Permanent resident.

* 21. *Thryothorus Bewickii* (Aud.), var. *leucogaster* (Gould). Bewick's Wren. Not uncommon in southern part of territory in fall. Probably breeds.

* 22. *Troglodytes ædon* Vieill., var. *Parkmanii* (Aud.). Parkman's Wren. Abundant in the mountains. Permanent resident.

* 23. *Cistothorus stellaris* (Licht.). Short-billed Marsh Wren. Probably rare. Not taken, but evidence obtained of its breeding on borders of Utah Lake.

* 24. *Cistothorus palustris* (Wils.), var. *paludicola* Baird. Long-billed Marsh Wren. Exceedingly abundant in the marshes everywhere. Permanent resident.

MOTACILLIDÆ. The Wagtails.

25. *Anthus Ludovicianus* (Gmel.). Tit Lark. Abundant in the marshes. Winter resident.

SYLVICOLIDÆ. The Warblers.

26. *Helminthophaga ruficapilla* (Wils.). Nashville Warbler. Apparently common. Ogden, September. (Allen.)

* 27. *Helminthophaga Virginiæ* Baird. Virginia's Warbler. Frequent among the scrub oaks of foot-hills, breeding. (Ridgway.)

* 28. *Helminthophaga celata* (Say). Orange-crowned Warbler. Breeds in mountains from 7,000 to 9,000 feet high. (Ridgway.) Common in September. Ogden. (Allen.)

*29. *Dendroica æstiva* (Gm.). Yellow Warbler. Very common in neighborhood of settlements.

*30. *Dendroica Audubonii* (Towns.). Audubon's Warbler. Abundant, especially in fall. "Breeds in the pine region of the Wahsatch." (Ridgway.)

31. *Dendroica blackburniæ* (Gm.). Blackburnian Warbler. "Not common. Ogden. September." (Allen.)

32 (?). *Dendroica nigrescens* (Towns.). Black-throated Gray Warbler. Ogden. September. (Allen.)

*33. *Geothlypis Philadelphia* (Wils.), var. *Macgillivrayi* (Aud.). Macgillivray's Warbler. Common in the mountains.

*34. *Geothlypis trichas* (L.). Maryland Yellow-throat. Common. Distributed generally through the valleys of the territory, in the neighhood of water.

*35. *Icteria virens* (L.), var. *longicauda* (Lawr.). Long-tailed Chat. Common. Inhabiting indifferently the thickets of foot-hills and valleys.

36. *Myiodioctes pusillus* (Wils.). Wilson's Black Cap. Common as a spring and autumn migrant.

*37. *Setophaga ruticilla* (L.). Redstart. Rather common as an inhabitant of the mountains and valleys.

HIRUNDINIDÆ. The Swallows.

*38. *Progne subis* (L.). Purple Martin. Quite abundant in the mountains, frequenting aspen groves.

*39. *Petrochelidon lunifrons* (Say). Cliff Swallow. Very abundant in the mountains. Breeds in large colonies on the cliffs.

*40. *Hirundo horreorum* Bart. Barn Swallow. Common. Builds in barns, deserted shanties and caves.

*41. *Tachycineta bicolor* (Vieill.). White-bellied Swallow. Abundant. Generally distributed. Breeds in the aspen groves in company with the Martins.

*42. *Tachycineta thalassina* (Swains.). Violet-green Swallow. Somewhat rare. Breeds in limestone cliffs, with the White-throated Swift (*P. melanoleuca*) and the Cliff Swallow. (Ridgway.)

*43. *Cotyle riparia* (L.). Bank Swallow. Quite common at Provo. Breeds in the river banks, in company with the rough winged (*S. serripennis*).

44. *Stelgidopteryx serripennis* (Aud.). Rough-winged Swallow. Far more numerous than the preceding, with which it is associated.

VIREONIDÆ. The Greenlets.

45. *Vireo olivaceus* (L.). Red-eyed Vireo. Quite common at Ogden in September. (Allen.)

*46. *Vireo gilvus* (Vieill.), var. *Swainsonii* Baird. Warbling Vireo. Very abundant. Generally distributed. Found breeding, by Mr. Ridgway, from lowest valleys to altitude of 8,000 feet.

*47. *Vireo solitarius* Wils., var. *plumbeus* Coues. Solitary Vireo. Rather rare.

AMPELIDÆ. The Waxwings.

48. *Ampelis cedrorum* (Vieill.). The Cedar Bird. Rather common. Ogden, September. (Allen.)

MYIADESTINÆ. The Solitaires.

*49. *Myiadestes Townsendii* (Aud.). Townsend's Solitaire. Rather rare. Breeds on the mountains and winters in the cedar groves of valleys.

LANIIDÆ. The Shrikes, or Butcher Birds.

50. *Collurio borealis* (Vieill.). Great Northern Shrike. Of frequent occurrence in fall. Winter resident.

*51. *Collurio Ludovicianus* (L.), var. *excubitorides* (Swains.). White-rumped Shrike.* Quite common. Permanent resident.

TANAGRIDÆ. The Tanagers.

*52. *Pyranga Ludoviciana* (Wils.). Louisiana Tanager. Common.

FRINGILLIDÆ. The Finches, Sparrows, Buntings, etc.

*53. *Carpodacus frontalis* (Say). House Finch. Very abundant. Breeds in the valleys.

*54. *Carpodacus Cassinii* Baird. Cassin's Purple Finch. Abundant. Breeds on the mountains. (Ridgway.)

*55. *Chrysomitris pinus* (Wils.). Pine Finch. Breeds abundantly in pine regions of mountains. Resident. (Ridgway.)

*56. *Chrysomitris tristis* (L.) Yellow Bird. Common. Permanent resident.

*57. *Chrysomitris psaltria* (Say). Arkansas Finch. Quite common in southern part of territory late in fall. "Breeds sparingly near Salt Lake City and to the eastward." (Ridgway.)

58. *Leucosticte tephrocotis* Swains. Gray-crowned Finch. Obtained near Salt Lake City in winter. (Stansbury.)

*59. *Passerculus savanna* (Wils.), var. *alaudinus* Bon. Lark Sparrow. Abundant in marshy localities.

*60. *Poocaëtes gramineus* (Gm.) var. *confinis* Baird. Bay-winged Sparrow. Very abundant. Frequenting the plains.

*61. *Coturniculus passerinus* (Wils.), var. *perpallidus* Ridgway. Yellow-winged Sparrow. Rare.

*62. *Chondestes grammaca* (Say). Lark Bunting. Abundant everywhere on plains and benches.

*63. *Zonotrichia leucophrys* (Forst.). White-crowned Sparrow. Breeds abundantly in the mountains.

64. *Zonotrichia leucophrys* (Forst.), var. *intermedia* Ridgway. Exceedingly abundant in fall, and also a winter resident.

65. *Junco hyemalis* (L.). Black Snow Bird. Rare in fall. One specimen only taken in flock of *Z. intermedia.*

66. *Junco Oregonus* (Towns.). Oregon Snow Bird. Common in fall. Winters at least in southern part of territory.

*67. *Junco caniceps* (Woodh.). Red-backed Snow Bird. Tolerably common in the pines of Wahsatch mountains in the breeding season. (Ridgway.)

*68. *Poospiza bilineata* (Cass.). Black-throated Sparrow. Breeds abundantly in the vicinity of Salt Lake City. (Ridgway.)

*69. *Poospiza belli* (Cass.), var. *Nevadensis* Ridgway. Bell's Finch. Very common, especially as a winter resident, frequenting the sage brush plains.

*70. *Spizella socialis* (Wils.), var. *Arizonæ* Coues. Chipping Sparrow. Not common. "Breeds near Salt Lake City." (Ridgway.)

*71. *Spizella pallida* (Sw.), var. *Breweri* (Cass.). Brewer's Sparrow. Abundant. Permanent resident. Frequents the sage brush of the benches.

*72. *Melospiza melodia* (Wils.), var. *fallax* Baird. Western Song Sparrow. Abundant. Permanent resident.

*73. *Melospiza Lincolnii* (Aud.). Lincoln's Finch. Rather uncommon. Found breeding in Parley's Park, by Mr. Ridgway.

74. *Melospiza palustris* (Wils.). Swamp Sparrow. Very rare. A single specimen taken in extreme southern part of Utah, Oct. 23.

*75. *Passerella Townsendii* (Aud.), var. *schistacea* Baird. Slate-colored Sparrow. Abundant in the mountains. Breeds. (Ridgway.)

76. *Calamospiza bicolor* (Towns.). White-winged Blackbird. A single specimen obtained in Parley's Park in July, by Mr. Ridgway. A few seen by Dr. Yarrow in Snake Valley on the borders of Utah.

*77. *Hedymeles melanocephala* (Swains.). Black-headed Grosbeak. Very common.

*78. *Cyanospiza amœna* (Say). Lazuli Finch. Numerous in the valleys.

*79. *Pipilo maculatus* Sw., var. *megalonyx* Baird. Long-spurred Towhee. Common in the valleys and in chaparral of foot-hills.

*80. *Pipilo clorurus* (Towns.). Green-tailed Bunting. Common. Confined exclusively to the mountains.

81. *Pipilo Aberti* Baird. Abert's Towhee. Not rare in extreme southern portion of Utah. Probably breeds.

ALAUDIDÆ. The True Larks.

*82. *Eremophila alpestris* (Forst.). Shore Lark. Abundant. Permanent resident. Var. *chrysolœma* Wagler. Breeding and found sparingly in winter. var. *occidentalis*, McCall. Predominating in winter. (Ridgway.)

ICTERIDÆ. The Orioles and Blackbirds.

*83. *Molothrus pecoris* (Gm.). Cow Bunting. Not very common.

*84. *Dolichonyx oryzivorus* (L.). Bobolink. Rather common through the meadows.

*85. *Xanthocephalus icterocephalus* (Bonap.). Yellow-headed Blackbird. Very numerous. Breeding in large companies. Winters in small numbers.

*86. *Agelæus phœniceus* (L.). Redwinged Blackbird. Common resident.

*87. *Sturnella magna* (L.), var. *neglecta* (Aud.). Western Meadow Lark. Very abundant. Permanent resident.

*88. *Icterus Bullockii* (Swains.). Bullock's Oriole. Abundant. Frequenting the vicinity of the settlements.

*89. *Scolecophagus cyanocephalus* (Wagl.). Brewer's Blackbird. Most abundant of the Blackbirds. Permanent resident.

CORVIDÆ. The Crows and Jays.

*90. *Corvus corax* L., var. *carnivorus* Bartr. Raven. Very abundant. Permanent resident.

*91. *Corvus Americanus* Aud. Common Crow. Apparently not common. Seen in vicinity of Provo, in July. Of recent occurrence.

*92. *Picicorvus columbianus* (Wils.). Nutcracker. Very common in fall. Inhabits exclusively the mountains. Permanent resident.

*93. *Gymnokitta cyanocephala* Pr. Maximilian's Jay. Abundant in the cedars. Permanent resident.

*94. *Pica caudata* Flem., var. *Hudsonica* (Sabine). Magpie. Numerous and generally distributed. Resident.

*95. *Cyanura Stelleri* (Gmel.), var. *macrolophus* Baird. Long-crested Jay. Common. Found only in the mountains. Resident.

*96. *Cyanocitta Floridana* (Bartr.), var. *Woodhousei* Baird. Woodhouse's Jay. Numerous. Resident. Not found in the mountains.

97. *Perisoreus Canadensis* (L.), var. *capitalis* Baird. Gray Jay. Wahsatch mountains. (Allen.)

TYRANNIDÆ. The Tyrant Flycatchers.

*98. *Tyrannus Carolinensis* (L.). The King Bird. Quite common near the settlements.

*99. *Tyrannus verticalis* Say. Arkansas Flycatcher. Common.

*100. *Myiarchus cinerascens* Lawr. Rare in Parley's Park. (Ridgway.)

*101. *Sayornis Sayus* (Bon.). Say's Flycatcher. Rather common. Found in the valleys and rocky cañons. (Ridgway.)

*102. *Contopus borealis* (Swains.). Olive-sided Flycatcher. Rare in the mountains.

*103. *Contopus virens* (L.), var. *Richardsonii* (Swains.). Short-legged Pewee.

* 104. *Empidonax flaviventris* Bd., var. *difficilis* Baird. Western Yellow-bellied Flycatcher. Rare in pine woods of the mountains in July. (Ridgway.)

* 105. *Empidonax obscurus* (Swains.) Wright's Flycatcher. Common. Chiefly confined to the mountains.

* 106. *Empidonax Hammondii* Baird. Hammond's Flycatcher. Less common than the preceding. Occurring in the fall.

* 107. *Empidonax Trailii* (Aud.), var. *pusillus* Swains. Little Flycatcher. Especially abundant in the valleys, frequenting the willow thickets along the streams. "Breeds on the mountains up to 7,000 feet." (Ridgway.).

ALCIDINIDÆ. The Kingfishers.

* 108. *Ceryle alcyon* (L.). Kingfisher. Common on all the streams. Found by Mr. Ridgway in the mountains up to 7,000 feet.

CAPRIMULGIDÆ. The Goatsuckers.

* 109. *Chordeiles popetue* (Vicill.), var. *Henryi* Cass. Western Night Hawk. Very abundant in the valleys, and breeding in mountains up to 7,000 feet.

* 110. *Antrostomus Nuttalli* (Aud.). Nuttall's Whippoorwill. Same range as preceding, though much less numerous.

CYPSELIDÆ. The Swifts.

* 111. *Panyptila saxatilis* (Woodh.). White-throated Swift. Not uncommon. Builds its nest in holes in limestone cliffs.

TROCHILIDÆ. The Humming Birds.*

* 112. *Trochilus Alexandri* Bourc. and Muls. Alexander's Humming Bird. Numerous in the valleys. "Breeds up to 8,000 feet." (Ridgway.)

* 113. *Selasphorus platycercus* (Swains.). Broad-tailed Humming Bird. Common at Ogden in September. (Allen.) Exceedingly abundant in Wahsatch mountains, from May to August. (Ridgway.)

CUCULIDÆ. The Cuckoos.

114. *Coccyzus Americanus* (L.). Yellow-billed Cuckoo. Heard in July at Provo. As the species breeds abundantly in Arizona (Tucson, Bendire), as well as in Nevada and Sacramento Valley (Ridgway), it doubtless nests in portions of Utah also. The season at which it was noted renders this supposition most probable.

---

* *Stellula calliope* Gould. The Star-throated Hummer doubtless occurs in the mountains of Utah, since it was observed plentifully by Mr. Ridgway in the East Humboldt mountains, in the eastern portion of Nevada, in August and September.

PICIDÆ. The Woodpeckers.

* 115. *Picus villosus* (L.), var. *Harrisii* (Aud.). Harris' Woodpecker. Common. Confined generally to the mountains. Permanent resident.

* 116. *Picus pubescens* (L.), var. *Gairdneri* Aud. Gairdner's Woodpecker. Rare. Our specimen noted at Provo in November. A few individuals seen by Mr. Ridgway in Wahsatch mountains in July.

* 117. *Sphyrapicus thyroideus* (Cass.). Brown-headed Woodpecker; Black-breasted Woodpecker; Williamson's Woodpecker. Rare in the pine region. (Ridgway.)

118. *Melanerpes erythrocephalus* (L.). Red-headed Woodpecker. A single individual observed at Salt Lake City in June. (Ridgway.)

* 119. *Melanerpes torquatus* (Wils.). Lewis' Woodpecker. Not very common, but generally distributed. Resident.

* 120. *Colaptes Mexicanus* Swains. Red-shafted Flicker. Very common everywhere. Resident.

STRIGIDÆ. The Owls.

* 121. *Speotyto hypogœa* Bonap. Prairie Owl. Not very common. Resident.

* 122. *Bubo Virginianus* (Gmel.), var. *Arcticus* (Swains). Great horned Owl. Common in the wooded portions. Resident.

* 123. *Otus vulgaris* Flem., var. *Wilsonianus* (Less.). Long-eared Owl. Exceedingly abundant in the thick brush along the streams. Resident.

FALCONIDÆ. The Hawks, Eagles, etc.

* 124. *Falco communis* Gmel., var. *anatum* Bonap. Duck Hawk. Rather common. Resident.

* 125. *Falco polyagrus* Cassin. Prairie Falcon. Somewhat common on the plains. Resident. (Ridgway.)

* 126. *Hypotriorchis columbarius* L. Pigeon Hawk. Rather frequent. Generally distributed. Resident.

* 127. *Tinnunculus sparverius* (L.). Sparrow Hawk. Very common everywhere. Resident.

* 128. *Pandion haliaëtus* (L.), var. *Carolinensis* Gm. Fish Hawk. Rather rare. Resident.

* 129. *Haliaëtus leucocephalus* (Briss.). White-headed Eagle. Rather common. Resident.

* 130. *Aquila chrysaëtos* L., var. *Canadensis* (L.). Golden Eagle. Rather common in the mountains. Resident.

* 131. *Archibuteo lagopus* (Brunn.), var. *sancti-johannis* Penn. Black Hawk. Exceedingly abundant in the vicinity of Provo Lake in winter.

* 132. *Archibuteo ferrugineus* (Licht.). California Squirrel Hawk. The eggs of this species, together with the parent birds, collected in the vicinity of Ogden, are in the Smithsonian collection.

* 133. *Buteo borealis* (Gmel.), var. *calurus* (Cass). Common. Resident.

* 134. *Buteo Swainsonii* Bonap. Swainson's Buzzard. Very abundant in the mountains. (Ridgway.)

* 135. *Accipiter Cooperii* Bonap. Cooper's Hawk. Rare. Generally distributed, but chiefly seen in the mountains. Resident. (Ridgway.)

* 136. *Accipiter fuscus* (Gm.). Sharp-shinned Hawk. Common. Resident.

* 137. *Circus cyaneus* (L.), var. *Hudsonicus* (L.). Marsh Hawk. Exceedingly abundant in the low lands. Resident.

CATHARTIDÆ. The American Vultures.

? 138. *Cathartes Californianus* Cuv. Californian Vulture. Very rare. Two individuals seen near Beaver, Nov. 25.

* 139. *Cathartes aura* (L.). Red-headed Vulture; Turkey Buzzard. Common. Resident.

COLUMBIDÆ. The Doves or Pigeons.

* 140. *Zenaidura Carolinensis* (L.). Carolina Dove. Abundant in the valleys. Breeds up to 8,000 feet. (Ridgway.)

TETRAONIDÆ. The Grouse.

* 141. *Tetrao obscurus* Say. Dusky Grouse. Abundant. Resident. Confined exclusively to the mountains.

142. *Centrocercus urophasianus* (Bonap.). Sage Hen. Very abundant, principally upon the plains, but found in the valleys of the mountains up to 7,000 feet.

* 143. *Pediocætes phasianellus* (L.), var. *columbianus* (Ord.). Sharp-tailed Grouse. A single company seen about the middle of September in grassy foot-hills near Meadow Creek. (Yarrow.) Resident.

* 144. *Bonasa umbellus* (L.), var. *umbelloides* (Douglas). Ruffed Grouse. Occurs sparingly in the mountains near Ogden. (Allen.) Also near Salt Lake City. (Ridgway.) Resident.

PERDICIDÆ. The American Quails.

* 145. *Ortyx Virginianus* (L.). Quail; Bob White. Introduced near Ogden and Provo. (Allen.)

* 146. *Lophortyx Californianus* (Shaw). Californian Quail. Introduced near Ogden. (Allen.)

* 147. *Lophortyx Gambelii* Nutt. Gambel's Quail. Very abundant in southern part of territory. Resident.

CHARADRIIDÆ. The Plovers.

* 148. *Ægialitis vociferus* (L.). Kildeer Plover. Very numerous. Resident.

* 149. *Ægialitis nivosus* Cassin. Snowy Plover. Very abundant on shores of Salt Lake in May. (Ridgway.)

SCOLOPACIDÆ. The Snipes, Sandpipers, etc.

150. *Gallinago Wilsonii* (Temm.). English Snipe. Abundant. Found in Parley's Park during the entire summer. Probably breeds. (Ridgway.)

151. *Macrorhamphus griseus* (Gm.). Red-breasted Snipe. Abundant during the fall. Probably breeds, as it was obtained at Provo in July, in full summer dress.

152. *Tringa alpina* L., var. *Americana* Cass. Red-backed Sandpiper. Common at Ogden in September. (Allen.)

153. *Actodromas minutilla* (Vieill.). Least Sandpiper. A few seen about July 26, at Provo. Not common at Ogden. (Allen.)

154. *Ereunetes pusillus* L. Semipalmated Sandpiper. Abundant during the fall migrations.

155. *Symphemia semipalmata* (Gmel.). Numerous on south shore of Salt Lake. Breeding. (Ridgway.)

156. *Totanus melanoleuca* (Gmel.). Greater Yellow Legs. Abundant during the fall migration.

157. *Totanus flavipes* (Gmel.). Summer Yellow Legs. Not common. Ogden, September. (Allen.)

158. *Rhyacophilus solitarius* Bonap. Not common. Ogden, September. (Allen.)

* 159. *Tringoides macularius* (L.). Spotted Sandpiper. Common along the streams and lakes.

* 160. *Actiturus Bartramius* (Wils.). Bartram's Field Plover. Rather common on Kamas prairies in July. (Ridgway.)

* 161. *Numenius longirostris* Wils. Long-billed Curlew. Breeding abundantly on shore and islands of Salt Lake, in May and June. (Ridgway.) Abundant during the fall migration.

RALLIDÆ. The Rails, Gallinules and Coots.

162. *Rallus elegans* Aud. King Rail. Said to be uncommon. Ogden. (Allen.)

* 163. *Rallus Virginianus* L. Virginia Rail. Common in the marshes. Resident.

* 164. *Porzana Carolina* (L.). Carolina Rail. Not so common as preceding. Winters?

* 165. *Porzana Jamaicensis* (Gm.). Little Black Rail. Occasional in summer. Parley's Park, June, July and August. (Ridgway.)

* 166. *Fulica Americana* Gm. Coot. Very abundant. Resident.

PHALAROPIDÆ. The Phalaropes.

* 167. *Phalaropus Wilsonii* Sab. Wilson's Phalarope. Common at Salt Lake.

RECURVIROSTRIDÆ. The Avocets and Stilts.

*168. *Recurvirostra Americana* Gm. American Avocet. Abundant. Breeding at Salt Lake in June. (Ridgway.)

*169. *Himantopus nigricollis* Vieill. Black-necked Stilt. Same as preceding.

GRUIDÆ. The Cranes.

*170. *Grus Canadensis* (L.). Sand Hill Crane. Not uncommon.

TANTALIDÆ. The Ibises.

171. *Tantalus loculator* L. Wood Ibis. Rather common visitant.

*172. *Ibis Ordii* Bonap. Glossy Ibis. Common.

*173. *Ibis alba* (L.). White Ibis. A few seen at Ogden, Sept. (Allen.) Probably breeds in considerable numbers.

ARDEIDÆ. The Herons.

*174. *Ardea herodias* L. Great Blue Heron. Common. Resident.

175. *Herodias egretta* (Gmel.). White Heron. Not uncommon in the fall.

*176. *Botaurus lentiginosus* Steph. Bittern. Common in all parts of the territory. Resident.

*177. *Nyctiardea grisea* (L.), var. *nævia* (Bodd.). Night Heron. Very common. Resident.

ANATIDÆ. The Swans, Geese and Ducks.

178. *Cygnus Americanus* Sharpl. Whistling Swan. Jordan River, March. (Stansbury.)

179. *Anser hyperboreus* Pal. Snow Goose. Common winter resident.

*180. *Branta Canadensis* (L.). Canada Goose. Immense flocks pass through the territory in fall, and large numbers winter.

*181. *Anas boschas* L. Mallard. One of the most common ducks. Breeding abundantly, and wintering in large numbers.

182. *Anas obscurus* Gm. Black Duck. A few seen at Rush Lake in Nov. (Yarrow.)

183. *Dafila acuta* (L.). Pin-tail. Common in fall.

*184. *Nettion Carolinensis* (Gm.). Green-winged Teal. Very abundant.

185. *Querquedula discors* (L.). Blue-winged Teal. Not nearly as abundant as preceding. Perhaps breeds.

*186. *Querquedula cyanoptera* (Vieill.). Red-breasted Teal. Common summer resident. Breeding abundantly in the marshes.

187. *Spatula clypeata* (L.). Shoveller. Very common in the fall.

*188. *Chaulelasmus streperus* (L.). Gadwall. Very abundant. But few winter.

*189. *Mareca Americana* (Gm.). American Widgeon. Abundant.

190. *Aix sponsa* (L.). Summer Duck. Common. Ogden, Sept. (Allen.)

191. *Fulix marila* (L.). Big Black Head. Common in fall.

192. *Fulix affinis* (Eyton). Little Black Head. Autumn migrant. Utah Lake. (Captain J. H. Simpson.)

*193. *Fulix collaris* Donovan. Ring-necked Duck. Common.

194. *Aythya ferina* (L.), var. *Americana* (Eyton). Numerous in fall.

195. *Bucephala Americana* Bon. Golden Eye. Abundant in fall and winter.

196. *Bucephala islandica* (Bd.). Barrow's Golden Eye. Perhaps not uncommon in fall and winter. A pair were taken in Provo River, December 1.

197. *Bucephala albeola* (L.). Butter Ball. Very common in fall and winter.

*198. *Erismatura rubida* (Wils.). Ruddy Duck. Common.

199. *Mergus merganser* L., Cass. Sheldrake.

*200. *Mergus serrator* L. Red-breasted Merganser. Abundant.

201. *Lophodytes cucullatus* (L.). Hooded Merganser. Common in fall.

PELECANIDÆ. The Pelicans.

*202. *Pelecanus erythrorhynchus* Gm. American Pelican. Common upon the lakes. Although no longer breeding upon Great Salt Lake, it undoubtedly does so within the limits of the territory.

PHALACROCORACIDÆ. The Cormorants.

*203. *Graculus dilophus* (Sw.). Double Crested Cormorant; Black Shag. Common at Salt Lake.

LARIDÆ. The Gulls and Terns.

*204. *Larus Californicus* (Lawr.). California Herring Gull. Common summer resident. (Ridgway.)

205. *Larus Delawarensis* Ord. Ring-billed Gull. Rather common Winter resident.

206. *Chrœcocephalus Philadelphia* (Ord). Ogden, Oct. 1. (Allen.)

207. *Xema Sabinei* (Sab.). Fork-tailed Gull. One taken at Ogden, Sept. 28. (Allen.)

*208. *Sterna regia* Gambel. Royal Tern. Not uncommon in summer. (Ridgway.)

*209. *Sterna Forsteri* Nutt. Forster's Tern. Abundant. "Breeds in marshes of Salt Lake." (Ridgway.)

*210. *Hydrochelidon fissipes* (L.). Short-tailed Tern. Rather uncommon. "Breeds in marshes of Salt Lake." (Ridgway.)

COLYMBIDÆ. The Loons.

211. *Colymbus torquatus* Brunn. Great Northern Diver. Probably not of infrequent occurrence.

PODICIPIDÆ. The Grebes.

212. *Podiceps occidentalis* Lawr. Western Grebe. Common. Probably breeds.

213. *Podiceps cornutus* (Gm.). Horned Grebe. Rather common in fall.

214. *Podilymbus podiceps* (L.). Carolina Grebe. Common in fall.

II.—*Notes on the Coal Measures of Beaver County, Pennsylvania.*

BY J. C. WHITE.

Read March 16th, 1874.

THE observations on which this paper is based have been confined almost entirely to the northern half of Beaver county, and that portion which lies along the Beaver River. This river flows along a nearly central line through this part of the county, and empties into the Ohio at Rochester. Its banks are frequently precipitous and afford excellent exposures of the strata.*

The city of New Brighton is on the left bank of the river, about three miles from its mouth, and almost directly opposite is the town of Beaver Falls, Seven miles above New Brighton, at the junction of the Pittsburg and Erie railroad with the Pittsburg, Fort Wayne and Chicago railroad, we find the village of Homewood. The line of section begins at Homewood and follows the Beaver River to Rochester. The strata here exposed extend from the Mahoning sandstone to the base of the Tionesta sandstone, and dip south-

* Beaver county occupies a nearly central position in the tier of counties which form the western border of Pennsylvania. The Ohio River, flowing nearly due west through the greater part of the county, divides it into two subequal portions, a northern and a southern; the former of these abuts against the Ohio state line, the latter against that of West Virginia, at the narrow end of the "Pan Handle." The Beaver River flows into the Ohio in a nearly southerly course, and thus divides the northern half of the county into an eastern and a western portion.

eastwardly at the rate of little more than twenty-five feet per mile.

The section as obtained along this line is as follows:

21.	Sandstone, "Mahoning"	30–75	feet.	
20.	Shale	0–8	"	
19.	*Coal*, "Upper Freeport"	2–4	"	
18.	Fireclay	3–4	"	Interval 25–68 feet.
17.	Limestone "Freeport"	2½–4	"	
16.	Shale and Sandstone	20–60	"	
15.	*Coal*	1¼–1½	"	
14.	Shale	15–20	"	
13.	*Coal*, "Lower Freeport"	1¼–4	"	
12.	Shale and Sandstone	25–30	"	
11.	*Coal*, "Kittanning"	2–3	"	
10.	Shale	25–30	"	Interval 53–79 feet.
9.	Shale	15–25	"	
8.	Limestone, "Ferriferous"	1–8	"	
7.	Shale	8–10	"	
6.	Sandstone	4–6	"	
5.	*Coal*, "Clarion"	1¼–1½	"	
4.	Sandstone and shale	20–25	"	
3.	*Coal*, "Brookville"	6 in–2	"	
2.	Shale	15–20	"	
1.	Sandstone, "Tionesta"	60–70	"	

The Mahoning Sandstone is usually a massive rock, and is seen capping the hills in the vicinity of New Brighton, where it rests directly upon the Upper Freeport coal. The decomposing pyrites of the coal, acting upon the base of this stratum, forms alum, so that in some portions of the county the mass is known as the "Alum Rocks." This sandstone shows the fantastic forms of weathering so characteristic of it. It presents marked irregularities in thickness, and its composition is not persistent. At some localities it occurs in sandstone bluffs seventy-five feet high, while in others it is simply a mass of shale.

The Upper Freeport Coal, owing to its impurity, as well as to its abrupt variations in thickness, is of little importance. It contains a very large proportion of pyrites, and within a few hundred feet will vary from one to three feet in thickness. It is occasionally mined for domestic use by those living on the hills near its outcrop, and it is the source of supply for some distance along the Darlington road. It is rarely used where other coals are accessible.

The Freeport Limestone is here a pure white limestone, and very persistent. It would burn into lime of excellent quality, but is not employed for that purpose, or indeed for any other. The original settlers discovered the impure Ferriferous limestone and burned that. Their descendants have continued to use that rock in preference to the Freeport; for what reason, it is difficult to say.

The lower portion of No. 16 is fossiliferous, and yielded large numbers of individuals belonging to the following species: *Productus semi-reticulatus*, *P. Nebrascensis*, *P. costatus* (?), *P. Prattenianus*, *Spirifer plano-convexus*, *Athyris subtilita*, and spines of *Zeacrinus mucrospinus*.

The thin *coal*, No. 15, is a persistent member of the group, but is not mentioned in Rogers' report. It is of fair quality.

The shale No. 14 is quite rich in vegetable remains, principally of the genera *Pecopteris*, *Sphenophyllum*, *Neuropteris*, *Hymenophyllites*, *Calamites*, and *Sigillaria*.

The Lower Freeport Coal nowhere attains workable thickness along the line of section, excepting at one locality on Trough Run, where it suddenly expands to four feet, and becomes an impure cannel of little value.

The Kittanning Coal is the important bed in this portion of the county, and is mined somewhat extensively, not only to supply the home demand, but also for shipping. It is quite pure, is an excellent gas coal, and cokes readily. It is rarely more than thirty-two inches thick, and never more than three feet, in this region, yet owing to its quality it is profitably mined for shipment on a large scale. At Clinton, ten miles above New Brighton, the Crawford mine yields two hundred tons daily, and there are others almost as productive. In the vicinity of New Brighton and Beaver Falls, the seam shows the same thickness and is of equally good quality, but is mined neither extensively nor intelligently. No more is taken out than suffices to supply the needs of those mining; and when from any cause it becomes inconvenient to work at an opening any longer, it is deserted and allowed to fall down, to the great detriment of the property.

The Ferriferous Limestone is of interest, both because of its fossils and of the variations in its thickness and quality. On Trough Run it is only eight inches thick; two miles below, on Rippling Run, it is eight feet; while on the other side of the river, and directly opposite the latter locality, it is only one foot. Traced northward, fifteen miles from New Brighton, it is found to be twenty-five feet thick at Wampum. Opposite the bridge over Block House Run, near New Brighton, it is seven feet thick. From it, at this locality, a very good hydraulic cement was manufactured by the Pittsburg and Erie Canal Co., which was used by them in building their locks. At Wampum it is extensively quarried to supply the iron-furnaces at Pittsburg, Alleghany, and other cities in the vicinity. Everywhere it is richly fossiliferous, and from various localities the following species have been obtained: *Productus Nebrascensis*, *P. semi-reticulatus*, *P. longispinus*, *Spirifer lineatus*, *Spirifer* sp. (?), *Athyris subtilita*, several species of *Platyceras*, *Pleurotomaria turbinella*, *P. Grayvilliensis*, *P. perhumerosa*, *Polyphemopsis peracuta*, *Polyphemopsis* sp. (?), *Euomphalus rugosus*, *Lophophyllum proliferum*.

The Clarion Coal is finely exposed in the vertical cliffs above New Brighton and below Trough Run, presenting a black band, which is conspicuous for some distance along the river. It never exceeds eighteen inches in thickness, but is said to be of remarkably fine quality.

The Brookville Coal is traceable with some difficulty. In a small gully, emptying into the Beaver River, opposite New Brighton, this seam is double, the two parts separated by four feet of shale. The bed is of no economic value.

The *Shale*, No. 7, is fossiliferous. On Trough Run I obtained from this stratum the following species: *Productus*

Nebrascensis, *Chonetes mesoloba*, *Hemipronites crassus*, *Spirifer plano-convexus*, *Athyris subtilita*, *Aviculopecten Whitei* (?), *Nucula ventricosa*, *Nucula* (?) *anodontoides*, *Nuculana bellistriata*, *Bellerophon Montfortianus*, *Bellerophon Stevensanus*, *Bellerophon percarinatus*, *Pleurotomaria Grayvilliensis*, *Pleurotomaria carbonaria*, and *Nautilus occidentalis*, together with many fragments of crinoidal stems. On a small run entering the Beaver, about three miles above New Brighton, the lower portion of this stratum is made up almost entirely of *Aviculopecten Whitei*, and attached to these shells are *Spirorbis carbonarius* in countless numbers. The latter fossil occurs at this locality only. This shale seems to disappear entirely where the overlying limestone attains considerable thickness.

In the *Shale* No. 3 are vast numbers of vegetable remains, for the most part so imperfect that anything beyond mere generic determination is impossible.

The Tionesta Sandstone is a very hard, coarse, white rock. It is quarried extensively at Homewood, by the Pennsylvania Railroad Co. It is there fifty feet above the river, but passes under the river opposite New Brighton.

III.—*Observations on some Irregularities of the Floor of the Coal Measures of Eastern Kentucky.*

By R. P. STEVENS.

Read October 27, 1873.

During a late trip to the Cumberland Mountains, I approached them via the Knoxville Branch of the Kentucky Southern Railroad.

At Mount Vernon, Rockcastle Co., and in that vicinity, the sub-carboniferous limestone is 300 feet thick (by estimate). Thence the railroad runs eastward to Rockcastle River, and after reaching the summit at the head of Rough Rock Creek (a tributary of the former) has a descending grade eastward of fifty feet to the mile.

In the first five miles, the limestone, which at Mount Vernon is 250 feet above the grade, has at Pine Hill descended to the grade, and even below it.

At Pine Hill is the first workable coal. The coal measures here rest upon the sub-carboniferous limestone without the intervention of the conglomerate.

Immediately across the first intervening valley the limestone rises above the grade of the railroad 30 feet; and piled upon it are some eighty or ninety feet of coarse siliceous conglomerate, reaching to the tops of the high hills bordering the railroad. Here, at the 136th mile post, is an anticlinal. The eastward dip of the limestone is $2\frac{1}{2}°$, and the westward dip $50°$; and through it are cut two tunnels.

Passing on eastward to the 137th mile post, the limestone has sunk beneath the railroad, and the conglomerate is at the grade. Half a mile farther, the conglomerate is replaced in part by sandstone.

At the 138th mile-post, and at the first crossing of Rough Rock Creek, the limestone is in the bed of the creek; over it are ten to twelve feet of sandstone, then thirty to forty feet of black and purple shale, with a few feet of sandstone; and over these, coal measures. The lower vein of coal appears a little farther on, in the left bank of the stream.

At the 139th mile post, sandstone replaces the colored shales; but in the distance of a few rods they come in again and continue to Livingstone, where sandstone appears with thin conglomerate bands, in place of the large volume of conglomerate.

At the termination of the railroad, a few rods beyond the depot, sands and pebbles begin to be cemented with lime; and at Goodin's Mine, limestone for ninety feet replaces the conglomerate.

Across Pond's Hollow, the limestone rests upon a sandstone, in its normal condition.

All these changes take place in the distance of five miles. We have here the evidence of the following series of conditions;—first, two miles of strong currents, bringing in coarse gravel; next, gentler currents for one mile, bringing in fine sand; then a quiet bayou, a mile broad, receiving deposits of carbonaceous mud; then for another mile, stronger currents again, carrying sands and pebbles; and finally at the Rockcastle River, tearing up the limestone and giving instead of it a mixed deposit of lime, sands and pebbles. All these changes, looking at them with reference to the coal above, are in one common horizon.

IV.—*On the Genitalia and Lingual Dentition of Pulmonata.*

By W. G. Binney.

With Plates I–VI.

Read May 25th, 1874.

It will be noticed that in the following descriptions of the genital system, I have followed Dr. Leidy (Terr. Moll. U. S., I) in applying the terms *ovary* and *oviduct.* I am aware of other names being applied to the organs by other authors.

I take this opportunity of strongly urging upon conchologists the study of the genital system as a most reliable specific character, in the terrestrial Pulmonata.

For the species extralimital to the United States, I am indebted to my friend, Mr. Thomas Bland, as well as for their identification. The most interesting of them were collected by Prof. Orton, in his late journey in northern Peru.

Limax flavus, Linn.

A few days since a colony of this species was discovered by a friend in the cellar of his house in Burlington, N. J.

The specimens agree perfectly with the description and figures in the "Terrestrial Mollusks of the United States." The genital system is also the same as figured by Leidy in the same work, and by Moquin-Tandon (Moll. Terr. et Fluv. de France). There can be no doubt, therefore, of the identity of the species.

The figure of the dentition of this species given by me in L. and F. W. Shells N. A., I, p. 63, f. 105, is drawn from some other species.

The true *L. flavus* now examined by me has central teeth with subobsolete side cusps, bearing no cutting points, central cusp short, with a short, bluntly pointed cutting point. Laterals like the centrals, but unsymmetrical. Marginals aculeate, the extreme ones bifurcated. Teeth in the lingual examined over 60–1–60.

The figure by Dr. Leidy published by Mr. Bland and myself (Ann. Lyc. Nat. Hist. of N. Y., IX, 285) though unsatisfactory, was, no doubt, drawn from this species.

The lingual membrane examined by me agrees with the figures given by Heynemann* of the dentition of *L. flavus.*

Limax agrestis, Linn.

Specimens from Burlington, N. J., of this species, of undoubted identity, agreeing externally and anatomically with the figures in the "Terrestrial Mollusks of the United States," furnished the lingual membrane here described.

Teeth 50–1–50, with 14 perfect laterals. Centrals long, narrow, with a middle long cusp, extending to the lower edge of base of attachment, and bearing a long, acute cutting point, extending far below the lower edge; side cusps subobsolete, but bearing well-developed, triangular cutting points. Laterals like centrals, but unsymmetrical by the changed form of the inner cutting point. Marginal teeth aculeate, the extreme ones do not appear to be bifurcate.

Jaw wide, low, slightly arcuate, with broad median projection.

---

*See Mal. Blatt, X.

Limax Hewstoni, I. G. Cooper.

The specimens examined are from the state collection of California, presented by Dr. J. G. Cooper.

These specimens are not in good condition for anatomical examination, but I am able to state that both testicle and ovary are large. The oviduct is long and greatly convoluted. The prostate is well developed. The vagina is very short, the very short duct of the genital bladder enters at about its middle. The last named organ is large, globular. The penis is small, short, cylindrical, expanded and bulbous at its apex, where the vas deferens enters. I could detect no accessory organs in the single specimen imperfectly examined.

The genitalia are somewhat of the same type as those of *L. flavus* (see Terr. Moll. U. S., I), Linn., but the dentition of the latter is quite distinct (see above). There is a still stronger resemblance to the genitalia of *Amalia gagates* as figured by Semper (Phil. Archip., pl. xi, fig. 9), so far as the penis and genital bladder are concerned.

The species certainly belongs to the section *Amalia*, as understood by Semper (l. c. p. 84) and Heynemann (Mal. Blatt., X, 200) as shown by the dentition of the lingual membrane. I have already, in connection with Mr. Bland (Ann. N. Y. Lyc. N. H., X, 349), described the dentition. It is necessary, however, to be more explicit in the description, as several types are found in the genus *Limax* (in the broad sense usually adopted).

Dr. Cooper's type now before me has the lingual membrane long and narrow. There are about 50–1–50 teeth. The centrals are tricuspid, the middle cusp is stout and reaches to the lower edge of the base of attachment, the side cusps are not well developed; all three cusps bear a cutting point. The base of attachment is almost as broad as high. The lateral teeth, about 22 or 25 in number, are of the same type as the centrals, equally tricuspid, and so symmetrical as to be with great difficulty distinguished from the central tooth, excepting the outer ones, which lose the inner cusp. The marginal teeth are aculeate, not bifid, and are generally short and stout, but in some specimens are long and slender.

So far as outward appearance goes, the species somewhat resembles *Amalia marginata*, Drap., as figured by Lehmann (Lebenden Schnecken, etc., pl. v, fig. B). It is, however, by no means certain that it was introduced into San Francisco, as Mr. H. Hemphill has sent me specimens of an

Amalia from Los Angeles. His species had about 48 teeth in each row, 16 being laterals, the balance marginals, a difference of arrangement which may fairly be considered to show a specific difference between his specimens and the San Francisco form, though his discovery leads us to consider *Amalia* as native to California.

Limax maximus, Linn.

I have also reëxamined the lingual of this species from specimens collected in Newport, R. I. (see my edition of Gould's Invertebrata of Mass., p. 407, fig. 669) and find it to agree with the descriptions and figures of Lehmann and Heynemann. I am preparing an exhaustive paper on the dentition of our land shells, in which more particular descriptions of the dentition of all our species will be given. I will here say, however, that in the specimen examined by me the bifurcation of the marginals commences nearer the median line than is described by Heynemann. There are but twelve marginals without bifurcation in my specimen, that is, the bifurcation commences at about the thirtieth tooth from the central line. Heynemann gives the commencement of the bifurcation at the sixty-fifth tooth. There are 76–1–76 teeth.

Limax campestris, Binney.

To complete the series of North American *Limaces*, I subjoin a summary of the characters of this species, the only one now known to be native to eastern North America. There are 36–1–36 teeth, 11 being perfect laterals, and 25 being marginals. Of the latter about one-half are bifid. The centrals and laterals are of the same type as in *L. agrestis*.

Judging from dentition alone, *L. maximus* and *flavus* would be placed in *Heynemannia*, a subgenus of *Limax; agrestis* in s. g. *Agriolimax; campestris* in s. g. *Malacolimax;* while *Hewstoni* would be in the genus *Amalia*. (See Heynemann, Nachr. Mal. Gesell., II, 163.)

Limax Weinlandi, Heynemann (Mall. Blatt., X, 212), I do not know. The figure given by Heynemann (l. c. pl. ii, fig. 1) of its dentition does not agree with that of *L. campestris.*

Limax campestris differs widely in its genitalia from *Limax agrestis*, as will be seen by Leidy's figures in Terr. Moll. U. S., I, pl. ii, figs. 6, 8.

Zonites capnodes,* W. G. Binney.

Tennessee.

Jaw as usual in the genus.

Lingual membrane broad, with numerous rows of about 66–1–66 teeth. Centrals long, with a long, slender, median cusp, reaching the base of attachment and bearing a long, slender point projecting beyond it. Side cusps subobsolete, but represented by the cutting points, which are greatly developed, triangular, stretching beyond the sides of the base of attachment. Lateral teeth of same type as centrals, but bicuspid; there are about nine perfect laterals. Marginals aculeate, as usual in the genus.

I have not been able to observe the complete genital system of the species. The penis has the same arrangement as in *Z. lævigatus.* The external orifice is quite under the edge of the mantle.

In the Land Mollusken of the "Archip. der Philippinen" (p. 78, pl. iii, fig. 27; pl. v, fig. 21), Semper describes and figures the genital system, jaw and lingual dentition, which he refers to *Z. lucubratus*, Say. The specimen examined by him was from Tennessee. It is difficult to decide from what species Semper drew his description. It certainly was not the true *lucubratus*, which is a Mexican species. A comparison of my descriptions and figures of *lævigatus*, *inornatus*, *fuliginosus* and *friabilis* shows that neither of those species could have been before Semper. His description of the lingual membrane would better apply to *capnodes.* I have not been able to examine the whole of the genital system to see how nearly that also agrees with his figures.

---

* Formerly erroneously spelt *Kopnodes.*

Zonites friabilis, W. G. Binney.

Mr. A. G. Wetherby.

Jaw as usual in the genus.

Lingual membrane similar to that above described of *Z. capnodes.* Teeth about 57–1–57, with six perfect laterals.

The genital system is figured on pl. V, fig. II. The ovary (11) is stout, light-brown, and blunt. The oviduct (8) is short. The vagina is long and narrow, with a yellow prepuce-like expansion at the entrance of the duct of the genital bladder, which is near the base. The genital bladder (9) is large, oval, on a duct of about equal length and size as the vagina. The penis sac (5) is long and slender, and peculiarly characterized by a lateral bulbous expansion near its base, bearing the retractor muscle (6). Beyond this bulb the sac is narrow, but gradually expands, and towards its end again very gradually tapers towards the apex, where the vas deferens (7) enters. Its orifice is side by side with that of the vagina.

I found no dart in the bulb-like organ attached to the penis. It probably is a form of prostate. The external orifice is under the mantle.

Zonites inornatus, Say.

The genitalia (pl. V, fig. I) have the same general arrangement as in *Z. friabilis,* herewith described. The ovary (11), however, is very much more developed, being in this species the most conspicuous organ in the system; the epididymis (2) is less convoluted, the oviduct (8) is longer, the vagina shorter, the genital bladder (9) more clavate, with a shorter duct (16), and there is a small globular vaginal prostate (13).

Zonites sculptilis, Bland.

Tennessee. Miss Annie E. Law.

Jaw as usual in the genus.

Lingual membrane long and narrow. Teeth about 40–1–40, with four perfect laterals. Centrals tricuspid, laterals bicuspid, the side cusps of each being almost obsolete, but surmounted by a triangular sharp point. Marginals aculeate. The dentition is of the same type as in *Z. capnodes,* see above. (Pl. II, fig. IV.) Fig. *b* represents the two extreme marginal teeth.

Zonites Elliotti, Redfield.

Haycsville, N. C. Miss Annie E. Law.

Lingual membrane as usual in the genus. It will be noticed that there are not any well developed side cusps to the centrals and laterals, though there are well developed cutting points. Teeth about 32–1–32, with six perfect laterals.

The character of the dentition, as well as the caudal mucus pore, proves the species to be a true *Zonites*, and not a *Macrocyclis*, in which genus it is placed by Tryon, Am. Journ. Conch., II, 246.

The existence of the dart sac and dart has already been published.

Zonites internus, Say.

An examination of the animal by Mr. Bland shows the existence of a dart.

Helix rufo-apicata, Poey. (*Hemitrochus.*)*

Cuba. Mr. Arango.

Jaw slightly arcuate, ends but little attenuated, blunt; anterior surface without ribs; cutting edge with a broad, blunt, median projection.

Lingual membrane (pl. V, fig. v) long and narrow. Centrals long and narrow with one median stout cusp, bearing a short, bluntly pointed cutting point, the side cusps subobsolete. Laterals like the centrals, but unsymmetrical. Marginals subquadrate, with one very broad, oblique, acutely trifid cutting point, the central division the largest.

The figure *a* gives one central tooth with two adjacent laterals, *b* gives two extreme marginals.

The dentition has the same general character as the other species of *Hemitrochus*, examined by me, viz., *gallopavonis*, *graminicola*, *varians* and *Troscheli.*

Helix badia, Fér. (*Dentellaria.*)

Martinique.

For jaw and dentition see Proc. Ac. Nat. Sc., Phila., 1874, p. 52.

Genital system resembling that of *H. Josephinæ*, herewith described.

Helix nuxdenticulata, Chemn. (*Dentellaria.*)

Martinique.

For description of jaw and lingual dentition see Proc. Ac. Nat. Sc. Phila., 1874, p. 52.

The genital system is figured on pl. V, fig. VIII. The ovary (11) is short, stout. The oviduct (8) is wide, sac-like. The vagina is short, small, with a bulbous expansion near its top; the duct of the genital bladder enters at about the middle of its length, the sac of the penis near its base. The penis sac (5) is very prominent. It is as long as the

---

*Mr. Bland and I have elsewhere (Ann. of Lyc. of Nat. Hist. of N. Y., X, 341) pointed out the great difference in the lingual dentition of *Helix muscarum*, Lea, the type of the subgenus *Polymita*, and the other species referred to the subgenus by von Martens. We have suggested using for the latter the name *Hemitrochus*. We have also shown that *H. picta* belongs to the true *Polymita*, sharing the peculiar dentition of *muscarum*.

oviduct, narrowed at its base, along the remainder of its course quite stout, but with a subcentral contraction, and a blunt apex, where the retractor muscle (6) is attached, and where the vas deferens (7) enters, the latter swollen at this point. The genital bladder (9) is small, oval; its duct (16) is long, irregular, narrowed above and below, but very much swollen along the middle three-fifths of its length. As with the penis, the duct of the genital bladder forms a conspicuous feature of the system.

Helix nucleola, Rang. (*Dentellaria.*)

Martinique.

Lingual membrane and jaw already described by me (Proc. Ac. Nat. Sc., Phila., 1874, p. 52).

Genital system figured on pl. II, fig. VI. The ovary (11) is long and narrow. The oviduct (8) is long, rather stout, but little convoluted. The vagina is narrow, about one-third the length of the oviduct; just below the middle of its length it has a bulbous expansion, which receives the long, slender duct (16) of the small. oval genital bladder (9). The penis sac (5) enters the vagina near its base; it is very long, cylindrical, slender, with the vas deferens (7) and retractor muscle entering at its apex.

Helix Josephinæ, Fér. (*Dentellaria.*)

Guadeloupe.

For description of jaw and lingual membrane, see Ann. Lyc. N. H. of N. Y., X, 306.

Genital system figured on pl. V, fig. IX. The testicle (1) is composed of white cæca tipped with brown. The epididymis is greatly convoluted near the ovary. The latter organ (11) is broad. The oviduct (8) is long. The vagina is long and narrow; it receives the long slender duct (16) of the small globose genital bladder (9) near its top. The penis sac (5) is long and slender, its opening being by the side of that of the vagina, rather than actually into the latter organ, its apex rapidly narrowing to an acute point, near which enters the vas deferens (7).

Helix discolor, Fér. (*Thelidomus.*)

Martinique.

Jaw and lingual membrane already described by me (Proc. Ac. Nat. Sc. Phila., 1874, p. 51).

Genital system short and stout in its various parts, excepting the ovary (11) which is long, slender, acutely pointed. The epididymis (2) is long, convoluted at the end near the oviduct. The oviduct (8) is stout, sac-like. The genital bladder (9) is as long as the oviduct, clavate, stout, with no distinct duct, but gradually tapering to its entrance into the vagina, which is at the upper end of the latter. The penis sac (5) is the most prominent organ. It enters the vagina at its base. It is as long as the whole system, stout, especially in its lower half, abruptly terminating in an acute point above, where it receives the vas deferens. The latter organ (7) is enlarged for some distance after leaving the penis sac. The retractor muscle (6) of the penis is inserted on the side of the sac, at the lower third of its length. Pl. II, fig. IX.

Helix Troostiana, Lea. (*Polygyra.*)

Kentucky, Mr. A. G. Wetherby.

Jaw as usual in the sub-genus *Polygyra*, with about ten, broad, crowded ribs, denticulating either margin.

Lingual membrane (pl. V, fig. VI) long and narrow. Teeth about 25–1–25. Centrals and laterals quadrate, the former tricuspid, the latter bicuspid, the cusps stout: all the cusps with cutting points. Marginals low, wide, with one inner, oblique, stout, short, bluntly bifid cusp, and one outer, shorter, bluntly bifid cusp.

Genital system (pl. V, fig. III) long and slender, especially the ovary (11), and oviduct (8); vagina long, receiving the duct of the genital bladder below its middle, and the sac of the penis still lower down; penis long, tubular, of about same width as the vagina, with a prominent bulb at its apex, into the end of which is inserted the vas deferens (7) and at the side of which the retractor muscle (6) is attached; genital bladder (9) moderate, oval, on a duct (10) of about equal length and size as the vagina.

Helix obstricta, Say. (*Triodopsis.*)

Ohio, Mr. A. G. Wetherby.

The genital system resembles exactly that of *H. palliata*, Say, as figured by Dr. Leidy in Terr. Moll. U. S., I, pl. vii, fig. 8.

Helix Clarki, Lea. (*Triodopsis? Mesodon?*)

Hayesville, N. C., Miss Annie E. Law.

Jaw as usual, arcuate, ends attenuated, blunt; anterior surface with about fourteen stout, separated ribs, denticulating either margin.

Lingual membrane long and narrow. Teeth about 35–1–35. Centrals with a stout, short, median cusp, bearing a very short, blunt, cutting point, the outer cusps subobsolete. Laterals like the centrals, but unsymmetrical. Marginals wide, low, with one, inner, short, broad, sharply bifurcated cutting point, and one shorter, outer, bifurcated cutting point. Pl. VI, fig. I.

The genital system (pl. VI, fig VI) is peculiar in several respects. The ovary (11) is very slender, and equals about one-half the length of the oviduct. The epididymis (2) is highly developed, greatly convoluted, stout, four times the length of the ovary. The oviduct (8) is convoluted.

The prostate (4) is greatly developed. The penis sac (5) is short, cylindrical, entering the vagina near its base, and receiving both vas deferens (7) and retractor muscle (6) at its apex. The genital bladder (9) is small, oval, with a short duct (16) entering the vagina about the middle of its length. The vas deferens (7) is swollen on leaving the prostate. Testicle not observed.

The marginal teeth of the lingual membrane are more of the type of *Triodopsis* than *Mesodon*, as known to us at present. I am in doubt, therefore, of the subgeneric position of the species.

Helix Wheatleyi, Bland. (*Mesodon.*)

Hayesville, N. C., Miss Annie E. Law.

Jaw as usual in the subgenus, with about twelve ribs.

Lingual membrane long. Teeth about 67-1-67. Centrals and laterals as described under *H. Clarki.* Marginals high, narrow, with one very long cutting point to the single cusp. Outer marginals about as high as wide, with one long inner, obtusely pointed, cutting point, and one shorter, outer cutting point.

The first marginal teeth resemble those of *H. thyroides* in the single, greatly produced cutting point. The extreme marginals, however, are bifid.

The genital system in the specimens received was too decayed to allow of complete examination. The penis, however, was in perfect condition. It forms the peculiar feature of the system on account of its enormous development. It is short, cylindrical, with blunt ends, very stout, three or four times as large as the oviduct, with retractor muscle, and vas deferens at its apex.

Helix Pennsylvanica, Green. (*Mesodon.*)

The upper portions of the genital system (pl. V, fig. VII) not observed. The penis sac (5) is long and slender, with the vas deferens (7) and retractor muscle (6) entering its apex, and its orifice entering the vagina near its base. The genital bladder (9) is long, stout, cylindrical, with a median contraction; its duct (16) is hardly distinct from it, with an entrance opposite that of the penis sac. The prostate (4) is very large.

Helix clausa, Say. (*Mesodon.*)

Ohio.

Pl. V, fig. IV. The penis sac (5) is the conspicuous feature of the system: it is longer than the oviduct, and almost as stout, of about equal size throughout; it has the entrance of the vas deferens (7) and retractor muscle (6) at its blunt apex. The genital bladder (9) is small, lengthened oval, with a long, slender duct (16). The prostate (4) is narrow, stout, prominent, cord like. The vas deferens (7) is large. The other organs present no peculiar features.

Helix Traski, Newc. (*Arionta.*)

Specimens from the mouth of San Tomas River, Lower California, collected by Mr. Henry Hemphill.

The genital system resembles very nearly that which I have figured of *Helix Nickliniana*, Lea (Proc. Phila. Acad. Nat. Sci. 1874, 41, pl. iv. fig. III). The duct of the genital bladder in this species is, however, very much longer, its accessory duct shorter in proportion, the flagellum of the penis sac longer. There is also a peculiar feature in the genitalia of *H. Traski*, a globular organ of about equal diameter with the vaginal prostate, attached laterally to the flagellum of the latter, before it becomes bifurcated. The bulbous expansions on the two branches of the flagellum are also much larger in *H. Traski*. It is figured in pl. VI, fig. IV.

Helix Stearnsiana, Gabb. (*Arionta?*)

To the kindness of Mr. Henry Hemphill I am indebted for living specimens of this species from Todos Santos Island and the mouth of the San Tomas River, Lower California. The result of the examination of the genitalia and lingual dentition establishes its specific distinction from the Catalina Island form (*H. Kelletti*, Forbes) to which it is nearly related by the characters of its shell. (See L. and F. W. Shells N. A., I, 176, 177).

The genitalia (pl. VI, fig. II) resemble very nearly those of *H. Kelletti* (Proc. Phila. Acad. Nat. Sci. 1874, pl. iii, fig. 4, p. 39).

A comparison of the figures, however, will show considerable difference, especially in the dart sac (14). In the species before me there is a long thread like duct (14^d) leading from the base of the dart sac (14) to a large globular organ, whose character is unknown to me. Opposite the entrance of this duct a corresponding duct (14^c) branches out, but instead of ending in a globular organ it becomes much enlarged in size and ends in enveloping the prepuce (12). The dart sac (14) contained a small dart of the form figured by Leidy (Terr. Moll. U. S., I) for *Tebennophorus Caroliniensis.*

The oviduct was closely and spirally wound around the duct of the genital bladder. The testicle (1) and ovary (11) are yellow.

The jaw is thick, arched, ends blunt, but little attenuated; anterior surface with six stout, separated ribs denticulating either margin, and several less developed, interstitial ribs.

The lingual membrane is long and narrow with about 50–1–50 teeth. The centrals are of the form of those of *H. Californiensis* (L. and F. W. Shells N. A., I. fig. 297). The cusp with its cutting point, however, is very much shorter, reaching only about half way to the lower edge of the base of attachment. Laterals of same type. Marginals low, wide, very variable in the denticles, but usually with one long, broad, sharply bifid inner denticle (the inner point much the smaller), and one short sharp, rarely bifid outer denticle.

The Catalina Island *H. Kelletti* has same type of dentition. The marginals, however, seem much more broadly denticulated.

Strophia iostoma, Pfr.

Inagua, Bahamas.

Jaw strongly arched, ends but little attenuated, bluntly rounded. Anterior surface without ribs. Cutting edge with a decided, blunt, median projection.

Lingual membrane (pl. II, fig. VIII) long and narrow. Teeth about 29–1–29. Centrals but little longer than broad, tricuspid, the middle cusp short and stout, with a short, bluntly rounded cutting point; side cusps slightly produced, with a short, sharp point. Lateral teeth like the centrals but bicuspid. Marginal teeth a simple modification of the laterals, with one short, bluntly pointed inner cusp, and one still shorter, bluntly pointed outer cusp. Fig. *a* represents the central and lateral teeth, *b* a marginal tooth, *c* an extreme marginal.

Geomalacus maculosus, Allm.

England. Mr. J. Gwyn Jeffreys.

The genital system is figured on pl. V, fig. x. For a description of it and of the jaw and dentition, see Ann. Lyc. Nat. Hist. N. Y., X, 308. As there stated, the vas deferens is conspicuous by its great length, and the penis sac has attached to its apex a singular globular organ, which is a conspicuous feature of the system.

Pallifera Wetherbyi, n. sp.

From near the mouth of Laurel River, Whitley Co., Kentucky, Mr. A. G. Wetherby collected many specimens of what appeared to be a small species of *Tebennophorus*. It was readily distinguished from the numerous young of *T. Caroliniensis* found in the vicinity by the arrangement of the blotches of color, they being in irregular, interrupted, transverse bands, instead of running longitudinally as in that species. The anterior portion of the body seemed also to be more swollen, and the posterior extremity to taper more rapidly than in *Caroliniensis*. On examining the jaw

I found it to be ribbed, a character placing the slug in the genus *Pallifera.* The presence of ribs was verified in four individuals. Small specimens of *T. Caroliniensis* from the same locality had the usual ribless jaw of *Tebennophorus.* It appears, therefore, that the slug must be considered a new species of *Pallifera.** It may be called after its discoverer. It is difficult to draw more satisfactory specific characters from specimens preserved in alcohol. One of them in its contracted state measures 12 millimetres in length.

Jaw (pl. II, fig. I) arcuate, ends blunt, but little attenuated; anterior surface with decided, separated, unequal ribs, denticulating either margin, about 15 on one specimen, those at the ends being less developed than on the balance of the jaw; cutting edge with a decided, short, blunt, median projection.

Lingual membrane (pl. II, fig. II) long and narrow. Teeth about 35–1–35. Centrals long, expanding towards the base, cusp stout, with a stout blunt cutting point not reaching the lower margin of the base of attachment, side cusps obsolete. Laterals same as centrals, but unsymmetrical. Marginals (*b*) low, wide, with one inner, long, oblique, blunt cusp, and one outer, short, usually bluntly bifid cusp.

Bulimus foveolatus, Rve. (*Orphnus.*)

Northern Peru. Prof. Orton.

This and the other species collected by Prof. Orton were determined by Mr. Bland.

Jaw slightly arched, wide, low, thin, with over 50 delicate ribs of the kind herewith described under *Bulimulus Lobbi:* ends but slightly attenuated, blunt.

Lingual membrane (pl. I, fig. III) long and narrow, composed of very numerous rows of about 34–1–34 teeth each. Teeth as usual in the *Helicidæ.* The centrals (a) with one short cusp, the side cusps being obsolete, cutting point short, bluntly pointed. Laterals like the centrals, but unsymmetrical, and with a more developed outer side cusp. Marginals *b*, a simple modification of the laterals, smaller, higher than wide, with the cutting point longer. The plate gives one central with its adjacent lateral, *a*, and three extreme marginals, *b*.

The membrane is very thick and strong, and of equal width throughout its length, the ends being bluntly truncated.

---

* Its dentition is more related to *Tebennophorus* than to *Pallifera* by the absence of side cusps and cutting points to the central and lateral teeth.

The genus *Bulimus* seems to be characterized by marginal teeth to its lingual membrane of the same type as the laterals, being simply a modification of the latter. Thus far we know the dentition of the following species: *B. porphyrostomus*, *scarabus*, *odontostomus*, *glaber*, *auris-sileni*, *multicolor*, *egregius*, *oblongus*, *ovatus*, *magnificus*, *Hanleyi*, *marmoratus*, and *aulacostylus*. *B. auris-sciuri* (which appears to be a var. of *B. glaber*), figured by Guppy and Hogg, may not agree with these, but the figure is too bad to judge from.

Bulimus auris-sileni, Born. (*Pelecychilus.*)

St. Vincent.

For description of jaw and lingual dentition, see Ann. Lyc. Nat. Hist. N. Y., X, 222. For figure of latter, see Proc. Phila. Acad. Nat. Sci. 1874, pl. vi, fig. 4.

The genitalia are figured at natural size as they appear suspended in water. The whole system is very long and slender. The testicle (1) is embedded in the upper lobe of the liver; it is composed of long cæca. The epididymis (2) is convoluted along the half nearer the oviduct. The accessory gland (3) is composed of prominent aciniform cæca. The ovary (11) is short and stout, much broader than the oviduct, lobulated. The oviduct (8) is long, narrow, greatly convoluted. The vagina is long, very narrow. The external orifice is behind the right eyepeduncle. The penis sac (5) is the most prominent organ. It is extremely long, exceeding the length of the whole system. It is tubular, of about equal length along three-fourths of its course, where it receives the vas deferens (6) and commences to taper gradually towards the apex, merging into a long, delicate flagellum or lengthened retractor muscle, said muscle being attached to the end. The penis sac does not appear actually to enter the vagina; the two organs terminating side by side.

The genital bladder (9) is small, globular, its duct (16) is almost as long as the oviduct, of very unequal breadth. For two-fifths of its length beyond the bladder it is delicate, then rapidly expands into a tube as wide as the ovary, then, tapering, becomes again narrow at the commencement of the last fifth of its course, but again widely expands before entering the vagina at the upper third of the length of the latter organ. Pl. IV, fig. v.

Bulimus glaber, Gmel. (*Pelecychilus.*)

Island of Grenada.

Jaw as in *Bulimulus*, *Cylindrella*, etc.

Lingual membrane long and narrow. Teeth as usual in the *Helicinæ*, long and narrow, centrals tricuspid, laterals bicuspid, marginals a simple modification of the laterals, with one large, long, inner, pointed cusp, and two outer, small points. See Proc. Phil. Acad. Nat. Sc., 1874, pl. vi, fig. 6.

Cylindrella sanguinea, Pfr.

Jamaica.

The genital system (pl. II, fig. VII), as would be inferred from the shape of the shell, is very much lengthened in all its organs. The testicle (1) is in a globular mass lying close to the oviduct. The epididymis (2) is short. The oviduct (8) is very long and narrow. The vagina is two-thirds the length of the oviduct, it is narrow, with a bulbous expansion at the insertion of the duct of the genital bladder, above its centre. The genital bladder (9) is very small, globular, on a very narrow, long duct (16), which expands at its entrance into the vagina. The penis sac (5) is short, thick as the oviduct, bluntly terminating above, where the vas deferens (7) and retractor muscle (6) are inserted. The ovary (11) is short and stout.

Cylindrella brevis, Pfr.

Jamaica.

The genitalia have the same arrangement as in *C. sanguinea*, herewith described. The duct of the genital bladder (16) in this species is much more expanded before it enters the vagina, and the latter organ below the junction is expanded to a greater size than the oviduct. The penis sac (5) is shorter and stouter in *brevis* than in *sanguinea.* Pl. II, fig. III.

Bulimulus Altoperuvianus, Rve. (*Drymæus.*)

Between Balsas and Cajamarca, Peru, Prof. Orton.

Genitalia (pl. I, fig. II) of the same general form as I have herewith described for those of *Bulimulus Lobbi.* The ovary (11) is smaller in proportion, the oviduct (8) more developed. The duct of the genital bladder (16) enters lower down upon the vagina. The testicle (1) is farther removed from the ovary, lying in the apex of the shell. It is composed of short, stout, blunt cæca. The ovary is of a dark slate color, the rest of the genital system is white. The external orifice is behind the right eye peduncle. The edges of the ovary are very deeply scalloped.

The jaw has thirty-one ribs. It is of same type as that herewith described of *Bul. Lobbi.* Lingual membrane (pl. I, fig. IV) of same type as herewith described and figured for *Bul. Lobbi* as far as centrals and laterals (*a*) are concerned. The marginal teeth, however, are quite different from those of that species. They are quite like the laterals, excepting that the cutting point is very much more produced, and somewhat curved towards the central line of the membrane.

These peculiar marginal teeth remind one of those of *Helix Ghiesbreghti* as figured by Messrs. Fischer and Crosse. In that species, however, the notch is on the outer, not the inner, side of the cutting point.

It will be noticed that the cutting point on the central tooth of *B. Altoperuvianus* is more produced than in *B. Lobbi*, to which I have compared the dentition.

Bulimulus Peruvianus, Brug. (*Plectostylus.*)

Talcahuana, Peru. Museum of Comparative Zoology, Cambridge.

Jaw and lingual dentition already described by me. (Proc. Ac. Nat. Sc. Phila., 1874, 53, pl. V, fig. 2.)

The genital system is figured on pl. I, fig. VIII. The testicle (1) is extremely large, apparently composed of aciniform cæca. The epididymis (2) is long, very thick, and greatly convoluted in its whole course. The ovary (11) is long and slender. The oviduct (8) is long and narrow. The vagina is short. The short duct (16) of the genital bladder (9) enters at its upper end. The genital bladder is very stout, almost as thick as the oviduct, tapering above gradually to a long flagellate point. The penis sac (5) enters the vagina near its lower end. It is smaller than the genital bladder, cylindrical, tapering gradually towards the apex, where it has a flagellate appendix, into the end of which, perhaps, is inserted the retractor muscle. The vas deferens enters the penis sac at its upper end. The external orifice of the generative organs is behind the right eyepeduncle.

Bulimulus Lobbi, Rve. (*Drymæus.*)

Between Balsas and Cajamarca. Prof. Orton.

The genital system is quite similar to that which I have figured of *B. Altoperuvianus* (pl. I, fig. II), the ovary (11), however, is much larger than in that species. The testicle (1) is composed of short, blunt cæca; it lies near the ovary. The epididymis (2) is short. The accessory gland (3) is composed of several long, threadlike cæca. The ovary is long, equalling one-third of the oviduct, and twice as broad. The oviduct (8) is long, convoluted, narrow, with deeply scalloped edges. The vagina is short, tubular, receiving the duct of the genital bladder near its top, and the opening of the penis sac just above its base; between the two there is a short decided expansion of the vagina. The penis sac (5) is long and slender, with a long, flagellate extension, on the end of which the retractor muscle (6) is attached. The vas deferens (7) enters the penis sac at about the middle of its length. The genital bladder (9) is small, globular, on a delicate duct (16) equalling in length the vagina and oviduct combined. The external orifice of generation is behind the right eyepeduncle.

The jaw (pl. I, fig. VI) is arcuate, with attenuated, blunt ends, thin, transparent, of the same type as is common to *Bulimulus*, *Cylindrella*, *Amphibulima*, *Gæotis*, etc., *i. e.*, with narrow, distant ribs, running obliquely towards the median line, so that those of the centre converge before reaching the bottom of the plate. These ribs serrate the upper and lower margins. They increase in thickness gradually on their outer edge. There are twenty-one ribs on the specimen examined. The material of the jaw is so thin on the outer edge of the ribs that it separates into distinct plates at these points, when macerated. In some specimens examined the ribs appear to be formed by an actual overlapping of distinct plates. I have no doubt, however, of the jaw being in one single piece, divided by these delicate ribs into numerous plate-like compartments. It is not composite as formerly believed by most authors.

The lingual membrane (pl. I, fig. 1) is broad, very delicate in texture and difficult to handle. There are numerous rows of about 90–1–90 teeth each. The centrals have a base of attachment longer than wide, with lower lateral expansions. The reflection has one stout median cusp, the side cusps being obsolete; this cusp bears a short, rapidly attenuated, sharp cutting point, not reaching the lower margin of the base of attachment. The laterals are of same type as centrals, but unsymmetrical, the cutting point, however, is very different from that of the centrals, being very broad, bluntly rounded at its end, oblique, extending far below the base of attachment, and having on its inner margin, near the blunt end, a prominent blunt notch. The marginals are a modification of the laterals, but lower, with a much more oblique cusp, bearing a much broader trifid cutting point, the middle division very much more produced than the outer ones.

The figures represent *a* one central with its adjacent lateral teeth, and *b*, two marginal teeth.

The lateral teeth are a modification of the usual *Helicidæ* type not before observed by me. The marginal teeth are somewhat like those seen in many species of *Bulimulus*, such as *laticinctus*, *Bahamensis*, *auris-leporis*, *papyraceus*, *Jonasi*, *membranaceus*. They only approach, however, the teeth of those species in form.

Bulimulus rhodolarynx, Rve. (*Scutalus.*)

Northern Peru. Prof. Orton.

The genital organs were so reduced as to be only threadlike, and not sufficiently developed to be described as perfect.

The jaw was not examined, being of so delicate texture as to be quite destroyed by the action of potash.

The lingual membrane is long, narrow. Teeth about 40–1–40, of the usual type of *Helicinæ* (see pl. I, fig. v). The central teeth, *a*, have one median cusp, the outer cusps being obsolete, the cutting point is shor and bluntly pointed. Lateral teeth same as centrals, unsymmetrical, the inner subobsolete cusp more developed. The marginals (b) are simple modifications of the laterals, subquadrate, bicuspid, each cusp with a ong, oblique, stout cutting point.

From this description it will be seen that *Bulimulus rhodolarynx* has the type of dentition which appears normal to the *Helicinæ*, in this respect agreeing with *B. cinnamomeo-lineatus*, *pallidior*, *chrysalis*, *Guadalupensis*, *alternatus*, *sporadicus*, *dealbatus*, *solutus*, *sepulcralis*, *durus* and *Peruvianus*. For the species differing from the common type of *Helicinæ* dentition, see remarks under *B. Lobbi*.

Bulimulus Proteus, Brod. (*Scutalus.*)

Northern Peru. Prof. Orton.

Genitalia quite like those described and figured of *Bul. Altoperuvianus* (pl. I, fig. II). All the organs were delicate, almost threadlike, and not so well developed as in the species to which I have compared them. Orifice behind right eyepeduncle.

Jaw, with 28 ribs, of same type as herewith described for *B. Lobbi.*

Lingual membrane of same type as *Bul. Altoperuvianus*, herewith described.

Bulimulus primularis, Rve. (*Mesembrinus.*)

Northern Peru. Prof. Orton.

The genitalia are like those of *Bul. Proteus* herein described, but the ovary is orange colored.

The jaw was imperfect and thus the number of ribs cannot be given. It is of the same type, however, as herewith described of *Bul. Lobbi.*

The lingual membrane (pl. I, fig. VII) is broad. Central teeth of same type also as in *Bul. Lobbi*, but much shorter and stouter. The lateral teeth of *Bul. Lobbi* and *B. Altoperuvianus* are wanting in this species, their place being entirely filled by marginal teeth of the form known in *Bul. laticinctus* (see Ann. Lyc. N. H. of N. Y. x, pl. i). The teeth are subquadrate, with a very large, curved, obliquely trifid cutting point, extending far below the lower margin of the base of attachment.

Fig. *a* gives one central tooth with the two adjacent marginals; fig. *b* an extreme marginal. The latter will be seen to be rather narrower than those nearer the median line of the membrane.

Orthalicus obductus, Shuttl.

Islands in Bay of Panama, Mr. McNiel.

Jaw as usual in the genus. Lingual membrane (pl. VI, fig. III) as usual in the genus. Teeth about 96-1-96. The side spurs to the cusps (representing the side cusps of the usual *Helicinæ* type) are not present on the first laterals, but are conspicuous on those farther removed, as shown in figure *b* of the seventh lateral tooth.

Orthalicus gallina-sultana, Chemn.

Marañon, Peru. Prof. Orton.

An opportunity having been given me by the kindness of my friend, Mr. Thomas Bland, of examining the animal of *Orthalicus gallina-sultana*, Chemn., I here give descriptions of its genital system and lingual dentition. It will be seen that my figures of the latter do not agree with those published by Troschel (Arch. für Nat., 1849, pl. iv, fig. 3), at least so far as centrals and laterals are concerned, these teeth not being represented in Troschel's plate. It must be borne in mind, however, that at that early date, the membranes were not so carefully studied as at present, and consequently the peculiarity of these teeth may have been overlooked by Troschel. Of the identity of the specimen examined by me, there can be no doubt.

The jaw (pl. IV, fig. E) is of the type usual in *Orthalicus* and *Liguus*, but up to the present time never observed in any other genus. It is composite, its separate plates being apparently soldered firmly at their upper portions, where, indeed, they seem collectively to form a jaw in a single piece as in *Helix*, etc., but at their lower portion positively detached and free, imbricated one upon another. The jaw may in one sense be said to be in a single piece, as argued recently by Messrs. Fischer and Crosse, (Moll. Mex. et Guat.), but with equal correctness it may surely be said to be composite, as the amalgamation of the upper portion is produced by the joining of absolutely separate pieces. There are fifteen of these plates, the three upper central ones apparently lying upon the fourth, which is very broad and extends from the upper to the lower margin of the jaw. The jaw is strongly arched, with attenuated, blunt ends. There are well marked perpendicular grooves upon the anterior surface of many of the plates.

The lingual membrane (pl. IV, fig. A–C) is very broad (13 mill.), for its length (16 mill.). The rows of teeth are arranged in a backward curve from the median line for a short distance, and then run obliquely to the outer margin of the membrane. The central teeth have a long and rather narrow base of attachment, squarely truncated at the top, incurved with slight lateral expansions at the base. The reflected portion bears one stout, median cusp, the side cusps being subobsolete. This cusp bears a long, stout, lance-like cutting point, extending below the base of attachment to a sharp point, and bearing at the centre of its length on each side a prominent, subobsolete, blunt spur. There are three lateral teeth of the same type as the centrals, but made unsymmetrical by the suppression of the inner lower lateral expansion to the base of attachment, and the inner subobsolete lateral spur to the cutting point. The fourth tooth from the central tooth changes suddenly into a marginal tooth of the form common in *Orthalicus*; *i.e.*, a long, stout, subquadrate base of attachment with fringed lower margin, bearing at its lower portion, a broad, bluntly rounded subobsolete cusp, from which springs a short, widely expanded, broad, bluntly rounded, gouge shaped cutting point, which has a small, outer, lateral spur of the same bluntly rounded form. This form of marginal teeth runs quite to the edge of the membrane, those nearer the outer edge being smaller, more widely separated, and in more oblique and more widely separated rows.

Fig. A gives a central tooth with adjacent teeth to the fifth tooth on one side, and only one lateral on the other side; fig. C gives the eighth tooth; fig. D two extreme marginals; fig. B an extreme marginal in profile.

The count of the teeth in one transverse row is over 108-1-108.

Peculiar as this form of dentition seems, it has already been noticed in *Liguus virgineus*. (See Am. Journ. Conch., VI, 209, fig. 3, 4, and below pl. III). That species differs widely, however, in the lesser size of its membrane (10 × 4½ mill.), the smaller count of the teeth, 40-1-40, and in having but two well marked laterals. That species also has several teeth intermediate between the laterals and marginals which vary greatly on different parts of the membrane.

This form of dentition is very instructive in showing the modification of the type usual to the *Helicinæ*. The central teeth may be said to be obsoletely tricuspid, and the side spurs to the greatly produced cutting point are but a modification of the usual cutting points on the side cusps of the *Helicinæ*. The lateral teeth are in the same way but a modification of the usual bicuspid laterals of the *Helicinæ*. The marginal teeth are more abnormal in form, but they still are but modified from the laterals by the expansion, bluntly rounding and shortening of the cusps, and by the still greater expansion, shortening and bluntly rounding of the cutting points. In *Orthalicus iostomus*, *melanochilus*, *undatus* and *Liguus fasciatus*, this process of suppressing the usually decided cusps and cutting points is extended equally to the central and lateral teeth. Other species show the same aberrant form of centrals and laterals, as *Bulimulus aurisleporis*, (Mal. Blatt., XV, pl. v, fig. 8). In less degree are the laterals modified from the usual *Helicinæ* type in *Simpulopsis sulculosa* (*ib.* fig. 10) as to the cutting points, and in the same particular in *Bulimus Peruvianus* (Proc. Ac. Nat. Sc. Phila., 1874, pl. v, fig. 2). No doubt future research will bring to light a complete series of teeth in land shells, showing a gradual modification in different directions of the normal tricuspid and bicuspid type.

There seem no peculiar characters to the respiratory, digestive and nervous system of the animal. The genitalia are figured on plate IV, fig. F. The external orifice is behind the right eyepeduncle. The testicle (1) is as usual in the *Helicinæ* embedded in the lobe of the liver occupying the extreme apex of the spire of the shell; it is composed of fasciculi of short, stout, blunt cæca. The epididymis (2) is short, convoluted as usual. The accessory gland (3) is on a short threadlike peduncle. The ovary (11) is very large, tongue shaped, lobulated above and decidedly spongelike in its division on its concave side. The oviduct (8) is long, narrow, convoluted. The genital bladder (9) is large and oval, on a long duct (16) which in its natural position is adherent to the oviduct in its entire length: it is much larger in its lower third, equalling the stout vagina, near whose middle it enters; below this point the vagina becomes very stout. The penis is cylindrical, about as long as the vagina, tapering rather abruptly to its apex, where is inserted a long, delicate, retractor muscle (6), which resembles a flagellum. The vas deferens (7) enters the penis on its side, near its summit. There are no accessory organs. The penis (5) does not appear to enter a common duct of male and female organs, but to have a separate opening of its own.

The general arrangement of the genitalia is like that of *O. undatus*, (see this paper), *O. longus* and *iostomus* (Fischer and Crosse), *Liguus fasciatus* (Leidy), and *L. virgineus*, see below. The last four, however, have a single multifid vesicle, which I failed to detect in *O. gallina-sultana;* and from them all there is ample specific difference in the size of the ovary, the shape and size of the penis sac, and the size of the duct of the genital bladder, near its base.

It may fairly be assumed that no generic difference exists between the genitalia of *Orthalicus* and *Liguus.*

These remarks are suggested by the treatment of *Liguus fasciatus* by Messrs. Fischer and Crosse (Moll. Mex. et Guat.). On account of the resemblance in dentition to the species of *Orthalicus* known to them rather than to the allied *Liguus virgineus*, these authors place *Liguus fasciatus* in *Orthalicus*, under the subgeneric name of *Orthalicinus*. The same reasoning will now oblige them to place *Orthalicus gallina-sultana* in the genus *Liguus*, for its dentition resembles that of *L. virgineus* and not that of the other known species of *Orthalicus*. It appears to me much better to wait till more is known of the dentition of *Orthalicus*, before we consider the teeth as reliable generic characters.

Orthalicus undatus, Brug.

It will be interesting in connection with my comparison of *Orthalicus* and *Liguus* to state that having had an opportunity of dissecting six specimens of this species, from Jamaica, I found the genitalia constantly agreeing with Lehmann's fig. in Malak., Blatt., 1864, pl. i, fig. 4. There is no multifid vesicle on the penis as in the species of *Orthalicus* figured by Fischer and Crosse (Moll. Mex.). With this exception, the genitalia are quite like those figured by Leidy for *Liguus fasciatus* (Terr. Moll. U. S. I. pl. v).

It will be seen above that *Orthalicus gallina-sultana* is also characterized by the want of the multifid vesicle.

Liguus virgineus, Lin.

Aux Cayes, Haiti. Mr. Robert Swift.

In connection with my friend, Mr. Thomas Bland, I have already described the jaw (L. and F. W. Shells N. A., I, p. 312, fig. 364) and lingual membrane (Am. Journ. Conch. VI, 209, figs. 3,4) of this species. The membrane having become still more interesting from its resemblance in some respects to that of *Orthalicus gallina-sultana*, Chemn., lately examined, I have given the accompanying more detailed illustrations (pl. III).

There is, it appears, considerable variation in the development of the cutting points of the central and lateral teeth, and the cusps of the first marginals, on different parts of the membrane. Fig. D is taken from the most perfect portion of the membrane, the most anterior portion. Fig.

A is taken from the least developed, or posterior end of the membrane. Figs. B and C are drawn from intermediate points, the former from near the centre.

Marginal teeth from various points of the membrane are figured in E and G, each tooth being numbered from the median line. Fig. F shows an extreme marginal in profile.

Near the outer edges of the membrane the teeth are not only much smaller, and arranged more obliquely, but they are more separated from each other on the same transverse row, and the rows themselves are not so crowded together as in the portions of the membrane nearer the centre.

On dissecting the animal I found nothing of peculiar interest in the digestive, respiratory or nervous systems. There appeared to be the same general arrangement as figured by Dr. Leidy (Terr. Moll. U. S., I, pl. v) for the allied species, *L. fasciatus.* The same may be said of the generative organs, which, however, I have figured (pl. IV, fig. G) to compare with the figure I have given of the same organs in *Orthalicus gallina-sultana.* The external orifice of generation is close behind the right eyepeduncle. The testicle, epididymis and ovary were separated from the specimen examined. The oviduct (8) is long, narrow, greatly convoluted. The genital bladder (9) is small and globose; its duct (16) is long and narrow; in its natural position it lies close against the oviduct: as the duct joins the vagina it becomes enlarged to the size of the latter which it enters at its upper third. The vagina is very wide below this junction. The vas deferens (7) runs as usual along the side of the vagina to its base, and thence to the summit of the penis where it enters. The penis sac (5) is long, slender, cylindrical, narrowing at its apex, into which is inserted a long delicate retractor muscle (6) which might be considered a flagellum: the penis does not seem to enter the vagina, but to have an independent opening of its own. Near its base it bears upon a short pedicle, a single prostate gland, a multifid vesicle of the same type as figured by Dr. Leidy in *L. fasciatus*, composed of about six short, ovate, detached lobes.

Thus it will be seen that *Liguus virgineus* agrees in its genitalia with the allied species, *L. fasciatus*, but differs in its shell, and in its lingual dentition. No generic value can be placed upon this last character, however, for while *L. fasciatus* resembles in its dentition *Orthalicus undatus*, *melanochilus*, and *iostomus*, its allied species *L. virgineus* is characterized by a widely different dentition, which is shared on the other hand in a great measure by *Orthalicus gallina-sultana.* From our present knowledge we are forced to believe that lingual dentition will furnish no guide to the generic distinction between *Orthalicus* and *Liguus.*

The tail of the animal is very long and pointed. There is no distinct locomotive disk to the foot.

Succinea obliqua, Say.

A specimen from New York, received from Dr. James Lewis, furnished the jaw and lingual membrane here described.

Jaw of shape usual in the genus, with the quadrate accessory plate. Cutting edge with a prominent median projection. Anterior surface with decided stout ribs denticulating the cutting edge; one specimen had three broad and two intervening narrow ribs: another specimen has seven ribs.

Lingual membrane long and narrow. Teeth about 43-1-43. Centrals subquadrate, tricuspid, the middle cusp long and stout. Laterals longer than wide, bicuspid, the third, inner cusp being only rudimentary. Marginals a modification of the laterals, with one long, slender inner cusp, and two short, slender outer cusps. The cusps of all the teeth bear sharp cutting points.

In Terrestrial Mollusks of United States, vol. I, pl. xiii, fig. 3, a jaw is figured as that of *Succinea ovalis*. It no doubt represents rather that of the true *obliqua*, Say, than of *Succ. ovalis*, Gld. not Say. The jaw of the latter is figured in L. and F. W. Shells of N. A., I, p. 258. The figure of genitalia given by Dr. Leidy on the plate referred to correctly represents that of *S. obliqua*.

EXPLANATION OF THE PLATES.

The figures of genitalia all have the same references:

1. The testicle.
2. The epididymis.
3. The accessory gland of the last.
4. The prostate.
5. The sac of the penis.
6. The retractor muscle of the penis.
7. The vas deferens.
8. The oviduct.
9. The genital bladder.
10. The external orifice of the organs.
11. The ovary.
12. The prepuce.

13. The vaginal prostate.
13a. flagellum to same.
13b. accessory gland to same.
13c. accessory duct to same.
13d. same as last with globular organ.
14. The dart sac.
15. The flagellum.
16. The duct of the genital bladder.

In the figures of dentition it will be understood that the general intention is to give (*a*) one central tooth with its adjoining lateral, and (*b*) one or two marginal teeth. The numbers of the teeth refer to their position in counting from the median line of the membrane. This arrangement gives as good an idea of the characters of the dentition as my space will allow.

PLATE I.

FIG.

I. Bulimulus Lobbi, Rve. Dentition; *a*. lateral teeth: *b*, extreme marginal teeth.
II. Bulimulus Altoperuvianus, Rve. Genitalia.
III. Bulimus foveolatus, Rve. *a*, central and lateral teeth: *b*, extreme marginals.
IV. Dentition of II. *b*, extreme marginals.
V. Bulimulus rhodolarynx, Rve. *b*, marginals—first and extreme.
VI. Jaw of I.
VII. Bulimulus primularis, Rve. *b*, extreme marginal tooth.
VIII. Bulimulus Peruvianus, Brug.

PLATE II.

FIG.

I. Pallifera Wetherbyi. Jaw.
II. Same; dentition. *a*, central and lateral teeth: *b*, marginal teeth.
III. Cylindrella brevis, Pfr. Genitalia.
IV. Zonites sculptilis, Bland. Dentition; *b*, extreme marginals.
V. Bulimus auris-sileni, Born. Genitalia.
VI. Helix nucleola, Rang. Genitalia.
VII. Cylindrella sanguinea, Pfr. Genitalia.
VIII. Strophia iostoma, Pfr. Dentition; *a*, central and lateral teeth: *b*, marginal tooth: *c*, extreme marginal tooth.
IX. Helix discolor, Fér. Genitalia.

PLATE III.

FIG.

Lingual dentition of *Liguus virgineus*, Lin.

A. From the least developed end of the membrane. The central tooth with the two lateral teeth and three marginal teeth.
B. From near the centre of the membrane.
C. From near the anterior end of the membrane; portions of two adjacent rows of teeth.
D. From still nearer the anterior end of the membrane.
E. Marginals from the same end of the membrane as the last.
F. Extreme marginal in profile.
G. Extreme marginals.

PLATE IV.

FIG.

A. Lingual dentition of *Orthalicus gallina-sultana*, Chemn.
B. A marginal tooth of the same in profile.
C. The same. The eighth from the median line.
D. The same. Extreme marginal teeth.
E. The same. Jaw.
F. The same. Genitalia.
G. Liguus virgineus, Lin. The genitalia.

PLATE V.

FIG. Genitalia and Dentition of

I. Zonites inornatus, Say.
II. Zonites friabilis.
III. Helix Troostiana, Lea.
IV. Helix clausa, Say.
V. Helix rufo-apicata, Poey.
VI. Dentition of III.
VII. Helix Pennsylvanica, Green.
VIII. Helix nuxdenticulata, Chemn.
IX. Helix Josephinæ, Fér.
X. Geomalacus maculosus, Allm.

PLATE VI.

FIG.

I. *Helix Clarki* Lea. Lingual dentition, *a*, central and lateral tooth; *b*, marginal tooth. See also fig. v for extreme marginals.
II. *Helix Stearnsiana*, Gabb. Genitalia.
III. *Orthalicus obductus*, Shuttl. Lingual dentition; *a*, central and lateral teeth; *b*, the seventh tooth: *c*, extreme marginal teeth.
IV. *Helix Traski*, Lea. A portion of the genital system, showing vaginal prostate.
V. See I.
VI. Same as I. Genitalia.
VII. *Helix Wetherbyi*; Bland. Lingual dentition; *a*, central and lateral teeth *b*, first marginal teeth: *c*, extreme marginal teeth.

Note on the Jaw of PARTULA.

Having lately received through the kindness of Dr. W. D. Hartmann a number of *Partula* preserved in alcohol, I am preparing a description of their lingual dentition, genitalia and jaw. The latter is the most important point to be studied, this organ never having been described, I now, therefore, give the following particulars:

In *P. fusca*, Pease, *umbilicata*, Pease and *virginea*, Pease, it is very thin and transparent; arcuate with attenuated ends; cutting margin with a broad very slight median prominence; anterior surface with numerous (over 60 in *virginea*) very delicate, separated ribs, slightly denticulating either margin, those of the centre converging and meeting before reaching the lower margin, as in *Cylindrella*, &c. The jaw appears therefore to be of the same type as in *Bulimulus*, *Gæotis*, *Amphibulima*, *Cylindrella*, *Macroceramus* and *Pineria*. The ribs, however, are in *Partula* exceedingly fine.

The lingual dentition of the species mentioned above is the same as figured by Heynemann (Mall. Blatt. 1867, pl. i, fig. 1,) excepting that I detect distinct cutting points to the side cusps of the central teeth, not figured by him.

V.—*Notes on the Upper Coal Measures of West Virginia and Pennsylvania.*

By I. C. WHITE.

Read May 25th, 1874.

In this paper I propose to describe that part of the coal measures known as the Upper Barren Group, and also to make such remarks on the Upper Coal Group proper, as may be deemed of interest.

The district under consideration includes portions of Monongalia, Marion, Marshall, and Ohio counties, W. Va., and Green Co., Penn.; and the section extends from the Pittsburgh coal on the Monongahela River near Morgantown, W. Va., across the basin to the same coal near the Ohio at Wheeling.

Almost midway between Morgantown and Wheeling, there rises in Pennsylvania, and extends south into West Virginia, what is locally known as the "Dividing Ridge," since it forms the watershed between the tributaries of the Monongahela, and those of the Ohio.

This seems to occupy the median line of a gentle uplift, or anticlinal axis, which passes across the coal measures from north to south. As a consequence of this anticlinal, about fifteen miles west of Laurel Hill, we find the dip changing, and thenceforward the strata rise gently westward until the "Dividing Ridge" is crossed, beyond which, the dip is again northwestward, to within ten miles of Wheeling, when the strata again rise and soon bring the Pittsburg coal to the surface.

On the eastern flank of the "Dividing Ridge," Dunkard creek rises, and flows a little north of east, reaching the Monongahela two miles above Greensboro, Penn. The eastern section was made along this stream.

On the opposite side of the ridge and a few miles north, Wheeling creek rises, and, following a southwesterly direction, enters the Ohio at Wheeling. The western section, commencing on the south fork, was taken on this stream.

For the sake of a ready comparison we give both sections together, but will confine our remarks chiefly to the eastern one.

No. I is the eastern or Dunkard creek section.

No. II is the western or Wheeling creek section.

I.		II.	
1. Sandstone and shales	300′	1. Shales	100′
2. Limestone	1½′	2. Limestone	1′
3. Shaly sandstone	190′	3. Shales and Sandstones	200′
4. *Coal*	1–1½′	4. *Coal*	1′
5. Sandstone	95′	5. Shale	35′
6. *Coal*	1½–2′	6. Limestone	8′
7. Shale and sandstone	85′	7. Red shale	18′
8. Limestone	3′	8. Sandstone and shales	40′
9. Shale	40′	9. *Coal*	2′
10. *Coal*	1–1⅓′	10. Sandstone	30′
11. Shale	10′	11. Limestone	6′
12. Limestone	2′	12. Shaly sandstone	25′
13. Shale	40′	13. Shale	15′
14. *Coal,* "Brownsville"	2–3½′	14. Black slate	1½′
15. Shale	20′	15. Shale	2′
16. *Coal*	1′	16. *Coal,* "Brownsville"	2′
17. Shale	15′	17. Shale	10′
18. Sandstone	45–50′	18. *Coal*	1½′
19. *Coal,* "Waynesburg"	4–9′	19. Shale	12′
20. Sandstone	15′	20. Limestone	6′

I.		II.	
21. Shale	8	21. Shale	10′
22. Limestone	5′	22. Sandstone	15′
23. Shale	4′	23. Limestone	2′
24. Sandstone	15′	24. Sandstone	25–30′
25. Limestone	30′	25. *Coal,* "Waynesburg"	2½–4′
26. Sandstone	25′	26. Fire clay	3′
27. Limestone	6′	27. Sandstone	7′
28. Sandstone	15′	28. Shale with iron nodules	3′
29. Limestone	7′	29. Limestone	1½′
30. Sandstone	10′	30. Shale	2′
31. Limestone	8′	31. Limestone	1′
32. Shale	12′	32. Shale	1½′
33. Sandstone	31′	33. Limestone	5′
34. *Sewickly Coal*	5′	34. Shales with limestone	35′
35. Shale	8′	35. Limestone	1′
36. Limestone	7′	36. Shale	2′
37. Sandstone	10′	37. Limestone	3′
38. Limestone	22′	38. Shale	30′
39. *Redstone Coal*	4′	39. Limestone	2½′
40. Limestone	12′	40. Shale	8′
41. Shale	8′	41. Limestone	1½′
42. *Pittsburg Coal*	14′	42. Shale	10′
		43. Limestone	35′
		44. Sandstone	30′
		45. *Sewickly Coal*	6in
		46. Limestone	30′
		47. Shale	3′
		48. *Redstone Coal*	4in
		49. Fire Clay	2′
		50. Limestone	18′
		51. *Pittsburg Coal*	7–8

III.

Total thickness of Upper Barren Group	in Sec. I, 800 feet;	in Sec. II, 514 feet.
" " " " Coal	" " " " 340	" " " " 278 "
	Total 1,140 feet	Total 822 feet.

The measurements in No. 1, from the Waynesburg coal to the Pittsburg, are taken from a paper on the Upper Coal Measures, by Prof. Jno. J. Stevenson.

It should be remarked that great difficulty was experienced in making these sections, owing to the fact that good exposures are rare, since the sandstones and shales of the Upper Barren Group disintegrate so readily as soon to conceal themselves and all other strata in their own débris.

The sections speak for themselves in showing the well known fact, that the coals and sandstones thin out toward the west, while the limestones thicken up. Their contrast in this respect is remarkable. In the description which follows, section No. I is always meant where no reference is made to No. II.

Prof. H. D. Rogers in his Pennsylvania Report intimates that possibly somewhere in the highest hills of the series in Greene Co., Pa., Permian types of fossils may yet be discovered. Without desiring to discourage future observers in searching for such forms, I can only say that I made a diligent search, not only in the highest hills found by me in Greene Co., Pa., but also in those of West Virginia, and as a result failed to discover a fossil animal or plant of any type above No. 5 of Sec. I. These upper sandstones and shales are very coarse, giving evidence of having been deposited by pretty strong currents.

No. 2 is the highest limestone found by me; it is rather impure, but has been burned for lime in a few instances. On account of its elevation, it is frequently found strewn over the ground on some of the summits of hills, and is locally known as the "Ridge" limestone. It is seen near the top of the hill on the road from Tom's Run to Wheeling creek, and also 300 feet below Hunsucker's Knob, four miles northeast of Burton, B. & O. R. R., where Sec. I begins.

No. 4 is the first coal that we meet with. Though a small vein, it is remarkably pure, and has frequently been used by the blacksmiths in the vicinity. Jno. Taylor, near the head of Dunkard, has procured his fuel from it for some time, and says it is an excellent coal. It is the same as No. 4 of Sec. II, which appears near Perry Moore's on Wheeling creek.

No. 6 is the highest coal that has been mined, the one above it having been worked by stripping. This bed was mined some years ago on Mr. Grim's property, on Pumpkin Run, Monongalia Co., W. Va., to supply fuel for Mr. Jno. Lautz's steam mill, one-half mile below. At this opening the dip is southeast. Mr. Franklin Taylor, one mile and one-half above Jollytown, Greene Co., Penn., has procured his fuel from it for several years. One mile above this point it is seen on land of Mr. Thos. White. It is doubtless identical with No. 9 of Sec. II, which has been worked by Mr. Leals, on Wheeling creek. It is quite sulphurous, and too impure to be used for smithing.

The shale above this coal is interesting, as it is the highest horizon at which fossil plants have yet been discovered. On land now owned by Mr. Shriver, two miles from West Warren, Monongalia Co., W. Va., I found some impressions of what seems to be a *Pecopteris*, but they are not well enough preserved for specific determination. This is the only locality found by me, though doubtless others exist.

No. 8 is the purest limestone found in the Upper Barren Group on the eastern side. It first appears above the surface one mile above Kent's Mills on Dunkard creek; from this point it is easily traced down the stream to near Mt. Morris, Greene Co., Penn.

Coal No. 10 is very impure, consisting merely of bituminous slate in many places. Mr. Jacob Minor has opened this coal near the creek bank, one mile above Blacksville, Monongalia Co.; it is here sixteen inches thick. The smut of this coal is seen all along the road from Mr. Minor's to New Brownsville, a distance of five miles. It seems to have no representative in the western section. In the shale above it were found some very good impressions of *Neuropteris Loschii*.

No. 12 is a very impure limestone, and is constantly associated with coal No. 10.

Coal No. 14. This coal, the most important one in the

Group, has its greatest development about one mile below Brownsville, Monongalia Co., W. Va., and from this fact I have given it the name of "*Brownsville coal.*" The first opening in this coal, as we travel down Dunkard, is Mr. Abraham Tenant's, nearly a mile below Brownsville. Mr. Alpheus Brown, the proprietor of Brown's Mills on the other side of the creek, has also an opening in this vein. Hon. Wm. Price has opened the same bed two miles below. The following section from Price's bank is typical of the openings in this locality:—bituminous shale, 2 ft.; *coal*, 1 ft., 3 in.; slate, 4–6 in.; *coal*, 2 ft., 4 in.

As is seen from the preceding section, this coal, like the Waynesburg, is double, and this characteristic it retains wherever I have examined it, thus rendering its identification easy and certain, since it is the only one in the Group possessing this peculiarity. The upper division is not good, as it is very slaty, and contains much pyrites, but the lower part is an excellent coal and in high repute for smiths' use, selling for ten cents per bushel at the bank.

This coal thins out towards the east. Mr. Adam Browne, at Dunkard ford, near the mouth of Doll's run, opened it on his farm, but the entire thickness of coal in both parts was only twenty inches, and the opening was abandoned. At this point it is eighty-five feet above the *Waynesburg coal*, as proved by a boring made for oil. Four miles east of this, near Mr. Samuel Lemley's, where the road leaves the creek and crosses a small bluff, it is seen as a mere bituminous shale, only eighteen inches thick, and just about as far above the surface of Dunkard as it is at Brown's Mills, eight miles west of this point. I cannot be mistaken in this identification, since I traced it all the way between the two points, and to confirm the same, *coal* No. 16 of Sect. I appears at Lemley's in its proper place twenty feet below.

I also traced this coal to the south through Monongalia and Marion counties, W. Va., to Mannington on the B. & O. R. R. It maintains an almost constant relation to the

Waynesburg coal, as wherever we find the "*Brownsville*" *coal*, the Waynesburg is always from eighty to one hundred feet below. There is a perceptible thinning out to the south, as at Monnington, Marion Co., it is barely three feet. It is here nearly on a level with the railroad track. On Little Paw-paw, near Phelix Michael's, it shows the following section:—*coal*, 1 ft., 6 in.; slate, 2–4 in.; *coal*, 2 ft. Throughout the entire country from Brownsville to Monnington, it is everywhere known as the "three foot vein," and every farmer that has the Waynesburg coal opened, knows that a certain distance above is a "three foot vein."

No. 16 of the western section is doubtless identical with the "*Brownsville*" *coal*. It is worked in only one locality that I could discover. Mr. George Woodruff, near Ryerson station, Wheeling creek, Greene Co., Pa., has an opening in it. Here it is only two feet thick, with a parting of three inches of slate. At this point, being twenty-five miles from Wheeling, it is eighty feet above the Waynesburg coal. I should also say that wherever it thins out from its normal thickness (three to three and one-half feet) it also deteriorates in quality. Impressions of *Neuropteris hirsuta* are frequently found in the shales and slates above this coal. At Brown's Mills they are very plentiful.

Coal No. 16, Sect. I, is probably the one referred to by Dr. Stevenson, in "Notes on the Geology of West Virginia," as having been struck at the head of Romp's Hollow, by Mr. Lumly. It is easily traced to the east, but I could not find it to the south in Marion Co. It may be identical with No. 18 of Sect. II.

No. 19 is the heavy sandstone that everywhere overlies the Waynesburg coal where it is of workable thickness. It is a very coarse, hard rock, being almost a conglomerate in some places, and its heavy massive outliers are seen projecting from the hills along its entire outcrop from Waynesburg to the B. & O. R. R., at Farmington, Marion Co., W. Va., which is as far south as I traced it. By means of these

I was enabled to trace the underlying coal to the south through Monongalia and Marion counties, to the B. & O. R. R.

In the eastern section it is seldom less than forty-five feet thick, but in the western section it has dwindled down to twenty-five feet, where we first strike it at Ryerson Station, Wheeling Creek, Greene Co., Pa., and as we follow it still farther to the west, it thins out, until near Wheeling it has entirely disappeared and limestone takes its place.

Waynesburg Coal. On Dunkard creek we first come to this coal a short distance below Mt. Morris, which is about nine miles west from the Monongahela river. At this point the dip is northwest. The development of this coal in the neighborhood of Mt. Morris, is similar to the same coal on Scott's Run, as described by Dr. Stevenson. At Mr. Thornt. Boidston's opening, one mile east of town, the "*horseback*" or slate has thinned away entirely, and he has eight and one-half feet of solid coal. On Morris's run, one mile south of the town, the following section was made: — shale 10 ft.; *coal*, 3 ft.; shale, 6 in.; *coal*, 4 ft. 8 in. Nothing can exceed the suddenness with which this coal changes its character in some localities; and of this an excellent example is seen at South's distillery near Newburg, Greene Co., Pa. One opening there shows the following section: — *coal*, 2½ ft.; shale, 2 ft.; *coal*, 4 ft. About forty feet from this, the sandstone is seen resting directly upon four feet of *coal*, the "*horse-back*" and upper coal having been torn away by the violence of the current which deposited the overlying sandstones.

I traced this coal south to the B. & O. R. R., and as it has never been described in Marion Co., some sections of it from that county, and the southern part of Monongalia may prove of interest.

Passing south from Scott's run to Big Indian creek, and travelling down it, we come to the first opening in this coal at Mr. John Musgrove's, seven miles from Arnettsville; here it shows the following section: — sandstone, 40 ft.;

coal, 1 ft.; shale, 1 ft. 7 in.; *coal*, 6 in.; *highly bituminous slate* 2 ft.; *coal*, 4 ft. 4 in.

One mile south of this, at Mr. Isaac Rigg's bank, the following section was taken:—shale, 10 ft.; *coal*, 9 in.; shale 1 ft. 4 in.; *coal*, 4 ft.

At the mouth of Little Paw-paw creek in Marion Co., Mr. Fluhearty's opening shows the following:—shale, 6 ft.; *coal*, 6 in.; shale, 3 in.; *coal*, 1 ft. 7 in.; shale, 6 in.; *coal*, 1 ft. 2 in.; shale, 1 ft. 4 in.; *coal*, 4 ft.

Five miles northwest of this, at Bassettsville, on Big Paw-paw, it shows the following:—shale, 4 ft.; *coal*, 1 ft.; shale, 1 ft. 2 in.; *coal*, 3 ft.

Farther south, at Mr. Hawkins' on Dunkard Mill run, about three miles from the B. & O. R. R., it shows the following:—sandstone, 35 ft.; *coal*, 2 ft.; shale, 1 ft.; *coal*, 4 ft. At the mouth of the Dunkard Mill run on the B. & O. R. R., it is worked high up on the hill, and exhibits a section similar to the preceding one.

At Farmington on the B. O. R. R. it has been opened by Mr. Hamilton and others, only within the last two years. Previous to this, the people in the vicinity had been getting their coal from the *Pittsburg seam* at Fairmount, not knowing that the *Waynesburg coal* was at their very doors, until a land-slide exposed it to them.

From Farmington it can readily be traced up Buffalo creek along the B. and O. R. R. to where it disappears under it two miles below Mannington.

On the western side of the "Dividing Ridge," and fifteen miles from it, we come to this coal two miles below Ryerson station, where Crab Apple creek enters Wheeling creek. Here the section is as follows:—Heavy sandstone, 25 ft.; *coal*, 4 ft. This is a typical section of this coal throughout the country where it is opened here.

As will be seen from the section, the *double* character of this coal, universal in the eastern section, does not appear here. But it is very probable that it once did exist, and has been torn away by the deposition of the coarse sandstone which rests directly upon it. What seems to sustain this conclusion is, that ten miles west of "Crab Apple," where the sandstone has disappeared and is replaced by a few feet of shale, the coal presents its normal character, but it has diminished in thickness, being, near Mr. Gardner's, only three feet thick, slate and all.

As Mr. Gardner expressed it "The horseback is almost as hard as steel," thus preventing the mining of the coal. It is ten miles from this point to Wheeling, and as there are no openings on the line of section, I can tell nothing concerning it in the intervening distance; but it is exposed at Wheeling in a ravine not far from the B. and O. R. R. Co's Steel Rail manufactory. It is here only 2½ feet thick, and single.

Nothing answering to the *Uniontown coal* of H. D. Rogers could be found in either section.

Sewickly coal. This coal is very well developed in the Dunkard creek section, attaining in some instances to 5½ feet in thickness. It is known everywhere as the "five foot vein." It is first seen on Dunkard creek about four miles below Mt. Morris, where the road crosses the creek opposite Newburg. At Bobtown, two miles from the Monongahela river, it is seen on the steep bluffs of Dunkard, eighty-five feet above the *Pittsburg coal*, and is here five feet thick. This point is ten miles north of the Scott's Run country. On Wheeling creek this coal is only six inches thick.

Redstone coal. This coal seems to thin out to the north, as no openings have ever been made in it throughout the entire district of country between Robinson's run and Dunkard creek.

The inhabitants of this district are not aware that there is such a coal; but it has a representative of some kind here, as the smut of a coal, occupying its place, can be seen very frequently. I do not think it can be more than eighteen feet thick, if anything can be judged from its smut. One noticeable thing concerning it on Dunkard, is the entire absence of the twelve feet of limestones found below it on Robinson's run, Monongalia Co., eight miles south of this locality. Its place is filled here by the Pittsburg sandstone, which is twenty-five feet thick, and generally rests directly upon the underlying coals. The Redstone coal is only four inches thick in the Wheeling creek section.

Pittsburg coal. This coal first appears on Dunkard creek at Taylortown, Greene Co., Pa. It is here eight feet thick, and single-bedded, the heavy Pittsburgh sandstone resting immediately upon it. One mile below, the following section is seen :—sandstone 30 ft.; *coal*, 1½ ft.; shale 1 ft. 3 in.; *coal* 7 ft.

The following section of this coal was taken on the top of the hill opposite the mouth of Cheat river, and 350 feet above the surface of the same :—sandstones 35 ft.; shale 6 ft.; *coal* 5½ feet.

For the sake of contrast with the foregoing, I give another from Robinson's run, at Mr. Hunt's opening, five miles southwest of Cheat. It is as follows :—Limestones 11 ft.; shale 2 ft.; *coal* 1½ ft.; shale 1 ft. 3 in.; *coal* 4 in.; shale 1 ft. 7 in.; *coal* 11 in.; shale 8 in.; *coal* 1 ft.; shale 3 in.; *coal* 8 ft. Here in the first section we have only one seam of coal, while in the next we have *five!*

On land of Mr. James Lazzell, Dog's run, Monongalia Co., W. Va., some fine impressions of *Neuropteris hirsuta*, *Calamites*, *Sigillaria*, etc., were found in the roof-shales of this coal.

In the roof-shales of the Waynesburg coal at Mr. Layton's bank near Cassville, Monongalia Co., W. Va. and also at Mr. Morris's just above, the following coal plants were found, together with several others undetermined :—*Alethopteris Pennsylvanica*, *Pecopteris arborescens*, *Sphenophyllum filiculinus*.

Borings. During the "Oil fever" which raged here some years ago, several borings were commenced high up in the upper Barren Group, and put down from six to seven hundred feet. It is a matter of great regret that the records of these wells were not preserved. I was able to procure the records of one boring that was made near Bellton, Marshall Co., W. Va., B. and O. R. R., on land now owned by Hon. H. S. White. It runs as follows :—

1. Shale	10 ft.	15. Sandstones	4 ft.	29. Shale	18 ft.
2. Sandstone	6 "	16. Shale	19 "	30. Sandstone	25 "
3. *Coal*	3 "	17. Sandstone	16 "	31. Shale	4 "
4. Sandstone	17 "	18. Shale	4 "	32. Limestone	10 ft.
5. Shale	7 "	19. Sandstone	30 "	33. Fireclay	3 "
6. Sandstone	11 "	20. Shale	2 "	34. Limestone	4 "
7. Shale	12 "	21. Sandstone	35 "	35. Sandstone	16 "
8. Fireclay	7 "	22. Shale	27 "	36. Limestone	6 "
9. Sandstone	25 "	23. Soft sandstone	45 "	37. Slate	7 "
10. Shale	12 "	24. *Coal*	6 "	38. Limestone	4 "
11. Sandstone	17 "	25. Sandstone	20 "	39. Shale	3 "
12. *Coal*	9 "	26. Limestone	8 "	40. Sandstone	33 "
13. Sandstone	9 "	27. Shale	19 "	Total	544 ft.
14. Shale	5 "	28. Sandstone	15 "		

Interval between *coal* No. 3 and *coal* No. 12, 108 feet.
" " " " *coal* No. 12 and *coal* No. 24, 196 feet.

It is very probable that *coal* No. 3 is the "*Brownsville*," No. 12 the *Waynesburg*, and No. 24 the *Pittsburgh*.

If this record is correct, it is a very anomalous one, as no limestone at all appears above *coal* No. 24. It is easier, however, to doubt the record than to believe it, as the first foreman employed by the company knew very little about the character of rocks.

upper Barren Group, and put down from six to seven hundred feet. It is a matter of great regret that the records of these wells were not preserved. I was able to procure the records of one boring that was made near Bellton, Marshall Co., W. Va., B. and O. R. R., on land now owned by Hon. H. S. White. It runs as follows:—

1. Shale............10 ft.	15. Sandstones....... 4 ft.	29. Shale............18 ft.
2. Sandstone....... 6 "	16. Shale............19 "	30. Sandstone........25 "
3. *Coal*............ 3 "	17. Sandstone........16 "	31. Shale............ 4 "
4. Sandstone........17 "	18. Shale............ 4 "	32. Limestone.......10 "
5. Shale............ 7 "	19. Sandstone........30 "	33. Fireclay.......... 3 "
6. Sandstone........11 "	20. Shale............ 2 "	34. Limestone....... 4 "
7. Shale............12 "	21. Sandstone........35 "	35. Sandstone........16 "
8. Fireclay.......... 7 "	22. Shale............27 "	36. Limestone....... 6 "
9. Sandstone........25 "	23. Soft sandstone...45 "	37. Slate............ 7 "
10. Shale............12 "	24. *Coal*............ 6 "	38. Limestone....... 4 "
11. Sandstone........17 "	25. Sandstone........20 "	39. Shale............ 3 "
12. *Coal*............ 9 "	26. Limestone........ 8 "	40. Sandstone........33 "
13. Sandstone........ 9 "	27. Shale............19 "	Total 544 ft.
14. Shale............ 5 "	28. Sandstone........15 "	

Interval between *coal* No. 3 and *coal* No. 12, 108 feet.
" " " " *coal* No. 12 and *coal* No. 24, 196 feet.

It is very probable that *coal* No. 3 is the "*Brownsville*," No. 12 the *Waynesburg*, and No. 24 the *Pittsburg*.

If this record is correct, it is a very anomalous one, as no limestone at all appears above *coal* No. 24. It is easier, however, to doubt the record than to believe it, as the first foreman employed by the company knew very little about the character of rocks.

VI.—*Poissons de l'île de Cuba. Espèces nouvelles décrites*

PAR FELIPE POEY.

Membre correspondant du Lycée d' Hist. Nat. de New York.

Présenté le 5 Octobre, 1874.

Chilodipterus affinis.

Le genre *Chilodipterus* appartient à la famille des *Amidæ*, dont le type est le genre Amia de Gronovius (Apogon Lacépède). Il se distingue des autres genres de cette famille par de longs crochets pointus qui se mêlent au fin velours de leurs mâchoires. Le Dr. Günther n'en décrit que cinq espèces, toutes des Indes Orientales, de la Mer Rouge ou de l'Océan Pacifique.

L'espèce que je décris a été trouvée par moi une seule fois à la Havane, en trois exemplaires, dont le plus grand est long de quatre-vingt millimètres. Sa hauteur entre quatre fois et deux tiers dans la longueur totale; l'œil est trois fois dans la longueur de la tête. La bouche est très fendue et oblique; le maxillaire échancré postérieurement, finit à l'aplomb du centre de la pupille. L'opercule a deux épines plates, et une strie qui aboutit à l'épine inférieure, au-delà de laquelle se prolonge le lobe sous-operculaire; le préopercule est dentelé, et porte un rebord ayant à son angle deux petites pointes à peine discernibles. On sent une épine sur la region mastoïdienne du crâne. Les mâchoires ont les dents en velours, et portent sur le devant quelques canines: la mâchoire inférieure a de plus sur les côtés quatre longues canines.

D. 6 + 1, 9; A. 2, 9. La seconde dorsale et l'anale sont opposées; le deuxième rayon de la première et le troisième de la seconde, sont de double hauteur que le dernier; l'épine ventrale est forte. La caudale est échancrée. Les écailles du dos sont cycloïdes; celles des flancs ont l'éventail et des cils trés-fins: il y en a aux joues. La couleur est rouge: il paraît que le péritoine est argenté. La base de la caudale est noirâtre. L'opercule est lisse et brillant.

Num. 601 de mon Ichthyologie MS. de Cuba.

Corvina subaequalis.

Longueur totale 245 millimètres.

La hauteur du corps, égale à la longueur de la tête; est contenue trois fois et cinq sixièmes dans la longueur totale. La tête est grosse, ayant l'œil contenu trois fois et un tiers dans sa longueur; le museau est court et arrondi. La bouche est mediocre, le maxillaire atteignant l'aplomb du bord antérieur de la pupille. Les deux mâchoires sont à-peu-près d'égale longueur, comme j'ai voulu le témoigner par le nom spécifique. Les dents sont en fin velours, sauf un rang externe de dents plus longues, égales, écartées, plus remarquables à la mâchoire supérieure qu'à l'inférieure. Le museau montre en dessous deux pores de chaque côté. Le préopercule est finement dentelé; l'opercule, entier.

D. 10 + 1, 25; A. 2, 7. Les deux nageoires dorsales sont séparées par un espace d'environ cinq millimètres. Le premier rayon de la première dorsale est très court; le second est robuste. Le bord postérieur de la caudale forme un angle saillant. Les écailles sont assez grandes, même celles des joues et de l'opercule: il y en a sur la base de l'anale.

La couleur parait avoir été plus ou moins argentée, ayant jauni dans l'eau de vie. Comparaison.—Le *Diapterus Lefroyi* des Bermudes, que M. G. Brown Goode a décrit dans le Amer. Journ. of Sc. and Arts, viii, Aug. 1874, ressemble à mon espèce sous plusieurs rapports, notamment par la forme allongée du corps et les rayons épineux de l'anale, qui sont au nombre de deux, le premier très-court, le second long et grêle. La comparaison qui suit montre cependant que l'espèce est différente. Je mets entre parenthèses les caractères de celle de Cuba.

L'origine de la dorsale est eloignée de l'extrémité du museau, deux fois la longueur de sa base, ce qui doit s'entendre de la partie épineuse (une fois et deux tiers), l'échancrure est profonde, ne laissant voir que la membrane connective, celle-ci a disparu, l'échancrure étant plus profonde; l'étendue de la partie molle de la dorsale est plus grande que celle de la partie épineuse (les deux sont égales); l'anale commence en arrière du milieu du corps (très en arrière); l'extrémité de la pectorale est à l'aplomb de la dernière épine dorsale (de l'avant dernière); l'axille de la pectorale et l'extrémité du museau sont brunâtres (le tronc brachial est amplement noir, et le museau n'a pas de brun; il y a du noir à la pointe de la dorsale épineuse, ce qui n'est pas indiqué par Mr. Goode).

J'ai trouve ce poisson dans un de mes bocaux, conservé dans la liqueur, ne sachant pas précisément d'où il m'est venu, mais soupçonnant qu'il m'a été remis de Cienfuegos, côte du Sud. Je l'ai envoyé à Mr. Peters, Directeur du Musée de Berlin, et je n'en ai pas revu depuis un autre exemplaire.

Num. 443, de mon Ichthyologie MS. de Cuba.

Eucinostomus productus.

Le Professeur Gill dans les *Proceed.* of the *Acad.* of *Phila.*, 1862, p. 238, a considéré le genre *Eucinostomus* de

Baird et Girard, comme synonyme du *Diapterus* de Ranzani, qui a la priorité ; mais il parait qu'il a plus tard abandonné ce dernier genre, à cause probablement de quelques erreurs dans lesquelles est tombé l'auteur italien ; puisque dans son catalogue de 1873 il accepte la dénomination de Baird et Girard : je ne crains pas de m'égarer sur les pas de ce savant ichthyologiste. Cependant, l'espèce que je décris a la dorsale tellement échancrée, que l'on pourrait tout aussi bien dire qu'il y a deux dorsales ; car la membrane du dernier rayon épineux touche, sans monter le premier rayon mou. Le nom de *Diapterus* lui viendrait bien ; nom proposé en 1841 dans les *Novi Commentarii Academiæ Bononiensis*, que je n'ai pas eu l'occasion de consulter.

Individu décrit : 225 millimètres ; c'est une femelle. Le corps est oblong élégammant attenué vers les deux bouts ; la ligne de la gorge et celle du front ont une égale courbure. La hauteur du poisson entre quatre fois dans la longueur totale, ainsi que la tête, qui contient l'œil trois fois, sans compter l'intermaxillaire. Un des caractères les plus distinctifs de cette espèce, c'est le diamètre transversal du corps, qui est grand, surtout vers les deux tiers de sa hauteur, où il mesure trente millimètres, sur cinquante-cinq de haut. Les ouvertures nasales sont petites et rapprochées, sans ressaut, la partie visible du maxillaire est triangulaire, ayant la hauteur deux fois aussi étendue que la base. Le préopercule et le sous-orbitaire sont entiers, comme l'exige le genre auquel le poisson appartient. Les dents sont en fin velours, plus visibles à la loupe sur la mâchoire inférieure.

D. 9, 10 ; A. 2, 8. La dorsale est échancrée jusqu'à la ligne du dos ; la portion épineuse est aussi étendue que la portion molle, dont le dernier rayon répond au dernier de l'anale, pas tout à fait cependant, car il est en arrière environ deux millimètres. Les rayons épineux sont faibles, le premier de la dorsale est tres-court, le deuxième égale en longueur la moitié de la hauteur du corps, égalant la distance qu'il y a entre le centre de la pupille et l'extrémité postérieure de l'opercule. Je ne vois que deux rayons épineux à l'anale : le premier est tres petit ; le deuxième est très grêle, et n'est en longueur que la moitié du second de la dorsale. La dorsale molle et l'anale ont sur le devant à-peu-près le double de hauteur qu'en arrière. Caudale bifurquée, pectorale pointue, ventrale médiocre, un peu en arrière de la base des pectorales, et surmontée d'un lobule écailleux.

Les écailles des flancs, marquées au centre d'un petit trait, sont plutôt grandes que médiocres ; celles de la région caudale sont de moitié plus petites. Je ne vois pas d'écailles sur l'opercule, mais il y en a sur les pièces inférieures et sur les joues, ainsi que sur l'espace interorbitaire ; le museau n'en a pas, et le maxillaire brille comme de l'argent poli. Les nageoires verticales n'ont pas d'écailles, mais leur base se loge dans un repli écailleux.

Le dos est bleuâtre et brillant, le ventre est d'un bleu très pâle ; les flancs sont verdâtres, ainsi que les nageoires impaires ; les autres nageoires sont jaunâtres. Il y a sur la base des pectorales, un caractère important ; c'est une tache noire qui fait reconnaître l'espèce au premier coup d'œil ; de plus la pointe antérieure de la dorsale est noirâtre, comme chez quelques autres espèces qu'on ne saurait confondre avec la présente.

L'espèce est rare : quelques-uns la nomment *Moharra de ley*, nom qui appartient plutôt à une autre espèce plus commune. J'ai envoyé le type ici décrit au *Smithsonian Institution.*

Num. 382 de mon Ichthyologie MS. de Cuba.

Mugil brasiliensis. PL. VII.

VULGO *Plateado.*

? *Curema* Marcgravus, Hist. Bras., p. 181, 1648.

Mugil brasiliensis Agassiz, in Spix, Pisc. Bras., p. 234, tab. 72, 1829.

? *Mugil incilis* Hancock, in Lond. Quart. Journal Sc., 1830 (*fide* Gthr.).

? *Mugil Gaimardianus* Desmarest, Dict. class., tab. 109, 1824–1830.

? *Mugil Curema* Valenciennes, in Cuv. et Val. Poiss., XI, p. 87, 1836.

? *Mugil petrosus* Valenciennes, *loco citato*, p. 89.

? *M. Curema* Gay, Hist. Chil. Zool., II, p. 259, 1848.

? *M. petrosus* Gay, *loco citato*, p. 260.

M. brasiliensis Günther, Catal., III, p. 431, 1861.

M. Gaimardinus Poey, Synopsis, p. 388, 1868.

Les espèces de ce genre sont très difficiles à distinguer ; parceque les auteurs ont ordinairement omis les caractères essentiels que le Dr. Günther signale dans son catalogue des poissons du Musée Britannique, tome 2, p. 412, à l'aide desquels il a pu rendre compte de soixante-six espèces décrites dans ce grand ouvrage.

Nous avons à Cuba deux espèces bien communes : la plus grande, nommée par moi *Mugil Lebranchus*, ayant la seconde dorsale et l'anale dépourvues d'écailles, l'autre, que je rapporte au *M. brasiliensis*, nommé à la Havane *Plateado*, pour le distinguer de la *Liza* commune. Les pêcheurs ne connaissent que ces deux espèces; mais parmi les individus à nageoires écailleuses, il y a des différences qu'un œil attentif peut découvrir, et qui suffisent pour ajouter deux autres espèces à celles que l'on connait déjà; et c'est ce que je vais faire, en commençant par donner les caractères essentiels du *brasiliensis*, que je prends pour chef de file, comme point de comparaison, ayant soin d'omettre quelques détails communs aux espèces du genre *Mugil*.

Individu décrit, 325 millimètres. Il se distingue au premier coup d'œil par un aplatissement sur les flancs; car sa coupe verticale, sur une hauteur de soixante-et-huit mill. donne en longueur trente-deux mill. au premier tiers, et quarante-et-un au deuxième. La hauteur du corps est contenue près de cinq fois dans la longueur totale; la tête y est cinq fois et un quart, et contient l'œil trois fois et trois quarts, séparé du bout du museau un peu moins de son diamètre. Le profil du museau est médiocrement pointu. Le dessus de la tête et les tempes montrent plusieurs écailles percées d'un trait longitudinal. Les narines sont éloignées l'une de l'autre; la postérieure à égale distance de l'antérieure et du bord de l'orbite; l'antérieure peu eloignée de la lèvre supérieure. Il y a sur l'œil un voile adipeux ouvert sur la pupille. Le préopercule forme un angle qui se rejette en arrière, où il devient membraneux et transparent.

La bouche n'est pas fendue jusqu'aux yeux: la lèvre supérieure est grosse, le maxillaire entièrement caché sous le premier sous-orbitaire. La mâchoire inférieure, moins avancée que l'autre, porte une lèvre étroite.

Les dents sont comme des fils, très courtes et rapprochées, et presque imperceptibles à la simple vue, environ soixante-et-cinq en haut, cent en bas, de chaque côte.

Le palais est lisse, ainsi que la langue, qui est arrièrée, attachée à un frein élevé en toit, prolongé en avant et également lisse. Les branches de la mâchoire inférieure, vues en dessous, forment un angle de quatre-vingts dégrés.

La ventrale s'attache sous les trois cinquièmes de la longueur de la pectorale, qui entre près de sept fois dans la longueur totale, et s'élève au-dessous de la moitié du corps: la première dorsale commence au milieu du corps, sans compter tout le bord supérieur de la caudale; sa ligne d'aplomb est séparée de la pointe de la pectorale un espace égal au tiers de cette dernière nageoire, et séparée de la seconde dorsale autant que de la base supérieure de la pectorale. La première épine dorsale égale en longueur la moitié de la hauteur du corps au-dessous d'elle; ce qui fait plus de la moitié de la longueur de la tête. La seconde dorsale commence au dessus du premier tiers de l'anale, dont les rayons sont 3, 9. L'espace libre entre les deux nageoires du dos, dépasse d'un cinquième l'étendue de la première.

Les écailles du tronc sont grandes, environ quarante sur une ligne longitudinale; marquées sur leur milieu d'un petit trait, sans distinction de la ligne latérale. La seconde dorsale et l'anale sont couvertes de petites écailles, trés serrées.

Couleur argentée, écailles miroitantes, dos verdâtre; il y a des reflets rougeâtres sur l'opercule: une bande pâle de reflet parcourt les séries longitudinales des écailles. Les nageoires participent de la couleur du corps: la pointe de la seconde dorsale et le devant de l'anale, ainsi que le bord postérieur de la caudale, sont noirâtres. La tache bleuâtre de la base des pectorales est peu prononcée et variable. Iris orangé.

Observations sur la Synonymie.

Valenciennes est le premier qui ait rapporté le *Curema* de Marcgrave au *M. brasiliensis* d'Agassiz, auquel il a enlevé injustement la priorité scientifique, rétablie par le Dr. Günther. Il n'y a rien dans Marcgrave qui fasse croire que son *Curema* appartienne au *brasiliensis*, plutôt qu'au *M. Liza*, car le caractère des nageoires écailleuses n'y est pas: la taille qu'il donne, de deux pieds, le jette, au contraire, dans la synonymie du *M. Liza.*

Le *Mugil brasiliensis*, figuré par Spix, ne peut avoir qu'une médiocre exactitude d'après le jugement que l'on peut former sur l'ouvrage entier: c'est cependant celle qui se rapproche le plus de l'espèce de Cuba, ayant comme elle les nageoires écailleuses, et à-peu-près la même position des nageoires paires; l'œil est trop petit. Reste à voir la langue.

Le *Mugil Gaimardianus* de Desmarest est peut-être antérieur au *brasiliensis*, mais on n'en est pas certain, car la date du Dictionnaire Classique est renfermée entre 1824 et 1830. Il a été reçu de Cuba; et comme il se conserve au Jardin des Plantes, il est probable que Valenciennes, qui le cite a son *Curema*, ait observé les écailles des nageoires verticales; mais je ne crois pas qu'il ait observé la langue. D'ailleurs, la figure de Desmarest est plus inexacte que celle de Spix, car la pointe de la pectorale est sous le premier tiers de la première dorsale ; et les nageoires sont d'une couleur uniforme ; ce qui doit nuire à la priorité. Voyez l'espèce qui suit.

Le *Mugil Curema* de Valenciennes n'est pas le même, par le seul fait d'avoir la langue plieé en toit, à arête aiguë, toute couverte de fortes âpretés. Eût-il pris le frein pour la langue, encore est-il vrai qu'il se distingue de l'espèce de Cuba par les âpretés. Je l'ai laissé avec doute dans la Synonymie, parcequ'il cite Agassiz et Desmarest, parcequ'il en a reçu un exemplaire de Cuba, et parcequ'il peut avoir mal observé, ou confondu quelque autre individu.

Le *Mugil petrosus* de Valenciennes, me semble, comme au Dr. Günther, n'être qu'une variété du *Curema* du même auteur. Il en a reçu de Cuba, du Brésil, de Surinam, et nous en voyons, dit-il, l'espèce s'avancer vers le nord jusqu'à New York. Ce serait le même que celui de Cuba, s'il eut différé du *Curema* par la langue ; mais il n'en dit rien, tout en le comparant au Curema, et il laisse croire qu'il en a les âpretés. Il est douteux que les Muges du Chili nommés *Curema* et *petrosus* par Gay, soient bien déterminés : l'auteur copie assez visiblement les données de Valenciennes.

Dans la déscription du *Mugil brasiliensis*, le Dr. Günther dit que la ventrale s'insère au milieu de la distance qu'il y a entre la pectorale et la dorsale épineuse : c'est ce qui se voit quelquefois.

Histoire. Les plus grands que j'ai vus n'arrivent pas à 400 millimètres de long. No. 52 de mon Ichthyologie MS. de Cuba.

Mugil Gaimardianus. PL. VIII, Figs. 1-3.

Mugil Gaimardianus, Desmarest, Dict. Classique (1824–1830).

En suivant la déscription de l'espèce qui précède je m'attacherai ici à donner principalement les caractères différentiels.

Longueur totale, 225 millimètres; contenant la hauteur cinq fois et un cinquième, et la tête quatre et quatre cinquièmes. L'œil est contenu trois fois et deux tiers dans la longueur de la tête, à trois quarts de son diamètre du bout du museau, qui est arrondi. La bouche est fendue jusqu'a l'aplomb du bord orbitaire antérieure; la lèvre inférieure renflée à son extrémité, qui se cache entre trois tubercules du palais. Les dents de la mâchoire supérieure sont ecartées, petites, un peu fortes; celles de la mâchoire inférieure sont très fiens, à peine discernibles.

Ventrale attachée sous le milieu de la pectorale, qui entre six fois et un quart dans la longueur totale: sa ligne d'aplomb n'est separée de la pointe de la pectorale, qu'un espace égal à un dixième de cette dernière nageoire. La première épine dorsale entre une fois et trois cinquièmes dans la hauteur du corps au-dessous d'elle. L'espace libre qui sépare les deux nageoires du dos, égale l'étendue de la première. Je ne vois pas de trait enfoncé sur les écailles des flancs.

Couleur argentée, dos gris de plomb; une bandelette brune parcourt les séries longitudinales des écailles. La base de la dorsale porte une tache noirâtre bien prononcée: les autres nageoires n'ont pas du noir. Il y a des reflets dorés sur l'opercule.

Observations.—Le reproche que j'ai fait à Desmarest sur la position avancée de la première dorsale, lorsque j'ai comparé sa figure à celle du *M. brasiliensis*, disparait ici et devient un caractère essentiel, confirmé par la ligne brune qui parcourt les écailles des flancs. J'ai donc lieu de croire qu'il est bien cité par moi, comme auteur de cette espèce, qui est peut-être celle du Dr. Günther, décrite sous le nom de *M. brasiliensis* quoiqu'il y rapporte la figure de Spix, qu'il dit toutefois n'être pas bonne.

Comparaison.—On peut voir par la déscription qui précède, que le *M. Gaimardianus* diffère principalement du *brasiliensis*, par un corps plus allongé, un museau plus court, la lèvre supérieure moins grosse, l'inférieure moins étroite, les dents plus fortes et écartées; la première dorsale presque sur la pointe de la pectorale et moins séparée de la seconde. Il y a encore quelques différences sur les couleurs. Je regrette de n'avoir pas observé la langue, l'angle de la mâchoire inférieure, les rayons de l'anale. Les écailles des nageoires verticales sont les mêmes.

Histoire.—L'espèce est très rare, si l'on considère que je ne l'ai vue qu' une fois ; mais il est probable que je l'aie confondue au marché avec le *M. brasiliensis.* C'est le No. 529 de mon Ichthyologie MS. de Cuba.

Mugil trichodon. PL. VIII, FIGS. 4–8.

C'est toujours en suivant la déscription de mon chef de file, et en m'arrêtant sur les différences, que je vais décrire cette nouvelle espèce à langue lisse et à nageoires verticales écailleuses.

Longueur totale, 275 millimètres, contenant la hauteur du corps un peu plus de cinq fois et la tête un peu moins. L'œil est contenu quatre fois et un cinquième dans la longueur de la tête, eloigné plus d'un diamètre du bout du museau, qui est pointu. La lèvre supérieure est médiocrement grosse ; le maxillaire est caché sous un sous-orbitaire dentelé, ou du moins bien strié sur son bord : la lèvre inférieure est aplatie et étroite.

Les dents sont longues de deux millimètres, comparativement écartées, flexibles, courbées, environ quarante sur chaque mâchoire de chaque côté : elles paraissent filiformes ; mais, à la loupe, elles se montrent comprimeés et élargies à leur extrémité (fig. 7). Les branches de la mâchoire inférieure forment un angle de soixante-et-dix degrés.

La ventrale s'attache sur les cinq septièmes de la longueur de la pectorale. La première dorsale a sa ligne d'àplomb séparée de la pointe de la pectorale, un espace égal aux trois cinquièmes de cette nageoire, et plus près de sa base que du commencement de la seconde dorsale. La première épine du dos n'est que la moitié de la longueur de la tête, quoique elle soit la moitié du corps au-dessous d'elle. Les rayons de l'anale sont certainement 3, 8. L'espace libre entre les deux nageoires du dos dépasse de moitié l'étendue de la première. Les écailles sont grandes, trent-cinq sur une ligne longitudinale, marquées sur la base d'un petit trait.

Couleur gris de plomb brillant, ventre argenté, nageoires d'un brun pâle, sans autre tache noirâtre : la tâche des pectorales est presque nulle. Il y a des reflets sur les côtés de la tête.

Comparaison.—Il resemble plus au *M. brasiliensis* qu'au *Gaimardianus.* Il est plus allongé, la région caudale bien comprimée, la tête plus longue, le museau plus pointu ; l'œil est plus petit ; l'angle de la mâchoire plus aigu ; la première dorsale est plus séparée de la pointe de la pectorale, et surtout du commencement de la seconde ; les stigmates secréteurs de la tête sont plus petits, mais ce qui les distingue le mieux, ce sont les dents.

Histoire.—Il est rare : Je l'ai vu plus d'une fois. Num. 611 de mon Ichthyologie MS. de Cuba.

Neoconger perlongus. PL. 9, FIGS. 3–4.

Ce poisson se rapproche complètement des Congres par la position des narines, ayant l'ouverture postérieure haute et près de l'œil ; et il se rapproche des *Ophisures* par l'extrémité de la queue : ses nageoires très basses le rangent dans le genre *Neoconger* de Girard.

Longueur totale 320 millimètres (140+180). La tête est contenue un peu plus de cinq fois dans la première partie du corps, qui termine à l'anus. Le museau est pointu, la gorge renflée ; la bouche est fendue jusqu'à la quatrième partie de la tête. L'œil est grand, et finit un peu en avant de la commissure buccale, séparé du bout du museau un diamètre et trois quarts. La mâchoire inférieure est arriérée. Il y a de chaque côté trois pores entre les deux ouvertures nasales, une autre plus bas, trois derrière l'œil, deux à la mâchoire inférieure. Les nombreux et fins rayons branchiostèges se laissent voir sur la peau, à la partie postérieure de la tête.

On reconnait à la loupe que les dents sont très courtes mais robustes, un peu crochues et pointues, toutes de même grandeur, et sur un rang ; quelques-unes placées sur le devant des mâchoires, sont plus longues. Je ne puis pas bien distinguer les vomériennes, mais sur le milieu du plateau nasal il y a un rang de dents courtes et robustes.

Ce poisson est remarquable par le peu de hauteur du corps, laquelle, prise entre la pectorale et l'anus, entre soixante-et-douze fois dans la longueur totale. La dorsale et l'anale sont basses, environ le quart ou le cinquième de la hauteur du corps. La première commence un peu en arrière de la pointe de la pectorale, et finit sur la pointe même de la queue, ainsi que l'anale. Couleur brun-violet, plus pâle sous le ventre. La peau, vue sous la loupe, est pointillée de noir.

Histoire.—Je ne l'ai eu qu'une seule fois à Matanzas. C'est le num. 639, de mon Ichthyologie MS. de Cuba.

Gymnothorax umbrosus. PL. IX, FIGS. 1–2.

Longueur totale 660 millimètres, savoir 340+320, ce qui fait la queue plus courte que le reste du corps, dont la tête occupe le quart : celle-ci n'est pas grosse et n'a pas la nuque relevée. La hauteur du poisson est contenue seize fois dans la longueur totale. La bouche est fendue jusqu'à la moitié de la tête. L'œil est petit, fait un sixième de la bouche, et se trouve placé un peu plus près du bout du museau que de la commissure. L'ouverture postérieure nasale est haute, devant l'œil, fendue longitudinalement; l'autre est tubuleuse et terminale. Le long des mâchoires, il y a quatre pores en haut, trois en bas et deux entre les ouvertures des narines.

La mâchoire supérieure présente à l'extrémité une rangée de petites dents, suivies en dedans d'autres plus longues et grêles, tant au palais comme au plateau nasal: ces dernières sont les plus longues. Les dents de la mâchoire inférieure sont sur un seul rang, plus nombreuses, plus serrées, tournées un peu en arrière, environ trente de chaque côté; les six premières plus longues et écartées, faisant jeu avec celles d'en haut. Les dents vomériennes sont sur un seul rang. Les deux mâchoires sont d'égale longueur.

La nageoire dorsale commence au-dessous de l'ouverture des ouïes, elle augmente insensiblement de hauteur jusqu'à l'anus, où elle a un peu moins du tiers de la hauteur du corps au-dessous d'elle; de là elle va en diminuant jusqu'à l'extrémité de la queue, où elle se réduit à presque rien, pour s'unir à l'anale; celle-ci est d'un tiers moins haute que la dorsale, entrant près de douze fois dans la hauteur du tronc. Deux lignes longitudinales, comme un pli, parcourent la longueur de la dorsale. Plusieurs plis se rendent de l'ouverture branchiale aux côtés de la bouche.

Couleur brune, tirant un peu sur le rouge. Cette couleur forme de nombreuses marbrures sur un fond plus pâle, et de la couleur uniforme rougeâtre du ventre; ces marbrures sont peu prononcées. Les nageoires sont aussi d'un fond rougeâtre.

C'est une femelle: les œufs, tombés dans l'abdomen, sont ronds, d'un millimètre de diamètre et très blancs. Je l'ai envoyé au Smithsonian Institution. No. 403 de mon Ichthyologie MS. de Cuba.

Gymnothorax polygonius. PL. X.

Longueur totale, 722 millimètres (344+378).

La tête est contenue plus de trois fois et demie dans la longueur du tronc, la tête incluse: elle parait grosse à cause du renflement de la gorge; l'occiput est relevé, le profil fait une ligne rentrante sur l'œil. La mâchoire inférieure est un peu arriérée. La fente buccale est contenue deux fois et demie dans la longueur de la tête. L'œil fait la cinquième partie de cette ouverture, placé plus près de la commissure que de l'extrémité du museau. L'ouverture postérieure des narines est arrondie, l'antérieure porte un tube qui dépasse le bout du museau. Le long des mâchoires on compte trois pores en haut, et trois en bas: entre les deux ouvertures antérieures, il y a deux pores. Les joues sont parcourues, depuis l'ouverture branchiale jusqu'à la bouche par sept lignes, ou plis parallèles: plus ces lignes sont inférieures, plus elles avancent.

La mâchoire supérieure est pourvue d'une série externe de dents, envirou quinze, courtes, écartées, tournées en arrière, presque égales au nasal et aux palatins : le plateau nasal a sur la ligne médiane deux dents plus longues. Les dents du vomer paraissent être sur un seul rang. La mâchoire inférieure porte une autre série de dents toutes semblables, un peu plus courtes que celles de la mâchoire supérieure : ces dents sont comprimées et aiguës, assez rapprochées, au nombre de seize à vingt.

La hauteur du tronc est contenue quinze fois et demie dans la longueur totale. La nageoire du dos commence aux deux tiers de la tête, d'abord basse, et peu après haute, de manière a entrer trois fois et demie dans la hauteur du corps : elle s'étend très peu à l'extrémité de la queue, où elle se continue avec l'anale, qui est extrêmement basse, comme un relief, dont la hauteur n'est que la douzième partie de celle de la dorsale, vers le milieu de la queue, ou un trente sixième de la hauteur du tronc.

La couleur est blanchâtre, ou jaunâtre pâle ; le tronc et la queue parcourus par des bandelettes d'un brun jaunâtre, qui décrivent des polygones incomplets, ordinairement des carrés irréguliers dont les cotés ont deux à quatre fois le diamètre de l'œil. Outre cela, toute la peau est couverte d'une marbrure fine, qui forme sur la tête des traits arrondis, comme j'en ai représenté une partie sur la figure. Ces bandelettes s'étendent sur la nageoire supérieure, qui est de la couleur du tronc. La peau est si grosse, qu'elle ne permet pas de compter les rayons. La nageoire anale a le bord tout blanc. Iris jaune.

L'espèce n'est pas commune. Je l'ai envoyeé au Smithsonian Institution. C'est le No. 602 de mon Ichthyologie MS. de Cuba.

Chilomycterus orbitosus.

Famille des *Diodontidi*. Longueur totale, 345 millimètres.

Brun clair en dessus et sur les flancs, où il se montre tout couvert de taches rondes, tracées par des lignes brunes circulaires qui se touchent sans se croiser, aussi grandes que la pupille, rehaussées souvent par le fond plus foncé des interstices. Le ventre a ses taches plus grandes et ovales, d'un orangé très vif tirant sur le vermillon, sur un fond bien noir des interstices. De plus il y a deux grandes taches paires, noires, bordées de clair, savoir : une au-dessus de la nageoire pectorale, une autre en arrière de cette même nageoire. La base de la dorsale porte une bande noire. Nageoires orangées ; lèvres rougeâtres, ainsi que le tube des narines. Iris jaunâtre, avec un cercle rouge.

Les épines sont fortes, courtes, affermies sur trois racines, au nombre à-peu-près de quatre-vingt sur tout le corps, sans compter les petites du ventre. Le dessus de la tête présente en avant une de ces épines, deux plus en arrière ; deux au-dessus de l'œil, une au-dessous, une en arrière. Il y a trois tentacles pendants de la mâchoire inférieure, de chaque coté.

D. 12; P. 23; C. 8. La vessie natatoire est comme celle du *Paradiodon hystrix;* la rate est arrondie, de même que la vésicule du fiel, laquelle est jaunâtre.

Variété:— On trouve de plus quelquefois une tache grande, noire, arrondie, en arrière de la mâchoire inférieure.

L'espèce est assez commune. C'est le No. 109 de mon Ichthyologie MS. de Cuba.

VII.—*Descriptions of Two New Species of Birds of the Families Tanagridæ and Tyrannidæ.*

BY GEO. N. LAWRENCE.

Read November 16, 1874.

Phænicothraupis cristata.

MALE. Upper plumage of a deep dull vinous color; the front, sides of the head, breast, and under tail coverts of a rather dull crimson; the throat bright scarlet; sides and lower part of abdomen dusky; the crest, which is much elongated and recurved, is bright scarlet; quills smoky-black with their outer margins the color of the back; tail feathers deep vinous red, the central ones and outer webs of the others brighter in color; bill black; tarsi and toes dark brown.

Length about 8 in.; wing 4; tail 3$\frac{3}{4}$; tarsi 1; bill $\frac{3}{4}$; from base of bill to end of crest 1 9-16 inches.

Habitat. New Granada, Bogota.

Remarks. I found the single specimen described above, in a collection of birds from Bogota.

It differs from all others of the genus in having a conspicuous and well developed crest; in its allies the crest is partly concealed. In general appearance otherwise, it is most like, and is of about the same size as *P. fuscicauda*, but differs in the throat being of a deeper color than in that species, and in having the sides of the head, the tail feathers and the outer margins of the quills dark red; in *P. fuscicauda* these parts are dusky.

Myiarchus flammulatus.

Entire upper plumage of a light greenish-olive, the crown just perceptibly of a darker shade; tail feathers of a rather light brown, the outer margins light rufous and the inner webs just edged with very pale salmon color; loral space and eyelids grayish-white; chin, throat, and upper part of breast grayish-white, the centres of the feathers on the upper part of the throat are very pale ash, but the lower part of the throat and the breast are marked with distinct light colored ashy flammulations, lower part of breast, abdomen and under tail coverts pale yellow; thighs of a light rusty-brown, quill feathers of a darker brown than the tail, the primaries edged with very pale rufous, the secondaries margined with grayish white, and the tertiaries broadly edged with grayish-white; the wing coverts end rather broadly with very pale rufous, forming three distinct bars across the wings; under wing coverts pale yellow, inner margins of quills pale salmon color; bill dark brownish-black, with a whitish spot on the angle of the lower mandible; tarsi and toes brownish-black.

Length 6 in.; wing $2\frac{7}{8}$; tail $2\frac{7}{8}$; tarsi $\frac{3}{4}$; bill $\frac{5}{8}$, width at base 7-16.

Habitat. Mexico, "Tehuantepec, Cacoprieto." Type in the National Museum at Washington. Procured by Prof. F. Sumichrast in June, 1872; original number 1555.

Remarks. Prof. Sumichrast thought it would prove to be a new species, and forwarded it to me for examination, but I did not receive the specimen until the summer of this year, the box containing it having been lost sight of for several months.

Its dimensions are less than those of *M. lawrencii*, and the colors throughout are paler; it also differs in having a whitish throat and flammulated markings on the breast; these parts in *M. lawrencii* being of a clear bluish cinereous; the lores and eyelids are grayish-white, in *M. lawrencii* they are brown like the crown; the bill in the new species is much broader.

In reply to my inquiry for other facts concerning it, and its relationship to *M. lawrencii*, Prof. Sumichrast wrote as follows: "I have two more specimens of the *Myiarchus* (No. 1555) in my possession (which I hope soon to send you), and consider them distinct from *M. lawrencii.* These two specimens, like the one you have seen, have a grayish-white throat, and on the breast deeper longitudinal spots, although slightly marked, and the bill also broad. The physiognomy of these birds in life is sufficiently distinct from *M. lawrencii*, to enable me to distinguish them even at a distance; the body of No. 1555 is in fact thicker and more robust. I have had occasion to kill a great many of the *M. lawrencii*, and I have always been able at first sight to recognize them as such, although perched at a great height. My immediate impression on seeing No. 1555 for the first time was that I had before me a new form. I have never seen in the *M. lawrencii* dark flammulations on the breast, which the three specimens of No. 1555 show, although but lightly marked."

VIII.—*Notes on Certain Terrestrial Mollusks, with Descriptions of New Species.*

BY THOMAS BLAND.

Read Oct. 5, 1874.

Oleacina flexuosa, Pfr.

THIS was described in 1854 (Zool. Proc.), from a specimen in Cuming's cabinet, and subsequently figured in Nov. Conch., I, t. 3, f. 16–17, but the habitat was unknown.

There is in the Swift cabinet * a very fine example, with

---

* I have recently had the opportunity of examining the collection of my late esteemed friend, Mr. Robert Swift, before its delivery to the Philadelphia Academy, to which it has been presented by his daughter.

note that it was received from Aux Cayes, in November, 1856, from Mr. Ross. Mr. Swift communicated this, and probably sent to Dr. Pfeiffer the imperfect shell referred to in Mon. VI, 278.

The specimen in the Swift cabinet is long. 65, diam. 24 mill., apert. 37 mill. long., infra medium 10 mill. lata.

This is the only species in the West Indies nearly allied to the large Mexican forms.

Macrocyclis euspira, Pfr.

In the Swift cabinet I lately found young specimens, as well as adults, of this Venezuelean species, and from one of the former obtained the animal. W. G. Binney favors me with the following report on its dentition: —

"The lingual membrane is indeed like that of *Macrocyclis* in its general type. It differs from our North American species only in having all the teeth purely aculeate, the usual form of marginals in the *Vitrininæ*. It has no laterals, but the first teeth are of a transitional character, between laterals and marginals. This cannot be considered a generic difference. *Zonites lævigatus* has no true laterals, and several species have not more than two.

M. euspira has a true Glandina-like lingual, especially in the form of the central tooth, which is of a somewhat different character in the North American species of *Macrocyclis*.

The presence of a jaw with smooth anterior surface and decided median projection to the cutting margin, in connection with the form and arrangement of the teeth and the absence of true laterals, warrant our placing *euspira* in *Macrocyclis*."

v. Martens has this species in *Ammonoceras*, subgenus of *Hyalina*, with, among others, *H. caduca*, Pfr. of Mexico, which is doubtless a *Zonites*.

Macrocyclis Baudoni, Petit.

The jaw and dentition of this species were described (Amer. Jour. Conch., VII, 1871, and Annals, X, 1873), by W. G. Binney and myself, and we found it to be a *Macrocyclis*.

Macrocyclis concolor, Fer.

This species, judging from its great similarity, if not identity, with *M. Baudoni*, is doubtless a *Macrocyclis.*

Shuttleworth (Diag. n. Moll. 1854) mentions, on the authority of Blauner, that *M. concolor* is viviparous. In the Swift cabinet a specimen is preserved, which he had alive, and from which he took five embryo shells. What the habit is in that respect of the North American species of *Macrocyclis* has not been noticed.

M. concolor and *Baudoni* are placed by v. Martens in *Mörchia* (subgenus of *Hyalina*), which must now, however, be treated as a synonyme of *Macrocyclis.*

M. laxata, Fer., is the type of that genus, but its dentition is, I believe, unknown.

The geographical distribution of the species shows that *Macrocyclis* is essentially an American genus.

In the Pacific Province of the Northern Continent, four species are found; *M. Vancouverensis, sportella, Voyana* and *Duranti.* In eastern North America, *M. concava. H. paucispira*, Poey, of Cuba, will, I think, prove to be a *Macrocyclis. M. concolor* belongs to Puerto Rico, and *Baudoni* to Guadaloupe and Dominica; *M. euspira* to Venezuela.

Zonites Lansingi, nov. sp.

T. imperforata, orbiculato-depressa, fusco-cornea, superne lævigata, basi substriatula; sutura impressa; anfr. 5½ convexiusculi, ultimus non descendens, ad peripheriam obsolete angulatus, subtus convexior, circa regionem umbilicarem excavatus; apertura anguste lunaris; peristomate acuto, margine dextro lamella obsolete serrata intus incrassato, columellari vix reflexiusculo.

Shell imperforate, orbicular-depressed, shining, dark horn-colored, smooth above, at the base substriate; suture impressed; whorls 5½ rather convex, the last not descending, obsoletely angular at the periphery, more convex at the base, excavated around the umbilical region; aperture narrow, lunate; peristome acute, the right margin thickened within by an obsoletely denticulated lamella, columellar margin scarcely reflected.

Diam. maj. vix 3, min. 2½ mill., alt. 1½ mill.

Habitat. In damp moist places, among leaves. Astoria, Oregon.

Remarks. Two figures of the species are annexed. The aspect of the upper surface of the shell is very like that of *Z. multidentatus*, Binney.

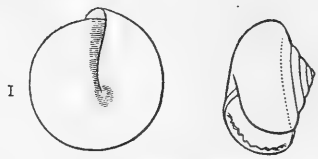


Fig. 1. *Zonites Lansingi.*

I am indebted to Mr. Henry Hemphill for this interesting little species, and dedicate it to my young friend, Mr. A. Ten Eyck Lansing of Burlington, New Jersey, a very promising student, to whom Mr. W. G. Binney and myself are much indebted for assistance in our examination of the dentition of terrestrial mollusks.

One specimen of *Z. Lansingi*, appearing to have the animal within it, was crushed between two glass slides, enabling Mr. Binney, without the use of potash, satisfactorily to observe the jaw and teeth remaining uninjured in the tissues of the animal. I am indebted to him for the subjoined particulars.

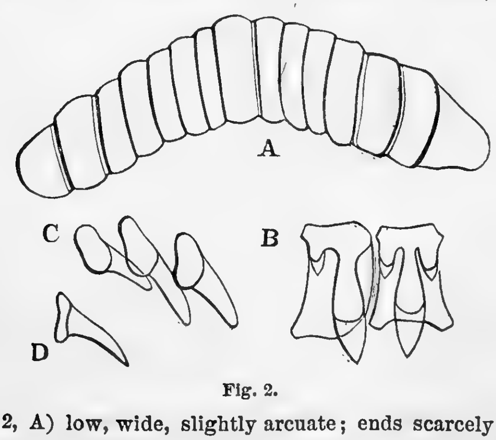


Fig. 2.

Jaw (fig. 2, A) low, wide, slightly arcuate; ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with fourteen, broad, unequal, crowded, flat ribs, slightly denticulating either margin.

The first impression given by the jaw is that it bears narrow, separated ribs, as in *Bulimulus*, *Cylindrella*, etc. A more careful study of it, however, shows the ribs to be very broad, crowded, flat, with narrow interstices between them.

Lingual membrane with 17–1–17 teeth; six laterals. Centrals (fig. 2, B) with the base of attachment longer than wide, the lower lateral angles expanded; upper margin broadly reflected; reflection very short, tricuspid, side cusps decidedly developed, short, bearing distinct cutting points, median cusp long, slender, bulging at sides, reaching nearly to the lower edge of the base of attachment, beyond which projects slightly the distinct, long cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower angle of the base of attachment, and inner side cusp and cutting point. Marginals (fig. 2, C) aculeate, their base of attachment less sole-like than usual in *Zonites*, but more circular in outline. Fig. C shows these bases of attachment. Fig. D gives one marginal tooth in profile.

This is the first known instance of a species with ribs on its jaw having aculeate marginal teeth; or of a species furnished with a Zonites-like shell having decided ribs on its jaw. It will be difficult to find a place for the species under any description of genus or subfamily. The shell is that of *Zonites*, but that genus has a ribless jaw with median projection.

Zonites Stearnsii, nov. sp.?

With land shells from the west coast, kindly sent to me for examination by my friend Mr. Stearns, I lately noticed a single specimen of a form from Astoria, Oregon, allied to *Z. Lansingi*. It is larger, more elevated and more distinctly striated than that species, has seven whorls, with rather wider and more rounded aperture, but without the lamella within the outer margin of the peristome.

The measurements are diam. maj., 4, min. 3½ mill., alt. 2½ mill.

Having before me a single specimen I am unwilling formally to describe the species, which for the present I designate as *Zonites Stearnsii*.

The accompanying figures of this and the preceding species were kindly drawn for me, on wood, by Mr. W. G. Binney.

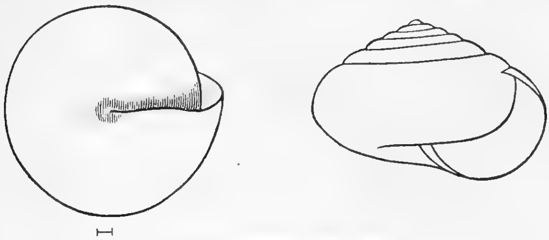


Fig. 3. *Zonites Stearnsii.*

Zonites indentatus, Say.

Pfeiffer, on the authority of Hjalmarson, mentions the occurrence of this species in St. Domingo.

I have specimens collected by Dr. Cleve in Puerto Rico which are scarcely distinguishable from *Z. indentatus*, but the color is very much darker than of American shells.

Hyalina Bermudensis, Pfr.

This has been shown (Bland and Binney, Annals, X, 221) from the character of the lingual dentition, to belong to the *Vitrinea*, not to the *Helicacea* of v. Marten's arrangement.

I am indebted to Mr. J. Matthew Jones for an opportunity of examining a remarkable sub-fossil form found in stalagmitic conglomerate, in caverns at Tucker's Town, Bermuda.

The living *H. Bermudensis*, as described by Pfeiffer (Zool. Proc., 1845), has seven whorls and in size is diam. maj. 23, min. 21 mill., alt. 12 mill.

The extinct form differs from it in having nine whorls, the last more convex above, a less acute carina, umbilicus smaller, but especially in size. The measurements are diam. maj. 37, min. 34 mill., alt. 19 mill.

I propose the name of *Hyalina Nelsoni* for the sub-fossil species, in honor of Lieut. Nelson, the author of valuable geological memoirs on the Bermuda and Bahama Islands.

Although its contemporary and survivor, *H. Bermudensis*, is nearly allied to it, I cannot refer to them as being identical.

The occurrence of this large extinct form in Bermuda is very interesting. It may surely be inferred that the species lived at a period when the area of the land was more extensive and elevated. The existing form, it should be mentioned, is also found sub-fossil.

Wollaston (Variation of Species, 1856) remarks, with respect to some large extinct Madeira Helices, that they may have been but forms of the smaller living species,—"coexistent with them, though more sensitive to the great diminution of altitude and area which were consequent on the breaking-up of a once continuous land."

Sub-fossil are not unfrequently larger than living allied or identical forms. I have noticed that the sub-fossil *Chondropoma? basicarinatum* and *chordiferum* of St. Croix are larger than their very near ally *C. Santacruzense*, now living on that Island. The extinct *H. Josephinæ*, found in St. Kitts, is considerably larger than the living forms of the neighboring Islands. St. Croix and St. Kitts, geologically speaking, are but fragments of larger areas.

Some living species, however, vary very much in size: I may instance *H. Luquillensis* Shuttl. of Puerto Rico. The measurements given by Shuttleworth are diam. maj., 40; min. 32 mill.; alt. 30 *ad* 33 mill. In the Swift cabinet there is a remarkably small specimen, diam. maj., 29; min. 25 mill.; alt. 18 mill.

M. concolor, Fer., of the same Island is another instance. In the Swift Cabinet there is one, 5½ whorls, diam. maj. 25; min. 23 mill.; alt. 9 mill. Adult specimens collected by Dr. Cleve, having 4½ whorls, are not more than half that size. Unfortunately, I have no note as to the stations of the different sized forms.

Guesteria Powisiana, Pfr.

M. Crosse (Jour. de Conch., 1872) described and figured *Helix Powisiana*, Pfr., placing it in the new genus *Guesteria*, of which it is the only known species. He remarks on its rarity and the absence of mention of it in my Catalogue of shells collected in New Grenada (Cont. to Conch., 1852).

On a recent examination of shells, which my late valued friend Mr. Robert Swift had from me in 1852, still preserved in his Cabinet, I identified a young specimen of *Guesteria Powisiana*, which I found in 1851 near Marmato, at an elevation of about 5,000 feet, on the Western Cordillera of the Andes. The shell had not been previously determined.

Simpulopsis dominicensis, Pfr.

In the Swift Cabinet are two specimens, marked "*Vitrina*," found by Hjalmarson near Puerto Plata (Haiti), but which are I believe young shells of *Simpulopsis dominicensis*. In Mal. Blatt. 1858, p. 146, Pfeiffer mentions a *Vitrina* from Haiti, on the authority of Hjalmarson, which was subsequently found probably, to be what I have suggested.

Helix bracteola, Fer. (*Microphysa*).

M. Mazé enumerates this in his Catalogue of Martinique species (Jour. Conch. April, 1874) and I am indebted to M. Crosse for a specimen of it. Looking at the description and figure by Deshayes (in Fer. Hist. I, p. 84, t. 86, f. 2), I do not doubt the determination, but believe that the species is the same as *H. vortex*, Pfr.

Helix Sargenti, nov. sp.

T. sub-perforata, globoso-depressa, oblique striata, tenuis, pallide cornea?; spira brevis, apice obtusa; anfr. 5, convexiusculi, ultimus antice descendens, ad peripheriam obsolete angulatus, basi subplanulatus; apertura obliqua, lunato-rotundata; perist. marginibus approximatis, dextro expansiusculo, columellari superne perdilatato, reflexo, perforationem fere tegente, basali introrsum lamellato-calloso.

Shell subperforate, globose-depressed; obliquely striated, thin, pale horn-colored?; spire short, apex obtuse; whorls 5, rather convex, the last descending at the aperture, obsoletely angular at the periphery, base subplanulate; aperture oblique, lunate-rounded; peristome with the margins approximating, right margin somewhat expanded, columellar margin much dilated above, reflected, nearly covering the perforation, basal margin with a lamelliform callus within. Diam. maj. 15; min. 13 mill.; alt. 8 mill.

Habitat. Little Inagua, Bahamas.

Remarks. This in general form is much like *H. Duclosiana*, Fer., but the interior projecting tooth is wanting and the callus on the basal margin is more developed.

The species belongs to the subgenus *Plagioptycha*, which is peculiarly characteristic of the Haitian fauna. I have elsewhere remarked (Annals X, 318) on the evidences of the former more intimate connection of Inagua and Turks Islands with Haiti. I name the species after Mr. Daniel Sargent of Inagua, to whom I am indebted for many interesting shells from the Bahamas.

Helix marginella, Gmel. (*Caracolus*).

In the Swift Cabinet there are specimens from Mayaguez, Puerto Rico, in which the dark band almost covers the upper whorls, leaving simply a narrow lighter colored margin next the sutures; the dark band equally wide at the base. There is also an *albino* specimen, which was found in 1864, by the late Mr. Haägenson in a wood, on San Isidio Estate, near the city of San Juan.

This species occurs in Vièque and Culabre as well as in Puerto Rico.

Helix Gaskoini, Pfr. (*Caracolus*).

M. Sallé first collected this in St. Domingo. He noticed, I learn from him, many specimens, but all appearing dead and white, collected two only, one of which remains in his Cabinet, the other in Cuming's.

Professor Gabb found specimens during his explorations in St. Domingo, and one of them was given to me by Dr.

Newcomb. It agrees entirely with Pfeiffer's description (Zool. Proc., 1851) and with Reeve's figure.

Helix bizonalis, Desh.

Several years ago Mr. Ferguson found on logwood brought to the Port of New York, two specimens of a shell allied in form to *H. marginella*, Gmel. of Puerto Rico; with them were examples of *H. crispata* Fer., an indication that the logwood was from Haiti. One of the specimens is still in my possession, the other in the Swift Cabinet.

Dr. Newcomb collected one fresh example when crossing the eastern end of the Island; the shell was sent to me for examination and found to be similar to that had from Mr. Ferguson.

In 1872 I received another (dead) specimen from Mrs. Wm. Klatte, found near Port au Prince, with *H. crispata.*

The Ferguson shell was compared in 1871, by Mr. Sowerby, in the British Museum, and agreed with specimens there labelled *H. bizonalis*, Desh.

In 1873 my specimens were examined by Sallé with the type of *H. bizonalis* in the collection of Deshayes, and pronounced identical with it.

Deshayes (Fer. Hist. I, 68, N. 90) has, in the synonymy of the species, *H. marginata*, Var. Fer. Hist., t. 63, f. 11–12, which figures certainly agree with *bizonalis.*

Deshayes does not give the habitat of *bizonalis;* in Chem. ed. 2, N. 956, the species is attributed, apparently on the authority of specimens in Cuming's Cabinet, to Manila, but undoubtedly it belongs to Haiti. Looking at the variability of *H. Sagemon* of Cuba, I am much inclined to consider that *H. Gaskoini* is a var. of *bizonalis.*

The occurrence of the nearly allied forms of *Sagemon* in Cuba, *bizonalis* in Haiti, and *marginella* in Puerto Rico, is an interesting fact. The connection of the faunas of the two latter Islands is strikingly shown by the prevalence of forms closely related to *H. caracolla**, and *H. Audebardi* of Haiti has a near ally in *H. Luquillensis* of Puerto Rico.

H. bizonalis is placed by v. Martens (Albers ed. 2) in the sub-genus Obba, probably with reference to the supposed habitat, "Luzon," while *Sagemon* and *marginella* are in *Caracolus*.

Helix platystyla, Pfr. (*Leptoloma*).

Pfeiffer described this species in the Zool. Proc., 1849, from a specimen, "*expallescens*," in Cuming's Cabinet. In Mon. Hel. III, 175, the habitat doubtfully given is Moluccas; it is placed next before *H. conspersula*, Pfr. and *H. fusco-cincta*, C. B. Ad. of Jamaica, to which it is very closely allied.

An example from Jamaica in my Cabinet agrees closely with Pfeiffer's description and Reeve's figure (Conch. Icon. N. 487, t. 90). Similar specimens in the Chitty Collection, British Museum, are labelled *H. fusco-cincta*, var. *H. conspersula* was described by Pfeiffer in 1845, the habitat unknown. In 1871 Mr. Sowerby informed me that a specimen in the British Museum is ascribed to India.

H. platystyla belongs, I believe, to Jamaica as well as *H. conspersula* and *fusco-cincta*.

Cylindrella gracilicollis, Fer.

I am indebted to Mrs. Wm. Klatte for several specimens of this species, found in the vicinity of Port au Prince, Haiti. It has been erroneously attributed to St. Thomas. Judging from a very young individual it appears that the number of whorls in a perfect shell must be from twenty to twenty-two. The four upper whorls are smooth.

On the axis there are two revolving laminæ. I have not had an opportunity of examining the internal structure of many species from the Island of Haiti, but find two lamellæ

---

* *H. caracolla* is found semi-fossil only in St. Croix, but Mr. Swift assured me that I erroneously referred to *H. marginella* as occurring there in a similar condition (Annals VII, 357).

on the axis of *C. Salleana* and *Hjalmarsoni.* It is curious that no species peculiar to Jamaica has a similar character of axis.

Macroceramus Swifti, nov. sp.

T. imperforata, cylindraceo-turrita, confertim striata, punctis numerosis et strigis obliquis fusco-corneis variegata; spira ovato-conica, apice obtusula, pallide cornea; anf. 11½ vix convexiusculi, ultimus rotundatus, infra medium obsolete filo-carinatus; apertura diagonalis, rotundato-lunario, perist. albido, expansiusculo, incrassato, margine dextro arcuato, columellari dilatato.

Shell imperforate, cylindrically turreted, crowdedly striated, variegated with oblique dark horn colored stripes and numerous spots; spire ovate-conic, apex rather obtuse, pale horn-colored; whorls 11½ scarcely convex, the last rounded, obsoletely carinated below the middle; aperture diagonal, roundly lunate; peristome whitish, rather expanded, thickened, the right margin arcuate, columellar margin dilated.

Long. 11, lat. 4 mill.; ap. 3 mill. long, 2 lat.

Habitat. Turks Island, also Inagua, Bahamas.

Remarks. This species is allied to *M. Hermanni*, Pfr., of Haiti, but is less distinctly costulated, the suture not crenulated and has thicker peristome.

I dedicate the species to the late Mr. Robert Swift, from whom I originally received specimens.

Macroceramus Klatteanus, nov. sp.

T. rimata, oblongo-turrita, solidula, oblique costulata, albida, strigis interruptis et maculis castaneis ornata; spira elongata, apice albido; sutura subcrenulata; anfr. 10 convexiusculi, ultimus rotundatus, basi ad aperturam compressus, infra peripheriam fascia 1 nigricante, interrupta, notatus; apertura diagonalis, subcircularis; perist. albo, obtuso, marginibus approximatis, dextro subarcuato, columellari subdilatato.

Shell rimate, oblong-turreted, rather solid, obliquely ribbed, whitish with chestnut colored interrupted stripes and spots; spire elongate, apex whitish; suture subcrenulated; whorls ten, rather convex, the last rounded, compressed at the base near the aperture, one interrupted dark band below the periphery; aperture diagonal, subcircular; perist. white, obtuse, with approximating margins, right margin subarcuate, columellar margin scarcely dilated.

Long. 11, lat. 4 mill.; ap. 3 mill. longa.

Habitat. Near Port au Prince, Haiti.

Remarks. This is allied in form and ornamentation to *M. tenuiplicatus,* Pfr., but is much smaller, is costate, and differs from it in form of aperture. I received specimens of this and other interesting Haitian shells from Mrs. Wm. Klatte after whom I name this species.

Bulimulus stramineus, Guilding (*Drymaeus*).

Several years ago I sent to Dr. Pfeiffer a specimen from St. Vincent, which he described (Mon. VI, p. 44) under this name as an authentic example of Guilding's species, of which however it is probably a variety. I have since received from Governor Rawson extremely fine specimens more closely agreeing with Guilding's description.

Pfeiffer (Mon. II, 203) gives the following description, "T. subdiaphana, straminea, transverse densissime striatula; anfr. 6–7, apicalis ferrugineus (G.). On referring, however, to the Linn. Trans. XIV, p. 340, I find the description to be "Testa tenera, tota straminea, transverse obscuro-dense striata; anfr. sex."

The most common form is of uniform bright yellow, some specimens have a purple apex and others several narrow reddish-brown bands. One of my specimens measures: long. 34, lat. 14; ap. 16 mill. long., 10½ lata. *B. stramineus* occurs also in the Island of Mustique one of the Grenadines.

Bulimus stramineus, Richard.

In the Swift Cabinet there are shells under this name, received from M. Sallé and said to be from St. Domingo. I can find no mention of, or reference to, such a species in the books.

The largest specimen, which is scarcely adult, has 5½ whorls; the two upper whorls have a pale yellowish tinge, the apex rather darker in color. It is very like and may be a variety of *B. liliaceus*, Fer. which occurs in Puerto Rico.

Stenogyra Dominicensis, Pfr. (*Pseudobalea*).

This was described in 1850 by Pfeiffer as a *Balea*, but in 1854 Shuttleworth (Diag. n. Moll. No. 6) referred it to *Stenogyra*.

Pfeiffer described it as *Bulimus hasta* in Malak. Bl. 1856.

From a Cuban specimen, in the Cabinet of R. Swift, I obtained the animal and found it to be viviparous. From one I took five embryonic shells, of from two to three whorls.

The jaw and lingual membrane were examined by W. G. Binney, who informs me that they exhibit the characters prevailing in *Stenogyra*, the jaw striate, without median projection; central lingual tooth small, laterals large, subquadrate, perfectly symmetrical in base of attachment and tricuspid.

The jaw of *S. decollata* has the same fine striæ.

Strophia calcarea, Pfr.

Several dead specimens of this rather rare shell were collected by Mr. D. Sargent on Little Inagua. The habitat of the species has not hitherto been known.

In a young shell (4 whorls), the umbilicus is 1½ mill. in diameter. The parietal tooth is shown in the figure in Chem. ed. 2, t. 19, fig. 4, but not referred to in Pfeiffer's description.

Strophia iostoma, Pfr.

From Mr. Sargent I have remarkably fine specimens of this species, from Turtle Cove, Great Inagua. The following are measurements of extreme forms:

13	whorls,	Long.	46	lat. in med.	14 mill.
11½	"	"	35	"	15 "
11	"	"	31	"	10 "

Choanopoma occidentale, Pfr.

Pfeiffer refers this species (Malak. Bl. 1860, p. 216) to Martinique, but as M. Mazé (l. c.) mentions, it does not occur in that Island.

Dr. V. Rijgersma collected it several years since in the Island of St. Martin, and very kindly supplied me with specimens.

Helix ammonoceras, Pfeiffer. (*Ammonoceras*, Pfr.)

I discovered this species in 1851, in New Grenada, and it was described, from a specimen in the Cumingian Collection, by Pfeiffer in 1854 (Zool. Proc.).

During last year Governor Rawson sent to me, for determination, a single shell from the Island of Grenada, W. I., which I found on comparison with a specimen of *H. ammonoceras*, preserved in the Robt. Swift Cabinet, to be identical with it.

Helix Hubbardi, A. D. Brown. (*Strobila.*)

This was first found near Indianola, Calhoun Co., Texas, by Mr. E. W. Hubbard, and described by Brown in the Phila Proc. (Oct., 1861). It was subsequently discovered at Bellevue, in the Parish of St. Andrew, Island of Jamaica, and described (Jour. de Conch., Oct., 1871) by Mr. C. P. Gloyne, as *H. Vendryesiana.*

In November, 1872, Dr. W. Newcomb found a few specimens on the trees in Bonaventure Cemetery, near Savannah, Georgia, and kindly sent to me a couple.

I have no doubt as to the identity of the Texas, Jamaica and Georgia shells.

Gloyne mentions the parietal lamella only, but there are others as described by Brown. The species is in fact allied to *H. labyrinthica*, Say, and not to *H. paludosa*, to which group it is referred by Gloyne.

The distribution of *H. Hubbardi* is certainly curious, but it may be observed that *H. Strebeli*, Pfr., which is extremely like, if not identical with, *labyrinthica*, belongs to the Mexican fauna.

Helicina nemoralis, Guppy.

This Trinidad species can scarcely be considered distinct from *H. Columbiana*, Philippi of Venezuela.

Auricula pellucens, Menke.

In 1871 I received several dead specimens of this species of *Auricula* from Mr. Henry Prime. He informed me that he "found about a dozen, none with the animal, on Punta Rasa, a small island on the west coast of Florida, at the mouth of Calvasahachee River; they were in one place only, at the edge of a mangrove swamp, in company with *Melampus bidentatus* and *M. coniformis;* the latter were in great abundance."

Auricula pellucens is referred to Demerara and *Ellobîum Ceylanicum*, H. & A. A., placed in its synonymy by Pfeiffer, to Ceylon. I have one specimen from each of those localities, given to me by the late Mr. Swift, and they are certainly very like those from Florida.

Pfeiffer gives the Antilles also, with doubt on the authority of Férussac, as one of the habitats.

I never heard of the collection of the species on the Florida Coast by any one excepting Mr. Prime. Stimpson (Am. Naturalist, IV, 587) refers to the present tropical character of the shells of the west coast of Florida as being plainly due to the influence of the Gulf Stream. *A. pellucens*, whether now living or not on that coast, doubtless originally owed its introduction there to the agency mentioned by Stimpson.

IX.—*Descriptions of Four New Species of Birds from Costa Rica.*

BY GEO. N. LAWRENCE.

Read December 21, 1874.

A third instalment of about six hundred specimens of birds was received quite recently at the Smithsonian Institution, from Prof. W. M. Gabb, in charge of the Talamanca Exploring Expedition, Costa Rica, and forwarded to me for examination. This collection was made by Mr. Juan Cooper, acting zoologist, Mr. Zeledon having retired from that position on account of failing health.

The species described below I consider new to science; they all seem to be rare, as the collection contains but a single example of each.

1. Cyanocitta argentigula.

Female The feathers of the front, lores, with those above and below the eye and of the chin are rigid, and of an intense black; crown, hind neck, upper part of back, sides of the neck and the breast black, lower part of back and rump of a dull deep blackish-blue; the abdomen, sides and under tail coverts are also dull deep blue, but brighter than the back, especially on the sides and under tail coverts; on the front part of the crown is a crescentic mark of bluish-white, which becomes narrower along each side of the crown, and extends over the ear coverts as far as the occiput; the feathers of the crown are elongated forming a short crest; the throat is marked with a sharply defined patch of silvery grayish-white, with just a tinge of blue, and is in strong contrast with the black that surrounds it; this patch widens out a little at its lower extremity, which is on the upper part of the breast; the wings and exposed portions of the quill feathers, are of a rich dark cobalt-blue, the inner webs and under surface of the quill feathers are glossy black; the tail above is colored like the wings, underneath it is glossy black; bill and feet black.

Length $10\frac{3}{4}$ in.; wing $4\frac{3}{4}$; tail $5\frac{1}{4}$; bill 1; tarsus 1 5-16.

Habitat. Costa Rica, Talamanca. Type in National Museum.

Remarks. This does not much resemble any other species; in general coloring it is somewhat like *C. ornata*, but the black in the new species is more prevalent and the blue darker and brighter. *C. nana* and *C. pumilo* each have a narrow whitish band on the forepart of the crown, and extending over the eyes, but uniformly narrow; the former is described as having the throat bluish-white; but in these species the black is confined to the front, sides of the head and throat, the blue color is much lighter and they are rather smaller.

The new species is very handsome, and the peculiar markings on the head and throat will at once distinguish it from all others.

2. Stenopsis albicauda.

Male. Crown and sides of the head blackish-brown finely freckled with bright rufous and gray, a grayish-white line extends from the bill over the eye; throat and sides of the neck white, tinged with pale rufous; there is a narrow band of pale rufous on the hind neck; upper plumage dark brown, the feathers crossed with narrow markings of light rufous; two central tail feathers grayish-ash, marked with narrow waving lines of brown, and crossed with eight irregular blackish-brown bars; the outer lateral feather is white, its outer web tinged with dull rufous almost to the end of the feather, and about midway of the web is a narrow brown stripe along the shaft half an inch in extent, the remaining feathers are white on their inner webs, except at their ends, where with their outer webs they are blackish-brown; the smaller wing coverts, secondaries and tertiaries are handsomely freckled with gray and rufous, and blotched with black and lighter rufous, the larger wing coverts are blackish-brown ending with pale rufous; the feathers of the breast are fuliginous at base, and crossed on the exposed portions with narrow bars of black and light rufous, the ends of the feathers whitish; the abdomen is very pale rufous, sparingly barred on the sides with blackish, the marks on the middle of the abdomen are nearly obsolete; the under tail coverts are clear light rufous and immaculate; the quills are dark brown, the outer four primaries have a conspicuous white bar at about one-third their length from the end, on the first primary is a white spot on the inner web towards the base, the other quill feathers have their inner webs more or less marked with pale rufous spots; under wing coverts dark brown mottled with rufous; bill black; tarsi and toes pale brownish-yellow.

Length 9 in.; wing $5\frac{1}{2}$; tail $4\frac{7}{8}$; tarsus $\frac{5}{8}$.

Habitat. Costa Rica, Talamanca. Type in National Museum.

Remarks. In appearance this species resembles *S. cayennensis*, but the tail is longer with narrower feathers; it wants the transverse black bar midway on the tail feathers as in *S. cayennensis*, and has the abdomen and under tail coverts more rufous than in that species.

This appears to be the first occurrence of a member of this genus north of the Isthmus.

3. Geotrygon rufiventris.

Front and a line under the eye extending as far as the occiput, light salmon color; crown, hind neck, upper part of back, throat and upper part of breast, of a rather dull violet-purple, on the lower part of the breast merging into brownish-ash; lower part of back, rump, and upper tail coverts of a dull bronzy olive-green; tail feathers brownish-black, the ends lighter or ashy-brown; abdomen, vent and sides dull brownish-rufous, on the middle of the abdomen is a patch of white feathers just tinged with rufous; under tail coverts dark brown largely ending with rufous; wing coverts, secondaries and tertiaries olive-brown, primaries brownish black, the shafts of a reddish or hazel-brown; under wing coverts and axillars deep cinnamon-red; inner webs of primaries at base dull pale cinnamon; bill black; feet in the dried specimen of yellowish-flesh color.

The sex is not given.

Length about 9 in.; wing $5\frac{1}{4}$; tail $3\frac{1}{4}$; bill from front $\frac{3}{4}$, from rictus 1; tarsus $1\frac{3}{8}$.

Habitat. Costa Rica, Talamanca. Type in National Museum.

Remarks. The number of handsome species of this genus discovered in Central America within the last few years is quite remarkable, this making the sixth; it is however much more sombre looking than most of its allies, the colors being darker and more subdued. It is so unlike all others of the genus that no comparisons are required.

4. Porzana cinereiceps.

Female. Upper part of head and cheeks bluish-cinereous, darker on the crown, but clearer and lighter on the cheeks; neck before and behind, upper part of back and breast bright reddish-chestnut, paler on the throat and grayish near the chin; back olivaceous-brown, on the rump and upper tail coverts dark brown; quill feathers brown; abdomen and under tail coverts crossed with alternate bars of black and white; upper mandible brown, brighter on the culmen, under mandible yellowish; tarsi and toes hazel brown.

Length about $5\frac{1}{2}$ in.; wing $2\frac{7}{8}$; bill $\frac{5}{8}$; tarsus $1\frac{1}{8}$.

Habitat. Costa Rica, Talamanca. Type in National Museum.

Remarks. Compared with *P. albigularis* this species differs in its ash colored head, more deeply colored chestnut breast and in not having a white throat; above it resembles *P. rubra* but the head in that species is darker, below they are quite unlike, as the entire under plumage of *P. rubra* is chestnut-red.

X.—*Notes on North American Lepidoptera.*

By H. K. MORRISON.

Read Jan. 7, 1875.

Family BOMBYCIDÆ.

Edema, Walk.

Ocelli absent. Eyes naked, unlashed. The antennæ of the female simple. The palpi stout, finely clothed, exceeding the front; the first joint of the usual form; the second long, flat, rectangular, and truncate at the extremity; the third, in the Texan species hidden in the villosity of the second, in *albifrons* short and slight, but perceptible.

The front rounded, but the frontal hairs converge forming an obtuse projection; the villosity above the antennæ elevated, forming a triangular projecting hood over the vertex. The collar circular, nearly flat, surrounded and limited above by the pterygodes, which are well defined, triangular, closely scaled and separated by the depressed dorsal portion of the thorax.

The prothoracic tuft absent, the metathoracic tuft present although low and rounded. The abdomen smooth, heavy, cylindrical, truncate and untufted.

All the tibiæ unarmed and clothed with long thin hair.

The anterior wings comparatively broad, with rectangular apices; the posteriors rounded.

M. Guenée notices in the first volume of the "Species Général" the great resemblance of *E. albifrons* to the higher genera of the Noctuidæ, and the discovery of the species described below gives fresh force to his remarks.

We would not be surprised if the genus should be ultimately referred to the neighborhood of *Demas* and *Diloba.*

Edema albifrons, Sm. Abb.

As this species is not uncommon in the Northern States it is known to almost every collector, and a specific description is unnecessary.

Edema Packardii, nov. sp.

Expanse 31 mm. Length of body 16 mm. The ground color of the anterior wings gray, sprinkled with black atoms and with white, and faint brownish and ochreous stains; the half-line and the interior line absent; the orbicular spot present as a geminate blackish upright lunulate mark, preceded by a white stain; the reniform a similar, but simple and more distinct mark, surrounded by a faint ochreous annulus; the median shade passes between the spots, it is thickened below the reniform forming a black spot, but is afterward lost; the exterior line is only present in the central part of the wings, it is geminate, dentate and forms a particularly prominent indentation opposite the reniform spot; a contrasting apical white shade, below which appears a diffuse blackish shade clearly cut above, and the black distinct subterminal line formed of oblique marks between the nervules; fringes long. Posterior wings uniform dark fuscous, with lighter fringes.

Beneath gray, with numerous black atoms; the lines and discal dots are obsolete.

Habitat. Waco, Texas. March 9. (Belfrage.)

We dedicate this interesting species to Dr. A. S. Packard, Jr., as an acknowledgment of the value of his exhaustive "Synopsis of the Bombycidæ" as well as of his kindness to a younger naturalist.

Family NOCTUIDÆ.

Acronycta brumosa, Guen.

Acronycta Verrilli, G. & R. Trans. Amer. Ent. Soc., Vol. III, p. 178, Pl. 2, fig. 82.

We are satisfied that Grote and Robinson's species is identical with *A. brumosa.*

The depth of the color on the hind wings has been mentioned as a sufficient character in separating the species; but it is variable, as a large series in our collection will show.

We have specimens from Canada (Prof. F. X. Belanger and Mr. George Norman), from Wisconsin (Prof. S. H. Peabody), from New York (Messrs. Fred. Tepper and E. L. Graef), from the Adirondack Mts. (Mr. F. C. Bowditch), from Mt. Washington, N. H., near the Half Way House (H. K. Morrison) and many from various localities in Massachusetts.

The variation in marking and particularly in size is considerable.

Acronycta pudorata, nov. sp.

Expanse 34 mm. Length of body 16 mm. We have had a single specimen of this species in our collection for a long time, but have hesitated to describe it, fearing that it was but a variety of *A. tritona,* Hubn.

The discovery of other specimens of both sexes convinces us that it is distinct. Anterior wings above, bluish gray, with the lines and dashes as in *A. tritona,* the ordinary spots are distinct, concolorous and black encircled, in this respect differing from *tritona.* The posterior wings instead of yellow are pure white with a faint discal dot and median line, followed by a vague suffused terminal band. Beneath white, with conspicuous discal dots and an angulate median line; in *tritona* the ground color is yellowish with scarcely traces of the usual discal dots.

Habitat. New York; Canada.

Specimens received from Messrs. Fred. Tepper and F. X. Belanger.

M. Guenée's description of *A. tritona* does not agree altogether with Hübner's figure, and perhaps another species is described by him.

Agrotis acclivis, nov. sp.

Expanse 35 mm. Length of body 17 mm. Eyes naked. All the tibiæ spinose. The antennæ of the male with fine short hairy clothing, black above, testaceous beneath. The thorax black above, having a low prothoracic tuft tipped with cinereous; the pterygodes light, and concolorous with the costal shade. Abdomen gray, conspicuously banded with ochreous.

The anterior wings with a broad costal carneous-gray shade extending over the middle and upper part of the basal space, filling the ordinary spots, narrowing and becoming extinct before the exterior line; the remainder of the wings blackish gray, becoming lighter in the neighborhood of the irregular, jagged and diffuse subterminal line, which is close to the external margin thus narrowing the terminal space; the interior line is lost above in the costal shade and below on the inner margin, it only appears in the middle of the wings and there has attached to it the small concolorous black edged claviform spot; the ordinary spots small, the space between them blackish, the orbicular elongate, nearly lost in the costal shade, the reniform followed by a distinct black streak which extends to the exterior line; the latter is black, simple, denticulate and not very distinct; a series of black dots before the fringe, the latter is yellowish at the base, outwardly gray. Posterior wings whitish with a slight yellow tinge, having an indistinct discal dot and an indefinite subterminal shade; the costa and inner margin are gray; the fringe ochreous. Beneath the anterior wings are blackish, the posteriors white with a gray costal border; the fringes of both wings more or less yellow.

Habitat. New York.

(From the collection of Mr. Fred. Tepper).

The distinctive characters of this *Agrotis* are found in the carneous-gray costal shade, the small spots, the distinct black dash following the reniform and the ochreous fringes. It is allied to *A. annexa*, Treits, but differs by the non-serrate antennæ, the absence of the basal black dash, and the whitish posterior wings with ochreous fringes; it also approaches more remotely *A. venerabilis*, Walk. and *A. volubilis*, Harvey.

Agrotis montana, nov. sp.

Expanse 30 ^{mm}. Length of body, 12 ^{mm}. Eyes naked. All the tibiæ spinose. The villosity of the palpi, front, collar and thorax coarse and thick; the collar black, edged broadly with white; the thorax and abdomen blackish, the latter having the anal tufts yellowish. The ground color of the anterior wings dark gray, as in *Anarta algida*, Lef.; the whole insect closely simulates *Anarta*. The anterior wings elongate, with the inner angle rounded; the half-line thick, black and twice undulate; the basal space is more or less suffused with bluish gray, and contains a black orbicular basal dash; the interior line very distinct, black, thick and perpendicular, preceded by a conspicuous bluish gray shade line; to it is attached the long blackish claviform; orbicular spot round, whitish and contrasting; the reniform whitish, upright, elliptical and closely approaching the exterior line; the latter is black, distinct, non-dentate and but slightly bent beneath the cell; beyond, the ground color becomes lighter; the subterminal line is irregular, preceded by cuneiform markings and by a blackish costal shade; the fringe concolorous. The posterior wings are dark fuscous with white fringes and faint discal dots.

Beneath whitish, without markings, except faint discal dots and suffused gray costal shades.

Habitat. Mountains of Colorado, above 12,000 feet, July 22 to Aug. 12.

One specimen in the possession of Dr. A. S. Packard, Jr., and another in our own collection.

This abnormal species is extremely interesting on account of its resemblance to the boreal genus *Anarta*, three species of which are found in the same localities. Messrs. Bates and Wallace have discovered numerous cases of mimicry between the species of *Heliconidæ* and *Pieridæ* inhabiting the tropical regions of South America; and now we have in the alpine fauna of these mountains a parallel instance of close outward resemblance between species of two widely differing genera of moths.

None of the northern Agrotids known to us, as *scropulana*, *opipara*, *hyperborea*, *islandica*, *okakensis*, approach in the least to *Anarta*.

Adita chionanthi, Sm. Abb.

We have received from our friend Mr. George Frazer, a female specimen of this rare and interesting species; which has remained unknown since 1797. The antennæ of the female are simple with fine hairy clothing, and the ovipositor projects slightly beyond the abdomen.

In his generic description Mr. Grote states that the tibiæ are spinose; this is apparently an error as the only spines present are the pair before the spurs on the middle tibiæ and a single spine (there possibly may have been two) between the two pair of spurs on the hind tibiæ; isolated spines sometimes occur in these positions in genera which do not have spinose tibiæ, as has been noticed by European entomologists.

Mamestra adjuncta, Boisd. (Miselia).

Hadena adjuncta, Grote, Bull. Buff. Soc. Nat. Sc., Vol. I, p. 108 (1873).

This species, considering its strong generic characters, has suffered many changes of position; described by Dr. Boisduval under *Miselia* and thought by him to be a European species, it was shortly afterwards correctly referred by M. Guenée, in the "Species Général," Vol. 5, p. 199, to the side of the well known *Mamestra brassicæ*, Linn. Mr. Grote places it in *Hadena;* why, we do not know, as the eyes are distinctly hairy.

Mamestra curta, nov. sp.

Expanse 30 ^{mm}. Length of body 15 ^{mm}. Eyes hairy. Anterior tibiæ unarmed. Collar, front and palpi as usual in this genus. A low prothoracic tuft. Abdomen smooth, yellowish and untufted, slightly exceeding the posterior wings. Anterior wings gray, with all the markings distinct and well defined; interior line simple, removed further than usual from the base, strongly lobed between the nervules; to the largest lobe the distinct, short and truncate claviform spot is attached; orbicular spot large, black-ringed and concolorous, reniform spot narrow and upright, crossed by the diffuse blackish median shade, below the spot the latter is lost in the ground color; exterior line of the normal form, black, distinct and dentate, followed by a narrow pale shade line; subterminal line very prominent, preceded by black shades which partially fill the subterminal space, becoming diffuse as they recede from the line, but near it are very intense and contrast with the light terminal space; a series of black dots at the base of the fringe. Posterior wings yellow, with a discal dot, a narrow median line, and a broad blackish terminal border; the fringe is yellow and contrasting. Beneath, both wings are yellow, with discal dots and traces of median and terminal lines.

Habitat. Colorado, July 20 and 22.

This species can at once be separated from the other *Mamestræ* by the yellow posterior wings. It was collected by Mr. T. L. Mead.

Mamestra promulsa, nov. sp.

Expanse 35 mm. Length of body 15 mm. Eyes hairy. Palpi ochreous. Villosity of the front, thorax and collar coarse and rough. Abdomen smooth and untufted, covered with mixed gray and yellow scales; in the female with a short, thick, projecting ovipositor.

The wings are thinly scaled, nearly unicolorous, the ground color being olivaceous gray, overspread with numerous yellowish scales; the median lines are blackish, diffuse, irregular and dentate; the subterminal line forming a series of blackish blotches, interrupted, and some times barely perceptible; the orbicular spot obsolete, the reniform reduced to a blackish stain; the median shade is seen at the costa and inner margin in diffuse spots; a yellow line at the base of the concolorous fringe. Posterior wings colored like the primaries, with a more or less distinct discal dot. Beneath, yellowish gray, with black discal dots and a diffuse, thick, but angulate median line.

Habitat. Colorado (Mr. T. L. Mead), July 20.

We refer this interesting species to *Mamestra* provisionally; the two specimens we have were placed in papers, so that the thoracic tufts are much defaced; we think that on the discovery of fresh specimens it will probably become the type of a new genus.

Scopelosoma devia, Grote.

Expanse 36 mm. Length of body 17 mm. The thorax is concolorous and provided with a sharp edged longitudinal crest behind the collar. The anterior wings have their apices rectangular; half-line present, whitish; the basal space brown, closely and evenly sprinkled with white atoms; the interior line white, even, oblique, and concave, contrasting strongly with the deep brown of the central and outer portion of the wings; the reniform spot is reduced to a fine white concave line, the orbicular absent; the exterior line is very fine, whitish, and broadly undulating, subparallel with the subterminal line which is also fine and clear; between these two ordinary lines there is another very distinct white concave line, parallel with the interior line and most distinct at the apex; outwardly this line contrasts with the brown subterminal space, inwardly it is suffused, but finally lost in the brown ground color before the exterior line; there is a sprinkling of whitish atoms towards the end of the terminal space; at the base of the brown fringe there is a bicolorous undulate brown and white line, outwardly the fringe is narrowly edged with white. The posterior wings are uniform dark fuscous, the fringes light. Beneath, the anterior wings are gray, with an indistinct double exterior line; the terminal space is brown having the apical portion suffused with whitish; the posterior wings are brown, thickly sprinkled with black atoms; the usual discal dot is present as well as a broad undulate median line.

Habitat. Brookline, Mass., Oct. 10.

From the collection of the late Dr. C. A. Shurtleff, now in the possession of the Boston Society of Natural History.

The style of marking in this species is very unique; it can at once be distinguished by the brown ground color and the two distinct, concave, white parallel cross lines inwardly suffused, outwardly clear and contrasting.

Plusia laticlavia, nov. sp.

Expanse 32 ^{mm}. Length of body 16 ^{mm}. Habitus and markings of *P. precationis*, Guen., to which it is closely related. Ground color lighter than in the allied species, aurichalceous shaded with delicate pink as in *P. purpurigera*, Walk.

The reniform spot, the usual metallic spots and the general pattern of the markings as in *precationis;* it differs in the course and distinctness of the median lines, the interior line being oblique, perfectly straight, broad, and golden from the inner margin to the median nervure, and the exterior line even, simple undulate and strongly contrasting; above purple, near the inner margin becoming golden. Posterior wings dark gray. Beneath suffused with yellow, lighter than in *precationis.*

Habitat. New York. July 10, 1872.

Described from a single specimen in good condition received from Mr. Fred. Tepper.

Plusia formosa, Grote.

(*Leptina formosa,* Grote, Proc. Ent. Soc. Phil. Vol. IV, p. 323).

The description of "*Leptina formosa*" has always been of great interest to us, for evidently the species intended was not a true *Leptina;* but its rarity has prevented us from deciding its proper place. A careful examination of the single specimen in the collection of the Boston Society of Natural History convinces us that it is a *Plusia*, rather remotely allied to *P. ampla*, Walk.

It may seem a wide leap from *Leptina* to *Plusia*, but nevertheless it appears to be a necessary one; the naked lashed eyes, the form of the palpi, the unition at the base of the costal and subcostal nervures of the posterior wings, the conspicuous saddle shaped metathoracic tuft, and particularly the style of ornamentation, admit of no doubt.

The wings are rounded at the apices, thus differing from our American species, but we do not consider this character of more than specific value, particularly as the European *concha* and *illustris* show an approach to this form.

Plusia Hochenwarthi, Hoch.

P. alticola, Walk. Cat. Brit. Mus. Noct., p. 912.
P. ignea, Grote, Proc. Ent. Soc. Phil., Vol. II, p. 274.
P. alticola, Grote, Bull. Buff. Soc. Nat. Sc., Vol. II, p. 31.

After comparing numerous specimens of the above species from Europe, Labrador, the White Mountains, N. H., and the mountains of Colorado (Dr. Carpenter), we agree with Mr. Strecker in uniting under one specific name the forms from these localities.

The specimens from Colorado are larger and better marked than the others; we do not see any other differences.

Mr. Herman Strecker has kindly sent us a specimen of *Plusia parilis*, Hübn., so that we are able to verify Möschler's record of the species from Labrador.

CALOCAMPA, Steph.

C. nupera, Lintn.
C. curvimacula, Morr.
C. cineritia, Grote.
C. germana, Morr.

In two recent papers Mr. Grote has made some remarks on this genus, which, as they do not seem to be founded on a careful study of its characters, require correction.

In the first of these papers from the Bulletin of the Buffalo Society of Natural Sciences, Vol. II, pp. 193-200, *solidaginis* and *germana* are separated under Hübner's genus *Lithomia;* we prefer to follow Lederer and all succeeding European Lepidopterists, and place these species in *Calocampa;* they resemble strongly in ornamentation the typical species, and their only material structural difference is in the less arched, more rounded collar.

In the second paper from the Proceedings of the Philadelphia Academy of Natural Sciences, p. 210, 1874, Mr. Grote takes exception to our statement that *nupera* is the representative of the European *vetusta*, and considers it rather to resemble the allied species *exoleta*.

After a reëxamination of our material, consisting of sixteen specimens of *exoleta* and eight of *vetusta* from various parts of Europe, and five specimens of *nupera* and fifteen of *curvimacula* from different localities in the Eastern and Middle states, we not only feel prepared to state again that *nupera* is our representative of *vetusta*, but further that it is still a matter of doubt whether the forms are specifically distinct.

If a series be examined it will be seen that every spot and line of *vetusta* is reproduced in *nupera* in exactly the same relative position; the black basal dashes, the strongest distinctive character, are found in the same place in both species, in the former brownish and nearly concolorous, in the latter accentuated and marked by black scales; we now know of no other constant distinguishing character than this; which is, as we have shown, merely a difference in intensity, not one of position.

In regard to the statement that *nupera* is more closely allied to *exoleta* we remark in addition to what is said above, that the former differs mainly from the latter in the obsolescence of the orbicular spot, and the presence of a single intense black dash beyond the reniform, or in other words precisely the same characters in which *vetusta* differs from the same species.

Anarta membrosa, nov. sp.

Expanse 33 mm. Length of body 15 mm. Eyes hairy. The antennæ of the female simple. The hairy clothing of the palpi and front coarse and uneven. The collar is gray with a black terminal border, tipped with white. The thorax is clothed with mixed black and gray hair. The abdomen smooth, except a slight low tuft on the first segment. The ground color of the anterior wings is dark gray; all the markings are black, and the lines are followed and the spots filled with clear bluish gray; the half-line thick, black and uneven, followed by a bluish gray shade which extends to the apex, only interrupted by the black diffuse starting points of the lines; interior line black and distinct, strongly outwardly lobed between the nervules; at the usual place of the claviform spot a diffuse blackish shade extends to the exterior line; the median shade is strongly marked on the costa, below much diffused, filling with black the space between the ordinary spots, on the inferior portion of the wings it is nearly obsolete; the usual spots are of nearly equal size, enclosed within blackish interrupted annuli; the exterior line is fine, distinctly dentate between the nervules and drawn in below the cell; on the submedian fold it is thickened forming a blackish spot; the subterminal space is more clearly bluish, but there is a blackish blotch in its upper portion with which the usual three bluish ante-apical dots contrast; the subterminal line light and undulate forming two blunted Hadena-like teeth on the second and third median branches, it is followed and set off by black shades the most prominent of which are above the teeth; the fringe distinctly chequered with black and white.

Posterior wings dark gray with a faint discal dot and median line; the fringes are black and white, but the colors are more mixed and not so well defined as on the anterior wings.

Beneath dark gray, with discal dots and a very conspicuous undulating median line; the fringe is also chequered.

Habitat. White Mountains, N. H.

From the collection of the Boston Society of Natural History.

This species can be distinguished from others of the genus by its large size and stout form, as well as the distinct spots filled with bluish gray, and the uniform dark gray posterior wings; it is slightly larger than *A. amissa* from Greenland and quite different in appearance.

Anarta melanopa, Thunb., is also found on Mt. Washington, and appears to be of common occurrence; it is interesting to observe its successive broods; it first emerges on the Ledge from June 15 to July 1, according to the season; as the summer gradually advances it comes out higher up, and from July 4 to 10 is found in perfect condition near the Summit, while below at this time none but worn and ragged females are to be seen.

EUTRICOPIS, nov. genus.

Eyes naked. Ocelli present. Palpi comparatively stout, the joints hidden by long, coarse, uneven hair. Front very full, rounded; without a projecting knob or horizontal plate. Antennæ of the male simple; by the aid of an ordinary lens the segments are seen to be well separated from each other, and each provided with a short tooth. Thorax rounded, moderately stout. Abdomen reaching to the anal angle of the posterior wings, untufted. All the tibiæ non-spinose, the anterior tibiæ without the claws found in allied genera. The anterior wings short and triangular, with the angles well marked; the nervures are very strong at their commencement, particularly the median and submedian; the posterior wings short and broad, having all the angles rounded. The thorax and head are clothed above and beneath with long, coarse hair.

This well-marked little genus differs from others of the group, by the non-spinose tibiæ; we consider it distantly allied to *Omia* and *Heliolonche;* to these genera it is related by the very hirsute head and body parts.

Eutricopis nexilis, nov. sp.

Expanse 18 mm. Length of body 8 mm. Ground color of the anterior wings dull olivaceous gray, with mingled pink scales, resembling that of *H. modicella*, Grote; the median space is occupied by three white spots, the largest is quadrate, situated between the median and submedian nervules, above and attached to this spot, another large spot occupying the place of the reniform; in the ordinary place of the orbicular spot appears another small, partially obscured spot; beyond, smooth and unspotted, overlaid with pink scales, through which passes a broad, even, olivaceous, subterminal band; fringe tipped with white. Posterior wings black, with white fringes, and two large, united, subquadrate discal white spots. Beneath, on the anterior wings, the white markings above are reproduced, the ground color is black, but the entire costa is beautifully and broadly banded with pink; on the posterior wings the ground color is also black, but the white markings are larger than the above, the entire anterior half of the wings are pink, excepting the central white band.

Habitat. Colorado, June 18.

This beautiful species will at once be recognized by its vivid colors beneath. From the numerous species of Heliothis described by Mr. Grote from the same locality, it differs at once by the unarmed tibiæ.

Telesilla vesca, nov. sp.

Expanse 23 mm. Length of body 10 mm. Eyes naked. The palpi and front as in *T. cinereola.* Thorax untufted, concolorous. Abdomen smooth, dark gray. The middle and posterior tibiæ are terminated by a pencil like tuft in addition to the ordinary spurs.

Different shades of brown prevail over the anterior wings, melting gradually into one another; the basal space is chestnut-brown deepening into black-brown on the first part of the median space, the outer and upper portions of the median space are cinereous-brown, beyond, the terminal and subterminal spaces are dull gray-brown; the ordinary lines are cinereous and the spots are encircled by annuli of the same color; the half-line and the interior line indistinct; the exterior line distinct, even and preceded by a darker shade line; it is followed by a series of black spots on the nervules; subterminal line whitish, preceded by lighter brown shades; orbicular and reniform spots distinct, concolorous, the former rounded, the latter upright having the lower inner corner drawn in on the median nervure.

The posterior wings are blackish gray. Beneath uniform dark gray; both wings flecked with white atoms; the posteriors with a discal dot and median line.

Habitat. Texas; Wisconsin.

Smaller than *cinereola*, with the markings much the same but on a deeper and more diversified ground color.

Eucalyptra, nov. genus.

Eyes naked. The antennæ in the male are clothed with fine, isolated, comparatively long hair.

The first joint of the palpus is normally formed, the second and third are united together to form a long (3 mm.), thin, distinctly triangular piece, united to the first joint at its smallest angle, the side opposite this angle being about one millimetre in length. The front is rounded; above and beyond the vertex the frontal villosity projects as a triangular tuft, directed towards and almost reaching the obtuse angle of the palpal piece. The thorax is weak, rounded and untufted; its clothing entirely scaly. The abdomen is slight and closely scaled, exceeding the margin of the posterior wings.

The legs are long, closely scaled, having the tibiæ non-spinose. The wings are elongate with all the angles rounded.

This is a peculiar, slender-bodied genus allied to *Amolita* and *Thaumatopsis*, the characters drawn from the palpi, antennæ and frontal villosity are very distinctive, and separate it at once from the genera mentioned above, as well as all others known to us.

Eucalyptra bipuncta, nov. sp.

Expanse 31 ^{mm}. Length of body 14 ^{mm}. Palpi black. The front and thorax whitish. The anterior wings are white, sprinkled with black atoms, outwardly they are gray and the atoms are more numerous. The ornamentation is extremely simple, the two ordinary spots are reduced to black dots; the median nervure is shaded with dark gray to the exterior line; the latter is distinct, even, grayish-ochreous, regularly arcuate beyond the cell and then extending obliquely to the inner margin; all other markings are obsolete. The abdomen and posterior wings are uniform light grayish fuscous, with an ochreous tinge.

Beneath, the anterior wings are dark gray, with a distinct ochreous costal border; the posteriors are lighter, grayish ochreous with a dark costal border.

Habitat. Massachusetts.

Taken at Belmont, Aug. 17, 1874.

The slight form, the obsolete markings, and the triangular black palpi will serve to identify this species.

XI.—*On an Asphaltic Coal from the shale of the Huron River, Ohio, containing seams of Sulphate of Baryta.*

BY PROF. ALBERT R. LEEDS.

[With a Geological Note by Dr. J. S. Newberry.]

Read January 11, 1875.

I HAVE received from Chas. N. Smith, Esq., of Norwalk, Ohio, a specimen of coal found on the Huron River, below the Lake Shore and Michigan Southern R. R. crossing. It occurs in a bank of shale, about seven feet below the surface of the ground, and a few feet above the bed of the river. The specimens forwarded to me for examination were three and a half centimetres in thickness. According to my informant, the thickness of the seam at its outcrop, and for a distance back of three feet, averages about two inches. It then divides into two seams, which are separated by a thin stratum of shale. The remarkable and, as we believe, novel fact concerning these seams of coal, is that they are traversed by innumerable sheets of sulphate of baryta, which divide the coal into small irregular fragments. The coal itself has a brilliant lustre, resembling asphalt. The white mineral traversing it, consisted, in the specimen examined, of 88.61 per cent. of sulphate of baryta, the remainder consisting of silica, alumina, and oxide of iron. By weathering, the surface of the sheets of white spar becomes stained yellow with ferric oxide. The causes which have operated to produce this deposition of barytes in the coal, whether by infiltration of meteoric waters percolating through overlying strata, or by some other agency, must be determined by an examination of the local stratigraphy.

Note by Dr. J. S. Newberry.

The mineral in question occurs in numerous localities in Ohio and Kentucky, filling narrow fissures in the Huron shale. This formation, which is the equivalent of the Portage group of the New York geologists, contains throughout from 10 to 25 per cent. of carbonaceous matter, and is the source whence most of the oil is derived, both in Pennsylvania and Ohio. These rocks are lower than any in which true coal has ever been found; and this material, moreover, occurs not in beds like true coal, but in fissures and crevices intersecting the layers of the rock. The mineral examined by Prof. Leeds should therefore be regarded as an asphaltic coal, originally derived from the spontaneous distillation of petroleum, like the Albertite of New Brunswick and the Grahamite of West Virginia.

The white scales which fill the cracks of this coal, as found in Huron and Lorain counties, in Ohio, have probably been derived from deep-seated sources, coming up, perhaps as chloride of barium, through the fissures which contain the asphaltic coal.

The region where this mineral occurs is occupied exclusively by unchanged sedimentary rocks, Devonian and Upper Silurian. These contain, so far as known, no disseminated sulphate of baryta; but the Water Lime group of the Upper Silurian, which lies some distance below the Huron shale, and comes to the surface a few miles west, on the Islands of Lake Erie, is much shattered, probably in connection with an uplift along the line of the Ohio anticlinal: and the cavities and crevices, once existing in this rock, are frequently filled with sulphate of strontia and sulphate of baryta, or with native sulphur. These minerals, occurring thus, should probably be regarded as deposits from thermal waters; and it is quite possible that the fissures in the Huron shale, containing this asphaltic coal, have derived their sulphate of baryta from a similar source.

XII.—*On a New Species of Anarta and on an allied Genus, with a note on the Genus Adita.*

By AUG. R. GROTE, A. M.

Read March 8, 1875.

Among a collection of Lepidoptera made by Mr. Theo. L. Mead in Colorado Territory, are specimens of an undescribed species of *Anarta*, which differs from all the American species known to me in its more lengthy villosity, in its colors and the greater proximity of the median lines on the primary wing. I describe it as follows:

Anarta nivaria, n. s.

♂. The eyes are hairy. Fore wings, thorax and head purple gray. Median lines approximate, scalloped or dentate, blackish, obsoletely geminate, accompanied by light gray shades. The narrow median space is darkened by the passage of the broad diffuse blackish median shade. Ordinary spots inconspicuous, the orbicular pale ringed, a little oblique, ovate; the reniform upright, narrowed, somewhat scroll-shaped, pale ringed with a darker centre. The sub-basal space more blackish than the basal and terminal spaces, the darker tint evenly spread and deepening to the subterminal line, which is continuously indicated by the contrast of color and of the usual irregular shape. Fringes not checkered, darker than the wing. Hind wings yellowish fuscous, with discal lunule and vague darker outer borders; an indistinct sub-continuous dark terminal line; fringes pale, not checkered. Abdomen of the same hue, but a little darker than hind wings. Body short, villose. Beneath, both wings, light yellowish, with distinct lunules and traces of a common fuscous line.

Expanse 28 mm. Two specimens varying in the distinctness of the markings on the primaries and numbered 21 and 22.

There is also in Mr. Mead's collection an interesting specimen which I have considered as belonging to the *Heliothidæ*, and as constituting the type of a distinct genus allied to *Anarta*. The legs are spinose, and thus it has a strong feature in common with *Agrotis*. The naked eyes are, however, encroached upon by the caputal tegument, somewhat sensibly narrowed, ovate, lashed. The shape and vestiture of the abdomen are as in *Anarta*. Its spinose legs are its only analogy with *Agrotis*. But it must be remembered that the spinose tibiæ are a prevalent feature in the group of genera allied to *Heliothis*, and to which *Anarta* belongs. The species seems to have been recently described as a species of *Agrotis*, by Mr. Morrison, who has regarded its characters as mimetic with *Anarta*, and its true relationship to be decided by the single character of its spinose tibiæ. The majority of the characters, however, ally the moth to *Anarta*, in my opinion, and we must also consider that genera with spinose tibiæ are scattered throughout the family, and that hitherto no attempt has been made to associate them on this single character. Mr. Morrison himself fails to remark any resemblances to *Anarta* in other species of *Agrotis* inhabiting the same regions with *Anarta*.* Mr. Morrison compares the cases of mimicry between the *Heliconidæ* and *Pieridæ* discovered by Bates and Wallace, with the present instance. I think there is no parallel to be sustained. The cases of mimicry reported among the butterflies from South America affected their coloration. In the present case there are structural differences which make the parallel untenable. I think that Mr. Morrison has merely mistaken the essential characters of his *Agrotis montana*, and that in consequence his remarks will not well bear criticism.

AGROTIPHILA, n. g.

All the tibiæ are spinose. The shape of the abdomen and habitus is as in *Anarta*. The eyes are naked, encroached upon by the caputal tegument, ovate, narrowed, fringed with lashes. The thorax is thickly and coarsely haired, without tufts. The maxillæ are stout. The antennæ are simple, thickly ciliate beneath in the male.

Agrotiphila montana.

Agrotis montana Morr., Ann. Lyc. N. H., Vol. XI, 94.

My specimen, numbered 28, agrees very well with Mr.

---

*Mr. Morrison applies the term "northern" to the species of *Agrotis* hitherto only found in the White Mountains, such as *scropulana, opipara*, perhaps incorrectly.

Morrison's description, except that the whitish orbicular is open superiorly, somewhat triangulate, and that the discal marks beneath and on the hind wings above are illegible. The ornamentation is like *Anarta*, with coarse lines above on the primaries, while beneath, both wings are pale, and here the concolorousness of both wings as to their ground color is characteristic of the group to which I conceive the insect belongs.

Adita Grote (1874).

I founded this genus upon the *Phalæna Chionanthi* of Abbot and Smith, having rediscovered the species in a collection of *Noctuidæ* sent me from Ithaca, N. Y., by Professor Comstock of Cornell University. It had not been mentioned previously, and since its first description in 1797, by any other author, to my knowledge. In my generic diagnosis, I gave as a character the spinose tibiæ. Mr. Morrison recently speaks of my generic description in the present volume of the Annals, p. 95, and says: "In his generic description Mr. Grote states that the tibiæ are spinose; this is apparently an error, as the only spines present are the pair before the spines on the middle tibiæ and a single spine (there possibly may have been two) between the two pairs of spurs on the hind tibiæ." I have again examined my specimen of *Adita chionanthi*. The middle tibiæ have *eight* spines arranged in irregular pairs, besides several other finer spinules massed on the joint. The hind tibiæ have three spines, and in perfectly fresh specimens will probably show at least four. It has been noticed by European entomologists that the spines on the legs in the *Noctuidæ* are, on occasion, accidentally absent. The fore tibiæ appear to me now to show merely the terminal claw which I have compared to that of *Oncocnemis*. I conclude, therefore, that my original statement, as applied to the middle and hind tibiæ of *Adita*, is correct.

XIII.—*Morgan Expeditions*, 1870–'71: *On the Devonian Trilobites and Mollusks of Ereré, Province of Pará, Brazil.*

By CH. FRED. HARTT,
Prof. of Geology in Cornell University,
AND
RICHARD RATHBUN,
Assistant in the Museum of the Boston Society of Natural History.

Read March 9, 1875.

We have given in this paper descriptions of the trilobites and of all the species of mollusks, not including the brachiopods, collected by the parties of the Morgan Expeditions, in 1870 and '71, from the Devonian rocks of the plain around the little village of Ereré. In the Bulletin of the Buffalo Society of Natural Science, for January, 1874, Vol. I, No. 4, Prof. Hartt has described at length the geography and geology of the Ereré-Monte-Alegre district, in which occur the fossiliferous Devonian beds forming the plain of Ereré. These beds consist of thin horizontal layers of white and reddish sandstones, interstratified more or less with shales. Both the sandstones and the shales contain at a few points an abundance of fossils, closely related to, and in some cases identical with, forms characteristic of the middle Devonian rocks of North America. The brachiopods, the most abundant fossils in the Ereré Devonian, were described by Mr. Rathbun in the work above cited, in a paper immediately following that of Prof. Hartt. There then remained for description the mollusks, including six forms of gasteropods and eight of lamellibranchs, with a single form of *Tentaculites*, two forms of trilobites of the genera *Dalmania* and *Homalonotus*, both probably new, and a number of obscure forms, many of which are entirely unrecognizable.

The mollusks and trilobites in the Devonian at Ereré are confined entirely to the sandstone, no traces of either having been found in the shale, in which the only recognizable forms are the very abundant *Discina* and two species of *Lingula*, already described.

By reference to the paper on the Brachiopoda of Ereré, mentioned above, it will be seen that many of the forms there described are identical with species of the Devonian age, more especially the Hamilton group, of New York state, and that most of the remaining forms have closely related ones in these same deposits of North America. The close relation in horizon of the middle Devonian of New York and the formations of the plain of Ereré was thus demonstrated. The study of the mollusks has greatly strengthened the proof of this relationship, for several of the forms of mollusks from Ereré have proved identical with forms recently described from the Hamilton group of New York by Prof. Hall, and possibly others, now apparently distinct, may also turn out identical with more extended collections. All the genera represented, with a single exception, are common to the Devonian elsewhere. We are under very many obligations to Prof. James Hall of Albany, N. Y., for identifying for us many of the following genera, some of which have been recently proposed by him. He also made a comparison of the species with the New York forms contained in his collection, and it was with his aid that we were enabled to unite the three forms, as hereinafter indicated. To Mr. R. P. Whitfield, of Albany, we are also much indebted for assistance in our work.

TRILOBITES.

Genus DALMANIA, Emmrich.

Dalmania Paituna, sp. nov.

Animal of medium size, sometimes quite large: test very tumid, and with the different lobes and segments sharply defined.

Buckler crescent-shaped; greatest breadth about one and one-fourth the greatest length, and nearly twice the length of the glabella; in front sub-acuminate or bluntly sub-angular, the margins on either side diverging at first at an angle of about 120°, and curving moderately and regularly; posterior lateral angle on either side produced backward in an acute spine. On each side of the frontal lobe the margins sometimes form nearly straight lines. The entire margin forms a curve, nearly equal to half an ellipse, in which the relation between the two diameters is about as 2 to 3. A specimen rather below the medium size measures: greatest length, $14{\cdot}5^{mm}$; greatest width, about 20^{mm}. A larger specimen has a length of about 21^{mm}.

Glabella very prominent, slightly flattened on top, bounded by deep axal furrows, sub-pentagonal in outline, and rounded or sub-angular in front; widest just back of the middle of the frontal lobe, or at about one-third the length of the glabella from the front. Thence backward the glabella narrows regularly, the width at occipital furrow being a little more than half the length of the glabella. Frontal lobe rounded or sub-angular at front and sides and very convex, curving strongly downward toward the margins of the head, and sometimes obliquely flattened on either side in front. Its length equals about the united length of the four succeeding pairs of lobes, and a little more than two-thirds its own width. Frontal furrows wider than middle and basal furrows. Originating at a distance from the front equal to about one-third the length of the entire glabella, they run inward and backward at a strong angle, terminating near the middle of axis. They reach a little more than one-third across the glabella. Upper and middle lobes wider and more prominent than the basal lobe. Middle furrows situated at a distance from the front equal to about 3–5 the length of glabella, deep and rather narrow, perpendicular to axis, and extending inward quite as far as the frontal furrows. Basal furrows deep, curving a little forward, and reaching to about one-third the distance across glabella, or slightly farther than do the middle furrows. Basal lobes narrow and much less prominent than the other lobes. Occipital furrow deep, broad and rounded. Occipital ring broad, strongly arched vertically and sub-angular behind. The highest part of the glabella is situated at a point about between the middle furrows. On the median line, and slightly in advance of frontal furrows, is a minute, more or less distinct depression, usually more marked in the internal cast.

Limb forming a blunt, rounded or sub-angular projection in front of glabella, but narrowing down to a mere line before reaching the axal furrows. Cheeks very convex, with a strong convex slope toward the margins; slope toward neck and axal furrows abrupt. The limb increases rather rapidly in size going backward from the axal furrows, being separated from cheek lobe by a well defined, broad furrow. The occipital furrow is inclined slightly backward, and is deep and well defined, not being extended into the nuchal spine, which last is short, acuminate and not differentiated from cheek. Length of spine, measuring from angle formed by lateral and occipital furrows, equal to about half the length of glabella. Spines directed slightly outward. Posterior marginal fold strongly convex and of moderate width. Eyes large and very prominent, situated exactly opposite outer extremities of anterior and median lobes. In none of the specimens in the collection are they sufficiently well preserved to allow of detailed description.

A Hypostome, probably of this species, is sub-quadrate in form and strongly convex. The front margin is strongly arched and slightly sub-angular. On each side it is produced in a short acuminate spine, extending directly outward. The sides are nearly straight and incline slightly toward one another in going backward. The body of the hypostome is very convex and abruptly separated from a flattened margin. The outline of the convex portion forms a very regular curve as follows: beginning at the anterior lateral angles it runs obliquely backward and inward, the flattened margin widening gradually; posteriorly with a regular arch it extends apparently nearly to the margin. The whole hypostome is strongly arched, transversely and vertically. The abrupt margin of central portion increases in height going backward. This specimen measures 7^{mm} in length and about 10^{mm} in greatest width. A fragment of a larger specimen of hypostome, having a length of 21^{mm}, was also obtained from the same bed as the above, and, although differing from it somewhat in appearance, may belong to an older specimen of the same species.

Pygidium triangular, with curved sides, and very convex. Axis narrow, prominent, regularly rounded from side to side, and extending about 3-4 length of shield; width in front apparently equal to 1-3 width of shield. It decreases slightly in width and gradually in height posteriorly, where it ends abruptly, the extremity being rounded and convex; width in front about one and one-half to two times the width behind. In one large specimen the axis shows 14 rings, the anterior of which, in the internal mould, are prominent, rounded, and separated by furrows of rather greater width; but they become very small and indistinct posteriorly, the last three or four being crowded together. In none of the specimens collected is the articular ring preserved, but several of these show 11 to 13 rings. Lateral lobes convex, but generally of much less elevation than the axis; margin slightly flattened. Furrows deep and extending to the margin in all but the last four or five rings. The segments are rounded near the axis, but are flattened and much broader toward the margin. The anterior one is nearly at right angles with the axis, but they become more strongly inclined posteriorly. On the first segments the sutures are faint and on the posterior ones not observable. The margin is denticulate, the terminations of each segment being apparently blunt and obliquely rounded or angular. Posterior part of pygidium, behind axis, highly inclined, rounded and smooth; posterior margin concave, arched and slightly turned up along the edge. A specimen of medium size measures in length, about 15^{mm}, in width, 14^{mm}. A very large specimen has a length of 32^{mm}.

A few detached segments, that may belong to the thorax, were found, but they are unsatisfactory for determination.

The first distinguishing feature of this species lies in the great prominence of the test, none of the forms, with which we have compared it, approaching it at all in convexity. This difference of character is supplemented by many others. From *Dalmania Boothii*, of the Hamilton group of New York, the only abundant form known in beds corresponding most nearly in age to the Ereré Devonian, it differs, among other features, in the greater proportionate length of the middle of the head, in the more gradual backward narrowing of the glabella, and in the greater length of the frontal lobe, which is generally more angular in front in the latter form.

This beautiful species occurs somewhat abundantly in the Devonian sandstone at Ereré, associated with *Spirifera Pedroana*, etc. The specific name is given in allusion to a mythical personage, after whom the Serra of Paitúna in the vicinity received its name.

Genus HOMALONOTUS, Kœnig.

Homalonotus Oiara, sp. nov.

There was obtained from the Devonian sandstone at Ereré, a single fragment of the head of a large trilobite, which belongs to this genus. It is very distinct from any other form yet known, but too imperfect to admit of proper description. It differs from *Homalonotus Dekayi*, Van., apparently, in the fact that the margins of the glabella are more concave than in the latter form, and the eyes are placed farther forward. We have ventured to rank it as a new species, naming it after the Tupí water maiden. Associated with the last species above described, *Dalmania Paitúna.*

GASTEROPODA.

Genus PLEUROTOMARIA, Defrance.

Pleurotomaria Rochana, sp. nov.

Shell quite small; outline, as seen in front and hind view, a rhomboid, of which two opposing sides are about twice the length of the other two sides. Height less than the breadth; spire very depressed-conical; apical angle somewhat greater than a right angle. Volutions about three in number, the last angular and carinate along the middle, with the upper surface flattened, or curving very slightly from the suture to the median carina. The upper surfaces of all the volutions, from the apex to the carina of last volution, lie in nearly the same plane and are separated by a shallow suture; lower side of the body volution slightly more convex than the upper. Aperture and surface markings not preserved. This is a very small species of *Pleurotomaria*, one specimen measuring about 8.5 ^{mm} in length, and 11 ^{mm} in breadth.

Only a few specimens of this species have been obtained, and none of these are in a very perfect condition. Associated with *Nuculites Nyssa*, *Streptorhynchus Agassizii*, etc., in the Devonian sandstone of Ereré, Prov. of Pará, Brazil.

Named in honor of Tenente Rocha, commandant of the Marine Arsenal at Pará, to whom the expedition of 1870 was indebted for the fitting out of the steamer Jurupensem.

Genus HOLOPEA, Hall.

Holopea Furmaniana, sp. nov.

Shell rather above the medium size, obliquely sub-conical in front view, with the length and breadth nearly equal. Volutions about three or four in number, very prominent and well rounded. They increase quite rapidly in size from the very small apex, the last one being ventricose and sometimes slightly flattened on the top near the suture, which is rather deep and acute-angular. Aperture slightly oblique, oval in outline and a little reflected on the lower side. Surface, as determined by external moulds, smooth. One specimen of average size measures: length and breadth each, about 17 ^{mm}; but many specimens are larger than this.

All the specimens of this form, so far obtained, are in the condition of moulds of the interior and exterior. In the internal mould there is a small umbilicus, probably due entirely to the removal of the columella. This form is easily recognized by its regular and well rounded volutions and low spire, the volutions commencing of very small size and increasing rapidly and regularly to the aperture. So far as we are aware the genus *Holopea* has not been recognized from the Devonian before; but the smooth exterior of this form precludes its being placed in the genus *Pleurotomaria*, to which it might seem to be related from the shape and appearance of the internal mould alone.

Very abundant in the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Spirifera Pedroana*, *Nuculites Nyssa*, etc.

Dedicated to Mr. Furman of Pará, a gentleman to whom both expeditions are deeply indebted.

Genus PLATYCERAS, Conrad.

Platyceras symmetricum.

Platyceras symmetricum, Hall. 15th. Ann. Rep. St. Cab., N. Y., 1862, p. 34.

Description of the Ereré form:—Shell small, argonautiform in side view, very slightly elongated and somewhat laterally compressed. From the apex, which is minute and twisted very slightly to the right of the median line, the shell increases very rapidly in size, the ventral side of the body volution passing tangentically for a short distance beyond the last preceding volution. Volutions about one and one-half in number, the outer one, small and much compressed where it commences, but becoming gradually less compressed and more fully rounded toward the aperture, enlarging rapidly at the same time. The aperture is oval in outline, with the sinistro-dextral diameter a little less than the dorso-ventral. The margin is apparently sinuous, but is defective in the specimen. Exterior surface of shell not preserved. Surface of internal mould of body volution not very irregular, somewhat rugose and traversed near the front by numerous, rather indistinct growth lines, which bear on each side a few deep, rounded flexures. To these flexures a few short, irregular, longitudinal undulations near the aperture appear to correspond. There is a slight prominence, probably the impression of the base of a spine, just on the left of the dorsal line, midway between the aperture and the beginning of the outer volution. Dimensions: greatest length from anterior margin of aperture, 19 ^{mm}; dorso-ventral diameter of aperture, 13.5 ^{mm}; sinistro-dextral diameter of same, 12 ^{mm}.

Only one specimen of *Platyceras*, the one described above, was obtained from Ereré. It agrees with *P. symmetricum* of Hall, Hamilton group, N. Y., in being symmetrical and in having the same number and character of volutions; but it is much smaller than any specimen of *P. symmetricum* from the Hamilton group which we have seen, and more perfect specimens, preserving the shell, may show it to be distinct from that species.

From the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Spirifera Pedroana*, etc.

Genus BELLEROPHON, Montfort.

Bellerophon Morganianus, sp. nov.

Shell of small to medium size, subglobose, with the umbilical openings small but rather deep. Body volution generally somewhat broadly flattened along the back, sometimes moderately rounded and curving abruptly to the umbilicus. It increases rapidly in size toward the aperture, where it expands quite abruptly, making the aperture large and apparently transversely sub-elliptical in outline. Surface covered with minute, rounded, transverse, parallel, raised lines, which first curve slightly forward from an indistinct, median dorsal band, and then extend nearly directly to the edge of the umbilical openings. Of a nearly perfect specimen of medium size, the greatest length from the outer edge of the aperture is about 17 ^{mm}; sinistro-dextral diameter of aperture of same specimen, about 19 ^{mm}.

This Brazilian species of *Bellerophon* appears to be closely related to *B. leda* of Hall, Hamilton group, New York, and is of about the same size as that species. The body volution of *B. Morganianus* is, however, generally larger where it commences than is the case in *B. leda*, and the revolving raised lines are entirely wanting in the former species.

Obtained in great abundance from the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Spirifera Pedroana*, etc.

Dedicated respectfully to Mr. Edwin B. Morgan, of Aurora, N. Y.

Bellerophon Coutinhoanus, sp. nov.

Shell rather small, subglobose, trilobed. The outer volution increases rapidly toward the aperture, and is divided into three longitudinal lobes, of which the middle or dorsal lobe is about two-thirds the width of the whorl itself, and is prominent, sharply defined at its margins and very regularly rounded. The lateral lobes curve regularly and quite abruptly from the dorsal lobe to the umbilical openings. Size of the most perfect specimen, which is not, however, the largest one obtained: greatest length from near the outer edge of the aperture, about 15 ^{mm}; width of the outer volution near the aperture, nearly 15 ^{mm}.

Although a number of specimens of this species of *Bellerophon* were obtained from Ereré, the aperture is not preserved in any of them, and the umbilical openings, if such existed, are covered up by the rock in every case. The specimens are all of internal moulds and the surface markings are not retained. *B. Coutinhoanus* is very closely allied to *B. trilobatus* of Sow., Devonian of Europe, more especially to the variety *tumidus*, from which, however, it differs in having the dorsal lobe broader, less prominent, and more flattened along the top, with its margins more distinctly defined.

From the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Nuculites Nyssa*, etc.

Respectfully dedicated to Dr. Silva de Coutinho, Rio de Janeiro, Brazil.

Bellerophon Gilletianus, sp. nov.

Shell very small, laterally compressed, somewhat lenticular in form and sub-circular in outline; umbilical openings of medium size, deep. The outer volution commences very small, somewhat compressed and more or less angular on the median dorsal line, and increases rapidly in prominence but quite gradually in width, becoming more and more strongly angular toward the aperture, where it is but slightly expanded. The summit of the mesial prominence is often well rounded, but sometimes acute, while on each side is generally a very shallow accompanying groove, growing more pronounced toward the aperture, and which gives to the shell near the mouth a somewhat trilobed appearance.

The surface of the shell is marked by numerous, very fine, rounded, thread-like, concentric raised lines, which arch very strongly backward from the umbilici to the median dorsal line, where the corresponding ones on each side unite in a curve. Of the largest specimen obtained, the greatest diameter, which is from the outer margin of the aperture to the opposite side of the shell, is about 10 ^{mm}; width of the body volution near the aperture, about 5 ^{mm}. Most of the specimens, however, are much smaller than this.

B. rotiformis of De Kon., Europe, resembles the species just described in size and general appearance, but it is more lenticular in shape and the whorls increase more rapidly in size. The umbilical openings are also smaller and the slope toward them is much less abrupt.

Moderately abundant in the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Nuculites Nyssa*, *Spirifera Pedroana*, etc.

Named after M. Léon Gillet, Prof. Hartt's able and obliging agent at Pará.

LAMELLIBRANCHIATA.

Genus NUCULITES, Conrad.

Nuculites Nyssa.

Nuculites Nyssa, Hall. Lamell. Shells of the U. Held., Ham. and Chem. Groups, etc., 1869. (Preparatory for the Palæontology of N. Y.)

Description of Ereré specimens:—Shell of medium size, longitudinally sub-ovate or sub-triangular in outline, and of moderate convexity. Anterior margin well rounded and narrower than the posterior. The dorsal margin, curving slightly, extends obliquely backwards from the beak to the posterior extremity of the shell, a short distance above the termination of the median antero-posterior diameter. The ventral margin is moderately rounded and, together with the anterior and posterior margins, forms an elliptical curve. Beaks about one-fourth the length from the anterior extremity, with the apices acute and strongly incurved to the hinge line. Valves most convex at a point just above and anterior to the middle. The surface arches rapidly and more or less regularly from the ventral margin to the beak, but is generally a little more strongly curved in the umbonal region, and is broadly flattened, rounding suddenly to the dorsal margin. The slope toward the posterior margin is convex and more abrupt than toward the ventral margin; toward the anterior margin it is still more abrupt, becoming gradually concave near the beaks. The septum, curving very slightly, and with its concave side forward, extends down nearly two-thirds the shell height, cutting the antero-posterior diameter at about one-fourth its length from the front. Surface smooth or marked with a few indistinct lines of growth. Length, 24 ^{mm}; height, 17 ^{mm}; depth of single valve, 5 ^{mm}. Specimens of larger size are numerous.

This species of *Nuculites*, which is the most common lamellibranch at Ereré, proves to be identical with *N. Nyssa* of Hall, found in the Hamilton group, New York.

We are indebted to Prof. Hall for the identification of the forms from the two places.

Abundant in the Devonian sandstone of Ereré, Prov. of Pará, Brazil, with *Spirifera Pedroana*, *Streptorhynchus Agassizii*, etc.

Nuculites Ererensis, sp. nov.

Shell small, elongate, nearly twice as long as high, sub-elliptical in outline, the margins forming quite a regular elliptical curve, broken by the slight upward extension of the beaks. Dorsal margin oblique and nearly straight. Beaks situated about one-third the length from the anterior margin, small, only slightly incurved, and apparently not reaching to the hinge line. The convexity of the valves is moderate, being greatest just below the umbonal region. The septum extends downwards for about three-fifths the height of the valves, and intersects the antero-posterior diameter at a little less than one-third its length from the front. Length, 13^{mm}; height, 8^{mm}; depth of single valve, nearly 3^{mm}.

This species of *Nuculites* is readily distinguished from the last one above described, *N. Nyssa* of Hall, by its elongate form and nearly elliptical outline, and by the absence of any flattening along the middle. Only two specimens have yet been obtained. These are both internal moulds of the left valve, and the surface markings are not preserved upon them.

Found, with *Spirifera Pedroana*, etc., in the Devonian sandstone of Ereré, Prov. of Pará, Brazil.

Genus GRAMMYSIA, De Verneuil.

Grammysia (Pholadella?) parallela.

Grammysia parallela, Hall. Lamell. Shells of the U. Held., Ham. and Chem. Groups, etc., 1869. (Preparatory for the Palæontology of N. Y.)

Shell small, elongate, about two-thirds as high as long, with the greatest height at the beaks. Valves moderately convex, the surface arching strongly from the beaks to the ventral margin, but being rather more abruptly curved in the upper portion. The beaks are situated at about one-fourth or one-fifth the length of the shell from the anterior extremity, and project but little above the hinge margin; they are small, rather strongly arcuate and turned somewhat abruptly forward, with the apices acute and contiguous. Dorsal margin straight and extending directly backward. The anterior margin extends obliquely forward in its upper half, forming at the beaks an angle of about 135° with the dorsal margin, and is slightly concave; it rounds somewhat abruptly to the ventral margin below, which is moderately curved anteriorly, but becomes nearly straight and subparallel with the dorsal margin along the middle of the shell. Posteriorly the ventral margin appears to round up more or less strongly toward the dorsal margin, but in none of the specimens obtained, is the posterior extremity of the shell perfectly preserved. From a line, extending obliquely across the valves, from just behind the beaks to the lower posterior extremity of the shell, and forming an angle of about 30° with the dorsal margin, the surface curves moderately and quite regularly to the anterior margin, and is traversed by about 10 or 12 low, wide, rounded, concentric undulations, which decrease in size from the ventral margin toward the beaks, where they are quite small. The lower ones round up quite abruptly in front, but are more gently curved along the middle. Posterior to the oblique line, above mentioned, the surface descends abruptly, and with a concave slope, to the hinge line and the posterior extremity, and is smooth in the moulds. Length, about 16 ^{mm} ; height, 10.5 ^{mm} ; depth of each valve, 3 ^{mm} .

Prof. Hall has identified this Brazilian form with his *Grammysia parallela* of the Hamilton group, New York, *loc. cit.*; but he expresses a doubt as to whether the species is a true *Grammysia*, or belongs to his new genus *Pholadella*, published in 1869.

Only a few specimens of this pretty form were obtained from the Devonian sandstone of Ereré, Prov. of Pará, Brazil, associated with *Spirifera Pedroana*, etc.

Genus EDMONDIA, De Koninck.

Edmondia Pondiana, sp. nov.

Shell below the medium size, elongate, nearly two-thirds as high as long, sub-elliptical in outline and moderately ventricose, with the greatest convexity in the lower posterior part of the umbonal region. Anterior end much narrower than the posterior, well rounded and prominent, the margin uniting by a moderate curve with the ventral margin, which, along the middle one-half of the shell, is quite straight and nearly parallel with the dorsal margin; posterior end strongly rounded, and apparently slightly truncate in its lower portion; dorsal margin straight and about one-half the length of the shell. Beaks situated at a little less than one-third the length from the front, broad, very prominent, and strongly incurved toward the hinge margin and the front, nearly or quite contiguous, and projecting a moderate distance above the hinge. The umbonal region is obliquely flattened, the flattened surface inclining anteriorly. This flattening, which commences on the beak, appears to extend downward, and somewhat obliquely backward, across the valve; but it becomes less and less perceptible toward the ventral margin, toward which the slope, for nearly the whole height of the valve, near the middle, is only slightly curved; toward the front, the slope is much stronger and it becomes concave in front of, and beneath, the beaks. Commencing at the anterior margin, the surface rises at a moderately strong angle for one-fifth the shell length, more or less, when, the angle of ascent becoming gradually less, it continues to rise with very little curvature toward an oblique line, extending across the valve from the posterior side of the beak to the lower posterior extremity of the shell. Along this line the valve rounds over toward the dorsal and posterior margins, quite gradually in the lower part, but more and more abruptly near the beak, the curve, from the point of greatest convexity of the valve toward the posterior end of the hinge margin, being abrupt and slightly sigmoidal. Exterior surface unknown. Length, 22^{mm}; height, 14^{mm}; convexity of single valve, 5.5^{mm}.

This species is founded on a single specimen, a very perfect internal mould of the left valve; but one or two much smaller specimens, probably referable to the same species, were also obtained from Ereré. From the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Spirifera Pedroana*, etc.

(Named after my friends, Mr. Fred. Pond, American Consul at Pará, and his brother, Mr. Thos. Pond, to whom I am indebted for a thousand favors. C. F. H.)

Edmondia Sylvana, sp. nov.

Shell small; length a little more than one and one-half times the height; outline apparently sub-elliptical. Valves moderately convex and nearly symmetrical, most prominent in the umbonal region. Beaks small, subcentral and obtuse in the moulds, incurving very little and hardly projecting above the plane of the hinge, between which and the apices of the beak is quite a space. The dorsal margin is regularly curved, and rounds down on each side of the beak to the anterior and posterior margins, of which the former seems to be the narrower, and is more regularly rounded than the latter; ventral margin nearly straight along the middle. The surface of the valves arches very strongly and quite regularly from the beaks to the ventral margin, while the curvature along the antero-posterior diameter is moderate and nearly regular. Length, 17^{mm}; height, 10^{mm}; convexity of single valve, 4^{mm}.

Although only a single specimen of this species, which has been referred with some doubt to *Edmondia*, has been obtained, and that is not a very perfect one, it has been possible from it to make out the principal characters of the species quite accurately. It is readily distinguished from all the other species of lamellibranchs yet found at Ereré, by the nearly symmetrical valves and sub-central beaks.

From the Devonian sandstone, Ereré, Prov. of Pará, Brazil, with *Spirifera Pedroana*, etc.

[Named in honor of my friend, Senhor José Gualdino da Silva, of Pará, to whom I am under many obligations. C. F. H.]

Genus MODIOMORPHA, Hall.

Modiomorpha Pimentana, sp. nov.

Shell of moderate size, elongate, sub-quadrilateral in outline. From the beaks, which are placed at less than one-fourth the length from the front, the height increases very gradually to the posterior end of the hinge margin, which last equals about three-fifths the length of the shell and is straight; height of shell at beak about five-sixths that at end of hinge margin. Anterior margin straight and oblique for about one-half its length, forming at the beak an angle of about 135° with the dorsal margin. It rounds abruptly to the ventral margin, which, in its posterior three-fourths, is nearly straight. The posterior margin is slightly convex, and extends obliquely backward from the dorsal margin, with which it forms an angle equal to about that at the beaks, and curves abruptly to the ventral margin. Beaks very small, obtuse and not produced above the hinge line. The valves are quite convex, the surface rising rapidly from the ventral and anterior margins on the one side, and from the dorsal and posterior margins on the other, toward a line running obliquely across the valves from the beaks to the lower posterior extremity. Along this line the valves are sometimes angular, at others they are regularly and strongly rounded; generally, however, they are angular near the beaks and become gradually rounded and flattened posteriorly. Above, the surface slopes to the dorsal margin very abruptly and is concave just behind the beaks, but the slope becomes more and more gradual toward the posterior extremity, and, from very slightly concave at first, it changes to very slightly convex posteriorly. The lower and anterior portion of the valves is sometimes broadly flattened. Surface marked with numerous concentric lines of growth. Length, 30^{mm}; height, 16^{mm}; depth of single valve, 5^{mm}. These dimensions are of the largest specimen found; most of the specimens are much smaller.

This form of *Modiomorpha*, which is quite abundant at Ereré, although very constant in its outline, varies considerably in its surface characters, as described above. The specimens obtained are all moulds of the interior and exterior. Associated with *Nuculites Nyssa*, *Spirifera Pedroana*, etc., in the Devonian sandstone of Ereré, Prov. of Pará, Brazil.

Named in honor of Senhor Pimenta Buenó of Para, to whom the expeditions are under obligations.

Genus PALÆANEILO, Hall.

Palæaneilo sulcata, sp. nov.

Shell of moderate size, elongate, slightly gibbous, and apparently subelliptical in outline, with the height less than two-thirds the length. Dorsal margin inclining slightly downward in extending backward from the beaks. The anterior margin appears to be slightly concave, for about one-third its length from the beaks, and forms an angle of nearly 120° with the dorsal margin; in its lower two-thirds it is well and regularly rounded. Ventral margin nearly straight and suddenly indented toward the posterior extremity of the shell, which is imperfect in all the specimens of this species yet obtained. Beaks situated at a distance from the front, equal to a little less than half the height of the shell, quite prominent and incurved to the hinge line. The valves are most convex just above and anterior to the middle, with the surface arching quite strongly and regularly, the curvature, however, increasing somewhat in strength, from the ventral margin to the beaks. A rather deep and well marked sinus commences in each valve on the posterior side of the beak, where it is very small, and extends obliquely across the valve to the ventral margin, near the posterior extremity of the shell, increasing gradually in size at the same time, the margin being deeply indented by it. The anterior edge of the sinus is quite abrupt and forms a slight fold on the surface of the valve; it makes an angle of about 30° with the dorsal margin of the shell; the posterior edge rounds over gradually. From the anterior margin of the valve the surface rounds up gradually for a short distance, and then extends with very little curvature to the sinus. Surface of mould smooth. Length, about 17 ^{mm}; height, 11·5 ^{mm}; depth of each valve, 3·5 ^{mm}.

This species of lamellibranch has the external characters of the genus *Palæaneilo*, but the specimens representing it are not in a condition to show the character of the hinge, which is crenulated in that genus. Only a few specimens have been obtained.

From the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Streptorhynchus Agassizii*, etc.

Palæaneilo? simplex, sp. nov.

Shell of medium size, elongate, quite regularly sub-elliptical in outline and of moderate convexity; height about two-thirds the length. Anterior margin not quite as high as the posterior; both anterior and posterior margins regularly and quite strongly rounded, and passing gradually into the ventral margin, which is regularly and moderately rounded. The dorsal margin is nearly straight and extends directly backwards from the beak; its length is less than one-half that of the shell. Beaks situated at about one-third the length of the shell from the anterior end, quite small, rather strongly incurved to the plane of the hinge, and slightly elevated above the hinge margin, with the apices acute. The point of greatest convexity of the valves is just above the middle. The curvature of the surface from the ventral margin to the beaks is moderate and nearly regular, growing gradually stronger, however, toward the beaks. The curvature along the antero-posterior diameter is quite moderate and regular, the slopes toward the anterior and posterior margins from the middle being sub-equal. Toward the dorsal margin the slope is moderate posteriorly, but grows gradually stronger as the beaks are approached, just behind which it is very abrupt. Immediately in front of the beaks the surface is slightly concave. Surface markings unknown; the surface of the internal moulds is quite smooth. Length, 16 ^{mm}; height, 12 ^{mm}; depth of single valve, 3 ^{mm}.

The above description of this form was made from a single, very perfect specimen, an internal mould of the left valve, in which, however, the characters of the hinge are not preserved. The generic relations of the species are thus rendered doubtful; but it agrees externally with Prof. Hall's genus *Palœaneilo* in which we place it provisionally. Besides the single specimen just mentioned, there are four or five other specimens of lamellibranchs from Ereré, which apparently belong to this same species. In them the beak is sometimes more acute, and the curvature of the surface varies slightly. In all the other characters they agree quite perfectly. This form of *Palœaneilo* is readily distinguished from *P. sulcata*, by the regular curvature of the surface from the anterior to the posterior end, and by the absence of a sinus.

From the Devonian sandstone of Ereré, Prov. of Pará, Brazil; associated with *Spirifera Pedroana*, etc.

Genus TENTACULITES, Schlotheim.

Tentaculites Eldredgianus, sp. nov.

Shell small, rather long, straight, circular in cross-section, at least 1^{mm} in diameter at the larger end, and tapering very gradually to an acute point. Length of the most perfect specimen, a fragment, about 16^{mm}. Annulations narrow, quite prominent, and angular or slightly rounded on the summit; the interspaces are generally about twice as wide as the annulations, though they vary somewhat in width, and are flattened or a little rounded in the bottom; they are ornamented by fine annular raised lines, of which there are about four or five in each interspace, near the larger end of the specimen. The annulations decrease in size, but become more numerous toward the apex. There are about 5 to 7 in the space of 3^{mm} near the large end.

The specimens of this species, so far obtained, are from the sandstone, in which they exist as moulds of the exterior surface, generally filled up with clay or sandy material. The moulds usually preserve the impression of the annulations very sharply; the annular raised lines, however, are seldom preserved. The casts formed by the filling up of the moulds are never exact copies, but in them the annulations are almost always low and rounded. The full length is not preserved in any of the specimens obtained, but it was probably not much greater than 16^{mm}. Although the distance between the annulations varies, the variation is never very great, and is generally regular through the same specimen, the interspaces becoming gradually narrower toward the apex.

From the sandstone of the Devonian age, Ereré, Prov. of Pará, Brazil; associated with *Spirifera Pedroana*, etc.

Dedicated to Mr. Rolfe Eldredge, one of Prof. Hartt's companions at Ereré, on his expedition of 1870.

Among the more obscure remains obtained from the Devonian sandstone beds at Ereré, and which it is impossible from their imperfect condition to properly identify, are fragments of crinoidal columns, the valves of a form which appears to be related to *Beyrichia*, M'Coy, fragments of wood, etc. They are all, however, in such a poor state of preservation, that it would be unwise to attempt anything beyond a mere notice of their appearance. The crinoidal remains occur as impressions of the detached disks of the columns, which are small and thin, and it is seldom that more than two or three of the disks are found together. The central canal is generally replaced by sandy material, but none of the surface markings are retained. Diameter of disks, about 2·5 to 3^{mm}; thickness of each, about $\cdot 5^{mm}$. The test of *Beyrichia* (?) is small, sub-ovate in outline, with a slight depression near one end. The surface, though imperfect in all the specimens obtained, seems to have been granulose. Diameter of a medium specimen, 2^{mm}. The remains that have been referred to with doubt as plants have no definite or describable shapes and are probably fucoidal. Many of the other fragments obtained will undoubtedly be explained with the aid of new collections from the same locality.

XIV.—*Note on a name in Entomology proposed by the late Coleman Townsend Robinson.*

By AUG. R. GROTE, A. M.

Read April 19, 1875.

It was my good fortune to have known somewhat intimately the late Mr. Coleman T. Robinson, latterly of New York city, who contributed to the Annals of the Lyceum of Natural History (vol. IX) two short papers on North American Moths, and previously, in conjunction with myself, a longer communication, in the Eighth Volume of the Annals, on the same subject. I was personally associated with Mr. Robinson from 1864 to 1868, and met him again for a few days in 1870. This was the last time that I had the pleasure before his premature death in 1872.*

Although Mr. Robinson had pursued his studies in Natural History somewhat fitfully, I know that he has performed some good work on the smaller moths, and especially on the *Tortricidæ.* The first part of his projected Revision of the North American species of that difficult group appeared in the Transactions of the American Entomological Society, Vol. II, 1869, and I have been anxious to discover his unfinished manuscripts for the second part, which I know were in existence. His and my own joint collections passed into the Central Park Museum after Mr. Robinson's death. At this moment I can only find a brief record of his study of the following species, belonging to the *Pyralides.*

Siparocera† **nobilis**, Robinson.

♀. The type of this new genus and species is in the Central Park Museum. It is allied in size to *Fabatana oviplagalis,* as well as in orna-

* A list of the scientific papers published by my late esteemed friend, under his sole signature, was given by me in the fourth volume of the Canadian Entomologist, pp. 109–111, June, 1872.

† This seems to have been the original writing of the generic term; in the collection at the Central Park the name is written "Callocera."

mentation. The genus is characterized by a large hollow expansion on the fore wings opening outwardly at basal third. This extraordinary feature is not shared by the Brazilian *Amblyura còrusca* Led., apparently its nearest ally. The basal and terminal fields of the primaries are rich purply brown, separated by paler median lines as in *corusca*. The median space is paler. The abdomen is tufted at the anus. The hind wings are dark, with paler indications of transverse lines on internal margin. The specimen is from New York.

I have searched the few papers left by Mr. C. T. Robinson which have come into my possession, without finding a detailed description of this species. Mr. Robinson's MSS. which I have yet seen consist almost entirely of enlarged drawings of the venation of small species of moths with brief notes. In 1870 Mr. Robinson exhibited to me prepared specimens and a drawing of the abdominal appendage of the male *Leucarctia acræa*, recently described by Mr. H. K. Morrison, in the pages of "Psyche." It had been accidentally observed by him during its voluntary extrusion. He had prepared a paper on the subject which I yet hope to discover.

XV.—*Some Observations on the Birds of Ritchie County, West Virginia.*

BY WILLIAM BREWSTER.

Read March 22, 1875.

In preparing the following paper, I have adopted the systematic arrangement of a faunal list, more for the sake of convenience than with any idea that it is deserving to take rank as such, for the time spent in the locality was by far too brief, for the acquirement of a very perfect knowledge of its avian inhabitants. However, the results, embracing as they do the joint labors of Messrs. R. Deane and Ernest Ingersoll, in addition to those of the author, between the dates of April 25th and May 9, 1874, must, I think, give a large proportion of the birds which occur at that season, and as many little known species were found in abundance and under very favorable conditions for observation, I have been induced to present a few notes on their habits, etc., trusting that they may prove acceptable contributions to science. The locality explored was the neighborhood of the little village of Petroleum, a rude hamlet of some hundred inhabitants, situated on Goose creek, a tributary of the Huse River. The characteristics of the country are essentially like those of all the region lying in that latitude, within the foot hills of the great Alleghanian range of mountains; wild rugged valleys walled in by steep ridges, of a nearly uniform elevation of perhaps 500 feet, which, in their turn, are here and there cleft by rocky ravines, the beds of the mountain torrents.

With the exception of the creek bottoms, where are a few imperfectly cultivated clearings, the whole face of the country is covered with a dense and apparently for the most part primeval forest, abounding in deer, bears and other large game. Consequent upon the small extent of open cultivated country, is the scarcity, and in some cases total absence of many species of birds, which might otherwise be confidently expected to occur here, although a careful examination at other seasons would undoubtedly increase largely the present list. In this connection, a comparison with Mr. Scott's "Partial list of the summer birds of Kanawha County" (Proc. Boston Soc. Nat. Hist., Vol. 15, p. 219) would prove interesting, for as the locality which he investigated lies but little more than fifty miles to the south, and possesses the same general features, his catalogue may be relied upon to furnish the data of several summer species not detected at the time of our visit in the region about to be considered.

Several interesting notes made by Mr. Ingersoll, during a previous visit in Sept., 1873, have been generously placed at my disposal by that gentleman, and I would also express my thanks to my friends Messrs. Ruthven Deane and H. A. Purdie, to the former of whom I am indebted for many valuable field notes, and to the latter for much kind assistance in the preparation of the present paper. It may be well for me to state that all differences in voice or habits, which I shall describe, are such as compared with the normal voice or habits of the same bird in the New England States. I shall also, for the sake of uniformity, use the terms song and note in their restricted sense, that is, song, as descriptive of the vocal performances of *the male* during the breeding season; notes, the calls of recognition, alarm, pleasure, etc., which are used indifferently by *both sexes* at all seasons. At the same time I am fully aware that some few exceptions may be found which will mar the uniformity of this system, as in the case of the cardinal grosbeak, both sexes of which *sing* equally well. In classification and nomenclature I have followed Dr. Coues' Key to North American Birds.

Family TURDIDÆ. The Thrushes.

1. *Turdus mustelinus* Gm. Excessively abundant, and one of the most characteristic birds of these woods, affecting alike the hillsides and tangled thickets of the ravines.

By May 1st all had arrived and were paired for the season. In the early morning and evening twilight, as many as six or eight males might frequently be heard singing at once. Their song, as compared with that of the Massachusetts bird, was hardly recognizable, being less loud, much abbreviated, and lacking all that variety and depth of intonation that makes our bird so preëminent among its companion songsters. They were also less shy than I have been accustomed to find them.

2. *Turdus migratorius* L. Rather common but restricted to the belt of cultivated country in the valley. On the 30th of April three nests were found, all containing eggs but slightly incubated.

3. *Turdus fuscescens* Steph. Apparently rare, a single pair noted by Mr. Deane, May 2d.

4. *Turdus Swainsonii* Cab. Arrived May 5th and for three or four

days were quite numerous. Found them in small companies in the deepest recesses of the woods, where they flitted on ahead in their characteristically silent and phantom-like way. All the specimens taken were quite typical.

5. *Turdus Pallasii* Cab. Frequent in the elevated woods during the latter part of April and first three or four days of May, when they all disappeared.

6. *Mimus Carolinensis* (L.) Gr. Very common. Found everywhere in the open country, but especially in the briery thickets along the margin of the creeks. The only peculiarity of song noticed was the occasional interpolation of notes foreign to the ear of a New England collector, but common enough here; such as the call of the tufted titmouse, the chirrup of the Carolina wren, and the sharp *tchip* of the red bird.

7. *Harporhynchus rufus* (L.) Cab. Not common. A few were seen daily up to about the 1st of May, when they all disappeared.

Family SAXICOLIDÆ. The Saxicolas.

8. *Sialia sialis* (L.) Haldeman. Not abundant, but very generally distributed, breeding in the dead stubs along the wood edges and creek bottoms.

Family SYLVIIDÆ. The Sylvias.

9. *Regulus calendula* (L.) Licht. More abundant than I have ever seen them elsewhere. Found frequently in companies of a dozen or more. Associated as they often were, with many of the rarer warblers, they proved a great nuisance, for although the characteristic and almost constant tremulous motion of the wings, together with the small size, never failed to identify the little bunch of animated feathers upon a good view, yet when dimly seen among the thick branches, they frequently fell unwished-for victims, in place of some more desirable bird that we had been pursuing. None of the males were heard to sing, and by May 9th all had disappeared.

10. *Polioptila cærulea* (L.) Scl. Common from the time of our arrival, and very generally distributed throughout the woods, although showing a rather decided preference for the heavy timber, where they kept high up in the trees. When seen one hundred feet or more above the earth they remind one more of insects than birds, so active and so very frail and slender do they seem. In motions they bear perhaps a greater resemblance to the redstart (*Setophaga ruticilla*) than to any other bird, like him launching out frequently after insects and alighting with spread tail and drooping wings, but they have withal an impertinent, quizzical air, savoring strongly of cat bird ways; the song is indeed quite that of the latter bird, but in miniature (if I may apply such an expression to sound) a quaint mocking little strain, continued half a minute or more at a time and full of mewings and harsh chatters, with an occasional full round note, but altogether so feeble as scarcely to be audible at twenty yards'

distance. The note used by both sexes is a harsh but rather faint lisp. A nest, upon which the parent birds were still at work, was discovered by Mr. Ingersoll, May 10th, on a horizontal oak branch fifty feet above the ground.

Family PARIDÆ. The Titmice.

11. *Lophophanes bicolor* (L.) Pr. A very common bird here, seeming to prefer high oak woodlands, though we also sometimes found them in the scrub or second growth. By April 25 they were commencing to lay, as we dissected several females which contained eggs nearly ready for the shell; no nests were, however, found. In habits and general appearance they strongly suggest the jays, the only Paridine attributes being some of the notes, and the flight, which is undulating, heavy and accompanied by a loud rustling sound.

They spend much of their time on the ground, hopping about slowly among the leaves until a nut or acorn is discovered, when it is taken up to some low branch and then hammered vigorously with the bill until broken open.

The crest is nearly always erect and looks much longer than it actually is. They are at all times very tame and unsuspicious.

The song of the male is sure to be one of the first sounds that one hears upon entering the woods, for it is very loud, and repeated almost incessantly. It is a rolling whistle uttered six or seven times in succession; something like *quee dle-t-or*, *quee dle-t-or*, etc. Other notes used by both sexes are a faint lisping chirp, a *chee de de* (almost undistinguishable from that of *Parus Carolinensis*) and a *tse-tsip*, which latter is, however, but seldom heard.

12. *Parus Carolinensis* Aud. Common and generally distributed. In habits and appearance it much resembles *P. atricapillus*, though its smaller size is at once noticeable. The notes are, however, all quite different. The song of the male is quite a pretty one and consists of four measures, whistled rather slowly, audible at a considerable distance; the first syllable is rather high, the second several octaves higher, the third and fourth lower than the first. Altogether, it bears quite a resemblance to the song of *Dendroica virens*, though lacking its peculiar, albeit rather pleasing, harshness. The chirp used by both sexes is very faint and partakes somewhat of a Fringilline character. They have also a scolding *chee de de* somewhat similar to that of our Northern species, but much feebler. Females of this species were dissected, which contained eggs nearly ready to be laid, as early as April 25.

Family SITTIDÆ. The Nuthatches.

13. *Sitta Carolinensis* Gm. Found sparingly in the woods. Its *hank* sounded a trifle harsher and less loud than at the north. A nest discovered May 9th, in a natural cavity near the top of a tall beech, must have

contained young, as the parent birds passed in at frequent intervals with food in their bills.

Family TROGLODYTIDÆ. The Wrens.

14. *Thryothorus Ludovicianus* (Gm.) Bp. Rather common. Most partial to the thickets along fences, brush piles on the edges of the woods, and dark rocky ravines. Found them very unsuspicious and easy of capture, even when in the most tangled thicket. If shot at and missed they seemed at once to become very angry, hopping nimbly from twig to twig with tail erect and uttering almost incessantly a shrill *chirr ree, chir r r, chir r r, chirr ree,* and occasionally a harsh chatter precisely like that of *T. ædon,* which bird, indeed, they closely resemble in every look and action. The song of the male is a beautifully clear and pure one, but it is so always and invariably the same that one soon tires of it. Heard in some deep, silent glen or ravine its loudness is positively startling, the rocks taking up and flinging back the sound till the air is fairly filled with the ringing melody. By May 1st several broods of young were seen fully fledged and on wing, and the females were laying again.

15. *Troglodytes ædon* V. Two specimens only taken: the first a male, April 30th; the second a female; both in deep woods, and silent.

Family SYLVICOLIDÆ. The American Warblers.

16. *Mniotilla varia* (L.) V. Perhaps the most abundant of the family here, being found everywhere throughout the woods.

17. *Parula Americana* (L.) Bp. Frequent from the time of our arrival, but less abundant than the preceding. As their numbers showed no sensible diminution with the advance of the season, they probably breed here.

18. *Helmitherus vermivorus* (Gm.) Bp. First specimen taken April 30th. Soon became common. Most partial to the retired thickets in the woods along water courses, and seldom or never found in the high open groves. They keep much on the ground, where they *walk* about rather slowly, searching for their food among the dried leaves. In general appearance they are quite unique, and I rarely failed to identify one with an instant's glance, so very peculiar are all their attitudes and motions. The tail is habitually carried at an elevation considerably above the line of the back, which gives them quite a smart, jaunty air, and if the dorsal aspect be exposed, in a clear light, the peculiar marking of the crown is quite conspicuous. Seen as they usually are, however, dimly flitting ahead through the gloom and shadow of the thickets, the impression received is that of a dark little bird which vanishes unaccountably before your very eyes, leaving you quite uncertain where to look for it next; indeed, I hardly know a more difficult bird to procure, for the slightest noise sends it darting off through the woods at once. Occasionally you will come upon one winding around the trunk of some small tree exactly

in the manner of *Mniotilta varia*, moving out along the branches with nimble motion, peering alternately under the bark on either side, and anon returning to the main stem, perhaps in the next instant to hop back to the ground again. On such occasions they rarely ascend to the height of more than eight or ten feet. The males are very quarrelsome, chasing one another through the woods with loud, sharp chirpings, careering with almost inconceivable velocity up among the tops of the highest oaks, or darting among the thickets with interminable doublings until the pursuer, growing tired of the chase, alights on some low twig or old mossy log, and in token of his victory, utters a warble so feeble that you must be very near to catch it at all, a sound like that produced by striking two pebbles very quickly and gently together, or the song of *Spizella socialis* heard at a distance, and altogether a very indifferent performance.

19. *Helminthophaga ruficapilla* (Wils.) Bd. One or two specimens seen every day, but by no means common. For the most part silent, though I heard the song of the male on a few occasions.

20. *Dendroica æstiva* (Gm.) Bd. Restricted entirely to the belt of willows, etc., along the margin of the creek, where it was not uncommon. First specimen noted April 29th.

21. *Dendroica virens* (Gm.) Bd. A general arrival May 2d, when the males were in full song; comparatively speaking however, they were not common. Found them mostly among the taller oak and beech growths.

22. *Dendroica cærulescens* (L.) Bd. Less common than the preceding, not more than half a dozen specimens being noted. The first (a female) was shot May 5th. Apparently most partial to the thickly wooded ravines.

23. *Dendroica cærulea* (Wils.) Bd. Decidedly the most abundant of the genus here. The first specimen taken May 5th. They inhabit exclusively the tops of the highest forest trees, in this respect showing an affinity with *D. Blackburniæ*. In actions they most resemble *D. Pensylvanica*, carrying the tail rather high and having the same "smart bantam-like appearance." Were it not for these prominent characteristics, they would be very difficult to distinguish, in the tree tops, from *Parula Americana*, the songs are so precisely alike. That of the latter bird has however at least two regular variations; in one, beginning low down, he rolls his guttural little trill quickly and evenly up the scale, ending apparently, only when he can get no higher; in the other, the commencement of this trill is broken or divided into syllables, like *zee, zee, zee, ze-ee-ee-eep*. This latter variation is the one used by *D. cærulea* and I could detect little or no difference in the songs of dozens of individuals. At best, it is a modest little strain, and far from deserving the encomium bestowed upon it by Audubon, who describes it as "extremely sweet and mellow;" decidedly it is neither of these, and he must have confounded with it some other species. In addition to the song, they utter the almost universal Dendroicine lisp, and also, the characteristic *tchep* of *D. coronata*, which I had previously supposed entirely peculiar to that bird.

24. *Dendroica coronata* (L.) Gr. Not very numerous, but saw more or less of them every day up to the date of our departure. Associated with the other warblers, in the woods.

25. *Dendroica Blackburniæ* (Gm.) Bd. First specimen May 1st, afterwards quite abundant, frequenting the tops of the highest forest trees in company with *D. cærulea* and *Parula Americana.* The males were in full song.

26. *Dendroica castanea* (Wils.) Bd. Two specimens observed and one taken, by Mr. Ingersoll, May 14th.

27. *Dendroica maculosa* (Gm.) Bd. A male was seen by Mr. Ingersoll, May 14th.

28. *Dendroica pinus* (Wils.) Bd. On the 7th of May I shot a pair in a high oak grove. They were evidently mated, the male warbling at intervals his simple strain, and the female following him closely through the branches. No other individuals were observed during our stay. The almost entire absence of coniferous trees, would perhaps explain the scarcity here of this and other pine loving species.

29. *Seiurus aurocapillus* (L.) Sw. These woods being well suited to their habits, they were abundant everywhere, and as usual a great nuisance, their songs continually repeated from all sides, frequently drowning every other sound. Arrived April 29th.

30. *Seiurus Noveboracensis* (Gm.) Nutt. Common during our stay. Found exclusively along the margin of Goose creek, where, in the early morning, I several times heard the beautiful song of the male. Three specimens taken vary quite appreciably from all of a large series collected in Massachusetts, Maine and New Hampshire. The superciliary line is, in each, dirty white, with a yellowish tinge where it intersects the eye, while in the northern specimens it is at its lightest, decidedly yellowish, intensifying at the anterior end to a brownish orange. The smallest bill among the West Virginia examples also shows an excess in length of ·03 over that of any of the northern birds, and the largest fully ·05. As Mr. Scott, in his "Partial list of Kanawha County," mentions an individual of this species taken there in August, it may very possibly breed here.

31. *Seiurus Ludovicianus* (V.) Bp. Not common, only seven specimens were secured in all.

While the Northern water thrush was confined to the muddy banks of the creek—and I will remark *en passant*, that I never saw one other than in a muddy locality—this species seemed to delight in the pebbly streams of the hills; just such streams as in the New England mountains would be called good trout brooks, overshadowed by mighty forest trees, frequently choked up by fallen logs, and abounding in beautiful cascades, still, deep pools, and wild rocky ravines.

In the deepest, darkest retreats you were most likely to find him and here on several occasions I was fortunate enough to hear his song. It is somewhat like that of *S. Noveboracensis,* being quite as loud, almost as rapid, and commencing in nearly the same way but lacking the beautiful crescendo termination, and altogether, a less fine performance.

Represented by words it would be nearly as follows: *pseur, pseur, per sée ser.*

This is usually uttered several times in succession from some shelving rock, or fallen log overhanging the stream, the bird in the intervals between each repetition tilting his body incessantly, and looking nervously about as if he didn't half like your presence and had a good mind to be off, and this expression in the majority of cases soon finds vent in action, for he is a very shy little fellow the moment he begins to suspect that he is wanted to grace your cabinet. Come upon him suddenly however, as he is running nimbly along the margin of some quiet pool or rippling eddy, and at times he will seem to pay little regard to your presence and you may have a fine chance to observe his motions and sandpiper-like ways, as he wades knee deep into the water, or splashes through it in hot pursuit of some aquatic insect.

I could distinguish not the slightest difference in general appearance and actions at such times, between him and his Northern analogue, and the sharp chirp of alarm is precisely the same. The larger size and general lighter color of the under parts will, however, usually serve to distinguish the Southern bird if you get a good view of him. The first specimen was taken April 29th.

32. *Oporonis formosus* (Wils.) Bd. First specimen May 4th. Soon became rather common frequenting nearly the same localities as *Helmitherus vermivorus.* Almost exclusively terrestrial in habits it reminded me much of *O. agilis*, though it was not so shy. You would find it most frequently in the vicinity of brush piles, fallen logs, etc., but if suddenly startled, instead of seeking refuge in them, it usually flew up to some low limb where it sat silent and thrush-like, awaiting further developments. On the ground it *walked* in somewhat the manner of *Seiurus aurocapillus,* though not quite so nimbly. The song of the male, usually delivered from some low limb or old stump, is a most beautiful one and very loud, but almost impossible of description. It most resembles that of *Geothlypis Philadelphia* with the first two notes omitted, is extremely rich and full, and altogether one of the best Sylvicolidine performances with which I am acquainted.

The only other note that I heard was a *chuck* so extremely like that of the ground squirrel (*Tamias striatus*) that I often found it very difficult to separate them.

33. *Geothlypis trichas* (L.) Cab. Rare. Only three specimens were observed.

34. *Icteria virens* (L.) Bd. Not very common and found only in certain localities, usually thickets of blackberry bushes and bull briers in retired portions of the woods. Arrived May 1st, and for a few days were silent, but soon became very noisy, especially when their retreats were invaded. Their notes are so varied as almost to defy description.

What I took to be the *song* of the male was a series of about eight very loud bell-like whistles, commencing quickly, and becoming slower and more emphatic toward the end, then after an interval of a few seconds would follow a scolding chatter, to be immediately succeeded by a single very clear note, then the series of whistles again, but all these notes were varied to an almost infinite extent. All this time the bird would be dodging through the bushes ahead, keeping always in the thickest places, and perhaps after a moment of silence would suddenly strike up directly behind you. In this way I have frequently pursued one for fifteen or twenty minutes without so much as getting a glimpse at him.

Several times when I came upon him suddenly however, he would put on a very innocent and injured air and vociferate his notes directly *at* me as if to dispel any possible suspicion on my part that he had been running, or, to speak more literally, flying away.

When alive they look much smaller than they really are, and in general markings, but especially those about the head, bear a resemblance to *Oporornis formosus;* their peculiar actions however, readily serve to distinguish them.

The tail is usually carried rather high and frequently flirted in an odd independent sort of way. I did not witness their performance so often described of singing on wing with dangling legs, etc.

35. *Myiodioctes mitratus* (Gm.) Aud. Very common. First specimen taken May 1st. Found generally throughout the woods, usually on the hillsides, where they sought their food low down among the undergrowth. As the day advanced the males would frequently ascend to the tops of the forest trees, and sing many times in succession sitting perfectly motionless in one place, then with expanded wings and tail would sail to the next tree and sing again. The chirp of alarm is a sharp chuck not unlike that of *M. Canadensis;* the song more resembles that of *Dendroica maculosa,* being short, clear and quite loud, with a decided emphasis on the last syllable! like *whee, whee, see sér.*

When among the low thickets they are restless and shy, keeping a considerable distance ahead however fast you may walk, and were it not for the loud song they would be most difficult to procure. At such times they have a habit, observable in others of the genus, of flirting up six or eight feet after an insect and dropping almost perpendicularly again with closed wings.

I rarely observed one on the ground. Although during the last week of our stay the males were abundant and numbers shot, only one female was seen.

36. *Setophaga ruticilla* (L.) In. Arrived April 29 and soon became common. Found both in the woods and along the banks of the creek.

Family TANAGRIDÆ. The Tanagers.

37. *Pyranga rubra* (L.) V. Quite common. Arrived May 1st. Found generally throughout the woods.

38. *Pyranga æstiva* (L.) V. A male in fine plumage shot May 5th,

was the only specimen noted. It closely resembled the preceding species in all its motions, occasionally launching out after an insect, and was silent and very shy. The uniformity of its coloring, together with its large size, served, however, to identify it at a glance.

Family HIRUNDINIDÆ. The Swallows.

39. *Hirundo horreorum* Barton. Abundant everywhere in the clearings.

40. *Tachycineta bicolor* (V.) Cs. Rare. A single specimen observed April 29th, by Mr. Ingersoll, in a flock of *Progne purpurea* around a martin box.

41. *Petrochelidon lunifrons* (Say.) Cab. Abundant, arriving May 3rd. Nested under the low eaves of a log hut in the village.

42. *Stelgidopteryx serripennis* (Aud.) Bd. Arrived May 1st, and several colonies of six or eight individuals each were soon established in the rocky "cuts" along the line of the railroad. Here they were evidently preparing to build, as each pair had already selected some little projection of the rocky cliff, where they would sit together for many minutes at a time. Another small company also haunted the vicinage of a bridge over the creek, and had probably selected the stone abutments for a nesting place, as they frequently passed in and out underneath.

This bird is readily distinguishable on wing from *C. riparia*, by its greater size and slower flight; indeed, in this latter attribute it much more closely resembles *T. bicolor*, like it sailing much of the time, and proceeding in a very leisurely manner; its note is, however, more nearly that of the former species, but rather louder and harsher. Like the other members of the family they were very fond of lighting along the telegraph wires to rest and plume themselves.

43. *Progne purpurea* (L.) Boie. Common, breeding in the martin boxes put up for their occupancy. No instances of the aboriginal habit of nesting in hollow trees came under our observation.

Family AMPELIDÆ.

44. *Ampelis cedrorum* (V.) Bd. Not common. A few specimens were noted by Mr. Ingersoll in September, 1873.

Family VIREONIDÆ. Vireos, or Greenlets.

45. *Vireo olivaceus* (L.) V. Rather common in the woods. Arrived May 1st.

46. *Vireo gilvus* (V.) Bp. Not very common and apparently restricted to the belt of willows, etc., along the creek. Arrived May 1st.

47. *Vireo flavifrons* V. Decidedly the most abundant of the family here, being found everywhere throughout the woods.

48. *Vireo solitarius* (Wils.) V. Rather uncommon. May possibly breed, as we saw them up to the date of our departure.

49. *Vireo Noveboracensis* (Gm.) Bp. Several individuals were procured by Mr. Ingersoll in September, 1873. Singularly enough it was not detected by any of our party, this spring.

Family FRINGILLIDÆ. Finches, etc.

50. *Carpodacus purpureus* (Gm.) Gr. Rare. A single male seen by Mr. Ingersoll, April 29.

51. *Chrysomitris tristis* (L.) Bp. Common. On the 8th of May took a male in full summer plumage, which is I think rather earlier than the change is usually perfected at the north.

52. *Melospiza palustris* (Wils.) Bd. Not common. A few individuals were observed in the thickets along the creek.

53. *Melospiza melodia* (Wils.) Bd. Common. Specimens taken average a little smaller than Massachusetts examples, and are very much darker, the entire under parts being a strong ashy color, instead of white. Although this peculiarity seemed constant in all the individuals observed, I suspect that it is due at least in part, to the stain received from the charred and blackened logs in the burnt clearings.

Several other birds, especially the woodpeckers and nuthatches were unmistakably disfigured in this way, and I took a *Thryothorus Ludovicianus* that was almost entirely black, with the markings but faintly discernible beneath.

54. *Junco hyemalis* (L.) Scl. Three or four specimens were observed during the last days of April.

55. *Spizella socialis* (Wils.) Bp. Very common. Found everywhere, penetrating even quite deep into the woods.

56. *Spizella pusilla* (Wils.) Bp. Not uncommon on the clearings on the hillsides.

57. *Zonotrichia albicollis* (Gm.) Bp. Extremely abundant during our entire stay, in flocks, and evidently migrating. The males frequently sang, but not so finely as when on their breeding grounds at the north.

58. *Zonotrichia leucophrys* (Forst.) Sw. A single specimen was observed by Mr. Ingersoll, May 10th.

59. *Goniaphea ludoviciana* (L.) Bowditch. Arrived May 1st, after which date a few individuals were observed daily. Frequented the woods.

60. *Cyanospiza cyanea* (L.) Bd. Not uncommon. Arrived May 8th.

61. *Cardinalis Virginianus* (Brisson.) Bp. Very abundant. Their most characteristic haunts seemed the thickets along fences and on the edges of the woods and the more open ravines. The males usually sang from some tree top overlooking their bushy retreat, which they were always ready to dive into upon any alarm. The ordinary position of the bird is a very erect one, with the tail lowered and the crest nearly always

raised. The flight is jerking and labored, and they rarely proceed far at a time on wing. The ordinary note of alarm and recognition, is a sharp *tchip*, kept up almost incessantly. The song, though loud, clear and full, strikes one as too bold and lacking of sentiment. The bird is nearly always in full view at the time, and seems to vaunt his powers to the utmost, and his performance, though pleasing at first, soon becomes tiresome, although varied to an almost infinite extent; it has two principal changes, of which some idea may be given by words, as follows: *quoit; queo, queo, queeo, quoit; or whittu; whittu; whittu; tu, tu, tu, tu, tu.* Occasionally he begins in a low undertone, then gradually raises his strain to its full volume, producing thereby quite a beautiful effect. The female sings nearly as much as the male and quite as well, going through all his variations. Though not so shy as I have found them in the vicinity of Washington, D. C., they were not at all easy to procure here. A whistled imitation of the song, would, however, usually bring up the male in full response, and I procured many in that way. Although we saw the females building as early as the 1st of May, no nests were discovered.

62. *Pipilo erythropthalmus* (L.) V. Very abundant everywhere but especially so in the scrub on the hillsides. The song of the male was not unlike that of the Massachusetts bird, but the ordinary note, a harsh guttural *tou geesh*, was very different. A comparison with Northern examples reveals a slightly darker shade in the brown of the throat of the Virginia female.

Family ICTERIDÆ. American Starlings.

63. *Dolichonyx oryzivorus* (L.) Sw. A few individuals of this species were seen May 14th, by Mr. Ingersoll, in the grassy meadows along the creek.

64. *Molothrus pecoris* (Gm.) Sw. Abundant from the time of our arrival and generally distributed. Although all its habits were quite familiar, some of its notes differed very much from any that I have heard at the north. One in particular a hissing *z-z-zeep* was quite unique, though apparently universal here.

65. *Agelæus phœniceus* (L.) V. Common but restricted to the belt of swampy land along the creek. Notes very different from those of our Massachusetts bird and as a rule decidedly harsher.

66. *Sturnella magna* (L.) Sw. Apparently not common, owing probably to the almost total absence of its favorite meadow land in this section.

67. *Icterus spurius* (L.) Bp. Arrived May 8th and on the succeeding day several individuals were observed in the trees along the banks of the creek. On the evening of our departure I heard a male in full song at Laurel Junction, a station some two miles from Petroleum, where we were awaiting the arrival of the eastward bound express train. The slanting rays of the setting sun streaming through the gaps in the Western divide, in places tinged the floating mists with a beautiful rosy hue, in others

where the beams fell more directly, threw so strong a light that the smallest insect floating in the still clear air was discernible at hundreds of paces, and as the chorus of bird voices swelled to the utmost, we heard many of our newly acquired feathered friends to the best possible advantage. The cardinals as usual were most prominent and their bold ringing notes quite drowned the efforts of some of the more modest performers though the lofty reverie of the wood thrush stole up occasionally from the valley below, and the bell like calls of the chat came almost incessantly from the thickets on the opposite mountain side. Above all, however, rose at intervals a clear loud warble resembling the spring song of *Passerella iliaca*, but possessing withal a wild abandon, that to my ear rendered it even more beautiful. Suspecting the author we approached the spot and soon caught a glimpse of his fine chestnut and black plumage among the branches of a tall sycamore. After singing for some time longer he dove down into a low thicket where we had a good chance to observe his motions. His relatively longer tail and more slender shape gave him quite a different aspect from his cousin the Baltimore, though his ways were very similar.

When closely approached he glanced at us suspiciously, jerking his tail and uttering a note closely resembling that usually given by *Agelœus phœniceus* when on wing. Mr. Ingersoll informs me that their numbers did not materially increase after our departure, and the species must be considered rather a rare one in this section.

68. *Icterus Baltimore* (L.) Daudin. Arrived April 29th and soon became common. Noticed many old nests in the cottonwoods along the creek. The song differed slightly from that of Northern individuals.

69. *Quiscalus purpureus* (Bartr.) Licht., var. æneus Ridg. Common, nesting in small colonies in the holes of the decayed cottonwood trees. All the specimens taken were quite typical of this variety.

Family CORVIDÆ. Crows, Jays, etc.

70. *Corvus Americanus* Aud. Quite common everywhere.

71. *Cyanurus cristatus* (L.) Sw. Common everywhere in the woods. A nest found by Mr. Deane contained four fresh eggs.

Family TYRANNIDÆ. Flycatchers.

72. *Tyrannus Carolinensis* (L.) Bd. Arrived April 28th and soon became rather common. Frequented for the most part, the belt of timber along the creek.

73. *Myiarchus crinitus* (L.) Cab. Abundant, affecting alike the open oak woods and the heavy undergrowth of the ravines. Their ordinary note is a single whistle, extremely loud, and possessed of something of a weird character, making it peculiarly noticeable in the gloomy depths of the forest where it is usually heard. In addition to this they utter a loud

and rather harsh rattle. Their habitual attitude is an erect one, and they have a peculiar habit of sailing from tree to tree with spread wings and tail, somewhat in the manner of *Perisoreus Canadensis.*

74. *Sayornis fuscus* (Gm.) Bd. Extremely common. A few were breeding under the railroad bridges along the creek, but by far the greater number clung to their aboriginal proclivities, and nested in the rocky ravines of the mountain brooks.

A nest found by Mr. Ingersoll, April 26th, contained six eggs, *every one* of which was spotted, and some of them as much so as average specimens of *Contopus virens.* This nest was attached to the stone abutments of a bridge and differed not appreciably from northern examples in either material or architecture.

75. *Contopus virens* (L.) Cab. The first specimen, taken May 9th, afterwards became rather numerous. Found exclusively in the woods.

76. *Empidonax minimus* Bd. A single individual taken May 7th was the only specimen noted. (*E. Acadicus* undoubtedly occurs as Mr. Ingersoll who is well acquainted with the species observed several old nests in the woods).

Family CAPRIMULGIDÆ. Goatsuckers.

77. *Antrostomus vociferus* (Wils.) Bp. Very common, as many as five or six individuals being frequently within hearing at one time. A male, which I heard on the evening of May 9th, after commencing in the usual way, regularly finished his song by omitting the first syllable on the last eight or ten repetitions thus: *poor-will, poor-will, poor-will,* etc.

78. *Chordeiles Virginianus* (Briss.) Bp. Rare. A single specimen noted at Laurel Junction, May 9th.

Family CYPSELIDÆ. Swifts.

79. *Chætura pelasgia* (L.) Steph. Arrived April 29th and soon became abundant. Whether or not they resorted to hollow trees in this section, for breeding, I was unable to ascertain, but if they breed here at all, I think such must be the case, as the small, narrow chimneys of the log houses in the village, are but ill adapted to their wants.

Family TROCHILIDÆ. Humming birds.

80. *Trochilus colubris* L. Rather numerous in the woods. Arrived May 2d.

Family ALCEDINIDÆ. Kingfishers.

81. *Ceryle alcyon* (L.) Boie. Very common. Several nests were discovered in the banks along the creek, but none of them explored.

Family CUCULIDÆ. Cuckoos.

82. *Coccyzus erythrophthalmus* (Wils.) Bd. Rare. One specimen seen by Mr. Deane, May 5th.

Family PICIDÆ. Woodpeckers.

83. *Hylotomus pileatus* (L.) Bd. Only a few individuals noted, most of which were observed well up on the mountain sides, though I shot a fine male on one occasion, in the very outskirts of the village, coming upon him suddenly as he was hammering away at an old prostrate log.

84. *Picus villosus* L. Not rare. Found usually in the woods. Specimens average considerably smaller than those taken in New England but differ not appreciably in other respects.

85. *Picus pubescens* L. Rather more common than the preceding but still hardly abundant. Confined principally to the woods.

86. *Centurus Carolinus* (L.) Bp. Not common, about half a dozen individuals noted in all. In habits, it seemed to me to resemble most closely *Melanerpus erythrocephalus*, like that bird showing great skill in winding about the tree trunks and keeping always on the side farthest from the observer.

The only note heard was a raucous *cr-ruk* very like the croak of a frog. Its tapping roll was also peculiar and rather more feeble than in most of the family. This tapping is so far as I have observed, a regular spring note or call and never (in its restricted sense) heard at any other season. It is likewise specifically characteristic, and in Maine where the Picidæ are very largely represented, I have always been accustomed to rely quite as much upon the tapping as a means of identification as upon any of the vocal notes. Thus, *P. pubescens* has a long unbroken roll, *P. villosus* a shorter and louder one with a greater interval between each stroke: while *S. varius* commencing with a short roll ends very emphatically with five or six distinct disconnected taps. In this latter species I am convinced it is literally a call of recognition, as I have repeatedly seen the bird after producing it, listen a moment when it would be answered from a distance and its mate would shortly appear and join it.

87. *Melanerpes erythrocephalus* (L.) Sw. Rather common, but apparently restricted almost altogether to the forest.

88. *Colaptus auratus* (L.) Sw. Very common. Found everywhere.

Family STRIGIDÆ. Owls.

89. *Scops asio* (L.) Bp. A single specimen in the red plumage was noted by Mr. Deane, April 27th. It was surrounded by a mob of small birds and was too shy to admit of its capture.

Family FALCONIDÆ. Diurnal Birds of Prey.

90. *Accipiter Cooperi* Bp. Saw a female of this species May 2d. This (with one of the larger Buteos which could not be satisfactorily identified) was the only member of the family observed here.

Family CATHARTIDÆ. American Vultures.

91. *Cathartes aura* (L.) Illiger. Was informed by the inhabitants that in former years it was very abundant, but for some unknown reason had almost totally disappeared. A single specimen which I saw sailing high over the valley was the only one noted during our stay.

Family COLUMBIDÆ. Pigeons.

92. *Zenaidura Carolinensis* (L.) Bp. Very abundant and one of the characteristic birds of this region. Though never molested by the inhabitants who regard them very much as the English do the robin redbreast, they were very shy and difficult to obtain. Although females containing eggs ready to be laid were dissected as early as May 1st, they almost invariably flew and fed in flocks, but on the latter occasion I noticed that the paired birds usually kept together. Early in the morning and again at sunset the deep resonant cooing of the males might be heard from all sides. At a distance this sound resembles the syllables *whoo, whoo, whoo;* or sometimes with only two repetitions *whoo, whoo*, but a short preliminary note with a rising inflection which always precedes this cooing is lost, unless the listener is very near. The bird when thus employed usually sits on the top of some lofty tree in the forest and, with his superlatively graceful attitudes and fine plumage glistening in the sunlight, presents a very beautiful appearance. In common with other members of the family they have the peculiar habit of oscillating the head and neck when approached and upon the slightest, suspicious movement on your part they are off giving three or four powerful raps of the tips of the wings under the body, as they start, which warning is usually acted upon immediately by all the others within hearing.

Family TETRAONIDÆ. Grouse, etc.

93. *Bonasa umbellus* (L.) Steph. Abundant everywhere in the woods where we started more or less of them every day and frequently heard the drumming of the males.

94. *Ortyx Virginianus* (L.) Bp. Apparently not very numerous. The males were first heard whistling *bob-white* on the 8th of May.

Family SCOLOPACIDÆ. Snipe, etc.

95. *Philohela minor* (Gm.) Gr. Probably not very common, an individual flushed by Mr. Deane, being the only specimen noted.

96. *Totanus flavipes* Gm. Noted a single bird of this species April 29th, in a wet meadow near the creek.

97. *Totanus solitarius* Wils. Quite numerous along the creek during our stay, but undoubtedly was on its way north.

98. *Tringoides macularius* (L.) Gr. Common along the creek.

Family ARDEIDÆ. Herons.

99. *Ardea cœrulea* L. On the 30th of April I saw a fine adult bird of this species on the banks of the creek and identified it to my complete satisfaction, but owing to an unfortunate accident failed to obtain it.

100. *Ardea virescens* L. Not common; a few specimens only, observed.

XVI.—*Notes on the Sub-generic Character of Helix Jamaicensis, Chemn., and on certain Terrestrial Mollusks from Haiti; with Description of a New Species of Helix from Colorado.*

BY THOMAS BLAND.

Read March 8, 1875.

Helix Jamaicensis, Chemn. (*Thelidomus*).

THIS well known Jamaica species is given by v. Martens (Albers, 2nd. ed., 147) as the type of the subgenus *Liochila*, in which he also places *H. picta*, Born. and *H. sulphurosa*, Morelet, of Cuba.

W. G. Binney and myself have shown (Annals, X, 341, pl. xvi, figs. 1, 2, 1873) that *H. picta* has the same form of jaw and dentition as the Cuban *H. muscarum*, Lea (Amer. Jour. of Conch., VI, 204, pl. 9, figs. 4 and 16), which v.

Martens (l. c., 146) has as the type of *Polymita*. We assigned both *muscarum* and *picta* to *Polymita*, proposing that other species, the dentition of which we had examined, embraced in that subgenus by v. Martens, should form a distinct group under the name of *Hemitrochus*, Swainson.

We expressed the opinion that the curious lingual dentition of *H. picta* might be found in *H. sulphurosa*, but not in *H. Jamaicensis*, adding "the latter, which is the type of *Liochila*, will therefore remain undisturbed in its systematic position, unless indeed, it belongs to *Thelidomus*, in which case the name *Liochila* will be placed in the synonymy of the last named subgenus."

Through the kindness of Mr. V. P. Parkhurst, who lately visited Jamaica, I am enabled to solve the doubt as to the subgeneric position of *H. Jamaicensis*. He brought from that Island, and placed at my disposal, one living and two dead specimens (in alcohol) of the species in question. I am indebted to W. G. Binney for the following description of the jaw and dentition:—

H. Jamaicensis has a jaw high, slightly arcuate, ends attenuated; no median projection to cutting edge; anterior surface with 13 decided ribs, varying in size and irregularly disposed, but denticulating either margin.

Lingual membrane long and narrow; teeth about 41–1–41, of the usual *Helicinæ* type. Centrals with the base of attachment longer than wide, and lower lateral angles greatly developed; side cusps subobsolete, side cutting points absent, median cusp stout, reaching only half way to the lower edge of the base of attachment, beyond which projects slightly the cutting point, whose outer lower sides are somewhat bulging. Laterals same as centrals, but unsymmetrical as usual, and very gradually changing into the marginals. The latter are a simple modification of the laterals, with a very short, blunt, broad, bluntly bifid cutting point.

Comparing the forms of jaw and lingual teeth with those, especially of *H. aspera* (Amer. Jour. of Conch., VI, 204, 1870) and *H. discolor* (Proc. Phila. Acad. Nat. Sci., 51, pl. x, fig. 1, 1874), belonging to *Thelidomus*, there can be no doubt as to the correctness of placing *H. Jamaicensis* in that subgenus.

There is a variety of *H. Jamaicensis*, notice of which I have not seen mentioned. The aperture is remarkably produced laterally, the columellar margin is oblique, having a very broad callus, with denticles across its edge; in one of my specimens there are two, and in another three, denticles. In this respect the species shows an alliance with *H. aspera*.

This variety has moreover, usually, a small tooth on the parietal wall. Férussac's figure (Hist., t. 9 B, fig. 10) shows the form of aperture above mentioned.

The other form of the species, which is generally smaller, has a much less oblique columella, without the broad callus, and the aperture is more oval than lunate.

Helix obliterata, Fér. (*Eurycratera*).

In the description of this species (Fér. Hist., 342, N. 406, pl. 61, figs. 3–4) the habitat quoted is Porto Rico, on the authority of Maugé. In Chemn., ed. 2, and by Pfeiffer (Mon. Hel.), the same habitat is given.

The late Mr. R. J. Shuttleworth (Diag. n. Moll., 45), referring to the species, says, "ex affinitate maxima cum *H. angulata*, Fér. verisimiliter Portoricensis, sed nuperrime non inventa."

Shuttleworth, in his correspondence with me in 1854–5, expressed surprise that Blauner had not found *H. obliterata*, and some doubt as to its specific distinctness from *H. angulata*.

v. Martens (Die Heliceen, ed. 2d, 147) assigns, but I do not know on what authority, *H. angustata* to Haiti and Jamaica, *H. obliterata* to Haiti, and *H. angulata* to Porto Rico and Jamaica, but most certainly neither the first nor the last occurs in Jamaica.

Mr. V. P. Parkhurst lately spent a few days in Haiti, at Port au Prince and its immediate northern vicinity, where he found not only specimens (dead) of *H. bizonalis* (see *ante* p. 81), but one dead specimen of *H. obliterata*, which he has kindly presented to me. The shell is destitute of epidermis, and white, without any trace of brown bands. Deshayes (in Fér. Hist., l. c.) mentions that the bands are on the epidermis only, on removal of which the shell is white.

The dimensions of my specimen are as follows: Diam. maj., 49; min. 35 mill.; Alt. 20 mill.

The surface of *H. obliterata* is described as covered with coarse granulations, of *H. angulata*, with numerous striæ, but the nuclear whorls of the latter and the striæ are finely granulated; this character, at least of the three upper whorls, is distinctly seen in young specimens.

I am disposed, from Mr. Parkhurst's discovery, to consider that Haiti may be the true habitat of *H. obliterata*, presenting another illustration of the remarkable connection of the land shell fauna of Haiti with that of Porto Rico (see ante p. 81–2). With respect to the doubt of Shuttleworth as to the specific difference of *obliterata* and *angulata*, I would remark that the latter may be fairly treated as a geographical variety of the former, as may *H. Luquillensis* of *H. Audebardi*.

Helicina intusplicata, Pfr.

SYNONYMY.

Helicina intusplicata, Pfr., Zool. Proc., p. 98, 1850.

Helicina intusplicata, Sow., Thes., III, N. 37, figs. 60–61, 1866.

Helicina intusplicata, Reeve, Conch. Icon. N. 25, pl. iv, fig. 25, 1873.

Helicina Smithiana, Pfr., Malak. Blat., p. 90, 1866.

I have no doubt of the identity of *H. Smithiana* and *intusplicata;* of the latter the habitat is not given by the authors who refer to it.

H. Smithiana was discovered by Mr. Smith (brother of my friend Mr. Sanderson Smith) on Mount Platon, about thirty miles northeast from Aux Cayes, and I sent specimens to Dr. Pfeiffer, who described it in 1866.

Mr. V. P. Parkhurst, during his late visit to Haiti, collected a considerable number of specimens near Port au Prince.

The aperture of *H. intusplicata* is described as "parum obliqua, semiovali-subtriangularis, altior quam lata, ad columellam angulata et plica intus fere ad marginem decurrente munita," of *H. Smithiana* as "obliqua, late semiovalis, juxta columellam plica approximata, parallela canaliculata."

Specimens received from Messrs. Smith and Parkhurst agree with each other, slightly varying in size only, and with the figures of Sowerby and Reeve.

Helicina Cumingiana, Pfr.

SYNONYMY.

Helicina Cumingiana, Pfr., Proc. Zool. Soc., p. 121, 1848.

Helicina Cumingiana, Chemn., ed. II, No. 35, taf. 6, figs. 13–14.

Helicina Cumingiana, Pfr., Mon. Pneu., I, 359, 1852.

Helicina Cumingii, Sow., Thes., III, N. 165, figs. 282–3, 1866.

Helicina Cumingii, Reeve, Conch. Icon., N. 62, pl. viii, 1873.

I am indebted to Mr. Parkhurst for one dead specimen, found near Port au Prince, Haiti.

Pfeiffer was ignorant of the habitat, but by Sowerby and Reeve this species is assigned to St. Domingo under the name of *Cumingii*, the latter erroneously referring to the Zool. Proc. of 1845.

The species is readily identified by its well developed striæ, subangular periphery, etc.

Among other species, also collected by Mr. Parkhurst near Port au Prince and in its vicinity, were *Cyclotus flocco-*

sus, Shuttl., *Cyclostomus Aminensis*, Pfr., *Chondropoma serraticosta*, Wein., *Helicina rugosa*, Pfr., and *Paivana*, Pfr., *Helix pubescens?* Pfr., *crispata* and *indistincta*, Fér., *cepa*, Mull., *Cylindrella gracilicollis*, Fér., and *Macroceramus Klatteanus*, Bland.

Species not yet determined, among them an *Oleacina*, believed to be new, will be described on another occasion.

Helix Ingersollii, nov. sp. (*Microphysa*).

T. umbilicata, discoidea, tenuis, translucida, sublevis, alba; spira plana, vertice, subimmersa; sutura impressa; anfr. 5½ convexiusculi, lente acrescentes, ultimus non descendens, infra peripheriam convexior; umbilicus fere 1 mill. latus; apertura subverticalis, altior quam lata, lunaris; perist. simplex, acutum, marginibus remotis, columellari brevissime patente, basali subsinuato.

Shell umbilicated, discoidal, thin, translucid, nearly smooth, white; spire flat, summit subimmersed; suture impressed; whorls 5½ rather convex, slowly increasing, the last not descending, more convex below the periphery; breadth of umbilicus nearly 1 mill.; aperture subvertical, higher than broad, lunate; perist. simple, acute, margins remote, columellar margin slightly reflexed, basal margin subsinuate.

Diam. maj. 4; min. 3⅝; alt. 2½ mill.

Station and Habitat. Howardsville, Baker's Park, 9300 ft. above the sea, abundant in wet places on the mountains; not uncommon at Cunningham Gulch, near the former locality, clinging to the almost vertical face of a trachyte cliff, at an elevation of about 11,000 feet; the finest specimens came from this spot; found also on the southern slope of the Saguache Mountains, in the Las Animas and La Plata valleys, in the same stations as affected by *Succinea*.

All the localities mentioned are in the southwestern corner of Colorado (Ingersoll!).

Remarks. This species was discovered by Mr. Ernest Ingersoll, Naturalist of the United States Geological Survey of the Territories, under Professor Hayden. It can scarcely be compared with any known North American species.

The magnified figures herewith given, from drawings made by my friend Mr. A. Ten Eyck Lansing, faithfully represent the shell.

At first sight I was disposed to consider the species a *Zonites*, but examination of the animal by Mr. W. G. Binney proved it to belong to the *Helicinæ;* I am indebted to him for the following particulars :—

Jaw low, wide, slightly arcuate, ends slightly attenuated; whole anterior surface with about 22, broad, flat, slightly separated ribs, whose ends denticulate either margin. This form of jaw is unusual among the *Helicinæ.* It is of same type as in *H. Lansingi* (Ann. Lyc. N. H. of N. Y. XI, 74, fig. 2.)

Lingual membrane long and narrow. Teeth about 16–1–16. Centrals as usual in the *Helicinæ:* the side cusps and cutting points are well developed, the base of attachment longer than wide. Laterals of same type, but unsymmetrical and consequently only bicuspid. The change from laterals to marginals is very gradual, there being no splitting of the inner cutting point. Marginals low, wide, with one inner, long, blunt cutting point, and one outer small blunt cutting point.

Geostilbia Gundlachi, Pfeiffer.

Through the kindness of Dr. H. E. van Rygersma, I have lately received specimens of this species, with the animal (in alcohol), collected by him in the Island of St. Martin. The species was described as *Achatina Gundlachi* by Pfeiffer in 1850.

In 1867, M. Crosse established the genus *Geostilbia* (Jour. de Conch., p. 184), for a species from New Caledonia, and referred *Achatina Gundlachi* to the same genus in 1874 (l. c. p. 88).

Dr. van Rygersma informs me that he had an opportunity of examining the animal and could discover no eyes. He says it has "four tentacles, of which the lower ones are very small, scarcely perceptible, the upper thick, cone elongated, without any black spot, indicating eyes. The animal citron yellow in color; the foot long and narrow."

v. Martens (Die Heliceen, ed. 2) has *A. Gundlachi*, Pfr. in *Acicula*, subgenus of *Cionella;* he mentions that *Acicula* is without eyes, but gives no other particulars of the animal.

Arango (Repertorio, I, 128) assigns the species under consideration to the genus *Coecilianella*, Bourguignat. While for the purposes of the present note, I have adopted *Geostilbia*, I have much doubt as the necessity for its establishment.

Mr. W. G. Binney, to whom I sent the specimens received from St. Martins, has obliged me with the following particulars:

Jaw low, wide, slightly arcuate, ends attenuated; whole surface covered with about 22 crowded, broad, flat ribs, denticulating either margin.

Lingual membrane long and narrow. Teeth 18–1–18, with 4 perfect laterals. Centrals with their base of attachment long, narrow, their reflected portion about one-half the length of the base of attachment, tricuspid; the middle cusp stout, with a short blunt cutting point, side cusps subobsolete, but with small, distinct cutting points. Lateral teeth with their base of attachment subquadrate, much longer, and very much broader than that of the centrals, the reflected portion short, stout, tricuspid, the middle cusp very stout and long, reaching the lower edge of the base of attachment, beyond which projects the short, stout cutting point; side cusps subobsolete, but bearing distinct, though small cutting points. There are four perfect laterals, the fifth tooth being a transition to the marginals, by the base of attachment being lower, wider, not exceeding the reflected portion, with one inner large cusp bearing one outer large cutting point representing the outer cutting point of the first four lateral teeth and one inner, still larger, cutting point, representing the middle cutting point of the first four laterals, and one smaller, outer cusp bearing one small, sharp, bifid, cutting point, representing the outer side cutting point of the first four laterals. The sixth tooth has the largest cutting point bifid. The balance of the teeth are true marginals. They are very low, wide, with two low, wide cusps, bearing each several irregular, blunt cutting points.

The dentition of this species is, as would be anticipated, of the same type as the allied *Cæcilianella acicula* as figured by Lehmann (Lebenden Schnecken Stettins, p. 128, pl. xiii, fig. 43, and Sordelli, l. c., fig. 26). The jaw, however, has no appearance of the "brace" like ribs described in that species by Sordelli (Atti Soc. Ital. Sc. Nat., xiii, 1870, 49, pl. i, fig. 25). The ribs are quite like those figured of *Helix Lansingi* (Ann. Lyc. Nat. Hist. N. Y., XI, p. 75, fig. 2 A) although they are narrower.

For a figure of a similar type of dentition, see that of *Stenogyra hasta*, Pfr., in Proc. Ac. Nat. Sc. Phila., 1875, pl. xx, fig. 3.

G. Gundlachi is widely distributed; it occurs in Cuba, Jamaica, Haiti, St. Thomas, St. Martin and Barbados. A closely allied, if not identical, species, has recently been collected by M. Marie in Guadeloupe.

XVII.—*Notes on Ceraurus pleurexanthemus*, Green.*

BY C. D. WALCOTT.

Read June 7th, 1875.

THE writer has had the opportunity, by his residence at the type-locality of the Trenton Limestone, to make some investigations upon the structure and habits of the trilobites of that interesting horizon. The results of these observations and studies, he hopes to present from time to time, as they shall become sufficiently definite to call for permanent record.

In the present article, it is proposed to consider certain facts of occurrence, which seem to bear upon the habits and mode of life of one of the principal species of the Trenton rocks, *Ceraurus pleurexanthemus*. *Asaphus* and other genera are referred to here, only as giving additional evidence on the points involved.

Ceraurus pleurexanthemus is one of the most characteristic trilobites of the Trenton Limestone, in numbers and distribution exceeded only by *Asaphus gigas*, *A. megistos*, and *Calymene senaria*. It has a wide geographical, as well as vertical, range. Entire specimens, however, are rare in most localities, the head and the hypostoma being the parts usually found. At Trenton Falls, N. Y., in the upper third of the limestone, the separated heads are found in immense numbers; in many places, the surface of the rock is nearly covered with them, while only an occasional pygidium or portion of the thorax is seen.

About twenty-seven feet below the coarse crystalline lime-

* The genus *Ceraurus* (Green, 1832, Monograph, p. 84) was founded upon specimens not clearly showing all the characteristics of the genus, as subsequently known. The description, however, was sufficiently accurate for the ready identification of the genus, and of the species, *C. pleurexanthemus*. The name should therefore stand; and *Cheirurus* of Beyrich (1845), must be regarded as a synonym; since the objection raised to Green's figure, on the ground of its indistinctness, is not tenable. The use of *Cheirurus* by authors is not allowable, under the rule as to priority of date adopted by the British Association for the Advancement of Science, twelfth meeting, 1842.

stone that caps the upper portion of the ravine at Trenton Falls, there is a thick layer of uneven gray limestone; upon this rests a thin layer of shale and clay, varying from a quarter of an inch to an inch in thickness. This was the sea-bed where the remains of trilobites, crinoids, and other forms of animal life lay when buried by the overlying deposit, which now is a thin layer of bluish-gray limestone, one to two inches thick. Attached to the under surface of this layer, the following species of fossils have been found:

Stenopora fibrosa, *S. lycoperdon*, *Ptilodictya acuta*, *P. recta*, *Aulopora arachnoidea*, *Stellipora antheloidea*, *Stictopora elegantula*, *Alecto inflata*, *Intricaria reticulata*, three species of *Heterocrinus*, two of *Glyptocrinus*, one each of *Anomalocystites* and *Glyptocystites*, one of *Stenaster*, *Lingula quadrata*, *Trematis filosa*, *Trematis* n. s., *Leptæna sericea*, *Strophomena alternata*, *Orthis testudinaria*, *O. lynx*, *Rhynchonella recurvirostra*, *Crania Trentonensis*, *Conularia Trentonensis*, *Asaphus gigas*, *Calymene senaria*, *Ceraurus pleurexanthemus*, *Acidaspis Trentonensis*, *Acidaspis* n. s., *Proetus parviusculus*, *Phacops callicephalus*, *Dalmanites*.

These fossils are generally found in groups of associated species, but often commingled, so that trilobites, crinoids, cystids, brachiopods, and bryozoans occur on the same slab of stone. The prevailing and characteristic fossil is *Ceraurus pleurexanthemus*. Individuals from three-sixteenths of an inch to two inches in length, are scattered over the surface, often to the exclusion of all other fossils. In a space thirty by forty feet, 326 entire specimens were seen. Of this number, and of many seen before, a record was kept; eight lay with the dorsal surface up; the remainder were on their backs, attached by the ventral surface of the dorsal shell to the under side of the layer. The view that this was the natural position of the trilobite is sustained by the following considerations: —

1. Individuals of all stages of growth are preserved entire; which would not have been the case, had they been

subjected to the action of the water in drifting them into the position found. The thorax is easily dismembered and broken, and could not have withstood such transportation.

2. Very few fragments are found, and when consisting of the head or pygidium, they have the dorsal surface down.

3. Upon all uneven layers, and those showing the action of strong currents, and holding coarser fossils, the trilobites are distorted and broken up.

4. When found upon smooth layers above the Ceraurus layer, they are invariably back-down. Fine specimens showing the interior of the shell, are obtained from the upper surface of several layers.

5. The drifting of the shell into the position found, would not probably have taken place, as the shell is nearly flat. Asaphus might, from its boat-like shape, assume such a position; but a force sufficient to place a trilobite like Ceraurus upon its back, if the natural position when living was the reverse, would not have left the bryozoans and crinoids as they grew, without breaking the more delicate portions, which are often like fine hairs of stone, lying loosely in the imbedding clay, and breaking at the slightest touch.

6. The trilobites never have shells or corals drifted into them, or lying on them, when upon the upper surface of the layers. Occasionally a coral encrusts the upper surface, and frequently a coral (*Stenopora lycoperdon*) has taken the interior or ventral surface as a base for its growth, showing clearly that the shell had assumed the inverted position prior to the growth of the coral.

Forty specimens of *Acidaspis Trentonensis* were associated with the Ceraurus,—every individual upon its back. *Calymene senaria*, when not coiled (numerous), *Proetus parviusculus*, *Asaphus gigas* (one only), and *Dalmanites*, were uniformly back down.

Upon the upper surface of the Ceraurus layer, a layer of clayey shale was deposited, giving the same conditions as below the Ceraurus layer. Attached to the under surface of the succeeding layer, or imbedded in the clayey shale, were bryozoans, cystids, crinoids, brachiopods, and trilobites of the following genera:—*Ceraurus*, *Acidaspis*, *Calymene*, *Phacops*, and *Spherocoryphe*. The trilobites, without exception, were back-down. In the succeeding layer, which is six inches thick, many of *Asaphus gigas* and *A. megistos* have been found, scattered through the lower three inches of its thickness. Of seventy-five noted, thirty were back-down, twenty-nine presented the dorsal surface up, sixteen were in various positions, coiled, perpendicular to the layer, and edgeways. The succeeding five feet of the stratum is of the same nature as that below. Fossils are rare, especially trilobites. Above this, the coarse earthy limestone extends to the thick crystalline strata.

Prof. Burmeister, in his "Organization of Trilobites,"* gives the following among other conclusions, as the result of comparison of the trilobites with the recent crustacea.

1. That these animals moved only by swimming; that they remained close beneath the surface of the water; and that they certainly did not creep about at the bottom.

2. That they swam in an inverted position, the belly upwards, the back downwards, and that they made use of their power of rolling themselves into a ball, as a defence against attacks from above.

4. That they most probably did not inhabit the open seas, but the vicinities of coasts, in shallow water; and that they here lived gregariously in vast numbers, chiefly of one species.

If the first and second conclusions are correct, we should look in a quiet, undisturbed deposit for evidence as to the position of the trilobites while living, by their position when buried in the sediment after death. As before stated, the conditions are such in the species mentioned, as to preclude the idea of their arrangement by other causes than the nat-

---

* Page 52, conclusions 1, 2, 4.

ural position of the living animal, which must, therefore, have been with the back downward.

The *Asaphus* is more frequently broken; but the finest and most perfectly preserved specimens, with but few exceptions, are found on their backs.

That portion of the fourth conclusion in reference to trilobites living gregariously in vast numbers, is true of *Ceraurus pleurexanthemus*, *Asaphus gigas*, and *A. megistos*, as found in the stratum mentioned.

Note. To October 16th, 1875, 1160 specimens of *Ceraurus pleurexanthemus* have been noted on the under surface of the thin layer ("Ceraurus layer"). Of these 1110 lay on their backs; while but fifty presented the dorsal surface up. Forty-five of these fifty were very small, the remaining five of medium size.

XVIII.—*Description of the Interior Surface of the Dorsal Shell of Ceraurus pleurexanthemus*, Green.

By C. D. WALCOTT.

Read June 7, 1875.

This interesting species, which has been referred to in the preceding pages, has already been described by earlier writers,* as regards the general features of its structure and the outer surface of its shell. In this article, therefore, I shall omit all detailed reference to any of these points, and confine the description, as closely as may be, to the inner, or ventral, surface of the dorsal shell. This description is de-

---

* Green, Monograph of Trilobites, 1832, page 84, fig. X. Hall, Palæontology N. Y., vol. I, page 242.

signed to be compared with the several figures in Plate XI, which have been drawn from the combined evidence obtained by the examination of numerous specimens.

It should be borne in mind, that as the shell, in the following description, is supposed to be placed back-downward, as shown in figure B, Plate XI, the words *upper* and *under*, etc., when used in this article, are to be taken in their strict sense, as compared with figure B, and not in the sense that they usually have, when a trilobite is placed with its back uppermost.

HEAD. Anterior, lateral, and free posterior margins bordered by a "doublure." Glabellar depression, concave, longer than broad, narrowed posteriorly; anterior margin a semi-lunate curve, to which the hypostoma is attached by a suture (hypostomatic suture); from the extremities of this suture, lateral ridges extend to the posterior lateral margins of the central neck depression. Four short processes project obliquely backward from each ridge into the glabellar depression. The four anterior processes are rudimentary and concealed by the hypostoma. The four posterior processes have rounded knob-like tubercles upon their upper extremities; the posterior pair attached opposite the inner posterior angles of the occipital depressions. A low arching ridge separates the glabellar and neck depressions.

The occipital depressions include the spaces within the "doublure," glabellar ridges, and neck depression. Occipital cavity in the anterior lateral third. Glabellar and occipital depressions finely punctate.

The neck depression extends laterally as shallow grooves under the "doublure," deepest towards the central depression. Central depression a concave groove, the posterior margin reflected upward and forward, terminating in a thin edge, which articulates with the articular fold of the first thoracic segment.

The facial sutures arise a little on each side of the centre of the posterior margin of the frontal "doublure, pass forward crossing the "doublure," and curve under its anterior margin, thence obliquely backward to the anterior margin of the occipital cavities, then into those, describing a curve around their anterior lateral bases, and passing out at their posterior lateral margins; thence they extend obliquely outward and backward to the lateral margins of the cephalic shield at their posterior third, obliquely cut the "doublure," and terminate at its inner margin, at the posterior lateral angles of the occipital depressions.

Hypostoma subovate, with wing-like extensions of the anterior lateral margins; central convex portion surrounded by a sinus, and an elevated margin; this margin, at the anterior half, widens, and forms a slightly elevated projecting surface; outer surface granulated. Interior concave, the margin a reflected edge or "doublure." Anterior margin a semi-lunate curve, attached to the anterior margin of the glabellar depression by the hypostomatic suture.

THORAX. Each segment may be divided into three parts, viz.: 1, Axial groove; 2, Thoracic pleuræ; 3, Free pleuræ. The axial groove consists of the axial ring, anterior "articular fold," and a reflexed posterior articular margin. The "articular fold" rests upon the thin edge of the reflected posterior articular margin of the next anterior segment. The anterior margin of the "articular fold" describes a curve from the anterior lateral extremities of the axial ring, forward into the axial groove, nearly concealing the preceding axial ring. The anterior margin of the axial ring is thickened, as a base for the articular fold, and also as the base of a pair of processes extending from the lateral extremities obliquely backward one-fourth the distance across the axial groove. Each process is a plate-like projection, surmounted at its upper extremity by a small knob-like elevation.

Thoracic pleuræ of each segment divided by diagonal ridges into two triangular depressions upon each pleura, separated from the axial groove and circular cavities, by short transverse ridges. Circular cavities situated between the triangular depressions and the free pleuræ; they are deeper than the triangular depressions. Anterior and posterior margins of the pleuræ parallel.

The free pleuræ curve outward and backward, terminating in falcate extremities. The hollow interior of each opens into the thoracic cavity at the inner extremity, which has upon its upper margin a crescent-shaped surface or slight sulcus. The whole thorax narrows posteriorly.

PYGIDIUM semicircular, concave, and surrounded by a strong "doublure," which has a smooth subcrescentiform surface upon each anterior lateral margin. Anterior lateral margins parallel to those of the posterior segment of the thorax. The articular fold rests upon the axial ring of the posterior segment. The pygidium is composed of four anchylosed segments; the anterior one, penetrating the "doublure" and lateral margins, is produced into long curved spines. Four pair of axial processes project into the axial depression; the anterior pair well developed, the posterior pair as rudimentary tubercles under the "doublure." Upon the posterior surface of the anterior anchylosed segment, there are two minute oval openings, one on each side of the median line, the longer axis extending obliquely upward and backward.

Formation and locality, upper third of the Trenton Limestone, Trenton Falls, Oneida Co., N. Y.

EXPLANATION OF PLATE XI.

Figure A. Section of thorax at fourth segment; enlarged to two diameters.

- *a.* Axial groove.
- *bb.* Axial processes.
- *cc.* Thoracic pleuræ and triangular depressions.
- *dd.* Circular cavities.
- *ee.* Free pleuræ.
- *gg.* Inner extremities of thoracic pleuræ.

Figure B. Interior of the dorsal shell; enlarged to two diameters.

- 1. Hypostomatic suture.
- 2. Hypostoma.
- 3. "Doublure."
- 4. Occipital depression.
- 5. Occipital cavity.
- 6, 7. Facial sutures cutting "doublure."
- 8. Glabellar depressions and processes.
- 9. Neck depression.
- 10. Spines of the head.
- *a.* Axial groove.
- *bb.* Axial processes.
- *cc.* Triangular depressions.
- *dd.* Circular cavities.
- *ee.* Free pleuræ.
- *f.* Crescent shaped surface on free pleuræ.
- *m.* Elevated margin of the hypostoma.
- *rr.* Axial processes.
- *s.* Smooth crescent-shaped surface on "doublure."
- *t.* Pygidium.
- *x.* Oval openings.
- *z.* "Doublure."

Figure C. Longitudinal section at median line; enlarged to two diameters.

1. Hypostomatic suture.
2. Hypostoma.
3. "Doublure."
4. Head.
5. Thorax.
6. Pygidium.

Figure D. Section of segment at median line; enlarged to five diameters.

1. Posterior reflected articular margin.
2. Outer surface of segment.
3. Union of articular fold and axial ring.
4. Articular fold.

XIX.—*Description of a New Species of Jay of the Genus Cyanocitta; also of a supposed New Species of the Genus Cyanocorax.*

BY GEORGE N. LAWRENCE.

Read October 11, 1875.

Cyanocitta pulchra.

A narrow band on the front next the bill, the lores, the sides of the head and the chin are deep black; entire crown and occiput silvery bluish-white; a band of bright ultramine blue crosses the hind neck, becoming deeper in color and gradually merging into the smoky black of the upper part of the back, where it inclines to brownish, the lower part of the back and upper tail coverts are deep cobalt blue; wings and tail of a rich cobalt blue, brighter than the color of the body; the under surface of the wings and tail glossy black; throat cobalt blue, breast and sides of the neck smoky black, abdomen and sides dark cobalt blue like the back, under tail coverts smoky black ending with cobalt blue, thighs smoky brown washed with blue; bill and feet black.

Length, 11 in.; wing, $5\frac{3}{4}$; tail, $5\frac{1}{2}$; bill, $1\frac{1}{8}$; tarsus, $1\frac{1}{2}$.

Habitat. Ecuador, Quito. Type in my collection.

Remarks. Compared with *C. armillata* it is shorter and proportionally stouter, the bill very much stronger and the tail not so long; it cannot be mistaken for that species as they differ throughout in color and markings. In *C. armillata* the vertex, occiput and nucha are of a light blue, which merges into the fine dark ultramarine blue of the back; whereas in the new species, the silvery bluish-white of the head, is separated from the smoky black back, by a rather narrow band of blue; the throat patch in *C. armillata* is of a clear ultramarine blue, strongly defined and separated from the darker blue of the under parts by a black collar; in the new species the throat mark is rather dull in color and without any collar below it. It is unlike any species which I can find described, and I compare it with *C. armillata* that its characteristics may be more clearly elucidated.

Cyanocorax ————?

MALE. Fore part of the head as far as upon a line with the middle of the eye, sides of the head and of the neck, throat and upper part of the breast, deep black; moustache, a spot over the hind part of the eye, the central portion of the upper and lower eye lids, and a mark from the lower eye lid to the moustache, white; occiput, nucha and under plumage, pure white; back, wings and two central tail feathers dark cobalt blue, all the other tail feathers and the ends of the two middle ones are pure white, the under surface of the two middle tail feathers is deep black; the outer webs of the primaries are of a dull rather light blue for about half their length, the color of the terminal portion of the webs still paler and of a greenish shade; inner webs of the quills black, on their under surface the quill feathers are of a dark silvery-gray: the concealed parts of the feathers of the back are largely pure white, on the rump the ends of the feathers only are blue; "eyes yellow;" bill, tarsi and toes, black.

Length, $12\frac{1}{2}$ in.; wing, $5\frac{3}{4}$; tail, 6; bill, $1\frac{1}{4}$; tarsus, $1\frac{3}{4}$.

Habitat. North Peru, Pacasmayo and Ticapa, Oct., 1874.

Remarks. This species belongs to the group represented by *C. cayanus*, but differs in being smaller, with the back very differently colored, and in having all the tail feathers pure white except the two central ones, whereas in *C. cayanus* all the tail feathers are more or less blue on their basal portions, the ends only white.

I find but two species of this genus described as having the tail feathers white, with the exception of the two middle ones; these are, *Cyanocorax mystacalis*, Geoff. Mag. de Zool., 1835; and *C. uroleucus*, Heine Jour. fur Orn., 1860, p. 115.

C. mystacalis is admitted as a valid species by G. R. Gray, Hand List 11, p. 5, and Sclater and Salvin, Nomenclator, p. 39. It is referred to *C. cayanus* by Bonaparte, Cons. Av. 1, p. 379; Cab. et Hein. Mus. Hein. 1, p. 224; Heine, Jour. fur Orn. 1860, p. 116, and Schlegel Mus. des Pays Bas, Liv. 9, p. 51. According to its description, the tail is white with the exception of the two middle feathers; this seems to debar it from being considered identical with *C. cayanus*.

From *C. mystacalis* the bird under examination appears to differ, as follows: in having no tendency to bluish reflections on the top of the head, and the feathers of the back, rump, smaller wing coverts and scapularies, being uniform in color, and without grayish margins, as is stated to be the case in *C. mystacalis*. The upper plumage of *C. mystacalis* is given as "bleu clair." The shades of blue being so various it is sometimes difficult to understand satisfactorily the color intended by the description, and among the Jays one of the most distinguishing characters, is that of the different shades of this color, especially in the group now under discussion, in which the pattern of coloration is much the same. In my bird the back, wings and middle tail feathers are of a uniform dark cobalt blue. The tail of *C. mystacalis* is stated to be 4½ inches long, and the two middle feathers to have one-quarter their length at the end white, and at the extreme end a small spot of bluish-black; in the present bird the tail is 6 inches long, with the white ends of the central feathers rather less than one-sixth their length in extent, and immaculate. The inner webs of the quills are given as brown in *C. mystacalis*, in the bird before me they are black. These differences seem sufficient, I think, to show the two to be possibly distinct species.

C. uroleucus Heine, I have not seen recognized by any writer as a good species, it is noticed by Gray (Hand List, 11, p. 5) and referred to *C. mystacalis*, Geoff.; to which species he also refers *C. bellus* Schlegel, Mus. des Pays Bas Liv. 9, p. 50. This last Schlegel describes as having the basal portions of all the tail feathers more or less blue, and therefore it is unlike *C. mystacalis*.

Judging from the description of *C. bellus*, it seems to me to be entitled to a distinct position, for with the cobalt blue back in connection with the markings of the tail, it appears to differ from all other species.

C. uroleucus is described as having the quills and wing coverts "fuscis" broadly margined with blue—this does not apply well to the specimen before me, as the wing coverts are blue, uniform in color with the back, the quills are black on the inner webs and blue on the outer; the under surface of the middle tail feathers is also given as "fuscis," in my bird the color is deep black. The color given of the upper plumage is "cæruleus." In size it is stated to be larger than *C. cayanus*, my bird is smaller than that species. In neither *C. mystacalis* nor *C. uroleucus* is there any allusion to the feathers of the back having pure white bases as in my bird.

Mr. Gray may be correct in considering *C. uroleucus* the same as *C. mystacalis*, and the bird I have described may be the same also, but the differences pointed out seem sufficient for its separation, and should it prove to be distinct, I propose to name it after my friend Prof. James Orton, it would then stand as *Cyanocorax Ortoni*.

There are two specimens of this handsome species, in a small collection from Northern Peru; these were lately received by Prof. Orton of Vassar College, Poughkeepsie, and sent to me for determination.

It is much to be desired that the types of *C. mystacalis*, *C. uroleucus* and *C. bellus*, may be carefully examined, and their status more satisfactorily determined.

XX. *On the Genitalia, Jaw and Lingual Dentition of certain species of Pulmonata.*

By W. G. Binney.

[With a Note on the Classification of the Achatinellæ, by Thomas Bland.]

Read October 11, 1875.

In the following pages I have not considered it necessary to offer a full description of the dentition in cases where a figure is given. In the Proceedings of the Academy of

Natural Sciences of Philadelphia, 1875, p. 145, full explanation will be found of the terms I use. In the plates, I have endeavored to give a perfect idea of the several forms of teeth on each lingual membrane by figuring the central with the first lateral tooth, the transition from lateral to marginal teeth, and a decided marginal, usually the last. The position of each tooth from the median line is indicated on the plates by numerals. The plates must, however, be studied with the text. It will be seen that the cutting points of the teeth are shaded. I have not, also, considered it necessary fully to describe the genitalia in cases where I have given a figure of the system. I have rather confined myself to pointing out the characteristic feature of each. In the lettering of the plates, I have not deemed it important to indicate the testicle, epididymis, accessory gland, prostate, vas deferens, ovary or oviduct, as those organs cannot fail to be recognized. I have, however, indicated the penis sac, retractor of same, genital bladder with its duct, and any accessory organs that may occur. As in my former publications, I apply the terms ovary and testicle as does Dr. Leidy in the first volume of "Terrestrial Mollusks of the United States."

Glandina truncata, Say.

On plate xiv, fig. F, I have given a figure of the central tooth of this species which is more accurate than that given in Proc. Phila. A. N. S., 1875, pl. i, fig. 1. It will be seen to agree with the figure of Morse (Ib. p. 156, fig. 2) as regards the presence of a distinct cusp. The figure was drawn from the lingual membrane of a large Florida specimen.

It will be of interest to note here that the largest specimens of *Glandina* found by me near St. Augustine, were in the centre of the clumps of large, coarse grass covering the marshes at the edge of Matansas River. Mr. Say also speaks of finding the largest specimens in the marshes immediately behind the sand hills of the coast.

Nanina radians, Pfr. (*Microcystis*).

Rarotonga Isl., Mr. A. Garrett.

Plate xvi, fig. 1, represents one central, lateral and marginal tooth. There are 40–1–40 teeth, 8 being perfectly formed laterals. The marginals are sometimes trifid.

For the identification of this and of the following Society Island species I am indebted to Mr. Garrett. They form a part of an extremely interesting collection of Society Island land shells, preserved in spirits, just received from him, through Dr. W. D. Hartman of West Chester, Pa.

Nanina conula, Pease.

Island of Huahine, Mr. A. Garrett.

Central and lateral teeth as in *N. radians*, Pfr. (see above). Lateral teeth seven in number. Marginals aculeate, multifid, very numerous.

The species is viviparous.

Nanina calculosa, Gould.

Island of Huahine, Mr. A. Garrett.

Jaw as usual in the genus. Lingual membrane long and narrow. Teeth 38–1–38. Centrals and (7) laterals as in *N. radians* (see above), the latter, however, have slightly developed, inner, side cutting points. First 15 marginals bifid, the balance multifid.

The species is viviparous.

Trochomorpha Cressida, Gould.

Island of Huahine, Mr. A. Garrett.

Jaw arched, high; ends blunt; cutting margin with a median beak-like projection.

Lingual membrane (pl. xvi, fig. H.) with 55–1–55 teeth. The bifurcation of the cutting point of the marginals commences in the 11th tooth. There are no side cusps to centrals and laterals, which have a long, narrow base of attachment.

I figure one central, one lateral and one marginal tooth.

Von Martens puts the species in *Discus*, a subgenus of *Nanina*.

Zonites cerinoideus, Anthony.

Charleston, S. C., Mr. W. G. Mazyck.

The animal has the distinct locomotive disk and the parallel furrows above the margin of the foot, meeting above a distinct, caudal mucus pore, characteristic of the genus. It has also a dart and sac, as in *Z. ligerus.*

Jaw as usual in the genus. Lingual membrane (pl. xiii, fig. B), as usual in the genus. (See Proc. Phila. Ac. Nat. Sc., 1875, 161). Teeth 34 – 1 – 34 with 9 perfect laterals.

Limax montanus, Ingersoll.

(Report on Nat Hist. of U. S. Geolog. and Geogr. Survey of the Territories, 1874, p. 130.)

This species was found by Mr. Ernest Ingersoll, in the mountains of Colorado, at "camps 9 – 11, Blue River Valley," while attached to the Survey of the Territories, in 1874.

The animal is about 18 – 25 mill. long. It presents no peculiar external characters. Its color is brown, with mantle, head, tentacles and eye-peduncles black: bottom of foot white. On opening the animal I found it does not agree in dentition with *L. campestris*, the only native species whose presence could be expected there.

The jaw is as usual in the genus. The lingual membrane is long and narrow. Teeth 50 – 1 – 50 (pl. xviii, fig. D), arranged as usual in the genus *Limax.* The central teeth have decided side cusps and cutting points. The lateral teeth are like the centrals, but unsymmetrical and consequently bicuspid; there are about 16 perfect laterals. The marginals are purely aculeate in form, are arranged as usual in the genus (see Proc. A. N. S. Phila., 1875, 172), and all have a slightly developed side spur, making the tooth bicuspid.

L. campestris has no side spur to its inner marginals, though it has such on the outer ones. Otherwise the dentition is about the same.

In its genitalia also, this species is nearly allied to *L. campestris*, as will be seen in comparing my figure (pl. xii, fig. 4), with that of Dr. Leidy (Terr. Moll. U. S. pl. ii, fig. 6). *Limax Ingersolli*, however, differs in the shape of its genital bladder and the shortness of the duct.

With *Limax montanus* were specimens whose dentition (pl. xviii, fig. F), differs only in having a less number of teeth, 34 – 1 – 34, with 12 perfect laterals. The teeth are of the same type as in *L. montanus.* The animal is shorter, by about one-half. This form has been noticed as *L. castaneus* by Mr. Ingersoll, l. c. p. 131.

In dentition and genitalia *L. montanus* differs from all the other species, native and introduced, thus far known to exist in North America.

Patula Cumberlandiana, Lea.

Sewanee, Tenn. Dr. Jno. B. Elliott.

Jaw of the same type as in *P. alternata* (see Proc. Ac. Nat. Sc. Phila., 1875, 177, fig. 21). There are coarse vertical striæ.

Lingual membrane (pl. xv, fig. E) long and narrow. Teeth of same type as in *P. solitaria, alternata*, etc. (see same reference, 178). The centrals and laterals have, however, a much shorter median cusp. Side cusps subobsolete, and side cutting points wanting on the centrals and first two laterals, the third lateral beginning to show them; the outer laterals, as the seventh lateral etc. (see plate), have them well developed. The transition to marginals is very gradual and is not formed by the bifurcation of the inner cutting point, which remains simple to the extreme outer edge. The smaller, outer cutting point is sometimes bifid in the outer marginals. These last are usually but a simple modification of the laterals, as shown (see plate) in the 20th and 30th teeth.

There are 30 – 1 – 30 teeth, with hardly 13 laterals, and certainly not so many absolutely perfect ones.

In *P. alternata* (see as above, p. 180, pl. vii, fig. 5) there are decided prominent side cusps and cutting points to centrals and first laterals. The shape of the centrals and first laterals also in *alternata*, is quite different from those of this species.

The genitalia agree with those of *P. alternata* figured by Dr. Leidy, in Terr. Moll. U. S., I. pl. vii, fig. 2, excepting, perhaps, that in *Cumberlandiana*, the genital bladder is smaller, and its duct longer and narrower.

For the specimens examined I am indebted to Dr. Elliott, a son of the late Bishop Elliott, who so generously contributed specimens from southern localities a number of years ago, most materially assisting Mr. Bland and myself in our studies.

This species was described by Dr. Lea, from Jasper, Marion Co., Tenn. Sewanee, the University Place of Bishop Elliott, is in Franklin, the adjoining county. These are the only localities of the species thus far known.

Patula mordax, Shuttl.

East Tennessee.

I have lately had an opportunity of examining its genitalia, and find them to agree with those of the typical *alternata*. The dentition is also the same (see Proc. Phila. Ac. Nat. Sc., 1875, pl. VII, fig. 7).

Patula alternata, Say.

I have also examined and here figure (pl. xvii, fig. 15), the genitalia of the heavily ribbed form of *P. alternata*, from Eastern Tennessee (Mr. A. G. Wetherby). It agrees with the typical *P. alternata*, and also in dentition. In both forms I found the duct of the genital bladder much longer than is figured by Leidy, in the Terrestrial Mollusks U. S. In *P. Cumberlandiana* also it is long, thus agreeing with *alternata*.

Patula Huahinensis, Pfr.

Huahine Isl., Mr. A. Garrett.

Lingual membrane, with 18 – 1 – 18 teeth, of which about six are laterals. The type of dentition is about the same as in *Endodonta incerta*, herewith described. The marginals are, however, different, the two cutting points being bifid, the base of attachment low and wide. (Plate xvii, fig. 17).

Endodonta incerta, Mousson.

Huahine Island, Mr. A. Garrett.

I am indebted to Mr. Garrett, for the identification of this and all the Huahine species herewith described.

I regret not succeeding in obtaining the jaw of any species of this group, the more because some doubt about its existence has been expressed. It is, however, probable that it will be found, as no agnathous genus has yet been noticed with the quadrate marginal teeth, which characterize *E. incerta*, and also *E. tumuloides*, Garrett (Proc. Ac. Nat. Sc. Phila., 1875, p. 248, pl. xxi, fig. 6).

Lingual membrane (pl. xvii, fig. 16) with 11–1–11 teeth, of which 4 are perfect laterals. The marginals (of which the last is shown in the figure) are but a simple modification of the laterals. They differ from those of *tumuloides*, unless, indeed, I have, from their exceeding minuteness, failed rightly to interpret them.

Helix Ingersolli, Bland (*Microphysa*).

Mr. Ernest Ingersoll: U. S. Survey of Territories, 1874.

Jaw low, wide, slightly arcuate, ends slightly attenuated: whole anterior surface with about 22 broad, flat, slightly separated ribs, whose ends denticulate either margin.

This form of jaw is unusual among the *Helicinæ*. It is somewhat like that of *H. Lansingi* (see Phila. Pr., 1875, p. 169).

Lingual membrane long and narrow. Teeth about 16–1–16. Centrals as usual in the *Helicinæ* (pl. xviii, fig. C). The side cusps and cutting points are well developed, the base of attachment longer than wide. Laterals of same type, but unsymmetrical, and consequently only bicuspid. The change from laterals to marginals (8th and 9th teeth of figure) is very gradual, there being no splitting of the inner cutting points, at least not as in most species (see pl. xii, fig. E). Marginals (16th tooth of figure) very low, wide, with one inner, long, blunt cutting point, and one outer, small, blunt.

The low, wide marginal teeth of this species are peculiar.

Helix rufescens, Pennant (*Fruticicola*).

Extracted from a dry English shell furnished by Mr. A. G. Wetherby. I include it here because the species has been introduced at Quebec. I was not able to illustrate it when treating of the Lingual Dentition of North American Land Shells, in Proc. Ac. Nat. Sc. Phila., 1875, 214.

There are 26–1–26 teeth. The characters of all are shown in my figures. It will be seen that the transition from laterals to marginals (16 to 19), see also Lehmann, in Malak. Blatt. xvi, is gradual. The inner cutting point is not bifid.

Helix pubescens, Pfr. (*Fruticicola*).

Haiti. Mr. V. P. Parkhurst to Mr. T. Bland.

Jaw (pl. xv, fig. C) thin, semitransparent, low, slightly arcuate, ends scarcely attenuated, blunt; upper margin with a strong muscular attachment: no median projection to cutting edge; anterior surface with about 20 ribs denticulating either margin; these ribs appear in most cases to be broad, flat, with narrow interstices, but in others there are appearances such as I have described in *Bulimulus limnæoides* (see below).

Lingual membrane long and narrow (pl. xv, fig. D). Teeth as usual in the *Helicinæ*. The change from laterals to marginals is very gradual, not formed by the splitting of the inner cutting point. The 12th tooth (figured) shows the commencement of the transition. The 22d (figured) is a marginal tooth. The inner cutting point of the marginals is rarely bifid.

Teeth about 24–1–24.

Helix Studeriana, Fér. (*Stylodon*).

Seychelles, Consul Pike to Mr. T. Bland.

Jaw stout, strongly arched, ends but little attenuated, blunt; anterior surface without ribs; there are, however, a few, coarse, broad, vertical wrinkles. One jaw had a slightly developed median projection to its cutting edge, another has no approach to a projection.

Plate xiv, fig. C, shows the lingual dentition. Teeth 69-1-69, with about 22 laterals. There is considerable resemblance to the dentition of *H. fringilla* herewith described. The cutting points on centrals and laterals are, however, more pointed.

This species is viviparous.

Helix dentiens, Fér. (*Dentellaria*).

See Proc. Ac. Nat. Sc. Phila., 1874, p. 57. I now offer fig. G of pl. xvi, to give more full details of the changes of the teeth from centrals to marginals, especially the side cusp and cutting point of the outer laterals, and the transition from laterals to marginals. Tooth 33 is the last.

Helix aspera, Fér. (*Thelidomus*).

Jamaica. Mr. V. P. Parkhurst to Mr. T. Bland.

For jaw and lingual membrane see Amer. Journ. Conch. VI, 204.

Pl. xii, fig. 2, represents the genital system. The genital bladder (g. b.) is elongated oval, on a short, stout duct. The penis-sac (p. s.) is stout, long, tapering bluntly to its apex, someway below which is the entrance of the vas deferens. The retractor muscle is inserted at about the middle of the length of the penis-sac.

Helix Jamaicensis, Chemn. (*Thelidomus*).

Jamaica. Mr. V. P. Parkhurst to Mr. T. Bland.

Mr. Bland has already called attention (Ann. Lyc. N. H. of N. Y. XI, 146, 1875) to the true subgeneric position of this species. I propose here only to give a figure of the dentition and genitalia.

There are 41-1-41 teeth on the long and narrow lingual membrane (pl. xiv, fig. B).

Jaw thick, arcuate, ends attenuated: anterior surface with 14 decided but unequal, irregularly disposed ribs, denticulating either margin.

Genitalia figured on pl. xiii, fig. F. The peculiarity of it is the extremely long epididymis (e), convoluted at either end. The penis-sac has a contraction at its middle, below which it is black, above it, white.

Helix crispata, Fér. (*Eurycratera*).

Port au Prince. Mr. V. P. Parkhurst to Mr. T. Bland.

Lingual membrane and jaw already described (see Proc. Acad. Nat. Sc., 1874, 57, pl. x, fig. 9*).

Plate xii, fig. 8, represents the lower portions of the genital system. The genital bladder (g. b.) is very small, globular, on a long duct, which is very narrow in its upper half and gradually enlarges below until it becomes very stout. On the penis-sac (p. s.), above the junction of the retractor muscle, is a small globular mass, of character unknown to me.

Helix spinosa, Lea (*Stenotrema*).

Tennessee. Mr. A. G. Wetherby.

Plate xii, fig. 3, represents the genital system of this species. The penis-sac (p. s.) is very long, attenuated at either end, greatly swollen at the median third of its length. The genital bladder is oval, on a short duct.

Helix stenotrema, Fér. (*Stenotrema*).

Tennessee. Mr. A. G. Wetherby.

The genitalia are as figured for *hirsuta* by Dr. Leidy, in Terr. Moll. U. S. There is, however, in this species, a much greater development of prostate, testicle and epididymis. The last named organ is scarcely convoluted. The margins of the first named are scalloped.

Helix barbigera, Redf. (*Stenotrema*).

Genitalia as in the last species.

Helix tridentata, Say (*Triodopsis*).

On pl. xvii, fig. 19, I have given the genitalia of this species. They may be compared with those of the other species of *Triodopsis* given below. The genital bladder with its duct offer slight variations in all these species; whether constant or not must be decided by future study. My figures will draw attention to this point.

Helix fallax, Say (*Triodopsis*).

Genitalia (pl. xvii, fig. 11). See last species.

---

* There are decided side cutting points to centrals and laterals, though I failed to see them in the lingual figured.

Helix Hopetonensis, Shuttl. (*Triodopsis*).

City of Charleston, S. C.

Genitalia (pl. xvii, fig. 14). See above, *H. tridentata.*

Helix Van Nostrandi, Bland, MS. (*Triodopsis*).

Aiken, S. C. Miss Emma Van Nostrand.

Jaw as usual in *Triodopsis:* ribs 17.

Lingual membrane (pl. xvii, fig. 8) long and narrow. Teeth 24–1–24, with 10 laterals. The centrals have no distinct side cusps or cutting points, but the latter are replaced by decided bulgings on the median cutting point. The figure gives the central with the first, tenth, eleventh, nineteenth and twenty-fourth teeth; the last two are marginals.

Genitalia (pl. xvii, fig. 12). See above under *H. tridentata.*

Helix Rugeli, Shuttl. (*Triodopsis*).

East Tennessee. Mr. A. G. Wetherby.

Genitalia (pl. xvii, fig. 18). See above under *H. tridentata.*

Helix Harfordiana, J. G. Cooper (*Triodopsis*).

California. Mr. Henry Hemphill to Mr. T. Bland.

Lingual membrane (pl. xviii, fig. A) as usual in the subgenus (see Proc. Ac. Nat. Sc. Phila., 1875, 206). Teeth 26–1–26, with 12 laterals. The side cutting points to central and lateral teeth are well developed.

Jaw as usual in the subgenus (see same references as above), with over 12 ribs.

Helix fringilla, Pfr. (*Merope*).

Admiralty Island. Mr. A. G. Wetherby.

The dried remains of the animal in the shell of a cabinet specimen furnished the lingual membrane and jaw here described. The shell is the variety with the pink peristome.

Jaw with numerous, crowded, stout ribs, denticulating either margin.

Lingual membrane (pl. xiv, fig. A, pl. xv, fig. A) long and narrow. Teeth 28–1–28, with about 11 laterals. Centrals with base of attachment longer than wide; side cusps obsolete, side cutting points wanting; middle cusp broad, blunt, with a very short, broad, blunt cutting point.

Laterals like the centrals, but unsymmetrical: the cutting point becomes longer as they pass off laterally, and at the 12th tooth it commences to be bluntly trifid. The marginals are peculiar; their base of attachment is subquadrate with a single broad cusp, bearing a very broad, oblique, expanding, trifid cutting point; the outer division very small, pointed; the median longer, very broad, squarely truncated; the inner one about half the size of the median, recurved and sharply pointed.

In pl. xiv, fig. A, I have represented the dentition of that portion of the lingual membrane where the cutting points are least developed. Pl. xv, fig. A, represents that portion where they are most so. It must always be borne in mind that such differences of development exist in all membranes.

The dentition of this species is peculiar, resembling that common in *Orthalicus* rather than the type usual in *Helix*.

Helix leporina, Gould (*Polygyra*).

Texas. Mr. A. G. Wetherby.

Jaw as usual in the subgenus (see Phila. Proc. 1875, 201), with 12 ribs.

Lingual membrane as usual in the subgenus (see id.). Teeth 18 – 1 – 18, with 8 laterals (pl. xviii, fig. B). The 15th tooth figured is from another portion of the membrane from that furnishing the 13th. The extreme right hand figure of my plate represents a deformed first lateral tooth.

Helix auriculata, Say (*Polygyra*).

St. Augustine, Florida, under the ruins of the sugar house chimneys at Hanson's deserted plantation.

Having collected specimens of undoubted identity at Mr. Say's original locality, I have compared the genitalia with those figured by Leidy (Terr. Moll. U. S., I. pl. ix) and find them to agree. This is important, as the name "*auriculata*" was used in that work to cover several species.

I have also given (pl. xviii, fig. E) a better figure of the dentition than in Proc. Phila. Ac. Nat. Sc., 1875, pl. viii, fig. 12. There are 26 – 1 – 26 teeth. The inner cutting point of the 13th tooth is bifid, so that there are 12 laterals.

Jaw with 10 ribs.

Helix uvulifera, Shuttl. (*Polygyra*).

Genitalia as in *H. auriculata*.

Helix septemvolva, Say (*Polygyra*).

St. Augustine, Florida.

Plate xii, fig. 6, represents the genital system of the large form of this species. It is characterized by its extreme length, as would be expected from the form of the shell. The vagina (v.) is extremely long and narrow. The genital bladder (g. b.) is elongated oval, on a short, slender duct. The penis-sac (p. s.) is very long, attenuated to a point above, where the retractor muscle is inserted.

The digestive system is also very much elongated. The œsophagus especially is excessively long, as are also the ducts to the salivary glands.

This species is extremely common all over St. Augustine and its vicinity. The large form I found almost restricted to the moat of the old fort, especially at the foot of the main western wall.

Helix Febigeri, Bland (*Polygyra*).

Near Mobile, Alabama. Dr. E. R. Showalter.

Genitalia as in *H. septemvolva* (see pl. xii, fig. 6).

Helix cereolus, Muhlf. (*Polygyra*).

For this and many species of Key West I am indebted to the kindness of Mr. W. W. Calkins.

Jaw as usual in the subgenus (l. c.), with over 14 ribs.

Lingual membrane as usual (pl. xvi, fig. C). Teeth 22–1–22, with 9 laterals, the inner cutting point of the 10th tooth being bifid. Marginals with base of attachment low, wide, with one inner, long, oblique, bifid cutting point, and one short, bluntly bifid, small, outer cutting point.

Genitalia as in last species.

Helix Carpenteriana, Bland (*Polygyra*).

Key West. Mr. W. W. Calkins.

Jaw as usual in the subgenus: (l. c.): ribs over 12.

Lingual membrane as usual (pl. xiii, fig. K). Teeth 22–1–22. The character of the various teeth is shown in the figures. There are 9 laterals, the 10th tooth having a bifid inner cutting point.

I can now state that *H. cereolus, Carpenteriana, septemvolva, volvoxis,* and *Febigeri* have the same dentition. In all, the splitting of the inner cutting point commences at the tenth tooth.

Genitalia as in *H. septemvolva* described herewith.

Helix exoleta, Binn. (*Mesodon*).

I have already referred to the peculiarity of this species in sometimes having, and sometimes wanting, side cutting points to outer lateral teeth, and a bifurcation to the inner cutting point of the marginals (see Proc. Phila. Ac. Nat. Sc., 1875, 243). I here figure teeth from a lingual membrane differing in this respect from that figured by me before (l. c. pl. xi, fig. 7). The cutting point of the central and first lateral teeth have a lateral bulging which represents the side point.* This point appears about the 11th tooth.

Plate xvi, fig. D. E. The 60th tooth is the last.

Fig. E represents an inner marginal tooth from another membrane, agreeing with my former figure in having a simple, not bifid, inner cutting point.

I am sure of the identity of each individual examined, having verified it by the peculiar genital bladder and penis-sac, figured by Leidy, l. c.

Helix ruficincta, Newc. (*Arionta*).

Catalina Isl., California. Mr. Henry Hemphill.

Plate xiii, fig. A, shows the genitalia. There are no peculiar accessory organs, as in *ramentosa*, *Nickliniana*, *Kelletti*, etc. (see Proc. Phila. Acad. Nat. Sc., 1874, pl. iii, iv). A dart sac ? (*d. s.*) is, however, present.

Helix Carpenteri, Newc. (*Arionta*).

Coronado Islands, coast of Lower California. Mr. Henry Hemphill.

Genitalia as in *H. Nickliniana* (see Proc. Ac. Nat. Sc. Phila., 1874, pl. iv, fig. 3). The flagellate ends of the vaginal prostate are shorter in this species.

Jaw as usual in the subgenus (see Proc. Ac. Nat. Sc. Phila., 1875, 216), with over seven ribs.

Lingual membrane long and narrow. Teeth 48 – 1 – 48, with 20 laterals. See pl. xv, fig. B. It will be seen that the central and first lateral teeth have no side cusps or cutting points; it appears first on the 8th tooth. The change from laterals to marginals is formed as usual, the inner cutting point of the 21st tooth being bifid. A marginal is shown in the 34th tooth.

---

* I fear that in my figure of the dentition of *M. albolabris* (l. c.) I have mistaken this bulging for a distinct cutting point. The membranes of all our species should be carefully restudied with the view of learning whether there is any difference other than of degree between this bulging and a distinct cutting point. The figures of Semper (Phil. Archip.) should be carefully studied, as they show best the two planes of the cusp and cutting point.

Helix Ayresiana, Newc. (*Arionta*).

San Miguel Isl., California. Mr. H. Harford.

Genitalia as in *H. Traski* (see Ann. Lyc. N. H. of N. Y., XI, 30, pl. vi, fig. 4). The flagellate extensions of the vaginal prostate beyond the bulbs in this species are, however, much shorter and stouter.

Helix exarata, Pfr. (*Arionta*).

Alameda Co., Calfornia. Dr. L. G. Yates.

Genitalia as in *H. Nickliniana*, Proc. Ac. Nat. Sc. Phila., 1874, pl. iv, fig. 3.

Helix Diabloensis, J. G. Cooper. (*Arionta*).

Alameda Co., California. Mr. L. G. Yates.

Jaw as usual in the genus, (see Proc. Phila. Ac. Nat. Sc., 1875, 216), with 5 ribs.

Lingual membrane (pl. xv, fig. G), as usual in the subgenus. The central and first lateral teeth have no side cusps or cutting points; these appear on the 13th tooth. The 18th tooth has its inner cusp bifid; there may, therefore, be said to be 17 laterals. The marginals (see figure for the last one), are low, wide, with one inner, long, oblique, bifid cutting point, and one outer small cutting point. There are 37–1–37 teeth.

Genitalia as in *H. exarata.*

Helix arrosa, Gould (*Arionta*).

Plate xii, fig. 5, gives the genital system.

The penis-sac is extremely long and gradually tapers into a flagellum. It receives the retractor muscle beyond the middle of its length, and the vas deferens at three-quarters of its length from the vagina. The genital bladder (g. b.) is very small, oval, on a very long duct, which has a very long, stouter, accessory duct (a. d.).

From *H. Nickliniana*, *H. arrosa* differs greatly in the total want of the peculiar accessory organ, probably a vaginal prostate, which characterizes that species (see Phila. Proc. 1874, 41, pl. iii, fig. 4). From *H. Townsendiana*, it still more widely differs (see same, 1873, 254, pl. i, fig. 4), in the character of the penis-sac and genital bladder.

Helix facta, Newc. (*Arionta*).

Sta. Barbara Island, California. Mr. H. Hemphill.

In my account of the dentition of North American Land Shells in Proc. Phila. Ac. Nat. Sc., 1875, I was unable to include this species.

Jaw already described.

Lingual membrane long and narrow (pl. xvii, fig. 13). Teeth 26 – 1 – 26, as usual in *Arionta.* The fourth has decided side cusp and cutting point, which on the central and first three laterals are replaced by a prominent bulging of the large cutting point. The thirteenth tooth has its inner cutting point bifid. My figures give the central with the first, fourth, twelfth, thirteenth, seventeenth and twenty-sixth teeth, the last two being marginals.

Genitalia (pl. xvii, fig. 9) without the accessory duct of the genital bladder, and with a dart sac (?). They resemble nearly those of *H. ruficincta* (see above), differing chiefly in the length of the duct of the genital bladder. At the base of the dart sac there appear two simple, thread-like organs, reminding me of those of *H. Stearnsiana*, but without their terminal complications. I have not figured them, being uncertain whether they should be considered as a part of the genital system.

Helix Tryoni, Newc. (*Euparypha*).

Sta. Barbara Island, California. Mr. H. Hemphill.

Jaw already described by me (L. & Fr. W. Shells, I. 179).

Lingual membrane (pl. xvii, fig. 5) long and narrow, quite as in *Arionta.* Teeth 42 – 1 – 42. The eleventh lateral has a decided side cusp and cutting point. The 14th has its inner cutting point bifid. The characters of the individual teeth are shown in the figure, which gives the central, the first, eleventh, fourteenth, thirty-seventh and forty-second teeth.

Genitalia (pl. xvii, fig. 10) as usual in *Arionta*, especially in *H. Stearnsiana*, but with this important difference, that from the base of the dart sac one thread-like organ alone proceeds, the other being replaced by a sponge-like process, evidently a form of vaginal prostate.

Anadenus ?

Himalaya Mts. Museum of Comparative Zoology, Cambridge, through Mr. Anthony.

On pl. xviii, fig. 1, I have figured the dentition of this slug, whose specific name is unknown to me. There are 58 – 1 – 58 teeth.

The jaw is thick, low, wide, slightly arcuate; ends but little attenuated: anterior surface with 14 stout, unequal, separated ribs, denticulating either margin.

The dentition is of the same type as described in the genus by Heynemann, Malak. Blatt. X, 1863, p. 138.

Orthalicus undatus, Brug. *Var.*

Key West. W. W. Calkins.

This is the form figured as *O. zebra*, Müll., in Terr. Moll. U. S., IV, pl. lxxviii, fig. 12, and L. & Fr. W. Sh. N. A., I. p. 216, fig. 370 (not fig. 371). It has also been found on Indian Key, Sandy Key, Cape Sable and Key Biscayne.

Mr. Calkins kindly sent me specimens preserved in spirits. The genitalia are like those of the typical *O. undatus*, from Jamaica (see Ann. N. Y. Lyc., N. H., XI, 41). So also is the jaw.

The lingual dentition I have figured on pl. xiii, fig. E, giving one central with its adjacent lateral, and one marginal tooth. There are 126 – 1 – 126 teeth. The cutting points are somewhat more developed than in the typical *undatus* (see Proc. Ac. Nat. Sc. Phila., 1875, pl. vi, fig. D).

Ariolimax Hemphilli (n. sp).

From Mr. Henry Hemphill I have received specimens of an undescribed species of *Ariolimax*, collected by him at Niles Station, Alameda Co., California.

It is from 25 – 31 mill. long, of a transparent flesh color, much more slender than the other known species, with a much more pointed tail. The mantle is also longer. These characters, even in specimens preserved in alcohol, readily distinguish the species. On dissecting the specimens, I also found distinguishing specific characters in the genitalia (pl. xii, fig. 7). The testicle (t.) embedded in the liver, is brown, composed of thickly packed fasciculi of long, blunt cœca, the mass formed by them is cuneiform. The ovary (ov.) is narrow and pointed. The genital bladder (g. b.) is small, oval, with a short, narrow duct, which becomes much more swollen at its junction with the vagina. The penis sac (p. s.) is extremely short, globular, receiving the vas deferens at its upper posterior portion, and the retractor muscle at its farther end. Opposite the mouth of the penis sac the vagina is greatly swollen.

A comparison with my figures of the genitalia of *A. Andersoni?* (pl. xii, fig. 9), and *A. Columbianus, Californicus* and *niger* (Phila. Proc., 1874, pl. ii and xi), will show how widely they differ from those of the present species.

The jaw is thick, low, wide, slightly arcuate, ends scarcely attenuated; anterior surface with 8 – 12 decided ribs, denticulating either margin.

Lingual membrane (pl. xviii, fig. H) as usual in the genus (see Phila. Proc., 1875, 193). Teeth 31 – 1 – 31.

Ariolimax Andersoni, J. G. Coop.?

From Mr. L. G. Yates I have received specimens of an *Ariolimax* found in the mountains of Alameda Co., California. From the fact of the reticulations of the surface of the animal having the foliated appearance noticed in *Arion foliolatus*, Gld., *Prophysaon Hemphilli*, Bl. & Binn., and *Arion Andersoni*, J. G. C., I am inclined to refer the specimens to one of those species. I am entirely unacquainted with the first (see Ann. N. Y. Lyc. N. H., X, 297), the second is generically distinct, the latter may be identical.* The specimens have all the characters of *Ariolimax* (see Proc. Ac. Nat. Sc. of Phila., 1874, 33). They are about 35 mill. long.

The jaw is as usual in the genus, wide, low, with about 13 broad, separated ribs, denticulating either margin. The lingual membrane is as usual. Teeth 48–1–48. The characters of the teeth are sufficiently shown in my fig. G, of plate xii. The change from laterals to marginals is very gradual (43), the latter being but a simple modification of the former.

The genitalia (pl. xii, fig. 9) are very much like those of *A. niger* (see Phila. Proc. l. c., pl. xi, fig. C), especially in the shape of the penis-sac, and the peculiar accessory organ (v. p.), probably a vaginal prostate. The genital bladder differs somewhat in shape, and also the testicle.

The rudimentary shell has decided concentric layers. The caudal mucus pore is as in *A. Columbianus* (Phila. Proc. l. c., pl. ii, fig. B).

Should this not prove the species described as *Arion Andersoni* by Dr. J. G. Cooper, it must receive a new name. It is a true *Ariolimax*, most nearly related to *A. niger*. The latter species wants the foliated reticulations, and has its posterior termination more blunt, with a decided lateral cleft at the mucus pore.

---

* I have lately received from Dr. Cooper, under the name of *Arion Andersoni*, specimens agreeing perfectly with the form of *Prophysaon* referred to as probably undescribed on p. 296, and pl. xiii, fig. 5, of Ann. of Lyc. of N. H. of N. Y., vol. X. Should Dr. Cooper's *Arion Andersoni* prove, therefore, to be a *Prophysaon*, it will retain its specific name, while the slug before us may also retain the specific name *Andersoni*.

Binneya notabilis, J. G. Coop.

Sta. Barbara Island, California. Mr. Henry Hemphill.

Mr. Hemphill, who has contributed so largely to our knowledge of the land shells of the Pacific coast, has lately visited the Island of Sta. Barbara. Among the species found by him is *Binneya notabilis*, which was originally described from thence by Dr. J. G. Cooper. Mr. Hemphill has kindly sent me living specimens, as well as others preserved in spirits. I am, therefore, able to give a full generic description, with a figure (pl. xvii, fig. 4) of the animal as it appears when half extended. I did not succeed in inducing it to protrude itself fully. The descriptions will supersede those formerly given by Mr. Bland and myself in L. & Fr. W. Sh. N. A., I. 67.

When received, the living examples were furnished with the peculiar epiphragm described by Dr. Cooper. On becoming again active, this epiphragm was left entire, still adhering to the surface on which the animal had formed it. In one individual I observed a second, inner epiphragm, simple, without the perpendicular walls.

The Mexican genus *Xanthonyx*, is no doubt nearly allied to *Binneya*, but it does not appear from the figures of alcoholic specimens given by Messrs. Fischer and Crosse (Moll. Mex. et Guat.) that the mantle of *Xanthonyx* is extended anteriorly, and the position given by them of the respiratory office is different. Should future study of the living animal prove *Xanthonyx* identical with *Binneya*, the former will be considered as a synonyme of the latter.

Dr. Pfeiffer (Mon. Hel. Viv. VII) suggests the identity of *Binneya* with *Daudebardia*, ignoring entirely the distinction of the first divisions now recognized among the *Geophila* of presence or absence of a jaw, or of aculeate or quadrate teeth. By the modern arrangement these two genera are most widely separated.

The surface of the animal is dirty white, with about seventeen vertical rows, on each side, of dark blue or slate blotches, interrupted by the longitudinal reticulations running parallel to the foot, but again commencing and extending to the edge of the foot. These blotches diverge in all directions from under the shell and mantle, running almost perpendicularly on the side of the animal, but very obliquely in front and behind. The tail is quite keeled with oblique blotches. These blotches also run obliquely from a median line on the fore part of the extended animal. Tentacles, eyepeduncles and front of head slate color. Lips developed and kept constantly in motion as tentacles. The reticulations of the surface are large and few.

In specimens preserved in alcohol there appears a locomotive disk. There is no caudal pore. The respiratory and anal orifices are far behind the centre of the mantle edge on the right of the animal. The genital orifice appears somewhat behind the right eyepeduncle. The mantle is scarcely reflected upon the shell, even in front. When the animal is fully extended, Dr. Cooper says the mantle equals one-fourth of its length. The mantle exudes mucus freely. It seems fixed to the shell, not changing its position with the movements of the animal.

One of the shells collected by Mr. Hemphill is twice as large as that whose measurements are given by Mr. Bland and myself.

The jaw is thick, slightly arcuate, ends blunt: anterior surface with six well developed ribs denticulating either margin, situated on the central third of the jaw, and as many subobsolete ribs on each outer third: no median projection. Pl. xvii, fig. 2.

Lingual membrane (pl. xvii, fig. 3) long and narrow. Teeth 31–1–31; with about fifteen laterals, but the change into marginals is very gradual, the latter being a simple modification of the former. My figures give a central with the first, sixteenth and thirty-first teeth.

The genitalia I did not succeed in extracting, they being but imperfectly developed in the individuals received. The nervous ganglia and the digestive system present no peculiar features.

The generic description will be as follows:—

Animal heliciforme, antice obtusum, postice rapide acuminatum. Pallium subcentrale, extra testam antrorsum prolongatum. Discus gressorius distinctus. Porus mucosus caudalis nullus. Apertura respiratoria et analis ad dextram sita, in parte posteriore marginis pallii. Apertura genitalis post tentaculam dextram oculigeram.

Testa externa, paucispira, haliotoidea, animal non includens. Pars exclusa in hibernis epiphragmate albido, duro, membraneo protecta.

Maxilla arcuata, costis validis exarata. Dentes linguales quadratæ, centrales tricuspidatæ, laterales et marginales bicuspidatæ.

Coecilianella Gundlachi, Pfr.

St. Martin. Dr. H. E. Rygersma to Mr. T. Bland.

Mr. Bland has already noticed this species, in Ann. Lyc. Nat. Hist. of N. Y., XI, 152, 1875, where a detailed description of the jaw and lingual membrane will be found.

I add a figure of the jaw (pl. xiii, fig. D), with a still more enlarged view of a portion of it (fig. G), to show the character of the ribs. As stated in the article referred to, these ribs are quite different from those described by Sordelli for *C. acicula.*

Pl. xiii, fig. H gives a camera lucida drawing of a central, lateral and marginal tooth. Fig. 1 gives a still more magnified view of the transition and marginal teeth, not drawn, however, by camera lucida.

Jaw low, wide, slightly arcuate, ends attenuated; whole surface covered with about 22 crowded, broad, flat ribs, denticulating either margin.

Lingual membrane long and narrow. Teeth 18 – 1 – 18, with 4 perfect laterals. Centrals with their base of attachment long, narrow, their reflected portion about one-half the length of the base of attachment, tricuspid; the middle cusp stout, with a short blunt cutting point, side cusps subobsolete, but with small, distinct cutting points. Lateral teeth with their base of attachment subquadrate, much longer, and very much broader than that of the centrals, the reflected portion short, stout, tricuspid, the middle cusp very stout and long, reaching the lower edge of the base of attachment, beyond which projects the short, stout cutting point; side cusps subobsolete, but bearing distinct, though small cutting points. There are four perfect laterals, the fifth tooth being a transition to the marginals, by the base of attachment being lower, wider, not exceeding the reflected portion, with one inner large cusp bearing one outer large cutting point representing the outer cutting point of the first four lateral teeth and one inner, still larger, cutting point, representing the middle cutting point of the first four laterals, and one smaller, outer cusp, bearing one small, sharp, bifid cutting point, representing the outer side cutting point of the first four laterals. The sixth tooth has the largest cutting point bifid. The balance of the teeth are true marginals. They are very low, wide, with two low, wide cusps, bearing each several irregular, blunt cutting points.

The dentition of this species is, as would be anticipated, of the same type as the allied *Cœcilianella acicula* as figured by Lehmann (Lebenden Schnecken Stettins, p. 128, pl. xiii, fig. 43, and Sordelli, l. c., fig. 26). The jaw, however, has no appearance of the "brace" like ribs described in that species by Sordelli (Atti Soc. Ital. Sc. Nat., XIII, 1870, 49, pl. i, fig. 25). The ribs are quite like those figured of *Helix Lansingi* (Ann. Lyc. Nat. Hist. N. Y., XI, p. 75, fig 2 A) although they are narrower.

Stenogyra juncea, Gld.

Island of Huahine. Mr. A. Garrett.

The species was described originally as a *Bulimus*, in which genus it is retained by Pfeiffer. I do not find it in die Heliceen, ed. 2.

Lingual membrane with 28–1–28 teeth, eight of which are laterals. Teeth as in *S. hasta* as figured by me, Proc. Ac. N. S. Phila., 1875, pl. xx, fig. 2.

Strophia incana, Binney.

Key West. Mr. W. W. Calkins.

Jaw already described (Proc. Acad. Nat. Sc. Phila., 1875, p. 190, fig. 37).

Lingual membrane (see above reference) with 27–1–27 teeth. The change from laterals to marginals is as shown in the ninth and tenth tooth. There is the usual splitting of the inner cutting point beyond the ninth tooth. The extreme marginals are low, wide, with one inner, long, bluntly bifid cutting point and one outer, short.

All the changes from centrals to extreme marginals are shown in the figures. Pl. xiii, fig. J.

The splitting of the inner cutting point of the marginals was not detected by me before in *S. iostoma* and *mumia.* I have, however, lately found it in those species.

Bulimulus pallidior, Sowb.

Lower California. Mr. A. G. Wetherby.

Plate xii, fig. 1, represents the genital system. The penis sac is long, tapering at its end, where the retractor muscle is inserted. The genital bladder (g. b.) is globular, on a long, stout duct.

Bulimulus limnæoides, Fér.

St. Kitts. Dr. Branch to Mr. T. Bland.

Jaw (pl. xvi, fig. A.) low, wide, semitransparent, slightly arcuate, ends scarcely attenuated, blunt: anterior surface with about sixteen ribs, denticulating either margin. It is extremely difficult to decide upon the character of these ribs. Some appear to be a simple thickening of the jaw formed by the overlapping of distinct separate plates. Others remind me of the distant narrow ribs of most of the *Bulimuli*, of the character of the ribs in *Cylindrella*, etc. At other points upon the jaw there seem to be broad, flat ribs with narrow interstices.

Lingual membrane long and narrow (pl. xvi, fig. B.). Teeth as usual in the *Helicinæ*. The change from laterals to marginals is very gradual, the latter being but a modification of the former, with two cutting points, the inner the longer. Thus it appears that this species in its dentition agrees with *B. cinnamomeo-lineatus, pallidior, chrysalis, dealbatus, Guadalupensis, alternatus, sporadicus, solutus, sepulcralis, durus, Peruvianus, rhodolarynx,* and not with *laticinctus, Bahamensis, auris-leporis, papyraceus, Jonasi, membranaceus, trigonostomus, flavidus, virginalis, convexus, Vincentinus, Lobbi, alternans, multifasciatus, primularis* (see Ann. Lyc. N. H. of N. Y., XI, 34 et seqq.).

Teeth 30–1–30 with about ten laterals. The outer cutting point of the marginals is sometimes bifid.

Cylindrella Poeyana, Orb.

Key West. Mr. W. W. Calkins.

Jaw as usual in the genus, with about 40 delicate ribs.

Lingual membrane long and narrow (pl. xv, fig. F). Teeth 14 – 1 – 14 of the same type as I have already shown to exist in this subgenus *Gongylostoma* (see *C. elegans*, Pfr. Proc. Phil. Ac. Nat. Sc., 1875, pl. xx, fig. 6).

Cylindrella ornata, Gundl. (*Gongylostoma*).

Cuba. Cabinet of Mr. Bland.

Jaw not observed.

Lingual membrane with 18 – 1 – 18 teeth, of which three only are well formed laterals, the change to marginals being very gradual. The type of dentition is the same as I have described in *C. Poeyana* (see above). It will be noticed in my figure F of plate xv, that there is a slender, simple, upper prolongation or pedicle above the inner, palmate cutting edge, as well as the pedicle on which the outer cutting edge rests. This is the case also in *C. elegans* and *C. Poeyana*, and may, therefore, be considered characteristic of the section *Gongylostoma*.

Amphibulima Rawsonis, Bland in litt.

Governor Rawson to Mr. T. Bland. Island of Montserrat, between Nevis and Guadeloupe.

Plate xiii, fig. C, represents the genital system. There are no accessory organs.

The jaw is as usual in the genus (see Proc. Phila. Ac. Nat. Sc., 1874, pl. viii, fig. 2, for that of *A. rubescens*). About 33 ribs, those at the upper centre of the jaw running obliquely and meeting or ending before reaching the lower margin.

Lingual membrane (pl. xiv, fig. E) as usual in the genus. Centrals with the base of attachment very much larger than that of the laterals, and with an enormous, single, broad, long, rapidly and obtusely pointed cutting point. No side cusps or side cutting points. Laterals of the form usual in the *Helicinæ*, with a stout, inner cusp, bearing a broadly truncated, short cutting point, and a small side cusp bearing a short cutting point.

The change from laterals to marginals is shown in the 10th, 15th and 27th teeth in the plate.

The marginals (28th and 68th teeth in the plate) have a long, narrow base of attachment, which near its lower margin bears a short, slightly expanding, bluntly trifid cusp: from this cusp springs a short, expanding, bluntly denticulated, broad, cutting edge, the inner denticle the largest. This cutting edge is shown in the 67th and 68th teeth on a more enlarged scale. There is great variation in the denticulation of the cutting edge.

There are 68 – 1 – 68 teeth.

The peculiarity of this membrane is the enormous development of the central tooth.

I have (l. c.) given figures of the dentition of *A. patula*, Brug., of St. Kitts and of Dominica, of *A. appendiculata*, Pfr. of Guadeloupe, and of *A. rubescens*, Fér. of Martinique.* Dr. Fischer (Journ. de Conch. XXII, 1874, pl. v), figures that of *A. depressa* of Guadeloupe, and *A. patula* of Guadeloupe.

Dr. Fischer also (l. c.) figures the dentition of *A. rubescens*. He gives inner side cutting points to the lateral teeth which I did not find in my specimens. His figure of the dentition of the Guadeloupe *A. patula* is certainly specifically distinct from the St. Kitts and Dominica form. It seems as if there were the following distinct species of *Amphibulima: depressa*, *appendiculata*, *rubescens*, *patula* of Guadeloupe, *patula* of St. Kitts and Dominica and *Rawsonis*.

It is with extreme regret that I find the *Amphibulimæ* still treated as species of *Succinea* by Dr. Pfeiffer in vol. VII of his Monographia, even as late as the present year. Messrs. Fischer and Crosse, as well as Mr. Bland and myself, have

---

* My friend Mr. Bland and myself were indebted to Gov. Rawson of Barbados, for specimens of this last, as well as for many other valuable West Indian species. The sense of our great obligation to him is increased at this moment by hearing that he has left Barbados to settle permanently in England.

shown the genus to be widely distinct from *Succinea*, in its jaw, its lingual membrane, and its genital system.

Succinea campestris, Say.

St. Augustine, Fla.

Genitalia as in *S. obliqua*, Say, figured under the name of *S. ovalis*, by Leidy, Terr. Moll. U. S., I. pl. xiii. fig. 1–3.

Succinea pallida, Pfr.

Raiatea Isl. Mr. A. Garrett.

Lingual membrane (pl. xvii, fig. 7) with 30–1–30 teeth, with about eleven laterals, but the change into marginals is very gradual. The figure shows a central, first lateral and a marginal in the fifteenth tooth.

Jaw as usual in the genus: no anterior ribs.

Succinea papillata, Pfr.

Huahine Isl. Mr. A. Garrett.

Jaw as usual: no anterior ribs.

Lingual membrane (pl xvii, fig. 6) with 25–1–25 teeth; nine laterals, the tenth tooth having its inner cutting point bifid. Some of the outer laterals have their outer cutting point bifid.

Tornatellina aperta, Pease.

Huahine Isl. Mr. A. Garrett.

Among the species received from Mr. Garrett were two of this genus, *T. aperta*, Pse. and *T. oblonga*, Pse. I did not succeed in extracting the jaw of either. With the lingual membrane I was more fortunate, which is the more satisfactory from the fact of the dentition being quite similar to that which Mr. Bland and myself have described for *Achatinella*, s. s., *Partulina*, etc., sub-genera of *Achatinella* (Ann. Lyc. N. H. of N. Y., X. 331). From the exceeding minuteness of the individual teeth I find great difficulty in counting the cutting points. They seem to be about eight, in the form of regular denticles, not of unequal size as in *Achatinella*.

Tornatellina is recognized as a genus by Pfeiffer (Mon. VI), but by von Martens (Die Heliceen) is considered as a subgenus of *Cionella*. It now remains to be seen whether this peculiar dentition is shared by other species.

I am indebted to my friend, Mr. A. T. E. Lansing, for the drawing of the teeth here given. It represents the central, with the first and second side teeth. There are an exceedingly large number of teeth beyond this, of the same type quite to the exterior margin of the membrane. The teeth are arranged obliquely in waving rows, as is also the case in *Achatinella*.

Tornatellina oblonga, Pease.

Island of Huahine. Mr. A. Garrett.

Dentition same as in the preceding species.

Achatinella.

Already in connection with my friend, Mr. T. Bland (Ann. Lyc. Nat. Hist. of N. Y., X, 331, pl. xv), I have described and figured the jaw and lingual dentition of several groups or subgenera of *Achatinella*. Recently, I have received from Mr. J. G. Anthony, some more specimens in alcohol. I am indebted to Mr. J. H. Redfield for their identification.

I find *A. marmorata*, Gould, of which *A. plumbea*, Gul., already examined, is a synonyme, of the subgenus *Partulina*,* to have the same dentition as we have shown to characterize that subgenus as well as *Achatinella* s. s.

Of *Leptachatina* there was the following: *textilis*, Fér. The dentition is as in the other species of the subgenus examined by me. There are 26-1-26 teeth, with 8 laterals. On pl. xiv, fig. G, I figure the transition from lateral to marginal teeth, and two decided marginals. These last

---

* I use the subgeneric names of Von Martens.

show the two cutting points which characterize the section *b* (see my paper referred to above, p. 334). On the same membrane, however, are some marginals having three cutting points and some which are quite pectinate, being, therefore, like my section *c* to which I formerly referred the subgenus. This variation shows that my distinction between *b* and *c* was not well founded.

Of *Laminella* there was one species: *A. obesa*, Newc. The jaw is like my fig. 7 (l. c.). Teeth 27 – 1 – 27, of same type as other species of the subgenus (see my paper, l. c.). I have, however, figured the 19th tooth (pl. xiv, fig. H), to show that here, again, I do not find the character of only two cutting points to be constant in the marginals, the outer cutting point being trifid in the tooth figured.

Of *Newcombia* there was *A. venusta*, Mighels. There are 24 – 1 – 24 teeth, with about 8 laterals (pl. xiv, fig. D). Here, again, the marginals figured are pectinate, though others are simply with two cutting points as I formerly (l. c.) supposed the case in all species of this subgenus. Jaw slightly arcuate, with blunt ends; a few vertical wrinkles.

From my finding the variation I have noted above in the marginal teeth of *Leptachatina* and *Newcombia*, I am forced to doubt the accuracy of the distinction in my sections *b* and *c* (see l. c).

There were also specimens of *Achatinella auricula*, Fér., which is included in *Achatinella* by Pfeiffer (Mon. VI), but referred by von Martens to *Partula*. The dentition proves it to be an *Achatinella*, being of the same type as *Achatinella* s. s., and *Partulina*.

Note on the Classification of the Achatellinæ.

BY THOMAS BLAND.

In the paper by my friend Mr. W. G. Binney and myself, "On the Lingual Dentition and Anatomy of Achatinella and other Pulmonata" (Annals X, 1873), we adopted and gave particulars of the classification of v. Martens (Die Heliceen, ed. 2) and came to the following conclusion, viz., that three groups are indicated by the forms of lingual dentition in the genus *Achatinella*.

a. *Partulina*, *Achatinella* s. str.

b. *Newcombia*, *Laminella*.

c. *Leptachatina*.

As regards the subgenera (of v. Martens) not represented among shells received from Mr. Gulick, we concluded, judging from the shell alone, that *Bulimella* and *Apex* belong to the group *a*, and *Labiella* rather to *b* or *c* than to *a*.

Considering the intimate acquaintance of my friend, Mr. Gulick, with the genus, and his publication of a classification of the *Achatellinæ* (Proc. Zool. Soc., 1873), it seems to me very desirable that his views should be compared with those of v. Martens, with especial reference to the results obtained from examination of the dentition.

In the foregoing paper by Binney, he expresses doubt as to the validity of our group *c*, and for my present purposes I therefore adopt two groups only, *a* and *b*, as indicated by the dentition of the species.

Gulick's classification is as follows:—

ACHATELLINÆ.

A. *Arboreal Genera.*

1. *Achatinella*, Swainson.
   Type *A. vulpina*, Fér.
   This is equivalent to the s. g. *Achatinella* s. str. of v. Martens.
2. *Bulimella*, Pfeiffer.
   Type *B. rosea*, Sw.
   This agrees with the s. g. *Bulimella* of v. Martens.
3. *Apex*, v. Martens.
   Type *A. decora*, Fér.
   This also agrees with the s. g. *Apex*, v. Mart.
4. *Laminella*, Pfeiffer.
   Type *L. gravida*, Fér.
   Laminella, Gulick, includes section *b* of *Newcombia*, v. Mart., but otherwise agrees with *Laminella* of that author.
5. *Partulina*, Pfeiffer.
   Type *P. virgulata*, Mighels.
   Gulick embraces in this s. gen. two sections, *Perdicella* and *Eburnella*, proposed by Pease, the type of the former placed in *Leptachatina* by v. Martens, of the latter in *Partulina*.
   Partulina, Gulick, otherwise agrees with the same s. gen. of v. Martens.
6. *Newcombia*, Pfeiffer.
   Type *N. Cumingi*, Newc.
   Gulick, in a measure, agreeing with Pfeiffer, confines this s. gen. to the plicated species of section *a*. *Newcombia*, v. Mart. *A. picta* of that section is in *Laminella*, Gulick.
7. *Auriculella*, Pfeiffer.
   Type *A. auricula*, Fér.
   Gulick and Pfeiffer correctly treat *A. auricula*. That and other species of the s. gen. (Bland & Binney, l. c.) have the same denti-

tion as species of *Partulina* and *Achatinella*, by no means of *Partula* in which *A. auricula* is placed by v. Martens. Gulick adopts *Frickella*, Pfeiffer, as a section of this s. gen.

B. *Terrestrial Genera.*

8. *Carelia*, H. & A. Adams.
   Type *C. adusta*, Gould.
   V. Martens places *C adusta* (as syn. of *bicolor*, Jay) in *Carelia*, s. gen. of *Achatina*. Pfeiffer includes species of *Carelia* in *Spiraxis*, C. B. Ad.
9. *Amastra*, H. & A. Adams.
   Type *A. magna*, C. B. Ad.
   This embraces species placed both in *Laminella* and *Leptachatina* by v. Martens. His type, *A. turritella*, Fér., of *Leptachatina*, is in *Amastra* of Gulick.
10. *Leptachatina*, Gould.
   Type *L. acuminata*, Gould.
   Gulick includes section *Labiella*, Pfr., treated by v. Mart. and Pfeiffer, as a separate s. genus.

In explanation of Gulick's views I add the following extract from a letter addressed to me by him, dated China, April 11, 1874.

"It appears from the teeth, that Pfeiffer was right in putting *Auriculella* with the *Achatellinæ*. I am sorry that when last in the Sandwich Islands, I did not succeed in getting any specimens of *Carelia* or *Newcombia* for examination. The latter is undoubtedly allied to *Partulina*, the former is more nearly allied to *Amastra*, but the form is so different, it would be very interesting to know about the teeth.*

Achatinella, *Bulimella* and *Apex* are evidently closely allied, but any classification which, like Pfeiffer's, recognizes the difference between the first two should also recognize the last, which is quite as distinct.

Achatinella and *Bulimella* are completely graded together by the varieties of *A. casta* and *A. oviformis*, Newc. and of *B. Sowerbyana*, Pfr.

Under the name *Laminella* I group only a few species, viz., *L. gravida*, *straminea* and *sanguinea* on Oahu, *citrina* and *venusta* on Molokai, *tetrao* on Lanai, *bulbosa* on E. Maui, and *picta* on W. Maui; these are all arboreal in their habits and sinistral in form, while the numerous species of *Amastra* are, with but rare exceptions, confined to the ground and dextral in form. *A. soror* and *A. acuta* are the only sinistral species that I now remember. Of most of the species, sinistral specimens have never been seen."

---

* I am disinclined to adopt the views of Pfeiffer and v. Martens, that *Carelia* belongs either to *Achatina* or *Spiraxis*.

The result of Binney's examination of the dentition of species of the genus *Achatinella*, as classified by Gulick, is as follows; group *a*, *Achatinella* s. str., *Bulimella*, *Apex*, *Partulina*, *Auriculella*, group *b*, *Laminella*, *Amastra*, *Leptachatina*. The subgenera of Gulick, of which the dentition is unknown, are *Newcombia* and *Carelia*.

It will be seen that the dentition of Gulick's arboreal s. genus *Laminella*, the species of which are said to be sinistral, is the same as of his terrestrial s. genera *Amastra* (the species with rare exceptions dextral) and *Leptachatina*.

V. Martens and Gulick place various species in different subgenera; this surely shows that the distinctions derived from consideration of shell alone are arbitrary, and the limits of the subgenera ill defined.

Pfeiffer, from form of shell alone (Mon. VI, 161), adopts the following names for the sections in which he arranges the species of Achatinella; the letters *a* and *b* indicate the group to which each section belongs from consideration of dentition.

a	1.	*Partulina.*	*b*	6.	*Laminella.*
a	2.	*Bulimella.*	?	7.	*Newcombia*, a.
b	3.	*Labiella.*	*b* ?	8.	" b.
a	4.	*Achatinellastrum.* (= *Achatinella* s. str.).	*b*	9.	*Leptachatina.*
			a ?	10.	*Frickella.*
b	5.	*Amastra.*	*a*	11.	*Auriculella.*

EXPLANATION OF THE PLATES.

PLATE XII.

Genitalia of:—

FIG.
1. Bulimulus pallidior, Sowb.
2. Helix aspera, Fér.
3. Helix spinosa, Lea.
4. Limax montanus, Ing.
5. Helix arrosa, Gld.
6. Helix septemvolva, Say.
7. Ariolimax Hemphilli.
8. Helix crispata, Fér.
9. Ariolimax Andersoni, J. G. Coop.

p. s. penis sac.
v. p. vaginal prostate.
r. retractor muscle.
g. b. genital bladder.
d. g. b. duct of same.
a. d. accessory duct of same.
ov. ovary.
t. testicle.
v. d. vas deferens.
f. flagellum.
e. epididymis.
ov. oviduct.
v. vagina.
or. external orifice.
pr. prostate.

PLATE XIII.

FIG.
A. Genitalia of Helix ruficincta, New.
d. s. Dart sac?
B. Zonites cerinoideus, Anth. Central, lateral and marginal teeth of the lingual membrane.
C. Genitalia of Amphibulima Rawsonis, Bl.
r. The retractor muscle of the penis sac.
D. Cœcilianella Gundlachi, Pfr. Jaw.
E. Orthalicus undatus, Brug. var.
Central, lateral and marginal teeth.
F. Genitalia of H. Jamaicensis, Chemn.
e. The long epididymis.
G. Same as D; enlarged still more to show the nature of the ribs.
H. Central, lateral and marginal teeth of same.
I. Same. Transition and marginal teeth.
J. Strophia incana, Binn. Central, lateral, transition and marginal teeth.
K. Same of Helix Carpenteriana, Bl.

PLATE XIV.

FIG. Lingual Dentition of:—

A. Helix fringilla, Pfr. See also pl. xv, fig. A.
B. Helix Jamaicensis, Ch.
C. Helix Studeriana, Fér.
D. Achatinella venusta, Mighels.
E. Amphibulima Rawsonis, Bl.
F. Glandina truncata, Say.
Central and first-lateral tooth and part of the latter still more enlarged.
G. Transition and marginal teeth of Achatinella textilis, Fér.
H. An inner marginal tooth of Achatinella obesa, Newc.

Plate XV.

Fig. Lingual dentition of:—

A. Helix fringilla, Pfr. See also pl. xiv, fig. A.
B. Helix Carpenteri, Newc.
C. D. Helix pubescens, Pfr.
Jaw and teeth.
E. Patula Cumberlandiana, Lea.
F. Cylindrella Poeyana, Orb.
G. Helix Diabloensis, J. G. Coop.?

Plate XVI.

Fig. Jaw and lingual dentition of:—

A. B. Bulimulus limnæoides, Fér.
C. Helix cereolus, Muhlf.
D. E. Helix exoleta, Binney (see p. 178).
F. Helix rufescens, Penn.
G. Helix dentiens, Fér.
H. Trochomorpha Cressida, Gld.
I. Nanina radians, Pfr.

Plate XVII.

Fig.

I. Cylindrella ornata, G. The central, first and last teeth.
II-IV. Binneya notabilis. Jaw, animal in half repose, and the central, first, sixteenth and last teeth.
V. Helix Tryoni, Newc. The central, first, eleventh, thirteenth, fourteenth, thirty-seventh and last teeth.
VI. Succinea papillata, Pfr. Central, lateral and marginal.
VII. Succinea pallida, Pfr. Central and first and fifteenth teeth.
VIII. Helix Van Nostrandi, Bl. Central, first, tenth, eleventh, nineteenth and twenty-fourth teeth.
IX. Helix facta, Newc. Genitalia.
X. Helix Tryoni, Newc. Genitalia.
XI. Helix fallax, Say. Genitalia.
XII. Helix Van Nostrandi, Bl. Genitalia.
XIII. Helix facta, Newc. Central, first, fourth, twelfth, thirteenth, seventeenth and twenty-sixth teeth.
XIV. Helix Hopetonensis, Shuttl. Genitalia.
XV. Helix alternata, Say, var. Genitalia.
XVI. Endodonta incerta, Mouss. Central, first and last teeth.
XVII. Patula Huahinensis, Pse. Central, lateral and marginal.
XVIII. Helix Rugeli, Shuttl. Genitalia.
XIX. Helix tridentata, Say. Genitalia.

Plate XVIII.

Fig. Lingual dentition of:—

A. Helix Harfordiana, J. G. Coop.
B. Helix leporina, Gld.
The right hand figure shows an abnormal first latera..
C. Helix Ingersolli, Bland.
D. Limax montanus, Ing.
E. Helix auriculata, Say.
F. Var. castaneus of D.
G. Ariolimax Andersoni, J. G. C.?
H. Ariolimax Hemphilli.
I. Anadenus.

XXI.—*Notes on certain Terrestrial Mollusks, with description of a New Species of the Genus Amphibulima.*

By THOMAS BLAND.

Read October 11th, 1875.

Helix Sagemon, Beck. (*Caracolus*).

In former papers (Annals XI, 81 and 148) I mentioned the receipt from Haiti of dead specimens of *H. bizonalis*, Desh., and referring to *H. Gaskoini*, Pfr., of Santo Domingo, remarked as follows: "looking at the variability of *H. Sagemon* of Cuba, I am much inclined to consider that *H. Gaskoini* is a variety of *bizonalis*." I am now indebted to Professor Linden of Buffalo, for several living specimens, collected by himself on Gonave Island, of a species not only very closely allied in every respect to, but I believe identical with the variety of *H. Sagemon*, described as *H. Arangiana* by Poey.*

The Gonave shells differ only from a Cuban specimen of *Arangiana*, received from my friend Don Rafael Arango, in having a white instead of a reddish brown peristome.

Seeing that this Cuban form belongs also to the Haitian fauna, and comparing *H. Gaskoini* with varieties of *H. Sagemon*, I am led to the conclusion that the former belongs to the latter group, and is not a variety of *bizonalis*. Indeed *H. Gaskoini* is strikingly similar to *H. marginelloides*, Orb., as figured by Pfeiffer (Nov. Conch. taf., XCI, figs. 9 and 10).

I submitted the animal of the Gonave shell to my friend W. G. Binney, who examined that of the Cuban *Arangiana* received from Arango. Binney reported that in jaw and dentition they agree, but the former has an outer small cut-

* Poey, in his Introduction to the Catalogue of Land and Fresh Water Mollusks of Cuba, by Arango (Repertorio I, 71), acquiesces in placing *Arangiana* and other allied species in the synonymy of *Sagemon.*

ting point to the outer laterals and marginals, appearing first on the ninth tooth.

In correspondence on the subject of this difference, Binney remarked as follows:

"I have reëxamined the linguals of the Gonave and Cuban shells, with a view of verifying the existence of the side cutting point. In the Cuban *Arangiana* (Notes, Proc. Acad. N. S. Phila., pl. XXI, fig. 1) you will see in the 8th and 11th teeth, an approach to a side cutting point by the bulging on the side of the main cutting point. This sometimes occurs on the extreme marginals also, both of *Arangiana* and *Sagemon* (l. c. fig. 4), while in the Gonave species it is very much more pronounced on the outer laterals. The difference is quite worth noting; whether it be specific may well be doubted, especially as we have never examined many linguals of any one species to ascertain the limits of variation."

The occurrence in Haiti of the Cuban *Sagemon* affords additional evidence of the faunal connection of the two Islands. Identical species are, however, rare. The following may be mentioned as the most important: *Helicina rugosa*, Pfr., *Succinea ochracina*, Gund., *Zonites Gundlachi*, Pfr., *Helix Boothiana*, Pfr., *Montetaurina*, Pfr., *vortex*, Pfr., *Oleacina oleacea*, Fér., *Strophia striatella*, Fér., *microstoma*, Pfr., *Macroceramus Gundlachi*, Pfr., *Coecilianella Gundlachi*, Pfr., *Stenogyra hasta*, Pfr.

Helix cepa, Mull. (*Cepolis*).

Prof. Linden found in the vicinity of Port au Prince, living specimens of *H. cepa*, var. *minor*. The color is an uniform, very dark (blackish) chestnut,—rather more rufous at the apex; the pale band scarcely perceptible. I had not previously seen fresh specimens of this curious species.

Liguus virgineus, L.

This species doubtless lives on Gonave Island.

Prof. Linden found specimens inhabited by living *Pagurus*, "moving about briskly in an old pasture, at a distance of two miles from the nearest sea beach."

Bulimulus Bahamensis, Pfr.

One specimen was found by Prof. Linden near Port au Prince (at Fort Jacques), of the var. of *B. Bahamensis* collected by my friend Mr. D. Sargent, at Durham Creek, Great Inagua.

In a former paper (Annals X, 318) I remarked on the faunal connection of that Island with Haiti.

Amphibulima Rawsonis, nov. sp.

T. ovato-oblonga, tenuis, subruguloso-striata, lineis impressis sutura parallelis subdecussata, nitens, vix pellucida, fusco-cornea, maculis rufis raris ornata; spira brevis, obtusiuscula, rubescens; linea rufa infra suturam impressam posita; anfr. 3, ultimus convexus, antice perdeflexus, columella callosa, recedens; apertura obliqua, peroblongo-ovalis, intus nitido-cærulescens; perist. simplex, leviter incrassatum, margine dextro sinuato, columellari arcuato.

Shell ovate-oblong, thin, with rather rib-like striæ irregularly decussated by impressed lines parallel with the suture; shining, scarcely pellucid, rather dark horn-colored, ornamented with a very few reddish spots; spire short, rather obtuse, rufous; with a reddish line beneath the impressed suture; whorls 3, the last convex, much deflexed at the aperture; columella callous, receding; aperture oblique, oblong-oval, cœrulescent within; perist. simple, slightly thickened, right margin sinuous, columellar margin arcuate.

Long. 18; Diam. 10 mill.; Ap. longit. max. 14; Diam. max. (infra medium) 9 mill.

Habitat. Island of Montserrat, West Indies.

Remarks. This species is most nearly allied in form to *A. pardalina*, Guppy, of Dominica, but very distinct from *A. patula* and *rubescens*. The single specimen found was sent to me for determination by Sir Rawson W. Rawson, to whom I dedicate the species.

W. G. Binney, in the preceding paper, has described the jaw and dentition of the animal, pointing out the peculiarities of the latter as compared with other species of the genus.

As might be expected from the geographical position of Montserrat, the land shells inhabiting it, belong to the same fauna as that of the neighboring islands. With *A. Rawsonis*, were found *H. Josephinæ*, *B. exilis*, *Helicina Guadelupensis* and *picta*.

Helix Van Nostrandi, nov. sp. (*Triodopsis*).

This species is in form and character of the aperture very nearly allied to *H. introferens*, but is more decidedly costate, more convex at the base, with smaller umbilicus, and without the internal tubercle. It connects *introferens* and *vultuosa* with, but is quite distinct from *fallax*.

The measurements of a specimen with 6½ whorls, are, diam. max. 12½: min. 11, mill. Alt. 7 mill. Of a specimen with 6 whorls; diam. max. 10; min. 8 mill.; alt. 5 mill.

Several specimens were collected at Aiken, S. Carolina, in the winter of 1874–5 by Miss Emma Van Nostrand, daughter of my esteemed friend Mr. Henry D. Van Nostrand.

Mr. W. G. Binney has, in the preceding paper, described the dentition of this species.

XXII.—*Some Additional Light on the so-called Sterna Portlandica, Ridgway.*

By Wm. Brewster.

Read Nov. 1, 1875.

Shortly after Mr. Ridgway's article on this supposed species appeared in the "American Naturalist," I published a few additional notes on the same subject in the "American Sportsman" (Jan. 16, 1875). Having since been enabled by the acquisition of a fine series of terns to make some further investigations into the matter, I am now not a little disposed to question the specific validity of *S. Portlandica*, and trust in the course of the present paper to show clearly its true position.

Among the terns before me are eight specimens collected on Muskegat Island, Mass., between the respective dates of July 1st and August 9th; of these I will briefly describe the most extreme example.

In size and proportion of parts, similar to *S. hirundo*. Forehead, sides of head, neck all around, throat and entire under parts, clear, pure white. Mantle, rump, and upper surface of tail, pale pearly blue. Occiput, crown, and space around eye, sooty black. A dark, slaty, cubital bar on the wings. Bill deep glossy black, tipped with pale yellow, and with but the faintest possible suspicion of a reddish tinge at the base of the lower mandible. Tarsi and feet black, also with a slight shade of reddishness, perceptible however, only when the parts are exposed to the strongest light.

Of the remaining seven specimens five are precisely similar in every respect but one, namely, in the slightly increased reddishness of the feet and tarsi. The seventh bird has the tarsi dark red with a blackish cast, while at the base of the otherwise perfectly black bill is a small but distinctly outlined area of brick red, confined almost entirely to the lower mandible and encroaching but slightly upon the upper. In the eighth bird we find the tarsi and feet clear, bright coral, the bill black, with the lower mandible dull red as far out as the gonys. Through this series of eight specimens there runs but little variation of plumage, excepting that the increasing reddishness of the tarsi and bill is regularly correlated with a whiter shade in the color of the rump and upper surface of tail, and a gradual decadence of the dark bar on the wing, which mark, well known to indicate immaturity, is altogether wanting in the last specimen.

We now pick up a tern of a still more advanced stage. The white of the forehead is encroached upon and narrowed down by the black of the crown, the tarsi and feet are coral without any tinge of duskiness, the bill is bright, clear, red as far out as the angle of the gonys on both mandibles, and the rump is now for the first time entirely white. From this specimen we find an easy and complete transition through birds with redder and still redder bills and white foreheads spotted and blotched with black, up to the typical, adult *Sterna hirundo*, with its black cap and red bill simply tipped with black. A more complete and perfect series could not be desired than that we have before us connecting the bird first described with the typical *Sterna hirundo*. Let us compare this same black billed, black legged *hirundo* with our specimen of *Sterna Portlandica*, taken at Muskegat Island, July 1st, 1870.

The two birds placed side by side, a careless observer would say at once they are the same, and indeed the general effect is surprisingly similar. The pattern of the head is precisely identical, the under parts in both are pure white, the mantle dark pearly ash, and the cubital bar nearly equal in color and extent. But the rump of *Portlandica* is emphatically white in decided contrast with the ashy one of the other bird, and upon comparing the shape and proportions of the tarsi, feet, bill, etc., the two in this respect, are found to differ irreconcilably. Evidently *S. Portlandica* is not to be confounded with the bird we have been studying.

What then are its true affinities? Let us take up a specimen of *Sterna macrura*, and ignoring for the moment all discrepancies of *color*, compare it carefully with *Portlandica*. Part for part it agrees perfectly; not a measurement of bill, feet, tarsi, wings or tail, but can be exactly matched in the series of *macrura* before us. Undeniably then the difference is *purely one of color*.

But it may be urged the Arctic tern never in any plumage possesses a black bill and feet. True it has never *been known* to have these parts so colored, neither has *S. hirundo;* and yet we have just traced a bird of the size and proportions of *hirundo*, but with the bill and feet black, or nearly so, directly and unmistakably up through closely connecting forms, into the ordinary typical plumage of that bird. Now why should not *S. macrura* be subject to the same variations of color? It is a bird very closely allied to *hirundo* and with—so far as is known—nearly the same seasonal changes of plumage. What can be more likely than that *S. Portlandica* bears the same relation to *macrura* that our black billed bird does to the adult *hirundo*. With as good a series of skins of *Sterna macrura* as that now at our command of *S. hirundo*, there can be but little doubt that this point could be directly established. At present we have only analogy to reason by, but the indirect evidence is most strong. The fact that *Portlandica* has the rump white is very pertinent, inasmuch as *Sterna macrura* is the only species among those we have named, whose nestlings have not that part more or less washed with slate or pearly blue. Two specimens of undoubted young *macrura* before us, though not sufficiently feathered to fly at the time of their capture, still have the rump of most immaculate whiteness. Our specimen of *Portlandica* has the bill, tarsi and feet, *absolutely black;* but in this respect it probably represents an extreme and perhaps accidental limit of variation.

The Smithsonian specimen we have never seen, but in the past connection, mark the following clause taken from Dr.

Coues' description of that example (Birds of the Northwest, p. 691). He says, "bill and feet black, *but the latter with a perceptible reddishness.*"* Now here we have an approach, however slight, to the red bill and feet of *S. macrura*, the first link in fact of a chain or series of specimens which is required to connect the two stages of plumage.

Dr. Coues in the article above quoted, compares *Portlandica* with *Dougalli;* but if our specimen be identical with the type (and it has been unqualifiedly declared to be so, by the best judges, Dr. Coues himself included), he is surely at fault, for in almost every respect does our bird differ. The wings are much longer, the tarsi shorter and "the size of the white areas on the inner webs of the primaries" is decidedly *not* "exactly as in *Dougalli.*" In *Dougalli* these white areas run along the entire length of the feather on its inner edge, narrowing as they approach the tip, where they again broaden out and including the extreme point of the feather, extend a little way back on the margin of the outer web.

In Portlandica they come entirely to an end a full inch from the tip of the feather, and in this and every respect the pattern of coloration of the primaries is precisely the same as in *S. macrura*. Neither is the bill of our specimen at all "identical" either in "shape or size" with that of any example of *S. Dougalli*, young or old, in the series of some forty specimens of that bird before us, but as previously stated it is *precisely similar* to the average bill of *Sterna macrura*.

Another point of resemblance to *macrura* exists in the presence of a few feathers on the under parts, which are tipped with plumbeous, faintly but yet distinctly. These feathers are somewhat isolated and give the plumage a soiled appearance.

Again the Massachusetts specimen of *Portlandica* was taken on a portion of Muskegat Island, where the Arctic

* The italics are our own.

terns breed apart from the other species, and at Portland, Me., whence the type specimen was obtained, *Sterna macrura* is one of the most abundant terns.

Now supposing the relationship of *Portlandica* to *macrura* to be granted, as we consider that of our other black billed tern to *hirundo*, to be proven, the question at once arises, what is this peculiar condition of plumage, and how accounted for? The young of *hirundo* and *macrura* are not described as with black bill, tarsi and feet, in their first fall and winter plumage, and assuredly these members cannot become *darker* as the bird advances in age. Now strange as it may appear, this is precisely the fact. With the special purpose of obtaining information on this point, another expedition was made to the breeding ground of the terns after the capture of the black-billed birds in July and August, and a large series of young and fall specimens of *Sterna hirundo* collected, careful notes being taken on the color of the bill, feet, etc., while the birds were freshly killed. The facts elicited by a careful comparison of specimens are briefly as follows. The color of the bill and feet in chicks a few days old varies individually to a considerable extent, but in the average the tarsi and feet are light, while on the bill, reddish or orange-colored areas predominate over the dusky or black.

In birds nearly or just able to fly the bill averages much darker, in most instances the whole of the upper mandible being black or dark brown with the exception of the maxillary tomium, which is light, like the lower mandible. After this period, as the bird advances in age the black area of the bill spreads, the forehead whitens and the brown and gray tipping of the feathers of the back wears off.* To this rule there are, however, a few exceptions, some birds with a nearly pure mantle and snow white forehead, having the

---

* All the specimens of which we are now speaking are birds of the year, collected in Sept. and Oct., but owing to the persistency with which their nests are broken up by the eggers, their ages are various, several taken at the latter date being scarcely able to fly.

lower mandible red as far out as the gonys, but in by far the greater number of cases, where the mantle has nearly lost its rusty spotting, and the forehead becomes pure white, the bill is nearly and in some examples, entirely black, with but a slight reddishness at the base.

With the greater or less amount of black on the bill is usually correlated a darker or lighter color of the feet and tarsi, but this rule also has one or two exceptions in the series. Now to return. The black-billed birds taken in July and August cannot be birds hatched this season. That is manifestly impossible, for they are all in perfectly developed plumage, and the mantle is as clear and immaculate as in mature specimens. What then are they? They are birds that have completed the first year only of their existence; birds that in the fall of the previous year had the mantle slightly obscured by brownish blotchings, the bill nearly black and the tarsi and feet dark: in short, birds like the ones we have just been examining. The dark color of the bill and legs has since spread and intensified. Indeed one of the October specimens is so nearly like these summer birds, that had not its age been carefully determined by dissection, we should hesitate before calling it a bird of this season. Its bill and feet are quite as dark as the average of the summer specimens, and the mantle has become nearly immaculate. Now in this same category we would place *Sterna Portlandica*, referring its parentage of course, as before stated, to *macrura* instead of *hirundo*. Only one more question remains to be answered, namely; why are these black-billed birds so rare, if they represent a regular stage or plumage of species so common as *S. macrura* and *S. hirundo?* Here we are obliged to confess ourselves nearly at fault and can offer little more than conjecture.

It is, however, nearly certain that neither species while in this plumage breeds, and this is decidedly the opinion of the gentlemen to whom we are indebted for the most interesting and important specimens, an opinion founded moreover on dissection and observation of the habits while in life. Now such being the case, the natural tendency to wander, in individuals which are burdened by no family cares and have nothing to do but enjoy themselves, will scatter them away from the breeding grounds and thus render their capture much less likely. We do not, however, at the present time, feel at all sure that *all* the young of either *macrura* or *hirundo*, assume this plumage, and do *not* breed the first season; this is a point which future investigation can alone decide.

In conclusion, we desire to express our great indebtedness to Mr. E. B. Towne, Jr., of No. Raynham, and Mr. Jesse Warren of Newton, Mass. A large portion of the material investigated during the preparation of the present paper was collected by these gentlemen, and many of the conclusions herein arrived at were the result of their careful study while in the field, and were first suggested by them.

We have also to express our thanks to Messrs. G. N. Lawrence, J. A. Allen and C. J. Maynard, for the use of valuable specimens.

XXIII.—*Index to the Literature of Manganese*, 1596–1874.

By H. CARRINGTON BOLTON.

Read December 14, 1874.

* *General Literature*, 1740–1874; *for Minerals see next Section.*

1740	Pott		Examen chymicum magnesiae vitriariorum, Germanis Braunstein. Miscell. Berolinensia, VI. 40.
1765	Rinmann	Braunsteinkönig	Versuch einer Geschichte des Eisens. Abh. Schw. Akad. Wiss., 1765. 251.
			Vetensk. Acad. Handl., 1765. 241.
1767	Westfield	Researches	Mineral. Abhandl., 1767.
			See: Scheele's Chem. Essays. London. 1786.
1770	Kaim and Winterl		De metallis dubiis. Viennae, 1770. 4to.
1774	Scheele	Researches	Opuscula, I. 227.
			Abhandl. Schw. Akad. Wiss., XXXVI. 95.
			Vetensk. Acad. Handl., 1774. 89.
			Crell's N. Entd., I. 112 & 146.
			Scheele's Chem. Essays. London, 1786.
1774	Engeström		Vetensk. Acad. Handl., 1774. 196.
			Abhandl. Schw. Akad. Wiss., 1774. 201
			Scheele's Chem. Essays. London, 1786.
1774	Bergmann	Researches	Vetensk. Acad. Handl., 1774. 194.
			Abhandl. Schw. Akad. Wiss., 1774. 199.
			Bergmann's Opuscula, II. 201.
			Crell's Ann., 1784. II. 397.
			Crell's N. Entd. I, 156, 1781.
1775	Margraff	Researches	Abh. Acad. Wiss. Berlin, 1775. 3.
			Journ. de Phys., XV. 223.
1776	Hagen		Nova. Acta. Acad. Nat. Curios. VI Append. 329.
1778	Hjelm		Vet. Acad. Handl., 1778. 82.
			Abhandl. Schw. Akad., 1778. 78.
			Crell's N. Entd., VI. 164.
1779	de Morveau		Journ. de Phys., XIII. 470.
1780	de Morveau	Chameleon (?)	Journ. de Phys., XVI. 348.
1780	Anonymous	Researches	Vet. Acad. Handl. 1780, I, 282.
			Crell's N. Entd. VIII, 191.
1781	Ilseman		Crell's N. Entd. IV, 24.
1782	Bindheim	Chameleon mineral	Crell's N. Entd. V, 70.
			Schw. Berl. Ges. Naturf. Fr. IX, 101.
			Beob. Berl. Ges. Naturf. Fr. V, 451.
1785	Volta	Use of MnO^2 in preparation of chlorine	Crell's Ann. 1785, II, 433.
1785	Hjelm		Vet. Acad. Nya. Handl. 1785, 141.
1785	Gerhard	Dendritic figures	Crell's Ann. 1785, I, 56.

*For explanation of abbreviations, see the end of this paper.

1786	Hermbstädt	Preparation of O from MnO_2	Crell's Ann. 1786, I, 316.
1786	Rinmann		Crell's Ann. 1786, I, 357.
1787	Hermbstädt		Crell's Ann. 1787, I, 152 and 296.
1787	Hjelm		Crell's Ann. 1787, I, 158 and 446.
1788	Gmelin	Alloy with copper	Crell's Ann. 1788, II, 3. A. c. p. (1), I, 303.
1788	Porcel	Separation from iron	Journ. de Phys. XXXIII, 436.
1788	Achard		Abh. Acad. Wiss. Berlin, 1788-89, 32.
1789	Hjelm	Preparation of O from MnO_2	Vet. Akad. Nya. Handl. 1789, 161. Neue Abh. Schw. Akad. 1789, 149.
1789	Anonymous	Preparation of metal by wet process	A. c. p. (1), VI, 31.
1789	Klaproth		Crell's Ann. 1789. A. c. p. (1), VI, 6.
1789	Bindheim	Preparation of metal by wet process.	Schrift. Ges. Naturf. Fr. Berlin. IX, 101. A. c. p. (1), VI, 15. Crell's Ann. 1789, II, 31 and 117.
1789	Gadolin		Vet. Acad. Handl. 1789. Crell's Ann. 1790, I, 129. A. c. p. (1), IX, 97. Gren's. J. d. Physik. I, 264.
1790	Sage	Occurrence in Spathic iron	J. d. m. XVIII, 215.
1790	Sage	Researches	J. de. Phys. XXXVII, 28. Crell's Ann. 1790, II, 441.
1790	de Morveau	Chameleon mineral	J. de. Phys. XXXVII, 386.
1791	Fuchs		Geschichte des Mn. Jena. 1791.
1792	Hermbstädt	Separation from iron by tartaric acid	Crell's Ann. 1792, II, 315.
1792	Pelletier	Phosphide	A. c. p. (1), XIII, 137.
1792	Fuchs	Preparation of metal from sulphate	Crell's Ann. 1792, I, 225. A. c. p. (1), XIX, 359.
1793	Gmelin	Alloys	Crell's Ann. 1793, I, 99. A. c. p. (1), XIX, 367.
1794	Vauquelin and Bouvier		A. c. p. (1), VII, 287. Crell's Ann. 1794, I, 407.
1795	Bucholz	Sulphate, etc.	Beiträge. I, 29.
1796	Richter	Separation from iron	Crell's Ann. 1796, II, 300.
1797	Kirwan	Tech. estim.	Crell's Ann. 1797, II, 436.
1797	Kirwan	Magnetic properties	Trans. Roy. Irish Acad. VI, 177. Gilb. Ann. VI, 405.
1799	Proust	Occurrence in vegetable kingdom	J. de Phys. XLVIII, 469.
1799	Vauquelin	Separation from iron	J. d. M. V, 15.
1799	Phillips		Phil. Mag. (1), V, 214.
1800	Ritter	Magnetic properties	Gilb. Ann. IV, 20.
1801	Gazeran	Mn. in steel	A. c. p. (1), XXXVI, 61. Crell's Ann. 1801, II, 326.
1801	Bordier	Oxides	A. c. p. (1), XLI, 150.
1804	Proust	Occur. in meteorites	Gehlen's J. III, 429. Gilb. Ann. XXIV, 284, 296, 380.
1804	Thomson	Purification of Au, Ag by MnO_2 (?)	Gehlen's, J. II, 692.
1805	Ritter	Occurrence in meteoric iron	Gehlen's, J. V, 397. Schweigg. IV, (1), 23.

1805	Bucholz		A. c. p. (1). LVI, 86.
1805	Fourcroy	Monograph	Encyclopédie Méthodique. IV, 672.
1806	Brugnatelli		Gilb. Ann. XXIII, 214.
1806	de la Méthérie	Catalogue of analyses	J. de Phys. LXII, 337.
1807	Thénard	Occurrence in an aërolite	Gilb. Ann. XXIV, 198; 207.
1807	Proust	Sulphide	Gilb. Ann. XXV, 204.
1807	J. F. John	Researches	Gehlen's, J. III, 452; IV, 436. Ann. Phil. II, 172 and 263; III, 413. J. d. M. XXII, 130, 245 et seq.; XXIII, 195.
1808	Reynolds	Use in mnf. of steel	Repert. Arts and Mnftrs. XII, 151.
1808	Vauquelin and Fourcroy	Occurrence in bones	Ann. Mus. d' Hist. Nat. XII, 136. Brugnatelli, G. I, 497.
1811	Berzelius and Hedenburg	Sulphide	Schweigg. II, 160.
1811	Vauquelin	Sulphide	Gilb. Ann. XXXIX, 432. Ann. Musée. d. Hist. Nat. XVII, 16.
1811	Bucholz	Separation from Fe.	J. d. Mines. XXX, 301. A. c. p. (1), LXXIX, 310. Ann. Phil. II, 287.
1812	Pfaff	Separation from Fe.	Schweigg. IV, 368.
1813	Davy	Hydrated protoxide	Schweigg. VII, 514.
1813	Vogel	Oxides	Schweigg. VII, 191.
1813	Berzelius	Oxides	Trommsd. J. d. Pharm. (2), II, 359. Schweigg. VII, 76. A. c. p. (2), V. 149.
1813	Roloff	Chameleon Sol. a test for As_2O_3	Schweigg. VII, 420.
1814	J.Davy	Chloride	Schweigg. X, 329.
1814	Prechtl	Occurrence in steel	Schweigg. X, 96.
1815	Fischer	*vide* Roloff	Schweigg. XII, 194.
1815	Schweigger	Sulphate	Schweigg. XIV, 377.
1815	Hatchett	Sep. from Fe.	Ann. phil. II, 343. Schweigg. XIV, 352.
1815	Brandenburg	Sulphate	Schweigg. XIV, 336.
1815	Vauquelin	Occurrence in hair	Schweigg. XII. 194.
1817	Chevreul	Chameleon	A. c. p. (2), III, 42. Phil. Mag. L, 291. Schweigg. XX, 324. Trommsd. J. d. Pharm. (2), II, 188.
1817	Grotthuss	Sep. from Fe.	Schweigg. XX. 272.
1817	Clarke	MnO_2 conducts electricity	Schweigg. XXI, 391.
1817	Chevillot and Edwards	Examination of "chameleon mineral"	Trommsd. J. d. Pharm. (2). II, 199; III, 133. A. c. p. (2), IV, 287; VIII, 237. Schweigg. XX, 332.
1817	Berzelius	Oxides	A. c. p. VI, 204.
1818	Berzelius	At. Wt.	Schweigg. XXII, 336.
1818	Berzelius	Seleniate	Schweigg. XXIII, 456.
1818	Mushet	Occurrence in steel	Gilb. Ann. LVIII, 156.
1818	Arfvedson	Oxides	Afhandl, Fysik. K. och. M. 1818, 222. Journ. de Phys. LXXXVI, 464. Schweigg. XLII, 202. Ann. Phil. VII, 267. Trommsd. N. J. Pharm. X, 170.

1818	Turner	Oxides	Edinb. J. Sci. IV. Phil. Mag. (2), IV, 22 and 96. Karsten's Archiv. XIV, 359. Schweigg. XXVI, 166.
1819	Faraday	Separation from Fe.	Quart. J. Sci. VI, 357.
1819	Pfaff	Sep. from Fe.	Schweigg. XXVI, 91.
1819	Clarke	Reduction of oxides	Gilb. Ann. LXII, 353.
1820	Pfaff	Oxides	Ann. Gen. des Sci. Phys. VI, 1820, 368.
1820	Van Mons		Ann. Gen. des Sci. Phys. V, 1820, 284.
1820	Doebereiner	Prep. of O by $Mn O_2$ and $H_2 SO_4$	Schweigg. XXVIII, 247. A. c. p. (2), XVI, 109, 267.
1820	Forchhammer	Two acids	Trommsd. J. d. Pharm. VI, (1), 277. Ann. Gen. Sci. Phys. Ann. Phil. (1) XVI, 130. Quart. J. Sci. X, 175.
1820	Gahn	Blowpipe reactions	Schweigg. XXIX, 308.
1821	Forchhammer	Oxides	Ann. Phil. (2), I, 50.
1821	Braconnot	Mn in waters	A. c. p. (2), XVIII, 223. Schweigg. XXXIII, 487.
1821	Pfaff	Action H_2S on $Mn SO_4$	Schweigg. XXXIII, 475.
1821	Herschell	Sep. from Fe.	Ann. Phil., N. S. III, 95. A. c. p. (2), XX, 304. Schweigg. XXXII, 452.
1822	Ure		Dingler pol. J. VIII, 451.
1822	Berthier	Researches on oxides	A. c. p. (2), XX, 186. Dingl. pol. J. IX, 243. Schweigg. XXXVI, 303.
1822	Gmelin	Cyanide Mn and K.	Schweigg. XXXVI, 223.
1824	Fromherz	Permanganic Acid	Schweigg. XLI, 257. Pogg. XXXI, 677.
1825	Fromherz	Colored salts	Schweigg. XLIV, 327.
1825	Fromherz	Sulphides	Pogg. I, 50.
1825	Geiger		Geiger. Mag. Pharm. XI, 27.
1825	Berzelius	Fluoride	Pogg. I, 24.
1825	Berzelius	Fluosilicate	Pogg. I, 197.
1825	Berzelius	Sulphocarbonate	Abh. Schw. Akad., Wiss. 1825. Pogg. VI, 454. A. c. p. (2), XXXII, 87.
1825	Gmelin	Physiological action of Mn	Schweigg. J. XLIII, 110. Edinb. Med. Surg. J. XXVI, 137.
1826	Berzelius	Sulpharsenate	Pogg. VII, 24 and 143.
1826	Bouis	Analysis	Dingler, pol. J. XXI, 331.
1826	Unverdorben		Trommsd. J. Pharm. (1), IX, 36. Pogg. VII, 322.
1826	Nasse	Use in coloring porcelain	Schweigg. XLVI, 79.
1826	Dumas	Acichloride	A. c. p. (2), XXXIII, 390. Berz, Jahresb, VII, 112.
1826	Berzelius	Sulphomolybdate	Pogg. VII, 274.
1826	Doebereiner		Doeb. Lehrb. d. Chem. 1826.
1826	Berzelius	At. Wt.	Pogg. VIII, 185; XIV, 211.
1826	Heeren	Hyposulphate	Pogg. VII, 55 and 180.
1827	Phillips		Ann. Phil. 1827, 341. Dingler pol. J. XXIV, 371.
1827	Hünefeld	Sulphate	Schweigg. L, 346.

1827	Stromeyer	Sep. from CaO and Al_2O_3	Pogg. XI, 169. Schweigg. LI, 222. Geiger's Mag. Pharm. XXII, 339.
1827	Dumenil	Sep. from Fe.	Schweigg. LI, 225.
1827	Wöhler	Fluoride	Pogg. IX, 619. A. c. p. (2), XXXVII, 101.
1827	H. Rose	Phosphite	Pogg. IX, 33 and 224.
1827	Unverdorben	Sylvate	Pogg. XI, 400.
1827	McMullen	Prep. of Cl	Ann. Phil. 1827, 142. J. of Roy. Inst. XXII, 231. Phil. Mag. I, 313.
1827	Dumas	Acichloride	Pogg. XI, 165; Quart. J. Sci., II, 475. A. c. p. (2), XXXVI, 82. Berz. Jahresb. VIII, 177. Geiger's Mag. Pharm. XXI, 122.
1827	QuesnevilleJr.	Separation from Fe.	Journ. de Pharm. A. c. p. (2), XXXIV, 198.
1828	H. Rose	Hypophosphite	Pogg. XII, 87.
1828	Pfaff	Sulphate	Schweigg. LIII, 121.
1828	Turner	Researches	Phil. Mag. 1828. Pogg. XIV, 211. Geiger's Mag. Pharm. XXVI, 111. Dingler. J. XXX, 74.
1828	Erdmann	Alloy with Cu	J. techn. Chem. I, 33.
1828	Sprengel	Occurrence in soils	J. techn. Chem. III, 68.
1828	Morin	Estimation of $CaCl_2O_2$ by $MnCl_2$	Bibl. Univers. 1828, 140. J. techn. Chem. III, 104.
1829	Lassaigne	Purification of oxide	A. c. p. (2), XL, 329. Schweigg. LVI, 163. Dingler. J. XXXIII, 126.
1829	Fischer	Reduction	Pogg. XVI, 128. Kastn. Archiv. XVI, 219. C. C. 1831, 689.
1829	Bonsdorff	$HgCl_2$ with $MnCl_2$	Pogg. XVII, 247 and 263.
1829	Berzelius	Vanadate	Pogg. XXII, 58.
1829	Graham	$MnCl_2$ and alcohol	Phil. Mag. IV, 265, Pogg. XV, 151.
1829	Martini	Sep. from Fe.	Schweigg. LVI, 162.
1829	Gay Lussac	Estimation	J. techn. Chem. IV, 274.
1829	Phillips and Turner	"Warwick oxyd"	Schweigg. LVI, 186.
1829	Henry and Plisson	Quinate	Journ. Pharm. 1829, 389. Geiger's Mag. Pharm. XXX, 91.
1829	Dingler		Kastner's Archiv. XVIII, 252.
1829	Wright	Recovery	Pat. Specif. Abr. Acids and Salts. 101.
1829	Bachmann	Metal and oxides	A. c. p. (2), XXXIX, 244. Pogg. XV, 284.
1830	Wurzer	Mn. in blood	Schweigg. LX, 481. Geiger. Mag. Pharm. XXXII, 379. Am. J. Sci. XXI, 370.
1830	Hünefeld	Preparation of manganates	Schweigg. LX, 133.
1830	Berzelius	At. Wt.	Geiger. Mag. Pharm. XXXII, 293.
1830	Brandes	Researches	Pogg. XX, 556; XXII, 225. Ann. d. Mines. (3), II, 320. C. C. 1831, 267.

1830	Berthemot	Bromide	A. c. p. (2), XLIV, 392.
1830	Fuss	Preparation pure MnO.	Schweigg. LX, 345. C. C. 1831, 107.
1830	Bachmann	Monograph	*See* Schweigg. LVIII, 388.
1830	H. Rose	Ammonio-sulphate	Pogg. XX, 148.
1831	Liebig and Wöhler	Protoxide	Pogg. XXI, 584. Geiger Mag. Pharm. XXXIV, 140.
1831	Becquerel	Detection by galvanism	Mém. de l' Inst. X, 286. A. c. p. (2), XLIII, 380. C. C. 1831, 809.
1831	Hünefeld and Wibmer.	Physiological action	C. C. 1831, 96.
1831	Liebig (?)	Separation from Fe.	Geiger's Mag. XXXV, 111. C. C. 1831, 747. A. c. p. (2), XLVIII, 290.
1831	Turner	Estimation of Ores	J. of Roy. Inst. I, 293. Rep. Pat. Inv. XI, 224. Phil. Mag. IX, 235. J. techn. Chem. X, 485. Ann. d. Mines. (3), II, 321. Dingler. XL, 212. C. C. 1831, 304. Am. J. Sci. XXI, 364.
1831	Sefström	Coloring glass	J. techn. Chem. X, 183.
1831	Fuchs	Separation from Fe.	Schweigg, J. LXII, 192. C. C. 1831, 461.
1831	Serullas	Perchlorate	A. c. p. (2), XLVI, 305. Pogg. XXII, 298. C. C. 1831, 529.
1832	McMullen	Bleaching power of MnO_2	Quart. J. Sci. XXII, 232. Quart. J. Sci. (2), II, 261. Pogg. XXV, 623, note.
1832	Burkhardt	Estimation	J. techn. Chem. XIII, 278.
1832	Lassaigne	Iodide	J. Chem. Med. V, 330. Ann. d. M. (3), I, 114.
1832	Ohlmann		Schweigg. LXVI, 239.
1832	Duflos	Estimation in ores	Schweigg. LXIII. 346, LXIV, 81.
1832	Mitscherlich	Acids	Abh. Acad. Wiss. Berlin, 1832. A. C. P. II, 5. A. c. p. (2), XLIX, 113. Schweigg. LXV, 62. Pogg, XXV, 287.
1832	Pearsall	Color of solutions	J. of Roy. Inst. IV, 49. Ann. d. Mines. (3), II, 319. Pogg. XXV, 622.
1832	Berthier	Analyses ores	Dingler pol. J. XLVII, 104. A. c. p. (2), LI, 79.
1833	Zenneck	Estimation	J. techn. Chem. XVIII, 75. Am. J. Sci. XXIX, 374.
1833	Göbel	Prep. MnO_2	Schweigg. LXVII, 77.
1833	Trommsdorff	Valerianate	Trommsd. J. Pharm. XXVI. A. C. P. VI, 201. Pogg. XXV, 154.
1833	Gay Lussac and Pelouze	Lactate	A. c. p. (2), LII, 410. A. C. P. VII, 46. Pogg. XXIX, 117.

1833	Wöhler	Permanganates	Pogg. XXVII, 626. Ann. d. Mines. (3), V, 457.
1834	Demarçay	Quantitative Separation	A. C. P. XI, 241.
1834	Berzelius	Tellurate	Pogg. XXXII, 595 & 607.
1834	Joss	Preparation of $H_2 Mn_2 O_8$	J. p. C. I, 125.
1834	Vogel	Prep. of Cl.	J. p. C. I, 446.
1834	Fromherz	Permanganates	Pogg Ann. XXXI, 677.
1834	Otto	Arsenate of Mn and NH_4	J. p. C. II, 414.
1834	Böttger	Action Hg Na on sulphate	J. p. C. III, 284.
1834	Doebereiner	Action alcohol on MnO_2	J. p. C. I, 452.
1835	Zeller	Separation from Fe	J. p. C. V, 33. C. C. 1835.
1835	Thomson	Estimation ores	Records Gen'l Sci. 1836, 412. Pol. Centr. 1836, 788. J. p. C. IX, 433. Ann. d. Mines. (3), XI, 249. Dingl. LXI, 55.
1835	Balard	Bromide	J. p. C. IV, 178.
1835	Bonnet	Reduction by As_2O_3	Pogg. XXXVII, 303.
1835	Everitt	Prep. of salts for technical uses	Phil. Mag. (3), VI, 193. J. p. C. V, 33. Dingler pol. J. LVI, 129. Pol. Centr. 1835, 360.
1835	Berzelius	Pyrotartrate	Pogg. XXXVI, 18.
1835	Gay Lussac	Volumetric estimation	A. c. p. Nov., 1835. Pol. Centr. 1836, 286. A. c. p. XVIII, 47.
1835	Gregory	Permanganic acid	J. pharm. XXI, 312. A. C. P. XV, 237.
1835	Winkelblech	Oxalate	A. C. P. XIII, 280. J. p. C. VI, 67.
1836	Graham	Sulphate	Trans. Roy. Soc. Edinb. VIII. Pogg. XXXVIII, 123. A. C. P. XX, 147.
1836	Baup	Pyrocitrate	A. C. P. XIX, 34.
1836	Regnault		A. c. p. (2), LXII, 349 and 381.
1836	Anthon	Tungstate	J. p. C. IX, 340.
1836	Wittstein		Buchn. Repert. LVII, 30.
1836	Zeller	Recovery of Cl residues	J. p. C. VII, 137. A. C. P. XX, 172.
1836	Osborn	$Mn Cl_2$ for nose bleeding	Allg. med Ztg Juli. 1836. A. C. P. XXI, 86.
1836	Böttger	Carbonate	Beitr. zur Phys. u. Ch. II, 12.
1837	Ebelmen	Analytical	Ann d. M. (3), XII, 607. J. p. C. XIV, 312.
1837	Gay Lussac	Use of MnO_2 in sep. CO_2 from SO_2	A. c. p. (2), LXIII, 333. A. C. P. XXIII, 79.
1837	Richter	Sep. from ZnO	J. p. C. IX, 159. Ann. d. Mines. (3), XIII, 460. A. C. P. XXIV, 309.
1837	Marchand	Sulphethylate	J. p. C. XII, 263.

1837	Berthier		Ann. d. Mines. (3), XI, 489.
1837	Gay Lussac	Decomp. of sulphate by carbon	J. p. C. IX, 67.
1837	Heller	Rhodizonate	J. p. C. XII, 228.
1837	Heller	Croconate	J. p. C. XII, 238.
1837	Brett		Phil. Mag. (3), X, 98 and 335.
1837	Böttger	Amalgam	Beitr. zur. Phys. u. Ch. I, 302, and III, 278. J. p. C. XII, 350.
1837	Rammelsberg	Cyanide of Mn. and K.	Pogg. XLII, 117.
1838	Cooper	Physiological action	J. de chim. Medicale. 1838. Pol. Centr. 1838, 29. Dingl. J. LXVII, 236.
1838	Anthon	Solubility of sulphate in alcohol	Buchner's Repert. II, 13. J. p. C. XIV, 125.
1838	Jahn	Sulphide	A. C. P. XXVIII, 101.
1838	Rammelsberg	Iodate	A. C. P. XXVIII, 213. Pogg. XLIV, 588.
1838	Wackenroder	Sep. from Fe. Ni and Co.	C. C. IX, 673.
1838	Simon		Buchn. Repert. LXV, 208.
1838	Wackenroder		Archiv. d. Pharm. (2), XVI, 114.
1839	Wöhler	Sep. from Co.	A. C. P. XXIX, 217. Ann. d. Mines. (3), XV, 492.
1839	Brown	Carburet	J. p. C. XVII. 492. Bullet. Scient. V, 203.
1839	Fikentscher	Techn. estimation	J. p. C. XVII, 173. Dingl. J. LXXIII, 204. Pol. Centr. 1839, 665.
1839	Binks	Recovery of Mn O_2	Pat. Specif. Abridge. Acids. Alkalies, etc. 149.
1839	Graham	Chloride	A. C. P. XXIX, 31.
1840	Böttger	Elect. depos.	Pogg. L, 49.
1840	Fellenberg	Action of Cl on sulphide	Pogg. L, 76.
1840	Erdmann	Mineral waters	J. p. C. XXI, 399.
1840	Ebelmen	Techn. recovery of Mn O_2	Ann. d. Mines. (3), XVII, 517.
1840	Münzing		Dingl. LXXVI, 364. Pol. Centr. 1840, 538.
1841	Rammelsberg	Sulphantimoniate	Pogg. LII, 193. A. C. P. XL, 286.
1841	Ullgren	Sep. from Co.	Chem. Gaz. I, 13. Berz. Jahresb. XXI, 147. Ann. d. Mines. (4), II, 206. A. C. P. XL, 266.
1841	Wöhler	Action of Cl on oxide	A. C. P. XXXIX, 253.
1841	Bensch	Chromate	Pogg. LV, 97. A. C. P. XLIV, 272.
1841	Warrington	Chromate	Phil. Mag. XXI, 380. Chem. Soc. Trans. 1842. A. C. P. XLIV, 272.
1842	Levol	Estimation	Dingl. J. LXXXV, 299. Ann. d. Mines. (4), II, 205. J. p. C. XXVI, 151. Pol. Centr. 1842, 874.

1842	Millon	Nitrate	A. c. p. Sept., 1842, 73.
			J. p. C. XXIX, 351.
			C. R. XIV, 905.
1842	Haidlen and Fresenius	Action of KCy on solutions	A. C. P. XLIII, 133.
1842	Rammelsberg	Hyposulphite	Pogg. LVI, 305.
1842	Lea	Estimation ores.	Am. J. Sci. (1), XLII, 81.
1842	Fresenius	Racemate	A. C. P. XLI, 20.
1842	Rammelsberg	Anal. Ps.	Leonh. Jahrb. 1842, 599.
1842	Otto	Test for Mn.	Chem. Gaz. I, 180.
			A. C. P. XLII, 347.
			Am. J. Sci. XLVII, 194.
			Ann. d. Mines. (4), III, 569.
1842	Otto	Estimation	Dingl. J. LXXXV, 296.
			Pol. Centr. 1842, 876.
1842	Meitzendorff	Sulphocyanide	Pogg. LVI, 73.
1842	Rammelsberg	Bromate	Pogg. LV, 66.
1843	Wächter	Chlorate	J. p. C. XXX, 326.
1843	Heldt	Citrates	A. C. P. XLVII, 180.
1843	Doepping	Succinate	A. C. P. XLVII, 275.
1843	Ebelmen	Estimation as MnO	A. c. p. (3), VIII, 503.
			Ann. d. Mines. (4), IV, 409.
			A. C. P. XLVIII, 369.
			Chem. Gaz. 1843, 685.
1843	Fresenius and Will	Estimation	Dingl. J. XC, 219.
			Pol. Centr. 1843, 394.
			Pamphlet, Heidelberg. 1843.
			Chem. Gaz. 1844, 52.
1843	Walters	Recovery	Pat. Specif. Abr. 197.
1844	Rieckher	Fumerate	A. C. P. XLIX, 46.
1844	Muspratt	Sulphite	A. C. P. L, 280.
1844	Schaffner	Hydrated oxide	A. C. P. LI, 170.
1844	Arrot	Recovery	Chem. Gaz. 1845, 73.
			Pat. Specif. Abr. 211.
1844	Arrot	Double sulphate	Phil. Mag. (3), XXIV, 502.
			Rep. Pat. Inv. 1845, 323.
			A. C. P. LII, 243.
			Pol. Centr. 1845, II, 430.
			Dingl. XCVI, 301.
1844	Böttinger	Sulphite	A. C. P. LI, 405.
	Apjohn	Ores from Cork	Trans. Irish Acad. II, 598.
1844	Rammelsberg	Anal. Kali-Ps.	Leon. Jahrb. 1844, 205.
1844	Elsner	Purification of Sulphate	Hoffmann's Mitth. 1843, 20.
			Pol. Centr. 1844, II, 48.
	Barnes and Mercer	Mordant	Chem. Gaz. 1844, N. 46.
			Pol. Centr. 1845, I, 384.
1845	Cloez	Sep. Co. from Mn.	Journ. Pharm. Feb., 1845.
			Chem. Gaz. 1845, 102.
1845	Crum	Test for Mn.	A. C. P. LV, 219.
			Chem. Gaz. 1845, 502.
			Am. J. Sci. (2), I, 262.
			Ann. d. Mines. (4), XI, 496.
1845	Schlieper	Alloxanate	A. C. P. LV, 280.
1845	Buchner	Tannate	A. C. P. LIII, 211.
1845	Delanoue	Ores of Orsay	Bull. Géol. Soc. Paris. III, 47.

1846	Phillips	Test for Mn.	Chemist, Apr. 1846. Am. J. Sci. (2), II, 259.
1846	Pierre	Sulphate of Mn and K+aq	A. c. p. (3), XVI, 239. J. p. C. XXXVII, 488.
1846	Ebelmen	Silicate	J. p. C. XXXVII, 257.
1846	Böttger and Will	Styphnate	A. C. P. LVIII, 288.
1846	Völker	On red color of salts	A. C. P. LIX, 27. Chem. Gaz. 1846, 396. J. p. C. XXXIX, 233.
1846	Völker	Sulphides	A. C. P. LIX, 35. J. p. C. XXXIX, 247.
1846	Levol	Estimation	J. p. C. XXXVIII, 341.
1847	DeVry	Analysis	A. C. P. LXI, 249. Pharm. Centr. 1847, 479. J. c. T. I, 19.
1847	Bobierre	Estimation	Moniteur Industriel. 1847, No. 1190. Dingler, Pol. J. CVII, 448.
1847	Maddrell	Metaphosphate	Chem. Soc. Mem. III, 273. A. C. P. LXI, 58.
1847	Engelhardt and Maddrell	Lactate	A. C. P. LXIII, 107.
1847	Rose, H.	Separation	A. C. P. LXIV, 417.
1847	Schönbein	Reagent	Pogg. LXXII, 450 and 466. Jahresb. 1847, 952.
1847	Barreswil	Separation from Co.	A c. p. (3), XVII, 53. Am. J. Sci. (2), II, 260. J. p. C, XXXVIII, 171. Pol. Centr. 1847, 642. Berz. Jahresb. XXVII, 214. Chem. Gaz. 1846, 159. J. de. Pharm. 1846, 189. Ann. d. Mines. (4), XI, 499. Dingler, J. C, 157. Jahresb. 1847, 974.
1847	Strecker	Criticism on Barreswil	A. C. P. LXI, 219. Chem. Gaz. 1847, 205. Am. J. Sci. (2), IV, 271. Pol. Centr. 1848, 1296.
1847	Lefort	Carbonate.	C. R. XXVII, 268. J. pharm. (3), XV, 18. Jahresb. 1847, 420.
1848	Herrmann	Sesqui salts	Pogg. LXXIV, 303. J. p. C. XLVI, 413. Chem. Gaz. 1848, 325. C. C. 1848, 508. Jahresb. 1848, 421.
1848	Schönbein	Reactions of Mn_2O_7	J. p. C. XLI, 228. Pol. Centr. 1848, 1291. C. C. 1847, 776. Jahresb. 1848, 421.
1848	Rose	Action of NH_4Cl on MnO_2	J. p. C. XLV, 116.
1848	Millon	Occurrence in blood	C. R. XXVI, 41. Pogg. LXXIV, 284. Pol. Centr. 1848, 606.

1848	Schwarzenberg	Pyro-phosphate	A. C. P. LXV, 150. Dingler, J. CIV, 467.
	Hautz	$Mn\,Cl_2 + NH_4\,Cl$	A. C. P. LXVI, 285. Jahresb. 1848, 393.
1848	Heintz	Phosphate	Pogg. LXXIV, 449. A. C. P. LXVIII, 257. Am. J. Sci. (2), VIII, 111. Chem. Gaz. 1848, 488.
1848	Ebelmen	Chromate	A. c. p. (3), XXII, 213. A. C. P. LXVIII, 269.
1848	Parkes	Metal	Pol Centr. 1848, 1338.
1849	Schrötter	Phosphide	Jahresb. 1849, 247.
1849	Millon		C. R. XXVIII, 42. Instit. 1849, 29. C. C. 1849, 203. Jahresb. 1849, 254.
1849	Cottereau	Occurrence in blood	J. chim. méd. (3), V, 179. Jahresb. 1849, 530.
1849	Fleitmann	Dimetaphosphate	Pogg. LXXVIII, 233 and 338. A. C. P. LXXII, 238.
1849	Bödeker	Phosphate	A. C. P. LXIX, 208. Chem. Gaz. 1849, 138.
1849	Muspratt	Selenite	A. C. P. LXX, 275.
1849	Ebelmen	Separation by means of $H_2\,S$	A. c. p. (3), XXV, 92. J. pharm. (3), XV, 266. J. p. C. XLVI, 305. A. C. P. LXXII, 329. C. C. 1849, 169. Chem. Gaz. 1849, 82. Jahresb. 1849, 592.
1849	Senarmont	Carbonate	C. R. XXVIII, 693. Instit. 1849, 177. C. C. 1849, 535. Jahresb. 1849, 225.
1849	Elsner		Berl. Gewerbe Handelsbl. 1849, No. 6. Dingl. J. CXII, 461.
1849	Schönbein	Action of Ozone	Pogg. LXXVIII, 162. Jahresb. 1849, 222.
1849	Rammelsberg	Anal. Ps.	Leon. Jahrb. 1849, 574.
1850	Ed. Davy	Test for Mn.	Irish Acad. Proc. IV, 345.
1850	Sobrero and Selmi	Action of Cl on chloride	A. C. P. (3), XXXIX, 161. J. p. C. L, 305. C. C. 1850, 615. A. C. P. LXXVI, 234. Jahresb. 1850, 314.
1850	Bibra	Occurrence in sea water	A. C. P. LXXVII, 90. C. C. 1851, 362. Jahresb. 1850, 621.
1850	Horsford	Occurrence in urine	Am. J. Sci. (2), XI, 259. Jahresb. 1851, 602.
1850	Stein	Arsenite	A. C. P. LXXIV, 222.
1850	Dubost	Technical	Br. d. Inv. LXXII, 140.
1850	Senarmont	Artificial minerals	A. c. p. (3), XXX, 137.
1850	Kekulé	Sulphethylate	A. C. P. LXXV, 289.
1851	Personne et L'Hermite	Acids	J. pharm. (3), XIX, 115 and 161.

1851	J. Davy	Incrustation of MnO_2	Edinb. Phil. J. (2), LI, 87.
1851	Fairrie	Chromate	Quart. J. Sci. IV, 300.
			J. p. C. LV, 255.
1851	Lefort	Purification	J. pharm. (3), XX, 243.
			J. p. C. LIV, 307.
1851	Reynoso	Permanganate	A. c. p. (3), XXXIII, 324.
			C. R. XXXII, 644.
			Instit. 1851, 138.
			J. pharm. (3), XX, 263.
			J. p. C. LIII, 126.
			A. C. P. LXXX, 272.
			C. C. 1851, 525.
			Jahresb. 1851, 352.
1851	H. Rose	Carbonate	Pogg. LXXXIII, 147, and LXXXIV, 52.
			Berl. Acad. Ber. 1851, 597.
			J. p. C. LIV, 23.
			C. C. 1851, 778.
			A. C. P. LXXX, 235.
			Chem. Gaz. 1851, 457.
			Instit. 1852, 69.
			Jahresb. 1851, 304.
1851	Burin de Buisson	Occurence in blood	Sur l'exist. de Mn. dans le sang, etc. Lyons, 1852.
			J. chim. méd. (2), VIII, 392.
			Jahresb. 1852, 702.
1852	Murdoch	Benzoate as pigment	Pat. Specif. Abr., 346.
1852	Gibbs	Separation	Am. J. Sci. (2) XIV, 204.
			Chem. Gaz. 1852, 368.
			A. C. P. LXXXVI, 52.
			J. p. C. LVIII, 241.
			Jahresb. 1852, 728.
1852	Müller	Technical estimation	A. C. P. LXXX, 98.
			Pol. Centr. 1852, 312.
			C. C. 1852, 312.
			Chem. Gaz. 1852, 75.
			Dingl. J. CXXIV, 50.
1852	Scheerer	Hydrated Carbonate	Pogg. LXXXVII, 87.
1852	Schabus	Testing	Pol. Centr. 1852, 571.
1852	Chapman	Detection	Phil. Mag. (4) III, 144.
			Chem. Gaz. 1852, 60.
			C. C. 1853, 16.
1853	Schwerdtfeger	Color of MnO solutions	N. Jahrb. Pharm. II, 18, 30.
1853	Malaguti		A. c. p. (3) XXXVII, 203.
1853	Schiel	Separation from Ni	J. p. C. LIX, 184.
			Am. J. Sci. [2] XV, 275.
			Pol. Centr. 1853, 1512.
			Chem. Gaz. 1853, 413.
1853	Flajolot	Separation from Co and Zn	Ann. d. Mines. (5) III, 641.
			J. p. C. LXI, 508, 105.
			A. c. p. (3) XXXIX, 460.
			C. R. XXXVI, 1090.
			Chem. Gaz. 1853, 380.
1853	Price	Technical valuation	Chem. Gaz. 1853, 416.
1853	Kerl	Ilefeld ore	C. C. 1853, 362.
			Pol. Centr. 1853, 547.

1853	Rivot and others	Estimation	Pol. Centr. 1853, 821.
1853	Bunsen	Estimation	A. C. P. LXXXVI, 283.
1853	Krieger	Volumetric estimation	A. C. P. LXXXVII, 257. Chem. Gaz. 1853, 450. Am. J. Sci. (2) XVII, 126. J. p. C. LXI, 472.
1853	Wöhler and Merkle	Phosphide	A. C. P. LXXXVI, 371. C. C. 1854, 32. Jahresb. 1854, 358.
1853	Gorgeu	Color of MnO solutions	C. R. XXXVI, 861. Instit. 1853, 162. Am. J. Sci. (2) XVI, 416. J. p. C. LIX, 325. C. C. 1853, 383. J. de Pharm. (3) XXVII, 253. Chem. Gaz. 1853, 248. Jahresb. 1854, 358. A. c. p. (3) XLII, 70.
1853	Rammelsberg	Crystallographic	Pogg. XCI, 340.
1853	Wöhler and Merkle	Permanganic acid	A. C. P. LXXXVI, 373. J. p. C. LX, 184. C. C. 1853, 943. Chem. Gaz. 1854, 89. Jahresb. 1854, 359.
1853	Slater	Action of P on $K_2Mn_2O^3$	Chem. Gaz. 1853, 329. J. p. C. LX, 247.
1853	Burin de Buisson	Color of MnO salts	J. pharm. (3) XXVIII, 345.
1854	Streng	Volumetric estimation	Pogg. Ann. XCII, 57. A. C. P. XCII, 411. Chem. Gaz. 1854, 271. J. c. T. I, 20.
1854	Ed. Davy	Detection	Proc. Roy. Soc. VI, 385. Chem. Gaz. 1854, 117.
1854	Von Hauer	Chloride	Wien. Akad. Ber. XIII, 453. J. p. C. LXIII, 436. Jahresb. 1852, 353.
1854	Zwenger	Potassic manganate	A. C. P. XCI, 46. J. p. C. LXIII, 251. C. C. 1854, 784.
1854	Trommsdorff	Phospho-permanganic acid	Arch. Pharm. (2) LXXX, 262. N. Jahrb. Pharm. III, 219.
1855	Liebig	Protoxide	A. C. P. XCV, 116. Chem. Gaz. 1855, 330. Jahresb. 1855 379.
1855	Mohr	Estimation of MnO_2	Lehrb. d. Titrirmethode. 1855, I, 170. Dingl. J. CXXXV, 289. A. C. P. XCIII, 51. J. c. T. I. 19.
1855	Vohl	Double salts	J. p. C. LXV, 178.
1855	Reithner	Color (?)	Vierteljahresschr. Pharm. IV, 377.
1855	Marignac	Crystallographic	Recher. des formes cryst. Genevè. 1855. Ann. d M. (5) IX, 1. C. R. XLII, 288.

1855	Rammelsberg	Crystallographic	Pogg. Ann. XCIV, 507. J. p. C. LXV, 181. C. C. 1855, 344.
1855	Deville	Pure fused metal	A. c. p. (3) XLVI, 182. Dingl. CXL, 428. A. C. P. CII, 326.
1855	Otto	Hydrated three-fourths oxide	A. C. P. XCIII, 372. Chem. Gaz. 1855, 171. J. p. C. LXIV, 512. Jahresb. 1855, 379.
1855	Lotz	Tungstate	J. p. C. LXIII, 214.
1855	Bonnewyn	Occurrence in blood	J. de Pharm. (3) XXVII, 284.
1855	Fresenius	Analytical	Dingl. J. CXXXV, 277. Pol. Centr. 1855, 693 and 745. J. c. T. I, 19.
1855	Balmain	Technical; recovery of MnO_2	Lond. J. Arts. 1856, 36. Hessisch. Gewerbebl. 1856, 176. Chem. Gaz. 1856, 79. Pat. Specif. Abr. 446. J. c. T. II, 72. Dingl. J. CXXXIX, 238. Technologiste. 1856, Apr. 341. Pol. Centr. 1856, 700. Jahresb. 1856, 792.
1855	Dunlop	Technical; recovery of MnO_2	Pat. Specif. Abr. 453 and 471. Chem. Gaz. 1856, 200. Rep. Pat. Inv. 1856, 236. Dingl. CXL, 104. Jahresb. 1856, 792. Pol. Centr. 1856, 832. J. c. T. II, 71.
1855	Playfair	Cyanide	J. p. C. LXIX, 287.
1856	Condy	Patent disinfectant	Pat. Specif. Abr. 496. Hofmann's Rep. Exhib. of 1862.
1856	Gorup-Besanez	Occurrence in "Trapa][natans"	A. C. P. C, 106.
1856	Barrow	Technical recovery	Pat. Specif. Abr. 477.
1856	Cook	Treatment of ores	Pat. Specif. Abr. 505.
1856	Von Hauer	Chloro-bicadmiate	Sitzungsb. Akad. Wiss. Wien. XVII, 331. Chem. Gaz. 1856, 6.
1856	Béchamp	Transformation of albumen into Urea by means of $K_2Mn_2O_8$	A. c. p. (3), XLVIII, 348. J. pharm. (3) XXXI, 32. Cimento. IV, 155. A. C. P. C, 247. C. C. 1857, 127. Jahresb. 1856, 696.
1856	Carius	$Mn_2O_3\,3SO_3$	A. C. P. XCVIII, 53. J. p. C. LXVIII, 377. C. C. 1856, 465. Arch. ph. nat. XXXII, 235. Chem. Gaz. 1856, 292. Jahresb. 1856, 382.
1856	Thénard	Permanganic acid	C. R. 382. Instit. 1856, 88. Arch. ph. nat. XXXI, 351. Jahresb. 1856, 384.

1856	Thénard	Permanganic acid	J. p. C. LXIX, 58. C. C. 1856, 289.
1856	Gössmann	$K_2Mn_2O_3$ as a decolorizer	A. C. P. XCIX, 373. Pol. Centr. 1856, 1275. J. p. C. LXIX, 469. J. c. T. II, 162. Dingl. J. CXLII, 316. Jahresb. 1856, 496.
1857	Spiller		Quart. J. Chem. Soc. IX.
1857	Muspratt	Recovery of MnO_2	Pat. Specif. Abr. 536. Pol. Centr. 1858, 700.
1857	Gatty	Nitrate	Pat. Specif. Abr. 545.
1857	Richardson	Ores	Pat. Specif. Abr. 554.
1857	Frémy	Metal	C. R. XLIV, 632. Inst. 1857, 102. J. pharm. (3) XXXI, 321. J. p. C. LXXI, 79. A. C. P. CII, 331. C. C. 1857, 463. Jahresb. 1857, 201.
1857	Brunner	Preparation of metal	Dingler J. CXLIV, 44. Chem. Gaz. 1858, 5.
1857	Brunner	Properties of metal	Pogg. CI, 264. Dingl. J. CXLIV, 184. Pol. Centr. 1857, 1325 and 1636. C. C. 1857, 408. J. c. T. III, 35. C. R. XLIV, 630. Chem. Gaz. 1857, 163. Instit. 1857, 101. Am. J. Sci. (2) XXIV, 140. J. p. C. LXXI, 77. A. C. P. CII, 330. Bern. Mitth, 1857, 72. Jahresb. 1857, 201.
1857	Deville	Metal	C. R. XLIV, 673. Chem. Gaz. 1857, 201. J. p. C. LXXI, 289. A. C. P. CII, 332. Jahresb. 1857, 203.
1857	Brunner	Metal containing Si	Bern. Mitth, 1857, 128. Pogg. CIII, 139. Chem. Gaz. 1858, 178. C. C. 1858, 161. Jahresb. 1857, 204.
1857	Von Hauer	Atomic weight	Wien. Acad. Ber. XXV, 124. J. p. C. LXXII, 352. C. C. 1857, 881. Chem. Gaz. 1858, 41. Am. J. Sci. (2) XXVIII, 437.
1857	J. Hoffman	Borate	Mitth. d. Nassauer Gewerbvereins. 1857, XIV. Dingl. J. CXLV, 450. Pol. Centr. 1857, 1514. J. c. T. III, 432.

1857	Reissig	Technical recovery of MnO_2	A. C. P. CIII, 27. Dingl. pol. J. CXLV, 439. Pol. Centr. 1857, 1508. J. p. C. LXXII, 383. C. C. 1857, 833. Jahresb. 1857, 206.
1857	Marignac	Cryst. form of chloride	C. R. XLV, 650. Instit. 1857, 364. Arch. ph. nat. XXXVI, 207. Phil. Mag. (4) XV, 157. Jahresb. 1857, 207.
1857	Böttger	Delicate test for Mn	J. des phys. Ver zu Frankf. 1856, 27. J. p. C. LXX, 433. Pol. Centr. 1857, 886. N. Repert. Pharm. VI, 247. Pol. Notizbl. 1857, No. IX. C. C. 1857, 635. Jahresb. 1857, 136.
1857	Elliot	Recovery of Mn from Cl residues	Rep. Pat. Inv. 1857. Polyt. Centr. 1857, 1033. Dingl. Pol. J. CXLV, 238. Jahresb. 1857, 623. Pat. Specif. Abr. 503.
1857	Field	Separation from FeO	Chem. Gaz. 1857, 374. Dingl. CXLVI, 315. Jahresb. 1857, 592.
1857	Barreswil	Test for MnO	C. R. LXIV, 677. Instit. 1857, 114. Chem. Gaz. 1857, 291. J. pharm. (3) XXXI, 342. C. C. 1857, 449. J. p. C. LXXI, 317. Jahresb. 1857, 592.
1857	Terreil	Separation from Zn, Co, and Ni	C. R. XLV, 652. Instit. 1857, 366. J. pharm. (3) XXXII, 383. Chem. Gaz. 1857, 452. J. p. C. LXXIII, 481. Jahresb. 1857, 593.
1857	Souchay and Lenssen	Oxalates	A. C. P. CII, 35; CIII, 308. J. p. C. LXXI, 295. J. p. C, LXXIII, 42. C. C. 1857, 519. Jahresb. 1857, 291.
1857	Croft	Oxalate	Canad. J. II, 30. Chem. Gaz. 1857, 62. J. pr. Chem. LXXIII, 59. C. C. 1857, 233. Jahresb. 1857, 292.
1857	Städeler	Action of $K_2Mn_2O_8$ on albumen	J. p. C. LXXII, 251. C. C. 1858, 90. J. pharm. (3) XXXIII, 156. Chem. Gaz. 1858, 101. Jahresb. 1857, 537.
1858	Henry	Separation from Co and Ni	Phil. Mag. (4), XVI, 197. C. C. 1859, 94.

1858	Henry	Separation from Co and Ni	J. p. C. LXXVI, 252. Jahresb. 1858, 619. Am. J. Sci. 1869 (4) XVI, 197.
1858	Abich	Geological	Petersb. Akad. Bull. XVI, 305.
1858	Schönbein	Acetate of MnO_2	Verh. Naturf. Ges. Basel, 1858. J. p. C. LXXIV, 325. C. C. 1858, 778. Jahresb. 1858, 188.
1858	Von Hauer	Sulphate of Mn and K	J. p. C. LXXIV, 431.
1858	Haeffely	Technical recovery	Pat. Specif. Abr. 1000.
1858	Kestner	Dunlop's process	Bull. Soc. Ind. Mulh. No. 142, 332. Pol. Centr. 1858, 800.
1858	Schabus	Cryst. form of $MnSO_4+K_2SO_4+2H_2O$	Wien. Akad. Ber. XXIX, 441.
1858	H. Rose	Sesquioxide solutions	Pogg. CV, 289. C. C. 1859, 12. J. p. C. LXXVI, 115. Chem. Gaz. 1859, 101. Berl. Acad. Ber. 1858, 519. Jahresb. 1858, 171.
1858	Cloez and Guignet	Action of $K_2Mn_2O_8$ on organic matter	C. R. XLVII, 710. A. C. P. CVIII, 378. Dingl. CL, 419. Jahresb. 1858, 171.
1858	Souchay and Lenssen	Oxalates	A. C. P. CV, 245. J. p. C. LXXIV, 167. C. C. 1858, 289. Chem. Gaz. 1858, 264. Jahresb. 1858, 244.
1858	Wöhler	Silicide	Nachr. Göttingen, 1858, 59. A. C. P. CVI, 54. Chem. Gaz. 1858, 233.
1858	Gorgeu	Oxalate	C. R. XLVII, 929. Chem. Gaz. 1859, 71. Instit. 1858, 419. Jahresb. 1858, 245.
1858	Hempel	Action of KI on $K_2Mn_2O_8$	A. C. P. CVII, 100. J. p. C. LXXV, 383.
1858	Tennant	Technical	Dingl. CXLVII, 440.
1859	Béchamp	Occurrence in blood	C. R. XLIX, 895.
1859	Schneider	Atomic Weight	Pogg. CVII, 605. C. C. 1859, 768. Phil. Mag. (4) XVIII, 268. Chem. Gaz. 1859, 474. A. C. P. CXIII, 77. Jahresb. 1859, 178.
1859	Beketoff	Experiments with $K_2Mn_2O_8$	Bull. soc. chim. May, 1859, 43. Jahresb. 1859, 179.
1859	Béchamp	Preparation of $K_2Mn_2O_8$	A. c. p. (3) LVII, 293. J. c. T. VI, 258. Jahresb. 1859, 180. Rép. chim. appl. II. 65.
1859	Ordway		Am. J. Sci. (2) XXVII, 16.
1859	Fordos and Gélis	Analysis of sulphur compounds	J. de pharm. (3) XXXVI, 113.

1859	Krieg	Technical	Pol. Centr. 1859, 815.
1859	Phipson	Non][existence of $H_2Mn_2O_8$	C. R. L, 694. Instit. 1860, 124. J. p. C. LXXX, 122. Dingl. J. CLVI, 239. Z. C. P. 1860, 392. C. C. 1860, 460. J. c. T. VI, 258. Rep. chim. pure. II, 161. Jahresb. 1860, 166.
1859	Nolter	Technical	Berg. u. Hüttenm. Ztg. 1859, XVII. Dingl. J. CLII, 136. Chem. Gaz. 1859, 288. C. C. 1859, 414. Pol. Centr. 1859, 1079. J. c. T. V, 65.
1859	Béchamp	Action of $K_2Mn_2O_8$ on albumen	A. c. p. (3), LVII, 291. Jahresb. 1859, 181.
1859	Lenssen	Action of As_2O_3 on $K_2Mn_2O_8$	J. p. C. LXXVIII, 197.
1859	Luboldt	Decomposition of $K_2Mn_2O_8$	J. p. C. LXXVII, 315. Jahresb. 1859, 181.
1859	Böttger	Action of Ca Cl_2O_2 on $MnCl_2$	Jahresb. phy. Verein Frankfurt, 1858, 47. J. p. C. LXXVI, 235. Dingl. CLI, 428. N. Jahrb. Pharm. XI, 265. Vierteljahrschr. Pharm. VIII, 450. Jahresb. 1859, 202, note.
1859	Heintz	Ethyl succinate	Pogg. CVIII, 94.
1859	Von Kobell	Estimation	J. p. C. LXXVI, 415.
1859	Dumas	Atomic Weight	A. c. p. (3) LV, 129. A. C. P. CXIII, 25.
1859	Matthiesson	Organic compounds	Chem. Gaz. 1859, 78. J. p. C. LXXVII, 227.
1860	Rose	Estimation	Pogg. CX, 120. Z. C. P. 1860, 557. C. C. 1860, 583. Rep. chim. pure II, 391. Jahresb. 1860, 644.
1860	Lenssen	Volumetric estimation of protoxide	J. p. C. CLXXX, 408. C. C. 1861, 78. Jahresb. 1860, 655.
1860	Struve	Pyrophosphate	J. p. C. LXXIX, 346.
1860	Wöhler and Michel	Alloy of Mn and Al	A. C. P. CXV, 102.
1860	Rose	Separation from Co and Ni	Pogg. CX, 411. Z. C. P. 1860, 625. Rep. chim. pure III, 91. Jahresb. 1860, 655.
1860	Dellfs	Separation from FeO	Z. C. P. 1860, 81. Pol. Notizbl. 1860, 109. J. c. T. VI, 259. Jahresb. 1860, 166.
1860	Reinige	$K_2Mn_2O_8$	Archiv. Pharm. (2) CI, 145

1860	Debray	HNO_3 in ores of Mn	C. R. L, 868. J. p. C. LXXXVI, 412. C. C. Pol. Centr. 1860, 1340. Pol. Centr. 1861, 1386.
1860	Machuca	Analysis of $K_2Mn_2O_8$	C. R. LI, 140 and 214. Rep. chim. pure. II, 316. Z. C. P. 1860, 656. J. p. C. LXXXI, 40. C. C. 1860, 864. Dingl. J. CLVII, 239. J. c. T. VI, 259. Jahresb. 1860, 167.
1860	Aschoff	$K_2Mn_2O_8$	Berl. Acad. Ber. 1860, 474. J. p. c. LXXXI, 29. Arch, pharm. (2) CIV, 141. Pogg. CXI, 217.
1860	Gorgeu	Double salt of manganate and permanganate	C. R. L, 610. A. c. p. (3), LXI, 355. J. p. C. LXXX, 123. Chem. News. IV, 103. C. C. 1860, 838 and 460. Rep. chim. pure. 178. Inst. 1860, 140. Rep. chem. pure. II, 161. J. c. T. VI, 259. Jahresb. 1860, 169.
1860	Von Hauer	Sulphate	Wien. Acad. Ber. XXXIX, 447. J. p. C. LXXX, 230. C. C. 1860, 423. Jahresb. 1860, 170.
1860	Rose	Estimation as sulphide	Pogg. CX, 122 and 301.
1861	Lange	Acetate Mn and Ce	J. p. C. LXXXII, 138.
1861	Kraut	Hyposulphate	J. p. C. LXXXIV, 125.
1861	Böttger	Spectrum of chloride	J. p. C. LXXXV, 393.
1861	Rose	Analytical	Am. J. Sci. (2) XXXI, 113.
1861	Ordway		Am. J. Sci. (2), XXXII, 338.
1861	Schiff	Solubility of Mn SO_4 in alcohol	A. C. P. CXVIII, 370.
1861	Mohr	Estimation	A. C. P. CXVII, 382. Rep. chim. appl. III, 254. Jahresb. 1861, 850.
1861	Quadrat	Estimation	Schweitzer. pol. Zeitschr. VI, 103. Pol. Centr. 1861, 683. Z. C. P. 1861, 605.
1861	Schönbein	Manganese Amalgam	Pogg. CXII, 445. Jahresb. 1861, 95.
1861	Nordenskiöld	Artificial minerals	Pogg. Ann. CXIV, 619. J. p. C. LXXXV, 431. Jahresb. 1861, 260.
1861	Elliot and Storer	MnO_2	Proc. Am. Acad. Sci. V, 192. Chem. News. VI, 121. J. p. C. XC, 288. Jahresb. 1861, 261.

1861	Gentele	Crystallized Na_2MnO_4	J. p. C. LXXXII, 58. Rep. Chim. pure. III, 370. J. pharm. (3) XXXIX, 473. Jahresb. 1861, 261.
1861	Lea	Ammonio-picrate	Am. J. Sci. (2) XXXI, 85.
1861	Morin	Pigments	Pat. Specif. Abr. 749.
1861	Möller	Separation from FeO	A. C. P. CXX, 243. Z. anal. Chem. I, 217.
1861	Weltzien	Action of $K_2Mn_2O_8$ on iodine	A. C. P. CXX, 349. Jahresb. 1861, 262.
1861	Deville	Action of HCl on oxides at high temperatures	C. R. LII, 1264, LIII, 199. Instit. 1861, 206 and 257. Rep. chim. pure. II, 324 and 373. Jahrb. Min. 1861, 703; 1862, 80. A. C. P. CXX, 180. Jahresb. 1861, 7.
1861	Wöhler	Action of $NaNO_3$ on MnO_2	A. C. P. CXIX, 375. J. p. C. LXXXV, 311.
1862	Giles	Preparation of metal from its amalgam	Phil. Mag. (4), XXIV, 328. Pogg. CXVII, 528. Jahresb. 1862, 154.
1862	Pean de St. Gilles	Oxychloride	C. R. LV, 329. Instit. 1862, 286. Z. C. P. 1862, 569. C. C. 1863, 208. J. p. C. LXXXVIII, 123. J. c. T. IX, 360. Rep. chim. pure. IV, 379. Pol. Centr. 1863, 622. Jahresb. 1862, 155.
1862	Brodie	Catalytic phenomena	Proc. Roy. Soc. XII, 209. J. p. C. LXXXVIII, 342.
1862	Gorgeu	Manganous acid	A. c. p. (3), LXVI, 153. Rep. chim. pure. IV, 415. C. C. 1863, 145. Jahresb. 1862, 155.
1862	Terreil	Hyper-manganic acid	Bull. soc. chim. 1862, 40. Z. C. P. 1862, 437. J. c. T. VIII, 322. C. C. 1863, 78. Chem. News. VI, 57. Jahresb. 1862, 156.
1862	Binks and Macqueen	Recovery of MnO_2 from chlorine residues	Technologiste. 1862, 627. Polyt. Centr. 1862, 1659. Pat. Specif. Abr. 672. C. C. 1863, 254. Jahresb. 1862, 659.
1862	Simmler	Spectrum	Pogg. CXV, 242 and 425. Z. anal. Ch. I, 356.
1863	Wiederhold	Technical	Dingl. J. CLXIX, 316. Pol. Centr. 1863, 1310. J. c. T. IX, 361. Deutsche Gewerbe Ztg. 1863, 196.
1863	Caron	Fluxes	C. R. LVII, 786.
1863	Fresenius	Analytical	Z. anal. Ch. II, 346. Pol. Centr. 1864. 826.

1863	Oudemans	Laurate	J. p. C. LXXXIX, 213. C. C. 1863, 737. Bull. soc. chim. V, 568. Jahresb. 1863, 333.
1863	Guyard	Volumetric estimation	Bull. soc. chim. VI, 89. Chem. News. VIII, 292, IX, 13. J. pharm. (3) XLV, 409. C. C. 1864, 339. Jahresb. 1863, 679.
1863	Hoppe-Seyler	Optical properties of solutions of higher oxides	J. p. C. XC, 303. Z. C. P. 1864, 91. C. C. 1864, 479. J. pharm. (3) XLV, 355. Bull. soc. chim. VI, 269. Am. J. Sci. (2) XXXVII, 408. Jahresb. 1863, 228.
1863	Böttger	Preparation of $K_2Mn_2O_8$	Beglückw. J. Frankf. V, 1863, 6. J. p. C. XC. 156. Pol. Centr. 1864, 53. Dingl. J. CLXX, 286. Pol. Notizbl. 1863, 321. Vierteljahreschrift Pharm. XIII, 221. J. c. T. IX, 356. C. C. 1864, 430. J. pharm. (3) XLV, 356. Jahresb. 1863, 228.
1863	Demarquai	Disinfectant	Polyt. Centr. 1863, 1311.
1863	Richter	Amount Mn in iron	B. u. H. Jahrbuch. XI, 295. Am. J. Sci. (2) XXXV, 120.
1863	Kessler	Action of $K_2Mn_2O_8$ on protosalts	Pogg. CXVIII, 17. Z. anal. Chem. II, 383.
1863	Lang	Non-existence of nitrite	Pogg. CXVIII, 280. J. p. C. LXXXVI.
1863	Pope	Specific heat of sulphate	Pogg. CXX, 368.
1864	Mittenzwey	Volumetric estimation	J. p. C. XCI, 81. Dingl. CLXXIII, 294. C. C. 1864, 550. Z. anal. Ch. III, 371. Chem. News. IX, 253. Bull. soc. chim. (2) III, 131. Jahresb. 1864, 680.
1864	Fresenius	Volumetric estimation	Z. anal Chem. III, 209.
1864	Rosenstiehl	Barium manganate	Rapport sur le concours pour le prix Bonfils par J. Nickles 1865, 6 and 18. J. pharm. (3) XLVI, 344. Dingl. J. CLXXVI, 409. J. p. C. XLV, 233; XLVI, 344. Arch. Pharm. CXXIII, 146. Pol. Notizbl. 1865, 264. Deutsche Ind. Ztg. 1865, 368. Kurhess. Gewerbebl. 1865, 769. J. c. T. XI, 365. Jahresb. 1864, 822. Pol. Centr. 1865, 1374.

1864	Rosenstiehl	Barium manganate	Deutsche Gewrbe Ztg. 1865, 372.
1864	Gerland	Co and Ni in Pyrolusite	Berg. u. hüttenm. Ztg. 1864, 176. Pol. Centr. 1864, 1387. J. c. T. X, 124.
1865	Dittmar	Calcination of oxides in oxygen gas	Chem. Soc. J. (2) II, 294. Z. C. P. 1864, 449. J. p. C. XCIV, 345. C. C. 1865, 364. Jahresb. 1864, 234.
1865	Luckow	Estimation by electrolyt. precipitation as MnO_2	Dingl. CLXXVII, 231 and 296. Dingl. CLXXVIII, 42. Jahresb. 1845, 686.
1865	Rube	Separation	J. p. C. XCIV, 246. Z. C. 1865, 347. Z. anal. Ch. IV, 421. C. C. 1865, 830. Bull. soc. chim. (2) IV, 119. Jahresb. 1865, 711.
1865	Habich	Volumetric estimation	Z. anal. Ch. III, 474. Z. Chem. 1865, 473. Jahresb. 1865, 713.
1865	Schwartz		Bresl. Gewerbebl. 1865, No. 27. Pol. Centr. 1865, 1023. J. c. T. XI, 364.
1865	Gibbs	Separation from Co, Ni and Zn.	Am. J. Sci. (2) XXXIX, 58. Z. anal. Ch. III, 331. J. p. C. XCV, 356. Z. C. 1865, 307. C. C. 1865, 405. Dingl. CLXXVIII, 133. Chem. News. XI, 101 and 174. Jahresb. 1865, 712.
1865	Nickles	Superchloride and iodides	A. c. p. (4) V, 161. C. R. LX, 479. Instit. 1865, 73. Bull. soc. chim. (2) IV, 108. J. pharm. (4) I, 328. Z. C. 1865, 425. C. C. 1865, 316. Chem. News. XI, 129, 254. Jahresb. 1865, 224.
1865	Geuther	Protoxide	Jena. Zeit. Med. u. Nat. II, 127. Z. C. 1865, 347.
1865	Graeger	Preparation of $K_2Mn_2O_8$	J. p. C. XCVI, 169. Z. C. 1866, 60. C. C. 1866, 47. Z. anal. Ch. IV, 410. Jahresb. 1865, 226. Pol. Centr. 1866, 137. J. c. T. XI, 363.
1865	How	Technical	Transactions N. S. Inst. Nat. Sci. Chem. News. XII, 232.
1866	Roussin	Action of sodium amalgam on solutions	J. pharm. (4) III, 413. Bull. soc. chim. (2) VI, 93. Z. C. 1866, 576. Z. anal. Ch. VI, 100.

1866	Roussin	Action of sodium amalgam on solutions	Chem. News. XIV, 27 and 42. Jahresb. 1866, 170.
1866	?		Dingl. CLXVI, 197.
1866	Wagner	Disinfecting solutions	J. c. T. XII, 263.
1866	Clark	Techn. recovery	Pat. Specif. Abr. 1000.
1866	Reichardt	Separation from earths	Z. anal. Ch. V, 60. Arch. Pharm. (2) CXXIX, 234. Z. C. 1866, 592. Vierteljahrs. Pharm. XVI, 394. Bull. soc. chim. (2) VII, 495. Jahresb. 1866, 800.
1866	Baudrimont		C. R. LXII, 829. Instit. 1866, 134. J. pharm. (4) III, 347. Chem. News. XIII, 193. J. p. C. XCVIII, 283. Z. C. 1866, 247. C. C. 1866, 848. Jahresb. 1866, 160.
1866	Schad	"Casseler green"	Bull. soc. chim. (2) V, 477. Pat. Specif. Abr. 873. J. c. T. XI, 365.
1866	P. W. Hofmann	Technical recovery of MnO_2	Dingl. CLXXXI, 364. Z. C. 1866, 608. Chem. News. XVI, 163. Jahresb. 1866, 857.
1866	Müller	Action of CS_2 on K_2MnO_4	Pogg. CXXVII, 404. C. C. 1866, 561. Z. C. 1866, 267. Bull. soc. chim. (2) VI, 447.
1866	Müller	Optical properties of $K_2Mn_2O_8$	Pogg. CXXVIII, 335. Z. C. 1866, 573.
1867	Gibbs	Estimation as pyrophosphate	Am. J. Sci. (2) XLIV, 216. Chem. News. XVII, 195. Z. C. 1867, 721. J. p. C. CIII, 395. Jahresb. 1867, 845. Z. anal. Ch. VII, 101. Bull. soc. chim. (2) IX, 201.
1867	Sticht	$K_2Mn_2O_8$	Vierteljahres. Pharm. XV, 259. Pol. Centr. 1867, 614. Deutsch. Indust. Ztft. 1867, 198. J. c. T. XIII, 275.
1867	Tessié du Motay	$H_2Mn_2O_8$ for bleaching	Les Mondes. XIV, 95. Chem. News. No. 38, 222. Schweitz. pol. Ztschft. 1867, 98. Muster Ztg. 1867, XVI, 146. Buchner's Repert. XVI, 583. Dingler. J. CLXXXIV, 524. Pol. Centr. 1867, 540 and 1130. Deutsche. Ind. Ztg. 1867, 158 and 317. Kurhess. Gewerbebl. 1866, 962. Hannover Mittheil. 1866, 100. J. c. T. XIII, 652.

1867	Weldon	Technical recovery of MnO_2	Laboratory. I, 445. Chem. News. XVI, 125. Dingl. CLXXXVI, 129. J. p. C. CII, 478. Bull. soc. chim. (2) VIII, 449. Bull. soc. chim. (2) IX, 166.
1867	Tessié du Motay	Technical preparation of $K_2Mn_2O_8$	Bull. Soc. d'Encourage. 1867, 472. Bull. soc. chim. (2) VIII, 455. Dingl. CLXXXVI, 231. Jahresb. 1867, 911.
1867	Esquiron et Gouin	Recovery of MnO_2	Ann. Génie Civil. 1867, 270. Bull. soc. chim. (2) VIII, 137.
1867	Swiontowski	Action of $K_2Mn_2O_8$ on H_2O_2	A. C. P. CXLI, 205. Bull. soc. chim. (2) VIII, 404.
1867	Skey	Separation	Chem. News. 201. Z. C. (2) IV, 123.
1867	Nickles	Fluorides	C. R. LXV, 107. Chem. News. XVII, 10.
1867	Landauer	Blowpipe test	Chem. News. XVI, 105.
1867	Letheby	$K_2Mn_2O_8$ as disinfectant	Dingl. CLXXXIII, 227.
1867	Braun	Delicate reactions	Z. anal. Ch. VI, 73. Z. C. 1867, 541. C. C. 1867, 396. Jahresb. 1867, 845.
1867	Eaton and Fittig	Cyanides	A. C. P. CXLV, 157. Z. C. 1867, 107. N. arch. ph. nat. XXVIII, 361. Inst. 1868, 224. Jahresb. 1867, 373.
1867	Wheeler	Action on uric acid	Am. J. Sci. (2) XLIV, 110 and 218.
1867	Eggertz	Estimation in iron ores	Berg. Huttenm. Ztg. Schweitz. pol. Zts. 1867, 154. Z. C. (2) IV, 507. Z. anal. Ch. VII, 495. Jahresb. 1868, 872.
1868	Descamps	Cyanides	C. R. LXVI, 628. Bull. soc. chim. (2) IX, 443. Z. C. (2) IV, 415 and 592. Jahresb. 1868, 306.
1868	Sidot	Crystallized sulphide	C. R. LXVI, 1257. Z. C. (2) IV, 544. Jahresb. 1868, 229.
1868	Nickles	Fluorides	C. R. LXVII, 448. Z. C. (2) IV, 701. Instit. 1868, 265. Bull. soc. chim. (2) XI, 411. J. p. C. CVI. Jahresb. 1868, 229.
1868	Tuchschmidt	Ba in Pyrolusite	J. p. C. CIII, 478. J. c. T. XIV, 328.
1868	Terreil	Separation	C. R. LXVI, 668. Z. C. (2) IV, 337.
1868	Groth	Permanganates	Pogg. CXXXIII, 203.
1868	Braun	Detection	Z. anal. C. VII, 340. Z. C. 1869, 306.

1868	Braun	Detection	Jahresb. 1868, 227.
1868	Leykauf	"Nürnberger Violet"	Deutsch. Indust. 1868, 376 and 428. Pol. Notizbl. 1868, 272 and 335. Dingl. J. CXC, 70. Hessische Gewerbebl. 1868, 304. Pol. Centr. 1868, 1339. Monit. scientif. 1868, 713. Bull. soc. chim. (2), X, 76. J. c. T. XIV, 326.
1868	Städeler	$K_2Mn_2O_8$	J. p. C. CIII, 107. N. R. Pharm. XVIII, 178. Z. anal. Ch. VII, 467. Dingl. J. CLXXXIX, 84. J. c. T. XIV, 327. Pol. Centr. 1869, 696. Pol. Notizbl. 1868, 179. Jahresb. 1868, 228.
1869	Prior	Estimation	Z. anal. Ch. VIII, 428. Z. C. 1870, 274. Jahresb. 1869, 886. Bull. soc. chim. (2) XIV, 194.
1869	Damour	Separation from magnesia	C. R. LXIX, 168. Instit. 1869, 243. Jahresb. 1869, 891.
1869	Renard	Removal from zinc solution	Bull. soc. chim. (2) XI, 473. Z. anal. Ch. VIII, 460. Chem. News. XX, 35. Z. C. 1869, 662. C. C. 1870, 224. Jahresb. 1869, 896.
1869	Sidot	Crystallographic	C. R. LXIX, 201. Z. C. 1869, 606. Jahresb. 1869, 251.
1869	Lindner	Manganate of baryta	Z. C. 1869, 442. Jahresb. 1869, 217.
1869	How	Estimation	Jahresb. 1869, 887. Bull. soc. chim. (2) XIII, 48. Z. C. 1869, 414. Z. anal. Ch. IX, 382. Chem. News. XIX, 137.
1869	How	Oxalate	Chem. News. XIX, 41. Z. C. 1869, 246. Jahresb. 1869, 537.
1869	Delaurier	$K_2Mn_2O_8$	Chem. News. XX, 240. Les Mondes, 4. November, 1869. Jahresb. 1869, 1052.
1869	Luck	Spectroscopic; superchloride	Z. anal. C. VIII, 405. Bull. soc. chim. (2) XIII, 499. Z. C. 1870, 288. Jahresb. 1869, 184.
1869	Richters.	Regeneration of peroxide	Bull. soc. chim. (2), XII, 335. Dingl. J. CXCII, 60, 133 and 234. Pol. Centr. 1869, 670 and 1230. J. c. T. XV, 209.
1869	Weldon	Regeneration of peroxide	Bull. soc. chim. (2), XII, 497.

1869	Weldon	Regeneration of peroxide	Chem. News. 1869, XX, 109. Jahresb. 1869, 1031. Rep. Br. Assoc. 1869, trans. 79. Pol. Centr. 1869, 1325. Dingl. J. CXCIV, 51. C. C. 1870, 76. Monit. scientif. XII, 113. J. pharm. (4) XII, 45. J. c. T. XV, 196.
1869	Classen	Estimation	Z. anal. Ch. VIII, 370. Z. C. 1870, 285. C. C. 1870, 350. Bull. soc. chim. 1870, (2) XIV, 44. Jahresb. 1869, 887.
1869	Muck	Formation of green sulphide	Z. C. 1869, 580 and 640. Chem. News. XX, 226. Jahresb. 1859, 261.
1869	Flagey	MnO for coloring glass	Annal. du Génie civil. 1869, Oct., 732. Pol. Centr. 1870, 608. J. c. T. XVI, 273.
1869	Muck	Sep. of Co. from Mn.	Z. C. V, 626. Bull. soc. chim. XIII, 334.
1870	Vogel	In ash of plants	N. R. Pharm. XIX, 423. Jahresb. 1870, 994.
1870	Gruner	Effect of iron and steel	Dingl. J. CXCV, 336. Pol. Centr. 1870, 556. Berg- u. hüttenm. Z. 1870, 46. Jahresb. 1870, 1091.
1870	F. F. Allen	Alloys	Chem. News. XXII, 194. C. C. 1870, 772. Jahresb. 1870, 1103 and 351. Dingl. J. CXCVIII, 517.
1870	Kohn	Alloys with iron	Engineering. Sept., 1870. Dingl. J. CXCVIII, 205. Berg. u. hüttenm. Ztg. 1870, 419. Pol. Centr. 1871, 110 and 1080. J. c. T. XVII, 27. Jahresb. 1870, 1103.
1870	Ladenburg	Aceto-formiate	Jahresb. 1870, 334.
1870	Valenciennes	Alloy with Cu and Co	C. R. LXX, 607. Pol. Centr. 1870, 936. Bull. soc. chim. (2) XIV, 193. D. C. Ges. III, 326. Instit. 1870, 90. Berg. u. hüttenm. Ztg. 1870, 304. Dingl. J. CXCVI, 516. Deutsche Indust. Ztg. 1870, 155. Z. C. 1870, 318. C. C. 1870, 243. Jahresb. 1870, 350.
1870	Schwarz	"Manganlüster"	Dingl. J. CXCVII, 251. Turrschmiedt's Notizbl. 1870, 220. Deutsche. Ind. Ztg. 1870, 358. Pol. Notizbl. 1870, 290. C. C. 1870, 557. J. c. T. XVI, 307.

1870	Tissandier	Analysis pyrolusite	Monit. Scient. 1870, 279. J. c. T. XVI, 183.
1870	Reimann	"Mangan braun"	Deutsche ill. Gewerbe Ztg. 1869, 313. Dingl. J. CXCV, 283. Jahresb. 1870, 1264.
1870	Muck	Sulphide	Z. C. 1870, 6. C. C. 1870, 22. Bull. soc. chim. (2) XIII, 423. Jahresb. 1870, 331.
1870	Wagner	Analytical	Dingl. J. CXCV, 532. C. C. 1870, 229. Bull. soc. chim. (2) XIV, 96. J. c. T. XVI, 745. Pol. Centr. 1870, 829. Chem. News. 1870, No. 543, 192. Jahresb. 1870, 331.
1870	Rowan	Estimation in Spiegeleisen	Engineering. June, 1870, 455. Dingl. J. CXCVII, 328. C. C. 1870, 592. J. c. T. XVI, 13. Jahresb. 1870, 993.
1870	Schulz-Sellack	Nitrate	Z. C. 1870, 646. Jahresb. 1870, 334.
1870	Mohr	Permanganate potash	Z. anal. Ch. IX, 43. Z. C. 1870, 446. Jahresb. 1870, 333.
1870	Kolbe	Perman. potash	J. p. C. (2) I, 423. Jahresb. 1870, 333.
1870	Spiess	Perman. potash	J. p. C. (2) I, 421. C. C. 1870, 391. Bull. soc. chim. (2) XIV, 194. Jahresb. 1870, 332.
1870	Wernicke	Refraction of hydrated peroxide	Pogg. Ann. CXXXIX, 132. Phil. Mag. (4) XL, 105. Jahresb. 1870, 164.
1870	Wernicke	Hydr. peroxide formation and Sp. Gr.	Pogg. Ann. CXLI, 109. J. p. C. (2) II, 419. C. C. 1870, 689. Jahresb. 1870, 299.
1870	Pattinson	Estimation of peroxide in ores	Chem. News. XXI, 267 (1870). Bull. soc. chim. (2) XIV, 347. Pol. Centr. 1871, I, 117 and 1568. Am. Chem. 1870, 141. C. C. 1870, 636. Dingl. J. CXCVII, 422. Berg. u. hüttenm. Ztg. 1870, 347. Z. C. 1870, 442. Z. anal. Ch. IX, 509. J. c. T. XVI, 183. Jahresb. 1870, 991.
1870	Sherer	Estimation of peroxide in ores	Chem. News. XXI, 284. Z. anal. Ch. IX, 513. Jahresb. 1870, 992.
1870	Paul	Estimation of peroxide in ores	Chem. News. XXI, 16. Z. anal. Ch. IX, 410. Jahresb. 1870, 993.

1870	Deschamps	Tartrate of potassium and manganese	C. R. LXX, 813. Bull. soc. chim. (2) XIV, 250. Z. C. 1870, 317. C. C. 1870, 292. Jahresb. 1870, 662. D. C. Ges. III, 428.
1870	Parker	Estimation of Mn in spiegeleisen	Chem. News. 1870, No. 568, 186. Dingl. J. CXCIX, 48. Berg. u. hüttenm. Ztg. 1871, 55. C. C. 1870. 725. J. c. T. XVII, 13.
.870	Weldon	Oxidation of $MnCl_2$	Brit. Assoc. Rep. Liverpool meeting. D. C. Ges, III, 873. Chem. News. 1870, No. 570, 145. Chem. News. 1871, No. 606, 12. Pol. Centr. 1871, 50, 576, 965. Dingl. J. CCI, 354. C. C. 1871, 550. J. c. T. XVII, 250.
1870	Desclabissac	Directions for manufacturing manganates and permanganates	Verh. d. Vereins z. beford. des Gerverbefl. in Preussen. 1870, 142. Pol. Centr. 1871, 639. Dingl. J. CCI, 58. J. c. T. XVII, 353. Jahresb. 1871, 1023. Am. Chem. 1871, 233. C. C. 1871, 508.
1870	Pollaci	Presence in milk and blood	J. p. C. May, 1870. Am. Chem. I, 69 and 121.
1870	Bohling	Permanganate	Z. anal. C. IX, 277. Jahresb. 1870, 333.
1870	Böttger	Permanganate	J. p. C. (2) II, 135. C. C. 1870, 164. Jahresb. 1870, 333.
1870	Krebs	Action of Mn_2O_3 on $KClO_3$	Z. C. 1870, 243. Dingl. J. CXCVII, 293. C. C. 1870, 305. Jahresb. 1870, 208. Bull. soc. chim. (2) XIV, 190. Am. Chem. 1870, 76.
1870	Thomson	Treatment of ores	D. C. Ges. IV, 134.
1870	Mason and Parkes	Preparation	D. C. Ges. IV, 534.
1871	Kämmerer	Precipitation by bromine	D. C. Ges.. IV, 218. Z. C. 1871, 444. Z. anal. C. 1871, 444. Jahresb. 1871, 866.
1871	Talbut	Estimation	D. C. Ges. IV, 279. Jahresb. 1871, 928.
1871	Luck	Estimation of peroxide	Z. anal. C. 1871, 310 to 322. Jahresb. 1871, 929.
1871	Chatard	Estimation	Chem. News. XXIV, 196. Jahresb. 1871, 928.
1871	A. H. Allen	Detection by ferrocyanide of potash.	Chem. News. XXIII, 290, Z. C. 1871, 413. Bull. soc. chim. (2) XVI, 93.

1871	A. H. Allen	Detection by ferrocyanide of potash	Jahresb. 1871, 930.
1871	Hugo Tamm	Estimation as $MnNH_4PO_4+H_2O$	Chem. News. XXIV, 148. Z. C. 1871, 467. Bull. soc. chim. (2) XVI, 261. Jahresb. 1871, 932.
1871	Thomson	Alloys with iron	Mechanic's Magazine. Feb. 1871, 78 Dingl. J. CXCIX, 394. J. c. T. XVII, 32. Berg. u. hüttenm. Ztg. 1871, 232. Pol. Centr. 1871. 531. C. C. 1871, 345. Jahresb. 1871, 996.
1871	Skey	Position of MnS in the series of electrical tension	Chem. News. XXIII, 255. Jahresb. 1871, 122.
1871	Bell	Effect of oxide of carbon upon oxides	Chem. News. XXIII, 258 & 267. Jahresb. 1871, 265.
1871	Thomsen	Thermo-chemical examinations	Pogg. Ann. CXLIII, 354 to 396; 497 to 534. D. C. Ges. IV, 586 to 590, 308 to 314. Bull. soc. chim. (2) XVI, 63. Jahresb. 1871, 101, 104.
1871	Schrötter	Alloys	Wien Acad. Ber. (2 Abth.) LXIII, 453. Jahresb. 1871, 1004.
1871	Koosen	Use of $K_2Mn_2O_8$ in battery	Pogg. CXLIV, 627.
1871	Michaelis	Rejoinder	Jenaische Zeitschr. f. med. u. Naturw. VII, 110. J. p. C. (2) IV, 449. Jahresb. 1871, 250.
1871	Swan	Employment of $K_2Mn_2O_8$ in photography	Photographic News. Dingl. J. CCII, 388. Bull soc. chim. (2) XVI, 360.
1871	Baudrimont	Generation of oxygen	C. R. LXXIII, 254. Z. C. 1871, 415. Monit. Scientif. (3) I, 783. Bull soc. chim. XVI, 238. Jahresb. 1871, 206.
1871	Loughlin	Preparation of metal	Am. Chem. 1871, 454. Chem. News. XXV, 139. Bull soc. chim. XVII, 556.
1871	Rowan	Technical	D. C. Ges. IV, 856. Pol. Centr. 1871, 1569. J. c. T. XVIII, 350.
1871	Valentine	Regeneration	D. C. Ges. V, 228. Bull. soc. chim. XVII, 192. J. c. T. XVIII, 270.
1872	Krecke	Color of chloride	D. C. Ges. V, 582. J. c. T. XVIII, 348. J. p. C. (2) V, 105. Pol. Centr. 1872, 1159. Dingl. J. CCIV, 337. C. C. 1872, 289.
1872	Leclerc	Estimation in soil and plants	C. R. LXXV, 1209. D. C. Ges. V, 983. Bull. soc. chim. XIX, 177.

1872	Leclerc	Estimation in soil and plants	Dingl. J. CCVI, 366.
1872	Kessler	Estimation in steel and iron	D. C. Ges. V, 605. Bull. soc. chim. XVIII, 224. Chem. News. XXVII, 14. Dingl. J. CCV, 439 and 332. Le Technologiste. Dec., 1872. Am. Chem. 1873, 76. Pol. Centr. 1872, 1608.
1872	Schwartz	Manufacture of glass	Dingl. J. CCV, 422. Pol. Centr. 1872, 1624.
1872	Bayer	Preparation	J. p. C. 1872, V, 443. C. C. 1872, 499. J. c. T. XVIII, 347.
1872	Horner	Spectra in blowpipe beads	Chem. News. XXV, 139.
1872	Thomsen	Formation of oxide	D. C. Ges. V, 175.
1872	Tamm	Improvements in estimation	Chem. News. XVI, 37. Bull soc. chim. XIX, 121.
1872	Pahl	Pyrophosphate	D. C. Ges. VI, 1465.
1872	Kessler	Quantity in steel	Dingl. J. Sept., 1872. Chem. News. XXVI, 194.
1872	Tamm	Metallurgical	Chem. News. XXVI. 111. Bull soc. chim. XVIII, 552. Pol. Centr. 1872, 1348. Dingl. J. CCVI, 136.
1873	Pichard	Estimation by colorimetric process	C. R. LXXV, 1821. Chem. News. XXVII, 85. Bull soc. chim. XIX, 253. Z. anal. C. XII, 308. Dingl. J. CCVII, 136.
1873	Fresenius	Estimation	Z. anal. C. 1872, No. 3. Am. Chem. III, 472.
1873	v. Gerichten	Selenosulphates	A. C. P. CLXVIII, 214. D. C. Ges. VI, 162. Jahresb. reinen Chemie. I, 20.
1873	Hergh	Diconate	Jenaische Ztschrft. VII, 493. J. p. C. VIII, 372.
1873	Joulin	Exchange of $MnOSO_3$ with $NaOCO_2$	D. C. Ges. VI, 266. Jahres. reinen Chemie. I, 67.
1873	Kuhlman	Recovery	Pol. Centr. 1873, 1369.
1873	Joulin	Dissociation of $MnOCO_2$	D. C. Ges. VI, 969.
1873	Brünner	Volumetric estimation	Oesterr. Z. Berg. u. Hütten. 1873, No. 43. Pol. Centr. 1873, 1367.
1873	Brünner.	Utilization of Mn residues in glass mnft.	Dingl. J. CCVIII, 396. Bull. soc. chim. XX, 424.
1873	Fleischer	Barium manganate	Arch Pharm. III, 300. Jahres. reinen Chemie. I, 68.
1873	Percy	Mn as a substitute for Ni in German silver	Chem. News. XXVII, 249. Am. Chem. IV, III. Pol. Centr. 1873, 786.
1873	Parry	Estimation in Spiegeleisen	Chem. News. No. 743. Am. Chem. IV, 434.
1873	Kuhlman	Use of residues	Bay. Ind. Gewerbebl. May, 837. Pol. Centr. 1873, 986.

*Minerals. 1596–1873.**

ABBREVIATIONS.

H = Hausmannite.	Ps = Psilomelane.
Bn = Braunstein.	W = Wad
Br = Braunite.	A = Alabandite.
Py = Pyrolusite.	R = Rhodonite.
M = Manganite.	T = Tephroite.
Rh = Rhodochrosite.	Tr = Triplite.

1596	Cæsalpin	"Lapis manganensis"	Cæsalp. de metallicis. 1596.
1730	Bromell		Brom. Mineralogia.
1744	Cramer		Cram. Docimasie. 239.
1747	Wallerius	"Brunsten"	Wall. Min. 268 and 345.
1758	Gellert		Elements de chym. metallurgique.
1758	Cronstedt	"Magnesia indurata"	Cronst. Min. 106.
1767	Westfield		Mineralog. Abhandlungen.
1771	Cartheuser	"Magnesia fibris"	Mineralog. Abhandl.
1772	de Lisle	Mn cryst	de Lisle Crist.
1774	Crell	"Brunsten"	Crell's N. Entd. I, 156.
1774	Hjelm	"Brunsten"	Tillägnm om Brunsten. Vet. Acad. Handl. XXXV, 194.
1774	Rinmenn	"Braunstein"	Vet. Acad. Handl. 1774, 201. Schw. Akad. Abh. 1774, 206.
1780	de la Peyrouse	Ores	J. de Phys. XV, 67, XVI, 156. Mém de Toulouse. I, 256.
1782	Bergmann	"Mn acido aëreo mineralisatum" (Rh)	Sciagr Berg. 1782.
1782	Rupricht	"Rother braunstein" (R)	Phys. Arb. Wein. I, 55. Crell's Ann. 1790, I, 297.
1783	Wedgewood	"black wadd"	Phil. Trans. 1783, 284.
1784	Müller von Reichenstein	"Schwer blende"	Phys. Arb. Fr. Wein. II, 86.
1784	Kirwan		Kirw. Mineralogy. 390.
1784	Bindheim		Schrft Ges Nat. Fr. Berlin. V, 452.
1785	Sage		Mém. Acad. Sci. Paris. 1785, 235.
1786	de la Peyrouse	Native metal	Mém. de Toulouse. III, 256. Journ. d. M. VI, 599. Journ. d. Phys. XXVIII, 68. Crell's Ann. 1786, II, 302.
1786	Rinmann	Carbonate (?)	Scheele's Chem. Essays. London, 1786.
1787	Chaptal	Ores	Journ. d. Phys. XXXI, 100.
1787	Dietrich	Ores	Journ. d. Phys. XXX, 351.
1789	Werner	Schwarz braunsteinerz	Bergm. J. 1789, 386.
1791	Napione	"Oxyde rouge"	A. c. p. (1) X, 148. Mém de Turin. 4, 303.
1793	Emmerling	Psilomelane	Emmerl. Min. IV, 532.
1794	Lenz	"Luftsaures Braunstein" (Rh)	Lenz. Min. II, 1794.
1795	Vauquelin	Analyses	J. d. Mines. III.

*For many of the references the author is indebted to Dana's Mineralogy, 1868.

1796	Kirwan	Black Wad	Kirwan. Min.
1797	Klaproth	"Granat förmiges Braunsteinerz"	Klapr. Beitr. II, 239.
1798	Dolomieu	Romanèche Ore	J. d. Mines. IV, 27.
1800	Lampadius	Silicate	J. d. Mines. XVII 313. Samml. pr. Chem. Abh. III, 238.
1800	Lampadius	Rhodochrosite	Samml. pr. Chem. Abh. III, 239.
1800	Karsten	"Rother Braunstein" (R)	Karst. Tab, 54 and 78.
1801	Cordier	Useful Ores	J. d. M. X, 763.
1801	Vauquelin	Analyses	J. d. M. IX, 481.
1801	Haüy	Mag. oxide	Haüy Traité. IV, 1801.
1802	Klaproth	"Grau-manganerz"	Klapr. Beitr. III. 304.
1802	Klaproth	Analysis W	Klapr. Beitr. III, 311.
1802	Cordier	"violet oxide"	J. d. M. XIII, 135.
1802	Vauquelin	Phosphate	J. d. M. XI, 295. A. c. p. XLI, 242.
1805	Vauquelin	Sulphide	Ann. Mus. d. Hist. Nat. VI, 401. Gehlen's J. II, 41. Leonh. Taschenb. II, 266.
1806	Leonhard	Braunsteinkies	Leonh. Tab, 7.
1806	Lucus	Mn. phosphaté	Lucus Tabell. I, 169.
1807	Berzelius	Rother Braunsteinerz	Gehlen's, J. VI, 307. Leonh. Taschenb. I, 261 and 295.
1807	Blumenbach		Blumenb. Handb. I, 707.
1807	Klaproth	"Schwarz Braunstein"	Klapr. Beitr. IV, 137. Leonh. Taschenb. II, 220 and 266.
1808	G. Karsten	Grau Braunstein	Karst. Tab. 1808, 72, 100. Leonh. Taschenb. IV, 172.
1809	Haüy	Manganese Carbonaté (Rh)	H. Tabl. III.
1813	Hausmann	Grau braunstein	Hausm. Handb. 288.
1813	Hausmann	Schwarz braunstein	Hausm. Handb. 293.
1813	Hausmann	Triplite	Hausm. Handb. 1079.
1815	Ullmann	"Faseriges grau Braunsteinerz	Leonh. Tabell Uebers. 402. Leonh. Taschenb. IX, 432 and 434.
1815	Berzelius	Silicate	Afh. Fysik. IV, 382. Ann. Phil. VIII, 232. Schweigg, J. XXI, 254. Leonh. Taschenb. V, 174.
1816	Pusch	Manganspath	Leonh. Taschenb, X, 180.
1817	Jasche	Dialogite (Rh)	Kl. Min. Schrift. 1817, 4. Gilb. Ann. LX, 84.
1817	Doebereiner	"Knebelite"	Schweigg, J. XXI, 49.
1819	Du Ménil	Minerals	Gilb. Ann. LX, 87.
1819	Du Ménil	Silicate	Gilb. Ann. LXI, 190.
1819	Jasche	Rhodonit	Schweigg, J. XXVI, 110, Note.
1819	Brandes	Ores	Schweigg, J. XXVI, 103 and 121.
1819	Berzelius	Oxides	Schweigg, J. XXVI, 262.
1819	Berzelius	Analysis Tr.	Schweigg, J. XXVII, 70.
1819	Germar	"Hydropit" (R)	Schweigg, J. XXVI, 108.
1819	Berzelius	Phosphate	A. c. p. (2) XII, 34.
1820	Hitchcock	Pyrolusite	Am. J. Sci. (1) II, 374.
1821	Doebereiner	Analysis W	Gilb. Ann. LXVII, 333.
1821	Berthier	Ores	Ann. d. Mines. VI, 291 and 593. A. c. p. (2) XX, 344. Ann. Phil. III, 573.

1821	Berthier	Ores	Schweigg, J. XXXV, 81.
			Am. J. Sci. VII, 366.
1821	Ficinus	"Braunstein von Bodenmais"	Schweigg, J. XXX, 201.
1822	del Rio	"Blende"	Gilb. Ann. LXXI, 7.
1822	Cist		Am. J. Sci. IV, 38, 54, and 189.
1822	Haüy	"Oxyde Hydraté"	Haüy Traité. 1822.
1822	Arfvedson	Analysis A	Vetens. Acad. Handl. 1822.
1822	Dewey	Pyrolusite	Am. J. Sci. V, 249.
1823	Breithaupt	"Tephroite"	Breith. Char. 1823, 278.
1824	Mohs	"Prismatisches Manganerz"	Mohs. Grundriss. 488.
1824	Meade		Am. J. Sci. VII, 54.
1824	Haidinger	"Pyramidal Manganerz"	Mohs. Min. II, 416.
1824	Arfvedson	"Manganglanz"	Pogg. I, 58.
1825	Vauquelin	Huraulite	Ann. Sci. Nat. VIII, 349.
			A. c. p. XXX, 302.
1825	Hitchcock	Rhodonite	Am. J. Sci. IX, 22.
1824	Arfvedson	Analyses	Afh. Fysik. VI, 222.
			Schweigg, J. XLII, 202.
1825	Fowler	"Fowlerite"	Am. J. Sci. IX, 345.
1826	Brogniart	"Bustamite" (R)	Ann. Sci. Nat. VIII, 411.
1826	Leonhard	Hyperoxide	Leonh. Handb. 240.
1826	Haidinger	Braunite	Ed. J. Sci. IV, 48.
1826	Haidinger	Crystallographic	Pogg. VII, 225.
1827	Haidinger	Pseudomorph	Pogg XI. 374.
1827	Haidinger	M. H. Py. &c.	Pogg. XIV, 197.
			Ann. J. M. I, 409.
			Phil. Mag. IV, 22.
			Trans. Roy. Soc. Ed. 1827.
			Leonh. Ztschr. Min. 1829, 628.
1827	Berthier		Ann. d. M. (3) XI, 489.
1828	Thomson	"Ferrosilicate"	Ann. N. Y. Lyc. Nat. Hist. III, 28.
1828	Wackenroder	Anal. W.	Kastn. Archiv. XIII, 302 and XIV, 257.
1828	Turner	Analyses	Trans. Roy. Soc. Edinb. XI.
		Py. H. Br.	Leonh. Ztschr. 1829, 628.
1828	Rammelsberg	Analysis H.	Pogg. Ann. XIV, 222.
1828	Hartwall	Mangan-Epidot	K. Vet. Acad. Handl. 1828, 171.
			J. p. Ch. IV, 18.
			Geiger Mag. Pharm. XXX, 114.
1829	Phillips	Warwick mineral	Phil. Mag. (2) V, 209.
			Dingler. J. XXXII, 431.
1829	Kane		Quart. J. Sci. 1829. Oct. to Dec., 381.
			Leonh. Jahrb. 1830, 495.
1829	Dufrenoy	Huraulite and Hetepozit	A. c. p. (2). XLI, 337.
			Ann. d. M. (2) VII, 137.
			Schweigg, J. LVII, 454.
			Dingl. J. XXXIV, 444.
			Leonh, Jahrb. II, 189.
1829	Damour	Analysis T	Ann. d. M. (2) VI, 339.
1829	Berthier	Analysis Rh	Ann. d. M. (2), VI, 595,
1829	Cantu	Carbonate	Mem. Acad. Torino. XXXIII, 167.
			Leonh. Jahrb. 1835, 84.
1830	Kane	"Kaneite"	Quart. J. Sci. (2). VI, 386.
			Pogg. Ann. XIX, 145.

1830	Turner	Wad, &c	Edinb. J. Sci. (2) II, 213.
1831	Fuchs	Analysis Ps	Schweigg. LXII, 253.
1832	Berthier	"Groroilite"	A. c. p. (2), LI, 79.
		"Marceline"	J. t. C. XVI, 379.
			Dingler. J. XLVII, 104.
1832	Shepard	"Fowlerite"	Shep. Min. 1832, 186.
1832	Beudant	"Acerdèse"	Beud Traité. II, 399 and 678.
1832	Hitchcock		Am. J. Sci. XXII, 61.
1832	Kersten	Analysis W	Schweigg J. LXVI, 1.
1833	Stromeyer	Analysis Rh	Gött. Gel. Anz. stück. 109, 1081.
			Leonh. Jahrb. 1834, 224; also, 1835, 85.
1834	Stromeyer	Mangan alaun	A. C. P. X, 235.
			Pogg. Ann. XXI, 337.
1835	Cordier	Mangan epidote	J. pr. C. IV, 18.
1836	Thomson	"Narkirkite"	Thoms. Min. I, 509.
1837	Taylor	Peroxide containing silver	Phil. Mag. 279.
			Leonh. Jahrb. 1837, 571.
1838	Ed. Davy	Peroxide containing copper	Dubl. Geol. Soc. J. I, 241.
1838	Apjohn	Manganese alum	Phil. Mag. XII, 103.
			A. C. P. XXII, 272.
			J. pr. C. XI, 502.
			Leonh. Jahrb. 1840, 231.
1838	Ebelmen	Analysis	Ann. d. Mines. (3), XIV, 283.
			Leonh. Jahrb. 1839, 712.
1839	Fuchs	"Eisenapatit" (Tr)	J. pr. C. XVIII, 499.
1840	Breithaupt	"Heterokline"	Pogg. Ann. XLIX, 204.
			Breit. Handb. 1847, 801.
1841	Ebelmen	Analysis Ps	Ann. d. M. (3), XIX, 155.
			Leonh. Jahrb. 1842, 337.
1841	Huot	Kapnikite Ouatite	Huot. Manuel. 241.
1841	Böttger	Analysis W	Pogg. Ann. LIV, 545.
1841	Breithaupt	"Zwiselite" (Tr)	Breit. Handb. II, 299.
		"Rosenspath" (Rh)	Breit. Handb. II, 228.
1842	Damour	Analysis Br	Ann. d. M. (4), I, 400.
1842	Rammelsberg	Analysis Ps	Leonh. Jahrb. 1842, 559.
1842	Rammelsberg	Analysis H	Leonh. Jahrb. 1842, 602.
1843	Scheffler	Genesis of ores	Ber. ü. d. II Versamlung Naturv. f. Thüringen. Juni. 1843, 8 and 9.
			Leonh. Jahrb. 1844, 362.
			Arch. Pharm. (2) XXXV, 260.
1843	Clausbruch	Analysis Ps	Rammelsberg. 1st Supplement.
			Leonh. Jahrb. 1844, 205.
1844	Rammelsberg	Analyses	Pogg. LXII, 145, and 157.
			Pogg. LXIV, 531.
			Leonh. Jahrb. 1843, 206.
1844	Nöggerath	Chemical origin ot ores	Karst. Arch. Min. XVIII, 537.
			Leonh. Jahrb. 1845, 105.
1844	Ettling	Geological	A. C. P. XLIII, 185.
			Leonh. Jahrb. 1844, 70.
1844	Plattner	Analysis Py	Pogg. XLI, 192.
1844	Senez	Analysis	Ann. d. M. XX, 570.
			Leonh, Jahrb. 1844, 69.
			Leonh. Jahrb. 1843, 345.
1844	Breithaupt	"Polianite" &c	Pogg. LXI, 187.
			Leonh. Jahrb. 1844, 595

1845	Ebelmen	Analysis R	Ann. d. M. (4) VII, 8.
1845	Kersten	Genesis of ores	Karst. Archiv. Min. XIX, 754. Leonh. Jahrb. 1846, 229.
1845	Haidinger	"Wiserite"	Haid. Handb. 1845, 493.
1846	Missondakis	Analyses	Leonh. Jahrb. 1846, 614.
1846	Ebelmen	Analysis silicate	J. pr. Ch. XXXVII, 127.
1846	Breithaupt	Manganocalcite	Pogg. LXIX, 429. Instit. No. 726. Am. J. Sci. (2), V, 268.
1846	Kersten	Analysis Rh	J. pr. C. XXXVII, 163.
1846	Igelström	Analysis W	Berz. Jahresb. XXV, 342.
1846	Rammelsberg	Analysis Ps.	Pogg. LXVIII, 72.
1846	Rammelsberg	Analysis Mangano-calcite	Pogg. Ann. LXVIII, 511. Leonh. Jahrb. 1847, 344.
1847	Kersten	Analysis	Ann. d. M. (4), XI, 641.
1847	Hausmann	"Glanz Braunstein"	Hausm. Handb. 222 and 405.
1847	Schwarzen-berg	Analysis Py	A. C. P. LXI, 262.
1847	Haidinger	"Hauerite"	Nat. Abh. Wien. I, 107.
1847	Glocker	"Zwiselite"	Glock. Syn. 244.
1848	Kane	Carbonate	Phil. Mag. (3), XXXII, 37. C. C. 1848, 272. Jahresb. 1848, 1024. Leonh. Jahrb. 1849, 470.
1848	Monheim	Analysis	Verhandl. Rheinland. Vereins. V, 171. Leonh. Jahrb. 1852, 69.
1848	Rammelsberg	Manganese copper ores	Pogg. Ann. LXXIV, 559. Leonh Jahrb. 1849, 559.
1848	Credner	Occurrence	Pogg. Ann. LXXIV, 546. Leonh. Jahrb. 1849, 310.
1849	Del Rio	Mn Zn & Cu alloy	Bull. géol. Soc. III, 24 and 25. Leonh. Jahrb. 1849, 96.
1849	Hermann	Hydrated oxide from North America	J. p. C. XLVII. Leonh. Jahrb. 1850, 447.
1849	Hermann	"Mangan-amphibole"	J. pr. Ch. XLVII, 7. Am. J. Sci. (2), IX, 410.
1850	Websey	"Mangan-idokras"	Pogg. Ann. LXXIX, 166. Leonh. Jahrb. 1851, 89.
1850	Bahr	Analysis W	J. pr. Ch. LIII, 308.
1850	Delanoue	Geological	Ann. d. M. (4) XVIII, 455.
1850	Gruner	Geological	Ann. d. M. (4), XVIII, 61. Jahresb. 1850, 761 and 771.
1851	Igelström	"Paisbergite"	Afh. Ak. Stockh. 1851, 143. J. pr. Ch. LIV, 192.
1852	Rammelsberg	Analysis	Pogg. Ann. LXXXV, 297. Leonh. Jahrb. 1853, 176.
1852	Wells	Distribution	Am. J. Sci. (2), XIII. 9.
1852	Bechi	Analysis Br	Am. J. Sci. (2), XIV, 62.
1853	Kenngott	Hermannite (R)	Kenng. Min. 71.
1853	Sandberger	Mangan-spath	Pogg. Ann. LXXXVIII, 491.
1854	Müller	Minerals of Jura	Verh. Nat. Ges. Basel. 1854, 95. Leonh Jahrb. 1857, 168.
1854	J. L. Smith	Alum	Am. J. Sci. (2), XVIII, 379. J. pr. Ch. LXIII, 460. C. C. 1855, 7. Jahresb. 1854, 863.

1854	Schultz	Analysis Ps	Rammelsb. Mineralchemie, 1006.
1854	Huene	Ps in trachyte	Zeitschr. deutsch. geol. Ges. IV, 576.
			Leonh. Jahrb, 1854, 593.
1854	Müller	Pseudomorphs	Berg- Hütten-männ. Zeit. 1854, 289.
			Leonh. Jahrb. 1855, 69.
1856	Birnbacher	Carbonate	A. C. P. XCVIII, 144.
			J. p. C. LXVIII, 64.
			C. C. 1856, 495.
			Jahresb. 1856, 883.
1856	Haidinger	"Reissacherit"	Jahrb. geol. Reichs. VII, 209.
1856	Burkhart	Mangan-blende	Verh. Niederrhein. Ges. 1856, Jan.
1857	Bergemann	"Blende"	Leonh. Jahrb. 1857, 394.
			Jahresb. 1857, 659.
			Verh. Nat. Ver. Bonn. III.
1857	Glocker	Ps	Jahrb. geol. Reichs. VI, 97.
			Leonh. Jahrb. 1859, 433.
1857	Hornig	Analysis W	Jahrb. geol. Reichs. VII, 312.
1858	Field	Cupreous oxide	Chem. Gaz. 1858, 104.
1858	Abich	Ores of the Caucasus	Bull. Sci. St. Petersb. XVI, 305.
1859	Kenngott	Alum	Uebers. d. Min. Forsch. 1859, 12.
1859	T. S. Hunt	Carbonate	Am. J. Sci. (2), XXVII, 134.
			Jahresb. 1859, 813.
1860	Hildebrand	Carbonate	A. C. P. CXV, 348.
			Rep. chim. pure. III, 90.
			Verh. Nat. Nassau, XIV, 434.
1860	Rammelsberg	"Cummingtonite" (R)	Rammelsb. Mineralchemie. 1860, 473.
1860	Bergemann	Analysis Tr	J. p. C. LXXIX, 414.
1860	Breuilhs and Sevoz	Ores of Huelva	Bull. Soc. Ind. Min. VI, 29.
			Allg. Berg. Ztg. III, 213, 245.
1861	Hahn	Analysis R	B. H. Ztg. XX, 267.
1861	K. List	Analysis Ps	J. p. C. LXXXIV, 60.
			Pogg. Ann. CX, 321.
			Leonh. Jahrb. 1861, 186.
1861	Zerrenner	Geological	Die Braunstein Bergbaue in Deutschland, Freiberg. 1861.
			J. c. T. VII, 143.
1861	How	Analyses	Phil. Mag. (4), XXI, 165.
			Leonh. Jahrb. 1866, 724.
1864	Igelström	"Pyrochroit"	Oefv. Ak. Stockh. 1864, 205.
			Pogg. CXXII, 181.
			Leonh. Jahrb. 1865, 83.
1864	von Kobell	Analysis Tr	J. p. C. XCII, 390.
1864	Brush	Analysis T	Am. J. Sci. (2), XXXVII, 66.
1864	Rose	Br & H	Pogg. CXXI, 318.
1865	Breithaupt	Fauserite	B. H. Ztg. XXIV, 301.
1865	Igelström	"Chondrarsenite"	Oefv. Ak. Stockh. XXII, 3, 606.
1865	Rammelsberg	Analyses and Sp. Gr.	Berl. Acad. Ber. 1865, 112.
			Pogg. CXXIV, 513.
			J. p. C. XCIV, 401.
			Z. C. 1865, 346.
			C. C. 1865, 347.
			Arch. Pharm. (2), CXXVI, 39.
			Bull. soc. chim. (2), VI, 30.
			Jahresb. 1865, 877.

1866	Schmid	Psilomelan	Pogg. CXXVI, 151. Jahresb. 1865, 878.
1866	Schrauf	Twin crystals of alabandite	Pogg. CXXVII, 348.
1866	How	Analysis M	Phil. Mag. (4), XXXI, 166.
1866	Breithaupt	"Blumenbachite"	B. H. Ztg. XXIII, 193.
1866	Rammelsberg	Analysis R	Z. S. G. XVIII, 34.
1866	Pisani		C. R. LXII, 109.
1866	Kenngott	Pyrochroite	Leonh. Jahrb. 1866, 440.
1867	Cleve & Nordenskiöld	Analysis of silicates	J. p. C. C, 119. Bull. soc. chim. (2), VIII, 43.
1867	Igelström	Piemontit	Oefv. Akad. Stockh. 1867, 1. J. p. C. CI, 432. Leonh. Jahrb. 1868, 203. C. C. 1868, 624. Bull. soc. chim. (2), IX, 57.
1867	Braun	Analysis M	Z. anal. Ch. VI, 67.
1867	Blake	Tungstate	Am. J. Sci. (2), XLIII, 125.
1869	Heymann	Carbonate	Sitzungsb. d. niederrhein. Ges. in Bonn, 1869, 95. Leonh. Jahrb. 1870, 625.
1870	Ludwig	Analyses	Arch. Pharm. (2), CXLIII, 194. C. C. 1870, 627. Jahresb. 1870, 1124.
1870	Kayser	Manganite	Zeitschr. geol. Ges. XXII, 182. Jahresb. 1870, 1281.
1870	Roepper	Analysis of carbonate	Am. J. Sci. (2), L, 37. Leon. Jahrb. 1870, 892. C. C. 1870, 708. Jahresb. 1870, 1325.
1870	Enders	Anal. of carb.	Arch. Pharm. (2), CXLIII, 198. C. C. 1870, 627.
1871	Raab	Occurrence	N. R. Pharm. XX, 1 (prize essay). Leonh. Jahrb. 1871, 517. Jahresb. 1871, 1129.
1871	Mills	Analyses and geological occurrence	Am. Chem. (2), IV, 49. Jahresb. 1871, 1143.
1872	Pisani	Anal. Mangano-silico-aluminate containing vanadium.	D. C. Ges. V, 1057. Am. Chem. III, 465.

EXPLANATION OF ABBREVIATIONS.

Abh. Acad. Wiss. Berlin.	Abhandlungen der Königlichen Academie der Wissenschaften zu Berlin.
Abh. Schw. Acad. Wiss.	Abhandlungen der königlichen Schwedischen Academie der Wissenschaften. Stockholm.
A. c. p.	Annales de chimie et de physique, Paris.
A. C. P.	Annalen der Chemie und Pharmacie, Heidelberg.
Afhandl. Fysik K. och Min.	Afhandlingar Fysik, Kemi, och Mineralogi, Berzelius, Stockholm.
Allg. Berg. Ztg.	Allgemeine Berg- und Hüttenmännische Zeitung, Hartmann, Quedlinburg.
Am. Chem.	American Chemist, C. F. and W. H. Chandler, New York.
Am. J. Sci.	American Journal of Science and Arts, Silliman and Dana, New Haven, Ct.
Ann. Phil.	Annals of Philosophy, Thomson, London.
Ann. Ch. Pharm.	Annalen der Chemie und Pharmacie, Heidelberg.
Ann. d. Mines *or* Ann. d. M.	Annales des Mines, Paris.
Ann. Gen'l des Sci. Phys.	Annales générales des sciences physiques, Von Mons, Bruxelles.
Ann. Génie civil.	Annales du Génie civil, Paris.
Ann. Mus. d'Hist. Nat.	Annales du Musée d'Histoire Naturelle, Paris.
Ann. N. Y. Lyc. Nat. Hist.	Annals of the Lyceum of Natural History, New York.
Arch. Pharm.	Archiv der Pharmacie, Halle, etc.
Arch. ph. nat.	Archives des sciences physiques et naturelles, Genève.
Bay. Ind. Gewerbebl.	Bayerisches Industrie und Gewerbeblatt, München.
Beitr. zur Phys. u. Ch.	See Schweigg.
Beob. Berl. Ges. Naturf. Fr.	Beobachtungen der Gesellschaft der Naturforschende Freunde zu Berlin.
Berl. Acad. Ber.	Bericht über die . . . . Verhandlungen der K. Preussiche Academie der Wissenschaften zu Berlin.
Berl. Gewerb. Handelsbl.	Gewerbe, Industrie und Handelsblatt, Berlin.
Berg. Hüttenm. Ztg.	Berg- und Hüttenmännische Zeitung, Leipzig.
Beud. Traité	Traité élémentaire de minéralogie, Beudant.
B. H. Ztg.	See Berg. Hüttenm. Ztg.
Bern Mitth.	Mittheilungen der Naturforschenden Gesellschaft in Bern.
Berz. Jahresb.	Jahresbericht über die Fortschritte der Chemie, etc., Berzelius, Tübingen.
Bibl. Univers.	Bibliothèque Universelle des Sciences, etc., Genève.
Br. d. Inv.	Descriptions des Machines et Procédés spécifiés dans les Brevets d' Inventions, Paris.
Brugnatelli.	Annali di Chimica, Brugnatelli, Pavia.
Brugnatelli G.	Giornale di fisica, chimica e storia naturale, L. Brugnatelli, Pavia.
Buchner's Repert.	Repertorium für die Pharmacie, Buchner, Nürnberg.
Bull. Geol. Soc. Paris.	Bulletin de la Société Geologique de France, Paris.
Bull. Sci. St. Petersb.	Bulletin Scientifique publié par l'Académie Imp. des Sciences de St. Petersbourg.
Brom. Min.	Von Bromell's Mineralogia, Stockholm.
Breith. Char.	Vollständige Charakteristik des Mineralsystems, Breithaupt.

Bull soc. chim.	Bulletin de la Société chimique de Paris.
Bull. soc. d'Encourage.	Bulletin de la Société d' Encouragement pour l' Industrie National, Paris.
Bull. soc. Ind. Mulh.	Bulletin de la Société Industrielle de Mulhouse.
Bresl. Gewerbebl.	Breslauer Gewerbeblatt, Schwartz, Breslau.
Caesalp. de Metallicis.	De Metallicis, Caesalpinus, Romae, 1596.
Canad. J.	Canadian Journal of Industry, &c., Toronto.
C. C.	Chemisches Centralblatt, Leipzig.
Chem. Gaz.	Chemical Gazette, Francis & Croft, London.
Chem. News.	Chemical News, Crookes, London.
Chem. Soc. Trans.	Transactions of the Chemical Society of London.
Chem. Soc. Mem.	Memoirs of the Chemical Society of London.
Cimento.	Il Cimento, Giornale di fisica ecc. Pisa.
C. R.	Compte rendu des Séances de l'Académie des Sciences, Paris.
Crell's N. Entd.	Die neueste Entdeckungen in der Chemie, Crell, Leipzig.
Crell's Ann.	Chemische Annalen, Crell, Leipzig.
Cronst. Min.	Mineralogie, Cronstedt, Stockholm.
Dingl. J. *or* Dingl. pol. J.	Polytechnisches Journal, Dingler, Stuttgart.
D. C. Ges.	Berichte der deutschen chemischen Gesellschaft zu Berlin.
Deutsche Indust. Ztg.	Deutsche Industrie Zeitung. Binder, Chemnitz.
Deutsche Gewerbe Ztg.	Deutsche Gewerbe Zeitung, Wieck, Berlin.
Doeb. Lehrb. d. Chem.	Lehrbuch der Chemie, Doebereiner.
Dubl. Geol. Soc. J.	Journal of the Dublin Geological Society.
Edinb. J. Sci.	Edinburgh Journal of Science, Brewster.
Edinb. Med. Surg. J.	Edinburgh Medical and Surgical Journal.
Edinb. Phil. J.	Edinburgh Philosophical Journal.
Emmerl. Min.	Lehrbuch der Mineralogie, Emmerling.
Engineering.	Engineering, London.
Gehlen's J.	Allgemeines Journal der Chemie, Gehlen, Berlin.
Geiger's Mag.	Magazin für Pharmacie, Geiger, Carlsruhe.
Gilb. Ann.	Annalen der Physik, Gilbert, Halle.
Gött. Gel. Anz.	Göttingische Anzeigen von gelehrten Sachen.
Gren's J. d. Physik.	Journal der Physik, Gren, Halle.
Hannover Mitth.	Mittheilungen des Gewerbe-Vereins für das Königreich Hannover.
Hausm. Handb.	Handbuch der Mineralogie, Hausmann.
Haüy Traité.	Traité de Minéralogie par C. Haüy, Paris.
Hessische Gewerbebl.	Gewerbeblatt für das Grossherzogthum Hessen, Darmstadt.
Hofman's Report. 1862.	Hofmann's Report of the Exhibition of 1862.
Huot Manuel.	Manuel de Minéralogie par Huot.
H. Tabl.	Tableau comparatif . . . . . Minéraux. Haüy.
Irish Acad. Proc.	Proceedings of the Royal Irish Academy.
Instit.	L'Institut, Paris.
Jahrb. geol. Reichs.	Jahrbuch der k. k. geologischen Reichsanstalt, Wien.
Jahrb. Min.	*See:* Leonh. Jahrb.
Jahresb.	Jahresbericht über die Fortschritte der Chemie, Giessen.
Jahresb. reinen. Chemie.	Jahresbericht über die Fortschritte . . . . . der reinen Chemie, Tübingen.
Jahres. des phys. Ver. zu Frankfurt.	Jahresbericht des physikalischen Vereins zu Frankfurt am Rhein.

Jena. Zeit. Med. u. Nat.	Jenaische Zeitschrift für Medicin und Naturwissenschaft.
J. c. T.	Jahresbericht über die Fortschritte der chemischen Technologie, Wagner, Leipzig.
J. d. M.	Journal des Mines, Paris.
J. p. C. *or* J. pr. Ch.	Journal für praktische Chemie, Erdmann.
J. techn. Ch.	Journal für technische Chemie, Erdmann.
J. Chim. Méd.	Journal de chimie médicale.
J. Roy. Inst.	Journal of the Royal Institution of Great Britain.
Journ. de Phys.	Journal de Physique, Rozier, Paris.
J. Pharm.	Journal de Pharmacie et de Chimie, Paris.
Karsten's Archiv.	Archiv für Mineralogie, Geognosie, etc., Karsten, Berlin.
Karst. Tab.	Tabellarische Uebersicht der Mineralien, Karsten.
Kastn. Archiv.	Archiv für die gesammte Naturlehre, Kastner, Nürnberg.
Kenng. Min.	Das Mohsiche Mineralsystem, Kenngott.
Klapr. Beitr.	Beiträge zür chemischen Kenntnisse der Mineralkörpers, M. H. Klaproth.
Kurhess. Gewerbebl.	Gewerbeblatt für das Grossherzogthum Hessen, Darmstadt.
Les Mondes.	Les Mondes, Moigno, Paris.
Le Technologiste.	Le Technologiste, Paris.
Leonh. Taschenb.	Taschenbuch für die gesammte Mineralogie, Leonhard, Frankfurt am Main.
Leonh. Jahrb.	Jahrbuch für Mineralogie, Geognosie, etc. Leonhard, Heidelberg.
Leonh. Tab.	Systemmatisch-tabellarische Uebersicht der Mineralien, Leonhard, Frankfurt am Main.
Leonh. Zeitschr.	Zeitschrift für Mineralogie, Leonhard, Frankfurt am Main.
London J. of Arts.	London Journal of Arts and Sciences, Newton, London.
Lucas Tab.	Tableau méthodique des éspèces Minéraux, Lucas, Paris.
Mem. Acad. Sci., Paris	Mémoires d l'Académie des Sciences, Paris.
Mem. de Toulouse.	Mémoires de l'Académie des Sciences de Toulouse.
Mem. de 'l Inst.	Mémoires de l'Institut National des Sciences et des Arts, Paris.
Mitth. Naturf. Ges. Bern.	Mittheillungen der naturforschenden Gesellschaft in Bern.
Mohs' Min.	Grundriss der Mineralogie, Mohs.
Monit. Scientif.	Moniteur Scientifique, de Quesneville, Paris,
Muster Ztg.	Deutsche Muster Zeitung für Färberei, Berlin.
N. Arch. ph. nat.	Nouvelles archives des sciences physiques et naturelles, Genève.
Nachr. Göttingen.	Nachrichten von der G.-A.-Universität und der k. Gesellschaft der Wissenschaften zu Göttingen.
Neue Abh. Schw. Acad. Wiss.	*See:* Abh. Schw. Acad. Wiss.
N. Jahrb. Pharm.	Neues Jahrbuch für Pharmacie, Speyer.
N. R. Pharm.	Neues Repertorium für Pharmacie, Buchner, Nürnberg.
Oefv. Ak. Stockh.	Oefversigt af Kongl. Vetenskaps-Akademiens Forhandlingar; Stockholm.
Oesterr. Z. Berg. u. Hütten.	Oesterreichische Zeitschrift für Berg und Hüttenwesen.

Pat. Specif. Abr. Acids and salts.	Abridgements of Specifications relating to Acids . . . . . and Salts, A. D., 1622—1866. London, 1869.
Petersb. Acad. Bull.	Bulletin de l' Académie des Sciences de St. Petersburg.
Pharm. Centr.	Pharmaceutisches Centralblatt. Leipzig.
Phil. Mag.	London, Edinburg and Dublin Philosophical Magazine, London.
Phil. Trans.	Philosophical Transactions of the Royal Society of London.
Phys. Arb. Fr. Wien.	Physikalische Arbeiten der einträchtigen Freunde in Wien.
Pogg. *or* Pogg. Ann.	Annalen der Physik und Chemie, Poggendorff, Berlin.
Pol. Notizbl.	Polytechnisches Notizblatt.
Pol. Centr.	Polytechnisches Centralblatt.
Proc. Am. Acad. Sci.	Proceedings of the American Academy of Sciences, Boston.
Proc. Roy. Soc.	Proceedings of the Royal Society of London.
Quart. J. Sci.	Quarterly Journal of Science (Brandes), London.
Rammelsb. Min.	Handbuch der Mineralchemie, Rammelsberg, 1860.
Records Gen'l Sci.	Records of General Science, Thomson, London.
Rep. Arts and Manuf.	Repertory of Arts and Manufactures. First Series of Rep. Pat. Inv.
Rep. Pat. Inv.	Repertory of Patent Inventions, London.
Rep. Br. Assoc.	Reports of the British Association for the Advancement of Science.
Rep. chim. appl.	Répertoire de chimie appliquée, Paris.
Rep. chim. pure.	Répertoire de chimie pure et appliqueé, Paris.
Reuss Repertor.	Repertorium commentationum, J. D. Reuss, Göttingen.
Samml. pr. chem. Abh.	Sammlung praktisch-chemischer Abhandlungen, Lampadius, Dresden.
Schw. Berl. Ges. Naturf. *or*, Schrift. Ges. Naturf. Fr. Berlin	Schriften der Gesellschaft der Naturforschende Freunde zu Berlin.
Schweigg.	Journal für Chemie und Physik, Schweigger, Nürnberg.
Schweizer pol. Zts.	Schweizerische polytechnische Zeitschrift, Winterthur.
Sciagr. Berg.	Bergmann's Sciagraphia, 1782.
Shep. Min.	Treatise on Mineralogy, by C. U. Shepard.
Sitzungsb. Akad. Wiss. Wien	Sitzungsberichte der k. k. Akademie der Wissenschaften zu Wien.
Sitzungsb. d. niederrhein. Ges. in Bonn	Sitzungsberichte der niederrheinländische Gesellschaft in Bonn.
Thoms. Min.	Outlines of Mineralogy by T. Thomson.
Trans. Roy. Irish Acad.	*See* Irish Acad. Proc.
Trans. Nova Scotia Inst. Nat. Sci.	Transactions of the Nova Scotia Institute of Natural Science, Halifax.
Trommsd. J. d. Pharm.	Journal der Pharmacie, Trommsdorff, Leipzig.
Uebersicht d. min. Forsch.	Uebersicht der mineralogische Forschungen in der Schweiz, Kenngott.
Verh. Nat. Nassau.	Verhandlungen der Naturhistorische Gesellschaft in Nassau.
Verh. Nat. Ver. Bonn.	Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlände und Westphalens, Bonn.

Verh. Niederrhein. Ges.	Verhandlungen der niederrheinländische Gesellschaft zu Bonn.
Verh. Naturf. Ges. Basel.	Verhandlungen der Naturforschenden Gesellschaft in Basel.
Vet.Acad. Nya. Handl. *or* Vetensk. Acad. Handl.	Kongl.Svenska Vetenskaps Academiens Handlingar, Stockholm. (Old and New Series).
Vierteljahres. Pharm.	Vierteljahresschrift für praktische Pharmacie, Wittstein, München.
Wall. Min.	Mineralogia, Wallerius, Stockholm.
Wien Akad. Ber.	Sitzungsberichte der naturwissenschaftliche classe der kaiserliche Academie der Wissenschaften zu Wien.
Z. C.	Zeitschrift für Chemie, Göttingen.
Z. C. P.	Zeitschrift für Chemie und Pharmacie, Erlangen.
Z. anal. C.	Zeitschrift für analytische Chemie, Fresenius, Wiesbaden.
Zeitschr. deutsch. geol. Ges.	Zeitschrift der deutschen geologischen Gesellschaft, Berlin.
Zeitschr. Phys. Math.	Zeitschrift für Physik, Mathematik und verwandte Fächer, Baumgarten.

ERRATA.

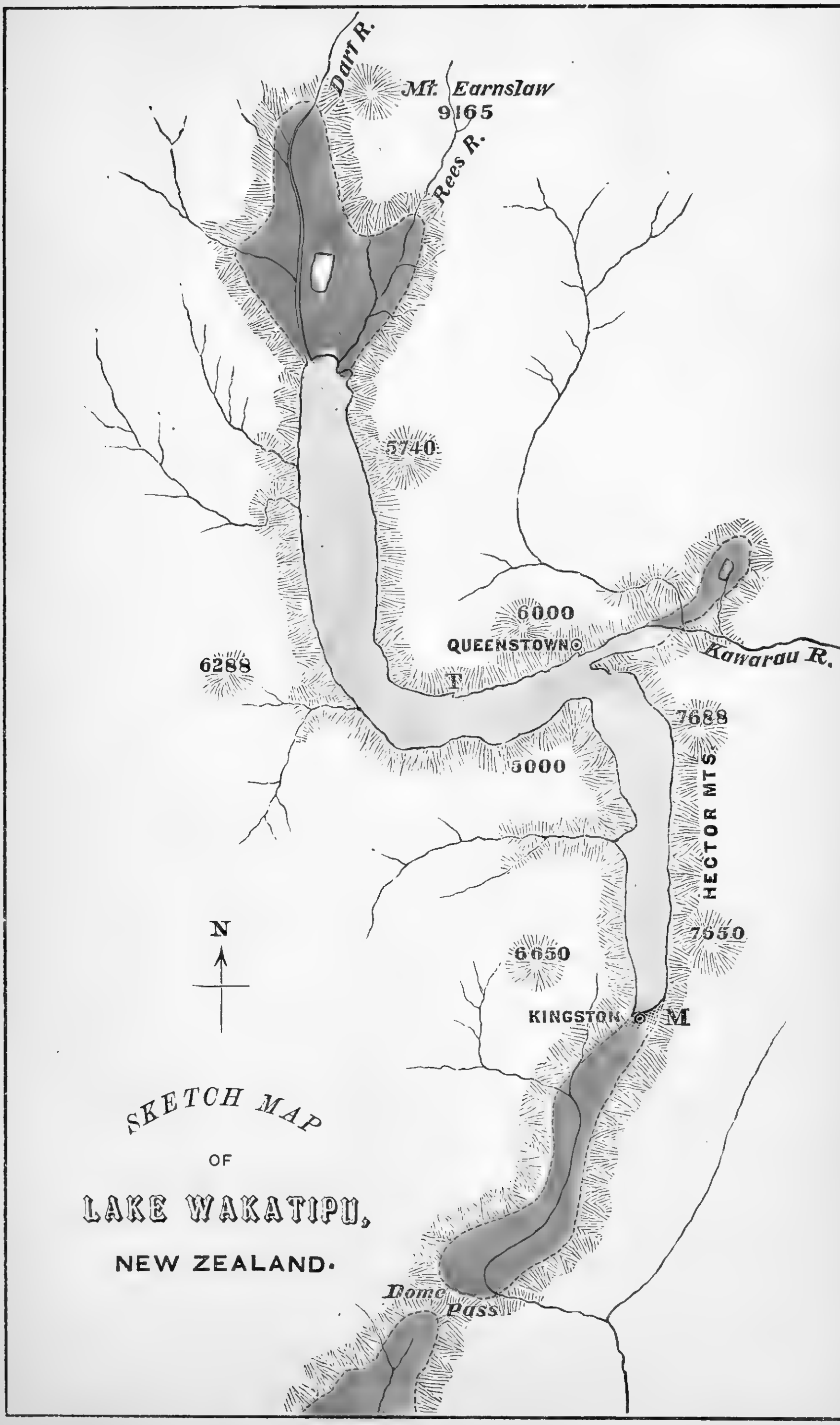
Page	208,	line	30	from	top,	remove the period after "Nova."
"	209,	"	23	"	"	for "J. de m." read: J. de M.
"	210,	"	5	"	bottom,	remove the period after "och."
"	213,	"	21	"	top,	after "Dingler" insert J.
"	213,	"	34	"	"	for "Chem" read: Chim.
"	217,	"	32	"	"	remove period after "de."
"	221,	"	36	"	"	strike out][
"	225,	"	2	"	"	strike out][
"	226,	"	12	"	bottom,	for "Schweitz" read: Schweiz.
"	230,	"	9	"	"	for "Schweitz" read: Schweiz.
"	231,	"	33	"	top,	for "Schweitz" read: Schweiz.

EXPLANATION OF PLATE XIX.

Position of Queenstown:—
Lat. 45° 2′ S.
Long. 114° 16′ W.
from Washington.

Scale, 10 miles to the inch.
Heights in feet.
Only a few out of numerous lofty peaks, are here represented.

Present lake area in blue.
Ancient extensions in yellow.
T. Outcrop of Tertiary limestone.
M. Old terminal moraine.



I. C. Russell, del. B. B. Chamberlin, sc.

XXIV.—Notes on the Ancient Glaciers of New Zealand.

[With map, Plate 19.]

By ISRAEL C. RUSSELL.

Read May 15th, 1876.

About twelve hundred miles east of Australia, are situated the islands of New Zealand, the most promising of the English colonies in the southern hemisphere. The name of New Zealand was given to these islands by the Dutch navigator Tasman, who discovered them in 1642, but considered that they were a portion of the *Terra Australis Incognita*. This land was shown by Captain Cook, however, to be composed of two main portions, known as the North and the South Islands, around which are grouped a few smaller and far less important islands.

The North Island is largely composed of igneous rocks, and is chiefly remarkable to the geologist for the regularity and beauty of its numerous volcanic mountains, and also for the extent of its hot-lakes and geysers. The mountains are mostly isolated trachytic cones, that have been formed by the overflow of lava during ancient volcanic eruptions. The grandest of these old volcanoes are Mt. Egmont and Ruapehu; the latter, situated near the center of the island, attains an elevation of 9,195 feet. Nearly all the volcanoes are extinct; two, however, Tongario and White Island, still give evidence that their ancient fires are smouldering in their depths. The indications of the expiring volcanic energy, as shown by boiling-springs and geysers, are best seen in the neighborhood of Lake Topo and Lake Roto-rura, situated on a line joining the smoking volcanoes just mentioned. Hochstetter describes this wonderful region of hot-lakes, fumaroles, mud-volcanoes, and boiling geysers, as "far exceeding all others in the world in variety and extent."

The South Island is traversed from N. E. to S. W. by the

Southern Alps,—a great chain of snow-clad mountains, that well deserve their name, as they are not inferior in the wildness and grandeur of their scenery to the Alps of Switzerland. This range of mountains seems formerly to have been a sloping table-land, the highest remaining point being the sharp and serrated summit of Mt. Cook, which reaches an elevation of 13,200 feet above the sea, and is by far the grandest object in New Zealand. This lofty peak is surrounded by a host of sister mountains, many of which attain an elevation of from 10,000 to 12,000 feet. Among the best known of these are Mt. Tasman, Mt. Arrowsmith, Mt. Aspiring, etc. As the snow-line is situated at a height of from 7,500 to 8,000 feet above the sea, all the central portion of this mountain-range is wrapped in perpetual snow.

The prevailing winds of New Zealand are from the westward. These winds, laden with the moisture gathered during their long journey over the South Indian Ocean, on coming in contact with these high mountains, are forced upwards to an elevation of 10,000 feet or more; and becoming rarified and chilled by their contact with the cold summits, part with the greater portion of their moisture in the form of snow and ice. In this manner, on all the higher portions of the mountains, immense ice-fields accumulate, that receive new additions from nearly every breath of air that passes over them. The result of this process of condensation, if carried on unchecked, it would be difficult to conceive. A compensation is found, however, in the fact that the ice flows down from the mountains in the great ice-rivers that are known as glaciers; the character and laws of which have been well studied in Switzerland.

The effect produced on the climate of the South Island, by the lofty mountains along the West Coast, is shown by the great contrast in the amounts of rain that fall on their eastern and western slopes. From May to the end of December, in 1856, the rain-fall at Hokitika, on the West Coast, amounted to 96·082 inches; while at Christchurch, east of the mountains, during the same period, it reached only 17·395 inches.

The glaciers that for long ages have descended from these constantly accumulating snow-fields, have cut the high table-land from which the Southern Alps were formed, into many deep valleys and cañons; through these the traveller obtains an easy access to the very heart of the mountains. It is only in the extreme upper portion of these valleys that the glaciers are now found; but the great valleys that extend beyond them, and that now are dotted with villages and farms, have been excavated by the ancient glaciers, which form the subject of our sketch. Many of these old valleys have been worn into rock-basins by the action of the ice; and these, having become filled with water, now form some of the most charming features in the wonderful scenery of the South Island.

The existing glaciers of New Zealand are all confined to the Southern Alps, and occupy the higher portions of nearly all the principal valleys. Many of these ice-fields are of great size, and by their slow melting afford a never-failing supply to numerous rapid rivers. While glaciers of considerable extent are found in many places throughout the mountains, they have their greatest extension, as we should naturally expect, around the highest peaks. At Mt. Cook, five glaciers have been discovered, flowing in a southerly direction, and supplying the lakes that form the source of the Waitaki river. The largest of these is the Great Tasman Glacier, which has a length of eighteen miles, and a breadth at its terminal face, of nearly two miles; it is the largest glacier yet discovered in New Zealand. Dr. Haast describes it as being so completely covered with an immense bed of débris, as to conceal the ice beneath, which could only be seen in the deep transverse crevasses. About nine miles up the valley this great glacier receives a tributary stream of ice one mile in breadth, descending in two arms from Mt. Cook, Mt. Tasman, and the neighboring peaks.

Another glacier well worthy of notice, is the Great Clyde glacier, which flows from the snow-fields of Mt. Tyndall. The extremity of this glacier is about 4,000 feet above the sea, and forms a wall of ice across the valley 1,300 feet long and 120 feet high. The river Clyde, which has here its source, springs from the glacial cave at the foot of the ice-wall.

Perhaps the most remarkable of the glaciers that flow in various directions from the Southern Alps, is the Francis Joseph glacier, which affords an escape for the snow and ice that accumulate around Mt. Tasman. Situated in latitude 43° S, it corresponds in position, as Hochstetter remarks, in the northern hemisphere, with Marseilles in the south of France, and Leghorn in Italy, where the vine, the orange, and the fig tree flourish. This glacier, descending westward, reaches to within 705 feet of the sea-level, where it ends abruptly amid a dense growth of arborescent ferns, fuschias, and beeches.

At some points in the course of the ice-streams that descend towards the West Coast, ice-cascades are formed—like the falls of the Glacier du Géant—where, owing to the steepness of the mountains, the ice is carried over the perpendicular cliffs, and "falling with a tremendous crash, is again cemented together and forms a new glacier below."

These are but a few examples of the many glaciers that have been discovered by the intrepid explorers of New Zealand. Others probably exist, which have never been seen; as there are large areas amid the mountains that have not yet been penetrated by the white man, and were totally uninhabited by the aborigines.

But interesting as the existing glaciers are, and vast and wonderful as they may seem to us, they yet sink into insignificance when compared with the mighty rivers of ice that in past time flowed from the same mountains, and carved out those grand valleys of the Southern Alps to a depth of many thousand feet in the solid rock.

The evidences of a great extension of the glaciers of New Zealand in past time, are furnished by the following considerations :—

(1.) Immense moraines surround the mountains on every side, and are found far below the terminus of the existing glaciers,—in many cases reaching the level of the sea. Sometimes the narrow valleys are crossed by a huge bank of confused glacier-worn material, brought down and deposited as a terminal moraine by a glacier that has long since passed away. These old moraines, by forming dams across the valleys, sometimes give rise to extensive lakes. On the East Coast of the South Island, the Plains of Canterbury, which extend along the foot of the mountains for a distance of a hundred miles, and are fifty miles wide at the center, are regarded by Dr. Haast as composed of the material that has been brought out of the mountain valleys by the ancient glaciers. On the West Coast, the country is described by the same writer, and by other intelligent travellers, as being entirely covered with huge moraines, that extend from the sea coast—where they have frequently been cut away by the waves, so as to form steep walls and precipices—far up the valleys, to the foot of the existing glaciers. Through this immense layer of glacier-worn débris, the present streams have excavated their channels.

(2.) Scattered throughout the valleys are found huge boulders, which usually differ in the nature of their material from the rocks of the surrounding cliffs, and are frequently eighty or a hundred miles lower down the valleys than the present glaciers extend. These transported boulders are sometimes of great size, often measuring thirty to forty feet in diameter.

(3.) Another indication of the magnitude of these ancient streams of ice, is to be found in the extent of the great valleys that they have worn out in the sides of the mountains. These are far too large for the streams that now flow through them, and they frequently bear on their rocky walls the well known markings due to glacial action. The sides of these narrow valleys are frequently towering mountain-peaks, two or three thousand feet high, descending in some places perpendicularly into the débris at their base, which fills the bottom of the valley to a great depth.

(4.) The numerous lakes of the South Island, filling rock-basins that have been excavated by ice-action, sometimes lower than the level of the sea, bear similar testimony, as well as the fiords along the West Coast, like Milford Sound and Martin's Bay. These are deep, narrow sounds, that penetrate far into the mountains, "but universally become shallower at their entrance into the sea;" and are in fact glacier-worn basins, of the same character as the lake-basins, excepting that they are at a lower level, and open to the ocean. They afford, perhaps, one of the strongest indications of the great extent and duration of the ancient glaciers.

During our connection with the U. S. Transit of Venus Expedition, we were stationed at Queenstown, N. Z., on the shore of Lake Wakatipu. As the great glaciers to which the valley of this lake owes its origin, may be taken as an example of the hundreds of ice-streams that in past time flowed from the Southern Alps, we may obtain from the records that they here left behind them some idea of the phenomena of what may prove to be the "glacial epoch" in New Zealand.

Lake Wakatipu is situated about 100 miles from the southern end of the South Island, and extends into the very heart of the mountains. We will not attempt a description of its scenery which, as has been said, equals, or even exceeds in grandeur, the lake scenery of Switzerland, but will endeavor merely to tell as briefly as possible, the story of its formation.

The lake is of a sigmoidal shape, about seventy miles long, and from one to three miles broad. Its waters are very clear and cold, and have been sounded to the extraordinary depth of 1,400 feet. The surface of the lake is about 1,000 feet above the level of the sea; and its bottom, therefore, is 400 feet lower than the surface of the ocean. On either side of the lake, throughout its whole extent, the mountains rise in a continuous series of very rugged peaks, to a height of from 5,000 to 7,500 feet; while Mt. Earnslaw, which forms the head of the valley, attains an elevation of 9,165 feet, its top white with perpetual snow, and its sides scored by descending glaciers.

The valley of Lake Wakatipu extends southward beyond the foot of the lake for a distance of fifty or sixty miles, and opens out into the level country that forms the province of Southland. As the physical features of the lower portion of the valley are not essentially different from those of the immediate shores of the lake, we are forced to consider them as having a common origin, and being but portions of the same valley; the upper part of which is filled with 1,400 feet of water, and the lower portion by an unknown depth of worn and rounded shingle. The rocks that inclose the valley are for the most part, clay-slates and gold-bearing mica-schist, which are very much curved and twisted, and in many places green with chlorite.

We will not attempt to trace the geological history of the mountains themselves, but will confine our attention to the last chapter in their history—the formation of the valleys.

Valleys may be considered as owing their origin, primarily, to one of three causes. (1.) They are formed by a folding of the rocks. These produce depressions, the sides of which slope inwards towards the axis—*synclinal valleys.* Examples of valleys formed in this way are to be met with wherever stratified rocks have been upheaved, as in the Sierra Nevada, Rocky, and Alleghany Mountains. (2.) Valleys are sometimes formed by the fracturing of the earth's crust by volcanic forces. Valleys of this kind are seldom seen, being confined to regions of great igneous disturbance. (3.) The kinds of valleys above noticed are usually greatly modified by denudation, which is another great agent in their formation. By denudation we understand not only the wearing away of rocks by wind, frost, and rain, but also by the more powerful action of ice and running water; the operation of which we can see everywhere about us.

As the evidence of a synclinal axis is nowhere apparent in the valley of Lake Wakatipu, we are unable to account for its existence by the upheaval of the mountains on either side of it. We are likewise at a loss to find any indication of the rocks having been rent asunder by volcanic forces. The formation of the valley can only be referred to the third cause, that of denudation, or the slow removal, by ice and water, of the rock that once filled it to a height greater than that of the mountains which now tower above it.

It may seem strange at first sight that such an immense amount of rock — measured by hundreds of cubic miles in the valley of Lake Wakatipu alone — could have been worn down and transported to distant places, by the slow action of ice and water. This difficulty would be removed could our readers examine the region about Mt. Earnslaw, whose summit can be seen from the lake, rising clear and brilliant above the surrounding mountains. On its sides are blue regions of ice; these are the descending glaciers,— the keys that unlock the secrets of the valley's history. In those streams of ice, although they are of great extent and of irresistible power, we see but the puny remains of the mighty river of ice that at one time flowed through the whole valley of Lake Wakatipu. The extent of this glacier was probably only limited by the ocean, whose waters undermined its terminal face, and floated away the fragments in the form of ice-bergs, in the same manner that ice-bergs are formed at the present day on the coast of Greenland. It takes but a glance to convince the pilgrim to the shores of Lake Wakatipu, that this great ice-river was the engraving tool which, aided by storm and frost, excavated in the living rock the scene of wonderful grandeur and beauty that is now spread out before him.

The glaciers around Mt. Earnslaw are still at work, as they have been for ages, in extending the valley. The streams that are formed by the melting of the ice — the rivers Dart and Rees — are all the year turbid with silt, which is the rock that has been ground fine by the glacier — the flour from the mill — which they deposit in the upper end of the lake. In this manner some six or eight miles of the valley have been filled up to a height of a few feet above the present level of the lake. We have but to extend the forces now in operation on Mt. Earnslaw to the whole valley of Lake Wakatipu, to have an accurate and satisfactory explanation of its formation.

There is another feature of great interest in the history of this valley. On the shore of the lake, about twelve miles above Queenstown,* is a limited deposit of Tertiary limestone; containing as fossils, *Ostrea Wullerstorfii*, *Cucullæa alta*, *C. Worthingtoni*, *Panopæa plicata*, and many others. The junction of the limestone with the crystalline rocks beneath, can be seen but a few feet below the surface of the lake. The limestone being at the present level of the water, the valley must have been eroded to that depth before the limestone was formed. As its deposition took place beneath the waters of the ocean, the valley was at one time an arm of the sea, and was afterwards upheaved to its present elevation or higher, and the wearing-down of the valley continued. We have, therefore, in the sequence of events that resulted in the formation of Lake Wakatipu, the following series of stages.

(1.) The Southern Alps existed as a sloping table-land, the highest remaining point of which is Mt. Cook. On this high table-land were deposited immense amounts of ice and snow, brought by the warm, moist winds from the ocean, and forming the glaciers that flowed off in various directions towards the sea. One of these ancient rivers of ice had its source

---

* At T on the accompanying map.

in the region of Mt. Earnslaw — then, however, greatly different from its present form — and flowed over what is now the valley of Lake Wakatipu. This old-time glacier continued its slow motion towards the sea for unknown ages, until it had ground out the solid rock to a depth of 5,000 or 6,000 feet in vertical thickness and for over 100 miles in length.

(2.) The work of this mighty glacier was finally terminated by a sinking of the land, which caused the valley to become an arm of the sea, similar in every respect to the deep narrow fiords that form such a characteristic feature of the wild West Coast of New Zealand at the present day. What was before an Alpine valley, filled with hundreds of feet of ice, then became the home of huge oysters and many other forms of marine life, whose remains we now find in the limestone. We know that the sea filled the valley for a long time, since the compact gray limestone that it left behind was not formed rapidly, as sandstone and conglomerate may be, but the material had to be first gathered from the waters to form the shells of mollusks and foraminifera, or the hard parts of corals, crinoids, etc., and these worn down to a fine detritus by the waves, and spread out as a calcareous sediment, before the hardening process of rock-making could commence. Together with the limestone are beds of fine shale, and masses of conglomerate composed of both angular and rounded pebbles, and containing fossil shells (*Crassatella ampla*); these deposits speak of other, although minor changes, during the time that the sea occupied the valley.

(3.) In the third stage the land was again upheaved to the dignity of a mountain chain, whose lofty summits became covered with fields of snow and ice, which, seeking an equilibrium, again flowed as a glacier down the valley of Lake Wakatipu. This second extension of the ice-stream down the old valley resulted in the removal not only of most of the limestone that had been deposited, but also of 1,400 feet of the crystalline rocks beneath. The limestone on the shore of the lake is thus shown to be an inter-glacial deposit, not by being interstratified with beds of till, but by the existence, both above and below it, of distinct glacier-worn valleys. It is similar in position to the inter-glacial lignite beds of Switzerland, and to the inter-glacial forest beds of Scotland and America. Like these northern formations, it indicates a period of warm and genial climate, in the very midst of the time of great cold. Geologists will notice, however, the far greater age of the limestone of Lake Wakatipu, which, as indicated by its fossils, is Upper Eocene.

The second glacier that flowed down the valley of Lake Wakatipu, like the first, had its time of great extension and then slowly passed away. As its terminus retreated up the valley, it left behind it the material it had gathered from the overhanging cliffs along its course, or had torn from the sides of the valley, together with the finer products ground by the bottom of the glacier from the rocks over which it passed. This material now forms the filling of the valley below the lake, and has been worked over, perhaps many times, by the action of water, which has left it in many regular lines of terraces along the sides of the valley; these giant stair-ways often form a striking contrast with the angular crags and rocks that tower above them.

At Kingston, situated at the southern extremity of the lake, a huge terminal moraine,* composed of cyclopean masses of angular rock, has been thrown by the glacier directly across the valley, and now forms the shore of the lake. In this confused mass of rocks we have indisputable evidence that here, for a long time, stood the terminal face of the glacier, which ended abruptly—as is common with glaciers at the present day, and as is notably the case with the Great Clyde glacier, that ends, as we have seen, in a wall of ice 120 feet high. The rocks now forming the terminal moraine at Kingston, were once lateral moraines on the surface of the glacier; and as the stream moved on and melted away, they

* At M on the accompanying map.

were carried over its terminal face—just as trees and blocks of ice are carried over Niagara—and were left as the confused mass that we now find.

Some idea of the time required for this truly herculean task of valley-making, may be gathered, perhaps, from the fact that the average motion of the Swiss glaciers can be taken at about twelve inches a day, or one mile in fourteen and one-half years. At this rate, a block of stone falling upon the glacier of Lake Wakatipu near its source at Mt. Earnslaw, would require more than a thousand years to reach its final resting place in the terminal moraine at Kingston, which is only midway down the valley.

As the warmth increased, the glaciers retreated to their present position around the summit of Mt. Earnslaw, leaving the valley dammed-up by the moraine at Kingston, and filled by the water formed by the melting of the ice. On the sides of the valley, in many places, huge blocks of stone were scattered, similar to those in the Kingston moraine. The rounded form of *roches moutonnées* was also given to the low hills and knolls along the shores of the lake.

Lake Wakatipu thus furnishes a striking example of a lake filling a glacier-worn rock-basin, the lower lip of which has been raised by the formation of the moraine at Kingston. Taking Lake Wakatipu and the ancient lake-basin that continues below it, as one valley, we have an instance of a rock-basin that has been worn out by glacial action to a known depth of 1,400 feet. That this is a true rock-basin is shown by the fact that in the Dome Pass, at the southern end of the old lake, the country rock again comes to the surface in the bottom of the valley. Although the glaciers probably at one time passed beyond this point, yet they left a barrier of rock across the valley, which formed the southern end of the ancient lake, and compelled the waters to cut a new channel to the S. E., that resulted in the complete drainage of the valley. Such we conceive to be a simple, although very imperfect, reading of the grand history of Lake Wakatipu.

Other great changes probably took place, the records of which have been erased.

Not only, however, may we trace the past history of this interesting lake, but we can also look beyond the veil that obscures its future. As the combined actions of ice and water have been the instruments for its formation, so are they also working its destruction. After the formation of the moraine at Kingston, the waters sought a new outlet from the valley over the falls of the Kawarau, which are constantly wearing away by the action of the water, and thus tending to drain the lake to a lower level: we see, indeed, by the terraces along its shores, that it has been already lowered. While the outlet is every moment becoming deeper, the water that flows from the foot of the glaciers, together with every rill and rivulet born among the mountains, is continually bringing down its burden of sediment, however small, which it deposits in the lake, and does its part towards filling the valley. While at the upper end of the lake the water is of a light-blue tint, caused by the foreign material held in suspension, thus indicating its glacial origin, a few miles down it becomes beautifully clear, and of almost as deep a blue as the open ocean itself.

The present conditions continuing, Lake Wakatipu will at no very distant day, geologically speaking, have reached the end that awaits all lakes, and be drained dry—the fate that has already overtaken the lake which once existed to the southward.

Some of the able geologists of New Zealand are inclined to attribute the former extension of the glaciers of the South Island, solely to a greater elevation of the land. Such an elevation may account very well for all the known facts relating to the glaciation of that island. When we take into consideration, however, the records left by ancient glaciers on other lands in the southern hemisphere,—as in South Africa,* where well-characterized moraines and transported

* G. W. Stow, Quart. Jour. of the Geol. Society. xxvii, 550.

boulders, indicate the former existence in that country, of glaciers that have long since passed away,—and also the evidences of former ice-action at the southern extremity of South America and on the Falkland Islands, so well known through the writings of Darwin and Agassiz,—we cannot well escape the conclusion that they are all due to a common cause.

If we look for the reasons of the great variations of climate in the northern hemisphere, in astronomical changes, as seems to be the increasing tendency among scientists,—either in a change in the eccentricity of the earth's orbit, as advocated by Prof. Croll, or in a variation of the angle of the earth's axis with the plane of the ecliptic—we are obliged to admit that the southern hemisphere has been subjected to the same influences, and that the climates of the two hemispheres must have undergone similar changes.

It seems to us that the great extension of the glaciers in these southern lands could not have been due altogether to changes of elevation in the several countries, but, rather, that the advance and retreat of these glaciers have been controlled by the same—to us mysterious—laws, that in the Tertiary period clothed Greenland with a varied and beautiful vegetation, and replaced it in our times with immense glaciers and fields of snow and ice.

If the evidences of a glacial epoch in the southern hemisphere seem too meagre for comparison with the corresponding formations in our own country—where they cover many thousand square miles—it is to be remembered that the land itself is wanting in the former, on which to find the inscriptions left by the old glaciers. In North America the records of an ice-age reach as far southward as the fortieth parallel. In the southern hemisphere nearly all the area in corresponding latitudes, is occupied by the waters of the ocean; the only lands on which similar formations could reasonably be expected, are the southern extremities of South America and Africa, together with New Zealand and Australia; and on all of these, excepting the last, positive, and in many places, astonishing, evidences of ancient glaciation can be seen.

As far as can be at present judged from the limited explorations in those distant lands, the combined facts seem to point to a time of extreme cold in the southern hemisphere, answering to the similar period at the North, that has received the long contested title of the Glacial epoch.

Another parallel between the changes of climate in the two hemispheres is indicated by the Tertiary deposits. These at the South, like the Tertiary formations in Europe and America, show by their fossils that a mild climate preceded the ancient glaciers, during which, as these formations on the eastern coast of Africa prove, the forms of life now indicative of tropical or sub-tropical conditions extended farther towards the pole.

XXV.—*Recent Progress in Sanitary Science.*

BY ALBERT R. LEEDS.

Read October 9th, 1876.

THE recent progress in Sanitary Science is the history of our knowledge of what constitutes clean air, clean water, clean food, and clean environments; of our knowledge of what is filth in air, filth in water, filth in food, and filth in our environments, whether it be filth mineral, vegetable, or animal; and finally, of the means of preserving cleanliness on the one hand, and of repressing filthiness on the other. The great factors in this progress therefore are, in the first place, knowledge, a knowledge both comprehensive and exhaustive, and in the second place, a moral zeal, which shall make that knowledge effective in increasing cleanliness and preventing filth among men. The necessity of this kind of knowledge is mostly due to the crowding of multitudes into overgrown commercial communities; and its development, which is largely that of chemical science, is also dependent upon the skill of the microscopist, the experience of the medical practitioner, and the learning of the biologist, requiring the colaboration of such various classes of savans as are also found in great cities,—for its growth to perfection.

The demands of sanitary science extend to the most refined methods of chemical research, and lay under contribution some of the most obscure branches of Natural History, like that of Helminthology, sciences which, in their inception, appeared to have little bearing on the daily wants of mankind; and they even extend to the most abstruse researches of biology, in matters pertaining to the generation of spores, the development of ova, the growth of parasites, etc. Indeed, the demand reaches far beyond the present powers of scientific inquiry to supply; and a more subtle analysis is required of the chemist, a more searching scrutiny of the microscopist, before questions can be answered, on the correct solution of which the action of communities depends, in reference to infection, irrigation, water-supply, etc.

While sanitary science makes such great and varied demands upon our present and prospective stores of knowledge, its aim is nevertheless a very modest one. It finds man, whether from ignorance, from cupidity, or from the many maladjustments of our existent social systems, deprived of essentials to the enjoyment of long life, or even a prey to the inroads and devastations of disease; and it seeks to restore to him, under these circumstances, the same pure air, pure water, and fitting food and clothing, as are enjoyed by the beast which stalks through the primeval forest, or the cattle grazing healthfully in the fields. No one has ever shown that a better ratio could be substituted for the oxygen and ozone, the nitrogen and ammonia, the carbonic acid and moisture present in the atmosphere, than what actually holds between them. No one has shown that drinking-water would be the better, if it took up a little more iron and lime, potash and phosphoric acid, than it actually contains, or if in nature's alembic, it were restored to us in the condition of the distilled water of our laboratories. Neither is it clear that sugar would be better food by the addition of nitrogen, or albumen if it were without it. In short, so far as the sciences at present at least extend, they are unanimous in declaring the natural order existent in the atmosphere, water, and food, the best adapted to the wants of man. This being true, every element of disturbance is to be looked upon with suspicion, a suspicion daily increasing with the increase of our knowledge concerning the true nature of disease, its causes, and its remedies.

Upon the basis of such ideas, we have attempted a classification of the departments into which sanitary science naturally divides itself, and the arrangement of the subject-matter properly falling into each.

SANITARY SCIENCE.

I.—Upon the Preservation of Natural Order, so far as relates to the Prolongation of Life.

NATURAL ORDER IN	REQUIRING INCREASED KNOWLEDGE OF	BY THE SCIENCE OF
CLEAN AIR;	Composition of Atmosphere { *a.*—Above ground; *b.*—Under ground; Determinations of Oxygen, Ozone, Carbonic Anhydride, Moisture, Compounds of Nitrogen with Oxygen, Hydrogen, etc.	Eudiometry. Ozonometry. Hygrometry. Meteorology, etc.
CLEAN WATER;	The fit presence and proportional amounts of Mineral Acids and Bases, Nitrates, Nitrites, Ammonia, Organic Carbon and Nitrogen, Oxygen, other gases, etc. Clean-water plants; Clean-water animals;	Water-analysis. Micro-chemistry. Spectroscopy, etc. Botany, Zoology. Microscopy, etc.
CLEAN FOOD;	Solid { Animal { *a.*—Nitrogenous; *b.*—Non-Nitrogenous; Vegetable { *a.*—Nitrogenous; *b.*—Non-Nitrogenous; Liquid	Food-preserving. Food-preparing. Cooking. Gastronomy.
CLEAN ENVIRONMENTS;	Construction of Dwellings, Churches, Schools, Public Buildings, etc. Grading and Paving of Streets, Highways, etc. Clothing, Furniture, Apparatus for Heating, etc.	Architecture. Engineering. Mechanics.

SANITARY SCIENCE.

II.—Upon the removal of Disturbing Forces, so far as relates to the Preservation of Health.

PRODUCED BY	RESULTING FROM	IN	REMOVED BY
FILTH IN AIR;	Deficiency of Oxygen and Ozone, Excess of Carbonic Anhydride, Sulphuretted Hydrogen, Acid Vapors, Solid Particles, Floating Germs, etc.	Confined spaces:— *a.* Dwellings; *b.* Public Buildings; *c.* Factories; *d.* Ships, cars, etc.	Ventilation.
		Contamination: Garbage of streets; Sewer gases; Exhalations; Infected buildings;	—Scavenging. —Sewerage. —Drainage. —Disinfection.
FILTH IN WATER;	Undue Hardness, Excess of Salts, Dissolved Poisons, Putrescible Matter, Excess of Organic Matter. Infectious Germs, etc.	Sewage, Drainage, and Refuse; Soiled-water plants; Soiled-water animals;	Prevention, Filtration, Precipitation, Irrigation —to the benefit of— Agriculture, Water-supply, Manufactures, Fish-Culture.
FILTH IN FOOD;	Foreign Bodies, Putrescible Matters, Deleterious Substances, Infectious Germs, etc.	Putrescence; Decay; Infection;	Regulation of Markets.
		Falsification; Adulteration;	Criminal Prosecution.
FILTHY ENVIRONMENT;	Neglect.	—	—

On referring to these tables, it will be seen that the first element to be determined is the amount of oxygen in the atmosphere, and within what limits this amount may vary, the atmosphere still remaining in a state of purity. So important is this determination, that many of the greatest physicists have expended all the resources of their skill upon its solution. About a century ago, Lord Cavendish made no less than five hundred analyses of the atmosphere, and by the method of absorption of oxygen by nitric oxide, a method which now to us appears too crude to give reliable results, arrived at the number 20·833 as representing the percentage of oxygen. This result is little more than $\frac{1}{10}$th of one per cent. less than 20·95, which is the number now accepted as the most accurate mean of recent determinations. And yet Lord Cavendish could not satisfy himself that there was any difference in the percentage of oxygen in London air, as compared with that of air from the surrounding country. To determine whether the composition of the atmosphere was indeed invariable, the subject was reopened by Dumas and Boussingault, who employed in their classic research the chemical attraction of copper for oxygen at an elevated temperature. The air from the Jardin des Plantes, after purification from every trace of moisture and carbonic anhydride, was passed through a weighed tube containing turnings of pure copper, and the residual nitrogen collected in a glass balloon, previously exhausted of air. Every precaution that ingenuity could suggest, was used to insure the accuracy of the experiments, which were repeated a great number of times and on large quantities of air; and yet these two illustrious chemists did not venture to assume that the composition of the atmosphere was otherwise than invariable, and that the slight differences in the percentages of oxygen obtained were due to real differences, and not to variations within allowable limits of instrumental error.

By improved eudiometrical methods, Regnault afterwards settled conclusively the fact of variations in the percentage of oxygen in the earth's atmosphere, and ascertained with accuracy the amount of the variation in the atmosphere of the same locality and at different points on the earth's surface. The minimum amount for 100 analyses of the air at Paris, was 20·913 per cent., and the maximum 20·999, giving as a mean the number 20·956. The lowest percentage in five analyses of the atmosphere of the ocean, was 20·918, the highest 20·965. Of mountain air ;—in that of the summit of Mt. Pichincha, which is higher than Mt. Blanc, the oxygen was 20·949 and 20·981 per cent. Of all places, Berlin had the distinction of an atmosphere with the lowest percentage of oxygen, 20·908. This does not appear surprising, when we call to mind the stinking waters of the river Spree flowing through the most crowded portion of the city, under the windows of the Academy of Music, and within a stone's throw of the Emperor's palace, the Opera-house, the Royal Library, the Museum, and, worst of all, the famous University. To quote the language of Dr. Folsom, the Secretary of the Massachusetts Board of Health—"Berlin and Munich, the filthiest and most scientific of the German cities, deserve Traube's sarcasm of not being able to stop the cholera, even in winter,—a more or less continuous epidemic, so to speak, having lasted since 1866 ; while in London and Paris, the cleanest of large cities, the last epidemic (in 1866) fell very lightly, and the death rates are one-third lower than in Munich and Berlin." The mean of all Regnault's analyses was 20·95 per cent., a number which should be remembered and quoted, instead of twenty-one, the percentage settled upon as a mean, after many experiments, by Gay Lussac and Humboldt, and the one usually given in manuals of chemical science. For it is worthy of note, that the maximum in no one of Regnault's analyses reached twenty-one per cent., while the minimum was never so low as 20·9.

After Prof. Bunsen had submitted the existing modes of gas-analysis to critical revision, he applied the improved methods to the determination of the oxygen in the atmosphere, finding as a minimum for the air at Heidelberg 20·84 per cent., and for the maximum 20·97, or a mean for all analyses, of 20·924. Since that time a great number of inquiries have been set on foot concerning the air in various parts of Europe, especially in Great Britain, where Dr. Angus Smith has instituted a very extended series of comparisons between the atmosphere of towns, and of country and mountain districts. The significance of the results is to be found in the fact, that while a falling off in the percentage of oxygen to the amount of one-tenth per cent., may appear so slight as to be unworthy of serious consideration, yet the place of this minus quantity is occupied by other gases whose presence is deleterious, even when in amounts represented by the hundredths of one per cent.

Until a very recent period, no similar investigation had been made, so far as we are aware, into the constitution of the atmosphere in the United States.

It would be fortunate for the interests of sanitary science, if Ozonometry was settled upon as well ascertained principles as those of the determination of oxygen. But this is far from being the case. The difficulty does not consist in a lack of knowledge concerning the properties, or even the chemical nature of ozone,—to both of which topics a great deal of attention has been paid since the time of Schönbein by Becquerel, Fremy, Andrews and Tait, Meissner, Angus Smith, and others, and in this country by M. Carey Lea, Wetherill, and Rogers,—but to a lack of concerted and systematic observation by practised observers, using equal precautions and pursuing the same methods. To illustrate the discrepancies, and even fallacies which arise, we may instance the ordinary ozone test, as it is called—a strip of paper previously moistened with a mixture of starch-water and iodide of potassium solution, and dried. Recently it was found, on preparing some of the ozone test, that every variety of paper purchasable, except the purest Swedish filter-paper, manifested an alkaline reaction to alizarine; that every sample of potassium iodide contained several impurities, rendering it unfit for use in the ozone test; and that even the starch had to be manufactured in the laboratory, to obtain material suitable for preparing reliable reagent papers. And yet, with suitable precautions, these ozone tests give results of a very striking character. As an instance, I may cite some unpublished observations during the past summer upon the atmosphere of the Adirondacks, where the indications of ozone were of the most decided character, and at times of atmospheric disturbance, intense. In this pure mountain air, the invalid, prostrated with malarial poison, or catarrhal affection, rapidly regained mental vigor and bodily strength. Similar ozone tests, exposed during the same season in Hoboken, where catarrhs are rife, and where the badly drained marshes, if they do not actually produce ague, are at least very unfavorable to recovery from it, showed a great deficiency in the amount of ozone.

I do not wish to be understood as saying that the absence of ozone is attended by the prevalence of catarrhal or malarial troubles. Heaven forbid! The result of collecting and reading most of the literature upon ozone, has been to make me extremely unwilling to express any opinion, concerning the connection between the abundance or exiguity of ozone and any disease whatsoever. The conflict of testimony could not be better exemplified than in the case just under consideration. To quote from a recent work on the subject—"Schönbein and other physicians made daily atmospheric observations during several catarrhal epidemics at Basle, which are stated to have been conclusive as to the simultaneity of the maximum of the coloration with the extreme intensity of the epidemic." "Dr. Seitz carried on observations for two years in Munich, and found that months in which the ozone was abundant, were not characterized by a predominance of catarrhal affections, when compared with months during which less ozone was noticed in the air. After days distinguished by a great excess of ozone, we did not observe the occurrence of a greater number of cases of catarrh." The result of a year's observations by the Medical and Scientific Club of Königsberg, in Prussia, was to the effect, "That the month of November, during which the spread of catarrhal affections was most extensive, and the month of September, which was notorious for the prevalence of intermittent fever, typhus, cholera, and diarrhœa, exhibited nearly an equal amount of ozone, and, that a sudden and considerable increase in the amount of ozone did not appear to be a cause of the commencement of catarrh of the respiratory organs." This is certainly a very decided negative, but the next observer quoted, Dr. Pfaff, of Plauen, in Saxony, has an equally explicit affirmative result. He concludes that, "A large proportion of ozone acts in a mischievous manner on diseases of the respiratory organs; that it favors the development of inflammatory affections, especially tonsilitis, and that the ozone exerts little or no effect on epidemic or other diseases, provided they are not complicated with catarrhal affections." Dr. Spengler calls upon the medical practitioners of Europe to test the accuracy of his observations, which were made at Roggendorf, a village of Mecklenburg. "Just before the commencement of an epidemic of influenza, no ozone was to be detected. Directly, however, catarrhal troubles set in and every one was coughing, an abundance of ozone was manifested. As the disease gradually diminished, so did the indications of this body decrease." Dr. Heidinreich also found that a strong ozonic reaction, coincided with an exacerbation of catarrhal symptoms and the appearance of pulmonary affections, while a diminution of those took place when it was feeble. Faber, Wunderlich, Schiefferdecker, T. Boeckel, and other observers, believe that there is no connection between the development of ozone and the prevalence of catarrhal affections. The authorities at the hospital of Metz, have found that there is a certain relation between the variations in the quantity of atmospheric ozone, and the number of cases of bronchial affections which present themselves. MM. Houzeau and Leudet, jr., have shown that there is no agreement between the prevalence of respiratory affections at Rouen, and the depth of ozonic reaction as presented by *true* ozone tests. These diseases are most numerous during the winter, when the amount of ozone, as distinguished from the other air purifiers, would seem from the researches of the former gentleman to be comparatively small. Mr. Harris, of Worthing, has always remarked during the prevalence of N. E. and E. winds, when no ozone is present in the air, the great frequency of irritative affections of the mucous membrane of the throat and air passages. The results arrived at by M. Béhard, of Havre, are:

"1. That the number of cases of pulmonary disease is probably in direct relation with the amount of ozone in the air, and in inverse relation with the temperature: and, 2. That atmospheric ozone appears to exert a certain influence on rheumatismal affections." Dr. Clemens, of Frankfort, states "that eleven saddle-horses contracted inflammation of the lungs in consequence of being run against a south wind, very powerful and very rich in ozone, and that the greater number died."

A similar wide difference of opinion exists concerning the connection between the prevalence of ozone and malaria, various descriptions of fever, and other diseases; and it is difficult to see how these discrepancies will be reconciled, except by systematic observations carried on by a number of competent observers. In this respect a great deal is being done in Great Britain and on the Continent. In the United States, isolated inquirers have pursued researches, some account of which, from time to time, has appeared in our scientific literature. The contradictory results hitherto obtained, however, have discouraged many who need the stimulus of united effort, and the certainty that their observations will be carefully preserved and collated, to continue this very valuable work.

Concerning the carbonic anhydride in the atmosphere, but little has been lately added to our scientific knowledge, it being already a well understood subject. But the determination of the amounts of carbonic anhydride present in the air of public buildings — as made in the examination into the defective ventilation of the House of Representatives by the late Dr. Wetherill; into the air of over-crowded school rooms, as has been done by the Board of Health of New York; and that of cars, as in the late investigation of Dr. Nichols of the Massachusetts Institute of Technology; — has been of excellent service in the interests of sanitary science. This is not so much on account of the deleterious nature of carbonic anhydride itself, but for the reason that the exhalations of the breath are always accompanied by volatile matters and products of organic decomposition, emanations from the body, etc., none of which admit of easy estimation, but whose quantity can be readily inferred from that of the carbonic anhydride. This gas, as we all know, is of a pungent agreeable flavor; and when reference is made to the "closeness" or bad air of rooms, and to the carbonic anhydride present, as if the "closeness" and carbonic anhydride were one and the same thing, it is but showing how completely the popular mind has identified the organic pollution of foul air with one, and that not the most unpleasant or most pernicious, concomitant.

In connection with this subject, it is worthy of note that the eminent sanitary chemist named above, has recently made an examination into the amounts of carbonic anhydride contained in the ground of certain localities below the surface — the *ground atmosphere*.

The importance of its study, as well as that of the ground-water, was first pointed out by Pettenkofer in 1854, followed in 1870 by systematic determinations of the percentage of oxygen below the surface. The analyses were made upon the alluvial gravel of the country surrounding Munich, in places not under cultivation, with the result of showing, that the amount of carbonic anhydride in the ground below the surface, was much greater than that above, and that it increased with the depth and varied with the season, being least in winter and greatest in summer. His object was similar to that in view in the determination of the carbonic anhydride in ill-ventilated buildings, that of obtaining a measure of the "impregnation" of the ground with organic impurities, by the oxidation of which the carbonic anhydride is produced. It is analogous to the determination of the nitric and nitrous acids in drinking water, bodies not of themselves detrimental in minute quantities, but important as affording a measure of the previous pollution of the water by nitrogenous excreta, etc., from the oxidation of which they are derived. The examinations of Dr. Nichols, which were conducted upon the made lands of the "Back Bay" of Boston, showed that there was very little difference in the amount of carbonic anhydride at different depths during most of the period occupied by the experiments; but in October, November, and December, it had increased sensibly at a depth of ten feet, above its amount at a depth of six feet. This curious result, which agrees with Pettenkofer's, he attributes to the diffusion of the carbonic anhydride from the surface, and to the increased rapidity of this diffusion when the temperature of the air falls below that of the ground.

With regard to ventilation itself, as an art, repeated failures, often with grave results, by architects of great prominence, are at last convincing the public that the ventilation of buildings constructed on different plans, of different materials, with different uses, and located differently in respect to air, wind, and sun, is an art of great difficulty; one not to be practised on occasion by the hospital-physician, the school-trustee, the alms-house inspector, the engineer, or even the architect, as a subject popularly supposed to be fully understood by every well-informed person, but should be placed in charge of persons making the heating and ventilating of buildings their especial study.

There is one more popular delusion, the overthrow of which is to be ranked as an onward step in sanitary science. This delusion is, that the senses are trustworthy sentinels over our lungs and stomachs, and that dangerous air, water, or even food, is always detected by them. They only serve as detectives when one of the concomitants of aerial, aqueous, or other filth is of the nature of a gas, like hydrosulphuric acid, affecting, even when present in very minute quantities, the sense of smell, or is one of the innumerable products of organic decay. But the cases must be rare indeed, in which fatal effects have been produced by exposure to an atmosphere containing hydrosulphuric acid sufficiently concentrated to act as a chemical poison; and although headache, nausea, or a general lowering of the health, is frequently produced in the case of persons occasionally exposed to a considerable amount of this and similar gaseous products of decomposition, or constantly inhaling them in minute quantities, yet they are comparatively harmless when compared with some emanations which are not evident to the sense of smell. The matter which propagates disease, is, so far as we know, not gaseous, but organized bodies of excessively minute dimensions, so small indeed that as yet the microscopist has not succeeded in distinguishing the "spores" which simply produce decomposition, from those which carry the specific poison of certain diseases, or the infectious germs of one disease from those of another. But one peculiarity they possess in common, a peculiarity distinguishing them from chemical poisons, in that their effect is not directly proportional to their amount, but vastly greater, insomuch that excessively minute amounts of these germs have the power of infinite self-multiplication, so long as they find themselves surrounded with circumstances favorable to their development. It frequently is the case that localities are obnoxious in odor, yet no alarming diseases are developed, while others are apparently inoffensive, and at the same time are richly productive in "zymotic diseases." A striking illustration is to be found in the case of laborers, whose duty it is to jump into the lime-purifiers employed in the defecation of illuminating gas, and to shovel out the lime charged with sulphur compounds. The smell is intolerable, frequently nauseating the workmen, yet not producing active disease. Sewer-gas, on the contrary, is not violently offensive, and may diffuse itself through apartments without detection, and, as in Glasgow and Edinburgh, in the houses of the better classes, may produce outbreaks of typhoid fever. For this reason, either the public sewers should be properly flushed and ventilated, which, practically speaking, is very difficult of accomplishment — or those who multiply bath-rooms and water-closets in connection with the sleeping apartments of a house (as is now done in city dwellings, where the desire of luxury on the part of the occupant, and the ingenuity of the mechanic in increasing the expense on the other, have permeated the house with an elaborate net-work of hot and cold-water pipes, waste-pipes, traps, sewer-connections and drains) should employ the services of a sanitary engineer, to see that a suitable system of flues is likewise provided to carry off the gases from the water-closets — the "practical plumber" being generally ignorant of both the necessity and the means of doing so. Either these remedies should be applied, or the water-closets should be made as few as possible, and the traps put in connection with flues, in which an upward draft is preserved both in winter and summer, by stoves or lamps.

No chemist, so far as we are aware, has attempted a complete analysis of sewer-gases, or those other exhalations from decomposing matters, which are laden with the ferments that become active in zymotic diseases. Even if he did determine the percentage of every gas present, he would not be able to estimate and isolate the septic ferments — the chief culprits in the origination of disease. It would be well if water-analysts would distinctly inform the public that they are daily asked to do in respect to water, something quite as difficult, and which they are altogether incapable of doing. Is not an experience somewhat like the following, familiar to every chemist present? A village has grown into a town, and that town into a city. Its growth has produced manufacturing communities in the vicinity, which pour their refuse and their sewage into the water-course originally filled with unpolluted water. The water grows worse to the taste, and stronger to the smell; and finally popular complaint compels the Board of Water Commissioners to take action. Their first step is to employ a chemist to find out how polluted the water is; and he finally sends in a report, with a long array of figures in decimals, telling how much silica, lime, magnesia, oxide of iron, phosphoric acid, sulphuric acid, potash, soda, ammonia, nitrous and nitric acids, chlorine and albuminoid ammonia, the water contains. All these data are of interest, requiring much skill in their accurate determination. They tell that a stream may be no worse drinking water than the Thames, the Schuylkill, the Ohio, the Passaic, or some other river, whose water is used at ordinary times by large communities without outbreaks of disease directly traceable to it. As in the case of the Schuylkill, a well-known expert to whom I appealed, said, "Yes, it always analyzed very well, but smelt and tasted very bad." Yet this gentleman drank daily of the Schuylkill water, and so do hundreds of thousands, without falling ill of violent maladies. Such analyses do not show how dangerous such drinking-water may be. That danger is known from other facts, independent of the water-analyses. The researches of Klein, Burdon Sanderson, Chevreau, and others, have shown that the germs of infectious diseases may be transported twenty or thirty miles in running water, may pass through thick beds of gravel, sand, etc., without being filtered out, and in fact, can be effectually destroyed only by the operation of an elevated temperature.

With regard to the chemical methods employed in the determinations of the organic constituents of drinking waters,

—and it is to these that we must chiefly look in deciding upon their fitness for domestic uses—it may be briefly said that they are four in number—the "ignition," "permanganate," "albuminoid ammonia," and "combustion" methods. The first is no longer regarded as adequate to give the information needed; the second is deemed fallacious; and the third, although still employed by many chemists, will, for similar reasons, have to be abandoned. The fourth gives the information required, with an accuracy adequate to the formation of correct judgment on the water analyzed, but at present has the disadvantage of requiring much time and care in its satisfactory performance.

It should be said here, in justice to the chemists who still employ the "albuminoid ammonia" process, that they do not claim that the albuminoid matters give up all their nitrogen in the form of ammonia, but only that they yield by this process a certain measure, and that this measure can be used as an index of the amount of the organic impurity present. But, as was shown by the authors themselves, and as has been since still more satisfactorily demonstrated, water containing known quantities of organic matter, when treated by this process, yields an amount of nitrogen which differs according to the character of the substances operated upon. It is evident that if the process were good, it should indicate either the whole amount of nitrogen present, or in every case, a definite proportion of it; and in failing, as it does, to meet these requirements, the albuminoid ammonia method of determining the organic impurity must be condemned. This failure is strikingly exemplified in the case of urea, perhaps the most characteristic ingredient of sewage, which may be present in a drinking water without detection by the albuminoid ammonia process. On the other hand, peaty matters, which color the water without rendering it noxious, yield a large amount of albuminoid ammonia, and such waters have in this wise been in some cases unfairly condemned.

It follows from what has been said, first,—that the albuminoid-ammonia method neither indicates the absolute or relative amounts of organic impurities present, nor discriminates between the putrescible and non-putrescible matters, with a sufficient degree of accuracy to allow the results, obtained by its use, to be employed in the formation of correct judgments upon the potability of drinking waters. Moreover, that analyses executed by this method must be thrown aside, and replaced by others executed by the "combustion" process. Finally, that until the results obtained in this more accurate way are obtained, we are still destitute of data adequate to the approval or condemnation of many sources of water-supply at present suspected of dangerous contamination.

With regard to the extent to which judgments founded upon the chemical and microscopical analyses of drinking waters are final, it may be said, that there can be no manner of doubt that the resources of chemical analysis, at the present time, are fully adequate to determine with accuracy the amount of organic impurity which is *actually present* in a potable water. Still more; it is possible to decide from the amounts of nitrates, nitrites, and ammonia present in the water—which bodies have been derived from organic bodies preëxistent, but are now converted into innocuous mineral compounds—whether at a *former* period the water has been polluted by sewage. But at this point the legitimate province of the chemist ends, and that of the pathologist begins. He must decide by a careful analysis of the diseases attributed to the drinking of infected waters:—1st. How large an amount of organic impurity may actually exist, without rendering the water noxious. 2nd. Whether water, which at any time has been polluted by infected sewage, can be afterwards employed with safety.

In conclusion, I wish to present a report, which I was deputed to draw up in the capacity of Chairman of a Committee, being an attempt to formulate conclusions arrived at from a consideration of the foregoing data. It is of the highest importance to be in previous possession of generally acknowledged first principles, so that when action must be taken in regard to any particular water-supply, there will exist just rules for its proper guidance.

REPORT OF THE COMMITTEE UPON THE WATER SUPPLY OF THE STATE OF NEW JERSEY, APPOINTED BY THE NEW JERSEY STATE SANITARY ASSOCIATION, READ AT ITS SECOND ANNUAL MEETING, HELD IN NEW BRUNSWICK, OCTOBER, 1876.

It is evident that the water-supply of the state of New Jersey cannot be considered as a whole; it resolves itself at once into the consideration of the various Water-Basins, into which the state is divided by the natural lines of demarkation between its water sheds.

Our first duty, therefore, is the determination of the character of these Water Basins. This involves:—

I. The construction upon the basis of a topographical survey, of an accurate Hydrographical map, prominently districting off the state into its water-basins.

II The determination of the rain-fall for each water-basin, and of the number of gallons of water flowing in its several water-courses for every month in the year.

III. An examination of the quality of the water in each basin, more especially in regard to its fitness for manufacturing and domestic purposes.

IV. An inquiry into, and a tabulated statement of, the amount and character of the pollution existing at the present time in the water-courses of the state. This fourth topic subdivides itself into:—

a. The Drainage and Sewage along their banks.

b. Statistics of Manufacturing establishments so far as relates to the question in hand, and the proper disposition of contaminating Refuse.

The topics above enumerated, refer only to the facts which must be settled, and the data which must be accumulated, before a final solution of all the problems involved in the question of water-supply can be arrived at. This is a work of years, to be actually performed only as the studies of those interested in sanitary science, and the vital interests of the people of the state, may require. In this report we wish only to map out, as it were, the question of the water-supply in a broad and comprehensive manner, and to settle, if possible, certain fundamental principles; leaving the working-out of the various subjects, and their application to particular cases and to particular communities, to those most concerned in so doing.

This being understood, we can proceed to consider:—

V. Whether any particular community has a natural right to the use of the water-supply of the water-basin in which such community is located, in an *uncontaminated condition*,—and whether this natural right should be paramount to any right which an individual, or a number of individuals in that community, has acquired in virtue of purchase, grant, use, allowance, or custom.

V*a*. If such a natural right be conceded, it must be settled what legislation is necessary to secure for a community that natural right; or, if the existence of such a natural right be denied, or only allowed in part, what legislation is required to regulate the extent to which drinking waters may be polluted.

VI. It is necessary to arrive at a decision upon the much-mooted point, whether a stream *after pollution* can by flowing for a limited number of miles, in contact with air and growing plants, be again made a safe drinking-water.

VII. Whether any means, microscopic, chemical, or otherwise, exist at the present time, of discriminating between *Infected* and *Non-infected* Sewage; and if, as some high authorities contend, they cannot be distinguished, whether sewage by one community into the water-supply of another community, should not be interdicted.

VIII. If sewage and other impurities be allowed to go into a water-supply, how much of them, and of what kind, are permissible without detriment to health.

IX. It is of the highest importance to determine, how many cases of disease and death in the state of New Jersey are fairly attributable to the use of contaminated water.

X. Finally, to apply these principles and this knowledge, to communities which, like Newark, Jersey City, and Hoboken, at the present time, demand an increase and perhaps a change of their water supply; and with a proper view to the actual difficulties involved, and a reasonable economy, to decide which are the best and most available sources of supply for communities throughout the state, or of particular sections thereof.

Returning to a fuller consideration of some of these points, we may inquire:—

V. Whether any particular community has a natural right to the use of the water-supply of the water-basin in which such community is located, in an *uncontaminated condition*, and whether this natural right should be paramount to any right, which one individual or a number of individuals in that community, has acquired in virtue of purchase, grant, use, allowance or custom.

We hold that such a natural right exists, for the reason that pure water, like pure air, is a natural gift to every man, which he cannot be deprived of without fatal injury to his well-being and happiness. It is just, therefore, that a community may use this water, or may allow, by law, individuals or bodies corporate to use it, but this privilege confers on no one the right to contaminate the water, whenever the general good is interfered with.

This great truth appears self-evident, but it has nevertheless in many cases been lost sight of, for which reason it is the more important that this representative body should authoritatively declare it. The whole course of legislation among civilized nations, as they grow into a higher appreciation of the obligations of the governing body to the governed, sustains the justice of this declaration. Five centuries ago, England, among modern nations, took the first step, by imposing a fine upon persons casting filth into ditches and streams. From this time onward, and more especially during the past thirty years, since most people of intelligence have become acquainted with the magnitude of the evils involved in the pollution of rivers, Parliament has passed a long series of Acts, to repress or put an end to these evils. Connected with these Acts, were many costly investigations conducted by Royal Commissions, the literature of which constitutes the material forming most recent books on sanitary science, and the most valuable part of numerous town and state Health reports. To present here the admirable code of sanitary legislation, built up by the wisdom of five centuries, is foreign to our object;—it will be sufficient, when the proper time has come, to embody its best features in our own state health-laws.

In France, strenuous endeavors have been made during the past two centuries to protect the purity of streams by repressive legislation. These have been in part successful, a result due in some cases to the discovery by manufacturers — when they had been enjoined from casting in refuse, and had thus been compelled to experiment in order to find out how to dispose of it — that their refuse might be actually a source of profit.

VI. It is necessary to arrive at a decision upon the much-mooted point, whether a stream *after pollution*, can by flowing for a limited number of miles, in contact with air and growing plants, be again made a safe drinking water.

We are all aware of the great extent to which this vexed question has been agitated in England, and how large an amount of contradictory testimony was collected by the Royal Commissioners on River-Pollution. On the one hand, the assertion was made that running streams purified themselves completely in the course of a few miles; on the other, that no such power of complete self-purification existed. It is probable that the truth lies somewhere between these extremes. Our reasons for this belief are drawn partly from the results of chemical analyses, and partly from experience.

Many of those present have seen the sewage of Paterson emptying into the Passaic, and a short time afterwards have partaken of these polluted waters, as delivered from the hydrants of Newark, Jersey City, and Hoboken, with impunity. Still more, they have done so for years, and no physician has shown that a case of active disease was attributable to these waters. Three years ago alarmists declared that, in a year or two, the most serious results would follow, if the inhabitants persisted in their use. So far is this from being the case, that housekeepers, dealers in fish and meat, and medical practitioners, have found less fault with the Passaic water this summer than in previous seasons. In fact, there has been much less popular complaint during this summer, of the water of the Passaic, than there has been of that of the Croton Aqueduct. This is a fair statement drawn from the experience, not of one, but of many of us. And to make it complete, it should be added that there have been times, as in mid-summer of 1872, when to quote from the Report to the Board of Public Works of Jersey City, the water "was highly offensive to both the smell and taste, was turbid from the presence of great numbers of microscopic vegetable and animal organisms, and when proper chemical tests revealed a shocking degree of contamination by organic matter."

Another case of river-pollution familiar to most of us, is that of the Schuylkill River by the sewage and refuse of Manayunk, and other manufacturing towns located a short distance above Philadelphia. So imminent did the danger appear, that in view of the vast multitudes whose presence at the Centennial Exposition was anticipated, the authorities of Philadelphia appointed a Commission to decide whether the Schuylkill waters should be condemned. Most unfortunately, the Commission failed to give an authoritative decision, and while it devoted a preponderate share of its Final Report to statements and arguments illustrative of the fatal dangers resulting from drinking polluted streams, the Schuylkill included, it recommended an extension of the present means of water-supply. In truth, the annual rate of mortality for New York is 29 per thousand, while in Philadelphia it is 23 per thousand; and during the excessive heats of last summer, while Philadelphia has been crowded to the extent of two hundred thousand people above its own population, no active disease has been fairly attributable to the Schuylkill water.

It will be hardly necessary to speak of the general use of the waters of the Thames by the people of London, after alluding to that of the Schuylkill, which is represented to be the more polluted of the two streams.

Now as to the information afforded by chemical analyses on this point. The waters of the Passaic have been repeatedly analyzed, and samples taken from the Reservoir at Belleville have shown but a very slight increase of putrescible organic matter over that of samples taken above the High Falls at Paterson. Moreover it is not at all improbable that this slight amount of contamination was due to the partial influence of the reflux tide from Newark. In other words, the waters of the Passaic as collected 14 miles below Paterson, have returned to about the same composition as they had before receiving the sewage of this large manufacturing town.

This unexpected result has a striking parallel in the case of another American river, that of the Blackstone in the state of Massachusetts. This stream flows past the city of Worcester, receiving all its sewage, together with "the refuse waters of 36 woollen mills, 23 cotton mills, 6 iron works, a tannery, and a slaughter-house—these works employing 7,200 hands," a total of 606,508 cubic feet per diem of badly polluted water. This would amount to about 1-10th of the entire dry-weather flow of the river at Blackstone, a town located near the southern boundary line of the state. A sample taken from the Gate-House of the City Reservoir on Lynde Brook, one of the head waters of the Blackstone, contained in 100,000 parts, 0.0235 parts of proteine matter, and 1.96 parts of organic, requiring 0·504 parts of oxygen to effect oxidation; while the waters of the Blackstone near the state line, after a flow of about 20 miles beyond Worcester, contained 0.0128 parts of proteine matter, 1.72 parts of organic, and required but 0.326 parts of oxygen to decompose the organic impurities.

We must conclude, therefore, that those who have denied any power of self-purification to a flowing stream, are mistaken in this matter; and that the receipt of tributary waters holding their normal percentage of dissolved oxygen in solution, intestinal movement in contact with growing plants and earthy oxides, and abundant exposure to light and air, should be elevated to the rank of *true causes* in the regeneration of rivers. Moreover, while it seems incredible that Philadelphia, Newark, Albany, Cincinnati, and other great cities, should drink waters after pollution by the sewage of towns located a few miles above them, and should do so without active disease traceable to this source, yet this is a fact, and one of so great magnitude that we must allow it due weight and must explain it by a sufficient cause.

Finally, while we believe the above statements to be true, yet in view of what has been previously said concerning the danger from infected sewage, and the deterioration of health from all sewage, we do not the less look upon the pollution of waters as a monstrous evil, to be done away with so soon as public opinion upon these important sanitary questions shall have become imperative.

VII. Whether any means, microscopic, chemical or otherwise, exist at the present time, of discriminating between Infected and Non-infected Sewage; and if, as some high authorities contend, they cannot be distinguished, whether sewage by one community into the water-supply of another community, should not be interdicted.

Upon this point all the best authorities have decided in the negative. Moreover the matter which carries the infection may, as appears from a recent case in Switzerland, be filtered through several miles of soil, and escape destruction. And this too, when, as the English Rivers-Pollution Commission has declared in their report of 1875, "Slow soakage through a few feet of gravel destroys more organic matter than does a flow of many miles in the Thames." It is unnecessary to bring to your recollection the great mass of testimony concerning the carrying of cholera and typhoid fever by infected streams. No process of filtration, precipitation, or irrigation appears adequate to destroy these germs of infectious diseases; according to recent investigations this can be effected only by an elevated temperature. To be altogether safe from contagion—and we should not be contented with anything short of this—no sewage should be allowed to enter into a water supply.

VIII. If sewage and other impurities be allowed to go into a water-supply, how much of them and of what kind, are permissible without detriment to health.

If the ground is taken that these cases of contagion are too rare to be a valid argument against the use of streams which, like the Thames, have been credited with carrying the cholera, etc., and yet under ordinary circumstances may be used without apparent ill effects, it is necessary, notwithstanding, to fix some limit to the degree of contamination. The standard determined upon by the Rivers-Pollution Commission, will answer as well perhaps as any other for this purpose. Yet we must still keep in mind that the danger of contaminated water is not limited to contagion and manifest disease. According to eminent medical authorities, no particular form of active disease may be traceable to such waters, and at the same time they may bring about an enfeebled or disordered condition of the bodily organs, decreasing the ability to labor, and increasing the susceptibility to disease from other causes. From this point of view, a wise regard to the eventual well-being and wealth of the community, would counsel the expediency of accepting no water after pollution, even if conformed to certain artificial standards, and when possible, of not stopping short of securing the purest water obtainable under the circumstances.

XXVI.—Description of a New Species of Bird of the Genus Pitangus.

By GEORGE N. LAWRENCE.

Read November 20th, 1876.

Pitangus Gabbii.

Crown and sides of the head dull black, with a concealed crest of light gamboge-yellow; the back is of a warm hair-brown color, the feathers barred with narrow rather indistinct lines of darker brown; the upper tail coverts dark-brown, margined with brownish-ferruginous; the feathers of the tail are hair-brown, darker than the back, and are edged with bright ferruginous for half their length from the base, except the two central and the outer ones; the inner margins of the tail-feathers, near their ends, have a tinge of ferruginous; the smaller wing-coverts are the color of the back; the other coverts are brown, the middle ones edged with ferruginous, and the larger with grayish-white tinged with ferruginous; the quill feathers are dark-brown, margined with bright ferruginous, except the inner quills, which have their edges narrowly grayish-white; under wing-coverts pale yellow, inner margins of quills light salmon color; throat gray; breast, abdomen, and under tail-coverts, white with a tinge of fulvous; bill and legs black.

Length (skin) 7¼ inch; wing 4; tail 3¾; tarsus 13-16; bill from front 1.

Habitat. St. Domingo. Type in my collection. Prof. Gabb writes me: "This specimen was obtained at Hato Vièjo, on the Mao River, Province of Santiago, in an open bushy tract, in a valley at the foot-hills of the Central Mountain chain."

Remarks. This is a smaller species than either *Pitangus caudifasciatus* or *P. Taylori;* it can be at once distinguished by the warm brown coloring of the upper plumage, instead of dusky grayish brown, and by the bright ferruginous edgings of the wing and tail feathers; the color of the crest, and the size and form of the bill, are much the same in the three species. Mr. A. Sallé, in the list of birds obtained by him in St. Domingo, published in the Proceedings of the Zoological Society, London, 1857, p. 230 (communicated by Mr. Sclater) gives two species of Tyrannus, viz., *T. matutinus* and *T. intrepidus.*

Dr. Bryant, in "A list of the Birds of St. Domingo" (Proc. of the Boston Society of Natural History, 1866, p. 289), says, under *T. intrepidus:* "I am inclined to believe that there was a mistake in the identification of this bird, and that probably the two tyrants found by Mr. Sallé were *griseus* and either *caudifasciatus* or some closely allied species; as such a bird is found in Cuba, Jamaica, and the Bahamas."

Dr. Bryant's conjecture that the *Tyrannus intrepidus* of Mr. Sallé would prove to be a Pitangus, would seem to be confirmed by the species now described being of that genus; it may possibly be the bird obtained by Mr. Sallé, and referred to *T. intrepidus;* but they are very unlike, and I can hardly suppose that Mr. Sallé would err so much, as to mistake a species with ferruginous margins on the quill and tail feathers for *T. carolinensis.*

As our Kingbird is found in Cuba, I can see no reason why it should not also occur in St. Domingo.

When Prof. Gabb's collections to be made during the coming winter, are received, they may furnish the means to clear up the uncertainty.

I have named the above described bird, in compliment to Prof. Wm. M. Gabb, who brought it with eight other species from St. Domingo, being all he was able to procure (for want of time) during his residence on that island during the past winter.

XXVII.—*Notes on the Lower Helderberg Rocks of Port Jervis, N. Y., with description of a New Pteropod.*

No. 1. SECTION AT BENNET'S QUARRY.

By DR. S. T. BARRETT.

Read Nov. 13th, 1876.

Port Jervis is situated in the long monoclinal valley lying between the Shawangunk Mountain to the eastward, and low and precipitous ridges of the Hamilton formation to the westward of it. This valley is known here by the name of the Neversink Valley, because that stream, for the last six or seven miles of its course, runs in it. The Delaware River, after flowing through a deeply corraded anaclinal in the Hamilton ridges, crosses the valley at a right angle, impinges against the deeply pitted rocks of the Corniferous Limestone Group, and, bending sharply southwest, passes Tri-States

Rock, at the southern extremity of which it receives the waters of the Neversink River. Tri-States Rock has a local reputation, because in the year 1874, I think, members of the U. S. Coast Survey were for a time stationed upon it, to determine its exact latitude and longitude. The boundary lines of three states, New York, Pennsylvania, and New Jersey, unite in a point upon this rock. It is about one-half mile outside the corporate limits of Port Jervis.

The geological boundaries are very sharply defined. The Shawangunk Mountain, called Blue Mountain in New Jersey, and Kittatinny Mountain in Pennsylvania, extends from the vicinity of the Hudson River, in Ulster County, nearly to the Maryland line, a distance of 240 miles; and its south-eastern front, when not buried under the piles of drift material which seem to have been poured through the low notches in its crest line, or softened by the uplifted shales of the Cincinnati Group, marks very plainly the beginning of the rocks of the Upper Silurian age. The westward-bound traveller upon the Erie Railway, may easily see the unconformable junction of the Shawangunk Grit, or Oneida Conglomerate, with the older shales of the Cincinnati Group, if he will look out of the right-hand window as he enters the rock-cutting a little west of Otisville. After running for some distance along the western slope of the Shawangunk, the reddish, banded, ripple-marked and sun-cracked surfaces of the Medina Sandstone formation, come into view. These continue until the road turns shortly to the right, and crosses a narrow, eroded valley, made at the expense of some of the strata of the Lower Helderberg Group, which, in a smoothed and striated condition, were uncovered to procure the earth (drift) to make the embankment. The train then plunges into another rock-cutting, made through a declining "tail" of Cauda Galli Grit. Along the north-west slope of this latter ridge for a mile or two, may be seen many examples of "crag and tail" structure, of glacially smoothed and striated surfaces, and, just as the road curves sharply again to the right, of *roches moutonnées*. Here the traveller passes through a small cutting, in rock so plainly distinct physically from the Cauda-galli as to raise the question whether it is not the equivalent of the Schoharie grit—a problem which I have never been able to solve, as the rock is unfossiliferous. A small exposure of Corniferous and Onondaga limestone comes into view along the eastern shore of the Delaware; and the remaining formations, to the base of the Hamilton escarpments along the western side of the valley, are buried under alluvial and diluvial deposits. Port Jervis is divided into "Uptown" and "Downtown" by a terrace which marks the bank of a former and much larger river.

In all this succession of strata, from the base of the Upper Silurian to the middle of the Devonian, it is only, so far as I know, the rocks of the Lower Helderberg, Oriskany, and Hamilton groups, that yield many specimens to the palæontologist. As my time for such work is very limited, I have confined my small efforts principally to the first two of these, which, with the Cauda-galli, were well enough described by Mather in the "Geology of the First District," pages 332 and 333, as follows. "The limestones of the Helderberg Division, in the Mamakating valley, from Carpenter's Point on the Delaware to Kingston, are all upturned, and frequently at a pretty high angle. In the township of Deerpark, Orange Co., they form a narrow range of hills or low mountains, sometimes sinking almost to the level of the Neversink valley, and at others, rising to one-third or one-half the elevation of the Shawangunk. They are always narrow, and generally close to the base of the last named mountain." Carpenter's Point is a suburb just outside of the corporate limits of Port Jervis, and Deerpark is the name of the town in which the latter is situated. "Fossils were rarely seen in the limestones of the Helderberg division south of Rochester" (near Kingston in this valley), "except in those of the mountain east of Carpenter's Point, and at this place they were extremely abundant. The specimens of trilobites were so numerous, and particularly the Asaphus, that Dr. Horton and myself gave the hill the name of Trilobite Mountain. The strata are traversed by two great systems of fracture, one longitudinal and approaching more or less to the direction of the strike; the other transverse. Their usual directions are S. 20° W. and N. 20° E. for the first, and S. 60° E. and N. 60° W. for the second." I cannot improve this description. The ridges are very narrow, often not much wider than the actual thickness of the strata of which they are composed; but whether buried beneath the drift or rising above it, they reach from the Hudson River many miles to the south-west. At Bennet's Quarry the strata have a dip of from 40 to 60° N. N. W., a dip so steep as to prevent an exposure of more than their upturned edges. The hill in which these strata rise in succession above each other, has a downward slope of from 30° to 40° S. S. E., a direction so nearly at right angles to both dip and strike, as to give, when measured, very nearly the exact thickness of the sub-divisions. At Mr. Sandford Nearpass' Quarry, two miles south-west of Bennet's Quarry, in the State of New Jersey, and very near Mr. William Nearpass' Quarry,—of which a transverse section is given by Prof. Cook in the "Geology of New Jersey," pages 153 and 155, and a columnar section on page 158,—the dip is 15° N. N.W. At Guymard, six miles north-east of Bennet's Quarry, the dip is 25° N. W. The width of the entire group varies with the dip; being greater where it is least, and *vice versa*. At Bennet's Quarry there has been more disturbance than at the other places mentioned.

At this quarry we have the following section, going from below upward.

1. Tentaculite Limestone, thirty feet exposed. It may be divided into,—1*a;* Thin-bedded, black or dark-blue concretionary limestone, with horizontal layers of *Strophodonta varistriata*, twenty-five feet; and 1*b;* Quarry Limestone, a fine-grained, blue stone, excellent for lime, with horizontal layers of gasteropods, five feet thick.

2. Coral or "Favosite" Limestone, from four to six feet thick. This particular stratum is full of large corals, principally favosites, among which *F. Niagarensis* (?) predominates. It is also filled with the fragments of undetermined crinoids, and contains besides, *Chætetes*, *Stromatoporæ*, and *Pentamerus galeatus*.

3. Lower Pentamerus Limestone, fifty feet thick, and divisible from below into,—*3a*, a coarse-grained limestone, twenty-five feet, with bands of *Pentamerus galeatus;* and, *3b*, shaly with layers of chert, twenty-five feet, less fossiliferous than the preceding.

4. Delthyris Shale, a hundred and seventy-five feet.

5. Upper Pentamerus Limestone, two hundred and fifty feet. It exhibits three divisions, viz. — *5a;* a coarse-grained, cherty, grayish limestone, ten feet thick, probably the equivalent of the Encrinal Limestone, though I have not seen the crinoids; *5b*, shale, rather sparingly fossiliferous, 235 feet; *5c*, trilobite layers, five feet. All the fossils enumerated further on as Upper Pentamerus, and associated with *Dalmanites dentata*, belong to *5c*.

6. Oriskany Sandstone, one hundred feet: it is probably more, the higher arenaceous layers of this division having been removed by glacial action.

7. Cauda Galli Grit, from five to eight hundred feet in thickness.

These sub-divisions are all encountered in a succession of terraces rising one above the other. Between the Oriskany and Cauda Galli there is generally a hollow with turbary deposits.

FOSSILS IDENTIFIED.

Those marked with a * were identified by Professor Hall.

From (1): — *Leperditia alta*, **Beyrichia notata*, *Tentaculites gyracanthus*, *Loxonema Fitchiana*, *L. obtusa*, *Holopea antiqua*, *H. elongata*, **Megambonia ovoidea*, **Spirifer Vanuxemi*, and **Strophodonta varistriata*. The gasteropods and other fossils seem to aggregate in layers or thin bands.

From (2) :—Favosites in great quantities, the species not authoritatively determined, but said by excellent judges to be very like *F. Niagarensis; Chætetes Helderbergia* (?),* *Favosites Helderbergia*, crinoidal fragments, and Stromatoporæ, species not known to me. There occur also *Strophodonta varistriata* rare, *Atrypa reticularis* (?) one specimen, and *Pentamerus galeatus* thick.

From (3) :—**Dalmanites pleuroptyx*, **Pentamerus galeatus* very thick, *Strophodonta varistriata*, *Favosites*.

From (4) :—**Dalmanites pleuroptyx*, **Phacops Logani*, *Lichas pustulosus*, **Tentaculites elongatus*, **Pterinea* sp., *Spirifer perlamellosus*, **S. macropleurus*, *S. modestus*, *S. cyclopterus*, *Rensselæria mutabilis*, **Merista levis*, *Eatonia medialis*, *E. singularis*, *Trematospira multistriata*, *Strophodonta Beckii*, **S. punctulifera*, *Strophomena rhomboidalis*, *Leptæna concava*, *Orthis multistriata*, *O. oblata*, *Lingula* sp., **Streptelasma stricta*, *Chætetes Helderbergia*, some other species not determined, and many weathered out corals.

From (5) :—This subdivision, Upper Pentamerus, begins at bottom with a very hard calcareous layer, which has been extensively quarried for farmers' lime at Buckley's Quarry, one mile north-east of Bennet's Quarry. From this layer Prof. Hall has identified for me a *Phacops*, a *Platyceras retrorsum*, and a *Rhynchonella ventricosa*. From this hard layer, strata of soft shale rise above each other in a nearly perpendicular craggy ridge, between two and three hundred feet in height, capped on the top with the highly fossiliferous layers already mentioned. This ridge shows best in the neighboring state of New Jersey, and was undoubtedly seen near Bennet's Quarry by Mather and Horton, when making the Geological Survey of this portion of the First District. As it is long and low, I prefer to call it Trilobite Ridge. That portion of it lying between the hard, gray, calcareous layer at the bottom, and the hard, fossiliferous layers at the top, is little known to me: but wherever tested, I have generally found it unfossiliferous. The top layers are crammed with the heads, thoracic segments, and pygidia of trilobites; the most abundant of which is the new species described by me under the name of *Dalmanites dentata* (Amer. Journal of Science, Vol. XI, page 200). *Homalonotus Vanuxemi* and **Dalmanites pleuroptyx* are less common, but occur quite frequently. **Chonetes complanata* and **Rensselæria mutabilis* could not well be thicker than they are in some of these layers. The Chonetes averages about the size of the figure of *C. tenuistriata* in Prof. Dawson's Acadian Geology, p. 596; and the *R. mutabilis* is very much larger than any known before, averaging one-half inch from beak to front. The same species from the Delthyris shale below, is no larger than Prof. Hall's figures of it on plate 45, vol. 3, N. Y. Palæontology. Besides these, there have been identified **Tentaculites*, n. sp., **Loxonema Fitchiana*, *Platyceras retrorsum*, *P. Gebhardii*, *Holopea* sp., **Hyolithes*, n. sp. (described further on), **Pterinea textilis*, *Spirifer concinnus*, *S. cyclopterus*, **Strophomena rhomboidalis*, **S. Conradi*, **Strophodonta cavumbona*, **Cyrtia rostrata*, *Orthis oblata*, *O. perelegans*, *O. planoconvexa*, **O. subcarinata*, *Discina discus*, **D. Conradi*, and some other species not yet described.

Lying immediately below these trilobite layers, is a very hard, cherty layer, full of gasteropods of the genus *Platyceras* (?). *Favosites conica* is found at about the same horizon. *Loxonema Fitchiana* preserves perfectly the fine sigmoidal lines of growth of that species; *Platyceras Gebhardii* is sometimes as plainly striated as are the living gasteropods found clinging to the rocks. The *Chonetes* and the three known species of trilobites likewise preserve their surface markings.

In my description of *Dalmanites dentata*, the Delthyris shale was wrongly given for the geological horizon of that species. It should have been the compact layers at the top of the Upper Pentamerus Limestone. I gave it at that time the horizon assigned by Prof. Hall to the most of its associates: but subsequent investigation by myself, and the authoritative identification by Prof. Hall of the hard, calcareous bottom layer (5*a*) as Upper Pentamerus, has convinced me of my error.

From the top of Trilobite Ridge to the foot of the Cauda Galli Ridge north-west of it, Oriskany fossils predominate. There is, however, such a gradual shading off from one into the other, that no one whose knowledge of the Lower Helderberg and Oriskany strata had been acquired by the study of their exposures in this locality, would ever think of running the line separating the Silurian and Devonian ages, between the two. They seem so intimately blended that the exact line between them is an arbitrary one altogether. Thanks to Professors Hall and Dana, we now have here in the mural south-east front of the Cauda Galli, as plain a dividing wall between the Silurian and Devonian ages, as there is between the Upper and Lower Silurian east of it.

From the Oriskany (No. 6), the following species have been determined:—**Tentaculites elongatus*, **Platyceras Gebhardii*, *Platyostoma ventricosum*, **Pterinea textilis* (var. *arenaria*), **Rensselaeria ovoides*, *Eatonia peculiaris*, **Spirifer arrectus*, *S. arenosus*, *Meristella* sp.

We find therefore at this point, a total thickness of some five hundred feet of well-marked Lower Helderberg rocks, overlaid to the north-west by an immense development of Cauda Galli Grit. The strata are not all visible at any one place; but the complete series is given from several quarries in the immediate vicinity of the town. The main trend of the monoclinal ridges that characterize the region, is usually about N. 60° E. and S. 60° W.; but they are crossed obliquely by transverse flexures, running nearly north and south, which elevate the strata in anticlinals transverse to the main uplift. In these are located the quarries that furnish the best sections; the particular members visible in each, depending, of course, on the amount of transverse uplift from below, and the extent of erosion above.

The two points of importance and novelty in this Port Jervis section are, the peculiar character of the beds termed (2), and the fossiliferous layer (5*c*) at the top of the Upper Pentamerus. The division called 2, for which I suggest provisionally the name of Favosite Limestone, is full of corals, principally Favosites, many of which are very massive. Small spheroidal coralla are abundant also. Eminent geologists question the correctness of the horizon that I have assigned to this member, as soon as they look over a collection of its contents. It is at once believed that such specimens must be from the equivalent of the "Coralline Limestone" at Schoharie; and the most abundant Favosites resembles *F. Niagarensis.* But an examination of the table will show that any other than a Lower Helderberg horizon for this Port Jervis limestone is simply impossible. The resemblance of the coral-bed of this locality to the one at Schoharie is in its corals only; the other fossils described in Vol. 2, N. Y. Palæontology, as belonging to the "Coralline Limestone" at Schoharie, are unknown here. Some of the corals are very large. One, a *Favosites Helderbergia*, is dome-shaped or plano-convex, fourteen inches in horizontal diameter and five in height. The corallites in this species are very uniform in size, and curve very regularly towards the outer surface; but most of the specimens are irregular in form, and in the direction and size of the corallites. There are many small spheroidal coralla also, in one of which I detected the two rows of minute mural pores characteristic of *F. Niagarensis.*

The lower layers of this bed have thin, shaly partings, similar to those of the rock below, (1); the upper portion is a coarse, brecciated limestone, shunned by lime-burners, and contains, besides the corals and stromatoporæ, a great abundance of *Pentamerus galeatus* and encrinal fragments. Its fossil contents are not regularly arranged, but seem to have been drifted about by the waves.

I regret that it has not been possible, prior to the publication of this paper, authoritatively to determine the corals from this bed, and thus to define more positively the interesting problem of its relation to the Coralline of Schoharie, which has usually been claimed as of Niagara age. It plainly overlies the Tentaculite Limestone, in all the quarries of this vicinity. These are now in every case worked in (1*b*), as that furnishes the only lime salable for building purposes; and (2), the Favosite limestone, invariably forms its roof.

Description of a new species of Pteropod.

Genus HYOLITHES, Eich.

HYOLITHES CENTENNIALIS, N. Sp.

Shell transversely trigonal or nearly semicircular, tapering gradually and evenly backward for about two-thirds of its length, then more rapidly—becoming conical and terminating posteriorly in an obtuse point. Ventral side slightly convex, narrowly rounded upwards at the lateral edges; dorsal side convex and narrowly rounded in the highest part. Largest specimen in my possession, one inch and a quarter long, width of aperture four lines, height two and a half lines. The anterior two-thirds taper at the rate of one line in half an inch; the posterior third tapers more rapidly, and is besides a little elevated. Lines of growth crowded,—120 to the inch,—curved forward very decidedly upon the ventral side, and continued straight over the dorsal. The lip, judging from the ventral striæ, must have projected forward rather more than half a circle.

Geological position and locality; at the top of the Lower Helderberg group (5*c* of this paper), near Port Jervis, Orange County, N. Y.

The specific name refers to the year (1876) in which the description was written.

XXVIII.—*Descriptions of New Noctuæ, with remarks on the variation of Larval Forms in the Group.*

BY A. R. GROTE.

Read Dec. 11th, 1876.

I HAVE already called attention in the "Popular Science Monthly" (for December, 1876), to the method of variation displayed by certain kinds of *Noctuæ*. These variations were observed in the cases of representative species, that is to say forms which have an ally in a widely separated locality, such as Europe is when compared with our Atlantic Coast Territory. It was found that the differences between such species are expressed on the upper surface of the wings (especially the front pair) most prominently; the under surfaces in the contrasted forms agreeing very nearly in both color and design. An instance was cited in the North American *Catocala relicta* and the European *Catocala fraxini*. Although the differences between the two are greater than in some other cases, and the changes undergone by one form or the other, or both, since a separation from a common stock, are thus greater than has often happened, yet the peculiar color and size of the two insects render the comprehension of the fact more easy. Beneath, both species have remained white. Above, the European form contrasts by its more uniformly gray and obscure primaries; in the American insect, these are white, more or less invaded by transverse bands of more intense gray or black. It is suggested that the habit of the moths which ensures the concealment from light, and from the more immediate atmospheric changes, of the under surface of the body and wings, has been the principal factor in the case. In the day-time, the moths rest against an opaque substance, the fore wings covering the hind pair. Both these species belong to the subgenus *Catocala*, as limited by Hubner. They are structurally identical; and no other species of this particular subgenus of the large genus *Catocala* are yet known. The European moth is a little the larger of the two. In a single specimen very clearly, and in others more obscurely, I have observed in the American form blue scales edging the white band which crosses the upper surface of the hind wing. This fact is interesting, because the band which occupies an analogous position in the European form, is wholly of a grayish blue. Especially interesting will be the study of species comparatively isolated in their structure from their nearest allies in our fauna. Such an instance in the *Noctuæ* is *Euparthenos nubilis* Grote ex Hubner. The genus *Euparthenos* Grote (= *Parthenos* Hubn.) is lower than *Catocala*, and in the cut of wing, the length of palpi, and the ornamentation (especially beneath), approaches *Ophideres* of the Tropical Eastern Hemisphere.

With regard to *Catocala relicta*, I have corrected* the mistake of previous writers, who considered the variation of the front wings, which are more or less invaded by black shades, to be a sexual character, the darker specimens being supposed to be the males. This mistake is fallen into by Mr. Herman Strecker, who figures two male specimens of the species as of opposite sexes, the whiter male being considered as a female. This is shown by the shape of the abdomen in the two figures; while at this time Mr. Strecker was unaware of the distinctional characters offered by the frenulum, which render the recognition of the sex an easy matter in the Noctuæ. This is shown by his remark that he cannot determine the sex of a specimen of *Catocala marmorata* figured by him, for the reason that the abdomen happened to be missing. In the case of *C. relicta* Mr. Strecker has overlooked even the shape of the abdomen, identical in his two figures, and has relied upon the statement of previous writers with regard to the assumed sexual character of the color of the fore wings, without personal verification in determining his material.

---

* Can. Ent. vii, 186.

With regard also to the differences in larval color and ornamentation in these representative species of *Noctuæ*, we find that they are often more clearly expressed than in the perfect state. This immature stage of growth has submitted independently to modification. An instance is offered by the American *Apatela occidentalis* and the European *Apatela psi*. Here the moths are exceedingly similar, and difficult to distinguish; while the larva of the American species, described by Mr. Wm. Saunders, of London, Ontario, offers prominent differences when compared with this same state in the European species. All the cases cited by Guenée, based upon drawings of the larvæ of North American *Noctuæ* by Abbot, where the moth resembles an European form very nearly, but the larva is very different, should probably be considered here. The larva has varied through natural selection, while the perfect form has remained more fixed. The whole extensive genus *Apatela* (= *Acronycta*) is remarkable for the eccentricities of the larval forms as compared with the uniformity of the species; so that the conclusion is not unreasonable that these larval differences have been evolved by a natural protective law.* There is within the genus *Apatela* another case of representation, between the American *Apatela funeralis* and the European *Apatela alni*, where a very singular form of larval ornamentation has been equally retained, while the comparisons as yet made between the moths show sufficient difference to warrant distinctional names. Again, in the case of the larvæ of the Cotton Worm moth (*Aletia argillacea*) I have pointed out two varieties,† which feed side by side, one with and one without a dorsal stripe. It will be interesting to observe the particulars of the struggle between these two varieties in the case of this imported insect.

Where the habit of life of the larva leads to no conceal-

---

* Bull. Buff. Soc. Nat. Sc., 1, 130, quoted by Prof. Morse in his Address before the Section of Biology of the Am. Asso. Adv. Sci., Buffalo, 1876.

† Alabama Geological Survey for 1875, 201.

ment of any part of the body during any particular period of the twenty-four hours, the causes for its variation may be sought outside of climatic influences to some extent. They will evidently bear more heavily upon the moth, which never or rarely voluntarily exposes the under surface of the body and wings to the light. In the case of *Catocala relicta*, before cited, I have been struck with the fact that the color of the upper surface of the primaries, which are alone exposed while the moth is at rest in the daytime, does not assist so well in its concealment from enemies as the hue of the same parts in the European species.

With regard to the "phytophagic species," first observed by Mr. Walsh and afterwards by Prof. Riley, I still think that they should not be necessarily considered as "species in process of formation," although it may be convenient to give them different Latin designations. Some of these cases, such as that of *Tortrix Rileyana*, Grote, may rest on an error of observation. Both Prof. Zeller and myself believe that the ordinary male of this species is mistaken for a phytophagic variety by Prof. Riley. I have formerly shown Mr. Walsh's mistake with regard to *Sphingicampa distigma*, which he regarded as a different insect, generically and specifically, from *Dryocampa bicolor*, on the strength of observations in breeding the insect, in which he was apparently deceived. These "phytophagic variations" may not go further than they do now, and the forms may continue to interbreed, or finally displace each other.

Very much more careful observations are needed to draw conclusions as to the relation of the larval state to its food. A separation of the determining cause of variations needs tact, as well as a knowledge of the facts.

In conclusion, I think that these representative species, studied in all their stages, will throw a strong light upon the horde of forms of these insects with which we are engaged. I shall be glad if my observations and deductions merely serve to draw fresh attention to the subject.

The following forms of North American Noctuæ seem to be either imperfectly described or new to science:

Agrotis rufipectus, Morrison.

♀. Antennæ simple, ciliate. Head and collar disconcolorous, dark brown (reddish brown in the type); collar with a narrow pale edging. Thorax and fore wings concolorous, grayish over purplish or fuscous brown. Lines narrow, dark, well written. Basal line distinct. Transverse anterior line with the inner line obsolete, slightly dentate at costa, indentated on submedian fold; the line is comparatively straight. Median space wide; no claviform; orbicular concolorous, rounded, incompletely annulate; reniform stained by the diffuse median darker shade, edged more distinctly than the other spot, and more complete. Transverse posterior line slightly waved, accentuated by dots or points, not much exserted, outer line obsolete. Terminal space paler than the rest of the wing, contrasting with subterminal. Beneath paler, costa of both wings powdered with reddish. A continued broad exterior common line. Cellular mark on hind wings extended. Abdomen beneath and lateral hairs reddish. Hind wings above pale fuscous, concolorous, with line hardly noticeable. *Exp.* 34 mil. Lewis Co., N. Y., July 29, Mr. W. W. Hill, coll.

In this species the fore tibiæ, I believe, are unarmed. The type which I have before me, was sent to Mr. Morrison for description, at his request for new material in this genus, and is briefly described by him in the Proc. Bost. Soc. Nat. Hist, XVII, 165. The species may be known by its single, fine, scalloped transverse lines on the primaries, and the discolorous head and thorax. It seems to be allied to *A. collaris* and *formalis*.

Agrotis perconflua, n. s.

This form is stouter than *conflua* and brighter colored. Fore tibiæ armed. Palpi at tips, upper surface of head and collar pale, contrasting. Palpi and breast rusty brown. Fore wings bright red brown, paler at base and vaguely paler along costa, with a purply tinge over median nervules. Lines indistinct, broken, obsoletely geminate. No claviform perceivable. Ordinary spots pale as in *conflua*, reniform stained inferiorly. The black t. p. line is broken into cuneiform marks. Terminal space concolorous with subterminal. Subterminal line very distinct, pale, preceded by black dots, and by a narrow dark shade on costa; fringes concolorous. Hind wings pale fuscous, with discal mark and pale fringes. Beneath pale, with the costal regions of both wings reddish; common exterior lines, the outer incomplete; hind wings with discal mark and the inner exterior line continuous, somewhat jagged inferiorly. Thorax red brown; abdomen pale above, with reddish or ochery shades beneath. Expanse 33 mil. From Prof. J. A. Lintner, Schenectady, N. Y., July 8.

Differs from *conflua* by the concolorous terminal spaces, pale black-marked subterminal, and broken t. p. line. It is brighter colored and stouter than its ally, the t. p. line more inwardly bent submedially.

Agrotis placida, n. s.

♀. Fore tibiæ unarmed; antennæ simple. Fuscous gray. Fore wings smooth, dark fuscous. Basal and subterminal spaces blackish and darkest; median space a little lighter, slightly brownish; terminal space gray, contrasting. Lines even, perpendicular, pale. Transverse anterior line with a slight subcostal notch, slightly oblique; median space wide; stigmata difficult to make out, pale ringed, concolorous; median shade noticeable, obscuring the reniform. Transverse posterior line with a straight outward costal extension beyond the point of origination, thence somewhat squarely exserted opposite the cell, and running nearly straight downwards without submedian sinus. Subterminal line indicated by the great difference in color between the two terminal spaces; fringes dark. Hind wings concolorous, rather dark fuscous, with paler interlined fringes. Beneath fuscous, with a slight purply shade, irrorate, with an external common band incomplete; a slight discal mark on hind wings. Terminal abdominal hairs somewhat ocherous. Expanse 35 mil. Lewis Co., N. Y., July 26.

Differs from other species of the *cupida* group in the shape of t. p. line at costa.

Hadena hillii, n. s.

♀. Eyes naked; tibiæ unarmed. Abdomen with short black tufts on basal segments. White, gray, and black, very distinctly marked. Lines black, geminate. A black basal dash. Sub-basal space wide, whitish. T. a. line black, its inner line indistinct, erect, touching the orbicular, dentate on costa, opposite the orbicular, again with a broad obtuse tooth from median to submedian vein, and with a shorter one at internal margin. Claviform large, concolorous, defined by two narrow black lines which run entirely across the median space. Orbicular white, irregularly rounded, a little oblique, large. Reniform well sized, white, of the normal kidney shape. T. p. line originating above the reniform, well exserted beyond the reniform, running rather strongly in at vein 2, and thus narrowing the median space inferiorly. This line is scalloped, the outer line faint. On the subterminal space the nervules are marked with black. Subterminal line preceded by a light fuscous shade; the usual W-mark much reduced. Terminal line black, interrupted. Fringes grayish. Costal anteapical white dots in a fuscous shading. Hind wings rather dark fuscous with whitish fringes. Collar and thorax whitish; tegulæ lined with black; collar with a blackish shade; abdomen pale fuscous. Beneath pale ochery fuscous; hind wings with a small incomplete discal annulus and a discal streak; common line sinuous. *Expanse* 30 mil. Lewis Co., N. Y., Mr. W. W. Hill, July 26.

This is a very distinctly marked, clear colored species, with something of the habit of *Dianthoecia capsularis.* I name it after its discoverer. It is very different from *H. leucoscelis* Grote, another white-colored species, being more silky-winged and differing throughout in ornamentation.

Polia medialis, n. s.

♂. Eyes naked, with lashes; tibiæ unarmed. A rather large species, vividly marked, white, gray, black, and fuscous. Median space discolorous, being of an even wood-brown or fuscous, shaded with gray on costa. A basal black dash. Basal and terminal spaces gray, shaded with fuscous. T. a. line black, its inner line faint, not very oblique, of the usual dentate form. Claviform concolorous with the wood-brown median space, large, reaching to the median shade, narrowly outlined with black, its lower margin straight, running along the submedian fold. Orbicular large, whitish or gray, oblique, with the reniform black-ringed. Median shade zigzig; reniform connected with t. p. line by black shades along the veins and discal fold, of the usual shape, large, whitish, but not outwardly excavate, being nearly straight on this side. T. p. line with its inner line evident, dentate, black; its outer indistinct. The white spaces between the component lines of all the three first transverse lines, in this species, are very apparent. T. p. line running obliquely inwardly from the point of its subcostal angle, without any inward bend submedially. Subterminal line white, preceded by black points or streaks at the dentations. Terminal space a little deeper shaded with fuscous opposite the cell, and again at internal angle. A dentate terminal line cutting the fingers. Hind wings blackish fuscous; beneath grayish fuscous, with double exterior shaded common lines, and broad discal mark on hind wings. Abdomen fuscous, tufted basally. Thorax gray, with the tegulæ laterally shaded with fuscous, and with double lines on collar. *Expanse* 41 mil. Schenectady, N. Y., September 13, Prof. Lintner.

This differs from the description of *P. confragosa*, Morr., in the discolorous median space and in other particulars.

XXIX.—*A Partial Synopsis of the Fishes of Upper Georgia.*

BY DAVID STARR JORDAN, M.D.

Read December 4, 1876.

THE material on which the present paper is based was obtained by the writer and his assistant, Mr. Charles H. Gilbert, during the past summer (1876), in a month's residence and constant field-work at Rome, Georgia; a week's seining in the South Fork of the Ocmulgee River at Flat Rock, Dekalb Co., Georgia; and a day's work in tributaries of the Chattahoochee River near Atlanta. As the fish-faunæ of these streams differ materially, I have deemed it best to take them up separately.

PART I. WATER BASIN OF THE ETOWAH, OOSTANAULA, AND COOSA.

Rome, Floyd Co., Georgia, is located in the hill country at the junction of the Etowah and Oostanaula Rivers, which unite to form the Coosa. Farther south-west, the Coosa in turn unites with the Cahawba and Tallapoosa to form the Alabama River. As the Etowah is the longest of all these branches, it may, perhaps, be considered as the head stream of the Alabama River.

These rivers are all too wide and deep, and their bottoms too rocky, for much successful seining; hence we gave our attention chiefly to their smaller tributaries. Of these, Silver and Rocky Creeks yielded the largest results, both in number and variety. The principal streams examined were Silver, Mobley's, and Dykes' Creeks, tributary to the Etowah; Rocky, John's, Big Armucha, Lovejoy, Waters', Big Dry, Little Dry, and Lavender Creeks, tributary to the Oostanaula; and Horse-leg and Beech Creeks, tributary to the Coosa. Most of these are clear streams, formed from "spring runs."

Some of them are muddy with red clay after a rain; and a few are merely successions of weedy pools full of spatter-docks and snakes. Of course, certain differences were observed in the faunæ of these streams, but nothing that need be dwelt upon here.

So far as is known to the author, there is no printed record of any fish whatever from the water basin of the Etowah; and the few species which have been described by Agassiz, Storer, and Girard, from neighboring parts of Alabama, are most of them very imperfectly known. The writer has, therefore, been able to do just what he anticipated doing in selecting this point for field-work, viz.: (*a*) to verify a number of little known species; (*b*) to consign a number of nominal species to the limbo of synonymy; and (*c*) to make known a few peculiar forms which are believed to be new to science.

Of most of the species here mentioned, hundreds of specimens were taken; and the descriptions in this paper have been generally drawn from the average of a large number of specimens, and not from a few individuals. These specimens are deposited in the Museum of the Butler University at Indianapolis, Indiana, under the auspices of which institution they were collected.

PERCIDÆ.

BOLEICHTHYS.

= **Boleichthys** Girard, Proc. Phil. Ac. Sc., 1859, 104. (Type *B. exilis* Girard).

> **Hololepis** Agassiz, Putnam, Bull. M. C. Z., 1863, 4. (Type *Boleosoma barrattii* Holbrook).

1. BOLEICHTHYS ELEGANS.

Boleichthys elegans Girard, Proc. Phil. Ac. Sc., 1859, 104. Jordan and Copeland, Bull. Buff. Nat. Hist. Soc., 1876, 135.

Numerous specimens of a small Boleichthys from the Etowah are identified with the above species, with some doubt. However, they cannot well belong to any other described species. They are so small and fragile that the fin formulæ, and some other characters, cannot easily be made out; but I find no discrepancy between the characters shown by my specimens and those noted in Girard's brief description.

My specimens are short, chubby, and compressed, bearing some resemblance in form to *Microperca punctulata*. The mouth is moderate, with equal jaws: the two dorsal fins about equal, and distinctly separated by an interspace. The scales are comparatively large, but apparently quite variable, the number of transverse series varying from 42 to 56. The lateral line traverses the scales of the operculum, and ends about midway of the body, being distinct on from 13 to 30 scales. This is also quite variable, one side of the same specimen often having twice as long a lateral line as the other. Lateral line arched high over the pectorals, running parallel with the elevated and rounded nuchal region.

Head $3\frac{3}{4}$ in length (without caudal, as in all cases in the present paper): depth $4\frac{3}{4}$. Eye 3 in head. Fin rays, D. X, 13, or IX, 12 or 13. A. II, 7, or II, 8. Scales, 42, 44, 44, 44, 46, 48, 55, 56, in as many specimens, those with the most scales usually having the lateral line continued farthest.

Color greenish, with dark specks: fins mottled: a dark line forward from eye.

Length of specimens examined a little less than an inch. They probably reach a somewhat larger size.

Habitat. Mill ponds in the Etowah water basin. Most of my specimens taken in Dyke's Pond, near Rome, Ga., with *Boleosoma stigmæum* and *Minnilus lirus*.

HADROPTERUS.

=**Hadropterus** Agassiz, Amer. Jour. Sci. and Arts, 1854, 305. (Type *H. nigrofasciatus* Ag.)

>**Cottogaster** Cope, Journ. Phil. Ac. Sci., 1869, 211 (not of Putnam?). (*C. aurantiacus* Cope.)

>**Hypohomus** Cope, Proc. Am. Phil. Soc., 1870. (Type *C. aurantiacus* Cope.)

=**Plesioperca** Le Vaillant, Nouv. Archives du Museum, 1873.

2. HADROPTERUS NIGROFASCIATUS.

Hadropterus nigrofasciatus Agassiz, Amer. Jour. Sci. and Arts, XVII, 305, 1854. Putnam, Bull. M. C. Z., 1863, 4.

Etheostoma nigrofasciatum Jordan, Bull. Buff. Soc. Nat. Hist., 164, 1876 (not of Manual Vert., 1876, 223 = *Alvordius evides* J. and C.).

Plesioperca anceps Le Vaillant, l. c.

This species is merely mentioned by Prof. Agassiz,* and does not seem to have been noticed by any other American author. My specimens show the following characters :—

Head and body stout and heavy, the latter deep and compressed, the depth being about 5 in the length in the larger specimens. Head and mouth much as in *Alvordius aspro*, but heavier, and the mouth rather narrower: intermaxillaries slightly projectile, but the skin of the middle of the upper lip continuous with that of the forehead, as in *Percina*. Eye moderate, 4 in head. Head about 4 in length, without caudal.

Scales rather large, 58 in the lateral line, which is continuous; median line of the belly, and the whole chest, covered with small scales.

Fins all large; dorsals slightly connected by membrane at the base; the second dorsal about the size of the anal.

Fin rays, D. XII, 11 or 12. A. II, 10.

Color dark olive above, with blackish markings as usual in these fishes: sides with vertical bars, somewhat diamond-shaped, but quite narrow, acute above and acuminate below, more or less confluent along the middle; about 12 in number; in color, dark greenish, varying to jet black in accordance with the feelings of the fish. These bars are most distinct near the middle of the body, and broadest behind.

Inner half of each of the vertical fins, black, outer half more or less speckled and barred: top of head black, a black band through eye and snout, and a dark vertical shade below the eye; markings more or less shown by all the Darters. A small black spot between two smaller ones at base of caudal fin.

Length four inches.

Habitat. My specimens were taken in small tributaries of the Etowah and Oostanaula Rivers, in clear, rapidly flowing

---

* Prof. Agassiz's *specific* account is as follows: "From the neigborhood of Mobile, Alabama. Discovered by Albert Stein, Esq. Brown above, lighter below, with transverse black bands, wider in the middle than nearer to the back or belly."

water, with *Percina caprodes*. Silver Creek, Rocky Creek. Known to the fisherman as *Crawl-a-bottom.*

BOLEOSOMA.

=**Boleosoma** DEKAY, N. Y. Zoology, 1842, 20. (Type *B. tessellatum.*)

>**Arlina** GRD., Proc. Phil. Ac. Sci., 1859, 64. (Type *A. effulgens.*)

>**Estrella** GRD., l. c. 65. (Type *E. atromaculata.*)

?>**Cottogaster** PUTNAM, Bull. M. C. Z., 1863, 4. (Type *B. tessellatum*, Thompson.)

3. BOLEOSOMA STIGMÆUM, sp. nov.

Body slender, of about the size and form of *Boleosoma brevipinne* Cope. Depth 5 in length in adult. Head $4\frac{1}{4}$ in length, narrow and thin, the snout pointed. Mouth small, inferior; intermaxillaries projectile, the skin of the lip and front not continuous; vomerine teeth.

Fins rather large, D. X, 11 or 12; A, II, 7; the spines well developed and subequal. Caudal emarginate. Scales rather large, 5-46-7, lateral line distinct. Opercles scaly, cheeks and neck also.

Colors rather bright. Tessellated above, as usual in *Boleosoma;* fins mottled; sides with about 8 M or W-shaped dark green blotches below lateral line, —fainter and smaller than in *D. blennioides*,—and various duller ones above. Body in the larger specimens sprinkled with small orange dots, which are more conspicuous after death, when the green has faded. Pectorals and caudal yellowish barred. Spinous dorsal with a band of bright orange-red above, and one or two narrow dark ones below it. A dark stripe forward from eye, and another downward.

Length of largest specimens, 2 inches.

Habitat. In small tributaries of the Etowah and Oostanaula Rivers, especially in clear waters and in mill-ponds of the hill-country. Known to boys and fishermen as *Speck.*

It will perhaps be necessary to revive the genus *Arlina* for this species, *B. effulgens*, and *B. maculaticeps*. It would differ from *Boleosoma* in the presence of two well-developed sub-equal anal spines.

PERCINA.

<**Percina** HALDEMAN, Journ. Phil. Ac. Sc., VIII, 1842, 330. (Type *Perca nebulosa* Haldeman = *E. caprodes* Raf.)

=**Pileoma** DEKAY, Fishes N. Y., 1842, 16. (Type *P. semifasciata* Dek. = *E. caprodes* Raf.)

=**Asproperca** HECKEL, MSS. in Canestrini, Verhand. Zool. Bot. Verein, Wien, X, 1860.

4. PERCINA CAPRODES.

Sciæna caprodes Rafinesque, Am. Monthly Mag., 1818, 334.

Etheostoma caprodes Raf., Ich. Oh., 1820, 38. Kirtland, Zool. Ohio, 1838, 168, 192; Bost. Journ. Nat. Hist., III, 346, 1841. Storer, Synopsis, 1846, 270.

Pileoma caprodes Agassiz, L. Superior, 1850, 308; Amer. Journ. Sci. Arts, 1854, 305. Le Vaillant, Recherches sur les Poissons, etc. 1873.

Percina caprodes Girard, Proc. Phil. Ac. Sci., 1859, 66. Putnam, Bull. M. C. Z., 1863, 5. Cope, Proc. Phil. Ac. Sci., 1865, 82; Journ. Phil. Ac. Sci., 1869, 211. Jordan, Ind. Geol. Survey, 1874, 213; Manual Vert, 1876, 224; Bulletin Buff. Ac. Sci., 1876, 93. Jordan and Copeland, Am. Nat., 1876, 337; Bull. Buff. Soc. Nat. Hist., 1876, 135.

Percina nebulosa "Haldeman, Journ. Ac. Sci., Phil., 1842, 330." Girard, Proc. Phil. Ac. Sci., 1859, 66.

Perca nebulosa Dekay, Fishes of N. Y., 1842, 7.

Etheostoma nebulosa Storer, Synopsis, 1846, 271.

Pileoma semifasciatum Dekay, Fishes of N. Y., 1842, 16. Günther, Catalogue of Fishes, 1859, I, 76.

Etheostoma semifasciata Storer, Synopsis, 271.

Percina semifasciata Girard, Proc. Phil. Ac. Sci., 1859, 66. Gill, Proc. Phil. Ac. Sci., 1860, 20.

Percina bimaculata "Haldeman, Proc. Bost. Soc. Nat. Hist., 1843, 157."

Etheostoma bimaculata Storer, Synopsis, 1846, 271, 272.

Etheostoma zebra Agassiz, Lake Superior, 1850, 308.

Pileoma zebra Agassiz, l. c. Le Vaillant, l. c., 1873.

Percina zebra Girard, Proc. Phil. Ac. Sci., 1859, 66.

Asproperca zebra Heckel, l. c.

This species is abundant in all the tributaries of the Etowah, Oostanaula, and Coosa Rivers. Comparison with northern specimens fails to show any difference of any sort. This is known to the fishermen as *Crawl-a-bottom* and *Hog-molly.* The latter appellation is more usually applied to *Catostomus nigricans*, and is apparently a corruption of "Hog-mullet."

Percina carbonaria Girard, from Texas, differs in several respects from my specimens of this widely diffused species.

STIZOSTETHIUM.

=**Stizostedion** Rafinesque, Ich. Ohiensis, 1820, 21. (Type *Perca salmonea* Raf.)

?**Pomacampsis** Rafinesque, Ich. Ohi., 23. (Type *Perca nigropunctata* Raf. = ?)

>**Sandrus** Stark, "Elements Nat. Hist., I, 465, 1828." (Same type.)

=**Lucioperca** Cuvier and Valenc., 110, 1829. (Type *Perca lucioperca L* = *Lucioperca sandra* Cuv., Europe.)

=**Stizostedium** Cope, Proc. Phil. Ac. Sci., 1865, 82.

5. STIZOSTETHIUM SALMONEUM.

Perca salmonea Rafinesque, Am. Monthly Mag., 1818, V, 354; Ich. Ohi., 1820, 21.

Stizostedion salmoneum Raf., Ich. Oh., 1820, 23.

Stizostedium salmoneum Cope, Proc. Phil. Ac. Sci., 1865, 82. Jordan, Man. Vert., 1876, 225; Bull. Buff. Nat. Hist. Soc., 1876, 92, and 136.

This species occurs in the Oostanaula River, and is known locally as Salmon Trout. I have no adult specimens at hand, and therefore refrain from attempting a comparison between it and *S. vitreum.*

MICROPTERUS.*

=**Micropterus** Lacepede, Hist. Nat. des Poiss., IV, 325, 1800? (Type *M. dolomieu* Lac. = ? *Labrus salmoides* Lac.)

>**Calliurus** Raf., Ich. Ohi., 1820, 26 (not of Ag.). (Type *C. punctulatus* Raf. = *Labrus salmoides* Lac.)

=**Lepomis** Rafinesque, Ich. Ohi., 1820, 30. (Not *Lepomis* Raf., Journ. de Phys., 1819.)

>**Aplites** Rafinesque, Ich. Ohi., 31. (Type *Lepomis pallida* Raf.)

>**Nemocampsis** Rafinesque, Ich. Ohi., 32, 1820. (Type *Lepomis flexuolaris* Raf. = *Labrus salmoides* Lac.)

>**Dioplites** Rafinesque, Ich. Ohi. 1820, 32. (Type *L. salmonea* Raf. = *L. salmoides* Lac.)

>**Huro** Cuv. and Val., Hist. Nat. des Poiss. II, 124, 1828. (Type *H. nigricans* C. and V. = *Cichla floridana* Le S.)

>**Grystes** Cuv. and Val., Hist. Nat. des Poiss. III, 54, 1829. (Type *Labrus salmoides* Lac.)

---

* See Gill "On the Species of the Genus Micropterus (Lac.) or Grystes (Auct.)" in Proceedings Am. Assoc. Adv. Science, 1873, XXII. B, 55;—from which valuable paper, most of the synonymy here given has been copied.

6. MICROPTERUS PALLIDUS Gill and Jordan.*

Lepomis pallida Raf., Ich. Oh., 30, 1820.
Cichla floridana Le Sueur, Journ. Phil. Ac. Sci., II, 1822, 219.
Micropterus floridanus Goode, Bull. U. S. Nat. Museum, 1876.
Huro nigricans Cuv. and Val., Hist. Nat. des Poiss. II, 124, 1828. Rich. F. B. A., III, 4, 1836. Jardine, Nat. Lib. I, Perches, 108, 1835. Dekay, Fishes N. Y., 1842, 15. Storer, Syn. 1846, 277. Günther, Cat. Fishes, I, 255, 1859.
Grystes nigricans Agass., L. Superior, 1850, 297.
Micropterus nigricans Cope, Proc. Phil. Ac. Sci., 1865, 83, and 1870, 451. Gill, Rept. Comm. Agr., 1866, 407; Proc. Am. Asso. Adv. Sci., 1873, 70 B. Jordan, Ind. Geol. Surv., 1874, 214; Man. Vert., 1876, 229.
Grystes nobilior Agassiz, Amer. Journ. Sci. Arts, XVII, 1854, 298. Putnam, Bull. M. C. Z., 1863, 6.
Grystes nuecensis Baird and Girard, Proc. Phil. Ac. Sci., 1854, 25.
Dioplites nuecensis Girard, U. S. Pac. R. R. Surv., 4, 1858; U. S. Mex. Bound. Surv., 1859, 3.
Grystes salmoides Holbrook, Ich. S. C., 1855, 25, and Second Ed., 1860, 28. Norris, Am. Ang. Book, 1864, 99.
Grystes megastoma Garlick, Treat. Art Prop. Fish, 1857, 108.

Abundant in the Etowah, Oostanaula, and Coosa Rivers, rather more so than the next species, and everywhere confounded with it under the name of *Trout.*

7. MICROPTERUS SALMOIDES.

Labrus salmoides Lacépède, Hist. Nat. des Poiss., III, 716, 1800 ?
Grystes salmoides Cuv. and Val., Hist. Nat. des Poiss., III, 54, 1829. Jardine, Nat. Lib. I, Perches, 158, 1835. Dekay, Fishes N. Y., 26, 1842. Storer, Synopsis, 1846, 288. Herbert, Fish and Fishing, 197.
Micropterus salmoides Gill, Proc. Am. Ass. Adv. Sci., 1873, 67 B. Jordan, Ind. Geol. Surv., 1874, 214; Man. Vert., 1876, 230.
Micropterus dolomieu Lacépède, Hist. Nat. des Poiss., IV, 325, 1800?

---

*Prof. Gill calls my attention to the fact that what is probably this species from Mexico, has been refigured by LeVaillant and Bocourt, under the names of *Dioplites treculii* sp. n., *D. salmoides* (Holbr.), *D. variabilis* (LeSueur) and *D. nuecensis* Grd., in Etudes sur les Poissons < Mission Scientifique à la Mexique, 1874. Letter-press descriptions have not yet appeared.

Bodianus achigan Rafinesque, Am. Mo. Mag. and Crit. Rev., 1817, II, 120.
Lepomis achigan Gill, Proc. Phil. Ac. Sci., 1860, 20.
Micropterus achigan Gill, Rept. Comm. Ag., 1866, 407.
Calliurus punctulatus Raf., Ich. Ohi. 26.
Lepomis trifasciata Raf., ib. 31.
Lepomis flexuolaris Raf., ib. 31.
Lepomis salmonea Raf., ib. 32.
Lepomis notata Raf., ib. 32.
Etheostoma calliura Raf., ib. 32.
Cichla fasciata Le Sueur, Journ. Ac. Sci. Phil., 216, 1822. Kirtland, Zool. Ohio, 191, 1838.
Centrarchus fasciatus Kirtland, Bost. Journ. Nat. Hist., V. 28. Dekay, Fishes N. Y., 28, 1842. Storer, Syn. 290. Thompson, Hist. Vt., 1842. Günther, Cat. Fishes, I, 258.
Grystes fasciatus Ag., L. Superior, 295, 1850. Eoff Smiths. Rep., 1854, 289. Putnam, in Storer's Fish Mass., 278, 1855.
Micropterus fasciatus Cope, Proc. Ac. Sci. Phil., 1865, 83; Journ. Ac. Sci. Phil., 1869, 216; Proc. Am. Phil. Soc., 450, 1870.
Gristes nigricans Herbert, Fish and Fishing, 195.
Grystes nigricans Garlick, Treat. Art Prop. Fish, 105, 1857. Norris, Am. Angler's Book. 103, 1864.
Cichla ohiensis Le Sueur, Journ. Ac. Sci. Phil., 218, 1822.
Cichla minima Le Sueur, Journ. Ac. Sci. Phil., 220, 1822. Kirtland, Rept. Zool. Ohio, 191, 1838.
Centrarchus obscurus Dekay, Fishes N. Y., 30, 1842. Storer, Synopsis, 1846, 40. Günther, Cat. Fishes, I, 258, 1859.
Grystes salmonoides Günther, Cat. Fishes, I, 252, 1859.

In the Etowah, Oostanaula, and Coosa Rivers, with the preceding. The yellow and black caudal markings, so striking in young specimens from the Ohio River, and which suggested to Rafinesque the name of *Calliurus*, are not well shown by my specimens. The lower fins are unusually red, and there is a tendency to the formation of parallel lines of dusky spots along the rows of scales. These peculiarities perhaps indicate a permanent variety.

AMBLOPLITES.

Ambloplites Rafinesque, Ich. Ohi., 1820, 32. Type *Lepomis ichtheloides* Raf. = *Bodianus rupestris* Raf.

8. AMBLOPLITES RUPESTRIS.

Bodianus rupestris Rafinesque, Amer. Monthly Mag., 1817, 120.

Ambloplites rupestris Gill, Proc. Phil. Ac. Sci., 1860, 20. Cope, Journ. Phil. Ac. Sci., 1869, 217; Proc. Amer. Phil. Soc., 1870, 451; Proc. Phil. Ac. Sci., 1865, 83. Jordan, Ind. Geol. Surv., 1874, 215; Bull. Buff. Soc. Nat. Hist., 1876, 92; Man. Vert., 231, 1876.

Icthelis erythrops Raf., Ich. Ohi., 29, 1820.

Lepomis ictheloides Raf., Ich. Ohi., 32, 1820.

Ambloplites ichtheloides Agassiz, Amer. Journ. Sci. and Arts, 1854, 299. Girard, Pac. R. R. Surv., X, 8, 1858.

Centrarchus æneus Cuv. and Val., Poissons, III, 88. Dekay, Fishes N. Y., 27, 1842. Richardson, Fauna Boreali Americana, 1836, III, 18. Kirtland, Bost. Journ. Nat. Hist., IV., 239. Storer, Synopsis, 289, 1846. Günther, Cat. Fishes, I, 256, 1858.

Ambloplites æneus Agassiz, Amer. Journ. Sci. and Arts, 1854, 299. Girard, Pac. R. R. Rep., X, 1858, 8.

Centrarchus pentacanthus Cuv. and Val., III., 88. Dekay, Fishes N. Y., 1842, 30. Storer, Synopsis, 1846, 290.

This species is moderately common in the Etowah and Oostanaula, where it is known as Goggle-eyed Pearch.

LEPIOPOMUS.*

"**Lepomus** Raf., Anal. Nature, 1815." (Agassiz.)

<**Lepomis** Rafinesque, Journal de Physique, 1819. (Type *Labrus auritus* L.)

=**Pomotis** Raf. l. c. (Same type.)

Icthelis Raf., Ich. Oh., 1820, 27. (Same type.)

=**Ichthelis** and **Pomotis** sp. Later writers.

9. LEPIOPOMUS PALLIDUS Gill and Jordan.

Labrus pallidus Mitchill, Trans. Lit. and Phil. Soc., 420, 1814.

Labrus appendix Mit., Am. Monthly Mag., 1818, 407 (not *Pomotis appendix* of authors).

Pomotis incisor Cuv. and Val., VII., 466. Dekay, Fishes, N. Y., 33, 1842. Storer, Synopsis, 293, 1846. Agassiz, Amer. Journ. Sci. and Arts, 1854, 302. Girard, Pac. R. R. Surv., 1858, 24. Günther, Cat. Fishes, I, 269, 1859.

Ichthelis incisor Holbrook, Ich. S. C., 1860, 12. Putnam, Bull, M. C. Z., 1863, 6. Jordan, Man. Vert., 1876, 235 and 317.

Lepomis incisor Gill, Amer. Journ. Sci. and Arts, 1864, 93. Cope, Proc. Phil. Ac. Sci., 1865, 83.

---

*I have seen fit to restore the correct orthography of this much abused name.

Lepomis megalotis Cope, Journ. Phil. Ac. Sci., 1869, 220; Proc. Am. Phil. Soc., 1870, 452 (not *Ichthelis megalotis* Raf.).
? *Lepomis ardesiacus* Cope, Jour. Phil. Ac. Sci., 1869, 222; Proc. Am. Phil. Soc., 1870, 453.
? *Lepomis purpurascens* Cope, Proc. Am. Phil. Soc., 1870, 453.
Ichthelis macrochira Jordan, Ind. Geol. Surv., 1874, 215 (not of Raf.).

This abundant species is known to the Etowah fisherman as the Spotted Pearch, or simply Pearch. My specimens are all young, and are precisely like young specimens of the same species from the Ohio.

10. LEPIOPOMUS OBSCURUS.

Pomotis obscurus Agassiz, Amer. Journ. Sc. and Arts, 1854, 302.
Ichthelis incisor var. *obscurus* Jordan, Man. Vert., 1876, 236.

This species is most nearly related to *L. pallidus*, but it is certainly distinct. It is known to the fisherman of the Etowah as the "Brim" (Bream), and according to some of them it is the only species to which that name can properly be applied. This species hides under rocks and bushes in deep holes in the smaller streams, and cannot easily be taken with the seine. We procured four or five large specimens, which showed when fresh the following characters. As in *Chœnobryttus melanops* (Grd.), the coppery colors become black in spirits.

Dark-green above, shoulders and front of back with distinct greenish-black spots; sides with wide dark-green bars, much as in young specimens of *incisor;* thorax bright dark coppery red, spotted with blackish, sometimes with orange; sides of body below mixed blackish and pale carmine; face, lower jaw, and lower part of sides of head, a peculiar bright leaden blue, mixed with some reddish,—a very distinctive feature, as shown by Prof. Agassiz. Cheeks orange and lead-blue, without distinct stripes; opercular spot rather large, all black, much as in *L. incisor;* dorsal and caudal fins blue-green; anal still darker and bluer. A dark blackish-green spot on last rays of dorsal and anal, as in *L. incisor.* In this species, as in other brightly colored Percoids, the colors become suddenly dull and pale in death.

Eye large, the iris black. Depth of body about half length, without caudal; length of head somewhat less. Pectoral fins very long and pointed, reaching beyond anal.

Spines shorter than in *L. incisor*. Profile much steeper than in specimens of *incisor* of the same size.

Large adult specimens are said by the fishermen to be thick, round, and almost black in color.

Habitat. Small tributaries of the Etowah and Oostanaula about Rome, Ga., particularly Dry Creek and Silver Creek.

XENOTIS.

Xenotis JORDAN, Proc. Phil. Ac. Sci. 1877 (Type *Pomotis fallax* B. & G.).

11. XENOTIS SANGUINOLENTUS.

Pomotis sanguinolentus Agassiz, Amer. Jour. Sc. Arts, 1854, 301.

This handsome species abounds in all the tributaries of the Etowah, Oostanaula, and Coosa. It is known to the fishermen as Sun Pearch.

12. XENOTIS INSCRIPTUS.

Pomotis inscriptus Agassiz, l. c. 302.
Ichthelis inscriptus Jordan, Man. Vert., 1876, 237.

A single specimen of this handsome species is in my collection from the Etowah. It was not noticed at the time of capture.

SCIÆNIDÆ.

HAPLOIDONOTUS.

=**Aplodinotus** RAFINESQUE, Journal de Physique, 418, 1819. (Type *A. grunniens* Raf.)

=**Amblodon** RAFINESQUE, Ich. Ohi., 1820, 24. (Type *A. grunniens.*)

<**Corvina** "CUVIER, Regne Animal, 1829." (Type *C. nigra* Cuv.)

=**Haploidonotus** GILL, Proc. Phil. Ac. Sc., 104, 1861. (Type *A. grunniens* Raf.)

13. HAPLOIDONOTUS GRUNNIENS.

Aplodinotus grunniens Rafinesque, Journal de Physique, 1819, 418.
Amblodon grunniens Raf., Ich. Oh. 1820, 24. Agassiz, Amer. Jour. Sc. & Arts, 1854, 307. Girard, Pac. R. R. Survey, 1858, 96.
Haploidonotus grunniens Gill, Proc. Phil. Ac. Sc., 1861, 104, and in other papers. Jordan, Ind. Geol. Surv., 1874, 216; Bull. Buff. Soc. Nat. Hist., 1876, 92; Manual Vert., 241, and of late American writers generally.
Sciœna oscula LeSueur, Jour. Phil. Ac. Sc., 1822, 254. Kirtland, Rep't Zool. Ohio, 1838, 168 and 192.
Corvina oscula Cuvier and Val. Poissons, V, 1830, 98. Rich. F. B. A. 1836, 68. Kirtland, Bost. Journ. Nat. Hist., 1840, III, 350. Dekay, Fishes N. Y., 1842, 73. Storer, Synopsis, 1846, 219. Günther, Cat. Fishes, II, 297, 1860; and of various compilers.
Sciœna grisea LeSueur, Jour. Phil. Ac. Sc., 1822, 254.
Corvina grisea Dekay, Fishes N. Y., 1842, 76.

b. var.? lineatus.

Amblodon lineatus Agassiz, Amer. Jour. Sci. and Arts, 1854, 307. (Osage River.)
Haploidonotus lineatus Gill, Proc. Phil. Ac. Sc., 1861, 105. Jordan, Man. Vert., 1876, 242.

c. var.? concinnus.

Amblodon concinnus Ag. Am. Journ. Sc. Arts, 1854, 307. (Tenn. R.)
Haploidonotus concinnus Gill, Proc. Phil. Ac. Sc., 1861, 104. Jordan, Man. Vert., 242.

d. var? neglectus.

Amblodon neglectus Girard, Mex. Bound. Surv. 12, 1859. (Rio Grande).
Haploidonotus neglectus Gill, Proc. Phil. Ac. Sc., 1861, 105.

The "Drum" is abundant in the river-channels of the Etowah and Oostanaula, but I was unable to secure specimens. Young specimens from the French Broad and Cumberland Rivers in Tennessee, show the lines of black dots ascribed to *lineatus* and *neglectus*, but do not otherwise differ appreciably from *grunniens*. In view of this fact, and as Prof. Agassiz's comparative diagnoses show no tangible specific characters, I deem it best to refer all our *Haploidonoti* to one species, until real differences are shown.

COTTIDÆ.

POTAMOCOTTUS.

< **Cottus** (Artedi) "Linnæus, Syst. Nat., 1748." ("Type *C. gobio.*" Europe.)

< **Cottus** Girard. Monograph N. Am. Freshwater Cottoids, 1851.

= **Potamocottus** Gill. Proc. Boston Soc. Nat. Hist., 1861, 41. (Type *P. carolinæ.*)

= **Pegedichthys** Jordan. Man. Vert., 1876, 244. (Type *P. ictalurops*, not of Raf.)

14. POTAMOCOTTUS ZOPHERUS. Sp. nov.

A species of this genus occurs in great abundance in tributaries of the Etowah and Oostanaula, particularly in Lovejoy, Rocky, and Silver Creeks.

Of the hundred or more specimens secured, none appear to be mature, and but three of them have reached a length of three inches. From these three large specimens the present description is drawn.

For the purpose of comparison with Girard's descriptions I have here followed the order of his account of *C. meridionalis*, a species probably as closely related to *P. zopherus* as any mentioned in Girard's Monograph. Its nearest relations, however, seem to be with *P. carolinæ*. If *P. zopherus*, *meridionalis*, *carolinæ*, and *alvordii* should prove ultimately to be varieties of one species, I shall not be surprised, although I have at present no evidence that such is the case.

Body rather slender, the greatest depth $5\frac{3}{5}$ in total length, or $4\frac{3}{4}$ without caudal. Body not greatly tapering, the least depth about one-fourteenth of the total length. The greatest thickness of the body is a trifle more than the greatest depth.

The head is just one-third of the length without the caudal fin, or more than one-fourth, that fin included. Its width is about equal to the length of its upper surface.

The eyes are large and close together; their form is circular, and their diameter is one-fourth the length of the head. The interorbital space is very narrow, scarcely more than half the width of the eye. The mouth is moderately large, and there are teeth on the palatines.

The preopercular spine is very large, hooked upwards and backwards; and below it are two other smaller ones, the lower minute.

The first dorsal commences behind the insertion of the ventrals. It is quite high, and its upper edge is quite convex. It is but little lower than the second dorsal. There are seven rays, the second, third, and fourth being the highest. The second dorsal is contiguous, and the two are connected by membrane. It is composed of seventeen rays. The caudal fin is considerably shorter than the head. In all the fins the tips of the rays project beyond the membrane. This is especially true of the pectorals. The ventrals are immediately beneath the pectorals, and consist of one spine and four soft rays.

The pectorals are rather large, reaching to the anal, and about to the fifth ray of the second dorsal. Their base of insertion is oblique and somewhat curved.

B. 6. D. VII–17. A. 13. V. I, 4. P. 14.

The vent is much nearer to the snout than to the base of caudal. The lateral line is high and parallel with the back. It vanishes at the end of the anal fin.

General color very dark, almost black, with three wide jet-black cross bands, and a bar at the base of the caudal; belly pale; fins mottled and barred; no red.

Habitat. Small tributaries of the Etowah and Oostanaula, abounding in shallow rapids with *Catostomus nigricans*, a species the young of which it much resembles in color. It is locally known as "Blob," and "Muffle-Jaw."

The most important characters of *P. zopherus* seem to be the high first dorsal, the narrow interorbital space, and the black color. This latter feature suggested the specific name.

It is well separated from all of Dr. Girard's species,—if they truly are species. To the present writer, his accounts seem to be descriptions of individuals rather than of species; but my acquaintance with these fishes is too limited for me to express any opinion on these matters.

CYPRINODONTIDÆ.

XENISMA.

=**Xenisma** Jordan, Check List, Bull. Buff. Soc. Nat. Hist., 1876, 142. (Type *X. stellifera* Jordan.)

The genera of our Cyprinodonts are in an extremely confused state. The following is an attempt at an analysis of their characters, as far as they can be ascertained, from the literature of the subject: —

* Intestinal canal short, but little convoluted; bones of each mandibulary firmly united (carnivorous species).

a. Anal fin of the male not modified into an intromittent organ.

b. Teeth in a single series, incisor-like, notched; dorsal nearly over ventrals; form stout. . . CYPRINODON.

bb. Teeth all pointed; ventrals present.

c. Teeth in a single series; dorsal in advance of anal.

d. Dorsal and anal fins long (each with more than 20 rays). . . . . GIRARDINICHTHYS.

dd. Dorsal and anal fins short (each with 10 to 14 rays). . . . . LUCANIA.

cc. Teeth in narrow bands.

e. Dorsal fin commencing in advance of anal.

f. Branchiostegals 6. . . . . . . HYDRARGYRA.

ff. Branchiostegals 5. . . . . . . FUNDULUS.

ee. Dorsal fin commencing directly over anal; both fins large; branchiostegals 4; coloration peculiar. XENISMA.

eee. Dorsal fin commencing behind origin of anal; branchiostegals 5.

g. Body small, short and thick, with broad head; (subgenus?). . . . . . . MICRISTIUS.

gg. Body elongate, slender, with narrow head. ZYGONECTES.

aa. Anal fin of the male modified into a peculiar, sword-shaped, intromittent organ; teeth pointed; dorsal fin short, behind anal. . . . . GAMBUSIA.

** Intestinal canal elongated, with numerous convolutions; bones of each mandibulary not united, the dentary being movable; sexes differentiated; limnophagous.

h. Teeth pointed, in bands; dorsal in advance of anal, greatly developed in ♂ (of more than 12 rays). MOLLIENESIA.

hh. Teeth pointed, in a single series; dorsal behind anal, small (less than 12 rays). . . . . GIRARDINUS.

hhh. Teeth unknown; dorsal in advance of anal, small (less than 12 rays). . . . . ADINIA.

15. XENISMA STELLIFERA. Sp. nov.

Xenisma stellifera Jordan and Copeland, Check List (name only).

This species — the type of the group called Xenisma —

may be compared with the other known species, *Xenisma catenata*,* as follows:—

Common characters. Dorsal and anal long, similar, and placed directly opposite each other. Branchiostegals 4. Ventrals with 6 rays; intestinal canal short; teeth pointed, in bands. Males with orange spots, females marked with short olive-brown lines.

a. D. 13; A. 13; lat. l. 53; dorsal and anal greatly elevated in ♂, the longest ray of the dorsal reaching caudal when laid back, its height equal to the depth of the body; orange spots irregularly placed, never forming continuous rows. Length 3 to 4 inches. *Habitat.* Head waters of the Alabama River. . . . . . . STELLIFERA.

aa. D. 13 or 14; A. 15; lat. l. 47; dorsal and anal much less elevated even in ♂, falling far short of caudal when laid back; the orange (or brown) spots, one on each scale, forming regular lines along the sides. Length, 4 to 6 inches. *Habitat.* Head waters of Tennessee River. CATENATA.

My specimens of *X. stellifera* show the following characters:—

Head $3\frac{3}{4}$ to 4 in length, flattened and broadened above in the usual *Fundulus* fashion: eye large, about 4 in head. Body rather long; depth about 5 in length; scales closely imbricated, much deeper than long, as in *Luxilus*, their edges punctate with black, 52 or 53 transverse rows of scales.

Dorsal beginning directly over anal, its last rays in males highly elevated, reaching base of caudal, their height equal to depth of body; anal similar, more elevated in front, and less so behind, the last rays falling just short of caudal. In female specimens, these fins are less elevated, but still very high. Pectorals reaching beyond base of ventrals, the latter reaching anal in ♂, but falling just short in ♀.

D. 13 (rarely 12); A. 13, rarely 12; V. 6; B. 4.

Colors brilliant; general color a bright pale greenish or livid blue, bluish silvery below with a golden lustre forwards. Body, cheeks, etc., in ♂ with large, bright, dark orange spots, irregularly placed, not following the rows of scales, and not always on the middle of the scales. These

---

* The synonymy of this species is as follows:—

Pœcilia catenata Storer, Synopsis, 430.

Hydrargyra catenata Agassiz, Amer. Jour. Sc. and Arts, 1854, 353.

Fundulus catenatus Günther, Cat. Fishes, VI, 322. Cope, Jour. Ac. Sci. Phil., 1869, 238.

Zygonectes catenatus Jordan, Man. Vert., 1876, 252.

Xenisma catenata Jordan and Copeland, Check List.

spots are not uniform in size; some are as large as a pin's head. Females with oblong horizontal line-like spots of olive brown, more numerous and smaller, and forming streaks to some extent. Fins (in ♂) all pale orange, with many spots of brilliant dark orange; caudal faintly barred with orange. Fins in ♀, plain olivaceous.

A large pale yellow blotch on the back in front of the dorsal fin, very distinct in life, so that the fish may be recognized in the water as far as it can be seen, fading in alcohol; a pale blue blotch from eye to mouth and a greenish one below it. Length 3 to 4 inches.

Habitat. Very abundant in many tributaries of the Etowah, Oostanaula, and Coosa rivers, preferring the clear, cold water of the "spring branches." Most specimens from Silver, Lavender, and Rocky creeks. We were unable to hear any vernacular name for it. Its congener, *catenata*, is known as the Stud-fish or Studdy-Pearch. This species is probably the most beautiful in life of all our Cyprinodont fishes.

ESOCIDÆ.

ESOX Linnæus.

16. ESOX RETICULATUS Le Sueur.

Esox lucius Mitchill, "Trans. Lit. and Phil. Soc., I, 410" (not of Linnæus).

Esox reticulatus Le Sueur, "Jour. Phil. Ac. Sc., 1818, 414." Storer, "Rept. Fish Mass., 97;" Synopsis, 1846, 437; Fishes Mass., 1855, 311. Dekay, Fishes N. Y., 1842, 223. Thompson, Hist. Vermont, 1842, 138. Ayres, Bost. Journ. Nat. Hist., IV, 269. ? Kirtland, Bost. Journ. Nat. Hist., IV, 233 (probably *salmoneus*). Cuv. and Val., XVIII, 327. Cope, Proc. Phil. Ac. Sc., 1865, 79; Cyp. Penn. (Trans. Am. Phil. Soc.), 1866, 408. Günther, Cat. Fishes, VI, 229.

Picorellus reticulatus Jordan, Man. Vert. 255.

? *Esox tridecemlineatus* "Mitchill, Mirror, 1825, 361."

? *Esox tridecemradiatus* Dekay, Fishes N. Y., 1842, 225.

b. var. **affinis**.

? *Esox phaleratus* Say, LeSueur., Journ. Phil. Ac. Sc. 1, 416. Dekay, Fishes N. Y., 226. Storer, Synopsis, 437.

Esox affinis Holbrook, Ich. S. C., 1860, 198. Gill, Am. Journ. Sc. Arts, 1864, 94. Cope, Proc. Phil. Ac. Sc., 1870, 457.

Picorellus affinis Jordan, Man. Vert., 1876, 255

This species is very abundant in Dyke's Pond and other mill-ponds tributary to the Etowah River, where it is known as Jack.

I recognize *E. affinis* as a variety even, solely on the authority of Holbrook and Cope. Careful comparison of specimens of "*reticulatus*" from the Delaware and Housatonic rivers, with "*affinis*" from the Etowah and Ocmulgee, fails to show any permanent difference whatever. The alleged greater number of dorsal and anal rays in the northern fish is due simply to Storer's having counted the rudimentary rays or "stubs," while Holbrook counted only the developed ones. It is the difference between "D. 17" and "D. II, 15." There is no obvious difference in dentition. The coloration varies somewhat, but my brightest colored specimens are from the clear tributaries of the Etowah, and the dullest from the muddy Ocmulgee.

CYPRINIDÆ.

CAMPOSTOMA.

Campostoma Agassiz, Amer. Journal Sci. and Arts, 1855, 219. (Type *Rutilus anomalus* Raf.)

17. CAMPOSTOMA ANOMALUM.

var. **anomalum** (Teeth 0, 4–4, 0).

?*Rutilus anomalus* Rafinesque, Ich. Oh., 1820, 52.

Campostoma anomalum Agassiz, Am. Journ. Sci. and Arts, 1855, 218 (part). Putnam, Bull. M. C. Z., 1863, 8. Jordan, Man. Vert., 1876, 275; Bull. Buff. Soc. Nat. Hist., 94.

Exoglossum lesueurianum "Kirtland, Rept. Zool. Ohi., 1838, 169, 193," (not of Raf.).

Exoglossum spinicephalum "Cuv. and Val., XVII, 489, 1844." Storer, Synopsis, 429, 1846.

Exoglossum dubium Kirtland, Bost. Journ. Nat. Hist., V, 272, 1845. Storer, Synopsis, 429, 1846.

Campostoma dubium Cope, Cyprinidæ of Penn., 1866, 395. Günther, Cat. Fishes, VII, 183, 1868. Jordan, Ind. Geol. Survey, 1874, 225.

Chondrostoma pullum Agassiz, Am. Journ. Sci. and Arts, 1854, 357.

? *Campostoma formosulum* Girard, Proc. Phil. Ac. Sci., 1856, 176; U. S. Mex. Bound. Surv., 1858, 41.

? *Campostoma nasutum* Girard, Proc. Phil. Ac. Sci., 1856, 176; U. S. and Mex. Bound. Surv., 41.

? *Campostoma hippops* Cope, Proc. Phil. Ac. Sci., 1864, 284; Journ. Phil. Ac. Sci., 1869, 235.

Campostoma callipteryx Cope, Proc. Phil. Ac. Sci., 1864, 284; Cyp. Penn. 395.

Campostoma mormyrus Cope, Proc. Phil. Ac. Sci., 1864, 284; Cyp. Penn. 395; Journ. Phil. Ac. Sci., 1869, 235.

Campostoma gobioninum Cope, Proc. Phil. Ac. Sci., 1864, 284; Cyp. Penn., 395; Journal Phil. Ac. Sci., 1869, 235.

b. var. **prolixum** (Teeth 1, 4–4, 0).

Leuciscus prolixus Storer, Proc. Phil. Ac. Sci., July, 1845; Synopsis, 1846, 417 (Fide Agassiz).

Chondrostoma prolixum Agassiz, Amer. Journ. Sci., and Arts, 1854, 357.

Campostoma anomalum Agassiz, Amer. Journ. Sci. and Arts, 1855, 218, (part). Cope, Journ. Phil. Ac. Sci., 1869, 235.

This species is quite abundant in the more sluggish streams tributary to the Etowah and Oostanaula. My specimens from the south are uniformly more slim than those from Indiana. They have also longer and narrower heads, and larger scales. Their coloration, too, is more uniform. All the Georgia specimens examined have the teeth 1, 4–4, 0, as stated by Agassiz and Cope, in Tennessee River specimens. Those from the north have the teeth uniformly 0, 4–4, 0.

The southern form may then be taken as a variety, to which Storer's name, *prolixum*, may be applied. Storer's short and irrelevant description might refer to several other species as well as to the present one, but Prof. Agassiz locates it here.

The tendencies of the two varieties are shown by the following table of the average of the measurements of several specimens of each.

Head in length, . .	*anomalum*	$4\frac{1}{5}$.	*prolixum*	$4\frac{3}{5}$.
Depth in length, . .	*anomalum*	$4\frac{2}{5}$.	*prolixum*	$4\frac{1}{2}$.
Eye in head, . .	*anomalum*	$4\frac{1}{2}$.	*prolixum*	4.
Eye in interorbital space,	*anomalum*	2.	*prolixum*	$1\frac{1}{2}$.
Lateral line, . .	*anomalum*	55.	*prolixum*	49.
Teeth, . . .	*anomalum*	4–4.	*prolixum*	1, 4–4, 0.

SEMOTILUS.

=**Semotilus** Rafinesque, Ich. Ohi., 1820, 49. (Type *S. dorsalis* Raf. = *Cyprinus corporalis* Mit.).

>**Leucosomus** Heckel, Russeger's Reise, 1843, 1042. (Type *L. chrysoleucus* Heckel, = *Leuciscus argenteus* Storer,—not *Cyp. chrysoleucus* Mit.)

>**Cheilonemus** Baird, Storer, Fishes Mass., 1855, 288. (Type *Leuciscus pulchellus* Storer, = *L. argenteus* Storer).

18. SEMOTILUS CORPORALIS.

Cyprinus corporalis Mitchill, Am. Monthly Mag. II, 1817, 289, and 1818, 324.

Leuciscus corporalis Dekay, Fishes N. Y., 1842, 213.

Semotilus corporalis Putnam, Bull. M. C. Z., 1863, 8. Ib. in Storer's Fishes Mass., 256. Cope, Cyp. Penn., 362, 1866; Proc. Phil. Ac. Sci., 1865, 85; Hayden's Geol. Surv. Terr., 1870, 442, and 1871, 472. Abbott, Am. Nat., April, 1870, 12. Jordan, Ind. Geol. Surv., 1874, 223; Bull. Buff. Soc. Nat. Hist., 1876, 94; Man. Vert., 1876, 278. Goode, Bull. U. S. Mus., VI, 1876, 64; and of various late U. S. writers.

Leucosomus corporalis Günther, Cat. Fishes, VII, 269.

Cyprinus atromaculatus Mitchill, Am. Monthly Mag., II, 324, 1817.

Leuciscus atromaculatus Dekay, Fishes N. Y., 1842, 210. Storer, Synopsis, 1846, 409.

Semotilus atromaculatus Girard, Proc. Phil. Ac. Sc., 1856, 204; Pac. R. R. Rept., 1858, 283. Abbot, Am. Nat., April, 1870, 13.

Leucosomus atromaculatus Cope, Proc. Phil. Ac., 1861, 523.

Semotilus dorsalis Raf., Ich. Ohi., 1820, 49. Kirtland, Zool. Ohio, 1838, 169; Bost. Journ. Nat. Hist., III, 1840, 345. Girard, Pac. R. R. Surv., 283.

Leuciscus dorsalis Storer, Synopsis, 411.

Semotilus cephalus Rafinesque, Ichthyologia Ohiensis, 1820, 49. Kirtland, Zool. Ohio, 169; Bost. Journ. Nat. Hist., III, 345, 1840. Girard, Pac. R. R. Survey, 283, 1858.

Leuciscus cephalus Dekay, Fishes of N. Y., 214, 1842. Storer, Synopsis, 409.

Leuciscus iris "Cuv. and Val., XVII, 255, 1844."

? *Leuciscus rotengulus* "Cuv. and Val., XVII, 318." Storer, Synopsis, 416.

Leuciscus storeri Cuv. and Val., "XVII, 319."

Leuciscus pulchelloides Ayres, Proc. Bost. Soc. Nat. Hist., III, 157.

Leucosomus incrassatus Girard, Proc. Phil. Ac. Sc., 1856, 190; Pac. R. R. Surv., 1858, 252.

Semotilus macrocephalus Girard, Proc. Phil. Ac., 1856, 204.

Leucosomus macrocephalus Girard, Pac. R. R. Surv., 252.

Semotilus speciosus Girard, Proc. Phil. Ac. Sc., 1856, 204; Pac. R. R. Surv., 1858, 283.

Semotilus hammondi Abbott, Proc. Phil. Ac. Sc., 1860, 474.

b. var.? **pallidus.**

Leucosomus pallidus Girard, Proc. Phil. Ac. Sc., 1856, 190; Pac. R. R. Surv., 251.

Semotilus pallidus Cope, Cyp. Penn., 363.

Semotilus corporalis var. *pallidus* Jordan, Man. Vert., 1876, 279.

This familiar species is abundant in the basin of the Etowah and Oostanaula. As elsewhere, it prefers clear waters, and it is most abundant in small brooks. It is known as Creek Chub or Roach.

NOCOMIS.

>**Nocomis** Girard, Proc. Phil. Ac. Sci., 1856, 190. (Type *N. nebrascensis* Grd.)

>**Ceratichthys** "Baird, 1853." Girard, Proc. Phil. Ac. Sc., 1856, 212. (Type *Semotilus biguttatus* Kirtland.)

>**Hybopsis** Girard, l. c. 211 (not of Agassiz, 1854).

>**Erinemus** Jordan, Man. Vert., 279, 1876 (subgenus). (Type *C. hyalinus* Cope.)

19. NOCOMIS AMBLOPS.

a. var. **amblops.**

Rutilus amblops Rafinesque, Ich. Oh., 1820, 51.

? *Ceratichthys amblops* Girard, Proc. Phil. Ac. Sc., 1856, 213. Cope, MSS., 1870.

b. var. **winchelli.**

? *Gobio vernalis* Girard, Proc. Phil. Ac. Sci., 1856, 188; Pac. R. R. Surv., 1858, 249.

Hybopsis winchelli Girard, Proc. Phil. Ac. Sc., 1856, 211; Pac. R. R. Surv., 1858, 255.

Ceratichthys hyalinus Cope, Jour. Ac. Sc. Phil., 1869, 236. Günther, Cat. Fishes, VII, 179. Jordan, Ind. Geol. Surv., 1874, 223; Man. Vert., 279.

c. var. **rubrifrons.**

Nocomis amblops var. *rubrifrons* Jordan, MSS. (Ocmulgee R.)

I adopt Rafinesque's name *amblops*, for this abundant and widely diffused species, for the following reasons:

1. The reference of Girard's *Hybopsis winchelli* to this species renders necessary the substitution of an older appellation for the well-chosen name *hyalinus.*

2. Rafinesque's short description of his *Rutilus amblops* from the falls of the Ohio (where this species abounds) may apply to the *hyalinus* (but might apply to two or three other fishes, but not as well).

3. Girard identifies *Rutilus amblops* as a species of Ceratichthys, and catalogues it as such. He gives no description; but as Rafinesque's account would apply to neither of the two other species in that region (*N. biguttatus*, *N. dissimilis*), Girard probably intended the name *C. amblops* for the species since called *C. hyalinus* by Prof. Cope; and we should accept Girard's identification as correct, until it is proved to be positively erroneous.

4. Where the adoption of a specific or generic name is to any extent a matter of choice, in the opinion of the present writer, preference should always be given to a descriptive name over a personal one.

Comparison of specimens from the Ohio, French Broad, Clinch, Etowah, Ocmulgee, and other rivers, shows several differences, but none which are in my opinion sufficiently constant or decided to be deemed of specific value.

Three varieties may probably be recognized, as follows :—

Head broadest; eye largest, 3 in head, its length greater than the width of the broad interorbital space; snout blunt, probably never tuberculate, mouth largest, the lower jaw being rather short; barbels long; color variable, usually hyaline, with a black lateral shade; size probably largest; depth 5 in length; teeth 1, 4–4, 1. *Habitat.* Ohio Valley. . . . . AMBLOPS.

Head narrower: eye large, 3 in head, much wider than the rather narrower interorbital space; snout bluntish, less so than in the preceding; not noticed as tuberculate; barbels shortest, decidedly shorter than in the preceding; colors rather dark, the dark lateral stripe passing around the nose; depth 5 in length; teeth 1, 4–4, 1. *Habitat.* Etowah River, Black Warrior River (water basin of Alabama River), Tennessee River. . WINCHELLI.

Head narrowest; eye moderate, $3\frac{1}{2}$ in head, less than the interorbital space, which is narrow and long, the snout projecting considerably; mouth smallest, lower jaw rather more lengthened; barbels quite long; face rosy in summer males, and the snout provided with small tubercles; body stoutest, depth $4\frac{1}{2}$ in length; color quite pale, with a leaden band along the sides, teeth 1, 4–4, 0. *Habitat.* Ocmulgee River. . . . . RUBRIFRONS.*

The variety *winchelli* is abundant in all tributaries of the Etowah, Coosa, and Oostanaula, where it shares with other small minnows the name of Roach. Girard's original specimens were from the Black Warrior. His description applies perfectly to my specimens. The reference of the species to *Hybopsis* arose from a misunderstanding of the characters of that genus. Prof. Cope identifies my specimens of *N. winchelli* with his *C. hyalinus*, and considers the northern form (*N. amblops*) as specifically distinct.† *C. hypsinotus* Cope, and *C. labrosus* Cope, are undoubtedly good species. The latter, from the backward position of the dorsal, is probably to be referred to *Apocope*.

---

* *Nocomis rubrifrons* sp. nov.

Head rather long and comparatively narrow and pointed, the snout unusually projecting. Head 4 in length; eye moderate, $3\frac{1}{3}$ to $3\frac{1}{2}$ in head, less than the interorbital space. Depth $4\frac{1}{2}$ in length. Barbels quite long and distinct. Scales large, dotted above, 36 in the course of the lateral line, 13 in front of the dorsal. Fins moderate, the first rays of the dorsal *generally* twice the height of the last.

D., I, 8. A., I, 7.

General color pale olivaceous; sides with a plumbeous band, sometimes dark and passing through the eyes, more usually pale. Snout in many specimens of a pale pink or reddish color, thickly covered with very minute, dust-like tubercles; teeth in 6 specimens (all examined) 1, 4–4, 0.

Length, 3 inches.

Habitat. South fork of Ocmulgee River, at Flat Rock, Dekalb Co., Ga.

† Since the above was in type, renewed examination has convinced me that Prof. Cope's view is the correct one, and that *amblops, winchelli,* and *rubrifrons* are to be considered as distinct species.

RHINICHTHYS.

Argyreus HECKEL, Russeger's Reisen, 1843, 1, 1040 (or "Fische Syriens, 1843, 50"). (Type *Cyprinus atronasus* Mit.; name preoccupied.)

Rhinichthys AGASSIZ, Lake Superior, 1850, 353. (Type *Cyprinus atronasus* Mit.)

20. RHINICHTHYS OBTUSUS.

Rhinichthys obtusus Agassiz, Amer. Jour. Sc. and Arts, 1854, 357. Jordan, Man. Vert., 1876, 280.

Argyreus obtusus Girard, Proc. Phil. Ac. Sc., 1856, 185.

Rhinichthys obtusus Günther, Cat. Fishes, VII, 1868, 190.

Rhinichthys lunatus Cope, Proc. Phil. Ac. Sc., 1864, 278; Journ. Phil. Ac. Sc., 1869, 228. Jordan, Ind. Geol. Survey, 1874, 223; Man. Vert., 281.

Argyreus lunatus Cope, Proc. Am. Phil. Soc., 1870.

Georgia specimens of this species are shorter, and darker than typical *lunatus*, and they have the lateral band quite faint. All have a dusky blotch in the middle of the base of the dorsal; and some specimens (males) in all cases have traces of a rosy lateral band. These also have the pectoral somewhat enlarged.

The following table shows the measurements of a number of specimens of *Rhinichthys* from different regions:

	Housatonic R.	(atronasus.)	Genesee R. (atronasus.)	L. Michigan. (lunatus.)	White R., Ind.	(lunatus.)	Rock R., Wis.	(lunatus.)	Etowah R.	(obtusus.)
Head in length..	4.1	4.2	4	3.8	4	4.3	3.7	4	4	4
Depth in length..	5	4.8	4	4.5	4.8	5	4.3	4.6	4.2	4.2
Eye in head......	4	4.1	4	4	4	3.3	4.1	4.2	4.1	4.3
Lat. l............	65	64	..	..	60	62	65	66	62	6.2
Dorsal...........	1.7	1.7	..	..	1.7	1.7	1.8	1.7	1.7	1.7
Anal.............	1.7	1.7	..	..	1.7	1.7	1.7	1.7	1.7	1.7
Teeth............	2.4-4.2	2.4-4.2	..	..	1.4-4.1	2.4-4.2	2.4-4.2	2.4-4.2	2.4-4.2	2.4-4.2

Specimens identical with *R. obtusus* Ag. are abundant in the small clear brooks which flow from the springs in the hill country, known locally as Spring Branches. Most of my specimens were taken in Mobley's "Spring Branch," which flows into Silver Creek, near Rome, Ga. The species is known locally as Rock Fish.

PHENACOBIUS.

Phenacobius Cope. Proc. Phil. Ac. Sc., 1867, 96.
Sarcidium Cope. Hayden's Geol. Survey, 1870, p. 440.

21. PHENACOBIUS CATOSTOMUS sp. nov.

Form rather slender, scarcely compressed and nearly terete, much as in *Catostomus teres*, which species it resembles in color.

Back nearly straight, hardly elevated at all; caudal peduncle rather stout. Depth 6 in length of body, without caudal.

Head large, 4½ in length of body, bluntly rounded, convex above, the vertex nearly plane; cheeks much swollen; snout blunt and heavy; mouth small, inferior, its structure as described by Cope under *P. uranops;* a small groove between premaxillary and nasal bones. Preorbital bone oblong.

Eyes large and prominent, 1⅓ in length of muzzle, 3½ in head, wider than the interorbital space; eyes high up, the orbits rising above the level of the top of the head.

Scales quite small, longer than deep, thin and rather loosely imbricated, about equal over the body; about 60 (58 to 62) in the lateral line, which is nearly straight.

Fins rather small. Dorsal very slightly in advance of ventrals, slightly nearer snout than base of caudal. Pectorals not reaching ventrals. Ventrals reaching vent, which is an unusual distance in advance of anal.

Pharyngeal bones rather small, the teeth slender, pretty strongly hooked, 4–4. Peritoneum white, intestinal canal shorter than body; air bladder quite small.

Color pale olivaceous, white below, a silvery lateral streak underlaid by blackish, which appears as a vague dusky blotch at base of caudal; head nearly black above; cheeks bright silvery; dorsal scales dusted with fine black points; fins unicolor; a yellowish vertebral line.

D., I, 8. A., I, 7. Lat. l. 60.

Habitat. This species is abundant in Silver Creek, Floyd Co., Ga., just above its junction with the Etowah. It reaches a length of four inches. I at first considered it *P. uranops*

Cope, but an examination of Cope's types, has convinced me that it is distinct. *P. uranops* has a longer and narrower head and more upward range to the eyes; and the dorsal is considerably nearer snout than caudal.

In *P. catostomus*, the dorsal is nearly midway, the cheeks more swollen, and the mouth less inferior. The scales appear smaller.

The species now known of this genus are the following; *teretulus* Cope, *mirabilis* Grd., *liosternus* Nelson, *scopiferus* Cope, *catostomus* Jordan, and *uranops* Cope. The genus *Sarcidium* is not distinguishable, and it has been abandoned by its author.

HYBOPSIS.

=**Hybopsis** AGASSIZ, Amer. Journ. Sci. Arts, 1854, 358. (Type *H. gracilis* Agassiz).

>**Alburnops** GIRARD, Proc. Phil. Ac. Sci., 1856, 194. (Type *A. blennius* Grd.)

>**Hudsonius** GIRARD, Proc. Phil. Ac. Sci., 1856, 210. (Type *Clupea hudsonia* Clinton).

22. HYBOPSIS GRACILIS.

Hybopsis gracilis Agassiz, Amer. Journ. Sci. Arts, 1854, 358. Girard, Proc. Phil. Ac. Sci, 1856, 211. Cope, Cyp. Penn., 1866, 381.

A few specimens of this species were found mixed with those of *Nocomis winchelli* from the Etowah River. The differences between the two were not noticed while in the field. *H. gracilis* is, however, a genuine Hybopsis, and is distinct from any species known to the author. My specimens do not enable me to add anything of importance to Prof. Agassiz's description.

23. HYBOPSIS CHROSOMUS. Sp. nov.

? ? Chrosomus erythrogaster Agassiz, Amer. Journ. Sci. Arts, 1854, 359 (not of Raf. ?)

A small Hybopsis abounds in tributaries of the Etowah and Oostanaula about Rome, Ga.

Its coloration is brilliant, and reminds one of *Chrosomus erythrogaster*, and it is possibly the species referred to by Prof. Agassiz (above cited) as having a continuous lateral line. This species is apparently related to *Hybopsis rubricroceus*, *chiliticus*, and *chlorocephalus* Cope, but I cannot identify it with any of them, nor with any of the species of *Alburnops* Girard, to which group or subgenus the present species belongs.

My specimens show the following characters.

Form chubby, little compressed, much as in Chrosomus, the back somewhat elevated; depth 4¾ to 5½ in length; caudal peduncle not much contracted, but more so than in *xænocephalus*. Head rather large, 4⅕ to 4½ in length, rather rounded above, with the snout somewhat pointed: mouth large, oblique, upper jaw a trifle longest. Eye as long as snout, 3 to 3½ in head.

Scales everywhere large, slightly dark-edged, but not enough so to give a dusky color. Lateral line scarcely decurved, continuous, with 36 to 38 scales; dorsal scales large, as usual in this genus, 16 before the dorsal fin.

D., I, 8. A., I, 8. Dorsal fin very slightly behind ventrals; pectorals not reaching ventrals; the latter reaching vent.

Snout minutely tuberculate in males, as in *Hybopsis xænocephalus* and *Nototropis rubrifrons*; teeth in all examined 2, 4–4, 2.

Coloration (in spirits) pale yellowish, with a plumbeous lateral band and a pinkish stripe above it; snout dusky.

In life,— back of a clear hyaline green as in *Labidesthes*, but with brilliant blue reflections; belly, etc., clear silvery, with blue lustre, not yellow. A scarlet bar across dorsal, anal, and base of caudal; a scarlet band from upper edge of opercle to caudal, very bright when the fish is just dead, shining silvery red in life. Iris with a red touch above. Sides with a very distinct silvery band, below the red line. A row of black dots along lateral line, forming a small distinct spot at base of caudal. Top of head and vertebral line golden; tubercles whitish.

Habitat. In Etowah, Oostanaula, and Coosa Rivers, and their tributaries, quite abundant in shallow still places and fords in the creeks, where it is often the commonest of the little Minnows. Length 2½ inches.

24. HYBOPSIS XÆNOCEPHALUS. Sp. nov.

This small species is an ally of the last, but it is entirely different in color, coarser in appearance, and has a larger head, mouth, and eye.

Body rather short and deep, with a thick caudal peduncle; depth $4\frac{3}{4}$ to 5 in length; back wide, not elevated. Head large, $4\frac{1}{3}$ in length, flattish and broad above, the snout rounded but rather long, mouth large, oblique, jaws about equal; eye very large, $2\frac{1}{2}$ to 3 in head. Scales large, dark-edged above. Lateral line somewhat decurved, with 38 scales, marked by a series of black points; 13 large scales in front of dorsal. Dorsal fin just behind the middle of the body, very slightly behind ventrals; pectorals not reaching nearly to ventrals. D., I, 9; A., I, 8; teeth, 2, 4–4, 2; snout in males somewhat swollen, and covered with minute tubercles.

Coloration in life, olivaceous above and quite dark, owing to the broad dark edges of the scales. A jet-black caudal spot, and a band along caudal peduncle, which vanishes into black points along the sides, and reappears on the opercles, passing around the snout.

Two varieties or forms may be appreciated, the one larger, stouter, and with a larger mouth and much larger eye. They seem, however, to shade into each other. They occur together in about equal abundance.

The following table of measurements shows the tendency of each: —

	VAR. *a* (wide mouth).					VAR. *b* (narrow mouth).							
Head in length	4.2	4.1	4.1	4.2	4.2	4.5	4.4	4.5	4.5	4.6	4.2	4.3	4.1
Depth in length	5.1	4.7	5.2	4.8	5	5	4.8	5.1	5.3	4.8	5.1	5.5	5
Eye in head	2.5	2.5	2.6	2.6	2.5	3	3	3.2	3	2.8	2.8	2.8	3.1
Lat. l.	38	38	38	37	38	36	36	38	38	38	38	37	36
Scales before D.	..	12	..	..	13	..	..	15	..	12	..	..	13

Habitat. With the preceding, and nearly as abundant. Length $2\frac{3}{4}$ inches.

PHOTOGENIS.

<**Photogenis** Cope, Trans. Am. Philos. Soc., 1866. (Type *P. spilopterus*).

=**Plargyrus** Jordan, Man. Vert., 1876, 287 (not of Raf., =*Leuciscus* Klein).

Minnilus, Section **Photogenis** Cope and Jordan, Proc. Phil. Ac. Nat. Sci., 1877.

I retain the name *Photogenis* provisionally for a large group of related fishes which form a most characteristic feature of the "Minnow-fauna" of the southern states. *Cyprinella* is very closely related to *Notoiropis*, the form of the scales being the only tangible generic difference, and that probably is of little importance.

The species, however, have a number of superficial characters in common. The mouth is sub-inferior in all, and the snout and ante-dorsal region is covered with small white tubercles in spring. The dorsal has a large black spot on the membrane between the last rays. This is always present in adults, and is most distinct in males. In all species known to me, the tip of the dorsal, anal, and caudal fins is filled with a shining satin-white pigment in spring and summer, a characteristic and most exquisite feature of coloration. The species are most readily known in life by their color-markings, which are more varied than in any other genus of Cyprinidæ, although not so gaudy as in several others. It is necessary to take account of these coloration features in the discrimination of species, although immature and alcoholic specimens show them imperfectly.

The case is similar to that of the genus *Dendrœca* among birds. It would puzzle any ornithologist to identify our warblers with the feathers plucked off—*i. e.*, with the coloration lost.

The species now referred to *Photogenis*, agree in the following characters:—

Body more or less compressed, covered with rather large scales, which are closely and smoothly imbricated, the exposed surfaces being higher than long. Head moderate or rather small, with a rather small eye. Mouth not large, usually little oblique, and typically slightly overlapped by the upper jaw. No barbels. Ventral fins somewhat in advance of dorsal. Anal fin short (except in *grandipinnis*, *pyrrhomelas*, and *xœnurus*.) Pharyngeal teeth hooked, without masticatory surface, their edges sharp and always entire. Teeth 1, 4–4, 1 (rarely one-rowed). Snout tuberculate, and fins with white pigment, in spring males. *Photogenis* is distinguished from *Lythrurus* by the sharp edged teeth, which have no grinding surfaces; from *Cliola* by the backward dorsal; from *Cyprinella* by the unserrated teeth. It however is probably rather a section of *Nototropis*, than a distinct genus.

25. PHOTOGENIS STIGMATURUS. Sp. nov.

Body elongated, fusiform, compressed, more slender and graceful than *callistius*; depth 4¾ in length (4⅓ to 5). Head quite long, truncate at the snout, 4⅓ in length, (without caudal) (4⅕ to 4½), rounded above, and in males thickly tuberculate. Mouth large for the genus, somewhat oblique, overlapped by the narrow upper jaw. Eye not large, about 4½ (4⅓ to 5) in head; iris white; maxillary reaching beyond nostrils. Scales large, deep, closely imbricated, 45 in the course of the lateral line, 19 or 20 in front of the dorsal.

Fins moderate; dorsal behind ventrals, slightly nearer the caudal than the snout, its height about 6½ times in length of body; pectorals not nearly reaching ventrals, the latter to vent.

Color pale clear olive, with a rich, faint blue lustre, much paler than in either of the other species here described. Sides and fins in males with the usual satiny pigment; cheeks somewhat pinkish, but no red pigment. Black dorsal spot not very distinct, but visible in all adults. A very distinct, large, oblong or quadrate, jet black spot at the base of the caudal, extending up on the rays. This spot is very conspicuous in all specimens—even the smallest. Its length is usually about one-third that of the head. In no other species known to me is this spot so large or distinct.

Teeth 1, 4–4, 1; dorsal rays I, 8; A., I, 8; length 4 inches.

Habitat. Small tributaries of the Etowah, Coosa, and Oostanaula, where it is the most abundant minnow. It is everywhere known as Spotted Tail Minnow, or Spot Tail.

This is the least gaudy, though perhaps the most graceful, of all our species of this genus. It reaches a larger size than any of the others.

26. PHOTOGENIS CALLISTIUS. Sp. nov.

Body rather stout and compressed, much as in *pyrrhomelas*, much heavier forward, and more *cornutus*-like, than in *stigmaturus* or *cœruleus*. Dorsal outline considerably elevated. Depth 4⅗ (4⅓ to 5) in length. Head stout and rather blunt, 4⅕ in length. Upper part of head flattish, in males sparsely covered with smallish tubercles, which are always arranged in a few more or less distinct longitudinal rows, not scattered without order, as in other species.

Mouth rather large, slightly overlapped by the heavy snout, nearly horizontal, the maxillary reaching to the nostrils. Eye rather large for the genus, 3⅗ in head (3⅓ to 4).

Scales large, deep, less closely imbricated than in *cæruleus* or *analostanus;* 39 in the lateral line (38 to 41), 15 or 16 in front of dorsal. Fins rather large, the height of dorsal about $5\frac{1}{2}$ in length of body. Dorsal fin slightly behind ventrals, midway between snout and caudal. Ventrals reaching vent; pectorals not to ventrals. D., I, 8. A., I, 8 (sometimes I, 9).

Coloration dark and brilliant. Back very dark steel blue; sides a very clear silvery violet, with blue shades; belly and lower fins satin white. A heavy black spot on upper posterior part of dorsal, extending downward and forming a horizontal bar at the base which rises into a sort of spot in front, as in *Lythrurus diplæmius;* the rest of the fin bright vermilion red, excepting the silvery tip. Caudal satin white at tip; the rest of the fin bright red, except the yellowish base.

A red lateral streak in place of the usual golden one: a broad golden vertebral band.

A large distinct round black spot at base of caudal, not so bright as in *stigmaturus,* the pigment seeming to lie *under* the scales (i. e., scales less transparent than in *stigmaturus*).

Females paler in color, with less black and no red.

Teeth 1,4–4,1, as in *stigmaturus.* Length 4 inches.

Habitat. Tributaries of the Etowah and Oostanaula, in clear water. Most of my specimens were taken in Silver Creek.

27. PHOTOGENIS CÆRULEUS. Sp. nov.

Body fusiform, somewhat elongated, moderately compressed; depth $4\frac{3}{5}$ in length ($4\frac{1}{3}$ to 5). Head moderately large, $4\frac{1}{3}$ in length ($4\frac{1}{5}$ to $4\frac{1}{2}$), the snout rather pointed, overlapping the small, oblique mouth. Upper surface of head and neck thickly covered with small tubercles, in the males. Eye moderate, $3\frac{1}{2}$ in head; the iris white. Maxillaries reaching nostrils.

Scales firm, high and narrow, edged with dusky, 38 in the course of the decurved lateral line (37 to 39); 13 to 17 in front of dorsal.

Fins all high, the height of the dorsal nearly $\frac{1}{5}$ of the length of the fish. Dorsal fin behind ventrals, its beginning equidistant between base of caudal and front of eye. Pectorals not reaching ventrals; the latter to vent.

This is one of our most elegant species. Its general color is a bright steel blue; the sides more silvery, pinkish-shaded anteriorly; the belly silvery white. Along the sides is a very distinct brilliant blue-green band, most conspicuous towards the caudal fin. This color is not a matter of lustre, but depends on the presence of blue pigment lying under the scales. In spirits it becomes of a dark steel blue color.

Fins all clear bright yellow, as in a highly colored *Chrosomus.* A vague diffuse dusky blotch on last rays of dorsal, as usual, and some black edgings on the anterior rays of most of the fins. Tips of dorsal, anal, and caudal, as usual, filled with satin-white pigment. No red. Young with the black, white, blue, and yellow obscure.

D., I, 8. A., I, 8. Length 3 inches. Teeth 1,4–4,1, of the usual type, hooked and sharp-edged.

Habitat. This exquisite little fish occurs in abundance in the clear tributaries of the Oostanaula River, above Rome, Ga. Most of our specimens were taken in Rocky Creek,—one of the clearest of the mountain streams of that region. It also goes in shoals in the river channel.

I give below an attempt at a synopsis of the species of this genus described from the region east of the Mississippi. Of these, *eurystomus* was found in the Chattahoochee River, and *xænurus* in the Ocmulgee. These will be described further on. *Grandipinnis* Jordan MSS., will be elsewhere characterized. *Spilopterus* Cope, is from the Ohio Valley and north-west; *pyrrhomelas*, from North Carolina. *Cercostigma* Cope, *calliura* Jordan MSS., and *analostana* Grd., are true *Cyprinellæ*, having serrate teeth.

Galacturus Cope, has the physiognomy of *Photogenis*, but differs in having the grinding surface on the teeth. It is probably referable to *Luxilus*.

* Anal fin elongate, I, 10 or I, 11; no distinct caudal spot; body and head stout; fins red in ♂.

† Scales on flanks tuberculate as well as those on head and neck, Ocmulgee River, ... XÆNURUS.

†† Scales on flanks not tuberculate; dorsal less posterior, body deeper; red pigment more nearly flame-color, Catawba River, ... PYRRHOMELAS.

††† Tubercles unknown; dorsal and anal immensely elevated, their tips nearly reaching caudal: E. Georgia, GRANDIPINNIS.

** Anal fin short, I, 8 or I, 9.

a. No conspicuous black caudal spot.

b. Colors chiefly blue and silvery; sides with a distinct band of clear blue; fins yellow; scales firm and smooth; body slender; mouth small; no red; eye $3\frac{1}{2}$ in head; size small. Alabama River, . CŒRULEUS.

bb. Colors olivaceous, no blue lateral band; fins not yellow.

c. Head, mouth, and eye rather small, the latter 4½ to 5½ in head; no red; black fin-markings distinct; scales firm.

d. Mouth oblique; body considerably compressed; depth more than one-fourth of length. Ohio River, Potomac River, Great Lakes, teeth serrate (*Cyprinella*), . . . ANALOSTANUS.

dd. Mouth wider, nearly horizontal; body elongate; less compressed; depth less than one-fourth of length. Ohio Valley and north-west, SPILOPTERUS.

cc. Head, mouth, and eye large, the eye about 4 in head; fins sometimes with red; black markings obscure; an obscure black caudal spot; scales rather loose; size large; appearance of Luxilus. Chattahoochee River, . . . EURYSTOMUS.

aa. A conspicuous black spot, much larger than eye, at base of the caudal fin; size large.

e. Fins in ♂, with much red; form stout; eye and mouth large; coloration dark; nuptial tubercles sparse, arranged in rows; caudal spot smaller than in the next, nearly round; lateral line about 39. Alabama River, ... CALLISTIUS.

ee. Fins without red; form elongate; eye and mouth moderate; coloration pale; nuptial tubercles crowded; caudal spot more distinct than in any other American Cyprinoid, ovate; lat. l. about 35. Alabama River, ... STIGMATURUS.

LUXILUS.

=**Luxilus** Rafinesque. Ich. Oh., 1820, 48. (Type *L. chrysocephalus* Raf. = *Cyp. cornutus* Mitch.)

=**Hypsolepis** Baird. Agassiz, Am. Jour. Sc. Arts, 1854, 359. (Type *Cyprinus cornutus* Mitch.)

=**Plargyrus** Girard. Proc. Phil. Ac. Sc., 1856, 195 (not of Raf.). (Type *Leuciscus plagyrus* Kirt. = *Cyp. cornutus* Mit.)

<**Hypsilepis** Cope. Cyp. Penn., 1866, and of authors.

28. LUXILUS CORNUTUS.

Cyprinus cornutus Mitchill, Am. Monthly Mag., 1817, 289, and 1818, 324.

Leuciscus cornutus Storer, Bost. Jour. Nat. Hist., IV, 182, 1842. Dekay, Fishes N. Y., 1842, 207. Storer, Synopsis, 409, 1846. Günther, Cat. Fishes, VII, 249, 1868.

Hypsolepis cornutus Storer, Fishes Mass., 1855, 284. Cope, Proc. Phil. Ac. Sci., 1864, 279. Putnam, Bulletin M. C. Z., 1863, 7.

Plargyrus cornutus Girard, Proc. Phil. Ac. Sci., 1856, 196.

Hypsilepis cornutus Cope, Cyp. Penn., 1866, 372; Proc. Phil. Ac. Sci., 1867, 158; Journal Phil. Ac. Sci., 1868, 229. Jordan, Ind. Geol. Surv., 1874, 223. Uhler and Lugger, Fishes of Md., 1876, 148, and of late American writers.

Hypsilepis cornutus vars. *gibbus, frontalis, cerasinus, cornutus, cyaneus* Cope, Proc. Phil. Ac. Sci., 1867, 157.

Luxilus cornutus Jordan, Bull. Buff. Nat. Hist. Soc., 1876, 94; Manual Vert., 1876, 286. Nelson, Bull. Ills. Mus. Nat. Hist., 1877.

Cyprinus megalops Raf., Am. Monthly Mag., 1818, 121.

Cyprinus melanurus Raf., *l. c.*, 1818, 121.

Luxilus chrysocephalus Rafin, Ich. Oh., 48, 1820.

Semotilus diplemia Kirtland, Rept. Zool. Ohio. 169, 1838 (not of Raf.).

Leuciscus diplemia Kirtland, Bost. Journ. Nat. Hist., V, 276, 1846. Storer, Synopsis, 411.

Argyreus rubripinnis Heckel, Russeger's Reisen, 1843, 1040.

Leuciscus gibbosus Storer, "Proc. Bost. Soc. Nat. Hist., July, 1845;" Synopsis, 418, 1846.

Hypsolepis gibbosus Agassiz, Amer. Journ. Sc. Arts, 1854, 359.

Plargyrus gibbosus Girard, Proc. Phil. Ac. Sc., 1856, 196.

Leuciscus plagyrus Kirtland, Bost. Journ. Nat. Hist., V, 26, 1845.

Leuciscus plargyrus Storer, Synopsis, 410, 1846.

Leuciscus frontalis Agassiz, Lake Superior, 1850, 368.

Hypsilepis frontalis Agassiz, Am. Journ. Sc. Arts, 1854, 359. Putnam, Bull. M. C. Z., 1863, 7.

Plargyrus frontalis Girard, l. c.

Leuciscus gracilis Agassiz, Lake Superior, 1850, 370.

Plargyrus gracilis Girard, l. c.

Hypsilepis gracilis Cope, Proc. Phil. Ac. Sc., 1867, 157.

Plargyrus typicus Girard, l. c., 195.

Plargyrus argentatus Girard, l. c., 196.

Plargyrus bowmani Girard, l. c., 196, and Pac. R. R. Surv., X, 263, 1858.

Hypsilepis obesus Cope, Proc. Phil. Ac. Sc., 1867, 157 (not *L. obesus* Storer, fide Agassiz).

This familiar species is excessively abundant in the basin of the Etowah. My specimens do not differ obviously from var. *cornutus* (of Cope) from the Ohio River. This fish is popularly known as Rotten-gut or Rot-gut Minnow, because its flesh spoils so soon after death. I did not find it either in the Chattahoochee or Ocmulgee, but in every other stream, east of the Mississippi, where I have fished, it occurs in abundance.

NOTOTROPIS.

=**Notropis** Rafinesque, Am. Monthly Mag., 1818, 204. (Type *N. atherinoides* Raf. = *Alburnellus* sp.)

=**Minnilus** Rafinesque, Ich. Oh., 45, 1820.

=**Alburnellus** Girard, Proc. Phil. Ac. Sc., 1856, 193. (Type *A. dilectus* Girard.)

=**Minnilus** Jordan, Man. Vert., 1876. (Type *M. dinemus* Raf. = *Alburnellus jaculus* Cope.)

29. NOTOTROPIS LIRUS. Sp. nov.

Body slim, somewhat compressed, of the general form of *Lythrurus ardens*, or some small-headed Minnilus; depth 4⅗ to 5 in length. Head rather small, short, moderately deep, flattish above, 4½ in length. Mouth rather large, very oblique, the lower jaw slightly projecting. Eye very large, white, longer than snout, 3 in head, about reached by the maxillary. Head and dorsal region profusely covered with white tubercles in the males. Scales very small, scarcely higher than long, loosely imbricated, obscure and difficult to count, about 45 (42 to 48) in the course of the lateral line, about 25 in front of the dorsal. Dorsal fin far back, decidedly behind ventrals, its height 5 to 5½ in length of the body. Fins all moderate.

D., I, 8; A., I, 9, to I, 11, the number varying, usually I, 10. Teeth as in *Lythrurus diplœmius*, 2, 4–4, 2, but without grinding surfaces.

Color pale, olivaceous, transparent green above, in life, general appearance decidedly pallid. Upper half of body with many black specks and points, which run together along the sides, forming a very distinct metallic blue band.

This band passes across the opercles, and around the snout, about the width of the eye. This is a very characteristic feature of the fish. A streak of black dots running along bases of dorsal and anal; that on the dorsal suggesting the peculiar dorsal spot of *L. diplœmius* and *L. ardens*, but not exactly forming a spot on the fin. Tip of snout almost always black; a golden lateral streak in life; belly transparent silvery. Fins pale olivaceous, pale red in most male specimens (in July), probably brighter in spring.

Length 2½ inches. ♀ with spawn July 10th.

This small species is one of the most characteristic fishes of the Etowah basin. It abounds in still deep waters, and in the clear mill-ponds. No species closely related to it seems to have been described. Its nearest relatives are probably *Lythrurus ardens* and *Nototropis matutinus*. The want of grinding surfaces to the teeth will separate it from the genus *Lythrurus*.

30. NOTOTROPIS STILBIUS. Sp. nov.

? *Alburnus amabilis* Girard, Proc. Phil. Ac. Sc., 1856, 193.
? *Alburnellus amabilis* Girard, Mex. Bound. Surv., 1859, 51. Cope, Proc. Am. Phil. Soc., 1870, 464.
? *Alburnus megalops* Girard, l. c.
? *Alburnellus megalops* Girard, l. c. Cope, l. c.
? *Alburnus socius* Girard, l. c.
? *Alburnellus socius* Girard, l. c.

I refer to this species a small minnow from the water basin of the Etowah. My specimens show the following characters: —

Head rather long, moderately pointed, about $4\frac{1}{3}$ in length, with a large oblique mouth, the maxillary reaching to the eye. Eye very large, white, about 3 in head, greater than interorbital width, or length of snout. Body slender, the depth about 5 in length. Lateral line, 37; 16 scales before the dorsal. D., I, 8; A., I, 10. Fins rather high, the ventrals reaching to the last rays of dorsal.

Color pale silvery green, with black points; sides and cheeks with a broad silvery band; belly pale. A vague dusky blotch at base of caudal, quite distinct in some specimens.

Teeth in two examined, 2, 4–4, 1.

This species resembles *N. photogenis* (*P. leucops* Cope) more than do most of the species. The large size of the eye, and the position of the dorsal, which is less posterior than in *rubellus*, etc., are characteristic.

Habitat. Small tributaries of the Etowah, Oostanaula and Coosa Rivers; abundant. Known locally as "Roach." This is nearest the description of *amabilis* in form and coloration, but it has the large eye of *megalops*. If *amabilis*, *megalops*, and *socius* are unlike, there is nothing in the descriptions to show it. Since the above was in press, I have examined the types of Girard above cited. This is not like any of them and I therefore propose to call this species *stilbius*, in allusion to its bright white lustre.

NOTEMIGONUS.

< **Abramis** Cuvier, "Règne Animal, II, 1817." (Type *Cyprinus brama* L., Europe.)

=**Notemigonus** RAFINESQUE, Journal de Physique, 1819, 421. (Type *N. auratus* Raf. = *Cyp. americanus* L.)

=**Stilbe** DEKAY, Fishes N. Y., 1842, 204. (Type *C. crysoleucas* Mit.= *C. americanus* L.)

=**Leucosomus** GIRARD, 1853 (not of Heckel = *Semotilus*). (Type *C. crysoleucas* Mit.)

=**Luxilus** GIRARD, Proc. Phil. Ac. Sc., 1856, 203 (not of Raf.). (Type *C. crysoleucas* Mit.)

=**Plargyrus** PUTNAM, Bulletin M. C. Z., 1863, 7 (not of Raf.). (Type *Rutilus* (*Plargyrus*) *chrysoleucas* (Mit.) Raf.)

=**Stilbius** GILL, Can. Naturalist, 1865, 18. (Type *Cyprinus americanus* Lacépède.)

31. NOTEMIGONUS AMERICANUS.

Cyprinus americanus Linnæus, "Syst. Nat., I, 530." Lacépède, "V, pl. 15, 1803." Shaw, "Gen. Zool., V, 204."

Leuciscus americanus Storer, Synopsis, 408, 1846.

Leucosomus americanus "Girard, 1853." Storer, Fishes Mass., 1855, 283.

Luxilus americanus Girard, Proc. Phil. Ac. Sci., 1856, 203.

Plargyrus americanus Putnam, Bull. M. C. Z., 1863, 7. Cope, Proc. Phil. Ac. Sc., 1864, 281.

Stilbius americanus Gill, Canadian Naturalist, Aug., 1865, 18. Jordan, Ind. Geol. Surv., 1874, 224.

Stilbe americana Cope, Cyp. Penn., 1866, 389. Abbott, Am. Nat., 1870, 4. Goode, Bulletin U. S. Museum, VI, 1876, 64. Uhler and Lugger, Fishes of Maryland, 1876, 145.

Abramis americanus Günther, Cat Fishes, VII, 1868, 305.

Notemigonus americanus Jordan, Bulletin Buffalo Nat. Hist. Soc., 1876, 93; Man. Vert., 291. Nelson, Bull. Ills. Nat. Hist. Soc., 1876.

Cyprinus crysoleucus Mitchill, "Rept. Fishes N. Y., 23;" "Trans. Lit. and Phil. Soc., 1, 459, 1815."

Rutilus chrysoleucus Raf., Ich. Oh., 1820, 48.

Cyprinus (*Leuciscus*) *chrysoleucus* Rich., "F. B. A., III, 122, 1837."

Leuciscus chrysoleucus Storer, "Rept. Fish Mass., 1839, 88." Kirtland, Bost. Journ. Nat. Hist., IV, 305, 1843.

Stilbe chrysoleuca Dekay, Fishes N. Y., 1842, 204.

Cyprinus hemiplus Raf., Am. Monthly Mag., 1818, 121.

Abramis versicolor Dekay, Fishes N. Y., 1842, 191.

Leuciscus versicolor Storer, Synopsis, 415.

Leuciscus obesus Storer, "Proc. Bost. Soc. Nat. Hist., July, 1845;" Synopsis, 418, 1846.

Stilbe obesa Agassiz, Amer. Journ. Sci. Arts, 1854, 359.

Luxilus obesus Girard, Proc. Phil. Ac. Sci., 1856, 203.

? *Luxilus seco* Girard, l. c.; Pac. R. R. Surv., X, 281.

This species is quite abundant in still places in small streams, and in cut-offs among weeds and "Spatter-docks." My specimens do not differ obviously from northern ones of this widely diffused species.

CATOSTOMIDÆ.

CATOSTOMUS.

< **Catostomus** Le Sueur, Journ. Phil. Ac. Sci., I, 1818. (Type *Cyp. catostomus* Foster = *C. hudsonius* Le S. = *C. longirostrum* Le Sueur, the prior name.)

> **Decactylus** Rafinesque, Ich. Oh., 1820. (Type *C. bostoniensis* Le S. = *C. teres*).

> **Hypentelium** Rafinesque, Amer. Monthly Mag., 1818. (Type *Exoglossum macropterum* Raf. = *C. nigricans*).

> **Hylomyzon** Agassiz, Amer. Journ. Sci. Arts, 1855, 207. (Type *C. nigricans* Le Sueur.)

32. CATOSTOMUS NIGRICANS.

var. **etowanus**. Var. nov.

var. **nigricans**.

Catostomus nigricans Le Sueur, Journ. Phil. Ac. Sci., 1, 102, 1818. Kirtland, Rept. Zool. Ohio., 1838, 169, 193. Dekay, Fishes N. Y., 1842, 202. Kirtland, Bost. Journ. Nat. Hist., V, 273, 1845. Storer, Synopsis, 421. Cuv. and Val., "XVII, 453." Günther, Cat. Fishes, VII, 17, 1868. Cope, Journ. Phil. Ac. Sci., 1868, 236; Proc. Am. Phil. Soc., 1870, 468. Uhler and Lugger, Fishes of Md., 1876, 138.

Cyprinus (*Catostomus*) *nigricans* Rich., "F. B. A., III, 120."

Hylomyzon nigricans Agassiz, Am. Journ. Sci. Arts, 1855, 90. Putnam, Bull. M. C. Z., 1863, 10. Cope, Proc. Phil. Ac. Sci., 1864, 285. Jordan, Ind. Geol. Surv., 1874, 231.

Hypentelium nigricans Jordan, Bull. Buff. Nat. Hist. Soc., 1876, 96; Man. Vert., 1876, 294. Nelson, Bull. Ills. Mus., 1876.

Catostomus maculosus Le Sueur, l. c., 103. Dekay, Fishes N. Y., 203. Cuv. and Val., "XVII, 454." Storer, Syn., 422. Uhler and Lugger, l. c., 139.

Exoglossum macropterum Raf., Journ. Phil. Ac. Sci., I, 421. Cuv. and Val., "XVII, 486." Storer, Synopsis, 428.

Hypentelium macropterum Raf., Ich. Oh., 1820, 68.

? *Catostomus xanthopus* Raf., Ich. Oh., 57.

? ? *Catostomus* (*Eurystomus*) *megastomus* Raf., Ich. Oh., 59.

Catostomus planiceps Cuv. and Val., "XVII, 450." Storer, Synopsis, 1846, 426.

My specimens of this species from the Etowah agree closely with each other, and differ somewhat from northern specimens. The southern form is, perhaps, a recognizable variety, which may be termed *etowanus*.

This form may be characterized as follows:—

Head shortish, 4⅓ to 4½ in length; eye moderate, about as in *nigricans*. Form, scales, etc., as in var. *nigricans*. Lat. l., 48. D. uniformly I, 10. A., 1, 7. V., 9. Pectorals shorter and broader than in *nigricans*, 4½ to 5 in length of body.

Body nearly black above, the color running down on the sides, and changing abruptly into the silvery hue of the belly. A whitish spot at the base of each scale,—these forming conspicuous pale streaks along the rows of scales. Dorsal black edged; other fins decidedly red in life.

Habitat. Water basin of the Etowah and Oostanaula, abounding in rapids and clear places. Known as Hog-molly (Mullet), Crawl-a-bottom, and Hog Sucker.

A number of specimens of this variety, compared with *nigricans* of the same size, show the following differences:—

* D. I, 11; head long (4⅕ in length); pectorals long; 4 to 4½ in length of body; lower fins olivaceous or dull orange; colors relatively dull; scales without streaks. Northern. . . . . NIGRICANS.

** D. I, 10; head shorter (4⅓); pectorals shorter (4¾); lower fins red; colors brighter; pale stripes along the rows scales. Southern. . . . . ETOWANUS.

ERIMYZON.

= **Moxostoma** AGASSIZ, Amer. Journ. Sci. Arts, 1854, 354; not *Moxostoma* of Raf., 1820. (Type *C. oblongus* Mit.)

= **Erimyzon** JORDAN, Bull. Buff. Soc. Nat. Hist., 1876, 95. (Type *C. oblongus* Mit.)

33. ERIMYZON OBLONGUS.

Cyprinus oblongus Mitchill, "Report Fishes N. Y., 23," and "Trans. Lit. and Phil. Soc., I, 459."

Catostomus oblongus Le Sueur, Journ. Phil. Ac. Sci., 1, 108. "? Cuv. and Val., XVII, 441." Storer, Synopsis, 423.

Labeo oblongus Dekay, Fishes N. Y., 193.

Moxostoma oblongum Agassiz, Amer. Journ. Sci. Arts, XIX, 203, 1855. Putnam, Bull. M. C. Z., 1863, 10. Cope, Proc. Amer. Phil. Soc., 1870, 468. Günther, Cat. Fishes, VII, 1868, 21. Jordan, Ind. Geol. Surv., 1874, 221.

Erimyzon oblongus Jordan, Bull. Buff. Soc. Nat. Hist., 1876, 95; Man. Vert., 294. Nelson, Bull. Ills. Museum Nat. Hist., 1876.

Catostomus gibbosus Le Sueur, Jour. Phil. Ac. Sci., I, 92, 1818. Storer, "Rep't Fishes Mass., 88." Cuv. and Val., "XVII, 443." Storer, Synopsis, 420; Fishes Mass., 291. Kirtland, Family Visitor.

Labeo gibbosus Dekay, Fishes N. Y., 194.

Catostomus tuberculatus Le Sueur, l. c., 83. Storer, "Report, 85." Dekay, Fishes N. Y., 199. Cuv. and Val., "XVII, 444."

Catostomus vittatus Le Sueur, l. c., 104. Dekay, l. c., 203. Cuv. and Val., "XVII, 459." Storer, Synopsis, 422.

Catostomus fasciolaris Rafinesque, Ich. Oh., 1820, 58.

Catostomus elegans Storer, Synopsis, 425.

Labeo elegans Dekay, Fishes N. Y., 1842, 192.

Labeo esopus Dekay, Fishes N. Y., 195.

Catostomus esopus Storer, Synopsis, 425.

Moxostoma anisurus Agassiz, Am. Journ. Sci. Arts, 1855, 203 (not of Raf.).

? *Moxostoma campbelli* Girard, Proc. Phil. Ac. Sci., 1856, 171; U. S. Mex. Bound. Surv., 34.

Moxostoma kennerlyi Girard, l. c. l. c.

My specimens do not differ obviously from northern ones of this widely diffused and variable species. It is known at Rome as Yellow Sucker.

34. ERIMYZON MELANOPS.

Catostomus melanops Raf., Ich. Oh., 1820, 57. Kirtland, Rep't Zool. Ohio, 169, 193; Bost. Journ. Nat. Hist., V, 271. Agassiz, Amer. Journ. Sci. Arts, 1854, 356.

Ptychostomus melanops Agassiz, Amer. Journ. Sci. Arts, 1855, 19. Cope, Proc. Am. Phil. Soc., 1870, 478.

Moxostoma melanops Jordan, Mss., 1875.

Erimyzon melanops Jordan, Bull. Buff. Nat. Hist. Soc., 1876, 95; Man. Vert., 294. Nelson, l. c.

Catostomus fasciatus Le Sueur, in Cuv. and Val., "XVII, 449." Storer, Synopsis, 426. Günther, Cat. Fishes, VII, 19.

Ptychostomus fasciatus Milner, Rep't U. S. Comm. Fish and Fisheries, 1872–3.

Moxostoma victoriæ Girard, Proc. Phil. Ac. Sci., 1856, 171; Mex. Bound. Surv., 34.

Abundant in the Etowah water basin, where it is known as Sand Sucker or Striped Sucker. My specimens are identical with those from the Ohio River and the Great Lakes. If *E. sucetta* (Lacépède) is not the same as *E. melanops*, we can never know it until specimens are taken in the original localities. The name *sucetta* has priority.

MYXOSTOMA.

<**Catostomus** Le Sueur, Journ. Phil. Ac. Sci., I, 1818. (Type *C. hudsonius* Le Sueur.)

>**Moxostoma** Raf., Ich. Oh., 1820, 54. (Type *C. anisurus* Raf.).

×**Teretulus** Rafinesque, Ich. Oh., 57, 1820. (Type *C. aureolus* Le Sueur.)

=**Ptychostomus** Agassiz, Amer. Journ. Sci. Arts, 1855. (Type *C. aureolus*, Le Sueur.)

35. MYXOSTOMA EURYOPS. Sp. nov.

I dislike to introduce another specific name into a genus already overloaded with nominal species, but the present fish is so singular in its physiognomy, and so apparently unlike the other species of this genus, that I do not know what to do with it unless I give it independent rank. The only species which seems to be at all similar is *M. bucco* (*Ptychostomus bucco* Cope, Hayden's Geol. Surv. Wyoming, 1870, 437).

Body stout, compressed, heavy forwards, tapering behind into a slender caudal peduncle; depth 4 in length; head 4½ in length, very short, deep, and thick, almost cubical, the snout prominent and nearly vertical, the profile being abruptly decurved in a manner very unusual among Suckers; eye excessively large, longer than snout, near to the top of the head, forming more than one-third of the side of the head (in a specimen six inches long), nearly equal to the wide and flattish interorbital space. Vertex slightly concave; mucous ridges rather prominent.

Greatest width of head (through cheeks) greater than the width of the body, and equal to greatest depth of head, 1¼ in length of head, and 6 in length of body; mouth inferior, the lips but faintly plicate; lower lip full, truncate behind, not Λ-shaped.

Scales large, equal; 15 before dorsal fin; lateral line distinct and nearly straight, with 43 scales.

D., I, 13. A., I, 7. V., 9.

Color plain olivaceous above, silvery below; dorsal and caudal dusky. Fins not red.

Length of only specimen, 6¼ inches.

Taken in Lovejoy's Creek, a small tributary of Oostanaula River, near Floyd Springs, 14 miles north of Rome. One of the "natives" "reckoned it was a Jumping Mullet," but no one else remembered having seen it before.

36. MYXOSTOMA DUQUESNII.

a. var. **duquesnii.**

Catostomus duquesnii Le Sueur, Journ. Phil. Ac. Sci., I, 105. Rafinesque, Ich. Oh., 60. Kirtland, Rep't Zool. Ohio., 169, 192; Bost. Journ. Nat. Hist., V, 268. Dekay, Fishes N. Y., 203. Storer, Synopsis, 423. Cuv. and Val., "XVII, 458." Günther, Cat. Fishes, VII, 18. Agassiz, Am. Journ. Sci. Arts, 1854, 356.

Ptychostomus duquesnii Agassiz, Amer. Journ. Sci. Arts, 1855, 89. Cope, Proc. Am. Phil. Soc., 1870, 476. Jordan, Ind. Geol. Surv., 1874, 221; Bull. Buff. Soc. Nat. Hist., 876, 195.

Teretulus duquesnei Cope, Journ. Phil. Ac. Sci., 1838, 236. Nelson, l. c. Jordan and Copeland, Check List, 1876.

Moxostoma duquesnei Jordan, Man. Vert., 295.

Catostomus erythrurus Rafinesque, Ich. Oh., 59, 1820.

Ptychostomus erythrurus Cope, Proc. Am. Philos. Soc., 1870, 474.

b. var. **lachrymalis.**

Ptychostomus lachrymalis Cope, Proc. Am. Phil. Soc., 1870, 474.

I do not think it possible to recognize *lachrymalis*, *duquesnei*, *erythrurus*, and *oneida*, as characterized by Prof. Cope, as distinct species. In the Ohio River, the "Common Red Horse of the fishermen," usually answers Le Sueur's *duquesnei* best, but most specimens have nine ventral rays, while many have nine rays on one side and ten on the other; and some not differing in any other respect, have ten.

My specimens from the tributaries of the Etowah answer best to *erythrurus* and *lachrymalis* of Cope. *Lachrymalis* is the more abundant, and my specimens of it are more blackish in color, with larger mouth and smaller scales than those of the former. Both in life have the lower fins rosy, becoming orange in death. They are locally known as White Sucker. Without further discussion of this unsatisfactory subject, I present the following table of measurements of "Red Horse" from different waters; all of which I would refer to *duquesnii* et vars.

	Etowah R. *erythrurus.*	Etowah R. *lachrymalis.*	Etowah R. *lachrymalis.*	Etowah R. *lachrymalis.*	Wabash R. *erythrurus.*	White R., Ind. *duquesnei.*	White R., Ind. *erythrurus.*	Lake Erie. *erythrurus.*	Lake Erie. *erythrurus.*
Head in length	4.1	4.5	4.1	4.3	4.3	4.5	4	4.3	4.3
Depth in length	4.2	4.4	4.1	4.3	4.3	4.7	4	3.3	3.4
Eye in head	4.2	4.3	4.5	4	3.6	3.3	3	5	3.7
Dorsal rays	I.13	1.12	I.13	I.13	I.14	I.13	1.14	I.13	I.12
Ventral rays	9.	9.	9.	9.	9.	10	9	9.	9
Lateral line	42-43	46	47	48	45	47	42	45	43
Length of specimen	12 in.	10 in.	11 in.	8 in.	14 in.	8 in.	12 in.	12 in.	10 in.

SILURIDÆ.

ICHTHÆLURUS.

Ictalurus Rafinesque, Ich. Oh., 63. (Type *P. maculatus* Raf. = *S. punctatus* Raf., 1818.)

ICHTHÆLURUS PUNCTATUS.

Silurus punctatus Rafinesque, Am. Monthly Mag., 1818, III, 355.

Ictalurus punctatus Jordan, Bull. Buff. Soc. Nat. Hist., 1876, 95; Manual Vertebrates, 300. Nelson, l. c.

Silurus maculatus Raf., Journal R. Inst., 1820.

Pimelodus maculatus Raf., Ich. Ohi., 62.

Silurus pallidus Rafinesque, Journ. Royal Inst., London, 1820.

Pimelodus pallidus Raf., Ich. Oh., 63. Kirtland, "Rep't Zool. Ohio, 169, 194."

Silurus cerulescens Raf., l. c.

Pimelodus cerulescens Raf., Ich. Ohi., 63. Kirtland, l. c. Storer, Synopsis, 405.

Ictalurus cœrulescens Gill, Proc. Bost. Soc. Nat. Hist., 1862, 43. Cope, Proc. Phil. Ac. Sc., 1865, 85; Proc. Am. Phil. Soc., 1870, 489. Jordan, Ind. Geol. Surv., 1874, 222.

Ichthælurus cœrulescens Cope, Journ. Phil. Ac. Sc., 1868, 237.

Silurus argentinus Raf., l. c.
? *Pimelodus caudafurcatus* LeSueur, Mémoires du Muséum, V, 152, 1819.
Amiurus caudafurcatus Günther, Cat. Fishes, V, 102.
Pimelodus argyrus Raf., Ich. Ohi., 64.
? *Pimelodus furcifer* Cuv. and Val., "XV, 139."
Ictalurus furcifer Gill, l. c.
? *Pimelodus olivaceus* Girard, Pac. R. R. Surv., X, 211, 1858.
Ictalurus olivaceus Gill. l. c.
Pimelodus hammondi Abbott, Proc. Phil. Ac. Sc., 1860, 568.
? *Ictalurus simpsoni* Gill, Proc. Bost. Soc. Nat. Hist., 1862, 43.

The Blue Cat or Channel Cat is taken in considerable numbers in the Etowah and Oostanaula. A large specimen, procured of a fisherman, does not differ obviously from others from the French Broad and the Wabash.

AMIURUS.

= **Ameiurus** Rafinesque, Ich. Ohi., 1820, 65. (Type *P. cupreus* Raf.)
= **Amiurus** Gill, Proc. Bost. Soc. Nat. Hist., 1862, 45.

37. AMIURUS CUPREUS.

Silurus cupreus Raf., Journal Royal Inst., London, 1820.
Pimelodus cupreus Rafinesque, Ich. Oh., 1820, 65. Kirtland, "Rep't Zool. Ohi., 169, 194;" Bost. Journ. Nat. Hist., IV. Dekay, Fishes, N. Y., 187. Storer, Synopsis, 404. Girard, Proc. Phil. Ac. Sc., 1859, 159.
Amiurus cupreus Gill, Proc. Bost. Soc. Nat. Hist., 1862, 45. Cope, Proc. Am. Philos. Soc., 1870, 485. Jordan, Bulletin Buff. Soc. Nat. Hist., 1876, 96; Man. Vert., 302. Nelson, l. c.
Ameïurus cupreus Cope, Proc. Phil. Ac. Sc., 1865, 276.
? *Pimelodus felinus* Girard, Pac. R. R. Surv., X, 209.
? *Amiurus felinus* Gill, l. c. Cope, l. c.
Pimelodus antoniensis Girard, l. c.
Amiurus antoniensis Gill, l. c. Cope, l. c.

This species abounds in the deeper and more muddy tributaries of the Etowah and Oostanaula. Most of my specimens were taken in Beech Creek. They do not differ obviously from specimens from the Illinois River. It is known locally as Yellow Cat.

NOTURUS.

Noturus RAFINESQUE, Am. Monthly Mag., 1818, 41. (Type *N. flavus* Raf.)

Schilbeodes "BLEEKER, Act. Soc. Sc., Indo-Nederl, 4, 258" (Type *S. gyrinus* Mitchill.)

38. NOTURUS LEPTACANTHUS. Sp. nov.

Head small, 4 in length, without furrow above, long and narrow, nearly as wide across the snout as behind the eyes; width of head 5½ in length, without caudal, less than the width of the body; upper jaw much the longer; eye 6 in head; barbels very short, the longest shorter than head. Premaxillary band of teeth without lateral processes.

Body slender, elongate, compressed behind; the belly full; depth 5¼ in length.

Dorsal fin beginning one-third the distance from snout to caudal, midway between snout and middle of anal; dorsal and pectorals very small and short, their spines extremely weak and slender, not one-fourth the length of the head. Caudal fin rounded, continuous with the adipose fin.

Fin rays. D., I, 6. P., I, 8. A., 14.

Color pale reddish yellow, slightly blotched.

Habitat. Silver Creek,—a single specimen taken a mile above its junction with the Etowah.

The species of this genus have not been well described and it is not easy to present a comparative table of their characters. This species seems to differ from all the others in the small and narrow head, and particularly in the very small and slender dorsal and pectoral spines which are devoid of internal serratures.

ANGUILLIDÆ.

ANGUILLA.

Anguilla "THUNBERG, Nouv. Mem. Stock., 179." (Type *Murœna anguilla* L. = *A. vulgaris*).

39. ANGUILLA VULGARIS Fleming (Dareste).

The Common Eel occurs in the Etowah and Oostanaula. The only specimens which we caught were less than half an inch long, and they escaped through the cover of the live-pail. The synonymy of this species will be presented elsewhere.

LEPIDOSTEIDÆ.

LEPIDOSTEUS.

Lepisosteus Lacépède, "Hist. Nat. des Poissons, V., 1803, 331." (Type *L. gavialis* Lac. = *Esox osseus* L.)

Lepidosteus Agassiz, Poissons Fossiles, II, 1843.

40. LEPIDOSTEUS OSSEUS. (Lacépède) Agassiz.

I shall present elsewhere what I consider to be the synonymy of this species, to which for the present all our long-nosed Gars may be referred. A single specimen was taken in the Etowah, which would probably be *L. otarius* Cope, in Prof. Cope's arrangement (Proc. Phil. Ac. Sci., 1865, 80), and *L. treculii* Dum. in the wonderful scheme of Prof. August Dumeril (Hist. Nat. des Poissons, 1870). This author recognizes 17 valid species of Lepidosteus proper, besides several doubtful ones. These are distinguished by characters often utterly trivial, some of them purely individual and often unlike on different sides of the same fish; others are dependent on age,—as the diameter of the eye compared with the length of the lower jaw.

The specimen referred to from the Oostanaula differs from all the other specimens of Gar Pike which I have seen, in its color, it being almost jet black in life.

I give here the measurements of three Gars, with the characters considered as specific in the schemes of Profs. Dumeril and Cope.

	"L. otarius," Cope. "L. treculii," Duméril.	"L. huronensis Rich." Cope. "L. copei," Duméril.	"L. oxyurus," Raf. "L. lesueurii," Duméril.
Habitat	Oostanaula R.	White R., Ind.	Rock R., Wis.
Length of specimen	30 inches.	30 inches.	42 inches.
Head in length (to upper base of caudal)	3.1	3.4	3.1
Head compared to distance from V. to A.	greater.	equal.	greater.
Eye in frontal width	1.9	1.7	2.8
Eye in distance to opercle, anteriorly	1.5	1.5	2.3
Eye in lower jaw	8.	8.5	11.
Ventrals in relation to position of P. and A.	midway.	nearer P.	¼ in. nearer P.
Scales	8-64-13	7-64-12	7-65-13
Dorsal rays	8	8	7
Anal rays	10	9 (?)	10
Ventral rays	6	6	6
Pectoral rays	12	11	11
Lower jaw as to distance from P. to V.	shorter.	shorter.	nearly equal.
Scales in first ring behind Ventrals	45	45	49
Scales in second ring before V.	43	43	41
First ring before D. = which before C.	second.	third.	third.
First ring before D. = which behind A.	sixth.	sixth.	fifth.
Distance from V. to A. in length to lower insertion of Caudal.	4.3	3.6	3.9

Part II. Chattahoochee River.

While waiting for a train at Atlanta, we were enabled to spend part of a day in studying the fishes of the tributaries of the Chattahoochee River. We first tried Peach Tree Creek, some five miles north of the city. This stream is deep and excessively muddy, and we secured nothing of note. We then proceeded to Pace's Ferry on the Chattahoochee, but the canes on the shores and the snags and rocks in the water, prevented us from accomplishing any thing. We then struck a clear rapid stream known as Nancy's Creek, a mile or two above its mouth, and secured the species below enumerated. It is to be noticed that the waters of the Chattahoochee, like those of the Etowah, find their way to the Gulf, while the Ocmulgee, whose source is only a few miles distant, flows into the ocean.

1. MICROPTERUS SALMOIDES (Lacèpéde) Gill.
2. *HELIOPERCA PALLIDA (Mitch.) Jordan.
3. NOCOMIS BIGUTTATUS (Kirtland) Cope and Jordan.

?*Catostomus melanotus* Raf., Ich. Oh., 58.
Ceratichthys melanotus Jordan, Man. Vert., 278.
Semotilus biguttatus Kirtland, Bost. Journ. Nat. Hist., 1840, III, 344.
Leuciscus biguttatus Dekay, Fishes N. Y., 1842, 214. Storer, Synopsis, 413.
Ceratichthys biguttatus Baird, Girard, Proc. Phil. Ac. Sci., 1856, 213. Putnam, Bull. M. C. Z., 1863, 8. Cope, Cyp. Penn., 1866, 366; Journ. Phil. Ac. Sci., 1868, 226; Proc. Am. Phil. Soc., 1870, 459. Günther, Cat. Fishes, VII, 178. Jordan, Ind. Geol. Survey, 1874, 223. Jordan and Copeland, Bull. Buff. Soc. Nat. Hist., 1876, 149. Nelson, Bull. Ills. State Mus., 1876. Uhler and Lugger, Fishes Md., 144. Cope and Yarrow, Lieut. Wheeler's Survey, 1876.
Nocomis biguttatus Cope and Jordan, Proc. Phil. Ac. Sc., 1877.

---

* *Helioperca* Jordan, gen. nov. This genus differs from *Lepiopomus* in the absence of palatine teeth, and in the structure of the gill rakers, which are more slender than in *Lepiopomus* and beset with fine prickles, like the stem of a briar. The type is *Labrus pallidus* Mitch. (=*Pomotis incisor* C. and V.). *Pomotis obscurus* Ag. and *Lepiopomus ischyrus* Jor. and Nelson, Mss., belong to *Helioperca*. The etymology is *helios*, sun, and *perke*, perch, suggesting the vernacular name of "Sun-fish," universal in this country.

?*Leuciscus croceus* Storer, "Proc. Bost. Soc. Nat. Hist., July, 1845;" Synopsis, 417. Agassiz, Am. Journ. Sci. Arts, 1854, 359.

?*Nocomis nebrascensis* Girard, Proc. Phil. Ac. Sci., 1856, 213; Pac. R. R. Surv., X, 254, 1858.

Nocomis bellicus Girard, Proc. Phil. Ac. Sci., 1856, 213.

Ceratichthys cyclotis Cope, Proc. Phil. Ac. Sci., 1864, 277; Cyp. Penn., 365. Günther, Cat. Fishes, VII, 178. Cope, Proc. Am. Phil. Soc., 1874, 136.

? *Ceratichthys micropogon* Cope, l. c., l. c. Günther, l. c., 179 (hybrid?).

Ceratichthys stigmaticus Cope, l. c. 278, l. c. 366. Günther, l. c.

We did not find this common species in any other of the southern streams. It is probably not rare, however. *L. croceus* Storer and *N. bellicus* Girard, seem to have been based upon it. Some highly colored spring males in my possession from the lakes of Northern Indiana, have the fins bright red, and the red spot on each side of the head, which suggested the name of "biguttatus," very conspicuous. Other spring males have a singular swollen crest on the head.

4. PHOTOGENIS EURYSTOMUS. Sp. nov.

Form elongated, resembling *P. stigmaturus*, but heavier forwards, the head more like that of *Luxilus coccogenis* and *L. cornutus*. Depth $4\frac{1}{5}$ in length.

Head large, rather elongate, about 4 in length, its upper surface rounded and (in males) covered with small tubercles.

Upper jaw slightly projecting beyond the large, oblique mouth, which reaches to opposite the eye. Eye large, $3\frac{3}{4}$ in head. Iris white, as in allied species.

Scales moderately large, rather loose, the edges unusually pale. Lat. l. 38 (37 to 40); 16 to 20 scales in front of dorsal.

Dorsal fin behind ventrals, nearer caudal than snout, low, about $5\frac{3}{4}$ in length of body.

D., I, 8. A., I, 8. Teeth 1, 4–4, 1, entire, without grinding surface.

Color very pale olive; a faint dark caudal spot. Dorsal with a very faint dusky blotch on its last rays, and its tip, as well as those of the anal and caudal, filled with white pigment. Some of the smaller specimens had the caudal chiefly pale red, a red bar across dorsal, and a faint red bar down the cheeks, as in *L. coccogenis*. It is possible that the breeding colors are brilliant, but all my specimens are very pale.

Habitat. Nancy's Creek, a small tributary of the Chattahoochee River above Atlanta, where it is quite abundant.

For a comparison with other species of *Photogenis*, see Part I of this paper.

5. ERIMYZON OBLONGUS (Mitchill) Jordan.

6. MYXOSTOMA DUQUESNII (Le Sueur) Jordan.

7. ICHTHÆLURUS PUNCTATUS (Rafinesque) Jordan.

This species is extremely abundant in Nancy's Creek, where we took two or three quite large specimens. In the north I have never seen it outside of the river channels, and hence its name of Channel Cat. Possibly the southern fish is different, but if so, the distinctions have escaped my notice. My specimens are very pale and silvery.

PART III. OCMULGEE RIVER.

Our collections in this stream were made in the South Fork, or South River, at Flat Shoals (Flat Rock P. O.), in Dekalb Co., some 16 miles south-east of Atlanta. At this point the river flows down an inclined plane on a bed of granite, and as its banks have been cleared in the immediate neighborhood of the "Shoals," it offers excellent advantages for small seining. Our work was confined to one point, as the river is thickly wooded above and below, and therefore full of snags.

All the species obtained here were exceedingly pale in color, probably owing in some way to the character of the water or the bottom. In a general way, the fauna is very similar to that reported by Prof. Cope, from the Catawba. The apparent absence of *Luxilus cornutus* is noteworthy. Of course the sixteen species which we obtained form but a small part of the number of fishes which occur in the basin of the Ocmulgee.

1. HADROPTERUS NIGROFASCIATUS Agassiz.

Three large specimens taken in rapid water.

2. MICROPTERUS SALMOIDES (Lacépède) Gill.

Abundant; known as "Trout."

Genus CHÆNOBRYTTUS.

= **Calliurus** Agassiz, Amer. Journ. Sci. Arts, 1854 (not of Rafinesque). (Type *C. punctulatus* Ag., not of Raf.)

= **Chænobryttus** Gill, Amer. Journ. Sci. Arts, 1864, 92. (Type *Calliurus melanops* Girard.)

= **Glossoplites** Jordan, Man. Vert., 1876, 234. (Type *Calliurus melanops* Girard.)

3. CHÆNOBRYTTUS VIRIDIS (Cuv. and Val.) Jordan.

Two specimens taken in the Ocmulgee River, respectively seven and three inches in length, are referred for the present to the above species. I have had considerable difficulty in identifying them, owing to imperfections in the descriptions. They agree fairly with *C. gulosus* Cuvier, but the coloration is certainly not that of "Pomotis vulgaris." *C. viridis* Cuv., is very briefly described, but the coloration is that of my specimens, and the reference of this species to Centrarchus, by Valenciennes, would imply that it is a large-mouthed species, and therefore a Chænobryttus. *Calliurus floridensis* Holbrook, agrees in the main, but differs in one or two minor characters. *Lepomis gillii* Cope, describes my smaller specimen perfectly, even to the least detail, but my larger one differs somewhat. These differences are probably due to age. But Prof. Cope does not mention the teeth on the tongue, which seem to me to be a very important feature, probably even of generic value.*

At present it seems probable that our true *Chænobrytti*, or Sun fishes with rounded operculum, three anal spines, an additional maxillary bone, large mouth, and teeth on the tongue, will ultimately be reduced to *two* species, which are closely

* Since the above was in press, I have examined the types of *L. gillii* Cope, and find that they have teeth on the tongue, and also various specimens in the Smithsonian Collections from localities in South Carolina and southward; I have no doubt whatever of the identity of *viridis*, *floridensis*, and *gillii*.

related, the one, *C. gulosus* (C. and V.), occurring chiefly west of the Alleghanies, and in the Great Lakes; the other, *C. viridis* (C. and V.), occurring in the South Atlantic States.

The other species referred to Chænobryttus, or "Calliurus," seem to me to form a natural genus for which the name *Apomotis* Raf., proposed for those species of *Lepomis* which have a very short opercular flap, must be retained. These have the tongue and pterygoids toothless, the mouth smaller, the supernumerary bone small but present, the spines low, and the appearance more like that of *Lepomis*. Type *Ichthelis cyanellus* Raf., = *Bryttus mineopas* Cope. The name *Glossoplites* was proposed by me for typical Chænobryttus, under the erroneous impression that *Chœnobryttus melanops* Cope (*Ichthelis* Raf.), was the type of Chænobryttus, instead of *Calliurus melanops* Girard. Glossoplites is therefore to be suppressed.

The synonymy of the supposed two species of Chænobryttus will probably be as follows:—

CHÆNOBRYTTUS GULOSUS.

Pomotis gulosus Cuv. and Val., III, 367 (Louisiana).

Centrarchus gulosus Cuv. and Val., VII, 344. Dekay, Fishes N. Y., 31 (copied). Storer, Synopsis, 291 (copied). Günther, Cat. Fishes, I, 258 (copied).

Calliurus gulosus Agassiz, Am. Journ. Sci. Arts, 1854, 300 (no description).

Chœnobryttus gulosus Cope, Proc. Phil. Ac Sci., 1865, 84 (Michigan, not described). Jordan, Man. Vert., 235 (copied). Jordan and Copeland, Bull. Buff. Soc. Nat. Hist., 1876, 137 (name only). Jordan, Proc. Phil. Ac. Nat. Sci., 1877.

Lepomis gulosus Cope, Journ. Phil. Ac. Sci., 1868, 223 (copied?).

? *Calliurus punctulatus* Agassiz, Am. Journ. Sci. Arts, 1854, 300 (Huntsville, Ala., Tenn. R.; not described; not of Raf.).

Calliurus melanops Girard, Pac. R. R. Surv., X, 11, 1858 (Texas—various streams).

Bryttus melanops Günther, Cat. Fishes, I, 260 (copied).

Chœnobryttus melanops Gill, Amer. Journ. Sci. Arts, 1864, 92 (not described; not of Cope).

Glossoplites melanops Jordan, Man. Vert., 1876, 223 (Illinois R.); ib. 317 (Lake Michigan; description of fresh specimens).

Lepomis charybdis Cope, Journn. Phil. Ac. Sci., 1868, 224 (copied; name proposed as a substitute for *melanops*, preoccupied by Rafinesque).

Chænobryttus charybdis Cope, Proc. Am. Phil. Soc., 1870, 252 (mere mention).

CHÆNOBRYTTUS VIRIDIS.

Centrarchus viridis Cuv. and Val., VII, 345 (South Carolina). Dekay, Fishes N. Y., 31 (copied). Storer, Synopsis, 291 (copied).

Chænobryttus viridis Jordan and Copeland, Bull. Buff. Soc. Nat. Hist., 1876, 137 (name only).

Bryttus reticulatus Cuv. and Val., VII, 345 (S. Car.), (and of various compilers).

Calliurus floridensis Holbrook, Journ. Phil. Ac. Sci., 1855, 53 (St. John's River).

Bryttus floridensis Günther, Cat. Fishes, I, 260 (copied).

Chænobryttus floridensis Jordan and Copeland, Bull. Buff. Soc., 1876, 137 (name only).

Lepomis gillii Cope, Journ. Phil. Ac. Sci., 1868, 225 (James R., Va.; good description of a young specimen).

Chænobryttus gillii Cope, Proc. Am. Phil. Soc., 1870, 452 ("All streams of North Carolina, east of the Alleghanies; not found in the French Broad"). Jordan and Copeland, l. c. (name only).

Glossoplites gillii Jordan, Manual Vert., 233 (copied).

My larger specimen shows the following characters:—

General form of Ambloplites; rather elongate; robust and thick; depth $2\frac{1}{2}$ in length; thickness half the depth; head large, somewhat acuminate, $2\frac{1}{3}$ in length. Eye large, equal to snout, $4\frac{1}{2}$ in head; maxillary extending to opposite its posterior margin; supplementary bone large; mucous cavities and grooves well developed; cheeks and opercles with large scales in about six rows each; limb of preopercle dentate; profile making but a slight angle. A conspicuous patch of teeth on the tongue.

Dorsal, X—9, in a furrow; A., III, 8. Lateral line 43, six rows of scales above it and about 11 below. Soft rays of vertical fins, considerably scaly.

Spines stout, the longest dorsal spine $\frac{1}{3}$ the length of the head, as long as from snout to middle of eye; third anal spine still longer. All the spines shorter than the soft rays. Pectorals reaching beyond tips of ventrals. Caudal emarginate. Opercular spot moderate, smaller than eye.

General color olive green, with a golden lustre; each scale with a blackish spot, these forming very conspicuous lines along the rows of scales; fins mottled, the mottlings darkest on the dorsal behind, but hardly forming a spot; three broad faint oblique bars across the opercles; faint traces of vertical bars; the general color retained in spirits; no red in life, except a shade on the iris, and no distinct black in death.

The small specimen is more elongate, with higher spines; higher than the short rays, and the vertical bars quite distinct, as in the young of *Helioperca pallida.*

Length of larger specimen, 7 inches; smaller 3 inches. Taken in the South Fork of the Ocmulgee River, where the species is known as "Bream" and "Red Eye."

This species is closely related to "*Ch. melanops*," or "*gulosus*." A specimen of the latter from Lake Michigan, eight inches long, differs from the above description in the following particulars: —

Body stouter, thicker and deeper; the generic characters more emphatic; depth $2\frac{1}{5}$ in length; head $2\frac{3}{5}$; angle made by projection of snout greater; lat. l., 40; spines shorter, longest $3\frac{1}{2}$ in head; opercular spot very large, as large as eye. Coloration quite different; in spirits nearly black; in life as follows: —Dark olive green above; sides greenish and brassy, with blotches of pale blue and bright coppery red, the latter shadé predominating; belly bright brassy yellow, profusely mottled with light red; lower jaw chiefly yellow; iris bright red; opercular spot black, bordered with copper color; three or four dark red bands radiating backwards from eye across cheeks and opercles, separated by narrow pale blue ones; upper fins barred with black, orange and blue, the black predominating; lower fins blackish. The young of this species is very much mottled and blotched, somewhat as in *Ambloplites rupestris*, but the pattern of marking more chain-like, sometimes forming obscure vertical bars.

4. LEPIOPOMUS AURITUS.

Labrus auritus "Linnæus, Systema Naturæ."

Lepomis auritus Gill, Amer. Journ. Sci. Arts, 1864, 93.

Ichthelis auritus Jordan and Copeland, Bull. Buff. Soc., 1876, 138.

Pomotis rubricauda Holbrook, Ich. S. Car. 1st. Ed., 10, 1855. Günther, Cat. Fishes, I, 262, part.

Ichthelis rubricauda Holbrook, Ich. S. Car., 1860, 15. Putnam, M. C. Z., 1863, 6. Jordan, Man. Vert., 239.

Lepomis rubricauda Cope, Proc. Am. Phil. Soc., 1870, 452.

Many small specimens of this species were taken; and the remains of two or three large ones, thrown away by the fishermen, were seen. The common long-eared Sunfish of the North-east (*Pomotis* or *Lepomis appendix* of authors) is probably identical with *Lepiopomus auritus.*

5. ESOX RETICULATUS Le Sueur.

var. AFFINIS (Holbrook) Jordan.

A single large specimen of this species was taken. It is known locally as the Jack.

6. SEMOTILUS CORPORALIS (Mitchill) Putnam.

A few small specimens from a little Spring run,—not found in the river.

7. NOCOMIS RUBRIFRONS Jordan.

This little fish we found quite abundant. It is possible that it is specifically different from the northern form.

8. HYBOPSIS HUDSONIUS.

var. AMARUS.

var. **hudsonius.**

Clupea hudsonia Dewitt Clinton, "Annals Lyceum Nat. Hist. N. Y., I, 49, 1824."

Leuciscus hudsonius Dekay, Fishes N. Y., 1842, 206. Storer, Synopsis, 409. Agassiz, Lake Superior, 1850, 272. Günther, Cat. Fishes, VII, 251.

Hybopsis hudsonius Putnam, Bull. M. C. Z., 1863, 9. Cope, Cyp. Penn., 386. Cope, Proc. Am. Philos. Soc., 1870, 460. Jordan, Man. Vert., 1876, 281. Jordan and Copeland, Bull. Buff. Soc., 1876, 150.

Hudsonius fluviatilis Girard, Proc. Phil. Ac. Sci., 1856, 210.

var. **amarus.**

Hudsonius amarus Girard, Proc. Phil. Ac. Sci., 1856, 210.

Hybopsis amarus Cope, Proc. Am. Phil. Soc., 1870, 460. Jordan and Copeland, Bull. Buff. Soc., 1876, 150.

Hybopsis phaënna Cope, Proc. Phil. Ac. Sci., 1864, 279. Abbott, Am. Naturalist.

My specimens show the following characters:—

Head stout, broad above and rather short, 4½ in length, depth 4⅗; the form elongated.

Top of head flattish; snout curved, but not so abruptly bent downward as represented in Dekay's figure of *L. hudsonius.* Eye very large, about 3 in head, rather greater than snout. Mouth moderate, inferior, somewhat oblique.

Scales large, 14 before the dorsal, 38 in the lateral line. Dorsal over ventrals; pectorals not reaching ventrals, the latter not to vent. D., I, 7. A., I, 8. Teeth in specimens examined 1, 4-4, 0. Length of largest specimen $4\frac{3}{4}$ inches.

Color uniform — very pale olive, becoming silvery; a silvery lateral band, a gilt vertebral line, and traces of a faint caudal spot.

Habitat. South fork of the Ocmulgee River, very abundant. This seems to differ from *hudsonius* chiefly in its pale color and less convex front. I therefore here consider *amarus* as a variety only; still it may be a distinct species. Later comparisons have assured me that the latter view is correct.

EPISEMA.

Episema Cope and Jordan, Proc. Phil. Ac. Nat. Sci., 1877. (Type *Photogenis scabriceps* Cope.)

9. EPISEMA CALLISEMA. Sp. nov.

Body elongated, fusiform, compressed; depth $4\frac{2}{3}$ in length ($4\frac{1}{3}$ to $4\frac{3}{5}$).

Head elongate, somewhat abruptly truncate, about 4 in length; snout projecting beyond the moderate-sized, oblique mouth, which reaches to nearly opposite the eye. Head and upper neck tuberculate, as in *Photogenis*. Eye moderate, $4\frac{1}{4}$ in head.

Scales firm, closely imbricated, with dark edges, 15 before dorsal, 39 in the lateral line. Dorsal fin — in male specimens — immensely high, its length more than $\frac{1}{4}$ the length of the body (in females $\frac{1}{5}$), the last rays extending backward nearly as far as the large anal.

Dorsal directly over ventrals, or perhaps very slightly posterior, its first ray over the second or third of ventrals, nearer snout than base of caudal fin. Pectorals not reaching ventrals, the latter to vent. D., I, 8. A., I, 8. Teeth uniformly 0, 4–4, 0, of the same form as in *P. stigmaturus*, hooked, and with sharp, entire cutting edge. Females smaller than males; dull in color, with small and slender heads; the two sexes appearing like different species. Length, 2 or 3 inches.

Coloration brilliant; clear dark blue above, sides and below abruptly silvery; a blue lateral streak resembling that of *P. cæruleus*, bounding the blue of the upper parts, the white pigment of the lower parts looking as if painted on over the blue.

Dorsal with a large black spot on its last rays above; dorsal, anal, and caudal with the usual satin-white pigment at their tips; these fins otherwise of a bright clear ferruginous orange, characteristic of this species.

Habitat. Very abundant in the South Fork of the Ocmulgee. One of the handsomest of our Minnows, both in form and coloration. Its relationships are entirely with *P. cœruleus*, *P. xœnurus*, and other species placed in *Photogenis*, but the anterior dorsal necessitates its reference to *Episema*. *E. callisema* resembles *Cyprinella whipplei* Grd., having a similar dorsal fin, but the latter species, according to Girard's description, has the dorsal nearer to the caudal than the snout. It has also a longer anal fin, a larger eye, and a deeper body, besides the presence of two rows of teeth.

10. PHOTOGENIS XÆNURUS.

Minnilus xœnurus Jordan, Proc. Phil. Ac. Sci., 1877, 79.

This beautiful species is fully described in the paper above cited. It is the most abundant species in the Ocmulgee River, and we obtained hundreds of specimens. The males are provided with rows of quite large tubercles along the sides of the caudal peduncle — one on each scale — in addition to those which are found upon the head and neck. The bases of the pectorals, ventrals, and anal, are filled with white pigment, as are the tips of the dorsal and caudal. The coloration in general resembles that of *P. callistius*, but the black caudal spot is obsolete, and the size is much smaller. I at first identified this with *P. pyrrhomelas* Cope; but a comparison with Cope's types shows several points of difference.

11. NOTEMIGONUS ISCHANUS. Sp. nov.

A species of this genus, for which the above name is proposed, is very abundant in still waters in the Ocmulgee River. It differs from *N. americanus* in the extreme compression of the body, and in the longer anal fin.

Head rather long and slender, depressed and flat between the eyes, more pointed than in *N. americanus*, and less rounded above, 4⅓ in length. Mouth longer and less oblique. Eye very large, white, much larger than in *americanus*, about 3 in head (nearly 4 in *americanus* of the same size), the maxillary reaching eye.

Body elongate; depth 3¾ in length; excessively compressed, perhaps more so than in any other Cyprinoid whatever; the greatest thickness being less than the thickness of the head, and less than half the length of the head. Back and belly closely compressed.

Scales rather larger than in *americanus;* lateral line 41 to 45; scales of sides and lateral line not dark-edged; the punctulations above not gathered into little spots.

D., I, 18. A., I, 16 (I, 15 to I, 18). Teeth 0, 5–5, 0, rather slender, with short hook, and the edge not strongly crenate; the 5 nearly in one line.

Color very pale olive above, with silvery lustre. My specimens are all extremely pale, which is, perhaps, a local peculiarity; lower fins red in spring males.

The described species of this genus may be compared as follows: —

* Beginning of dorsal decidedly nearer caudal than muzzle.
- *a.* Eye moderate, about 4 in head.
  - *b.* D., I, 7 or I, 8; A., I, 12 to I, 14; lat. l. 50; scales small, their edges punctate; head short, blunt, rounded above; lateral line strongly decurved; Maine to Minnesota and Alabama. . . . AMERICANUS.
  - *bb.* D., I, 10; A., I, 11; snout elongated, flattish; California. . . . . OCCIDENTALIS.
- *aa.* Eye very large, about 3 in head (in specimens of 4 inches in length).
  - *c.* Snout short; mouth little oblique; head 4½ in length; D., I, 8; A., I, 14; body considerably compressed. Texas. . . . . SECO.
  - *cc.* Snout elongated, flattened above; mouth strongly oblique; head 4⅓ in length; D., I, 8; A., I, 16; scales large; lat. l. 43; body elongated, very strongly compressed; its thickness not half the length of the head. Ocmulgee R. . . . . ISCHANUS.

** Beginning of dorsal not nearer caudal than muzzle.
- *d.* Body long and slender, the head 4½ in length; D., I, 8; A., I, 13; scales large; snout blunt. Texas. . LEPTOSOMUS.
- *dd.* Body stouter; head 4 in length; D., I, 8; A., I, 10. Arkansas. . . . . LUCIDUS.

12. ERIMYZON OBLONGUS (Mitchill) Jordan.

This species occurs in the Ocmulgee in some abundance.

13. MYXOSTOMA CERVINUM.

Teretulus cervinus Cope, Journ. Phil. Ac. Sci., 1868, 235. Jordan and Copeland, Bull. Buff. Soc., 1876, 157.

Ptychostomus cervinus Cope, Proc. Amer. Phil. Soc., 1870, 478.

Moxostoma cervinum Jordan, Man. Vert., 296.

This very distinct species has been well described by Prof. Cope. My specimens all have 9 ventral rays, instead of 10, and the dorsal rays vary from I, 10, to I, 12. This species seems to be the smallest of all the Catostomidæ. It abounds in the rapids and rock pools at the "Falls" at Flat Shoals.

14. MYXOSTOMA PAPILLOSUM.

Ptychostomus papillosus Cope, Proc. Am. Philos. Soc., 1870, 470.
Teretulus papillosus Jordan and Copeland, Bull. Buff. Soc. Nat. Hist., 1876, 158.

This marked and handsome species abounds in the Ocmulgee River, where it is known as the White Sucker. The papillose lips separate it sharply from all the other known species of this genus. My specimens differ somewhat from Prof. Cope's description, as follows. The dorsal outline I should call considerably elevated, rather than "not at all elevated;" the large head is rather *more* than one-fourth the length; the eye is quite *large*, about 4 in head; the lips seem to me to be *coarsely* granular, rather than "finely;" and finally the dorsal radii are I, 13, and I, 14. Its colors are very pale and silvery.

15. ALOSA SAPIDISSIMA (Wilson) Storer.

Fishermen told us that the Shad ascends the Ocmulgee River as far as the Shoals. We saw no specimens.

16. ICHTHÆLURUS PUNCTATUS (Rafinesque) Jordan.

The Blue Cat, White Cat, or Channel Cat, is excessively abundant in the Ocmulgee. We obtained a great number of specimens, mostly small. They seem to be identical with the northern species, although their habits appear different. This species occurs only below the "Falls" or "Shoals." We were informed that all attempts to introduce it above have failed.

17. AMIURUS BRUNNEUS Sp. nov.

A small Cat-fish from the Ocmulgee, was identified by me with Girard's *Pimelodus vulpeculus** (Proc. Phil. Ac. Sci., 1859, 160), but a comparison with Girard's type, made as this is passing through the press, assures me of their entire difference. *A. vulpeculus* has equal jaws, a truncate caudal, and 22 anal rays. I therefore propose to call my species *A. brunneus.*

My specimens show the following characters: — the measurements are taken from my largest specimen, which is about six inches long.

Body slender, elongate, depressed and broad in front, closely compressed behind, the greatest depth only about $\frac{1}{6}$ of length.

Head flat, broad, and long, about 4 in length.

Upper jaw much longest, projecting more than in any other *Amiurus* known to me; mouth wide; its width half the length of the head; as great as the greatest depth of the head. Eye rather large, 5 in head and $2\frac{1}{2}$ in the interorbital space (in young of 6 inches); the latter broad, flattish, its width half the length of head.

Dorsal fin well forward, nearer snout than adipose fin; the length of its spine being contained four times between its base and the adipose fin, which is small and narrow, well forward from the caudal, slightly behind end of anal. Spines moderate, serrated. Anal fin short and deep, its base equal to length of caudal, and less than one-fifth the length (without caudal). Caudal fin slightly emarginate, more so than in *catus*, much less so than in *nigricans* or *albidus.*

D., I, 6. P., I, 8. V., 8. A., 16 to 17. B., 10.

Color pale olive brown, white below; a blackish horizontal bar at base of dorsal, distinct in spirits. This species is well marked by its peculiar form, and very short anal fin. It is apparently related to *A. platycephalus*, but the latter has the jaws equal and the anal fin longer.

Habitat. *Amiurus brunneus* is extremely abundant in

---

* Girard's account is as follows: — "We have likewise collected in Charleston, S. C., a Cat-fish, the general form of which is more slender than that of the preceding species (*P. puma*); the anal fin is deeper and the caudal emarginated; features which will at once differentiate the species to which we give here the name of *Pimelodus vulpeculus.* The head, which is longer than broad, constitutes the fourth of the total length. The lower jaw is somewhat shorter than the upper one. The eyes are of medium size; their diameter being contained about eight times in the length of the side of the head and four times only across the interocular space. The anterior margin of the dorsal is somewhat nearer the apex of the snout than the adipose, which is smaller and inserted more anteriorly than in *P. puma*. The caudal fin enters five times and a half in the total length. The base of the anal is equal to the caudal."

the South Fork of the Ocmulgee, where we took great numbers of small specimens, but none over six inches in length. It is said to reach a considerable size, and is known as the Yellow Cat.

Recapitulation.

The present investigation has shown the occurrence of 53 species in the rivers of Georgia, distributed as shown in the list on the next page. Those species which we found so common that they may be considered as characteristic of the fauna,—or in other words, so abundant, that any succeeding ichthyologist can visit these streams with a certainty of securing them,—are designated by a star (*).

Note. The following species from Georgia, in the U. S. National Museum, may be added to the list on page 369. This paper will now practically include all that is definitely known in regard to the fresh-water fishes of Georgia.

Eupomotis pallidus (Ag.) Gill and Jor.	Coosa River.
Helioperca obscura (Ag.) Jor.	Coosa River.
Xenotis sanguinolentus (Ag.) Jor.	Savannah River.
Chaenobryttus gulosus (Val.) Cope.	Coosa River.
Pomoxys hexacanthus (Cuv. and Val.) Ag.	Coosa River.
Asternotremia mesotrema Jor., MSS.	Precise locality unknown.
Photogenis grandipinnis Jor., MSS.	Precise locality unknown.
Semotilus thoreauianus Jor., MSS.	Precise locality unknown.
Erimyzon melanops (Raf.) Jor.	Coosa River.
Carpiodes cyprinus (Le S.) Ag.	Coosa River.
Dorysoma cepedianum heterurum (Raf.) Jor.	Coosa River.
Ichthælurus punctatus (Raf.) Jor.	Coosa River.
Lepidosteus osseus (L.) Ag.	Coosa River.
Boleosoma olmstedi (Storer) Ag.	Ocmulgee River.
Centrarchus irideus (Bosc.) C. and V.	Coosa River.
Centrarchus macropterus (Lac.) Jor.	Ocmulgee River.
Aphododerus sayanus (Gill) Dekay.	Coosa River.
Pomoxys annularis Raf.	Coosa River.
Esox raveneli Holbr.	Coosa River.
Hybopsis xænocephalus Jor.	Coosa River.
Notemigonus ischanus Jor. (large specimens, lower fins yellow, crimson-tipped)	Ocmulgee River.
Amiurus marmoratus (Holbr.) Jor.	Altamaha River.
Amiurus lividus (Raf.) Jor.	Coosa River.

Etowah River.	Chattahoochee River.	Ocmulgee River.
Boleichthys elegans *		
Hadropterus nigrofasciatus *		Hadropterus nigrofasciatus *
Boleosoma stigmæum *		
Percina caprodes *		
Stizostethium salmoneum		
Micropterus salmoides *	Micropterus salmoides *	Micropterus salmoides *
Micropterus pallidus *		
Ambloplites rupestris *		Chænobryttus viridis *
Helioperca pallida *	Helioperca pallida *	Lepiopomus auritus *
Helioperca obscura		
Xenotis inscriptus		
Xenotis sanguinolentus *		
Haploidonotus grunniens *		
Potamocottus zopherus *		
Xenisma stellifera *		Esox reticulatus affinis
Esox reticulatus affinis *		Alosa sapidissima
Semotilus corporalis *	Nocomis biguttatus *	Semotilus corporalis
Nocomis amblops winchelli *		Nocomis amblops rubrifrons *
Rhinichthys atronasus obtusus *		
Phenacobius catostomus*		
Campostoma anomalum prolixum *		
Hybopsis gracilis *		Hybopsis hudsonius amarus *
Hybopsis xænocephalus *		
Hybopsis chrosomus *		
Photogenis stigmaturus *		Photogenis xænurus *
Photogenis callistius *	Photogenis eurystomus *	
Photogenis cæruleus *		Episema callisema *
Luxilus cornutus *		
Nototropis lirus *		
Nototropis stilbius *		
Notemigonus americanus *		Notemigonus ischanus *
Catostomus nigricans etowanus *		
Erimyzon oblongus *	Erimyzon oblongus *	Erimyzon oblongus *
Erimyzon melanops *		Myxostoma papillosum *
Myxostoma duquesnei *	Myxostoma duquesnii var.	
Myxostoma duquesnii lachrymalis *		Myxostoma cervinum *
Myxostoma euryops		
Ichthælurus punctatus *	Ichthælurus punctatus *	Ichthælurus punctatus *
Amiurus cupreus *		Amiurus brunneus *
Noturus leptacanthus		
Anguilla vulgaris *		
Lepidosteus osseus		

SUPPLEMENTARY PAPERS.

I. FISHES OF THE FRENCH BROAD AND CLINCH RIVERS.

A visit to Powell's River and other tributaries of Clinch River, near Cumberland Gap, Tenn., and to the French Broad and Big Pigeon Rivers, near Newport, Tennessee, enabled us to make considerable collections. Most of the species obtained have been well described by Prof. Cope, and I confine myself to a simple enumeration of them.

1. Alvordius aspro Cope and Jordan.
2. Diplesium simoterum (Cope) Copeland.
3. Micropterus salmoides (Lacépède) Gill.
4. Ambloplites rupestris (Raf.) Gill.
5. Haploidonotus grunniens Raf.
6. Potamocottus, sp. (carolinæ Gill?).
7. Xenisma catenata (Storer) Jordan.
8. Campostoma anomalum prolixum (Stor.) Jord.
9. Nocomis biguttatus (Kirt.) Cope and Jord.
10. Nocomis amblops (Raf.) Cope and Jord.
11. Phenacobius uranops Cope.
12. Luxilus cornutus (Mit.) Jord.
13. Luxilus coccogenis (Cope) Jord.
14. Luxilus galacturus (Cope) Jord.
15. Nototropis photogenis (Cope) Jordan (Photogenis leucops Cope).
16. Nototropis dinemus (Raf.) Jordan (Alburnellus jaculus Cope).
17. Catostomus teres (Mit.) Le S.
18. Catostomus nigricans Le S.
19. Erimyzon oblongus (Mit.) Jord.
20. Myxostoma duquesnei (Le S.) Jord.
21. Ichthælurus punctatus (Raf.) Jord.
22. Pelodichthys olivaris (Raf.) Gill and Jord.
23. Noturus eleutherus Jordan (Sp. nov.).

A single specimen of a Noturus, about 4 inches long, was taken alive from the jaws of a large water snake (*Tropidonotus sipedon*). It is related to *N. miurus* Jordan MSS. (*sp. nov.*), but differs in several respects from my specimens of that species. The anal fin contains but 11 rays, but as its position is unusually far behind the vent, this peculiarity may be the result of some accident to the fish when younger. The characters shown by my specimen are brought out in the following synopsis of the described species of Noturus, drawn from the type specimens of *exilis*, *miurus*, *marginatus*, *eleutherus* and *leptacanthus*, from numerous examples of *flavus* and *gyrinus*, and from the published descriptions of the other species. The new species or variety from the French Broad, I here refer to as *N. eleutherus*, in allusion to the free adipose fins.

* Pectorals with 6 to 8 soft rays; spines stout, that of the dorsal two-fifths the height of the fin, or more.

† Pectoral spines merely rough, not serrated, but usually channelled behind; body stout and thick, tadpole-like.

a. Head about 4 in length, shortish and very broad; depth 5 or less in length; dorsal spine nearer anal than snout; adipose fin high, not notched at all; anal fin high, of about 13 rays; barbels shortish; spines all strong; pectoral spine straightish, half the length of the head. Color nearly uniform yellowish brown, a dark lateral streak. Ohio Valley, to N. Y. and Penn., etc. . . . . GYRINUS (Mit., 1818).

†† Pectoral spines very strongly serrated behind, the lower half of each being provided with 5 or more prominent recurved hooks; anterior edges finely dentate or nearly smooth; body elongated; head flattened.

b. Spines extremely strong; pectoral spine curved, half or more length of head; body moderately elongated, the depth about $5\frac{1}{2}$ in length; head broad and flat, $3\frac{3}{4}$ in length; dorsal spine nearer anal than tip of snout; upper jaw notably longest; distance from snout to dorsal more than one-third of length; dorsal spine 2 to $2\frac{1}{2}$ in head.

c. Adipose fin continuous, high, interrupted by a notch, which does not quite break its continuity, the rudimentary caudal rays beginning in the notch; anal with 12 or 13 rays; dorsal region elevated, and ventral region correspondingly contracted, producing a hump-backed appearance; much mottled blackish and yellowish; margins of dorsal, anal, and caudal fins, and a broad patch in the middle of the adipose fin, definitely black. Ohio Valley and S. W. . . . . MIURUS (Jordan, 1877).

cc. Adipose fin high, divided to its base, a space nearly twice the diameter of the eye intervening between its termination and the beginning of the rudimentary caudal rays; spines larger and rougher than in any of the preceding; anal fin short and deep, of eleven rays (abnormal?); fins not black-margined; no definite black blotch on adipose fin; eye small; interorbital space rather narrow; form, coloration, and general appearance of a young *Pelodichthys*. French Broad R., Tennessee ELEUTHERUS Jordan, 1877.

bb. Spines shorter and weaker; pectoral spine straightish, about one-third the length of the head; dorsal spine $3\frac{1}{4}$ in head; body much elongated, more so than in any of the others, the depth one-sixth or less of the length; head small, $4\frac{1}{4}$ in length; dorsal spine rather nearer snout than beginning of anal; jaws nearly equal; dorsal fin scarcely higher than long; distance from snout to dorsal less than one-third of length; adipose fin with a shallow notch, as in *marginatus;* color nearly uniform; tip of dorsal blackish; anal rays 14 to 16. Illinois. Wisconsin. . . . . . EXILIS (Nelson, Dec., 1876).

bbb. Spines moderate, the serrations weak; pectoral spine about half length of head; body greatly elongated, as in the preceding; head broad, thin, and very flat; $3\frac{1}{2}$ in length; dorsal spine much nearer anal than snout; dorsal fin $\frac{1}{4}$ higher than long; distance from snout to dorsal more than $\frac{1}{3}$ of length; premaxillary band of teeth without backward process; anal rays 16 to 20. Ohio to Penn. and N. C. . . . . . MARGINATUS (Baird, 1869).

** Pectoral fins with 8 soft rays; head very small and narrow, with a small eye; the upper jaw much projecting; spines very short and small; that of the dorsal not one-third the height of the fin, and all of them less than one-fourth of the head; head 4 in length; anal rays about 14; dorsal nearer anal than snout; adipose fin not notched at all; color mottled. Alabama River. LEPTACANTHUS (Jordan, 1877).

*** Pectorals with 9 to 11 soft rays, adipose fin notched.

c. Head little longer than broad, much depressed and flat; barbels rather short; intermaxillary band of teeth with a very distinct backward process; pectoral spine coarsely dentate outside, grooved within; middle of body nearly cylindrical, subcarinate above; head deep, yet flattened; 4 in length; size very large, reaches length of a foot. Platte R. to St. Lawrence R., Ohio Valley, and N. E. . . *FLAVUS (Raf., 1818).

* = *N. occidentalis* Gill, 1862. = *N. platycephalus* Günther, 1864. *N. occidentalis* Gthr., is probably *N. marginatus*.

II. ROCK CASTLE RIVER.

In the Rock Castle River and tributaries, in Rock Castle and Laurel Counties in S. E. Kentucky, we obtained the following species:—

1. Etheostoma flabellare Raf.
2. Boleosoma maculatum Ag. (= brevipinne Cope).
3. Diplesium simoterum (Cope) Copeland.
4. Alvordius aspro Cope and Jor.
5. Percina caprodes (Raf.) Grd.
6. Micropterus salmoides (Lac.) Gill.
7. Micropterus pallidus (Raf.) Gill and Jor.
8. Ambloplites rupestris (Raf.) Gill.
9. Xenotis megalotis (Raf.) Jor.
10. Campostoma anomalum (Raf.) Ag.
11. Hyborhynchus notatus (Raf.) Ag.
12. Semotilus corporalis (Mit.) Putn.
13. Nocomis biguttatus (Kirt.) Cope and Jor.
14. Phenacobius uranops Cope.
15. Chrosomus erythrogaster Raf.
16. Luxilus cornutus (Mit.) Jord.
17. Luxilus galacturus (Cope) Jord.
18. Lythrurus ardens (Cope) Jord.
19. Hemitremia vittata Cope.
20. Nototropis dinemus (Raf.) Jord.
21. Nototropis micropteryx (Cope) Jord.
22. Catostomus teres (Mit.) Le S.
23. Catostomus nigricans Le S.
24. Erimyzon oblongus (Mit.) Jord.
25. Myxostoma duquesnii (Le S.) Cope.
26. Anguilla vulgaris Fleming.
27. Pelodichthys sp. (nov.?)

A single specimen of (Pelodichthys), about a foot long, was taken near Livingston in the Rock Castle, but having no means of preserving it at hand, I was compelled to throw it away. My field notes indicate a different species from *P. olivaris*, but are not sufficient to characterize it. They are as follows:—

Head very long and broad, 3½ in length, the depth much less; lower jaw longest; body moderately elongated. Dorsal spine not obvious, apparently slender and closely connected to the first short ray. In front of this a short stub beneath the skin.

Barbels long, longer than head.

Color pale, nearly uniform; D., I, 8. P., I, 7 +. A., 15. Length about a foot.

No detailed specific description of **P. olivaris* has ever been published. The following characters are shown by two specimens from the French Broad, respectively 10 and 14 inches in length.

Body very long, slender, much depressed forwards, closely compressed behind. Head very long and flat, tapering downwards and forwards, broadly rounded in front. Eye small; barbel shorter than head.

Dorsal spine small, moderately stout, enveloped in skin, about half the height of the fin. A concealed ventral spine, about ⅓ the height of the fin.

Pectoral spine very strong, ⅔ the height of the fin, flattened, serrated behind, somewhat enveloped in the skin at base. Adipose fin high and long. Dorsal spine nearer snout than tip of adipose fin.

Caudal fin slightly emarginate. Jaws thin and flat; the lower considerably longer; the width of the mouth half the length of head. Jaws with a very broad band of slender pointed teeth, that of the upper jaw with a strong backward process. Lateral line very distinct.

Color mottled brown and yellowish above, chiefly yellowish white below; fins blackish, mottled.

Fin rays, D., I, 7. A., 13. V., I, 8. P., I, 10.

MEASUREMENTS.

	NO. 1.	NO. 2.
Length, in inches	10	14
Head in length	3½	3⅗
Depth in length	5¾	6
Eye in head	9	8
Eye in snout	3	3½
Depth of head in its length	2½	2¼
Interorbital width in head	2½	2⅓
Dorsal spine in head	3⅓	2¼
Dorsal rays in head	1⅞	2
Pectorals in head	1⅞	2
Pectoral spine in head	3	2⅞
Ventrals in head	2⅓	2⅓
Ventral spine in head	6	5½
Base of anal in head	1¾	2

*In Gill's Report on Ichthyology, Capt. Simpson's Exploration, lately published, is a full account of this species with its synonymy. Rafinesque's generic name Pylodictis (properly Pelodichthys) has a year's priority over Hopladelus.

We heard several peculiar vernacular names for fishes on the Rock Castle and Cumberland, some of which may be worth recording:

Dollardee.	Helioperca pallida.
Brim.	Xenotis megalotis.
Log Perch.	Percina caprodes.
Jumper. Jumping Pearch.	Micropterus sps.
Blue Minnow.	Luxilus galacturus.
Red Minnow.	Lythrurus ardens.
Minny (with contempt).	Nototropis micropteryx.
Steel-backed Minnow.	Campostoma anomalum.
Creek Chub.	Semotilus corporalis.
River Chub.	Nocomis biguttatus.

I was told by a fisherman that the young of the latter species (*N. biguttatus*) made the best kind of bait for "Jumping Pearch," as "it will swim longer than any other with a hook in its body." It will be observed that the above are almost the identical words used by Rafinesque concerning his "Indian Chub" (*Luxilus kentuckiensis*).

III. WHITE RIVER, INDIANA.

As exact synopses of the fauna of any region are desirable, I here append a list of the fishes taken by Prof. H. E. Copeland and myself in the immediate neighborhood of Indianapolis, Ind., in White River and small tributaries during the three years past. The relative abundance of the different species, as shown by our collections, is indicated by the words "common," "frequent," "uncommon," and "rare."

PERCIDÆ.

1.	Microperca punctulata Putn.	Rare.
2.	Etheostoma flabellare Raf.	Rare.
3.	Nothonotus camurus (Cope) Jor.	Rare.
4.	Pœcilichthys variatus (Kirt.) Ag.	Common.
5.	Pœcilichthys spectabilis Ag.	Frequent.
6.	Pleurolepis pellucidus (Baird) Ag.	Frequent.
7.	Boleosoma maculatum Ag.	Common.
8.	Alvordius aspro Cope and Jor.	Frequent.
9.	Ericosma evides Jordan and Copeland	Rare.

10.	Rheocrypta copelandi Jor., MSS.	Rare.
11.	Diplesium blennioides (Raf.) Jor.	Common.
12.	Percina caprodes (Raf.) Grd.	Common.
13.	Pomoxys hexacanthus (C. and V.) Ag.	Rare.
14.	Pomoxys annularis Raf.	Uncommon.
15.	Ambloplites rupestris (Raf.) Gill	Common.
16.	Micropterus pallidus (Raf.) Gill and Jor.	Common.
17.	Micropterus salmoides (Lac.) Gill	Common.
18.	Apomotis cyanellus Raf. (et vars.)	Common.
19.	Lepiopomus macrochirus Raf. (nephelus Cope) .	Frequent.
20.	Helioperca pallida (Mit.) Jor.	Common.
21.	Xenotis inscriptus (Ag.) Jor.	Frequent.
22.	Xenotis megalotis (Raf.) Jor.	Common.
23.	Xenotis lythrochloris Jor., MSS.	Frequent.
24.	Xenotis aureolus Jor., MSS.	Frequent.

SCIÆNIDÆ.

25.	Haploidonotus grunniens Raf.	Uncommon.

COTTIDÆ.

26.	Potamocottus wilsonii (Grd.) Gill	Uncommon.
27.	Potamocottus carolinæ Gill	Rare.

ATHERINIDÆ.

28.	Labidesthes sicculus Cope	Common.

CYPRINODONTIDÆ.

29.	Zygonectes notatus (Raf.) Jor.	Common.

UMBRIDÆ.

30.	Umbra limi (Kirt.) Gthr.	Rare.

ESOCIDÆ.

31.	Esox salmoneus Raf.	Common.

CYPRINIDÆ.

32.	Campostoma anomalum (Raf.) Ag.	Common.
33.	Hyborhynchus notatus (Raf.) Ag.	Common.
34.	Hybognathus argyritis Grd.	Rare.
35.	Ericymba buccata Cope	Common.
36.	Semotilus corporalis (Mit.) Putn.	Common.
37.	Nocomis biguttatus (Kirt.) Cope & Jor.	Common.
38.	Nocomis amblops (Raf.) Cope & Jor.	Common.
39.	Nocomis dissimilis (Kirt.) Cope & Jor.	Frequent.

40.	Rhinichthys obtusus Ag.	Common.
41.	Hybopsis stramineus Cope	Frequent.
42.	Chrosomus erythrogaster Raf.	Common.
43.	Lythrurus diplæmius (Raf.) Jor.	Common.
44.	Luxilus cornutus (Mit.) Jor.	Common.
45.	Cyprinella analostana Grd.	Common.
46.	Photogenis spilopterus Cope	Frequent.
47.	Episema scabriceps Cope	Locally abund.
48.	Episema ariomma Cope	Frequent.
49.	Nototropis dinemus (Raf.) Jor.	Frequent.
50.	Nototropis rubellus (Ag.) Jor.	Common.
51.	Nototropis rubrifrons (Cope) Jor.	Common.
52.	Notemigonus americanus (Lac.) Jor.	Common.

CATOSTOMIDÆ.

53.	Catostomus teres (Mit.) Le S.	Common.
54.	Catostomus nigricans Le S.	Common.
55.	Erimyzon oblongus (Mit.) Jor.	Common.
56.	Erimyzon melanops (Raf.) Jor.	Common.
57.	Myxostoma duquesnii (Le S.) Jor.	Common.
58.	Carpiodes carpio Raf.	Rare.

SILURIDÆ.

59.	Ichthælurus punctatus (Raf.) Jor.	Rare.
60.	Amiurus melas Raf.	Uncommon.
61.	Amiurus cupreus (Raf.) Gill	Common.
62.	Amiurus xanthocephalus Raf.	Common.
63.	Noturus sialis Jor., MSS.	Common.
64.	Noturus flavus Raf.	Frequent.
65.	Noturus miurus Jor.	Common.

LEPIDOSTEIDÆ.

66.	Lepidosteus osseus (L.) Ag. (huronensis Rich.)	Uncommon.

POLYODONTIDÆ.

67.	Polyodon folium Lacep.	Uncommon.

PETROMYZONTIDÆ.

68.	Ammocœtes niger (Raf.) Jor.	Locally abund.
69.	Ammocœtes argenteus (Kirtland) Jor.	Rare.

⁎ The printing of this paper was begun in December, 1876. The actual date of final publication is June, 1877.

XXX.—*The Myxomycetes of the United States.*

BY M. C. COOKE, M.A.; LL.D.; A.L.S.

Corresponding Member Acad. Sci., N. Y. Read April 16th, 1877.

The production of a monograph of the Myxomycetes by Dr. J. Rostafinski, has presented an opportunity for a thorough revision of the North American species, and a new classification, in accordance, as far as possible, with this monograph. As the Polish language (in which the monograph is written) is one not generally read, there needs no apology for presenting the arrangement in an English dress.

This communication necessarily is of a very technical and uninviting character; but it is hoped that what is lacking in general interest will be compensated for in utility. There is no doubt whatever that the system proposed by Rostafinski is the one which will in the main be generally adopted; and as it is now impossible to obtain the original work, this synopsis is offered to the Academy for the assistance of Transatlantic mycologists. Although the measurements of the spores are given, that is by no means the most important element in the new classification.

For half a century the *Myxomycetes* have been classified on the basis of external characters alone, or such only as could be discerned by the aid of a pocket lens. In one or two instances an additional genus has been constituted in which some prominence was given to characters determined by the aid of the microscope, as for instance in the genus *Badhamia* proposed by Berkeley in 1851, but the general feature of the classification was one of external characteristics. The advance of Microscopy left behind such an incomplete system for many years, and at length Professor de Bary turned his attention to the subject, but made no definite propositions for a rectification of the classification, until in 1873 his pupil at Strasburg, Dr. Joseph Rostafinski, published in an inaugural address the outlines of a system of classification, based on new principles. In 1875, the more elaborate, and detailed "Monografia Sluzowce" expanded and illustrated his views in a complete and almost exhaustive manner.

At first Rostafinski recognized in the "Mycetozoa," as he termed them, two primary divisions, in one of which the spores were developed externally, on the surface of certain definite spore-bearers, and in the other they were developed internally, covered at first by a protective membrane or sporangium. In the monograph only a passing notice is given of the first division, and in the more recent "supplement" it is not mentioned at all. The inference to be deduced from this is that the Exosporous Mycetozoa are regarded as an encumbrance to the system, and are intended to be ignored.

The Mycetozoa proper being thus reduced to unity, our illustrations will be understood to refer to these alone. As in the *Agaricini*, so in the *Myxomycetes*, the first steps in classification relate to the colour of the spores. Two sections include the species (1) with violet spores, and (2) those having spores otherwise coloured. The *Amaurosporæ* and the *Lamprosporæ* are the two primary sections, each of which is subsequently again divided into two subsections, in one of which no evident capillitium is present, and in the other some kind of capillitium is always developed.

As the old method was based wholly on external features, so the new has nearly all its essential characteristics relating to internal structure. If there is any one feature in which the Rostafinski method is more assailable than another, it is the too slight regard which is given to external features. Naturally enough, in escaping from one extreme, the rebound has been to the other. Time and experience will undoubtedly hereafter develop a "happy medium."

In making use of this system, the first determination requisite is the colour of the spores, then the presence or absence of a capillitium, and finally the character of the capillitium, when present, in all its details. Undoubtedly the leading idea of the classification is the capillitium, or the capillitium and columella, and this should be borne in mind in any attempt which is made to master the details of the scheme.

The negative features of the method are important to remember in the transition from one system to another. The form of the sporangium must not be relied upon to the fullest extent of the old system; and, especially in some genera, the presence or absence of a stem is to be regarded as of little moment. Above all, *colour*, as exhibited in sporangium or stem, must be held as wholly untrustworthy, and this extends equally to the capillitium and spores in the *Lamprosporæ*.

Some disappointment will probably be felt at seeing so many old friends, formerly designated by distinct names, and each supposed to possess an individuality of its own, all thrown together in such species as *Didymium farinaceum* and *Trichia fragilis*. And again, on the other hand, that such minute differences, which require both faith and practice to appreciate, should separate *Trichia affinis* from *Trichia chrysosperma*. These applications of the system, however, do not vitiate the system itself, which undoubtedly must be accepted as a great and thorough reform of the classification of the *Myxomycetes*.

It is unnecessary to attempt any controversion of the proposition once made, but soon ignored, that these organisms are more intimately related to animals than plants. Although the proposed name of *Mycetozoa* is still retained by Rostafinski, it is entirely divested of any insinuation in the direction of *Infusoria* or *Rhizopoda*.

This arrangement of the American species was completed before the appearance of Rostafinski's supplement to his monograph, and although all essential corrections have been made, the sequence of orders and genera is that of the monograph. We have appended a synopsis of all the Orders, Families, and Genera, as they finally appear in the Supplement. Two of the genera established in the monograph, viz.: *Trichamphora* and *Scyphium*, have been cancelled, and two new genera added, which are indicated by an asterisk (*).

Sub-Division I. AMAUROSPORÆ.

Section A. *ATRICHÆ* (without capillitium).

ORDER I. **Protodermeæ.**

FAMILY 1. PROTODERMACEÆ.

Genus 1. *Protoderma.*

Section B. *TRICHOPHORÆ* (with capillitium).

ORDER II. **Calcareæ.**

FAMILY 2. CIENKOWSKIACEÆ.

Genus 2. *Cienkowskia.*

FAMILY 3. PHYSARACEÆ.

Genus 3. *Badhamia.*
" 4. *Physarum.*
" 5. *Fuligo.*
" 6. *Craterium.*
" 7. *Leocarpus.*
" 8. *Crateriachea.*
" 9. *Tilmadoche.*

FAMILY 4. DIDYMIACEÆ.

Genus 10. *Chondrioderma.*
" 11. *Didymium.*
" 12. *Lepidoderma.*

FAMILY 5. SPUMARIACEÆ.

Genus 13. *Diachea.*
" 14. *Spumaria.*

ORDER III. **Amaurochæteæ.**

FAMILY 6. ECHINOSTELIACEÆ.

Genus 15. *Echinostelium.*

FAMILY 7. STEMONITACEÆ.

Genus 16. *Lamproderma.*
" 17. *Comatricha.*
" 18. *Stemonitis.*

FAMILY 8. AMAUROCHÆTACEÆ.

Genus ~~19~~. 21 *Amaurochæte.*

FAMILY 9. BREFELDIACEÆ.

Genus 20. *Brefeldia.*

FAMILY 10. ENERTHENEMACEÆ.
Genus 21. *Enerthenema.*

Sub-Division II. LAMPROSPORÆ.

Section A. *ATRICHÆ* (without capillitium).

ORDER IV. **Anemeæ.**

FAMILY 11. DICTYOSTELIACEÆ.
Genus 22. *Dictyostelium.*

FAMILY 12. LICEACEÆ.
Genus 23. *Licea.*
" 24. *Tubulina.*
" 25. *Lindbladia.*

FAMILY 13. CLATHROPTYCHIACEÆ.
Genus 26. *Clathroptychium.*
" 27. *Enteridium.*

ORDER V. **Heterodermeæ.**

FAMILY 14. CRIBRARIACEÆ.
Genus 28. *Dictydium.*
" 29. *Heterodictyon.*
" 30. *Cribraria.*

Section B. *TRICHOPHORÆ* (with capillitium).

ORDER VI. **Columelliferæ.**

FAMILY 15. RETICULARIACEÆ.
Genus 31. *Siphoptychium.**
" 32. *Reticularia.*

ORDER VII. **Calonemeæ.**

FAMILY 16. PERICHÆNACEÆ.
Genus 33. *Perichæna.*

FAMILY 17. ARCYRIACEÆ.
Genus 34. *Cornuvia.*
" 35. *Arcyria.*
" 36. *Lachnobolus.*
" 37. *Dermodium.*
" 38. *Lycogala.*
" 39. *Oligonema.*

FAMILY 18. TRICHIACEÆ.
Genus 40. *Prototrichia.**
" 41. *Trichia.*
" 42. *Hemiarcyria.*

MYXOMYCETES Wallr.

Myxogastres Fries, Sys. Myc., iii, 67.
Myxogasteres Endl., Gen., p. 25.
Mycetozoa DeBary and Rostafinski.

Division I. EXOSPOREÆ.

This division, as originally proposed, contains the genus *Ceratium*, but latterly it has scarcely been insisted upon as a consistent ally of the 2d Division.

Division II. ENDOSPOREÆ.

Sub-Division I. AMAUROSPORÆ.

Spores violet, or brownish violet.

Section A. *ATRICHÆ.*

Sporangia without a capillitium.

Order I. Protodermeæ.

Family 1. PROTODERMACEÆ.

Genus 1. *Protoderma* R.

1. Protoderma pusilla (Schr.).

Licea pusilla Schrad., t. 6, fig. 4. Schw., Am. Bor., No. 2316.
Physarum licea Fries, Sys. Myc., iii, 143.

Spores .017^{mm}.

On pine wood. Bethlehem (Schw.); Carolina (Curt.).

Section B. *TRICHOPHORÆ.*

Sporangia constantly possessed of a capillitium.

Order II. Calcareæ.

Family 2. CIENKOWSKIACEÆ.

Genus 2. *Cienkowskia* R.

2. Cienkowskia reticulata (A. and S.).

Physarum reticulatum Alb. and Schw., t. 7, f. 2. Schw., Amer. Bor., No. 2295.
Diderma reticulatum Fries, Sys. Myc., iii, 112.

Spores ·009^{mm}.

On dead leaves. Salem (Schw.); Car. (Curt.); Bethlehem (Schw.).

FAMILY 3. PHYSARACEÆ.

Genus 3. *Physarum* P.

3. PHYSARUM LIVIDUM R.

Physarum effusum Link, Herb.
Physarum griseum Link, Diss., ii, 42.
Spumaria licheniformis Schwz., Amer. Bor., No. 2364.
Didymium glaucum Phillips, in Grevillea, V, 113.

San Francisco (Harkness).

Var. B. *licheniformis* Schw.

Spores ·01–·0125^{mm}.

This variety is the United States form. If *Physarum effusum* Schw., Am. Bor., 2297, is the same as Link's, it also belongs to this species.

Bethlehem (Schw.).

4. PHYSARUM DIDERMOIDES (Ach).

Diderma oblongum Schum., Saell. 1423.
Didymium congestum B. and Br., Ann. N. H., 1850, p. 365. Cooke, Hdbk. No. 1130.

Spores ·0125—·014^{mm}.

Car. (fide Rostafinski).

5. PHYSARUM AURISCALPIUM Cooke.

Sporangia globose, depressed, ochrey yellow, covered with orange mealy scales above, with a very short, almost obsolete, stem. Columella not evident. Capillitium strongly developed, expanded at the angles, which are filled with yellow granules of lime, combined into a network; deposits of lime in irregular angular masses. Spores violet-brown, nearly smooth or minutely warted, .013—.015^{mm}. diam. *Cooke, Brit. Myx.*, fig. 253.

On rotten wood. Carolina (Ravenel, No. 1854).

6. PHYSARUM SCHUMACHERI Spr.

Physarum compactum Ehr., Syl. Ber., 21. Schw., Am. Bor., No. 2283.
Physarum citrinum Schum., Saell., 1436.
Diderma citrinum Fries, Sys. Myc., iii, 100.
Didymium melleum B. and Br., Cey., No. 751.
Didymium chrysopeplum B. and C., Grev., No. 348.

Spores ·007—·011^{mm}.

Car. (Schw.).

This is probably the species intended by Schweinitz.

7. PHYSARUM SULPHUREUM A. and S., t. 6, fig. 1.

Physarum sulphureum Schw., Amer. Bor., No. 2289.

Spores ·01—·011^{mm}.

On dead leaves. Car. (Schw., Curt.).

8. PHYSARUM LEUCOPUS Link, Diss., ii, 42. Schw., Amer. Bor., 2275.

Didymium leucopus Fries, Sys. Myc., iii, 121.
Physarum bullatum Ditm., t. 22.

Spores ·0095—·011^{mm}.

Bethlehem (Schw.).

9. PHYSARUM CINEREUM (Batsch). Schw., Amer. Bor., No. 2291. Rav., Fun. Car., i, 79.

Didymium cinereum Fries, Sys. Myc., iii, 126.
Physarum plumbeum Fries, Sys. Myc., iii, 142.
Didymium terrigenum B. and C.

Spores ·0075—·013^{mm}.

On leaves, twigs, etc. Car. (Schw.); New York (Schw., Peck); Car. (Cur., Rav.); San Francisco (Harkness).

[*Physarum luteo-valve* Schw., Am. Bor., 2298, is very uncertain. Fries has referred it to *Perichœna*, and Rostafinski does not venture to refer it to anything.]

10. PHYSARUM PSITTACINUM Ditm., t. 62.

Didymium fulvipes Fr., Stirp.
Didymium erythrinum Berk., Grev., No. 344.
Didymium Ravenelii B. and C., Grev., No. 346.

Spores ·0083—·0092^{mm}.

On damp putrid logs. Car. (Rav.).

11. PHYSARUM PULCHERRIMUM B. and Curt. In N. A. Fungi, Grevillea, No. 354. Rav., Fungi Car., ii, 77.

Spores ·0083—·0092^{mm}.

On dead pine wood. Car. (Rav.); Penn. (Mich.).

12. PHYSARUM BERKELEYI Rtfki., Mon. p. 105.

Physarum flavicomum Berk., in Hook., Journ., 1845, p. 66.
Physarum cupriceps B. and Rav., in Rav., Fungi Car., iii, 76.
Physarum cupripes B. and Rav., in Grevillea, vol. iii, p. 65.
Physarum roseum B. and Br., Grevillea, vol. iii, p. 65.

On dead wood.

Spores ·0083—·01^{mm}.

Car. (Rav.).

Physarum pulcherripes Peck, is probably referable to this very variable species.

13. PHYSARUM DITMARI Rost.

Physarum virescens Ditm., Sturm, t. 61.
Physarum thejoteum Fr., Gast., p. 21.
Didymium nectriæforme B. and C., Grev., 353.
Didymium croceo-flavum B. and Br., Cey., 757.

Spores ·006—·009^{mm}.

New England (Murray); Carolina (Ravenel); New York (Peck).

14. PHYSARUM CONGLOMERATUM (Fr.).

Diderma conglomeratum Fr., S. M., iii, 111.
Diderma granulatum Fr., S. M., iii, 210.

On wood, leaves, etc. California (Harkness).

15. PHYSARUM POLYMORPHUM (Mont.).

Didymium polymorphum Mont., Cub., p. 314.
Didymium polycephalum Rav., Grevillea.
Didymium luteo-griseum B. and C., Grevillea, iii, p. 65.
Didymium connatum Peck, N. Y. Reports.

Spores ·0088—·01^{mm}.

On dead leaves. Car. (Curt., Rav.); N. Jersey (Berk.); New York (Peck).

16. PHYSARUM CONTEXTUM Pers., Syn., 168. Schw., Am. Bor., No. 2290.

Diderma contextum Pers., Obs., i, 89. Ditm., t. 31.
Leocarpus contextus Fries, S. V. S., 450.
Diderma flavidum Peck, N. Y. Reports.

Spores ·011—·013^{mm}.

On dead stems of plants. Car. (Schw., Curt.); Bethlehem (Schw.).

17. PHYSARUM GYROSUM R.

Reticularia muscorum Fr., Sys. Myc., iii, 91.
Æthaleum muscorum A. and S., t. vii, f. 1. Schw., Am. Bor., 2371.

Spores ·0083—·011^{mm}.

On mosses. Car. (Schw., Curt.); Boston (Farlow).

18. PHYSARUM SINUOSUM (Bull.).

Angiorideum sinuosum Grev., t. 310.
Diderma valvatum Fr., Sys. Myc., iii, 109.
Diderma pallidum B. and C., in Grevillea.
Angiorideum valvatum Fr., Sys. Myc.
Physarum bivalve Schw., Am. Bor., 2293.

Spores ·0083—·009^{mm}.

On pine leaves, stems, etc. Car. (Curt.); Salem (Schw.); Boston (Farlow); N. Eng. (Frost); N. York (Peck).

19. PHYSARUM PETERSII B. and Curt., in Grevillea, N. A. Fungi, No. 356.

Flocci yellowish, spores black.

On dead wood. Ala. (Peters).

Var. A. FARLOWI R.
Physarum Farlowi Rost., MSS.
Boston and Pennsylvania.

Var. B. INTERMEDIUM Rost.
Alabama.

Var. C. GENUINUM Rost.
Alabama.

20. PHYSARUM OBRUSSEUM (B. and C.).

Didymium obrusseum B. and C., Cub., 532.
Didymium tenerrimum B. and C., Cub., 533.

Spores ·008—·01mm.

Texas (Lindheimer); New Orleans (Drummond).

21. PHYSARUM SIMILE Rost.

Spores ·0075mm.

Carolina (Curtis).

22. PHYSARUM ELIPSOSPORUM Rost.

Enteridium olivaceum Schw., Am. Fung., 2365.

Carolina (Schw.).

23. PHYSARUM SCHWEINITZII, Berk., in Grevillea, N. A. Fungi, No. 358.

Polyangium vitellinum Schw., Am. Bor.

On vegetable fragments. Bethlehem (Schwz.).

SPECIES UNCERTAIN.

24. PHYSARUM ELEGANS Schw., Am. Bor., No. 2294.

On leaves and plants. Salem (Schw.); Car. (Curt.).

25. PHYSARUM MUSCICOLA Schw., Am. Bor., No. 2278.

New York (Torrey).

26. PHYSARUM POLYŒDRON Schw., Am. Bor., 2300.

On old trunks of *Juglans*. Bethlehem (Schw.).

27. PHYSARUM CŒSPITOSUM Schw., Am. Bor., No. 2301.

On leaves and stems of *Rhododendron*. Bethlehem (Schw.).

[*Physarum cœspitosum* Peck, from the color of the spores, cannot be a *Physarum;* it may be the species of Schweinitz, for aught we can tell.]

28. PHYSARUM ATRUM Schw., Am. Bor., 2299.

On bark. Bethlehem (Schw.).

Whatever Schweinitz's species may be, it does not appear that Rostafinski considers the *Physarum atrum* of Fries to be a Myxogaster at all.

Genus 4. *Craterium* Trent.

SUB-GEN. A. LEIOCRATERIUM.

29. CRATERIUM VULGARE Ditm., t. 9. Schw., Am. Bor., 2305.

Craterium pedunculatum Trent., Curtis, Cat., p. 112.

Spores ·0083—·01^{mm}.

On leaves, stems, etc. Car. (Curt., Schw.).

SUB-GEN. B. TRACHYCRATERIUM.

30. CRATERIUM LEUCOCEPHALUM Pers. Ditm., t. 4. Schw., Am. Bor., 2306.

Craterium leucostictum Fries, Sys. Myc., iii, 152.
Craterium pruinosum Corda, Ic., vi, f. 33.

Spores ·0083—·01^{mm}.

On bits of wood, etc. Car. (Schw., Curt.); N. York (Peck).

INCERTÆ SEDIS.

31. CRATERIUM MINIMUM B. and Curt., in N. A. Fungi, No. 367.

On dead grass, etc. Car. (Curt.).

32. CRATERIUM PORPHYRIUM Schw., Am. Bor., No. 2308.

On rotten wood. Bethlehem (Schwz.).

Genus 5. *Crateriachea* R.

The only species, *Crateriachea mutabilis* R., is not recorded in the United States, unless *Craterium obovatum* Peck, proves to belong to this genus, which it is too imperfectly described to determine.

Genus 6. *Tilmadoche* Fr.

33. TILMADOCHE NUTANS (Pers.).

Physarum nutans Pers., Syn., 171. Schw., Am. Bor., 2277.
Physarum bulbiforme Schum., Saell., 1432. Fl. Dan., t. 1974, f. 3.
Tilmadoche cernua Fr., S. V. S., 451.
Physarum connatum Ditm., in Sturn, t. 41.
Didymium polycephalum B. and Curt., MSS.

Spores ·009—·01^{mm}.

On wood and leaves. Car. (Schw., Curt.); Penn. (Schwz.). Boston (Farlow); Conn. (Wright).

34. TILMADOCHE GRACILENTA (Fr.).

Physarum gracilientum Fries, Sys. Myc., iii, 133.
Didymium furfuraceum Fr., Sys. Myc., iii, 116. Curt., Cat., p. 111.
Tilmadoche soluta Fries, S. V. S., 454.

On dead wood. Car. (Curt.).

35. TILMADOCHE MUTABILIS Rtfki.

Physarum aureum Pers., Disp., t. i, f. 6. Schw., Am. Bor., No. 2286.
Physarum viride Pers., Syn., 172, t. 24. Schw., Am. Bor., No. 2285.
Physarum nutans B. *viride* Fr., Sys. Myc., iii, 129.
Physarum nutans β. *aureum* Fr., Sys. Myc., iii, 129.
Physarum striatum C. *aurantiacum* Fr., Sys. Myc., iii, 131.

Car. (Schw., Curt.); Bethlehem (Schw.).

Var. B. *aurantiacum.* Schw., Am. Bor., 2287.

Car. (Schw.); San Francisco (Harkness).

36. TILMADOCHE OBLONGA (B. and C.).

Trichamphora oblongum B. and C., Grev., No. 360.

Spores ·0075—·01^{mm}.

Pennsylvania (Michener).

Genus 7. *Leocarpus* Link.

37. LEOCARPUS FRAGILIS (Dicks.).

Diderma vernicosum Pers., Obs., t. iii, f. 7.
Leocarpus vernicosus Link., Obs. i, 25. Nees, f. 110, Grev., t. 111. Rav., Fun. Car., i, 78.
Leangium vernicosum Fr., Stirp., p. 83. Schw., Am. Bor., 2303.

Spores ·012—·014^{mm}.

On stems, leaves, etc. Bethlehem (Schw., Curt.); Boston (Farlow); N. York (Peck); San Francisco (Harkness).

Genus 8. *Fuligo* Hall.

38. FULIGO VARIANS Sommf., Fl. Lapp.

Reticularia rufa Schw., Am. Bor., 2377.
Æthalium septicum Fr.
Æthalium flavum Schw., Am. Bor., 2367.
Æthalium candidum Schw., Am. Bor., 2368.
Æthalium violaceum Schw., Am. Bor., 2369.
Æthalium vaporarium Pers., Schw., Am. Bor., 2370.
Æthalium ferrincola Schw., Am. Bor., 2372.
Æthalium geophilum Peck, N. Y. Reports.

Spores ·0075—·01^{mm}.

On wood, stumps, etc. Car. (Schw., Curt.); Penn. (Schw.); Boston (Farlow); N. York (Peck).

Genus 9. *Trichamphora* Jungh.

This genus is abolished by Rostafinski in his "supplement."

Genus 10. *Badhamia* Berk.

39. BADHAMIA HYALINA Berk.

Physarum hyalinum Pers., Disp., t. 2, f. 4. Schw., Am. Bor., 2276.
Physarum membranaceum Schum., Herb.

Spores ·01—·0125mm.

On bark. Car. (Schw., Curt.); Penn. (Schw.).

40. BADHAMIA UTRICULARIS (Bull.).

Physarum utriculare Chev., Fl. Par., i, 337.

Spores ·01—·0125mm.

Penn. (Mich.).

Var. *Schimperiana*.

Maine (Fuller, 32).

41. BADHAMIA CHRYSOTRICHA (B. and C.).

Physarum decipiens Curt., in Sill. Journ.
Badhamia decipiens Berk. in Grev., N. A. Fungi, p. 66.
Physarum chrysotrichum B. and C., Grev., pp. 357.

On bark of oak trunk. Car. (Curt.). Ala. (Peters).

42. BADHAMIA PAPAVEREA Berk. and Rav. In Grev., N. A. Fungi, No. 359.

Spores ·01—·012mm.

On decayed oak wood. Car. (Rav.); Maine (Fuller).

43. BADHAMIA INAURATA Curt. Phillips, Grevillea, V, p. 115.

On wood. California (Harkness).

Genus 11. *Scyphium* R.

44. SCYPHIUM CURTISII Rtfki., Mon., 149.

Didymium Curtisii Berk., in Grevillea, N. A. Fungi, No. 351.

Spores ·0125mm.

On dead leaves, grass, etc. Car. (Curt., Rav.).

45. SCYPHIUM RUBIGINOSUM (Chev.).

Physarum rubiginosum Chev., Fl. Par., p. 338. Cooke, Hdbk., No. 1137.

Spores ·014mm. diam.

On leaves, stems, etc. New Jersey (Ellis, 2347); N. York (Peck, 87).

Rostafinski has abolished this genus in his "Supplement," and transferred both the species to *Badhamia*.

FAMILY 4. DIDYMIACEÆ.

Genus 12. *Didymium* Schr.

SUB–GEN. CIONIUM.

46. DIDYMIUM CLAVUS (A. and S.).

Physarum clavus A. and S., Consp., t. 2, f. 2. Schw., Am. Bor., No. 2281.

Spores ·0065—·0083^{mm}.

On dead leaves. Car. (Schw., Curt.); Canada (Poe); Boston (Farlow).

47. DIDYMIUM FARINACEUM Schrad, t. 3, f. 6.

Physarum farinaceum Pers., Syn., 174. Schw., Am. Bor., 2280.
Didymium lobatum Nees, f. 101. Schwz., Am. Bor., No. 2270.
Physarum melanopus Fr., Gast., 25.
Didymium melanopus Fr., Sys. Myc., iii, 114.
Didymium physarioides Klotsch.

Spores ·01—·0125^{mm}.

On fallen leaves, etc. New York (Torr., Peck); N. Eng. (Russell); Car. (Curt., Schw.); Bethlehem (Schw.).

48. DIDYMIUM GRANULIFERUM Phillips. In Grevillea, V, p. 114, t. 88, fig. 1.

On herbaceous stems. San Francisco (Harkness).

49. DIDYMIUM MICROCARPON (Fr.).

Physarum microcarpon Fr., Gast., 23.
Didymium nigripes Fr., Sys. Myc., iii, 119.
Didymium xanthopus Fr., Sys. Myc., iii, 120.
Physarum xanthopus Schw., Am. Bor., 2288.
Didymium megalosporum B. and C., Grev., No. 349.

Spores ·0058—·0065^{mm}.

On fallen leaves. Bethlehem (Schw.); Car. (Curt.); Conn. (Wright); Boston (Farlow); N. York (Denslow); Maine (Bolles).

50. DIDYMIUM PHYSARIOIDES Fr., Gast., 21. Curt., Cat., p. 112.

Spumaria physarioides Pers., Syn., 163.

Spores ·012—·014^{mm}.

On bark of trunks. Car. (Curt.).

SUB-GEN. ACIONISCIUM.

51. DIDYMIUM SQUAMULOSUM A. and S., t. 4, f. 5. Schw., Am. Bor., 2271.

Diderma squamulosum A. and S., t. 4, f. 5.
Didymium herbarum Fr., Sys. Myc., iii, 120.
Didymium leucopus Fr., Sys. Myc., iii, 121.
Didymium costatum Fr., Sys. Myc., iii, 118.

Spores ·0085—·01^{mm}.

On fallen leaves. Car. (Schw., Curt.); Penn. (Schw.); Conn. (Wright); N. York (Peck); San Francisco (Harkness).

52. DIDYMIUM CONFLUENS Pers.

Physarum confluens Fr., S. M., iii, 124. Schw., Am. Bor., 2292.
Didymium effusum Link, Obs.

Spores ·01—·011^{mm}.

On stumps. Car. (Schw., Curt.).

53. DIDYMIUM PROXIMUM B. and C. In Grev., N. A. Fungi, No. 345.

Didymium pusillum B. and C., Grev., No. 347.

On dead pine leaves and herbs. Car. (Curt.).

The following species are inadequately described to meet the requirements of the present classification.

54. DIDYMIUM SIMULANS Howe, in Bulletin Torr. Bot. Club., VI, 30.

On bark and wood of *Ailanthus*. N. York (Howe).

55. DIDYMIUM SUBROSEUM Peck, N. Y. State Museum Reports.

Spores globose, smooth, ·008^{mm}.

On bark of *Juglans cinerea*. N. York (Peck).

56. DIDYMIUM FLAVIDUM Peck, N. Y. State Museum Reports.

Spores globose, ·01^{mm}.

On bark of *Abies balsamea*. N. York (Peck).

Genus 13. *Chondrioderma* R.

SUB-GEN A. MONODERMA.

57. CHONDRIODERMA SPUMARIOIDES (Fr.).

Diderma spumarioides Fries, Sys. Myc., iii, 104. Berk. and Curt. in Grevillea.
Carcerina spumarioides Fr., S. V. S., 451.
Diderma farinaceum Peck, in N. Y. Reports.
Didymium oxalinum Peck, is probably the variety *carcerina* of the same species.

Spores ·0083—·013^{mm}.

On moss, leaves, etc. Car. (Curt.).

58. CHONDRIODERMA ALBESCENS (Phil.).

Diderma albescens Phillips, in Grevillea, V, pp. 114, t. 87, fig. 3.

Spores violet-black.

On pine bark. California (Harkness).

SUB-GEN. B. DIDERMA.

59. CHONDRIODERMA DIFFORME (Pers.).

Diderma difforme Pers., Disp., p. 9.
Didymium difforme Schw., Am. Bor., 2272.
Diderma cyanescens Fr., Sys. Myc., iii, 109.
Physarum cæsium Fr., Sys. Myc., iii, 147.
Physarum album Fr., Sys. Myc., iii, 147. Curt., Cat., pp. 112.

Spores $\cdot01$—$\cdot0125^{mm}$.

On herbaceous stems, leaves, etc. Car. (Schw., Curt.); Conn. (Wright).

60. CHONDRIODERMA TESTACEUM (Schr.).

Didymium testaceum Schr., t. V, f. 1, 2. Schw., Am. Bor., No. 2273.
Diderma testaceum Pers., Syn., 167.
Diderma Mariæ Wilsoni Clinton, in N. Y. Reports.

Spores $\cdot0092$—$\cdot01^{mm}$.

On dead stems of plants, leaves, etc. Car. (Schw., Curt.); N. Jersey (Ellis); California (Harkness).

61. CHONDRIODERMA GLOBOSUM (Pers.).

Diderma globosum Pers., Disp., t. i, f. 4, 5.
Didymium globosum Schw., Am. Bor., No. 2274.

Spores $\cdot0083^{mm}$.

On leaves. Car. (Schw., Curt.); Bethlehem (Schw.); Boston (Farlow); N. Eng. (Frost).

62. CHONDRIODERMA BRUNNEOLUM (Ph.).

Diderma brunneolum Phillips, in Grevillea, V, p. 114, t. 87, f. 4.

On oak bark. San Francisco (Harkness).

This seems, from the nature of the capillitium and some other points, to be hardly a good *Chondrioderma*.

SUB-GEN C. LEANGIUM.

63. CHONDRIODERMA RADIATUM (Linn.)

Lycoperdon radiatum Linn., Sp. Pl., 1654.
Didymium stellare Schrad., t. 5, f. 3, 4.
Diderma stellare Pers., Syn., 164. B. and Curt. in Grevillea.
Diderma umbilicatum Pers., Syn., 165.

Spores $\cdot009$—$\cdot012^{mm}$.

On pine wood. Car. (Curt.).

64. CHONDRIODERMA GASTERODES (Phil.).

Diderma gasterodes Phillips, in Grevillea, V, t. 87, fig. 1.

Spores violet-black, smooth, $\cdot015^{mm}$.

On bark and moss. California (Harkness).

65. Chondrioderma floriforme (Bull.).

Sphænocarpus floriformis Bull., t. 371.
Diderma floriforme Pers., Syn., 164.
Leangium floriforme Schw., Am. Bor., 2302.
Leangium lepidotum Ditm., t. 21.
Diderma concinnum B. and C., Grevillea, No. 343.

Spores ·01—·0125^{mm}.

On trunks. Car. (Schw., Curt.); Bethlehem (Schw.).

66. Chondrioderma laciniatum (Phil.).

Diderma laciniatum Phillips, in Grevillea, V, t. 87, fig. 2.

Spores dark violet, ·013^{mm}.

On dead wood. California (Harkness).

INCERTÆ SEDIS.

67. Chondrioderma stipata (Schw.).

Leangium stipatum Schw., Am. Bor., No. 2304.

On rotten wood. Bethlehem (Schw.).

68. Chondrioderma crustacea (Peck).

Diderma crustaceum Peck, in N. Y. Reports.

Spores globose, ·0125^{mm}.

On sticks and leaves. N. York (Peck).

69. Chondrioderma albula Howe.

Diderma albulum Howe, Bulletin Torrey Bot. Club, pp. 30.

On bark and wood of *Ailanthus*. N. York (Howe).

These last three species can only be entered provisionally, until the examination of authentic specimens can determine their proper position, for which the descriptions are insufficient.

Genus 14. *Lepidoderma* DeBary.

70. Lepidoderma tigrinum (Schrad.).

Didymium tigrinum Schrad., t. 6, f. 2, 3.
Didymium rufipes Fries, Sys. Myc., iii, 116. Curt., Cat., p. 111.
Physarum squamulosum Pers., Syn., 174. Schw., Am. Bor., 2279.
Physarum tigrinum Schw., Am. Bor., 2282.

Spores ·01—·0125^{mm}.

On trunks. Car. (Curt., Schw.); Bethlehem (Schw.).

FAMILY 5. SPUMARIACEÆ.

Genus 15. *Diachæa* Fr.

71. DIACHÆA LEUCOPODA (Bull.).

Trichia leucopoda Bull, t. 502, f. 2.
Diachæa elegans Fr., Stirp., 84. Rav., Ex. i, 80.
Diachæa leucostyla Schw., Am. Bor., No. 2342.

Car. (Schw., Curt.); Penn. (Schw.); N. Eng. (Sprague); N. York (Peck).

Genus 16. *Spumaria* Pers.

72. SPUMARIA ALBA (Bull.).

Spumaria mucilago Pers., Disp., t. i, f. a, b, c. Schw., Am. Bor., 2363.
Didymium spumarioides Fr., Sys. Myc., iii, pp. 121.

Car. (Schw.); N. York (Peck).

73. SPUMARIA MICHENERI Berk. In Grevillea, N. A. Fungi, No. 341.

Spores globose, ·025—·03^{mm}.

On very rotten wood. Penn. (Michr.).

ORDER III. **Amaurocheteæ.**

FAMILY 6. STEMONITACEÆ.

Genus 17. *Stemonitis* Gled.

74. STEMONITIS FUSCA Roth., Mag. Bot.; Lea, Cinc., p. 69.

Stemonitis fasciculata Pers., Syn., 187. Schw., Am. Bor., 2344.

Spores ·0066—·009^{mm}.

On wood, leaves, etc. Car. (Schw., Curt.); Boston (Farlow); Ohio (Lea); N. York (Peck).

75. STEMONITIS FERRUGINEA Ehr., Syl. Ber., f. vi. Curt., Cat., p. 112. Rav., Fun. Car., ii, 75.

Stemonitis decipiens Nees, Leop. Car., XVI, 95.
Stemonitis herbatica Peck, N. Y. Reports.

Spores globose, ·0053—·0075^{mm}.

On carious wood, plants, etc. Car. (Curt.); Boston (Farlow).

INCERTÆ SEDIS.

76. STEMONITIS PORPHYRA B. and Curt.

In Grevillea, N. A. Fungi, No. 374, not Rav., Exs., ii, 77.

On pine wood. Car. (Curt.).

77. STEMONITIS TUBULINA Schw., Am. Bor., 2345.

Car. (Schw.); Penn. (Schw.).

78. Stemonitis maxima Schw., Am. Bor., 2349.

On old *Polyporus.* Bethlehem (Schw.).

79. Stemonitis crypta Schw., Am. Bor., 2351.

In cracks of rotten trunks. Nazareth (Schw.).

Genus 18. *Comatricha* Preuss.

80. Comatricha typhina (Roth.).

Stemonitis typhina Roth., Fl. Germ., i, 547. Schw., Am. Bor., 2343.
Stemonitis typhoides Dc. Fl. Fr., ii, 257. Rav., Ex., ii, 76.
Stemonitis pumila Corda, Ic., V, 37.

Spores ·0046—·0067^{mm}.

On wood, sticks, etc. Car. (Schw., Curt.); Penn. (Schw.); N. York (Peck); California (Harkness).

81. Comatricha Friesiana DeBary.

Stemonitis obfuscata Fr., Sym. Gast., 17. Lea, Cinc. Pl., p. 69. Rav., Fungi Car., V, 84.
Stemonitis ovata Pers., Syn., 189. Schw., Am. Bor., 2347.
Stemonitis globosa Schum., Saell.

Spores ·0083—·01^{mm}.

Var. A. *obovata.*
Var. B. *oblonga.*

On dead wood. Ohio (Lea); Alabama (Peters); Car. (Curt., Schw.); Conn. (Wright); Penn. (Schw.); Maine (Morse); California (Harkness).

82. Comatricha Persoonii R.

Stemonitis oblonga Fr., Sys. Myc., iii, 159. Curt., Cat., p. 112.

Spores ·0066—·0083^{mm}.

83. Comatricha pulchella Bab.

Stemonitis papillata Pers. Disp., t. i, f. 4. Schw., Am. Bor., 2348.
Stemonitis pulchella Berk., Ann. and Mag. N. H., 1841, t. 12, f. 11.
Stemonitis tenerrima Curt., in Sill. Journ., p. 349. B. and Curt., Grev., No. 373.

A. *obovata.*

B. *oblonga.*

On bark, grass, etc. Car. (Curt., Schw.); N. York (Peck); Penn. (Schw.)

84. Comatricha confluens C. and E.

Stemonitis confluens Cooke and Ellis, in Grevillea, V, p. 51.

On oak bark. N. Jersey (Ellis).

Genus 19. *Lamproderma* R.

85. LAMPRODERMA PHYSAROIDES (A. and S.).

Stemonitis physaroides A. and S., t. 11, f. 8. Schw., Am. Bor., 2346.

Spores ·012—·014^{mm}.

On birch trunk. Car. (Schw., Curt.); Ohio (M. J. B.).

86. LAMPRODERMA COLUMBINA (Pers.).

Physarum columbinum Pers., Syn., 173. Schw., Amer. Bor., 2284.
Physarum bryophilum Fr., Sys. Myc., iii, p. 135.

Spores ·011—·014^{mm}.

On dead wood. Car. (Schw., Curt.); Penn. (Michr.); Boston (Farlow).

87. LAMPRODERMA ARCYRIOIDES (Som.).

Stemonitis arcyrioides Sommf., Tidschr.

On leaves, wood, etc. California (Harkness).

88. LAMPRODERMA ELLISIANA Cooke.

Badhamia penetralis C. and E., Grevillea, V, p. 49.

On pine boards. N. Jersey (Ellis).

This is certainly not a species of *Badhamia*, according to the present estimation of that genus. The character of the capillitium is that of *Lamproderma;* but the conglutination of the spores is a feature not yet recognized in any other species of *Lamproderma*. The specimens from which the species was originally described were by no means good; hence it requires further investigation.

FAMILY 7. ENERTHENEMACEÆ.

Genus 20. *Enerthenema* Bowm.

89. ENERTHENEMA BERKELEYANA Rtfki.

Stemonitis mammosa Fr., Sys. Myc., iii, p. 161.
Enerthenema elegans Berk., Ann. N. H., No. 338 (not Bowm.).

Spores ·0086—·01^{mm}.

On boards, wood, etc. Car. (Curt., Rav.).

Family 8. AMAUROCHÆTACEÆ.

Genus 21. *Amaurochœte* R.

90. Amaurochæte atra (A. and S.).

Lycogala atrum A. and S., Consp., t. 3, f. 3.
Reticularia atra Fr., Sys. Myc., iii, 86. Curt., Cat., p. 111.
Lachnobolus cribrosus Fr., Orb. Vet., 148.

Spores ·014—·015^{mm}.

On logs. Car. (Curt.).

Family 9. BREFELDIACEÆ.

Genus 22. *Brefeldia* R.

91. Brefeldia maxima (Fr.).

Dermodium inquinans Fr., Gast., p. 9.
Reticularia maxima Fr., Sys. Myc., iii, 85. Schw., Am. Bor., 2375.

On trunks. Bethlehem (Schwz.).

Family 10. ECHINOSTELIACEÆ.

Genus 23. *Echinostelium* DeBary.

Not represented in the United States.

Sub-Division II. LAMPROSPORÆ.

Spores diversely colored, never violet.

Section A. *ATRICHÆ.*

Sporangia without a capillitium.

Order IV. **Anemeæ.**

Family 11. DICTYOSTELIACEÆ.

Genus 24. *Dictyostelium* Bref.

Not yet recorded in the United States.

Family 12. LICEACEÆ.

Genus 25. *Licea* Schrad.

92. Licea flexuosa Pers., Syn., t. 1, f. 5, 6. Schw., Am. Bor., 2315.
Licea spadicea Fr., Sys. Myc., iii, 197.

Spores ·0125—·014^{mm}.

Car. (Schw.); Bethlehem (Schw.).

93. LICEA VARIABILIS Schrad., t. b, f. 5, 6. Schw., Am. Bor., 2314. On trunks. Bethlehem (Schw., Curt.).

SPECIES INQUIRENDÆ.

94. LICEA LINDHEIMERI Berk., in N. A. Fungi, No. 369.

Spores globose, ·0076^{mm}.

On dead bark. Texas (Lindheimer).

95. LICEA FALLAX Schw., Am. Bor., 2313.

Car. (Schw.); Penn. (Schw.).

96. LICEA OCHRACEA Peck, N. Y. Reports.

On grass and club-moss.

This is clearly not a *Licea*, but the description is too imperfect to determine the genus.

97. LICEA EPIPHYLLA Schw., Am. Bor., 2318.

On fallen leaves. Bethlehem (Schw.).

98. LICEA NITENS Schw., Am. Bor., 2319.

On bark. Bethlehem (Schwz.).

Genus 26. *Tubulina* Pers.

99. TUBULINA CYLINDRICA Bull.

Tubulina fragiformis Pers., Disp.
Licea tubulina Schrad., N. G., p. 16.
Licea fragiformis Nees, f. 102. Schw., Am. Bor., 2312.
Licea cylindrica Fr., Sys. Myc., iii, 195.
Licea microsperma B. and C., Grev., No. 367.

Spores ·005—·0067^{mm}.

On rotten wood, etc. Car. (Curt., Schw.); Bethlehem (Schw.); N. York (Berk., Peck); Penn. (Michr.); Boston (Farlow); New Jersey (Berk.).

100. TUBULINA STIPITATA (B. and Rav.);

Licea stipitata B. and Rav., Linn. Soc. Journ., IX, p. 350.

Spores pinkish umber, ·0046—·005^{mm}.

On dead wood. Car. (Rav.).

Genus 27. *Lindbladia* Fr.

FAMILY 13. CLATHROPTYCHIACEÆ.

Genus 28. *Clathroptychium* R.

101. CLATHROPTYCHIUM RUGULOSUM (Wall.).

Reticularia plumbea Fr., Sys. Myc., iii, 88.
Licea applanata Berk., Hook. Jour. 1845, p. 66.

Spores ·0083—·01^{mm}.

On bark of *Quercus alba*. Alabama (Peters); Car. (Rav.); N. Jersey (Ellis).

Genus 29. *Enteridium* Ehr.

102. ENTERIDIUM OLIVACEUM Ehr.

Reticularia applanata B. and Br., Ann. N. H., t. 11, f. 3.
Badhamia irregularis C. and E., in Grevillea, V, p. 89.
On pine wood. N. Jersey (Ellis).

Sporidia at first agglutinated together from 4 to 20 in a cluster.

ORDER V. Heterodermeæ.

FAMILY 14. CRIBRARIACEÆ.

Genus 30. *Dictydium* Schrad.

103. DICTYDIUM CERNUUM (Pers.). Schw., Am. Bor., 2355.

Dictydium umbilicatum Schrad., t. 4, f. 1. Curt., Cat., p. 112. Rav., Fungi Car., ii, 78.
Dictydium trichioides Chev., Fl. Par. Corda, Ic., V, f. 36.
Car. (Schw., Curt.); Penn. (Schw.); Boston (Farlow).

SPECIES DUBIÆ.

104. DICTYDIUM MICROSPERMUM Schw., Am. Bor., 2352.

Car. (Schw.); Penn. (Schw.).

105. DICTYDIUM VENOSUM. Schw., Am. Bor., 2354.

On carious wood. Car. (Schw., Curt.); Penn. (Schw.).

Genus 31. *Heterodictyon* R.

Genus 32. *Cribraria* Pers.

106. CRIBRARIA RUFA (Roth.).

Cribraria rufescens Pers., Disp., t. 1, f. 5. Schw., Am. Bor., 2358.
Cribraria fulva Schrad, t. 1, fig. 1.
Cribraria intermedia Schrad, t. 1, fig. 2.

Spores ·005—·0065^{mm}.

On the ground. Ohio (Schw.).

107. CRIBRARIA PURPUREA Schrad. Schw., Am. Bor., 2356.

Spores ·005—·0065^{mm}.

On carious wood. Car. (Schw., Curt.); Penn. (Schw.); Boston (Farlow).

108. CRIBRARIA VULGARIS Schrad, t. 1, f. 5. Schw., Amer. Bor., 2360.

Spores ·005—·0065^{mm}.

On rotten trunks. Car. (Schw., Curt.); Penn. (Schw.); Boston (Farlow).

109. CRIBRARIA TENELLA Schrad, t. 3, f. 2, 3. Schw., Am. Bor., 2361.

Spores ·005—·0065^{mm}.

On rotten wood. Penn. (Schw., Curt.).

110. CRIBRARIA MICROCARPA (Schrad).

Dictydium microcarpon Schrad, t. 4, f. 3, 4. Curt., Cat., p. 112.
Cribraria microcarpa Pers., Syn., 190.

Spores ·005—·0065^{mm}.

On carious wood. Car. (Curt.).

111. CRIBRARIA SPLENDENS (Schrad.).

Dictydium splendens Schrad, t. 4, f. 5, 6. Schw., Am. Bor., 2353.

Spores ·005—·0065^{mm}.

On rotten wood. Bethlehem (Schw.).

112. CRIBRARIA INTRICATA Schrad, t. 3, f. 1. Curt., Cat. Rav., Fungi Car., ii, 79.

Spores ·005—·0065^{mm}.

On dead wood. Car. (Curt.); N. Eng. (Sprague).

113. CRIBRARIA MACROCARPA Schrad, t. 2, f. 3, 4. Schw., Am. Bor., 2357.

Spores ·005—·0065^{mm}.

On the ground. Car. (Schw., Curt.); Ohio (Schw.).

114. CRIBRARIA ARGILLACEA Pers. Schw., Am. Bor., 2359.

Cribraria micropus Schrad, t. 2, f. 1, 2.
Licea spermoides B. and Curt., Grevillea, No. 368.

Spores ·005—·0065^{mm}.

On rotten trunks. Car. (Schw., Curt.); Penn. (Schw.).

115. CRIBRARIA ELEGANS B. and C. In Grevillea, N. A. Fungi, No. 362.

On decayed wood. Car. (Curt.).

116. CRIBRARIA MICROSCOPICA B. and C. In Grev., N. A. Fungi, No. 364.

On shingles. Car. (Curt.).

117. CRIBRARIA MINUTISSIMA Schw., Am. Bor., No. 2362.

Cribraria minima B. and C., Grevillea, No. 363.

On rotten wood. Car. (Schw., Curt.); Penn. (Schw.).

Section B. *TRICHOPHORÆ.*

Sporangia constantly possessed of a capillitium.

ORDER VI. Reticulariæ.

FAMILY 15. RETICULARIACEÆ.

Genus 33. *Reticularia* Bull.

118. RETICULARIA LYCOPERDON Bull.

Lycogala argentea Pers., Disp., p. 7. Schw., Am. Bor., 2373.
Reticularia umbrina Fr., S. M., iii, 87. Curt., Cat., p. 111.

Spores ·008^{mm}.

On rotten trunks. Car. (Schw., Curt.); Bethlehem (Schw.); N. Eng. (Murray); N. York (Peck).

INCERTÆ SEDIS.

119. RETICULARIA AFFINIS B. and Curt. In N. A. Fungi, No. 340. Berk., in Journ. Linn. Soc., Vol. x, p. 347.

Spores oblong, ·01^{mm}.

On dead trees. Car. (Curt.).

120. RETICULARIA APPLANATA Schw., Am. Bor., No. 2376.

On bark and wood of *Salix*. Bethlehem (Schw.).

121. RETICULARIA STRONGYLIUM Schw., Am. Bor., No. 2374.
Car. (Schw.).

ORDER VII. Calonenemeæ.

FAMILY 16. TRICHIACEÆ.

Genus 34. *Trichia* Hall.

122. TRICHIA FALLAX Pers., Obs., iii, t. 4, 5. Schw., Am., Bor., [2323.

Trichia cerina Ditm., t. 25.

Spores ·01—·012^{mm}.

On carious wood. Car. (Schw., Curt.); Penn. (Schw.); N. Eng. (Frost); California (Harkness).

123. TRICHIA FRAGILIS Sow., t. 279.

Trichia botrytis Pers., Disp., 9. Schw., Am. Bor., 2320.
Trichia serotina Schrad, Journ., t. 3, f. 1. Curt., Cat., p. 113.
Trichia pyriformis Fries, Sys. Myc., iii, 184.
Craterium floriforme Schw., Am. Bor., No. 2307.

Spores ·011—·013^{mm}.

On carious wood. Car. (Schw., Curt.); Bethlehem (Schw.).

124. TRICHIA VARIA Pers., var. *genuina*. Schw., Am. Bor., 2329.

Spores ·01—·014^{mm}.

On carious wood. Car. (Schw., Curt.); Penn. (Schw.); Conn. (Wright); N. York (Peck).

TRICHIA VARIA, var. *nigripes*.

Trichia nigripes Pers., Syn., i, 78. Schw., Am. Bor., 2325.
Trichia olivacea Pers., Obs., i, 62. Schw., Am. Bor., 2327.

Spores ·01—·014^{mm}.

On rotten wood. Car. (Schw., Curt.); Penn. (Schw.); California (Harkness).

125. TRICHIA SCABRA Rtfki., Mon., p. 258.

Var. A. *analogia* C.

The elaters are not so spinulose as in the typical form, being sometimes scarcely evident.

Spores ·01^{mm}.

On rotten wood. New York (Peck, 285).

Var. B. *aurea* C.

Sporangia densely cœspitose, sub-globose or obovate, shining golden yellow (resembling *T. chrysosperma*, but of a brighter, deeper yellow). Mass of spores and capillitium of a deeper color, nearly orange. Elaters cylindrical, obtuse at the ends, terminating in a smooth point about as long as the diameter of the elater. Spirals three to four, with intervening depressions rather wider, scarcely prominent. Spores globose, minutely but thickly spinulose, ·013^{mm}. diam. *Cooke, Brit. Myx.*, fig. 258.

On rotten wood. Portland, Maine (Fuller).

126. Trichia abrupta Cooke.

Sporangia clustered, globose or ovate, sessile on a delicate hypothallus, ochrey brown, or pale bay brown. Mass of spores and capillitium of nearly the same color. Elaters cylindrical, terminating in obtuse ends, with one, two, or three diverging acute spines as long as the diameter of the elaters. Spirals about four, with rather broader intervening depressions. Capillitium and spores dull yellow under transmitted light. Spores globose, delicately warted, ·012^{mm}. diam. *Cooke, Brit. Myx , fig.* 256.

On rotten wood. Portland, Maine (Fuller).

127. Trichia chrysosperma Bull. Curt., Cat., pp. 113.

Trichia nitens Pers., Obs., i, 62. Schw., Am. Bor., 2328.
Trichia turbinata With., Arr., iv, 180. Curt., Cat., p. 113.
Trichia ovata Pers., Obs., ii, 35. Schw., Am. Bor., No. 2326.

Spores ·01—·012, rarely ·015^{mm}.

On wood and sticks. Car. (Curt., Schw.); Maine (E. C. B.); California (Harkness); Boston (Farlow); N. England (Russell); N. York (Peck); Penn. (Schw.).

INCERTÆ SEDIS.

128. Trichia angulata Schw., Am. Bor., 2333.

Licea angulata Fries, S. V. S.
Inside fallen bark of *Fraxinus*. Bethlehem (Schw.).

129. Trichia miniata Schw., Am. Bor., 2322.

On bark. Bethlehem (Schw.).

130. Trichia punctulata Schw., Am. Bor., 2330.

On carious wood. Bethlehem (Schw.).

131. Trichia difformis Schw., Am. Bor., 2334.
On rotten wood of *Juglans nigra*. Bethlehem (Schw.).

132. Trichia reniformis Peck, N. Y. Reports.

On bark of *Acer*. N. York (Peck).

Genus 35. *Hemiarcyria* R.

133. Hemiarcyria rubiformis (Pers.).

Trichia rubiformis Pers., Disp., t. 1, f. 3. Schw., Am. Bor., 2321.
Trichia Neesiana Corda, Ic., i, 2886.
Trichia pyriformis Hoffm., V. Cry., t. i, f. 1.

Spores ·01—·011mm.

On rotten wood and moss. Car. (Schw., Curt.); Bethlehem (Schw.); Canada (Dickie); Boston (Farlow); N. York (Peck).

134. Hemiarcyria clavata (Pers.).

Trichia clavata Pers., Disp., p. 11. Schw., Am. Bor., 2324.
Trichia obtusa Wigand, t. 11, f. 4.

Spores ·008—·009mm.

Car. (Schw., Curt.); Penn. (Schw.); Boston (Farlow); Conn. (Wright); N. York (Peck).

135. Hemiarcyria leiocarpa Cooke.

Hemiarcyria pallidula Cooke in litt.

Sporangia simple, obovate or pyriform, rarely almost globose, pallid, with a stem of the same color, as long as the diameter of the sporangia. Mass of spores and capillitium concolorous, or with a slight ochraceous tint. Capillitium sparse, forming a loose net. Tubes branched in a reticulate manner. Spirals three, thin, prominent along the convex side of the tubes, mixed with a few short obtuse spines. Spores globose, with a thin membrane, ·0125—·014mm. *Cooke, Brit. Myx.*, fig. 252, 255.

On decayed vegetable debris. Portland, Maine (Bolles).

Many of the threads are attached to the inner wall of the sporangium, after the manner of *Arcyria*, short, few in number, and thin-walled, differing in this feature from *H. clavata* in a marked manner.

136. Hemiarcyria serpula (Scop.).

Trichia reticulata Pers., Disp., 10. Schw., Am. Bor., 2332.
Trichia serpula Pers., Disp., 10. Schw., Am. Bor., 2331.
Car. (Schw., Curt.); Bethlehem (Schw.); N. York (Peck).

137. HEMIARCYRIA STIPATA (S.).

Leangium stipatum Schwz., Am. Bor., No. 2304.
Carolina (Schw.).

FAMILY 17. ARCYRIACEÆ.

Genus 36. *Arcyria* Hill.

138. ARCYRIA PUNICEA Pers., Disp., 10. Schw., Am. Bor., 2338. Rav., Fungi Car., ii, 80.

Arcyria fusca Fr., Gast., 17.
Arcyria vernicosa Rost., Supp. p. 36.

Spores .0067—·0075^{mm}.

On carious wood. Car. (Schw., Curt.); Penn. (Schw.); N. York (Peck); Boston (Farlow); California (Harkness).

139. ARCYRIA POMIFORMIS (Roth.).

Arcyria umbrina Schum., Saell., 1479. Curt., Cat., p. 113.
Arcyria ochroleuca Fr., Sys. Myc., iii, 181. Curt., Cat., p. 113.
Arcyria lutea Schwz., Syn. Car., 396. Schw., Am. Bor., 2339.

Spores ·0075—·008^{mm}.

On carious wood. Car. (Schw., Curt.); California (Harkness).

140. ARCYRIA STRICTA R.

Arcyria cinerea Bull., Schw., Am. Bor., 2336.
Arcyria pallida B. and C., Grevillea, No. 365.
Arcyria trichioides Corda, Ic., 11, f. 86.

Spores ·0066—·0083^{mm}.

On carious wood. Car. (Schw., Rav.); Penn. (Schw.); Texas (Lindh.); Ohio (Lea); Boston (Farlow); N. Jersey (Berk.).

141. ARCYRIA DIGITATA (Schw.).

Stemonitis digitata Schw., Am. Bor., No. 2350.
Arcyria Leprieuri Mont., Ann. Sci. Nat., iii, (1855), p. 141.
Arcyria bicolor B. and Br., Cub. Fung., ii, p. 86.

Spores ·0066—·0095^{mm}.

On rotten wood. Car. (Schw.); Penn. (Schw.); N. York (Peck).

142. ARCYRIA INCARNATA Pers., Obs., t. v, f. 4, 5. Schw., Am. Bor., 2337.

Arcyria carnea Schum., Saell., 1477.
Arcyria adnata Rost., Supp., p. 37.

Spores ·0066—·0075^{mm}.

On carious wood. Car. (Schw., Curt.); Penn. (Schw.); N. York (Peck).

143. ARCYRIA NUTANS (Bull.) Curt., Cat., p. 113.

Arcyria flava Pers., Obs., i, 85. Grev., t. 309. Schw., Am. Bor., 2335.

Spores ·0075—·0083^{mm}.

On carious wood. Car. (Curt., Schw.); Boston (Farlow); Conn. (Wright); N. York (Peck, Schw.); Penn. (Schw.).

144. ARCYRIA VERSICOLOR Phillips, Grevillea, v, p. 115, t. 88, fig. 8.

Arcyria vitellina Phillips, in Grevillea, v, p. 115, t. 88, fig. 7 (exclusive of fig. *d*).

On bark and logs. California (Harkness).

From comparison of authentic specimens, we are convinced that there are no specific differences in the two forms *A. versicolor* and *A. vitellina.* In the threads of the latter we can find no structure like that of the figure 7, above cited in part.

145. ARCYRIA MINOR Schw., Am. Bor., 2341.

On soft wood. Bethlehem (Schw.).

Genus 37. *Lachnobolus* Fr.

146. LACHNOBOLUS GLOBOSUS (Schw.).

Arcyria globosa Schw., Syn. Car., 400. Schw., Am. Bor., 2340.
Craterium globosum Fr., Sys. Myc., iii, 154. Curt., Cat., p. 112.
Nassula globosa Fr., S. V. S.

Spores ·0067^{mm}.

On corn-stalks, involucres of *Castanea*, etc. Car. (Schw., Curt.); Penn. Schw.); N. York (Peck); Boston (Farlow).

INCERTÆ SEDIS.

147. LACHNOBOLUS CINEREUS Schw., Am. Bor., 2378.

On stems. Salem (Schw.); Car. (Curt.).

Genus 38. *Dermodium* Rtfki.

Genus 39. *Lycogala* Mich.

148. Lycogala epidendrum (Buxb.). Rav., Fungi Car., ii, 74.

Lycogala miniatum Schw., Am. Bor., No. 2268.
Lycogala punctata Pers., Syn. 158. Schw., Am. Bor., 2269.
Lycogala terrestre Fr., Sys. Myc., iii. Rav., Fungi Car., iv, 78.

Spores ·0035—·0058^{mm}.

Car. (Schw., Curt.); Penn. (Schw.); Ohio (Lea); Boston (Farlow).

Genus 40. *Cornuvia* R.

Genus 41. *Oligonema* R.

Family 18. PERICHÆNACEÆ.

Genus 42. *Perichæna* Fr.

149. Perichæna corticalis (Batsch.).

Perichæna populina Fr., Gast., 12. Curt., Cat., p. 113.
Perichæna quercina Fr., Gast., 12. B. and Curt., N. A. Fungi.
Physarum luteo-album Schum., Saell., 1430.
Perichæna circumscissa Schw., Am. Bor., No. 2309.
Perichæna artocreas B. and Rav., in N. A. Fungi, No. 370.
Perichæna marginata Schwz., Am. Bor., 2310.
Licea artocreas B. and Rav., Fungi Car., ii, 82.

Spores ·01—·012^{mm}.

On bark. Car. (Schw., Curt.); Penn. (Schw.).

150. Perichæna depressa Lib., Ex., iv, No. 378.

Perichæna vaporaria Schw., Am. Bor., No. 2311.
Perichæna marginata Schwz., Amer. Bor., 2310.

Spores ·009—·011^{mm}.

On branches. Car. (Schw., Curt.).

151. Perichæna variabilis R.

Ophiotheca umbrina B. and Curt., in N. A. Fungi, No. 372. Grevillea, V, p. 55.

Spores globose, ·0083—·01^{mm}.

Car. (Curt.); N. Jersey (Ellis).

152. Perichæna vermicularis Schw.

Physarum vermicularis Schwz., Am. Bor., No. 2296.
Carolina (Schwz.).

153. Perichæna irregularis B. and Curt., in N. A. Fungi, No. 371.

Spores globose, then broadly elliptic.

On bark Car. (Curt.).

SPECIES INQUIRENDÆ.

154. Perichæna flavida Peck, in N. Y. Reports.

On moss. N. York (Peck).

[*Perichæna strobilina* Fr., S. M., iii, 191, is referred to *Pleosporopsis strobilorum* Œrst.]

Note. Many species are inserted in this synopsis, as for instance those of Schweinitz, provisionally and approximately, as the intimate structure is too little known to give them a definite position with any degree of certainty. Although these uncertain species are included under definite genera, it must not be supposed that these approximations are given with confidence as to their absolute accuracy.

END OF VOL. XI.

INDEX.

[The names of *new* species are printed in Roman letters; synonyms and species to which reference is made are in *Italics;* names of sub-families, families, or higher divisions, in SMALL CAPITALS.]

—o—

ADDENDUM TO INDEX.

ERRATA.

Page 45, line 9 from the bottom, for "Partula," read "Partulæ."

Page 46, line 7 from the top, for "Mall." read "Mal."

Page 112, line 7 from the bottom, for "axal," read "axial."

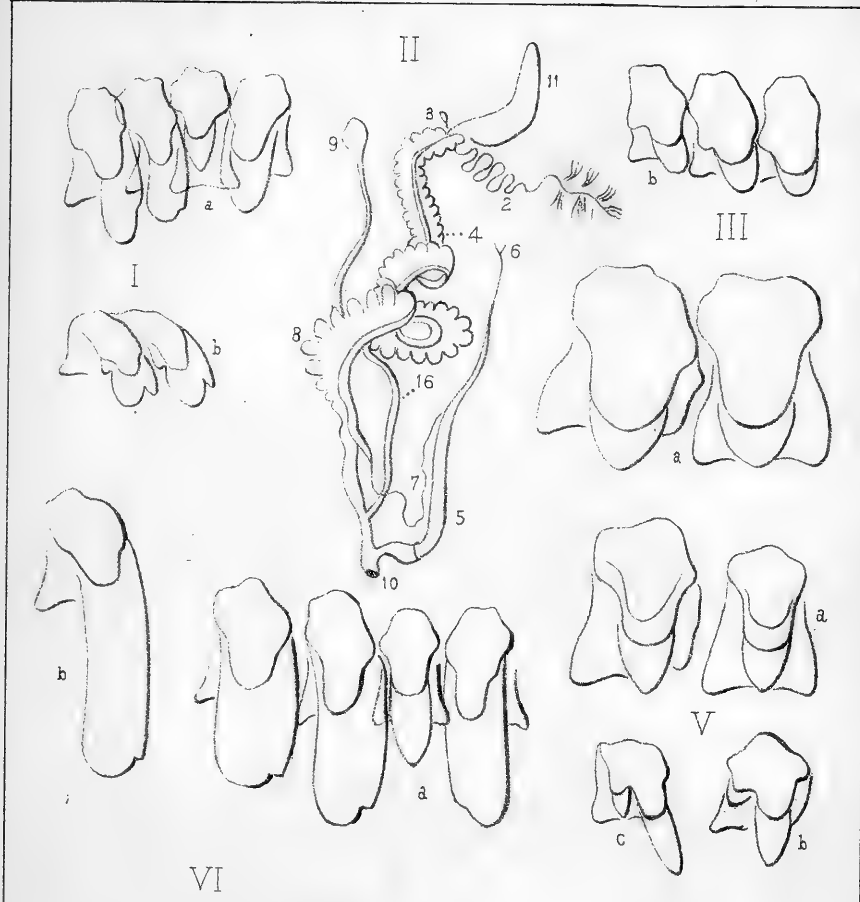
Page 116, line 17 from the top, for "tangentically," read "tangentially."

Page 195, line 9 from the bottom, for "fringiila," read "fringilla."

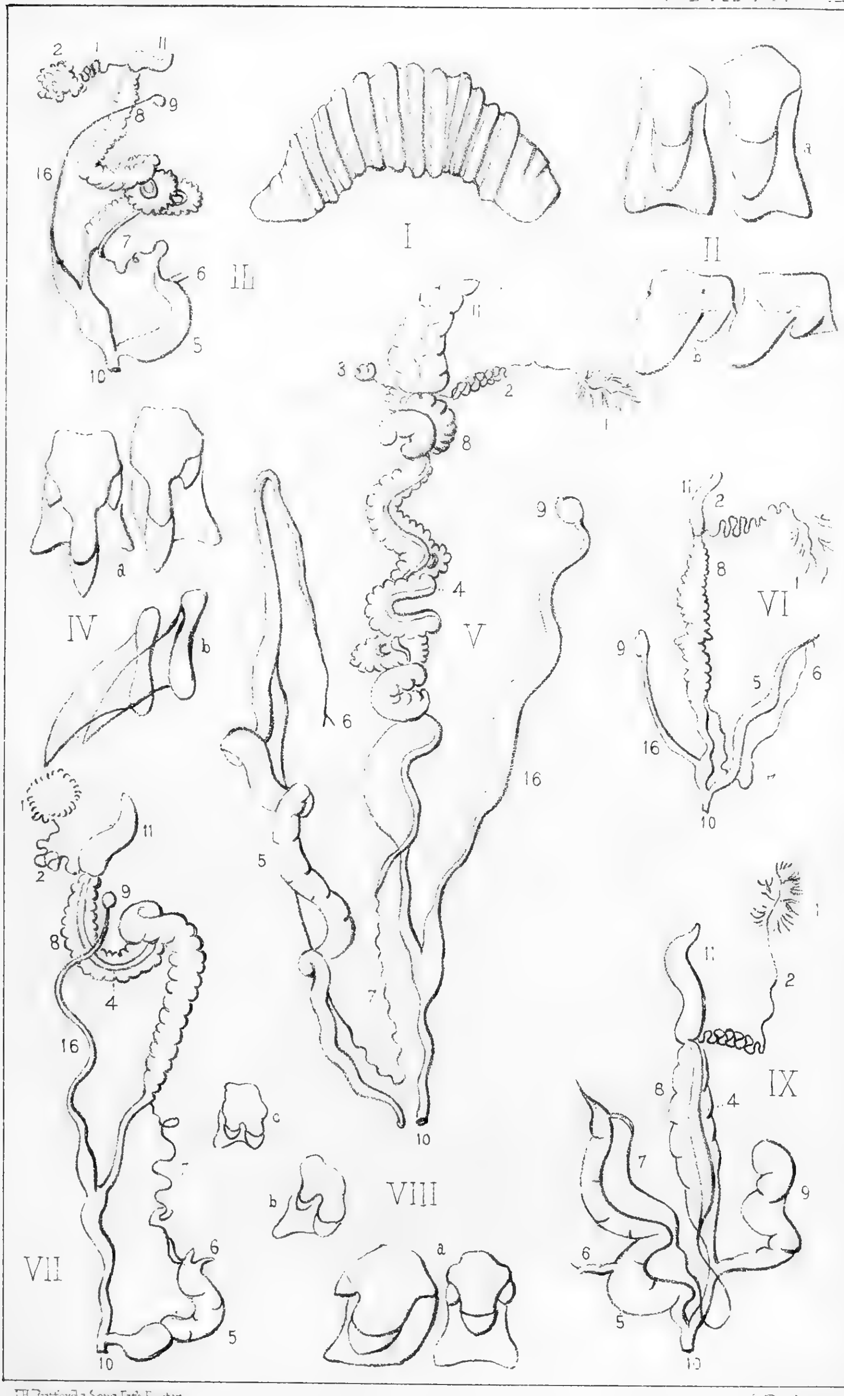
Page 306, line 17 from the bottom, for "zigzig," read "zigzag."

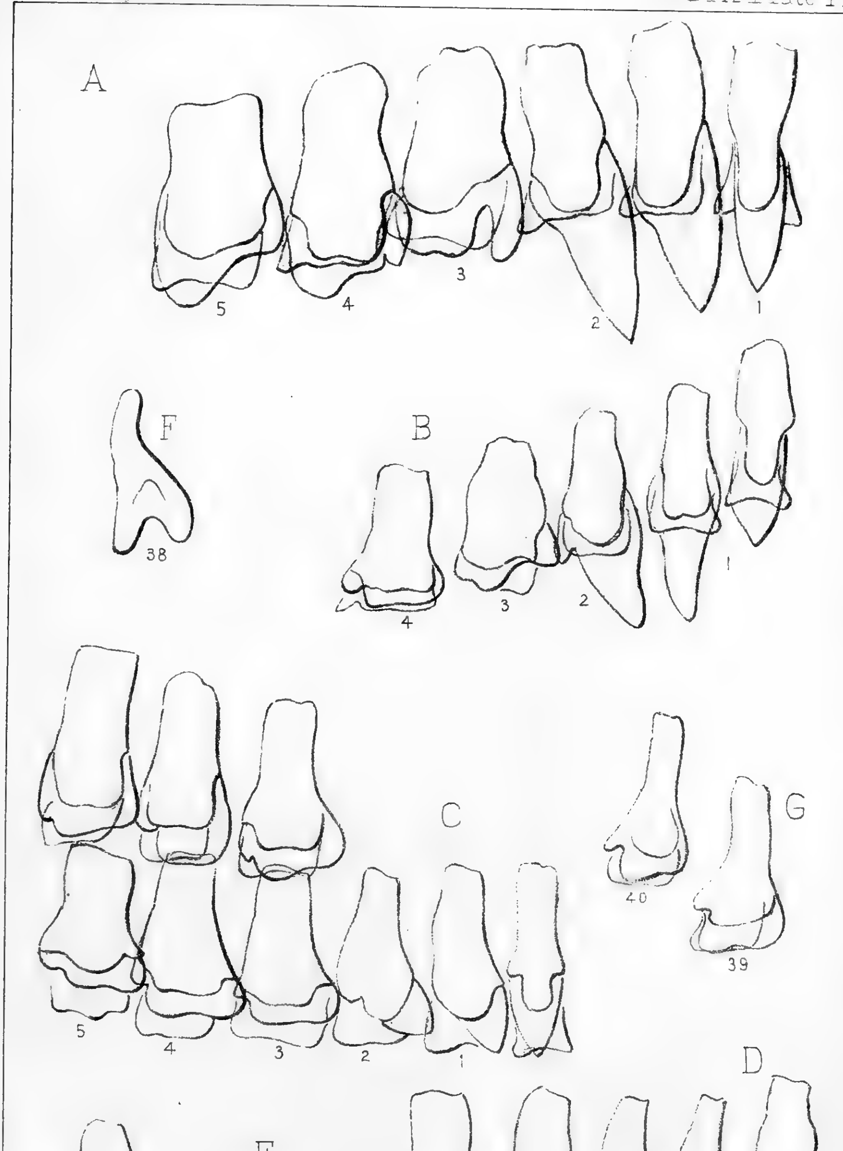
For errata in Article XXIII, "Index to the Literature of Manganese," see page 250.

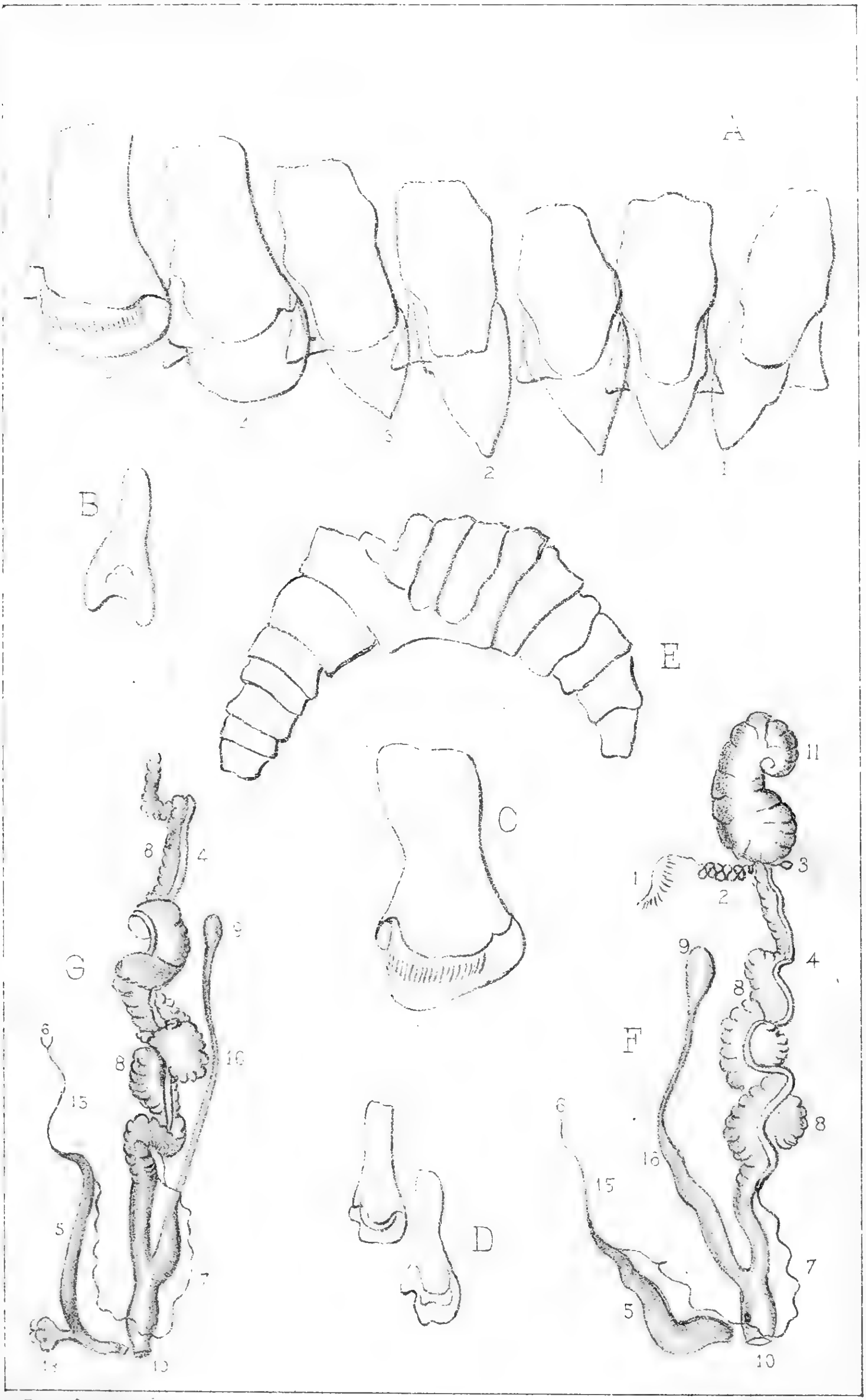
For addendum to Index, see page 433.

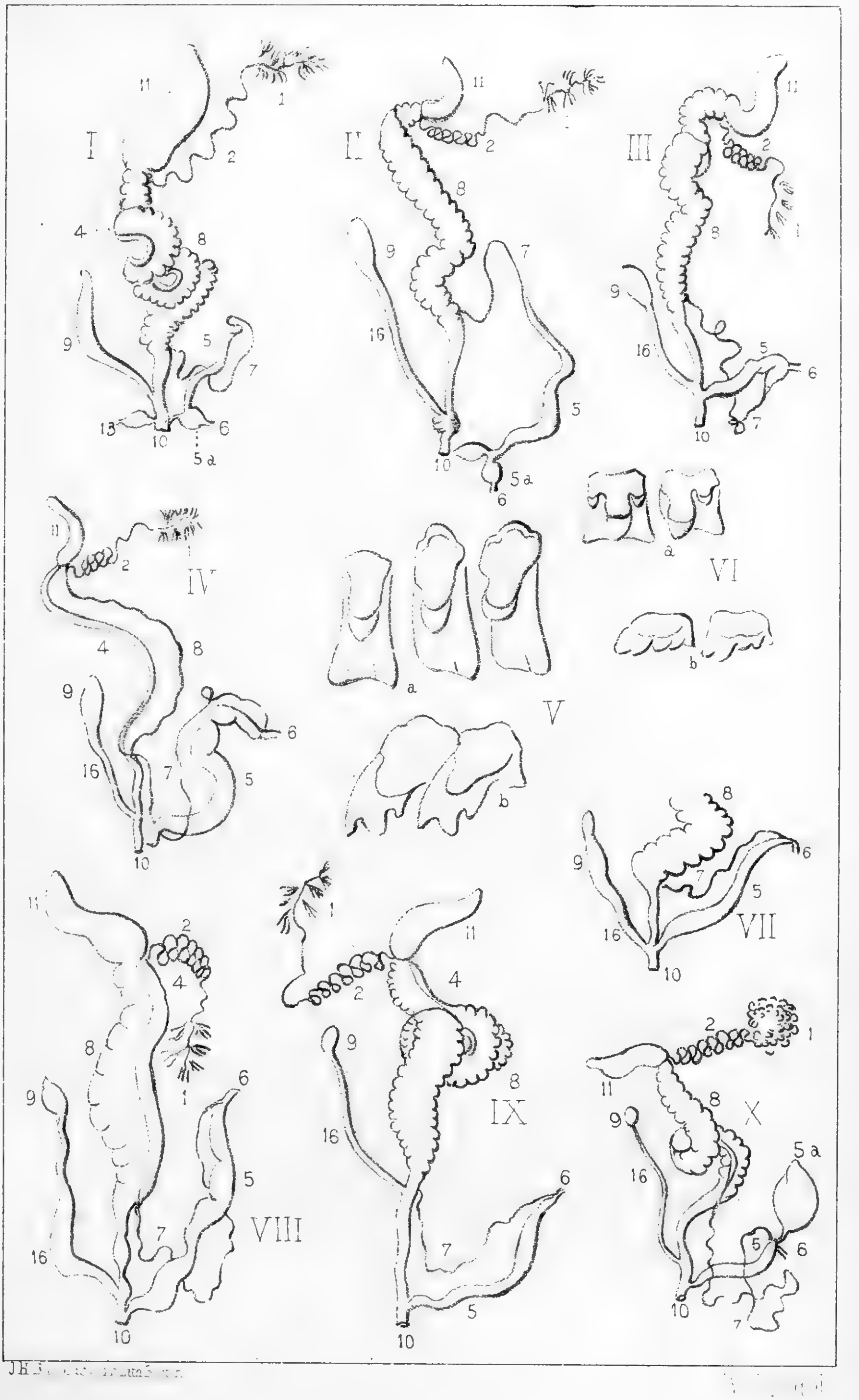


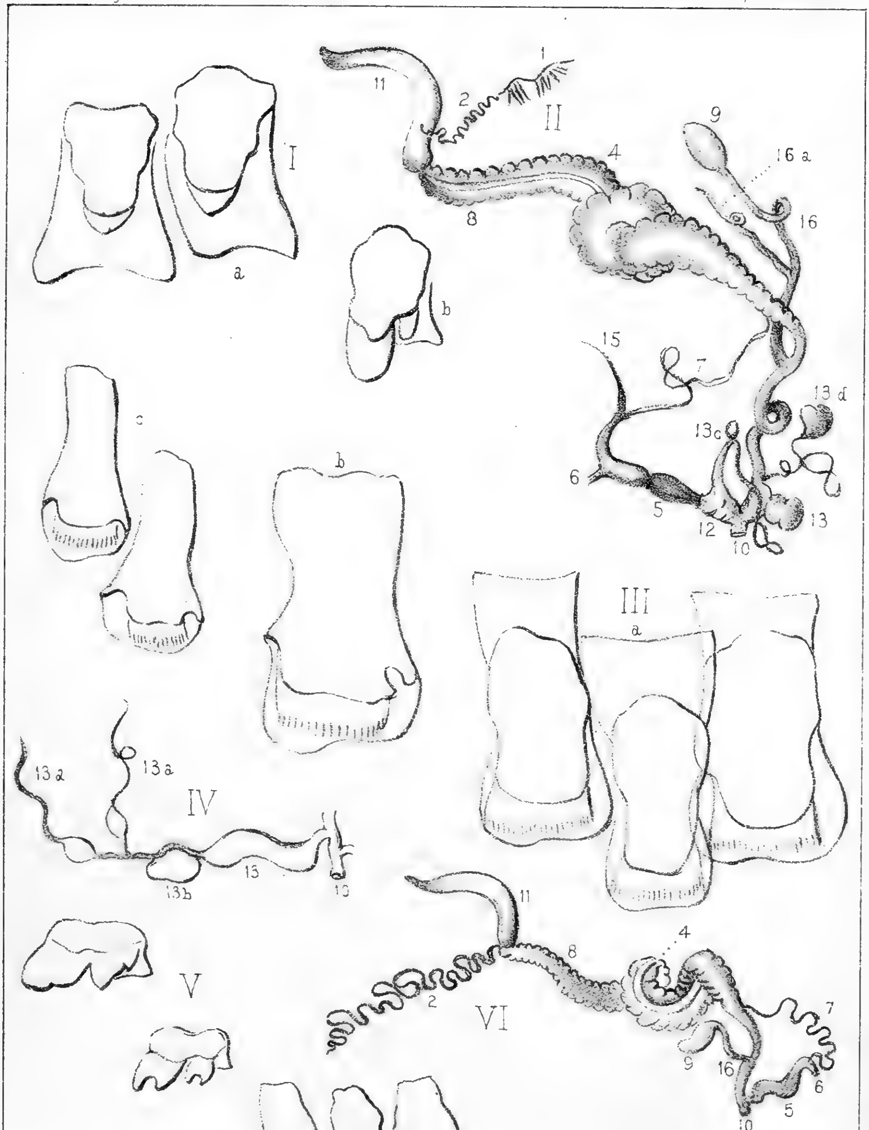
W.G.B del

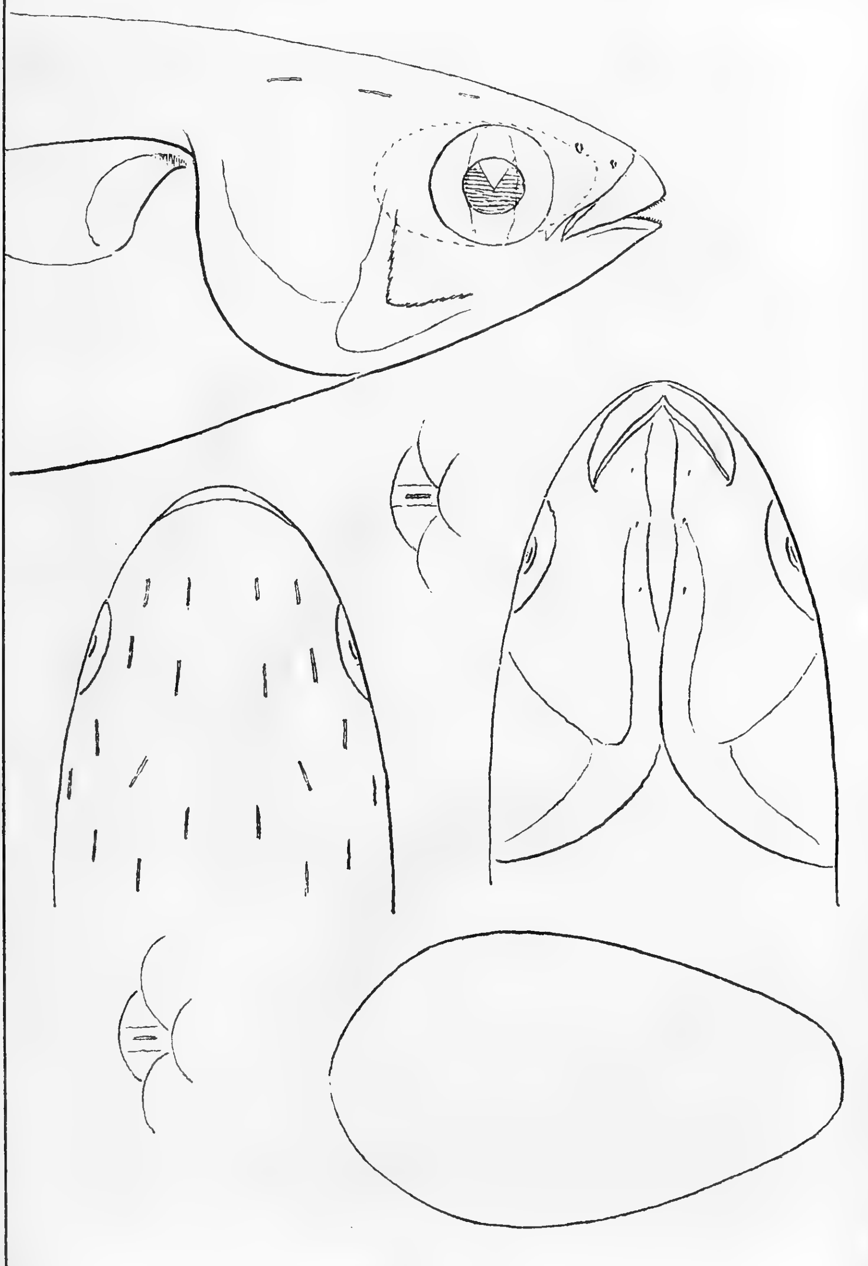

I
II
III
IV
V
VI
VII
VIII
IX
a
b
c
1
2
3
4
5
6
7
8
9
10
11
16


A
5
4
3
2
1
F
38
B
4
3
2
1
C
5
4
3
2
1
G
40
39
D
E
21
20
4
3
2
1

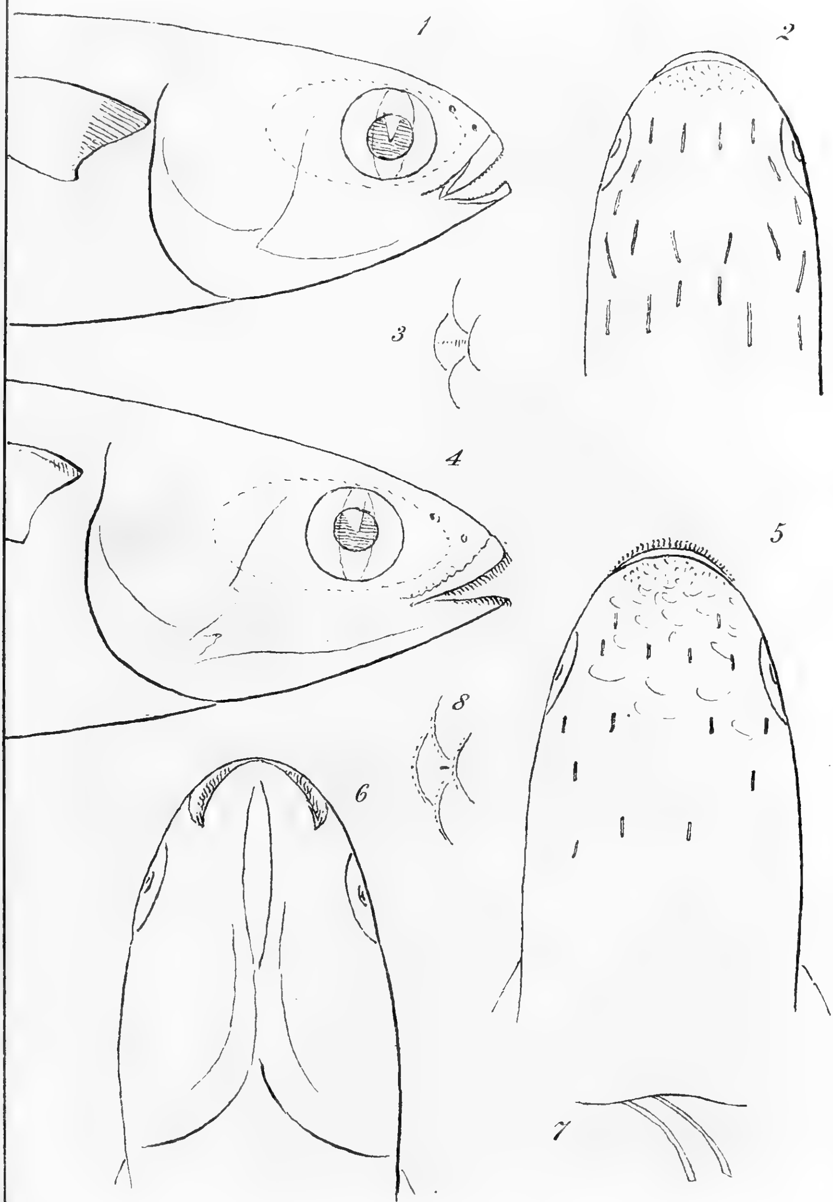

A
4
3
2
1
1
B
E
C
D
G
8
4
9
8
10
6
15
5
7
10
11
1
2
3
4
8
9
F
8
6
16
15
7
5
10


I
II
III
IV
V
VI
VII
VIII
IX
X

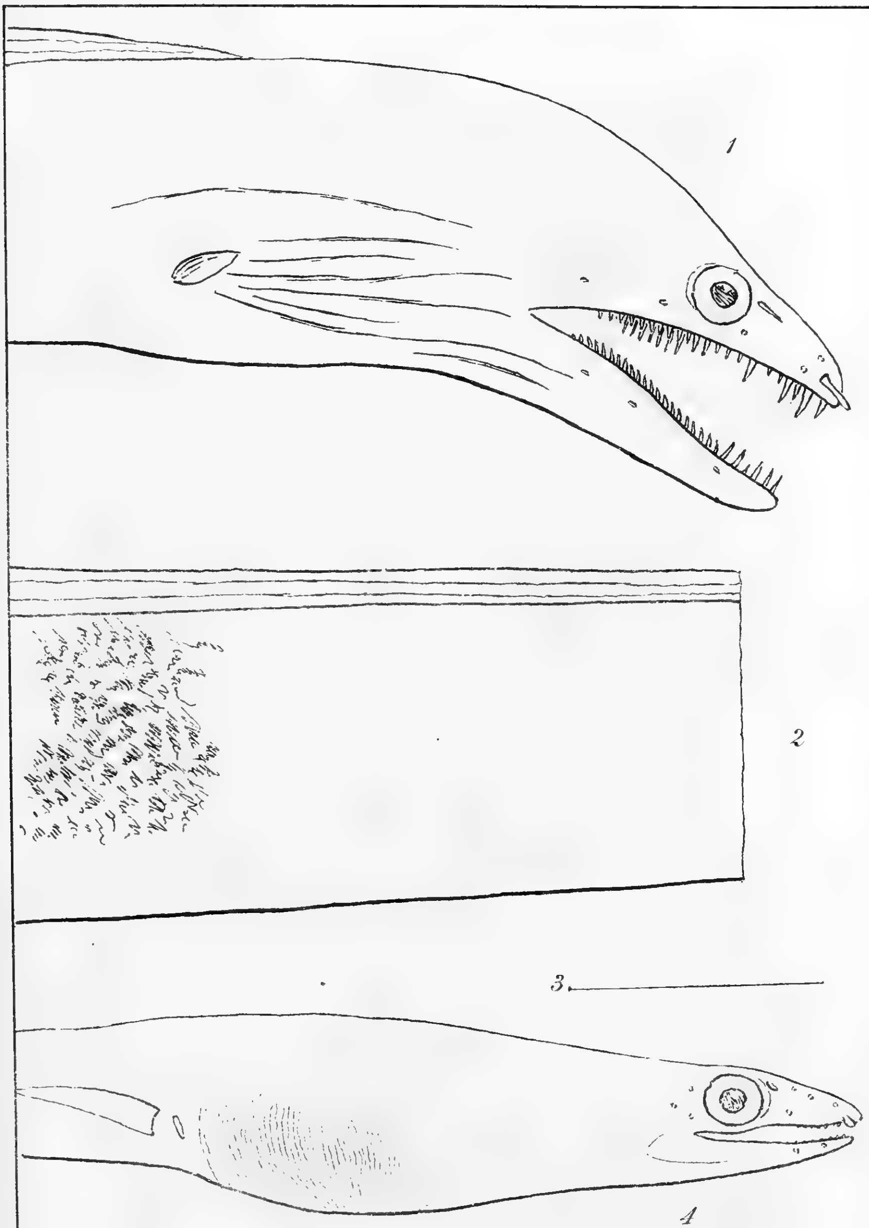

I
a
b
c
II
1
2
4
5
6
7
8
9
10
11
12
13
13 c
13 d
15
16
16 a
III
a
b
IV
13 a
13 a
13 b
13
10
V
VI
1
2
4
5
6
7
8
9
10
11
16
VII
a
b
c



Mugil brasiliensis.

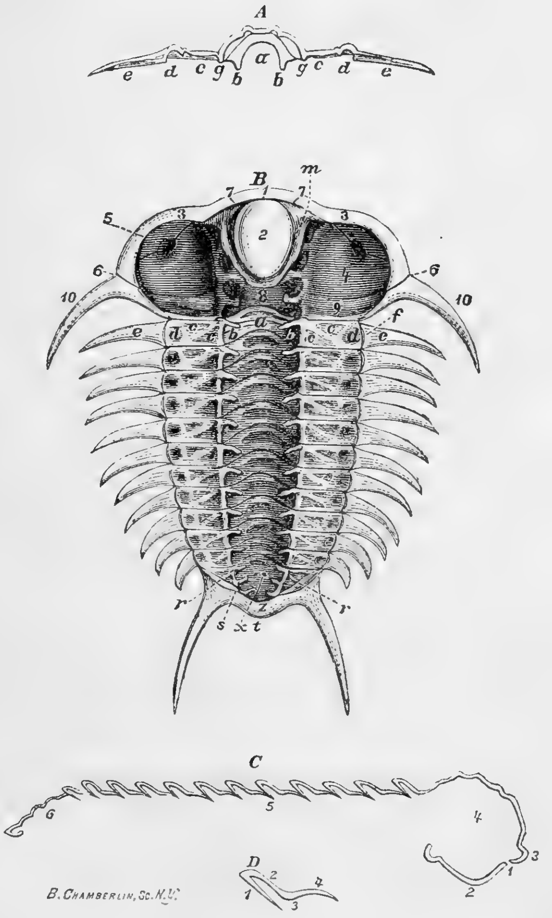


1-3. *Mugil Gaimardianus* 4-8. *Mugil trichodon.*



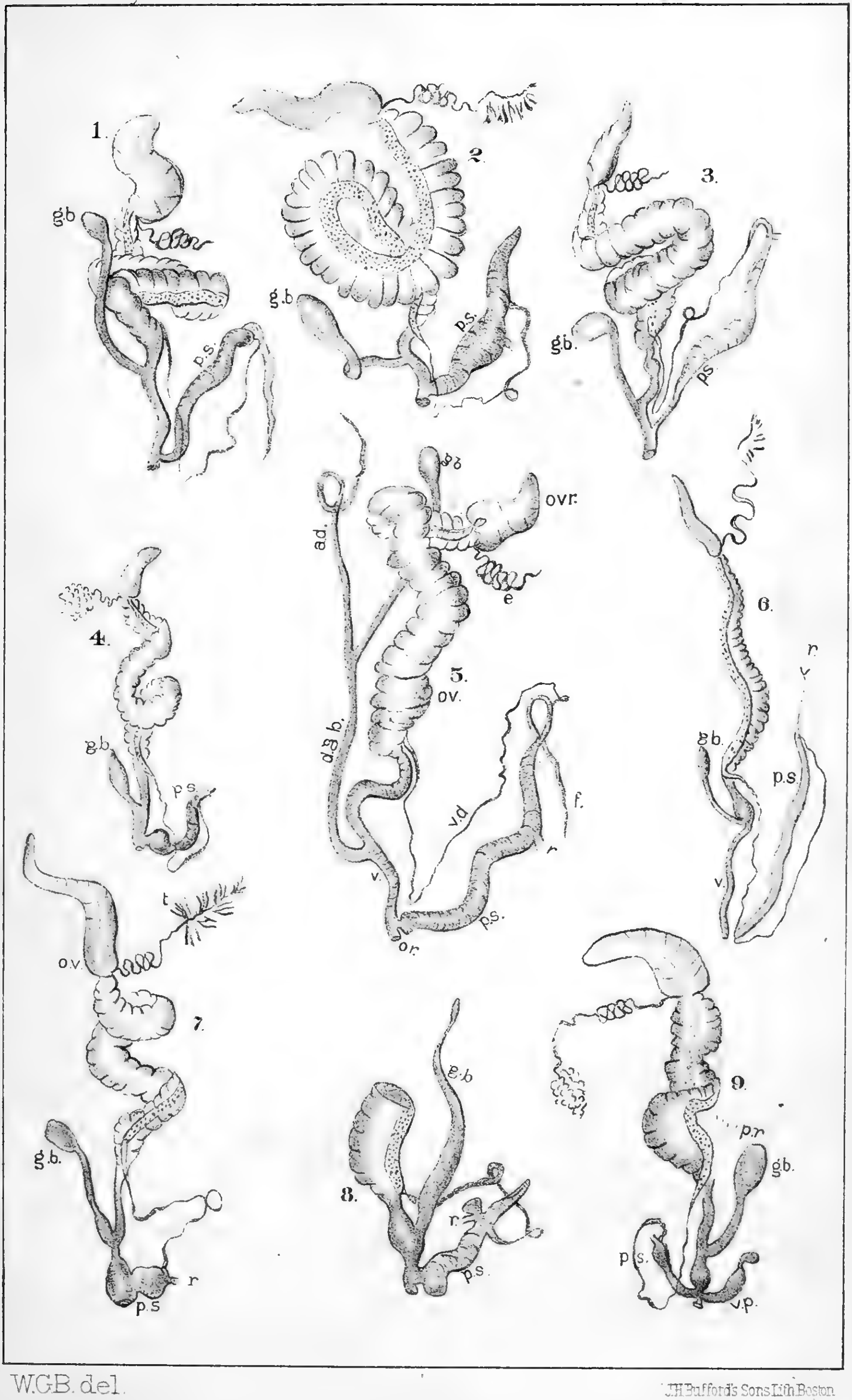
1.2. *Gymnothorax umbrosus.*
3.4. *Neoconger perlongus.*

Gymnothorax polygonius



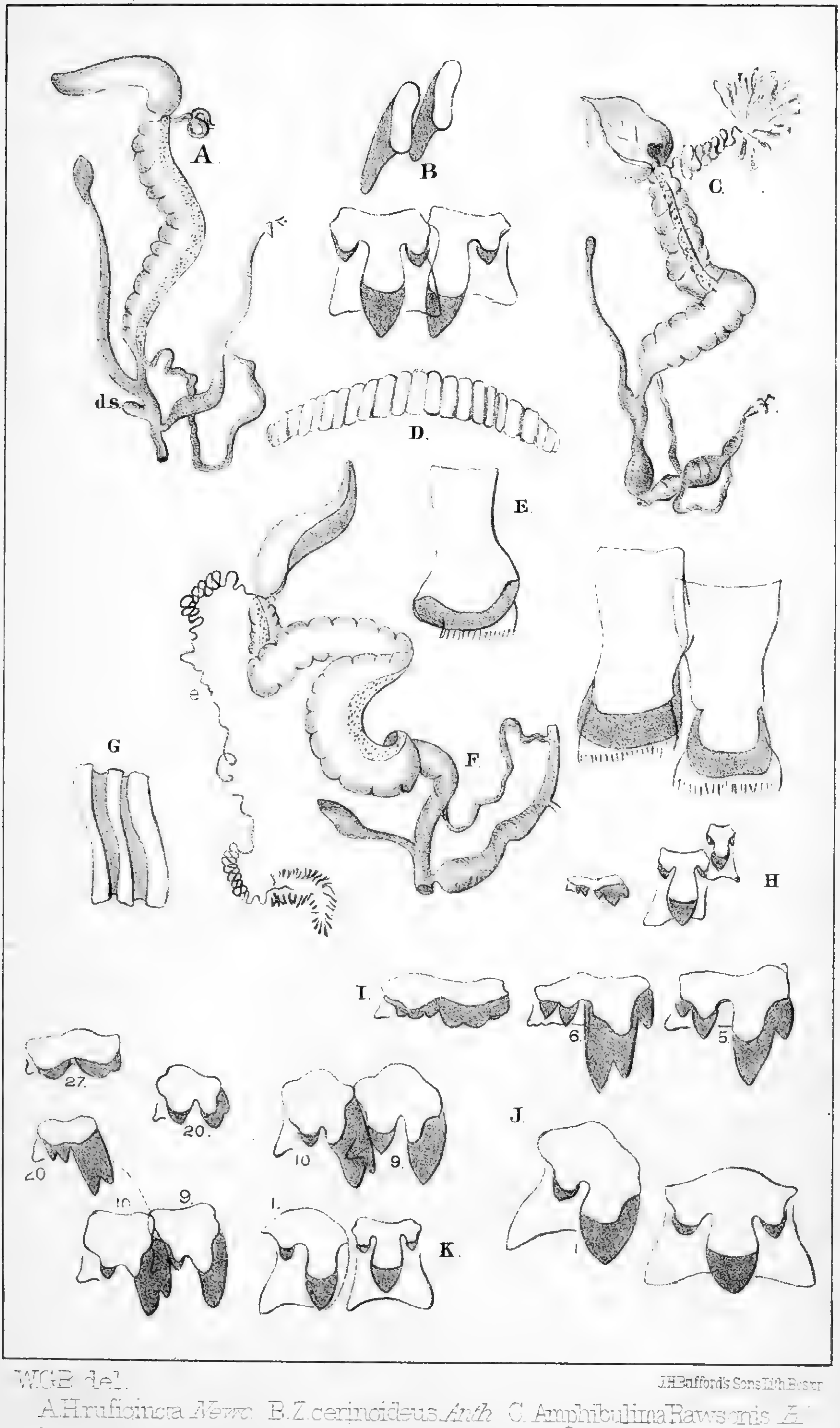
CERAURUS PLEUREXANTHEMUS, GREEN.

Drawn by C. D. Walcott. Engraved by B. B. Chamberlin.



W.G.B. del. J.H. Bufford's Sons Lith. Boston.

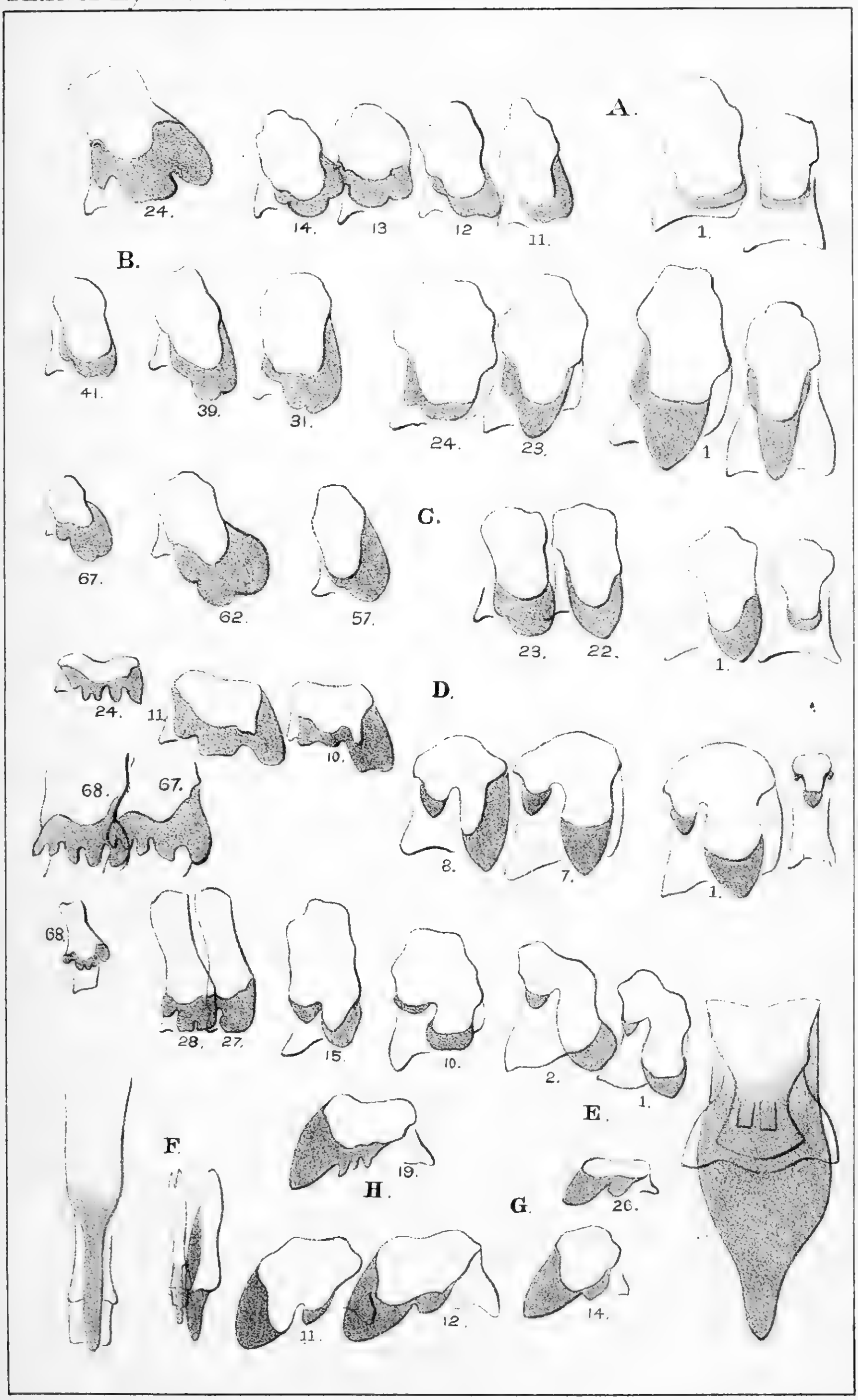
1. B. pallidior *Sby* 2 H. aspera *Fér.* 3. H. spinosa *Lea*
4. L. Ingersolli. 5. H. arrosa *Gld.* 6. H. septemvolva. *S.*
7. Ariol. Hemphilli. 8. H. crispata *Fér.* 9. A. Andersoni *J.G.C.*



WGB del.

J.H.Bufford's Sons Lith Boston

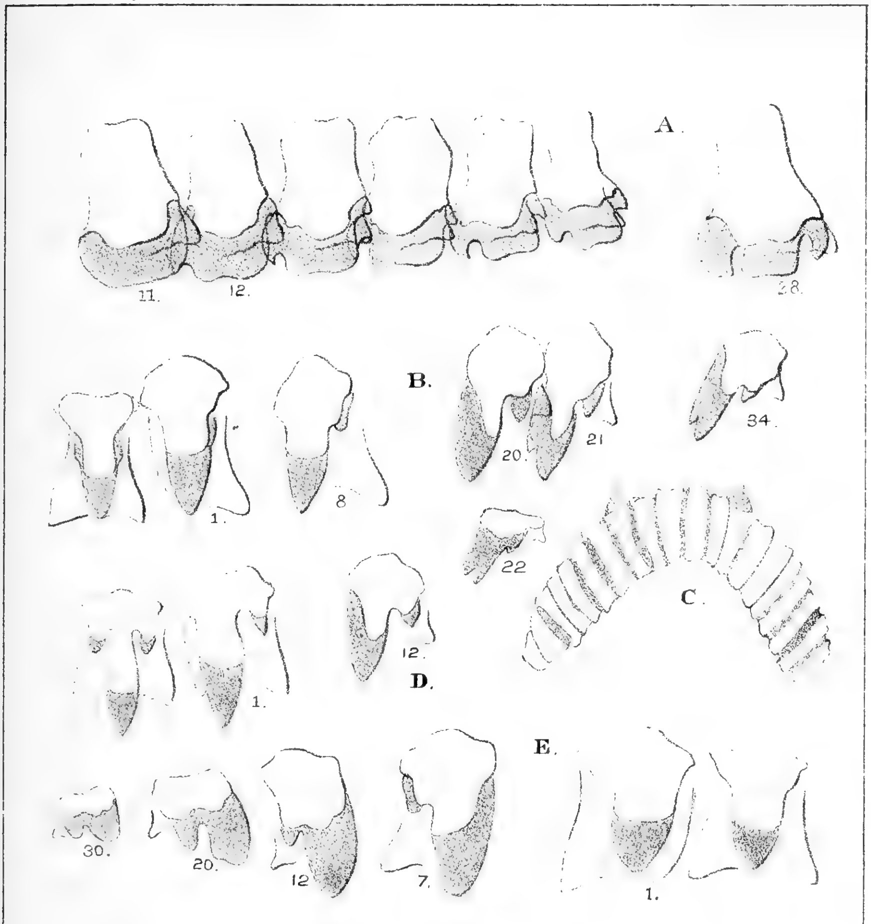
A. H. ruficincta *Newc.* B. Z. cerinoideus *Anth.* C. Amphibulima Rawsonis *[illegible]*
D. G. H. I. Coecil Gundlachi *Pfr.* E. Orthalicus undatus *Brug. var.*
F. H. Jamaicensis [illegible] J. Strophia [illegible] K. H. [illegible]



W.G.B. del

J.H. Bufford's Sons Lith. Boston

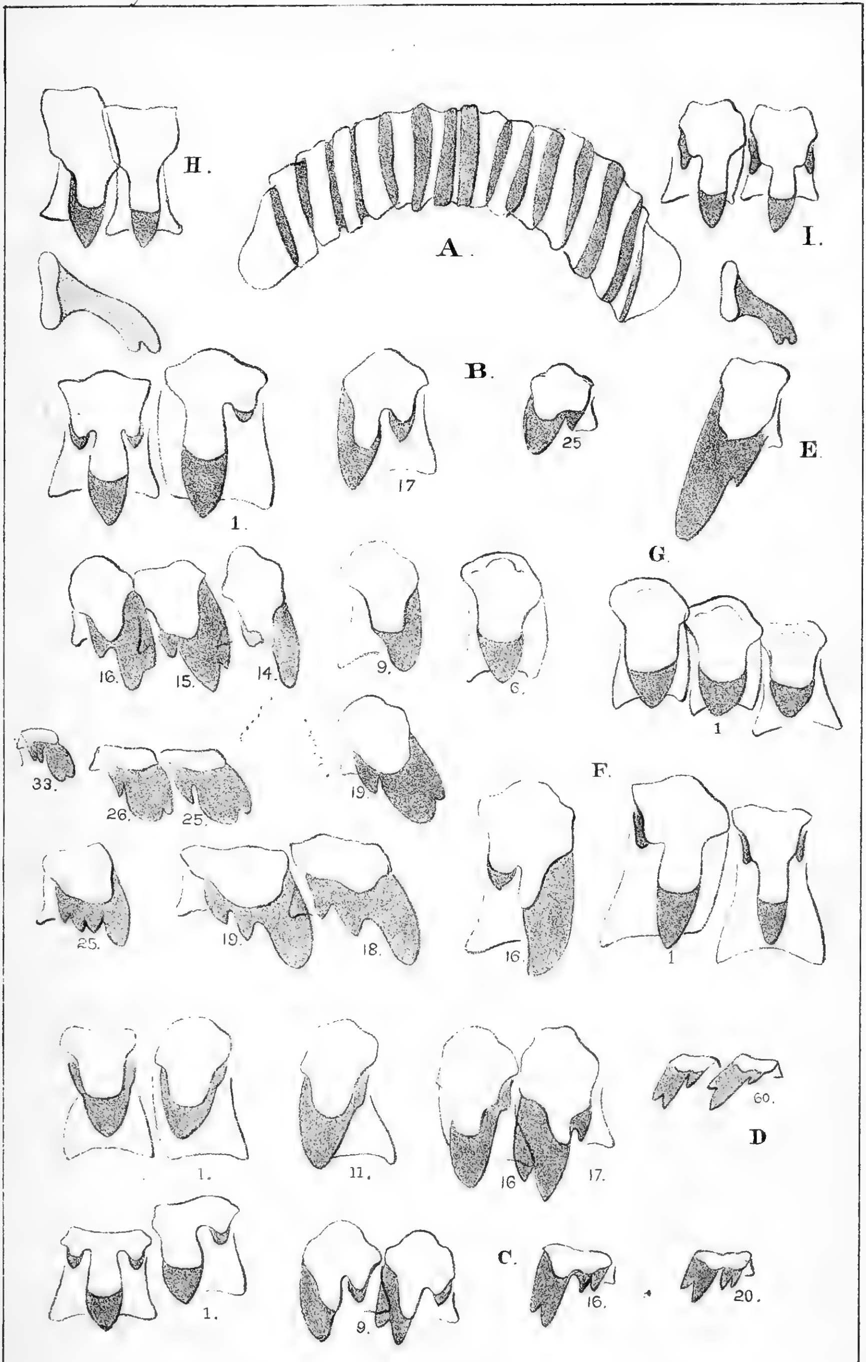
A. H. fringilla *Pf.* B. H. Jamaicensis *Chemn.* C. H. Studeriana. *Fer.* D. Achlla venusta *Migh.* E. Amphib. Rawsonis *Bl.* F. Gl. truncata. *Say.* G. Achlla textilis *Fér.* H. A. obesa *Newc.*



W.G.B. del.

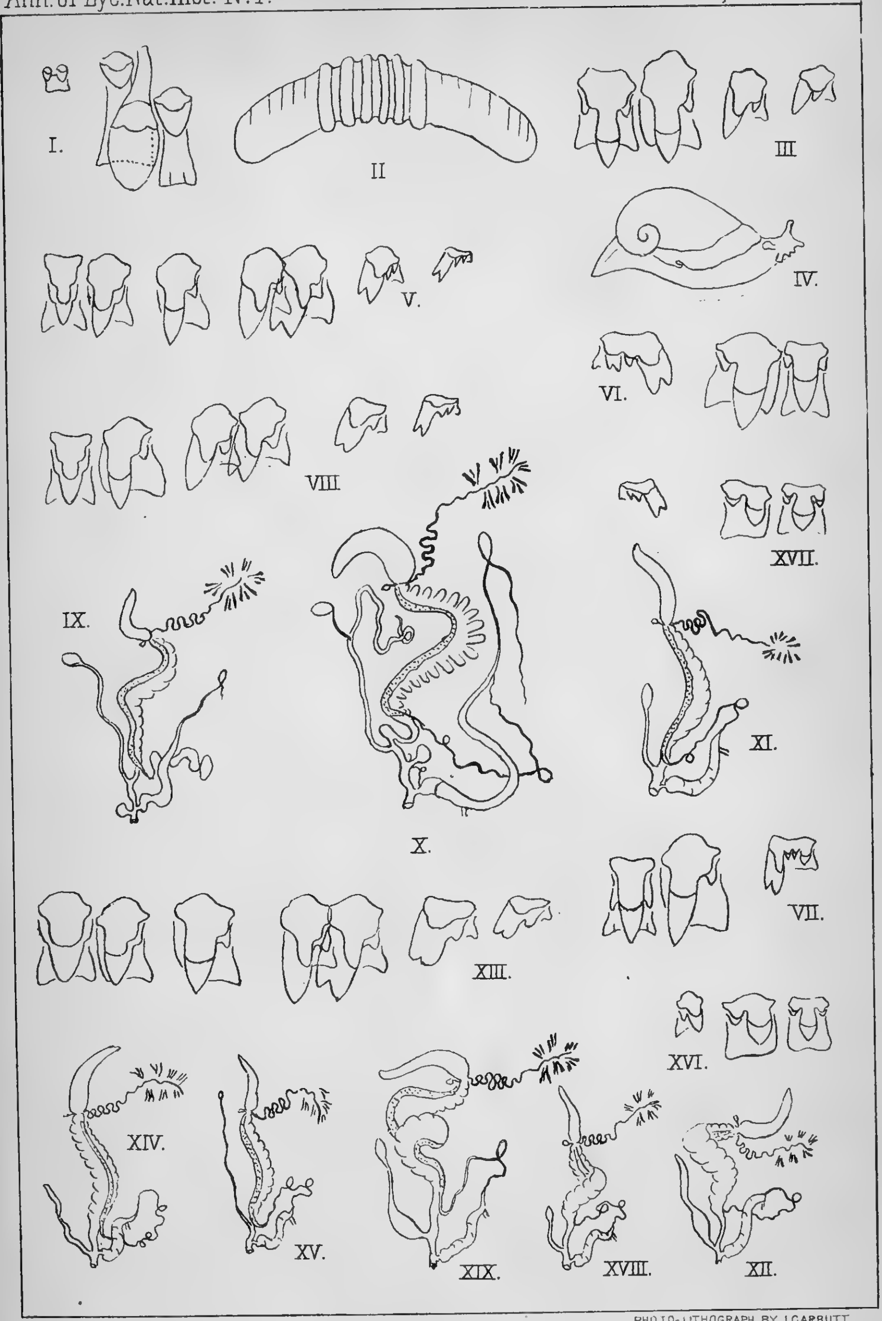
J.H. Bufford's Sons Lith. Boston.

A. H. fringilla. *Pfr.*
B. H. Carpenteri *Newc.*
C. D. H. pubescens. *Pf.*
E. Pat. Cumberlandiana *Lea.*
F. Cyl. Poeyana. *Orb.*
G. H. Diabloensis. *Coop.*



W.G.B. del. J.H. Bufford's Sons Lith. Boston

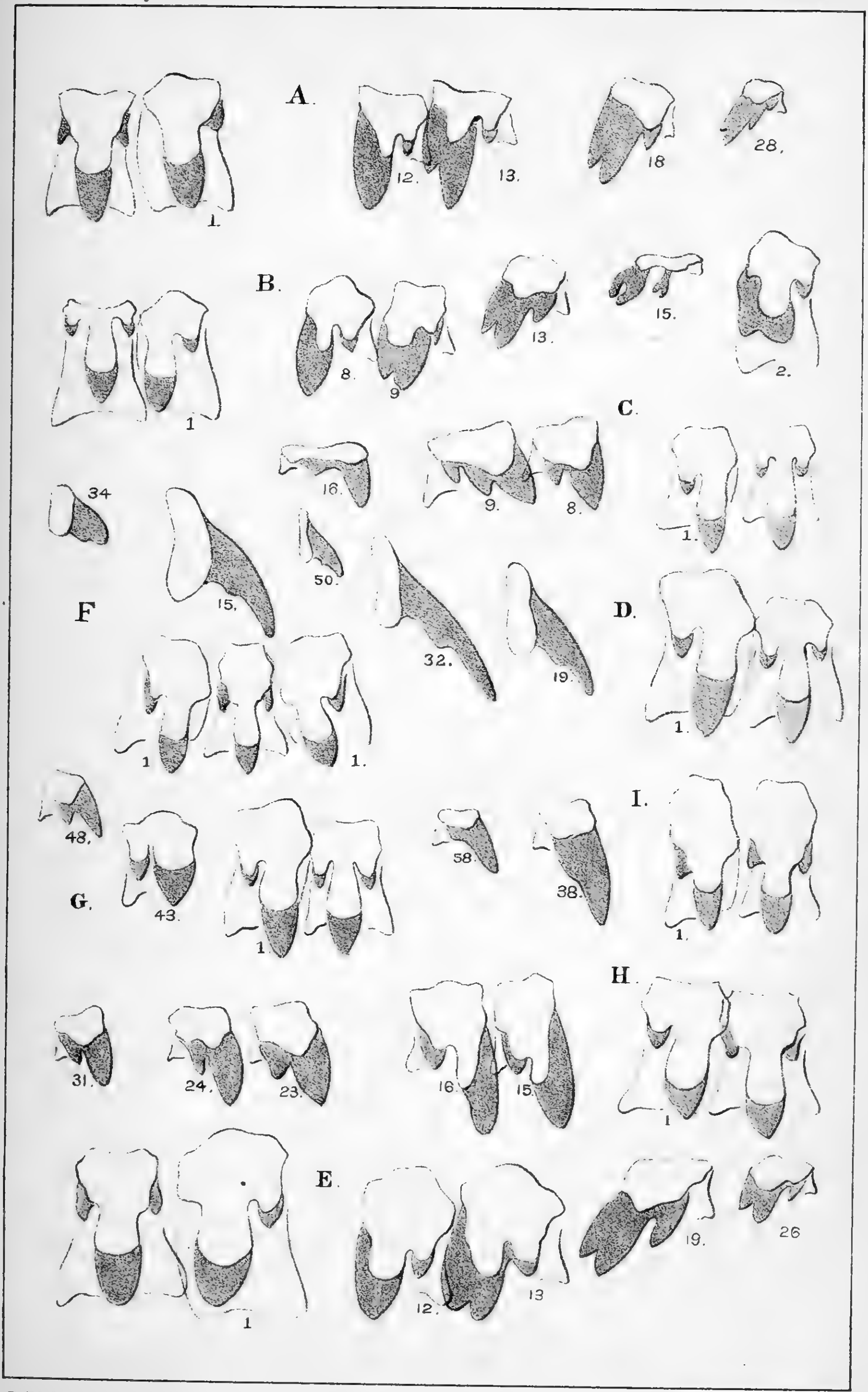
A. B. Bul. limnaeoides *Fer.* C. H. cereolus. *Muhlf.*
D. E. H. exoleta *Binn.* F. H. rufescens *Penn.* G. H. dentiens. *Fer.*
H. Trochom. Cressida. *Gould* I. N. radians *Pfr.*



W. G. B. del.

PHOTO-LITHOGRAPH BY J. CARBUTT. PHILADELPHIA.

I. Cyl. ornata, G.
II-IV. Binneia notabilis.
V. X. H. Tryoni, N.
VI. S. papillata, Pfr.
VII. S. pallida, Pf.
VIII. XII. H. Van Nostrandi, Bl.
IX. XIII. H. facta, Newc.
XI. H. fallax, Say.
XIV. H. Hopetonensis, Sh.
XV. Pat. alternata, S.
XVI. End. incerta, M.
XVII. P. Huahinensis, Pse.
XVIII. H. Rugeli, Sh.
XIX. H. tridentata, S.



W.G.B. del.

J.H. Bufford's Sons Lith. Boston.

A. H. Harfordiana. *J.G.C.* B. H. leporina. *G.* C. H. Ingersolli.
D. Limax montanus E. H. auriculata. *Say.* F. Limax castaneus.
G. Ariol Andersoni. *J.G.C.* H. A. Hemphilli. I. Anadenus.

New York Academy of Sciences,

No. 12 WEST 31st STREET,

NEW YORK.

In sending herewith the first numbers of the Annals of the Academy of Sciences, and the last of the Lyceum of Natural History, the undersigned requests, in behalf of the Academy, that all societies receiving these publications would inform him of any numbers which are missing from their sets of the Annals of the Lyceum of Natural History. The Academy wishes, in entering upon the exchange of its new series of Annals, to complete the former series, so far as may be in its power, in the libraries of all societies with which it is in correspondence.

The Index number, which will complete the last volume (XI) of the Annals of the Lyceum, is delayed—but will be sent ere long.

D. S. MARTIN,

Chairman of the Publication Committee,

N. Y. Academy of Sciences.

August, 1878.

Vol. XI. Index and Contents. No. 13.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY

OF

NEW YORK.

New York:

PUBLISHED FOR THE LYCEUM.

GREGORY BROS., PRINTERS, 34 CARMINE STREET, N. Y.

OFFICERS OF THE LYCEUM.

1876.

President.

JOHN S. NEWBERRY.

Vice-Presidents.

T. EGLESTON. BENJ. N. MARTIN.

Corresponding Secretary.

H. CARRINGTON BOLTON.

Recording Secretary.

OLIVER P. HUBBARD.

Treasurer

JOHN H. HINTON.

Librarian.

LOUIS ELSBERG.

Committee of Publication.

DANIEL S. MARTIN. JOHN S. NEWBERRY.
GEO. N. LAWRENCE. HENRY MORTON.
H. CARRINGTON BOLTON.

Vol. XI. July, 1874. Nos. 1-2.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY

OF

130585

NEW YORK.

NEW YORK:
PUBLISHED FOR THE LYCEUM.
NATURALISTS' AGENCY, SALEM, MASS.
1874.

Salem Press F. W. Putnam & Co., Proprietors.

OFFICERS OF THE LYCEUM.

1874.

President.

JOHN S. NEWBERRY.

Vice-Presidents.

T. EGLESTON. HENRY MORTON.

Corresponding Secretary.

ROBERT DINWIDDIE.

Recording Secretary.

ROBERT H. BROWNNE.

Treasurer.

JOHN H. HINTON, M. D.

Librarian.

B. G. AMEND.

Committee of Publication.

THOS. BLAND. JOHN S. NEWBERRY.
GEO. N. LAWRENCE. DANIEL S. MARTIN.
H. CARRINGTON BOLTON.

PUBLICATIONS

OF

THE LYCEUM OF NATURAL HISTORY

IN THE CITY OF NEW YORK.

THE LYCEUM OF NATURAL HISTORY commences the publication of Vol. XI of its Annals and proposes to issue four numbers every year; each number to consist of not less than thirty-two pages (octavo), with or without plates.

Price of yearly subscription, payable in advance, $2. Price of a single number, 60 cents.

The Lyceum has established a Publication Fund, contributors to which, in the sum of $100 at one time, are entitled to all the scientific publications of the Lyceum appearing subsequently to the payment of their contribution.

The Lyceum has on hand for sale, at the price of $38, complete sets of its Annals, as far as published, consisting of ten volumes (octavo), illustrated by one hundred and fourteen plates, each volume containing twelve or more numbers of thirty-two pages. It has also for disposal, separately, a limited number of all the volumes, at the price of $4 per volume uncolored plates, $5 per volume with colored plates.

THOMAS BLAND,

Chairman of the Publication Committee.

NEW YORK, JULY, 1874.

JOHN H. HINTON, M.D., *Treasurer*,

41 *West 32d Street.*

☞ Any person residing within the United States, on sending the amount of his yearly subscription to the Treasurer, will receive the numbers as they appear, without further cost.

Agents in London, TRÜBNER & CO.

In Leipsic, BERN. HERMANN.

Special agents for the Lyceum,

NATURALISTS' AGENCY,

Salem, Mass.

CONTENTS.

VOL. XI. June, 1875. Nos. 5-6.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY

OF

NEW YORK.

NEW YORK:
PUBLISHED FOR THE LYCEUM.
NATURALISTS' AGENCY, SALEM, MASS.
1875.

SALEM PRESS F. W. PUTNAM & CO., PROPRIETORS.

OFFICERS OF THE LYCEUM.

1875.

President.

JOHN S. NEWBERRY.

Vice-Presidents.

T. EGLESTON. BENJ. N. MARTIN.

Corresponding Secretary.

ROBERT DINWIDDIE.

Recording Secretary.

ROBERT H. BROWNNE.

Treasurer.

JOHN H. HINTON, M. D.

Librarian.

B. G. AMEND.

Committee of Publication.

THOS. BLAND. JOHN S. NEWBERRY.
GEO. N. LAWRENCE. DANIEL S. MARTIN.
H. CARRINGTON BOLTON.

PUBLICATIONS

OF

THE LYCEUM OF NATURAL HISTORY

IN THE CITY OF NEW YORK.

The Lyceum of Natural History has commenced the publication of Vol. XI of its Annals and proposes to issue four numbers every year; each number to consist of not less than thirty-two pages (octavo), with or without plates.

Price of yearly subscription, payable in advance, $2. Price of a single number, 60 cents.

The Lyceum has established a Publication Fund, contributors to which, in the sum of $100 at one time, are entitled to all the scientific publications of the Lyceum appearing subsequently to the payment of their contribution.

The Lyceum has on hand for sale, at the price of $38, complete sets of its Annals, as far as published, consisting of ten volumes (octavo), illustrated by one hundred and fourteen plates, each volume containing twelve or more numbers of thirty-two pages. It has also for disposal, separately, a limited number of all the volumes, at the price of $4 per volume uncolored plates, $5 per volume with colored plates.

THOMAS BLAND,

Chairman of the Publication Committee.

New York, June, 1875.

JOHN H. HINTON, M.D., *Treasurer,*

41 *West 32d Street.*

☞ Any person residing within the United States, on sending the amount of his yearly subscription to the Treasurer, will receive the numbers as they appear, without further cost.

Agents in London, Trübner & Co.

In Leipsick, Bern. Hermann.

Special agents for the Lyceum,

NATURALISTS' AGENCY,

Salem, Mass.

CONTENTS.

Vol. XI. February, 1876. Nos. 7-8.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY

OF

NEW YORK.

NEW YORK:
PUBLISHED FOR THE LYCEUM.
NATURALISTS' AGENCY, SALEM, MASS.
1876.

SALEM PRESS F. W. PUTNAM & CO., PROPRIETORS.

OFFICERS OF THE LYCEUM.

1875.

President.

JOHN S. NEWBERRY.

Vice-Presidents.

T. EGLESTON. BENJ. N. MARTIN.

Corresponding Secretary.

ROBERT DINWIDDIE.

Recording Secretary.

ROBERT H. BROWNNE.

Treasurer.

JOHN H. HINTON, M. D.

Librarian.

B. G. AMEND.

Committee of Publication.

THOS. BLAND. JOHN S. NEWBERRY.
GEO. N. LAWRENCE. DANIEL S. MARTIN.
H. CARRINGTON BOLTON.

Vol. XI. December, 1876. Nos. 9-10.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY

OF

NEW YORK.

NEW YORK:
PUBLISHED FOR THE LYCEUM.
NATURALISTS' AGENCY, SALEM, MASS.
1876.

SALEM PRESS, F. W. PUTNAM & CO., PROPRIETORS.

New York Academy of Sciences,

[LATE LYCEUM OF NATURAL HISTORY.]

1876.

President.

JOHN S. NEWBERRY.

Vice-Presidents.

T. EGLESTON. BENJ. N. MARTIN.

Corresponding Secretary.

H. CARRINGTON BOLTON.

Recording Secretary.

OLIVER P. HUBBARD.

Treasurer.

JOHN H. HINTON.

Librarian.

LOUIS ELSBERG.

Committee of Publication.

DANIEL S. MARTIN. JOHN S. NEWBERRY.
GEO. N. LAWRENCE. HENRY MORTON.
H. CARRINGTON BOLTON.

PUBLICATIONS

OF

THE LYCEUM OF NATURAL HISTORY

IN THE CITY OF NEW YORK.

The Lyceum of Natural History has commenced the publication of Vol. XI of its Annals, and proposes to issue four numbers every year; each number to consist of not less than thirty-two pages (octavo), with or without plates.

Price of yearly subscription, payable in advance, $2. Price of a single number, 60 cents.

The Lyceum has established a Publication Fund, contributors to which, in the sum of $100 at one time, are entitled to all the scientific publications of the Lyceum appearing subsequently to the payment of their contribution.

The Lyceum has on hand for sale, at the price of $38, complete sets of its Annals, as far as published, consisting of ten volumes (octavo), illustrated by one hundred and fourteen plates, each volume containing twelve or more numbers of thirty-two pages. It has also for disposal, separately, a limited number of all the volumes, at the price of $4 per volume, uncolored plates, $5 per volume with colored plates.

THOMAS BLAND,

Chairman of the Publication Committee.

New York, 1875.

JOHN H. HINTON, M.D., *Treasurer,*

41 *West 32d Street.*

☞ Any person residing within the United States, on sending the amount of his yearly subscription to the Treasurer, will receive the numbers as they appear, without further cost.

Agents in London, Trübner & Co.

In Leipsick, Bern. Hermann.

Special agents for the Lyceum,

NATURALISTS' AGENCY,

Salem, Mass.

CONTENTS.

ANNALS

OF THE

NEW YORK ACADEMY OF SCIENCES.

The "Annals," published for over half a century by the late Lyceum of Natural History, will be continued under the above name after the close of the present volume, 1876, by the New York Academy of Sciences.

It is proposed, as before, to issue four numbers every year, each number to consist of not less than thirty-two pages (octavo), with or without plates. Price of Yearly Subscription, Two Dollars, payable in advance.

The Academy has for sale a number of back volumes of the Annals of the Lyceum, each containing twelve or more numbers; the price per volume is $4.00 with uncolored plates, or $5.00 with colored plates.

The Academy has established a Publication Fund, contributors to which, in the sum of $100 at one time, are entitled to all the scientific publications of the Academy appearing subsequently to the payment of their contribution.

Communications should be addressed to

Prof. D. S. MARTIN,

Chairman of Publication Committee,

236 *West 4th St.*

JOHN H. HINTON, M. D.,

Treasurer, 41 *West 32d St.*

☞ Any person residing within the United States, on sending the amount of his yearly subscription to the Treasurer, will receive the numbers as they appear, without further cost.

Agents in London, Trübner & Co.

In Leipsic, Bern. Hermann.

Special agents for the Academy,

NATURALISTS' AGENCY,

Salem, Mass.

CONTENTS.

[Pages 307-314, belonging to No. 10, will be issued shortly with No. 11.]

Vol. XI. June, 1877. Nos. 11-12.

ANNALS

OF THE

LYCEUM OF NATURAL HISTORY

OF

NEW YORK.

130583

NEW YORK:
PUBLISHED FOR THE LYCEUM.
NATURALISTS' AGENCY, SALEM, MASS.
1876.

SALEM PRESS, F. W. PUTNAM & CO., PROPRIETORS.

New York Academy of Sciences,

[Late Lyceum of Natural History.]

1876.

President.

JOHN S. NEWBERRY.

Vice-Presidents.

T. EGLESTON. BENJ. N. MARTIN.

Corresponding Secretary.

H. CARRINGTON BOLTON.

Recording Secretary.

OLIVER P. HUBBARD.

Treasurer.

JOHN H. HINTON.

Librarian.

LOUIS ELSBERG.

Committee of Publication.

DANIEL S. MARTIN. JOHN S NEWBERRY.
GEO. N. LAWRENCE. HENRY MORTON.
H. CARRINGTON BOLTON.

ANNALS

OF THE

NEW YORK ACADEMY OF SCIENCES.

The "Annals," published for over half a century by the late Lyceum of Natural History, will be continued under the above name after the close of the present volume, 1876, by the NEW YORK ACADEMY OF SCIENCES.

It is proposed, as before, to issue four numbers every year, each number to consist of not less than thirty-two pages (octavo), with or without plates. Price of Yearly Subscription, Two Dollars, payable in advance.

The Academy has for sale a number of back volumes of the Annals of the Lyceum, each containing twelve or more numbers; the price per volume is $4.00 with uncolored plates, or $5.00 with colored plates.

The Academy has established a Publication Fund, contributors to which, in the sum of $100 at one time, are entitled to all the scientific publications of the Academy appearing subsequently to the payment of their contribution.

Communications should be addressed to

Prof. D. S. MARTIN,

Chairman of Publication Committee,

236 *West 4th St.*

JOHN H. HINTON, M. D.,

Treasurer, 41 *West 32d St.*

☞ Any person residing within the United States, on sending the amount of his yearly subscription to the Treasurer, will receive the numbers as they appear, without further cost.

Agents in London, TRÜBNER & CO.

In Leipsic, BERN. HERMANN.

Special agents for the Academy,

NATURALISTS' AGENCY,

Salem, Mass.

CONTENTS.

ANNALS

OF THE

NEW YORK LYCEUM OF NATURAL HISTORY.

With the present Number,—the concluding part of the Eleventh Volume,—the publication bearing this name will close, in consequence of the change recently made in the official name of the Society. It will at once be continued, however, under the same management, with the title of the

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES.

Volume I of the new Annals will begin with the year 1877.

It is proposed, as before, to issue four numbers every year, each number to consist of not less than thirty-two pages (octavo), with or without plates. Price of Yearly Subscription, Two Dollars, payable in advance.

The Academy has for sale a number of back volumes of the Annals of the Lyceum, each containing twelve or more numbers; the price per volume is $4.00 with uncolored plates, or $5.00 with colored plates.

The Academy has established a Publication Fund, contributors to which, in the sum of $100 at one time, are entitled to all the Scientific Publications of the Academy appearing subsequently to the payment of their contributions.

Communications should be addressed to

PROF. D. S. MARTIN,
Chairman of Publication Committee, 236 *West Fourth St.*

Or to

JOHN H. HINTON, M. D.,
Treasurer, 41 *West Thirty-second St.*

☞ Any person residing within the United States, on sending the amount af his yearly subscription to the Treasurer, will receive the numbers as they appear, without further cost.

Agents in London, TRUBNER & Co.
In Leipsic, BERN. HERMANN.

Special agents for the Academy,

NATURALISTS' AGENCY,
Salem, Mass.

N. B. All subscribers and correspondents are requested to inform the Chairman of the Publication Committee of any breaks or omissions existing in their sets of the Annals of the Lyceum. Wherever it is possible to do so, the Academy desires to fill such omissions and complete such broken sets; and with certain exceptions in some of the earlier volumes (I, II, and III), it can in most cases readily be done.

CONTENTS.