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PREFATORY NOTE

The six Memoirs included in this volume appeared at various dates as follows:

- Memoir No. 1, December, 1915;
- “ No. 2, November, 1916;
- “ No. 3, November, 1916;
- “ No. 4, April, 1917;
- “ No. 5, September, 1918;
- “ No. 6, July, 1920.

Owing to circumstances beyond the control of the Director and Editor of the publications of the Carnegie Museum a partial suspension of the publishing activities of the Museum took place during the period in which the United States of North America were at war with the so-called “Central Powers” of Europe. This cessation of our issue of scientific literature was only temporary. At the time these lines are being written a resumption of our activities along the lines alluded to has taken place. The issue of Memoir No. 6 from the pen of Mr. O. A. Peterson upon “The American Diceratheres” concludes the Seventh Volume of the Memoirs. The Eighth Volume of the Memoirs is well under way, Memoir No. 1 having already appeared and No. 2 being in the hands of the printers. The publication of the “Annals” has also been resumed.

W. J. HOLLAND.

CARNEGIE MUSEUM,
July, 1920.

TABLE OF CONTENTS

	PAGE
PREFATORY NOTE.....	iii
TABLE OF CONTENTS.....	v
LIST OF FIGURES IN TEXT.....	vii
LIST OF PLATES.....	xi
LIST OF SPECIES NEW TO SCIENCE DESCRIBED IN THIS VOLUME.....	xv
ERRATA, CORRIGENDA, AND AMPLIFICATIONS BY THE AUTHOR OF MEMOIR ON CHEIRODONTINÆ.....	xix
MEMOIR No. 1. The Cheirodontiæ, a Subfamily of Minute Characid Fishes of South America. By Carl H. Eigenmann..	1-100
MEMOIR No. 2. The Fossil Turtles of the Uinta Formation. By Charles W. Gilmore.....	101-162
MEMOIR No. 3. A Catalog of the Ophidia from South America at Present (June, 1916) contained in the Carnegie Museum, with Descriptions of Some New Species. By Lawrence Edmonds Griffin.....	163-228
MEMOIR No. 4. Pimelodella and Typhlobagrus. By Carl H. Eigenmann.....	229-258
MEMOIR No. 5. The Pygidiidæ, a Family of South American Catfishes. By Carl H. Eigenmann.....	259-398
MEMOIR No. 6. The American Diceratheres. By O. A. Peterson	399-476
INDEX.....	477-488

LIST OF FIGURES IN TEXT.

MEMOIR No. 1.

FIGURE	PAGE
1. Types of teeth and their variations in the <i>Cheirodontinae</i>	9
2. Phylogenic Arrangement of the Genera of the <i>Cheirodontinae</i>	13
3. Arrangement of teeth in <i>Grundulus bogotensis</i> (Humboldt)	18
4. Arrangement of teeth in <i>Spintherobulus papilliferus</i> Eigenmann	20
6. Outline of head and teeth in <i>Probolodus heterostomus</i> Eigenmann	22
6. Outline of head and teeth in <i>Aphyocharax dentatus</i> Eigenmann	26
7. Outline of head and teeth in <i>Aphyocharax anisitsi</i> Eigenmann	30
8. <i>Aphyocharax avary</i> Fowler	31
9. <i>Aphyocharax rathbuni</i> Eigenmann. Greatly enlarged	32
10. Dentition of <i>Aphyocharax paraguayensis</i> Eigenmann	33
11. Outline of head and dentition of <i>Prionobrama filigera</i> Eigenmann	40
12. Outline of head and dentition of <i>Parcebasis cyclolepis</i> Eigenmann	45
13. Dentition of <i>Maeropsobrycon uruguayanae</i> Eigenmann	49
14. Outline of head and dentition of <i>Megalamphodus melanopiterus</i> Eigenmann	51
15. Dentition of <i>Megalamphodus heterosthes</i> (Ulrey)	54
16. Outline of head and dentition of <i>Megalamphodus micropterus</i> Eigenmann	55
17. Dentition of <i>Oligobrycon microstomus</i> Eigenmann	57
18. Outline of head and dentition of <i>Aphyocheiroidon hemigrammus</i> Eigenmann	59
19. Outline of head and dentition of <i>Compsura heterura</i> Eigenmann	61
20. Dentition of <i>Microbrycon ribeiroi</i> Eigenmann	63
21. Dentition of <i>Cheirodon annae</i> McAtee	68
22. Interhæmal spines of <i>Cheirodon annae</i> , ♂	69
23. Dentition and enlarged view of interhæmal spines of <i>Cheirodon annae</i>	69
24. Interhæmals in <i>Cheirodon interruptus</i> Jenyns	72
25. Dentition of <i>Cheirodon monodon</i> Cope	73
26. <i>Cheirodon notomelas</i> Eigenmann	75
27. <i>Cheirodon piaba</i> Lütken	79
28. <i>Cheirodon piaba</i> Lütken	80
29. <i>Cheirodon microdon</i> Eigenmann	81
30. <i>Cheirodon stenodon</i> Eigenmann	82
31. <i>Holesthes pequirá</i> (Steindachner)	84
32. <i>Holesthes heterodon</i> Eigenmann	88
33. <i>Odontostilbe hastata</i> Eigenmann	91

34. <i>Odontostilbe drepanon</i> Fowler	93
35. <i>Odontostilbe microcephala</i> Eigenmann	94
36. <i>Odontostilbe madeira</i> Fowler	97

MEMOIR NO. 2.

1. Carapace of <i>Baëna arenosa</i> Leidy	108
2. Carapace of <i>Baëna inflata</i> Gilmore	113
3. Plastron of <i>Baëna inflata</i> Gilmore	114
4. Anterior lobes of <i>Baëna inflata</i> Gilmore	116
5. Carapace of <i>Baëna gigantea</i> Gilmore	117
6. Plastron of <i>Baëna gigantea</i> Gilmore	118
7. Lateral View of Carapace and Plastron of <i>Baëna gigantea</i>	119
8. Plastron of <i>Baëna platyplastra</i> Gilmore	120
9. Carapace of <i>Echmatemys callopyge</i> Hay	124
10. Plastron of <i>Echmatemys callopyge</i> Hay	125
11. Carapace of <i>Echmatemys douglassi</i> Gilmore	129
12. Plastron of <i>Echmatemys douglassi</i> Gilmore	130
13. Carapace of <i>Echmatemys hollandi</i> Gilmore	133
14. Carapace of <i>Echmatemys obscura</i> Gilmore	137
15. Plastron of <i>Echmatemys obscura</i> Gilmore	138
16. Carapace of <i>Echmatemys depressa</i> Gilmore	140
17. Portions of the Carapace and Plastron of <i>Echmatemys pusilla?</i> Hay	142
18. Plastron of <i>Hadrianus corsoni</i> (Leidy)	145
19. Anterior half of plastron of <i>Hadrianus robustus</i> Gilmore	147
20. Plastron of <i>Hadrianus utahensis</i> Gilmore	149
21. Carapace of <i>Testudo uintensis</i> Gilmore	152
22. Plastron of <i>Testudo uintensis</i> Gilmore	153

MEMOIR NO. 4.

1. <i>Pimelodella buckleyi</i> (Boulenger)	241
2. <i>Pimelodella laticeps</i> Eigenmann	243

MEMOIR NO. 5.

1. Phylogenetic tree of the Pygidiidæ	277
2. Details of structure of skulls of <i>Hatcheria patagoniensis</i> Eigenmann and <i>Scleronema operculatus</i> Eigenmann	282
3. <i>Hatcheria patagoniensis</i> Eigenmann	283
4. <i>Hatcheria areolata</i> (Cuvier & Valenciennes)	286
5. <i>Hatcheria burmeisteri</i> (Berg.)	286
6. <i>Hatcheria macrari</i> (Girard)	287
7. <i>Pygidium tenue</i> (Weyenbergh)	293

LIST OF FIGURES IN TEXT.

ix

8. <i>Pygidium cordureuse</i> (Weyenbergh).....	293
9. <i>Pygidium barbouri</i> Eigenmann.....	303
10. <i>Pygidium oroyæ</i> Eigenmann & Eigenmann.....	304
11. <i>Pygidium quacchorum</i> Steindachner.....	305
12. <i>Pygidium laticeps</i> (Kner & Steindachner).....	308
13. <i>Pygidium chapmani</i> Eigenmann.....	309
14. <i>Pygidium tenium</i> (Kner).....	310
15. <i>Pygidium caliense</i> Eigenmann.....	311
16. <i>Pygidium proöps</i> (Ribeiro).....	332
17. <i>Pygidium brasiliense</i> (Reinhardt).....	338
18. <i>Pygidium brasiliense</i> (Reinhardt).....	338
19. <i>Pygidium itatiayæ</i> (Ribeiro).....	339
20. <i>Pygidium minutum</i> (Boulenger).....	340
21. Outline of head, &c., of <i>Pareiodon microps</i> Kner.....	344
22. <i>Henonemus macrops</i> (Steindachner).....	346
23. <i>Henonemus punctatus</i> (Boulenger).....	347
24. <i>Henonemus</i> anatomical details.....	347
25. <i>Henonemus taxistigmus</i>	348
26. <i>Homodiætus maculatus</i> (Steindachner).....	352
27. <i>Stegophilus insidiosus</i> Reinhardt.....	354
28. <i>Acanthopoma annectens</i> Lütken.....	355
29. <i>Vandellia cirrhosa</i> Cuvier & Valenciennes.....	361
30. <i>Vandellia plazai</i> Castelnau.....	362
31. <i>Vandellia wieneri</i> Pellegrin.....	363
32. <i>Vandellia wieneri</i> Pellegrin.....	363
33. <i>Vandellia hasemani</i> Eigenmann.....	364
34. <i>Vandellia hasemani</i> , anatomical details.....	364
35. <i>Vandellia hasemani</i> , anatomical details.....	365
36. <i>Vandellia sanguinea</i> Eigenmann.....	365
37. <i>Vandellia</i> , left premaxillary.....	366
38. <i>Branchioica bertonii</i>	368
39. <i>Phreatobius cisternarum</i> Goeldi.....	372

MEMOIR NO. 6.

1. <i>Diceratherium pleuroceros</i> (Duvernoy).....	403
2. <i>Diceratherium minutum</i> (Cuvier).....	404
3. <i>Diceratherium douvillei</i>	404
4. Upper dentition of <i>Diceratherium cooki</i>	409
5. <i>Rhinoeeros</i> (? <i>Diccratherium</i>) <i>pacificus</i> Leidy.....	410
6. <i>Rhinoceros</i> (? <i>Diceratherium</i>) <i>hesperius</i> Leidy.....	411

7. <i>Rhinoceros</i> (? <i>Diceratherium</i>) <i>oregonensis</i> Marsh	412
8. <i>Diceratherium truquianum</i> (Cope)	412
9. <i>Diceratherium petersoni</i> Loomis	413
10. <i>Diceratherium armatum</i> Marsh	414
11. <i>Diceratherium annectens</i> (Marsh)	418
11a. <i>Diceratherium annectens</i> (Marsh)	420
12. <i>Diceratherium gregorii</i> Peterson	423
13. <i>Diceratherium niobrarense</i> Peterson	426
14. <i>Diceratherium niobrarense</i> Peterson	427
15. <i>Diceratherium niobrarense</i> Peterson, atlas	428
16. <i>Diceratherium cooki</i> Peterson, outline of skull	433
17. <i>Diceratherium</i> , atlas	436
18. <i>Diceratherium</i> , axis	436
19. <i>Diceratherium</i> , fourth cervical	437
20. <i>Diceratherium</i> , sixth cervical	437
21. <i>Diceratherium</i> , seventh cervical	438
22. <i>Diceratherium</i> , first dorsal	438
23. <i>Diceratherium</i> , tenth dorsal	439
24. <i>Diceratherium</i> , eighteenth dorsal	439
25. <i>Diceratherium</i> , second lumbar	443
26. <i>Diceratherium</i> , fourth lumbar	440
27. <i>Diceratherium</i> , fifth lumbar	441
28. <i>Diceratherium</i> , sacrum	441
29. <i>Diceratherium</i> , sternum	442
30. <i>Diceratherium</i> , scapula	443
31. <i>Diceratherium</i> , humerus	444
32. <i>Diceratherium</i> , radius and ulna	445
33. <i>Diceratherium</i> , radius and ulna	445
34. <i>Diceratherium</i> , pelvis	446
35. <i>Diceratherium</i> , femur	447
36. <i>Diceratherium</i> , tibia and fibula	447
37. <i>Diceratherium</i> , patella	448

LIST OF PLATES

PLATE		
I.		Map Showing Route of John D. Haseman of the Carnegie Museum Expedition to South America.
II.	FIG. 1.	<i>Grundulus bogotensis</i> (Humboldt).
	FIG. 2.	<i>Aphyocharax paraguayensis</i> Eigenmann.
III.	FIGS. 1-4.	<i>Spintherobolus papilliferus</i> Eigenmann.
	FIG. 5.	<i>Aphyocharax rathbuni</i> Eigenmann.
	FIG. 6.	<i>Aphyocharax anisitsi</i> Eigenmann & Kennedy.
IV.	FIG. 1.	<i>Aphyocharax dentatus</i> Eigenmann & Kennedy.
	FIG. 2.	<i>Paragoniates alburnus</i> Steindachner.
	FIG. 3.	<i>Leptagoniates steindachneri</i> Boulenger.
	FIG. 4.	<i>Prionobrama filiferus</i> (Cope).
	FIG. 5.	<i>Prionobrama paraguayensis</i> (Eigenmann).
V.	FIG. 1.	<i>Phanagoniates wilsoni</i> Eigenmann.
	FIG. 2.	<i>Parecbasis cyclolepis</i> Eigenmann.
VI.	FIG. 1.	<i>Leptobrycon jatuaranae</i> Eigenmann.
	FIG. 2.	<i>Macropsobrycon uruguayanae</i> Eigenmann.
VII.		<i>Megalamphodus megalopterus</i> Eigenmann.
VIII.	FIG. 1.	<i>Megalamphodus micropterus</i> Eigenmann.
	FIG. 2.	<i>Microschemobrycon guaporensis</i> Eigenmann.
IX.	FIG. 1.	<i>Oligobrycon microstomus</i> Eigenmann.
	FIG. 2.	<i>Aphyocheiroidon hemigrammus</i> Eigenmann.
X.	FIG. 1.	<i>Compsura heterura</i> Eigenmann.
	FIG. 2.	<i>Misobrycon ribeiroi</i> Eigenmann.
XI.	FIG. 1.	<i>Cheirodon anna</i> McAttee.
	FIG. 2.	<i>Cheirodon parahybae</i> Eigenmann.
XII.	FIG. 1.	<i>Cheirodon interruptus</i> Jenyns.
	FIG. 2.	<i>Cheirodon notomelas</i> Eigenmann.
XIII.	FIG. 1.	<i>Cheirodon madeira</i> Eigenmann.
	FIG. 2.	<i>Cheirodon piaba</i> Lütken.
XIV.	FIG. 1.	<i>Cheirodon microdon</i> Eigenmann.
	FIG. 2.	<i>Cheirodon stenodon</i> Eigenmann.
XV.	FIG. 1.	<i>Holesthes pequirá</i> (Steindachner).
	FIG. 2.	<i>Holesthes heterodon</i> Eigenmann.
XVI.	FIG. 1.	<i>Odontostilbe hastata</i> Eigenmann.
	FIG. 2.	<i>Odontostilbe paraguayensis</i> Eigenmann & Kennedy.

- PLATE
 XVII. FIG. 1. *Odontostilbe pulehra* (Gill).
 FIG. 2. *Cheirodon insignis* Steindachner.
 FIG. 3. *Odontostilbe paraguayensis* Eigenmann & Kennedy.
 FIG. 4. *Cheirodon pisciculus* Girard.
 FIG. 5-6. *Cheirodon piaba* Lütken.
 XVIII. FIG. 1. Carapace of *Baëna arenosa* Leidy.
 FIG. 2. Plastron of *Baëna platyplastra* Gilmore.
 XIX. FIG. 1. Carapace of *Baëna inflata* Gilmore.
 FIG. 2. Plastron of Do.
 XX. FIG. 1. Carapace of *Baëna gigantea* Gilmore.
 FIG. 2. Plastron of Do.
 XXI. FIG. 1. Carapace of *Echmatemys callopyge* Hay.
 FIG. 2. Plastron of Do.
 XXII. FIG. 1. Carapace of *Echmatemys douglassi* Gilmore.
 FIG. 2. Plastron of Do.
 XXIII. FIG. 1. Carapace of *Echmatemys hollandi* Gilmore.
 FIG. 2. Carapace of *Echmatemys depressa* Gilmore.
 XXIV. FIG. 1. Carapace of *Echmatemys obscura* Gilmore.
 FIG. 2. Plastron of Do.
 XXV. FIG. 1. Plastron of *Hadrianus corsoni* (Leidy)
 FIG. 2. Plastron of *Hadrianus robustus* Gilmore.
 XXVI. FIG. 1. Plastron of *Hadrianus utahensis* Gilmore.
 FIG. 2. Carapace of *Amyda scutumantiquum* (Cope)
 XXVII. FIG. 1. Carapace of *Testudo uinlensis* Gilmore.
 FIG. 2. Plastron of Do.
 XXVIII. FIG. 1. *Atractus tæniatus* Griffin.
 FIG. 2. Dorsal view of head of Do.
 FIG. 3. Ventral view of head of Do.
 FIG. 4. *Tropidodipsas spilogaster* Griffin.
 FIG. 5. Dorsal view of head of Do.
 FIG. 6. Ventral view of head of Do.
 FIG. 7. *Clelia euprepia* Griffin.
 FIG. 8. Dorsal view of head of Do.
 FIG. 9. Ventral view of head of Do.
 FIG. 10. *Elaps hollandi* Griffin.
 FIG. 11. Dorsal view of head of Do.
 FIG. 12. Ventral view of head of Do.
 XXIX. FIG. 1. *Pimelodella serrata* Eigenmann.
 FIG. 2. *Pimelodella cristata* (Müller & Troschel).
 FIG. 3. *Pimelodella avanhandaræ* Eigenmann.

PLATE		
XXX.	FIG. 1.	<i>Pimelodella hasemani</i> Eigenmann.
	FIG. 2.	<i>Pimelodella laticeps</i> Eigenmann.
	FIG. 3.	<i>Pimelodella notomelas</i> Eigenmann.
XXXI.	FIG. 1.	<i>Pimelodella meta</i> Eigenmann.
	FIG. 2.	<i>Pimelodella boliviana</i> Eigenmann.
	FIG. 3.	<i>Pimelodella itapicuruensis</i> Eigenmann.
XXXII.	FIG. 1.	<i>Pimelodella meeki</i> Eigenmann.
	FIG. 2.	<i>Pimelodella meeki</i> .
	FIG. 3.	<i>Pimelodella griffini</i> Eigenmann.
XXXIII.	FIG. 1.	<i>Pimelodella mucosa</i> Eigenmann.
	FIG. 2.	<i>Pimelodella grisea</i> Eigenmann.
	FIG. 3.	<i>Pimelodella chagresi</i> (Steindachner).
XXXIV.	FIG. 1.	<i>Pimelodella eutania</i> Regan.
	FIG. 2.	<i>Typhlobagrus kronei</i> Ribeiro.
XXXV.		Pectoral spines of species of <i>Pimelodella</i> viewed from above and greatly magnified.
XXXVI-XXXIX.		Maps showing the geographical distribution of the <i>Pygidiidæ</i> .
XL.		Anatomical details of the structure, principally of the heads, of <i>Eremophilus mutisii</i> Humboldt and <i>Henonemus punctatus</i> Boulenger.
XLI.	FIGS. 1-2.	<i>Eremophilus mutisii</i> Humboldt.
	FIGS. 3-4.	<i>Paracetopsis occidentalis</i> (Steindachner).
XLII.	FIGS. 1-2.	<i>Nematogenys inermis</i> (Guichenet).
	FIGS. 3-5.	<i>Hatcheria maculata</i> (Cuvier & Valenciennes).
XLIII.	FIGS. 1-2.	<i>Tridens melanops</i> Eigenmann & Eigenmann.
	FIGS. 3-5.	<i>Branchioica bertonii</i> Eigenmann.
XLIV.		<i>Seleronema</i> , <i>Hatcheria</i> , <i>Pygidium</i> , and <i>Pseudostegophilus</i> .
XLV.		<i>Pygidium</i> .
XLVI.		<i>Pygidium</i> .
XLVII.		<i>Pygidium</i> .
XLVIII.		<i>Pygidium</i> .
XLIX.		<i>Pygidium</i> .
L.		<i>Pygidium</i> .
LI.		<i>Pygidium</i> .
LII.		<i>Pygidium</i> .
LIII.		<i>Vandellia</i> .
LIV.	FIG. 1.	<i>Eremophilus mutisii</i> Humboldt.
	FIG. 2.	<i>Eremophilus mutisii</i> Humboldt, juv.

PLATE			
	FIG. 3.	<i>Parciodon microps</i>	Kner.
LIV.	FIGS. 1-5.	<i>Ochmaeanthus</i> .	
LVI.	FIGS. 1, 2, 4.	<i>Phreatobius eisternarum</i>	Goeldi.
	FIGS. 3, 5.	<i>Homodiatrus anisitsi</i>	Eigenmann & Ward.
LVII.		<i>Diceratherium armatum</i>	Marsh.
LVIII.		Type of <i>D. nanum</i>	Marsh and <i>D. Cooki</i> Peterson.
LIX.		<i>Diceratherium gregorii</i>	Peterson.
LX.		<i>Diceratherium cooki</i>	Peterson and <i>Diceratherium niobrarense</i> Peterson.
LXI.		Do.	Do.
LXII.		Do.	Do.
LXIII.		<i>Diceratherium cooki</i>	Peterson and <i>D. annectens</i> (Marsh).
LXIV.		<i>Diceratherium cooki</i>	Peterson.
LXV.		<i>Diceratherium cooki</i>	Peterson and <i>D. annectens</i> (Marsh).
LXVI.		<i>Diceratherium cooki</i>	Peterson and <i>D. annectens</i> (Marsh).

LIST OF GENERA AND SPECIES NEW TO SCIENCE DESCRIBED IN
THIS VOLUME

Class **MAMMALIA**.

Order *UNGULATA*.

Superfamily RHINOCEROTOIDEA.

Family RHINOCEROTIDÆ.

Genus **Diceratherium** Marsh.

(Fossil)

D. gregorii Peterson p. 421, Pl. LIX, text-fig., p. 423.

Genus **Cænopus** Cope.

Cænopus dakotensis Peterson, nom. nov. for *Aceratherium* (*Cænopus* Osborn) mite Cope, pp. 402, 435

Class **REPTILIA**.

Order *TESTUDINES*.

Family BAËNIDÆ.

Genus **Baëna** Leidy.

(Fossil)

Baëna inflata Gilmore p. 112, Pl. XIX; text-figs. 2 and 3.

Baëna gigantea Gilmore p. 116, Pl. XX, figs. 1, 2; text-figs. 5, 6, 7.

Baëna platyplastra Gilmore p. 120, Pl. XXVIII, fig. 2; text-fig. 8.

Family EMYDIDÆ.

Genus **Echmatemys** Hay.

(Fossil)

Echmatemys douglassi Gilmore p. 128, Pl. XXII; text-figs. 11 and 12.

Echmatemys hollandi Gilmore p. 133, Pl. XXIII, fig. 1; text-fig. 13.

Echmatemys obseura Gilmore p. 135, Pl. XXIV; text-figs. 14 and 15.

Echmatemys depressa Gilmore p. 139, Pl. XXIII, fig. 2; text-fig. 16.

Family TESTUDINIDÆ.

Genus **Hadrianus** Cope.

(Fossil)

Hadrianus robustus Gilmore p. 146, Pl. XXV, fig. 2; text-fig. 19.

Hadrianus utahensis Gilmore p. 148, Pl. XXVI, fig. 1; text-fig. 20.

Genus **Testudo** Linnaeus.

(Fossil)

Testudo uintensis Gilmore p. 150, Pl. XXVII; text-figs. 21, 22.

Order *SQUAMATA*.

Suborder SAURIA.

Family ANGUIDÆ.

Genus *Glyptosaurus* Auct.

Glyptosaurus sp. indet. p. 159.

Suborder SERPENTES.

Family TYPHLOPIIDÆ.

Genus *Helminthophis* Peters.

Helminthophis bondensis Griffin p. 165.

Family COLUBRIDÆ.

Aporophis melanocephalus Griffin p. 171.

Atractus taniatus Griffin p. 173, Pl. XXVIII, figs. 1-3.

Liophis clavoides Griffin p. 187.

Rhadinaea orina Griffin p. 195.

Tropidodipsas spilogaster Griffin p. 197, Pl. XXVIII, figs. 4-6.

Clelia euprepa Griffin p. 203, Pl. XXVIII, figs. 7-9.

Clelia peruviana Griffin p. 204.

Elaps columbianus Griffin p. 216.

Elaps hollandi Griffin p. 218, Pl. XXVIII, figs. 10-12.

Class *PISCES*.

Family CHARACIDÆ.

Subfamily CHEIRODONTINÆ.

Aphyocharax paraguayensis Eigenmann p. 33, Pl. II, fig. 2.

Leptobrycon Eigenmann, gen. nov. p. 46.

Leptobrycon jatuarana Eigenmann p. 46, Pl. VI, fig. 1.

Macropsobrycon Eigenmann, gen. nov. p. 48.

Macropsobrycon uruguayana Eigenmann p. 48, Pl. VI, fig. 2.

Megalamphodus Eigenmann, gen. nov. p. 49.

Megalamphodus megalopterus Eigenmann p. 50, Pl. VII.

Megalamphodus micropterus Eigenmann p. 54, Pl. VIII, fig. 1.

Microschembrycon Eigenmann, gen. nov. p. 56.

Microschembrycon guaporensis Eigenmann p. 56, Pl. VIII fig. 2.

Oligobrycon Eigenmann, gen. nov. p. 56.

Oligobrycon microstomus Eigenmann p. 57, Pl. IX, fig. 1.

Aphyocheirodon Eigenmann, gen. nov. p. 58.

Aphyocheirodon hemigrammus Eigenmann p. 59, Pl. IX, fig. 2.

Compsura Eigenmann, gen. nov. p. 60.

Compsura heterura Eigenmann p. 61, Pl. X, fig. 1.

Mixobrycon Eigenmann, gen. nov. p. 62.

- Cheirodon parahybæ* Eigenmann.....p. 70, Pl. XI, fig. 2.
Cheirodon notomelas Eigenmann.....p. 74, Pl. XII, fig. 2.
Cheirodon madeiræ Eigenmann.....p. 76, Pl. XIII, fig. 1.
Cheirodon microdon Eigenmann.....p. 80, Pl. XIV, fig. 1.
Cheirodon stenodon Eigenmann.....p. 82, Pl. XIV, fig. 2.
Holesthes heterodon Eigenmann.....p. 87, Pl. XV, fig. 2.
Megalamphodus ecuadorensis Eigenmann.....p. 99.

Family SILURIDÆ.

- Pimelodella serrata* Eigenmann.....p. 235, Pl. XXIX, fig. 1.
Pimelodella steindachneri Eigenmann.....p. 237.
Pimelodella avanhandaræ Eigenmann.....p. 240, Pl. XXIX, fig. 3.
Pimelodella hasemani Eigenmann.....p. 241, Pl. XXX, fig. 7.
Pimelodella laticeps Eigenmann.....p. 243, Pl. XXX, fig. 2.
Pimelodella laticeps australis Eigenmann.....p. 243.
Pimelodella notomelas Eigenmann.....p. 244, Pl. XXX, fig. 3.
Pimelodella meta Eigenmann.....p. 244, Pl. XXXI, fig. 1.
Pimelodella boliviana Eigenmann.....p. 254, Pl. XXXI, fig. 2.
Pimelodella itapicuruensis Eigenmann.....p. 247, Pl. XXXI, fig. 3.
Pimelodella griffini Eigenmann.....p. 250, Pl. XXXII, fig. 3.

Family PYGIDIIDÆ.

- Scleronema operculatum* Eigenmann.....p. 280, Pl. XLIV, fig. 1.
Pygidium zonatum Eigenmann.....p. 330, Pl. LI, fig. 1.
Pygidium proöps parahybæ Eigenmann.....p. 332.
Pygidium triguttatum Eigenmann.....p. 339, Pl. LII, fig. 4.
Pygidium santa-rite Eigenmann.....p. 341, Pl. LII, fig. 5.

ERRATA AND CORRIGENDA.

PAGE

13. In fig. 2 above "f" for "Aphiocharax" read *Aphyocharax*.
16. In fig. 2 above "o" for "Gompsoura" read *Compsura*.
27. Tenth line from bottom for "Macrosobrycon" read *Macropsobrycon*.
40. Ninth line from top for "*paraguayense*" read *paraguayensis*.
69. Figs. 22 and 23 for "*Cheirodon anne*" read *Cheirodon insignis*. (N.B. This change is made according to oral instructions reported to have been given by the author of the paper to one of the ladies in my front office. *Editor*.)
80. Third line from bottom for "*Aphiocheirodon*" read *Aphyocheirodon*.
99. Eleventh line from bottom for "having" read *leaving*.
99. Tenth line from bottom for "ridge" read *wedge*.
99. Second line from bottom for "small" read *mostly lost*.
99. Bottom line after the word "spot" add *no dorsal spot*.
241. Fourth line from top for "Eigenmanniorum" and "Eigenmanni" read *eigenmanniorum* and *eigenmanni*.
260. Nineteenth line from top for "Myoglanis" read *Miuroglanis*.
267. Fifteenth line from top for "Pseudolatystomus" read *Pseudoplatystomus*.
327. Seventh line from bottom for "*braziliense*" read *brasiliense*.
332. Fig. 16, for "Ribiero" read *Ribeiro*.
345. Ninth line from bottom for "Coblitiganis" read *Cobitiglanis*.
392. Fig. 4. for "reinhardtii" read *reinhardti*.
401. Thirteenth line from bottom delete ", both" and insert "both of" before "which."

PLATES

- V. For "*wilsoni* Eigenmann. Type" read *maerolepis* Meek & Hildebrand.
Type of *wilsoni*.
- IX. For "Jacquara" read *Jaguara*.
- X. For "Itapicuerú" read *Itapicurú*.

ADDENDA AND CORRIGENDA CHEIRODONTINÆ

(Note. More than a year after Memoir No. 1 upon the *Cheirodontinæ* had been published the Author sent the following paragraphs to one of the stenographers in the Museum, requesting her to include them in the corrigenda. This lady very properly turned the paper over to the Editor, who presumes that the Author intends that they shall be published, and accordingly inserts them here as submitted.)

P. 43. Instead of "19. *Phanagoniates wilsoni* Eigenmann" read:

"19. *Phanagoniates macrolepis* (Meek & Hildebrand).

Rocbooides macrolepis Meek & Hildebrand, Field Mus. Publ. Zool. Ser., vol. X, 1913, p. 84 (Rio Cupe, Boca de Cupe, Rio Tuyra).

P. 69. Meek & Hildebrand reporting on the wealth of material collected by them in Panama (Field Mus. Publ. Zool. Ser., vol. X, 1916, pp. 273-276), find that the specimens reported as *Cheirodon insignis* by Evermann and Goldsborough are representatives of a new genus and species, *Pseudocheirodon affinis*, Meek & Hildebrand, and that *Cheirodon gorgonae* Evermann & Goldsborough, placed in the synonymy of *Cheirodon insignis*, is a member of the genus *Comp-sura*.

P. 99, add: *Mimagoniates* Regan.

Mimagoniates Regan, Ann. & Mag. Nat. Hist., (7), XX, 1907, p. 402.

This genus is related to *Prionobrama* but lacks maxillary teeth and the anal is but slightly emarginate. The original description by Regan follows.

"Body strongly elongate, compressed; abdomen keeled, but not strongly compressed to an edge. Mouth small; teeth tricuspid, in a single series; *no maxillary teeth*: palate toothless. Nostrils close together. Gill-membranes not united, free from the isthmus. Scales cycloid, of moderate size; lateral line incomplete. Dorsal fin short, posterior in position; adipose fin present; anal fin elongate.

"Intermediate between *Chirodon*, Girard, and *Leptagoniates*, Blgr."

Mimagoniates Barberi Regan.

"Depth of body 3-3.66 in the length, length of head 4-4.4. Snout much shorter than eye, the diameter of which is 2.5-2.75 in the length of the head and a little less than the interorbital width. Cleft of mouth nearly vertical; maxillary not extending to below the eye. 42-45 scales in a longitudinal series; lateral line

on 4–8 scales only. Dorsal 10; origin equidistant from gill-opening and base of caudal, above the anterior part of the anal. Anal 34–38; origin equidistant from anterior part of eye and base of caudal; anterior rays the longest, about .6 the length of head; *free edge straight or slightly concave*. Pectoral extending to or a little beyond the base of ventral. Caudal forked. A lateral band (blackish in preserved specimens) from the lower part of eye to the lower lobe of caudal. An oblique dark stripe on the dorsal; anal with a dark margin.

“Habitat, Arroyo Yáca, Estación Cabellero, Paraguay.

“Several specimens, the largest 40 mm. in total length, collected by Dr. A. Barbero.”

Chirodon arnoldi Boulenger, Ann. and Mag. Nat. Hist. (6), *Chirodon arnoldi* Boulenger, Ann. and Mag. Nat. Hist. (8), IV, p. 497.

This species described as a Cheirodon is probably a Hemigrammus. If it is a Cheirodon and if it comes from the northern part of the Isthmus of Tehuantepec, it extends the known range of the genus Cheirodon northward for more than ten degrees latitude.

Head 4; depth 3. D. II. 9; A. III. 19; scales 32, 4 or 5 with pores, 11 scales in a transverse series.

Strongly compressed, snout shorter than eye, eye 2.66 in head, equals inter-orbital; maxillary not reaching anterior border of eye; lower jaw scarcely projecting. Origin of dorsal just behind base of ventrals, equidistant from snout and caudal longest ray of dorsal as long as head.

Yellowish above, finely speckled with black, silvery white beneath; a large round black spot on caudal peduncle, extending on base of middle rays of caudal; dorsal, ventrals, and caudal tinged with orange.

Length 33 mm. Said to have been imported by the Aquarist Arnold of Hamburg from Puerto Mexico, on the north coast of the Isthmus of Tehuantepec.

FEB 8 1915

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Publications of the Carnegie Museum, Serial No. 87.

MEMOIRS
OF THE
CARNEGIE MUSEUM.

VOL. VII.

NO. 1.

W. J. HOLLAND, Editor.

THE CHEIRODONTINÆ, A SUBFAMILY OF MINUTE
CHARACID FISHES OF SOUTH AMERICA

By CARL H. EIGENMANN.

PITTSBURGH.

PUBLISHED BY THE AUTHORITY OF THE BOARD OF TRUSTEES OF THE
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VOL. VII.

NO. 1.

THE CHEIRODONTINÆ, A SUBFAMILY OF MINUTE CHARACID
FISHES OF SOUTH AMERICA.¹

BY CARL H. EIGENMANN.

INTRODUCTORY.

The greater part of the work of preparing this monograph was done between January and May, 1915, while enjoying the hospitality of Mr. and Mrs. Carl G. Fisher on their estate at Miami, Florida. President W. L. Bryan and the Trustees of Indiana University appointed me Research Professor for the collegiate year 1914-1915, and the Director of the Carnegie Museum relieved me of resident curatorial duties at the Museum. I thus gained the opportunity under ideal conditions to give my undivided attention to this exceedingly difficult group of fishes. I am indebted, as in former articles, to Dr. W. J. Holland, Director of the Carnegie Museum, for assistance in arranging the figures in the text and on the plates and for his editorial revision of the manuscript. The drawings given on the plates were executed by Mr. Clarence Kennedy of Leland Stanford Jr. University. The drawings given in the text are from camera lucida sketches made by the author.

This paper would naturally form a chapter in my Monograph of the Characidae, to be published by the Museum of Comparative Zoölogy at Cambridge, Mass., but, as the publication of the first volume of the monograph has long been delayed, it is deemed best to publish this article at once.

The material on which this paper is based² consists of (*a*) the collections of

¹ Contributions from the Zoölogical Laboratory of Indiana University, No. 150.

² In enumerating the specimens at my disposal I have cited (*a*) the current numbers in the various museums; (*b*) the letters a-x, indicating the number of specimens in a given series in the Carnegie Museum; (*c*) the number of specimens in the particular lot under examination; (*d*) the size of the largest and sometimes

Harvard University, made chiefly by the Thayer expedition; (*b*) the collections of Indiana University, made by H. von Ihering in Rio Grande do Sul, by J. D. Anisits in Paraguay, and by Charles Wilson during the Landon-Fisher expedition to Colombia; (*c*) the collections made under the joint auspices of the Indiana University and the Carnegie Museum on the occasion of the author's expedition to British Guiana, and the reconnaissance undertaken by him in Colombia; and (*d*) the collections made by Mr. John D. Haseman during the expedition of the Carnegie Museum to central South America. The collections made by Mr. Haseman are by far the largest both in the number of specimens and species. An account of Haseman's travels, together with a list of his localities, was published in the *Annals* of the Carnegie Museum, Vol. VII, p. 287. A map showing his route accompanies the present paper.

There are twenty-one genera and fifty-six species and varieties of Cheirodontinæ now known.³ In the present paper seven genera and seventeen species for the first time are described. In all I have at one time or another described fourteen genera and thirty-three species. Nineteen of the genera and thirty-nine species are represented in the collections of the Carnegie Museum. In the other museums, so far as known, the species are represented as follows:

Paris (Musée National)	1
Vienna (K. K. Hofmuseum)	8
London (British Museum)	9
Genoa (Museo Civico)	2
Copenhagen (Zoölogisches Museum)	1
Cambridge (Mus. Comp. Zoölogy)	4
New York (Am. Mus. Nat. History)	1
Washington (U. S. National Museum)	2
Philadelphia (Acad. Nat. Sciences)	7
Bloomington (Indiana University Museum)	35
Ithaca, N. Y. (Cornell University)	1

I have examined practically all of the known species except *Cheirodon pisciculus* from western Chili and *Odontostilbe pulchra* from Trinidad. However, while pre- of the smallest specimen; (*v*) the locality; and (*f*) frequently the date of collecting and name of the collector. Where the entire series is reserved for the Carnegie Museum the letters after the current number and the number agree. When specimens have been destroyed by dissection or otherwise, or where there are numerous duplicates, the letters and numbers do not necessarily agree.

³ I have placed the genus *Psalidodon* in the Tetragonopterina, although it has the single row of notched teeth characteristic of the Cheirodontine. *Psalidodon* and *Henocheilus*, in the latter of which there is a double row of teeth in the upper jaw, form a little group bridging the gap between the Tetragonopterinae and Cheirodontinae; or, on account of the absence of lips, they may be regarded as forming a little group distinct from either of the above. *Megalamphodus ecuadorensis*, sp. nov. is described in the Appendix.

paring this revision, I did not have access to specimens of *Aphyocharax avary* Fowler, *Cheirodon eques* Steindachner, *Cheirodon agassizi* Steindachner, *Cheirodon pulcher* = *nattereri* Steindachner, *Odontostilbe drepanon* Fowler, *Odontostilbe madeira* Fowler, and *Leptagoniates steindachneri* Boulenger.

It is quite possible that several of these are here described under other names. It is possible that *C. agassizi* is the male of *Aphyocharax pulcher*, and that *Odontostilbe drepanon* is *Holesthes pequirã*.

THE CHEIRODONTINÆ.

The subfamily Cheirodontinæ (*Aphyocharacinae auctorum*) belongs to the large family Characidae. All the species are small or even minute. The giants of the subfamily are only about 90 mm. long at their best. *Paragoniates alburnus* reaches a length of 90 mm. The largest recorded *Grundulus* is 80 mm. long, the largest *Probolodus* 81, the largest *Parcebasis* 80, the largest *Odontostilbe microcephala* 80. Then follow *Aphyocharax dentatus* with a maximum length of 72 mm., *Cheirodon interruptus* 60 mm., *Aphyocharax alburnus* and *pusillus* 58 mm., *Holesthes pequirã* 56 mm., *H. heterodon* 50 mm., *Prionobrama paraguayensis* 50 mm., and *P. filigerus* 60 mm. The rest are all under 50 mm. in length.

Generalized type of the subfamily.—A composite of all the known species will give us an idea of the ancestor of these species, assuming for the moment that they had a common ancestor, which is open to some doubt. However, even if a few of the genera included do not belong to this an otherwise homogeneous group, they are so nearly like them that their inclusion will scarcely impair the full value of the generalized type.

The generalized type is a fish rather under fifty millimeters, or two inches, in length; compressed, oval, with symmetric dorsal and ventral outlines. Its depth at the origin of the dorsal is about one-third of the length from the tip of the snout to the end of the median series of scales. The head is about equal to one-fourth of this length. The eye is large, about one-third as long as the head. The mouth is terminal and the maxillary reaches to about the origin of the eye. The checks and postorbital portion of the head are protected by the well-developed chain of suborbital bones, of which the third is in contact with the lower limb of the preopercle, there being a naked wedge between it and the vertical limb of the preopercle. The teeth are in a single series, comparatively few in number, and with lateral notches. They occur along the entire edge of the premaxillary, at the upper angle of the maxillary, and along the front and sides of the lower jaw. The

teeth of the maxillary are similar to those of the premaxillary and the lateral teeth of the mandible are always smaller than those near the front. A frontal and a parietal fontanel are present, the latter being the larger, truncated in front; the former is triangular, the base of the triangle being caudad. The occipital crest is narrowly triangular and divides the scales of the two sides for a distance of about one-fourth of the length from its base to the dorsal. The dorsal is short, pointed, consisting of one rudimentary and ten developed rays; having its origin midway between the tip of the snout and the base of the middle caudal rays. The adipose is a small free lobe as in the greater number of all the characid fishes, and is placed over the end of the anal. The caudal is deeply forked. The anal is emarginate, having its origin under the last dorsal ray, and it consists of twenty-five rays. The ventrals are placed slightly in front of the origin of the dorsal and they do not quite reach the anal. The pectorals are lanceolate and do not quite reach the origin of the ventrals. The scales are thin, very regularly arranged. The fins are naked except for a few scales along the base of the anterior anal rays. There is a well-developed axillary scale over the ventrals. There are thirty-five scales along a median series, eight of which have lateral line pores. There is a dark spot on the sides from about the third to the fifth scales of the lateral line, and another larger spot on the end of the caudal peduncle and the base of the caudal. In a triangular area over the sides of the anterior air-bladder the wall of the body consists of skin and peritoneum only.

Minor deviations from the generalized type.—The deviations from this general type are numerous, but not very great. The greatest deviations are found in the size of the frontal fontanel; the armature of the cheek, especially the postorbital portion of it; the length of the anal; the degree of the development of the pseudo-tympanum; and especially the size of the mouth and its parts and the style of the teeth. Leaving these to be considered last, we find some of the species (*Aphyocharax*) are much less compressed than others, and in these the depth is frequently less than one-third of the length, the minimum depth being contained about four times in the length in a number of species of *Aphyocharax*. In the deepest the depth is contained but 2.4 times in the length (*Megalamphodus megalopterus*). The head varies from 3.3–4.66 in the length in different species. It is comparatively shortest in *Paragoniates paraguayensis* and comparatively longest in *Spintherobolus*. The eye is always large. In different species it is contained from 2.3–4.33 in the length of the head, but in only two forms, *Grundulus* and *Spintherobolus* is it contained as many as 3.75 times. In the great majority of cases it is contained 2.5–3 times. The adipose fin is absent in *Grundulus* and *Spintherobolus*, which otherwise

do not differ greatly from the other species. The caudal lobes may be a little longer or shorter, a little more pointed or rounded, and there may be more or less difference between the upper and lower lobes, but there is no striking deviation from the type. The ventrals and pectorals may be a little longer or shorter, but here again there is no great divergence from the central type. The scales differ materially. The lateral line may be developed on but two scales, or it may be complete. It is complete in *Probolodus*, *Parecbasis*, *Holesthes*, and *Odontostilbe*. It is almost complete in *Microschemobrycon*. In the other genera it is developed on less than fifteen scales, the exact number varying with the species. In *Grundulus* the predorsal scales have disappeared; in *Aphyodite* the caudal has become mostly covered with small adherent scales, and in *Compsura* and *Odontostilbe hastata* the male is provided with a few enlarged scales on the caudal which recall the Glandulo-caudinae. The degree of the development of the pseudotympanum differs greatly, the humeral region being apparently normal in a number of species. It is most highly developed in *Holesthes*, *Odontostilbe*, *Megalamphodus*, and the deeper species of *Cheirodon*. In color (alcoholic, which means the distribution of melanophores only) the species of this subfamily do not differ greatly from species of *Hemigrammus* and *Hyphessobrycon* of the Tetragonopterinae. In many species of the Tetragonopterinae and other subfamilies some sort of a spot occurs on the sides, a little behind the origin of the lateral line. This spot is found in over half of the species with tricuspid teeth. In the species with multicuspid teeth it occurs only in *Mixobrycon*. A caudal spot at the end of the caudal peduncle and on the base of the caudal has an even wider distribution among the Characins in general. Among the Cheirodontae it is all but uniformly found in the species with multicuspid teeth, *i. e.*, in those species in which the humeral spot is not developed. Other markings are some sort of a spot on the dorsal, which occurs in six species belonging to four genera. It is therefore not a sign of relationship. Similar spots occur on some of the smallest Tetragonopterids. Another marking which occurs sporadically in several species is a dark band along the tips of the short anal rays and across the lobe of the anal.

Deviations from the generalized type on which the genera are based.—The frontal fontanel may be small, having the form of an equilateral triangle, and may form only a wedge between the posterior part of the frontals (it has nearly reached the vanishing point in *Aphyocheirodon*) or it may, as in *Megalamphodus*, be of nearly uniform width and entirely separate the frontals.

In all but three genera, *Grundulus*, *Spintherobolus*, and *Mixobrycon*, the second suborbital is in contact with the preopercle below. In both *Grundulus* and

Spintherobolus the suborbitals are feeble, very different from those in the other genera. In *Mixobrycon* there is a naked area around the entire distal edge of the third suborbital, similar to that in most of the Tetragonopterinae. The greatest difference in the armature of the cheeks occurs in the postorbital region. In *Aphyocharax* there are two postorbitals. Of these the upper is minute and negligible, the lower is large, convex, similar to the third suborbital, and covers the entire postorbital area. *Prionobrama* has a similar arrangement. In other genera there are three or more postorbitals and there is a wider or narrower naked area between them and the vertical limb of the preopercle. In one genus, *Aphyocheiroidon*, there is considerable individual variation in the number and size of the postorbitals.

Anal fin.—The anal varies. In *Cheiroidon annæ* the base is very short, entirely behind the dorsal, the margin is rounded, and the highest rays extend beyond the tip of the last. In *Paragoniates*, *Leptagoniates*, and *Phanagoniates* the base is very long, having its origin below the first dorsal ray or far in front of it. In *Prionobrama* its margin is extremely falcate. Between these extremes there are various modifications, the rays varying from twelve in *Spintherobolus*, fourteen in *Leptobrycon*, *Cheiroidon annæ*, and *Cheiroidon pisciculus*, to fifty in *Paragoniates alburnus*, and seventy in *Leptagoniates*. In the great majority of species the number of rays ranges between twenty and twenty-six. In the genus *Cheiroidon*, the species of which fall into two groups, the greatest range is from twelve to twenty-seven. In *C. pisciculus* and *C. annæ* the number of rays ranges from twelve to fifteen; and in the nine other species from seventeen to twenty-seven. In seventy-nine specimens of one species, *Cheiroidon interruptus*, the number of anal rays is as follows:

Number of rays:	17,	18,	19,	20,	21,	22,	23,	24
Number of individuals:	2	6	28	16	12	11	3	1

These are from several distinct localities, and the extremes have not been observed in specimens from one locality.

Dorsal fin.—The variation of the dorsal is not nearly as great as that of the anal, and therefore of less taxonomic importance. Usually its origin is a little behind or in front of the middle of the body, the distance in either direction being negligible, but in *Grundulus* and in *Prionobrama*, *Paragoniates*, *Leptagoniates*, and *Phanagoniates* it is distinctly behind the middle. Its outline may be rounded, obliquely truncate, or it may be distinctly falcate as in *Parcebasis*. It reaches its extreme development in *Megalamphodus megalopterus*.

Mouth.—The greatest evolution in this group, as in the rest of the Characins, has taken place in the mouth and teeth. The mouth ranges in size from such a minute affair as is found in *Oligobrycon microstomus*, *Compsura heterura*, *Cheiroidon*

notomelas, and *C. piaba*, to the clupeoid openings in *Leptobrycon jatuarana*, *Macropsobrycon uruguayana*, *Megalampodus megalopterus*, and *M. micropterus*. But the size of the mouth in itself is of no great importance, for there is great variation within such genera as *Aphyocharax* and *Cheirodon*. There is very great difference in the size and shape of the premaxillary and maxillary, as the outlines in the text-figures show.

Teeth.—The greatest interest centers in the teeth. In *Grundulus* all of the teeth are peg-like, conical, single-pointed. Such teeth frequently appear on the sides of the lower jaw, when the teeth are otherwise very different. They are also frequently found on the distal part of the maxillary, when the number of teeth on this bone are considerable, and they are also found in the premaxillary when the teeth are feeble or numerous. The next degree of complexity is found in the three-pointed teeth in the genera *Spintherobolus*, *Probolodus*, *Aphyocharax*, *Macropsobrycon*, *Microschemobrycon*, and *Oligobrycon*. In *Aphyocheirodon* there are three- to five-pointed teeth in the upper jaw and five-pointed teeth in the lower jaw. In the remaining genera the teeth have typically five or more points. Frequently the teeth in the sides of the lower jaw are not only smaller, but belong to a lower order, *i. e.*, they have fewer points than the others in the same mouth. The same may be true, but to a less extent, of the teeth on the outer part of the premaxillary and on the distal part of the maxillary. Usually the number of teeth in any bone differs inversely as the number of points to each tooth, though this is not always the case. In the species with many-pointed teeth the number of teeth is usually very limited, none to three in the maxillary of *Cheirodon*, none to four in *Odontostilbe*, but in one species of that genus ranging from four to seven. However, several of the genera with tricuspid teeth have no teeth on the maxillary, others have as many as twenty or more.

To say that the teeth are unicuspid, tricuspid, or multicuspid, does not tell the whole story. There have evidently been divergent radiations within each of these groups both in the shape of the individual teeth and in their arrangement. These teeth are so difficult to observe, even with the aid of the modern binocular microscope and a spot-light, that in all cases where I had material the individual bones were dissected out and mounted in balsam. Camera-lucida sketches were then made. Under all the circumstances I think it will be best to entirely ignore statements about the teeth in the older descriptions, whether made by myself or by others. Statements that the entire edge of the maxillary is denticulate and that there are no teeth in the maxillary are especially to be doubted.

Reverting to the modifications of the three types of teeth, unicuspid, tricuspid,

and multicuspid, it may be observed that the conic tooth may be a simple cone, but is much more likely to be recurved. All the teeth of *Grundulus* are of this type. Part of the teeth on the maxillaries of the genera with tricuspid teeth are also unicuspid, and probably by degeneration some of those on the premaxillary. The tricuspid type varies from a slender conic tooth with a minute notch on each side to a tooth in which the three points are of about equal size, nearly coterminous, and arranged in a line, to a heavy tooth with a blunt central point and two minute lateral points, so arranged that the three points mark the angles of a triangle (*Probolodus*). The five- to nine-pointed teeth may have a large central cusp and two graduate cusps on the sides of the tooth, the line connecting the five (or more points) forming parts of an ellipse, or the points may be of nearly equal value and nearly coterminous. Between these there are many shades, several variations not infrequently occurring in different parts of the same jaw. A very distinct type of tooth as well as arrangement is found in the lower jaw of *Aphyocheirodon*. The teeth in this jaw are usually five-pointed. The three middle points are of about equal size and subtruncate, so that their tips form chisels rather than points. The outer cusps are very minute and so far withdrawn from the level of the rest that they are easily overlooked. That this surprising shape is not the result of wear is shown by the relay-teeth which have the same shape as the rest. With all these modifications the sides of the multicuspid teeth may be parallel or very much contracted basally. The teeth are usually quite flat, or rather thin, but in *Mirobrycon* the teeth are heavy and approach the shape of the teeth of the Tetragonopterinae. In all but one species the teeth are strictly uniserial. In *Megalampodus micropterus* one of the teeth of the premaxillary is sometimes out of line with the rest, a little further forward, and forms either an incipient or a reminiscent anterior series.

The number of teeth as well as the shape of the teeth described above indicate that the dentition of this group of the Characins is highly specialized. In this character of high specialization they are not unique among the Characins, for it is in the shape, number, and arrangement of the teeth that the greatest divergence has taken place.

The number of teeth on the premaxillary and the frequency of the appearance of any given number is indicated in the following table:

Number of teeth in premaxillary:	3,	4,	5,	6,	7,	8,	9,	10,	11,	12,	13,	14
Number of species having the given number of teeth:	1	7	11	10	11	9	6	5	2	2	1	2

In this table seventeen species occur in more than one count; to be exact, five species occur in two counts, ten in three, one in four, and one in five. In other

words, in five species there may be a deviation of one tooth from the normal, in ten species there may be a deviation of as many as three teeth (*Aphyocharax* seven to ten), and in one (*Odontostilbe melandeta*) there may be a deviation of as many as

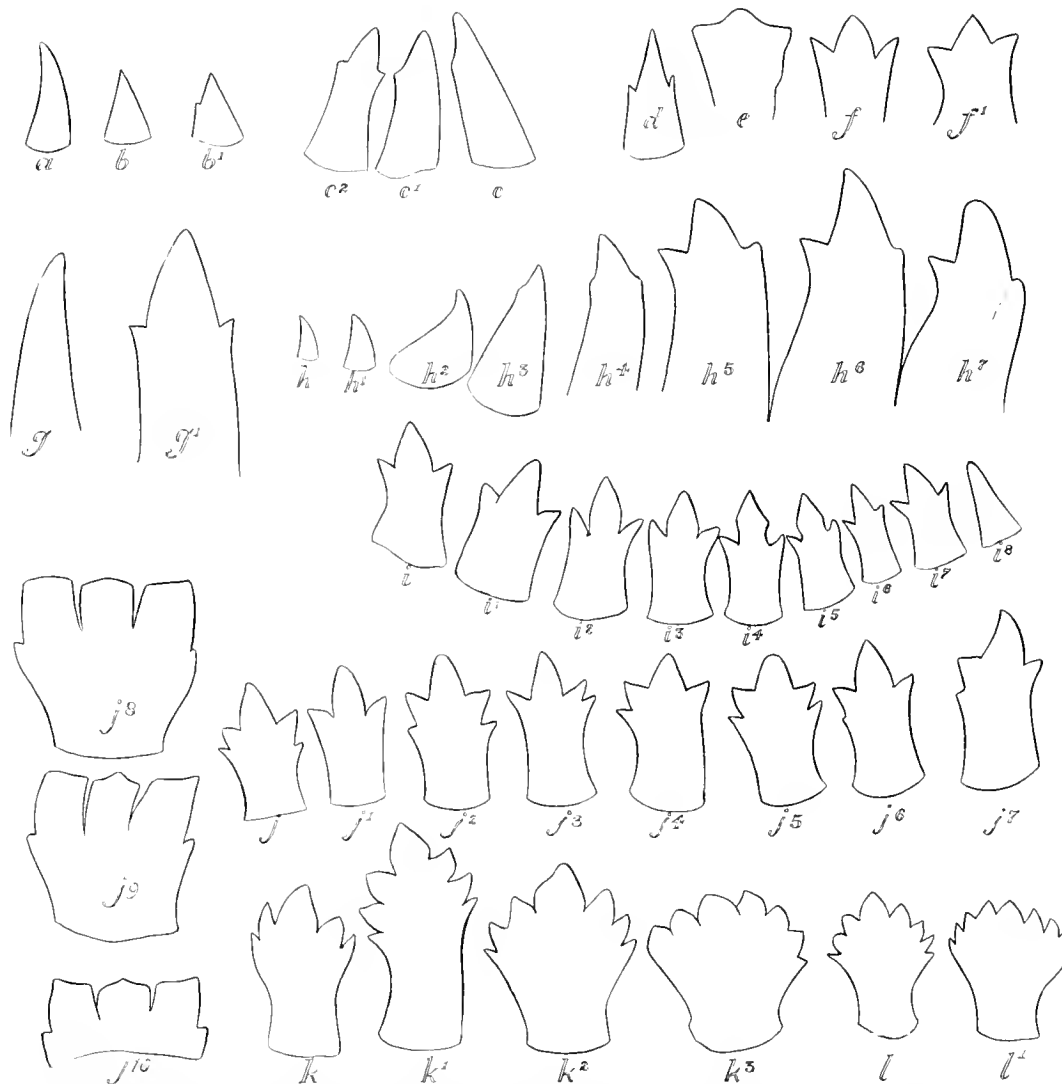


FIG. 1. Types of teeth and their variations in the Cheirodontinæ. *a*, mandibular tooth of *Grundulus*; *b* and *b*¹, premaxillary teeth of *Macropsobrycon*; *c*-*c*², premaxillary teeth of *Aphyocharax amisitsi*, *c*, the symphyseal tooth, *c*¹, the second, and *c*², the third tooth from it; *d*, mandibular tooth of *Megalamphodus megalopterus*; *e*, mandibular tooth of *Spintherobotus*; *f* and *f*¹, a mandibular and premaxillary tooth of *Parecbasis*; *g* and *g*¹, a maxillary and premaxillary tooth of *Prionobrama*; *h*-*h*⁷, entire set of mandibular teeth of an *Oligobrycon microstomus*; *i*-*i*⁸, entire set of premaxillary teeth of a *Megalamphodus micropterus*, *i* and *i*¹, the usual type, *i*¹, with incipient cusps on the sides of the median cusp; *j*-*j*⁷, entire set of premaxillary teeth of an *Aphyocheiroidon*; *j*⁸ and *j*⁹, active mandibular teeth of an *Aphyocheiroidon*; *j*¹⁰, relay tooth, which has not pierced the gum of an *Aphyocheiroidon*; *k*, *k*¹, *k*², *k*³, a mandibular tooth, a premaxillary tooth, and two maxillary teeth of *Compsoura heterura*; *l*-*l*¹, a premaxillary and a maxillary tooth of a *Cheirodon piaba*.

four teeth. But of this latter species I have but few specimens, unsatisfactorily preserved, and the result is doubtful. The larger number of the species have seven premaxillary teeth. The number of species having six or eight teeth are nearly equally matched. It must be borne in mind that the number of specimens examined has not been so great that we can be sure that all variations have been observed.

The maxillary teeth recorded are as follows:

Number of teeth: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
 Number of species: 4 7 19 10 7 5 5 2 1 1 3 2 4 4 3 2 2 1 1 1 3

Four of the species occur in two counts, six occur in three, four in four, one in five, one in seven, and one in twelve (from nine to twenty in *Aphyocharax dentatus*). The prevailing number is two teeth, which are found in nineteen species, as shown by the table; which also shows that the number of species having from twelve to fourteen and twenty teeth is relatively greater than those having from seven to eleven, and from fifteen to nineteen teeth.

THE RELATIONSHIP OF THE CHEIRODONTINÆ.

Are the Cheirodontinæ a homogeneous group with a common ancestry, or are they dwarfs of various other subfamilies? The most of them form a homogeneous group, divisible, however, into a number of minor groups. Doubt arises as to *Grundulus*, which has only conic teeth, *Paragoniates*, *Leptagoniates*, and *Phanagoniates* with a posterior dorsal, and *Mixobrycon*, which has tetragonopterid teeth and checks. Certain other characters, notably the peculiar scaling in the caudal of the males of *Compsura* and *Odontostilbe hastata*, also suggest relationship to another subfamily, the Glandulocaudinæ.

The unicuspid teeth of *Grundulus* suggest relationship with the Characinæ, as some of the Characinæ with partially tricuspid teeth, *Oligosargus exodon*, and *Bramocharax* suggest relationship with the Cheirodontinæ. The general shape and backward position of the dorsal of *Paragoniates* as well as the peculiar scales in the tail of the male *Compsura* and *Odontostilbe* recall the Glandulocaudinæ. The heavy teeth and armature of the checks of *Mixobrycon* suggest *Hyphessobrycon* of the Tetragonopterinae and so does the tooth out of line with the rest in *Megalampodus micropterus*. However, a double row of teeth has several times been evolved in the Characinæ from a single row; or a single row from a double row. I have pointed out such cases in Indiana University Studies No. 20, and will have occasion to point out others in the monographs on the Chaleininæ and Gasteropellicinæ. In fact if it were not for other considerations, the single series of teeth in the Cheirodontinæ would be no more sufficient to segregate them from the Tetragonopterinae

than would the completeness or incompleteness of the lateral line justify the collocation of the genera having these characters in subfamilies.

In the peculiar armature of the cheeks *Prionobrama* shows such similarity to *Aphyocharax* that Cope placed it in the latter genus. In spite of its general appearance and the backward position of the dorsal, *Prionobrama* is probably more nearly related to *Aphyocharax* than to any member of the Glandulocaudinæ.

The peculiar sealing of the caudal in two of the species recalls the similar character in the Glandulocaudinæ and in *Argopleura* of the Tetragonopterinae. It is possible that this is also an independently acquired character in a number of remotely related genera.

While it is very probable that we are dealing with a natural group, it is certain that different members point to three distinct subfamilies from which they may have been derived, or to which they may have given rise. The Cheirodontinæ are certainly near the generalized type of all the Characins.

SECONDARY SEXUAL DIFFERENCES.

There are no conspicuous secondary sexual differences in the group under consideration, unless there should be a striking difference in the lipochromes, which have been dissolved in alcohol.

The differences when present consist in the length of the fin-rays, in the filamentous termination of the fins, in the development of hooks on the anal, and less frequently on the caudals and ventrals of the male, in the development of scaly pockets on the caudal of the males, in the color of the dorsal, and, what is unique for this group, in the high development of the interhemals in the male in *Cheirodon*. The details are given under the respective species.

DISTRIBUTION.

The Cheirodontinæ apparently reach their maximum development in the middle Amazon and the upper La Plata basins. It is quite possible that this greater abundance in the middle Amazon and in the Paraguay basin is apparent rather than real. Little collecting has been done with fine meshed nets in the Orinoco and in the upper waters of the Amazon.

The group as a whole has a very wide distribution. The genus *Cheirodon* has a range all but coextensive with that of the subfamily. The species, with the exception of *Cheirodon piaba* Lütken, are confined to rather limited ranges. Only two species are found both in the Paraguay and in the Rio Guaporé. A number of species in the Madeira and Paraguay are evidently very closely related.

TABLE OF THE DISTRIBUTION OF THE SPECIES OF THE CHEIRODONTINÆ.

	Atlantic Slope, Colombia, Panama.	British Guiana.	Orinoco, Trinidad.	Amazon.	Madeira.	Paraguay.	La Plata, Uruguay.	Paraná.	R. Grande do Sul.	Coastal Streams, R. Dore to R. Grande do Sul.	Rio S. Francisco.	R. Itapicuru.	Plains, Bogotá and Santander, Colombia.	Western Chile.
1. <i>Grundulus bogotensis</i> (Humboldt).....														×
2. <i>Spintherobolus papilliferus</i> Eigenmann.....							×							
3. <i>Probolodus heterostomus</i> Eigenmann.....										×				
4. <i>Aphyocharax dentatus</i> Eigenmann & Kennedy.....						×								
5. <i>Aphyocharax alburnus</i> (Günther).....				×	×									
6. <i>Aphyocharax erythrurus</i> Eigenmann.....		×												
7. <i>Aphyocharax pusillus</i> Günther.....				×	×									
8. <i>Aphyocharax anisitsi</i> Eigenmann & Kennedy.....						×	×							
9. <i>Aphyocharax avary</i> Fowler.....					×									
10. <i>Aphyocharax rathbuni</i> Eigenmann.....						×								
11. <i>Aphyocharax paraguayensis</i> Eigenmann.....						×								
12. <i>Aphyocharax nattereri</i> (Steindachner).....					×	?								
13. <i>Aphyocharax ogassizi</i> (Steindachner).....					×									
14. <i>Aphyocharax maxillaris</i> Ulrey.....					?									
15. <i>Paragoniates alburnus</i> Steindachner.....				×										
16. <i>Prionobrama paraguayensis</i> (Eigenmann).....						×								
17. <i>Prionobrama filigerus</i> (Cope).....				×	×									
18. <i>Leptagoniates steindachneri</i> Boulenger.....				×										
19. <i>Phanagoniates wilsoni</i> Eigenmann.....	×													
20. <i>Parcbasis cyclolepis</i> Eigenmann.....				×	×									
21. <i>Leptobrycon jatuarana</i> Eigenmann.....				×										
22. <i>Aphyodite grammica</i> Eigenmann.....		×												
23. <i>Macropsobrycon uruguayana</i> Eigenmann.....							×							
24. <i>Megalamphodus megalopterus</i> Eigenmann.....						×								
25. <i>Megalamphodus eques</i> (Steindachner).....				×										
26. <i>Megalamphodus melanotus</i> Eigenmann.....		×												
27. <i>Megalamphodus heterostichus</i> (Ulrey).....				×										
28. <i>Megalamphodus micropterus</i> Eigenmann.....											×			
29. <i>Microschemobrycon guaporensis</i> Eigenmann.....					×									
30. <i>Oligobrycon microstomus</i> Eigenmann.....									×					
31. <i>Aphyocheiroidon hemigrammus</i> Eigenmann.....								×						
32. <i>Compsura heterura</i> Eigenmann.....										×				
33. <i>Microbrycon ribeiroi</i> (Eigenmann).....						×					×	×		
34. <i>Cheiroidon pisciculus</i> Girard.....														×
35. <i>Cheiroidon annæ</i> McAtee. ¹														
36. <i>Cheiroidon insignis</i> Steindachner.....	×													
37. <i>Cheiroidon parahyba</i> Eigenmann.....										×				
38. <i>Cheiroidon interruptus</i> (Jenyns).....							×							
39. <i>Cheiroidon monodon</i> Cope.....									×					
40. <i>Cheiroidon ibicuihyensis</i> Eigenmann.....							×							
41. <i>Cheiroidon notomelas</i> Eigenmann.....								×						
42. <i>Cheiroidon madeira</i> Eigenmann.....					×									
43. <i>Cheiroidon piaba</i> Lütken.....					×	×	×	×	×	×				
44. <i>Cheiroidon microndon</i> Eigenmann.....						×								
45. <i>Cheiroidon stenodon</i> Eigenmann.....								×						
46. <i>Holesthes pequirá</i> (Natterer).....					×	×								
47. <i>Holesthes heterodon</i> Eigenmann.....								×	×	×	×			
48. <i>Odontostilbe hastata</i> Eigenmann.....	×													
49. <i>Odontostilbe drypnum</i> Fowler.....					×									
50. <i>Odontostilbe fugitiva</i> Cope.....				×	×									
51. <i>Odontostilbe microcephala</i> Eigenmann.....						×		×						
52. <i>Odontostilbe pulchra</i> (Gill).....			×											
53. <i>Odontostilbe paraguayensis</i> Eigen. & Kennedy.....						×								
54. <i>Odontostilbe madeira</i> Fowler.....					×									
55. <i>Odontostilbe melanodeta</i> Eigenmann.....		×												
	3	4	1	13	12	13	6	5	2	4	4	2	1	1

¹ Habitat unknown. For *Megalamphodus ecuadorensis* sp. nov. Cf. Appendix.

The paired species are as follows:

Rio Madeira and its tributaries
Aphyocharax alburnus
Aphyocharax pusillus
Prionobrama filigerus

Rio Paraguay
Aphyocharax dentatus
Aphyocharax anisitsi
Prionobrama paraguayensis

Cheirodon pisciculus, which ranges in western Chile at least from Santiago to Puerto Montt, is one of two species of this group found on the Pacific slope. This species also has the distinction of being the only member of the family of Characins

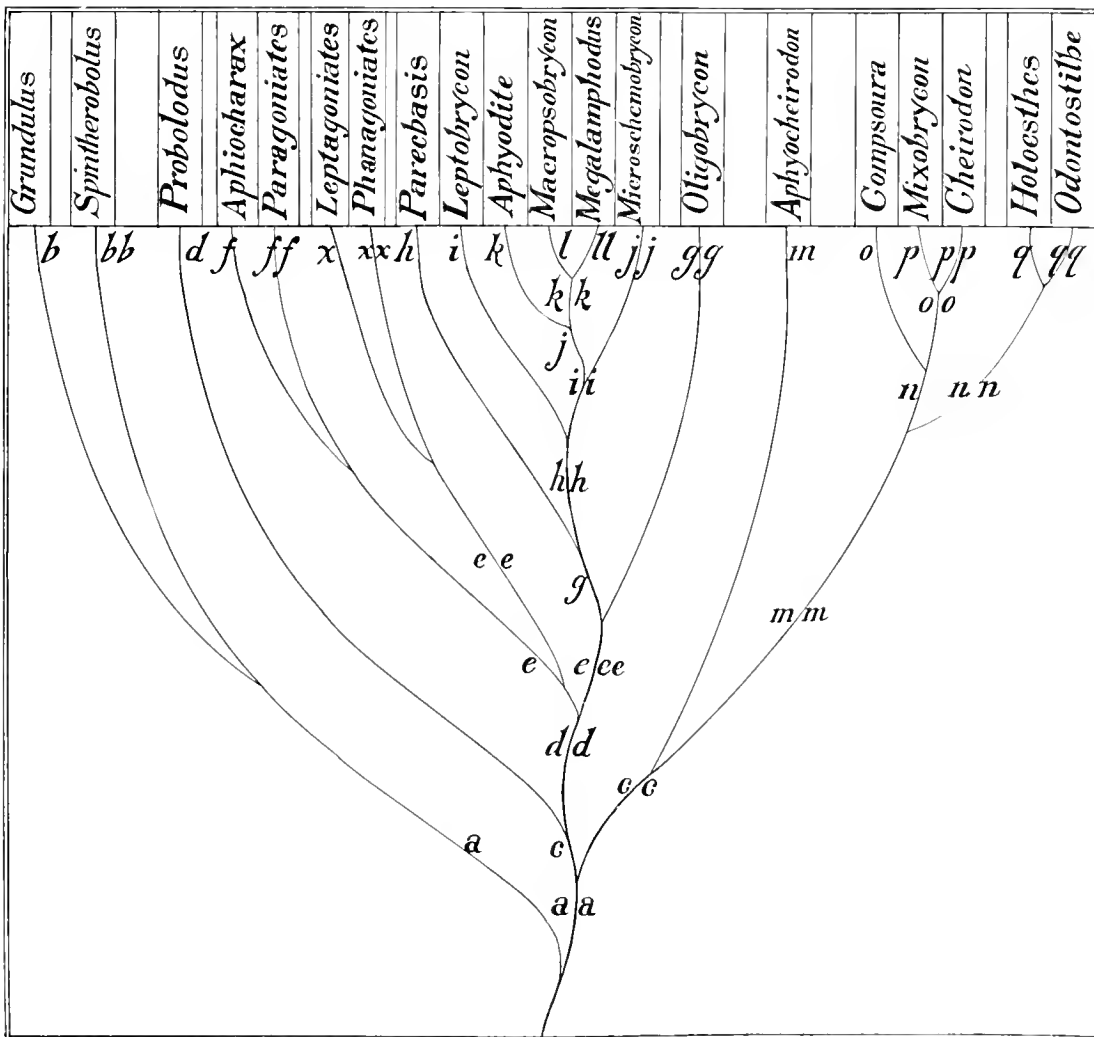


FIG. 2. Phylogenetic arrangement of the genera of the Cheirodontiinae. In this diagram the letters correspond to and have the significance of the same letters in the following key. The genus *Paragoniates*, in the diagram, includes the genus *Prionobrama*, now recognized as distinct.

which is found on the Pacific slope south of the dry area of central South America. Members of the genera *Cheirodon* and *Odontostilbe* are found in the Chagres and Atrato rivers in Panama and Colombia. *Megalamphodus ecuadorensis* is known from one specimen taken in western Ecuador.

The highest altitude is reached by *Grundulus*, which swarms in the streams of the plains of Bogotá at an elevation of about 9,000 feet. Several species are found in the San Francisco basin at a considerable elevation. The rest are, as far as known, confined to the low lands.

PHYLUM PISCES Artedi.

Class TELEOSTOMI Bonaparte.

SUPERORDER OSTARIOPHYSI Sagemehl.

Order PLECTOSPONDYLI Cope.

Suborder HETEROGNATHI Cope.

Family CHARACIDÆ Gill.

Subfamily CHEIRODONTINÆ Eigenmann.

Teeth well-developed, in a single series, arranged vertically in the premaxillary, dentary, and usually the maxillary. Usually some of the teeth with one or more notches or cusps symmetrically arranged on either side of the median cusp. Ventral surface rounded or slightly compressed, without serrations; body scaled; a parietal and a frontal fontanel; dorsal short, with eleven or fewer rays; gill-membranes free from the isthmus and from each other; nares close together, separated by a flap only; adipose fin usually present.

KEY TO THE GENERA OF THE CHEIRODONTINÆ.

- a.* No adipose fin; mouth small; armature of cheeks very weak. Teeth conic or tricuspid in both jaws; lateral line incomplete.
 - b.* Predorsal area partly naked; tactile papillæ normal; teeth all conic in a regular series.
 - 1. *Grundulus* Valenciennes.
 - 2. *Spintherobolus* Eigenmann.
 - bb.* Predorsal area entirely scaled; tactile papillæ excessively developed; teeth mostly tricuspid or conical.
- aa.* Adipose fin well developed, except in No. 7, *Phanaqoniates*, which see.
 - c.* Teeth tricuspid or conic.
 - d.* Teeth few, very heavy, tricuspid, five or six in each dentary, of which the first is directed upward and outward, the third laterad, the fourth and later ones upward, at nearly a right angle to the

third; premaxillary with three or four teeth directed downward and forward, maxillary with three to five similar teeth; third suborbital covering entire cheek in adult; three postorbitals with only a very narrow naked border; scales small, 45-53; lateral line complete; anal long; interhæmals normal. 3. **Probolodus** Eigenmann.

dd. Teeth slender, tricuspid, or conical in both jaws. Interhæmals normal.⁴

e. Third suborbital covering the entire cheek, two postorbitals, of which the upper is minute, the lower very large, similar to the third suborbital, and covering the entire area from eye to pre-opercle; lateral line incomplete. Anal with seventeen to twenty-seven rays in "f" and twenty-nine to nearly forty in "ff."

f. Anal short, with a blunt lobe or none; origin of anal behind the vertical from the middle of dorsal; mouth variable, maxillary with from two to twenty teeth; dorsal and ventral profiles similar in front of the vertical from the dorsal; caudal naked.

4. **Aphyocharax** Günther.

ff. Anal long, the anterior rays long, filiform; origin of anal about on the vertical from the origin of the dorsal; mouth large, maxillary with teeth along its entire margin directed downward and backward, largest near the middle; ventral profile much more arched than the dorsal. 5. **Prionobrama** Fowler.

ee. Third suborbital large, the fourth in one genus at least smaller than the fifth or second postorbital. Anal with more than forty rays, its origin in advance of that of the dorsal.

x⁵. Adipose dorsal small; lateral line incomplete; anal not falcate; teeth along entire maxillary; origin of dorsal but little behind vertical from origin of anal, which is equidistant from snout and base of middle caudal rays.

6. **Paragoniates** Steindachner.

xx⁵. Adipose dorsal small; lateral line complete; origin of anal equidistant from snout and the fourth fifth of its base. 7. **Leptagoniates** Boulenger.

xxx⁵. No adipose; lateral line short; origin of anal equidistant from the snout and the posterior fourth of its base. 8. **Phanagoniates** Eigenmann & Wilson.

eee. Third suborbital variable; three postorbitals, of which the uppermost is minute; all of them sometimes feeble. Anal moderate, its origin behind that of the dorsal.

g. Teeth minute, very slender, many conical, except in No. 17.

h. Lateral line complete; caudal lobes partly sealed; no pseudotympanum; third suborbital covering entire cheek; postorbitals large, but feeble; maxillary without teeth, its upper margin thickened; sides of lower jaw raised, without teeth; origin of dorsal in front of the middle. 9. **Parcebasis** Eigenmann.

hh. Lateral line incomplete.

i. Anal short, of fourteen rays, the highest extending beyond the tip of the last, its base equal to length of caudal peduncle; no teeth on the sides of the lower jaw, or on the maxillary; sides of the lower jaw high, as in *Parcebasis*; maxillary large, its outer margin very convex; lateral line very short.

10. **Leptobrycon** Eigenmann.

ii. Anal long, twenty-three to thirty rays, the highest ray not extending to the base of the last ray.

⁴ Dorsal 9-11, Cheirodontinæ; the Crenuchinæ, which are similar to the foregoing, have dorsal 15-18.

⁵ The letters *x*, *xx* and *xxx* are used here out of order because text-figure 2, in which the letters were made to agree with those in the key, was drawn before genera 6 to 8, which are quite aberrant, were included in this monograph.

- j.* Lateral line with but few pores; cheeks behind the eye mostly naked.
- k.* Caudal partly scaled. 11. **Aphyodite**⁶ Eigenmann.
- kk.* Caudal naked.
- l.* Pseudotympanum conspicuous; no teeth on maxillary; interorbital very convex; frontal fontanel moderate; premaxillary with five to seven mostly conical teeth, similar to *Parcbasis*; the lateral line incomplete. 12. **Macrosobrycon** Eigenmann.
- ll.* No pseudotympanum; maxillary with two to twenty teeth; four to eight tricuspid teeth in front part of mandible, minute teeth on side; fontanels very large. . . . 13. **Megalamphodus** Eigenmann.
- jj.* Lateral line extending to within four scales of the caudal. Twenty-five or more teeth on each ramus of the mandible; twelve teeth on the maxillary; frontal fontanel moderate; cheeks behind as well as below the eye covered; mouth moderate; subfusiform.
14. **Microschemobrycon** Eigenmann.
- gg.* Teeth heavy, four on the premaxillary; mouth minute; maxillary not reaching to below eye, with one or two teeth; origin of dorsal equidistant from snout and caudal; no pseudotympanum; three postorbitals covering nearly the entire postorbital area.
15. **Oligobrycon** Eigenmann.
- cc.* Teeth in part at least with five or more lobes.
- m.* Sides of teeth nearly parallel, those of the upper jaw narrow, with a prominent median cusp and one or two minute cusps on each side, about ten teeth in each premaxillary; mandible with three- to five-lobed teeth, much expanded at tip, the three middle lobes equal in size, blunt, those of successive teeth in contact, forming a continuous cutting edge, the lateral lobes excessively minute; mouth large, cheeks partly naked; frontal fontanel very short; no pseudotympanum; interhamals normal; lateral line incomplete. . . 16. **Aphyocheiroidon** Eigenmann.
- mm.* Teeth with five or more points, tops of those of the lower jaw not forming a continuous cutting edge.
- n.* Lateral line incomplete.
- o.* Male with a lobe of large scales extending along the base of the middle caudal rays; all but three or four last anal rays of the male with hooks; interhamals of the caudal peduncle weak; mouth minute; maxillary barely reaching to below eye; second suborbital covering the entire cheek; postorbitals very weak; no pseudotympanum; frontal fontanel moderate. 17. **Compsura** Eigenmann.
- oo.* Caudal of male without a median lobe of scales.
- p.* Interhamals of the caudal peduncle of the male, next the caudal, feeble; no pseudotympanum; teeth heavy, one on the maxillary; third suborbital with a naked border. 18. **Mixobrycon** Eigenmann.
- pp.* Interhamals of the caudal peduncle, especially in the male, prominent, spine-like, protruding; a conspicuous pseudotympanum; one to three teeth on the maxillary; teeth of upper and lower jaw similar, with five or more points.
19. **Cheiroidon** Girard.
- nn.* Lateral line complete; interhamals feeble, not projecting; maxillary with a few broad-tipped teeth; second suborbital in contact with the preopercle below.

⁶ *Aphyodite*, *Macrosobrycon*, and some of the species of *Megalamphodus* are very similar.

- q.* Premaxillary teeth but little expanded toward the tips, pointed, the median point a little the larger; mandibular teeth much expanded at the tip, with a small basal notch on each side and three median points of about the same size; third suborbital in contact with the preopercle below; fontanel short 20. *Holesthes* Eigenmann.
- qq.* Teeth of the upper and lower jaws similar; maxillary with a few broad-tipped teeth; third suborbital in contact with the preopercle below. Caudal in the male naked or with a row of scales reaching to the tip of the rays just below the shortest ones at the middle. 21. *Odontostilbe* Cope.

Genus *GRUNDULUS*⁷ Valenciennes.

Grundulus Valenciennes, Hist. Nat. Poiss., Vol. XVIII, 1846, p. 216.

Ctenocharax Regan, Ann. & Mag. Nat. Hist. (7), Vol. XX, 1907, p. 402.

Type: *Pæcilia bogotensis* Humboldt.

Cyprinodontoid fishes, reaching a length of about 80 mm., found on the eastern highlands of Colombia.

Teeth all recurved, conical, in a single series on greater part of maxillary, on premaxillary and mandible; third suborbital in the largest specimens a little wider than the naked area around its convex border, narrower than the naked area in the young; postorbital area naked; mouth small, maxillary just about reaching the orbit; eye comparatively small, placed high; a wide naked strip from dorsal to head, and another along middle of belly; dorsal placed behind the middle; origin of ventrals near the middle; anal short; no adipose fin; pectorals not nearly reaching ventrals; lateral line short; scales with very many faint, diverging radial striæ; no pseudotympanum. Gill-rakers about 8 + 10, very short, about one-third as long as eye; a few feeble interhæmals appearing as caudal fulera; a larger number of interneurals, but equally feeble.

1. *Grundulus bogotensis* (Humboldt). (Plate II, fig. 1.)

Native name "*Guapuche*."

Pæcilia bogotensis Humboldt, Recherches sur les Poissons Fluviatiles, in Rec. d'Observations, Zoologie et Anat. Comp., Vol. II, 1821, pp. 154 and 159, pl. XLV, fig. 1.

Ctenocharax bogotensis Regan, Ann. and Mag. Nat. Hist. (7), Vol. XX, 1907, p. 403 (Bogotá).

Range: The rivers of the plains of Bogotá and northward in the streams of Santander.

5084, C. M., 12843, I. U. M., over one thousand specimens, largest 80 mm.

North of Bogotá at Puente de Suba. Eigenmann.

⁷ Probably from *Grundules*, an appellation of the Lares.

5085, C. M., 12844, I. U. M., eighty. Esperanza. Eigenmann.

5086, C. M., 12845, I. U. M., two. Electric light plant at edge of plains of Bogotá. Eigenmann.

5087, C. M., 12856, I. U. M., one hundred and fifty. Madrid. Eigenmann.

5491, C. M., 13182, I. U. M., nine, largest 70 mm. Boyaca, Rio Chiquiquiseto. Gonzales.

5492, C. M., 13183, I. U. M., three. Quebrada Zuaita, Santander. Gonzales.

Head 3.5-3.7; depth 3-3.3; D. 11, rarely 10; A. 13-16; scales in a median series 32-34 of which 4 to 6 bear pores; eye 4-4.45 in the head, equal or nearly equal



FIG. 3. *Grundulus bogotensis* (Humboldt). *a*, maxillary; *b*, premaxillary; *c*, mandible.

to the snout, 1-1.33 in the interorbital. Compressed but heavy, dorsal and ventral outlines equally curved; the head rather blunt. Preventral area rounded, naked in the middle below the pectorals, the scales bordering the naked area rounded, isolated from each other; area along base of dorsal narrowly naked, a naked area in front of the dorsal as wide as the eye, growing wider toward the head and extending on both sides of the occipital process; the scales bordering the area sub-circular, small, isolated from each other; occipital process reaching about one seventh to the dorsal; interorbital broad; frontal fontanel large, entirely separating the frontals in the young, in contact for a variable length in the adult, frontal fontanel being nearly as long or only half as long as the parietal. Mouth moderate,

the maxillary oblique, about equal to length of eye; seven to nine teeth in the premaxillary, nine or ten teeth in the maxillary, about thirteen to sixteen teeth on the dentary; tooth-bearing portion of dentary over half the length of the lower jaw.

Origin of dorsal about equidistant from preopercle and base of middle caudal rays; margin of dorsal rounded, the fifth ray highest, little if any longer than post-orbital portion of head; caudal but feebly forked, its lobes short, about equal to length of head less snout; origin of anal under posterior part of dorsal; base of anal half as long as head, or a little longer; margin of anal nearly straight or rounded in front, without lobe, the fifth ray highest; ventrals nearly reaching anal, or a little beyond the base of the first ray; pectorals broad, reaching half-way to middle of ventrals; origin of ventrals in middle, or a little behind the middle of the distance from snout to caudal.

Scales of middle of sides large, decreasing rapidly towards the back and belly. No scales on base of anal or caudal.

Sides reticulated with dark, basal angles of scales very dark; upper parts of head and naked predorsal area blackish, an obscure humeral spot over and sometimes on the second and third scales of the lateral line; no caudal spot, a faint dusky lateral band.

Genus II. *SPINTHEROBOLUS* Eigenmann.⁸

Spintherobolus Eigenmann, Ann. Carnegie Mus., Vol. VIII, 1911, p. 167, Pl. V, figs. 1-4.

Type: *Spintherobolus papilliferus* Eigenmann.

Teeth tricuspid, in a single series in dentary, premaxillary, and upper part of maxillary; no adipose fin; lateral line on one or two scales; caudal naked; anal very short, naked; tactile papillæ excessively developed; suborbitals very feeble; predorsal area fully scaled.

2. *Spintherobolus papilliferus* Eigenmann. (Plate III, figs. 1-4.)

Spintherobolus papilliferus Eigenmann, *l. c.*

Range: Upper Tieté basin.

3882, C. M., **type** 41 mm. 3883, C. M., **paratypes**, four. 25-39 mm. Alto da Serra, Tieté basin, São Paulo, Aug. 4, 1908. Haseman.

Head 3.33; depth 3; D. 11; A. 12; scales 35, 13 between dorsal and ventral; eye 4.3; interorbital 3.5 in the head.

Cyprinodontiform; profile sloping rapidly to above the ventrals; caudal peduncle a trifle less than half the greatest depth, length of the peduncle twice its

⁸ *σπινθηροβόλος*, emitting sparks, referring to the appearance of the yellow tactile organs of the head.

height; predorsal area with thirteen scales, preventral area short, rounded, without a distinct median series of scales; occipital process about six times in the distance



FIG. 4. *Spitherobolus papilliferus* Eigenmann. *a*, premaxillary; *b*, maxillary; *c*, mandible.

from its base to the dorsal; frontal fontanel a very narrow slit; cheeks entirely naked; the suborbitals very narrow, concealed; mouth small, terminal; about six arrow-shaped teeth on the maxillary; seven similar more distinctly three-lobed teeth on the premaxillary; eight similar and two conical teeth in each dentary; organs of lateral line excessively developed about the head, each papilla orange; no gill-rakers.

Origin of dorsal near middle of body, its highest ray four and one-half times in the length; caudal lobes four to four and one-half times in the length; anal very short, its origin equidistant from preopercle and caudal; ventrals reaching to the anal, as long as the base of the latter; pectorals reaching beyond the origin of the ven-

trals. Pores of lateral line on only two scales. Scales regularly imbricate, no interpolated rows; caudal and anal naked; axillary scale minute.

Scales of sides outlined in dark, a dusky spot over the scales with developed pores.

This species, which resembles *Grundulus* in many ways, is known to occur only in small rills leading into the Rio Tieté and thence into the Paraná, at Alto da Serra near the coast at Santos, São Paulo, Brazil. The related genera *Grundulus* and *Spitherobolus* are thus known from nearly opposite parts of South America.

Genus III. PROBOLODUS⁹ Eigenmann.

Probolodus Eigenmann, Ann. Carnegie Mus., Vol. VIII, 1911, p. 164, fig. 1; Pl. IV, fig. 1.

Type: *Probolodus heterostomus* Eigenmann.

Premaxillary with three teeth somewhat directed outward, each with three points in the angles of a nearly isosceles triangle, the middle point, which is also the anterior one, much heavier; maxillary with three to five teeth, the first two or three of which are directed outward; each ramus of the mandible with four larger teeth, the first three directed outward, the fourth and one or more smaller ones following it, directed upward; the larger teeth of the lower jaw heavy, conical, with a minute cusp on each side. Lateral line complete; caudal naked. Adipose

⁹ προβολή = a putting forward; ὀδούς = a tooth.

well-developed. Mouth large; lower jaw heavy, its sides vertical; third suborbital in contact with preopercle below and behind in the larger, with a narrow naked border in the smaller specimens; three postorbitals covering the entire postorbital area; no pseudotympanum; frontal fontanel very long; the frontals not in contact.

3. *Probolodus heterostomus* Eigenmann.

Probolodus heterostomus Eigenmann, Ann. Carnegie Mus., Vol. VIII, 1911, p. 164, fig. 1; Pl. IV, fig. 1. (Campos on the Rio Parahyba; Iporanga on the Ribeira.)

Range: Southeastern Brazil in coastal streams from the Rio Doce to the Ribeira da Iguapé.

2973, C. M., **type**, 63 mm.; 2974, C. M., **paratypes**, three, 48–64 mm. Campos on the Parahyba. June 13, 1908. Haseman.

2975, C. M., **paratypes**, two, 78–81 mm. Iporanga on the Ribeira, Dec. 1, 1908. Haseman.

20910, M. C. Z., one, 77 mm. Rio Doce, between Linhares and Porto Souza, Hartt and Copeland. Thayer Expedition.

6882a, C. M., 45 mm. São João do Barra, Rio Parahyba. Haseman.

6879a–b, C. M., two, 37 and 44 mm. Jacarehy, Rio Parahyba, July 15, 1908. Haseman.

6880a–g, C. M., seven, largest 35 mm. Jacarehy, July 4, 1908. Haseman.

Head 4–4.33; depth 2.66; D. 11; A 26–31; scales 8 or 9–45 to 53–7 to ventrals; eye 3, interorbital 2.5, snout 3.5 in the head in the type, 2.5, 3.2, 3.5 respectively in the paratypes.

Dorsal and ventral outlines nearly equally curved, without distinct humps or depressions; ventral region rounded, the postventral area narrowly so. No regular series of median scales in front of the ventrals. Predorsal area narrowly rounded, with a regular median series of about twelve scales. Occipital process about five times in the distance from its base to the dorsal, bordered by four or five scales on each side; interorbital rounded, the frontal fontanel little more than half as long as the parietal without the occipital groove. Snout sharp, the lower jaw entering the profile when the mouth is closed; a distinct angle between maxillary and premaxillary; maxillary not quite equal to length of eye; third suborbital leaving a naked border around its entire lower edge. Gill-rakers 6 + 12.

Scales everywhere regularly imbricate, except over the anal musculature; caudal naked, a weak anal sheath of one series of scales along the base of the anterior rays; each scale of the side, with several (maximum about eight) radial striæ; axillary scale of the ventrals well-developed.

Dorsal small, about four times in the length; adipose well-developed; caudal forked, the lobes three and one-half to four times in the length; anal slightly emarginate, the highest ray reaching tip of thirteenth ray. Ventrals not quite reaching anal, pectorals to, or a little beyond, origin of ventrals.

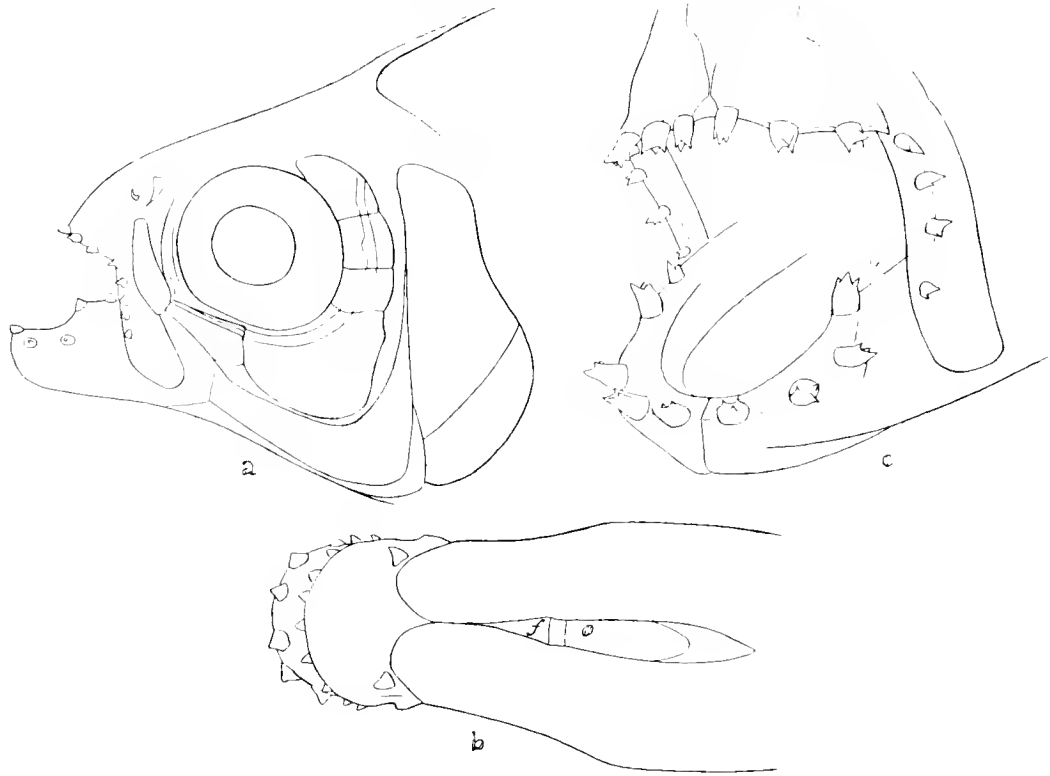


FIG. 5. *Probolodus heterostomus* Eigenmann. *a*, outlines of side of head; *b*, top of head showing frontal (*f*) and occipital (*o*) fontanelles; *c*, dentition. C. M. 6881.

A large vertical humeral spot, chiefly above the third and fifth scale of the lateral line; a silvery lateral band. A spot on caudal peduncle, in the young definitely continued to the end of the middle rays.

Genus IV. APHYOCHARAX¹⁰ Günther.

Aphyocharax Günther, Proc. Zool. Soc. London, 1868, p. 245 (*pusillus*).

Holoprion Eigenmann, Smithsonian Misc. Coll., Quarterly, Vol. XLV, 1903, p. 145 (*agassizii*).

Type: *Aphyocharax pusillus* Günther.

Elongate, slender fishes, reaching a maximum length of about 80 mm., most of them much shorter.

¹⁰ ἀφύη, = a small fish, anchovy, sardine, or *Motella*; χάραξ = a pointed stick, or palisade; *Charax*, a genus of characid fishes with pointed teeth.

Head pointed, skull convex above, with parietal and frontal fontanel, the latter very short, not extending beyond middle of eye in adult; mouth terminal, greatly variable in size in different species and with age in the same species (*cf. A. dentatus*); teeth all in a single series, conical, and usually with a cusp on each margin; those of upper and lower jaw alternating and interlocking when the mouth is closed; those of the side of the lower jaw notably smaller than the anterior teeth; cheeks entirely covered by the suborbital; nares close together; gill-membranes free from each other; gill-rakers setiform; tongue slender, free; scales regular, of about the same size, well imbricated, cycloid, firm; caudal naked; lateral line incomplete; adipose well-developed; origin of dorsal near middle of body; no pseudotympanum; a long pore on the base of the middle caudal ray.

The genus *Aphyocharax* is well marked by the very strong armature of the cheeks, the third suborbital and the single postorbital being of the same strength and texture, and leaving but little or any of the cheek naked; the scales are firmer than in any other genus of the subfamily and they have peculiar sculpturing. There are two sub-parallel radial striæ on the exposed part of the scales; the circuli are well-marked near the base of the exposed portion of the scale and parallel with the radial striæ at this point, or converge toward a median line.

A. dentatus, *alburnus*, *erythrurus*, *pusillus*, and *anisitsi* form a series from the large-mouthed *dentatus* with many maxillary teeth to the small-mouthed *anisitsi* with few maxillary teeth. Of these *A. alburnus* and *A. erythrurus* are scarcely distinct. *A. dentatus* is the Paraguayan representative, *alburnus* the Amazonian, and *A. erythrurus* the Guianian. *A. anisitsi* similarly is the Paraguayan representative, *A. pusillus* the Amazonian. *A. melanotus* probably belongs to another genus. *A. avari* is probably a synonym of *pusillus*.

At the time *A. agassizi* was selected as the type of the new genus, *Holoprion*, I had not seen that species. The genus was erected in view of Steindachner's statement, "oberer Theil des Oberkiefers am ganzen vorderen Rande deutlich gezähnt." While in Vienna, I was able to examine the types. It is certain that they have several teeth along the upper anterior margin, but I was unable with a hand-lens to detect any teeth along the distal portion of the maxillary. It seems possible that the type species of the genus *Holoprion* lacks the character assigned to the genus. However, there certainly are species with this character, viz.: *paraguayensis*, *maxillaris*, and possibly *nattereri*, which may be referred to *Holoprion*, provisionally retained as a subgenus. If a final microscopic examination of *agassizi* shows that it actually lacks teeth on the distal portion of the maxillary the name *Holoprion* becomes an exact synonym of *Aphyocharax*, and a

new generic or subgeneric name will have to be given to the above named species.

Nothing is said in the original description of the teeth on the maxillary of *Cheirodon pulcher* Steindachner. The description reads "Kieferzähne einreihig, sehr klein, schlank und zahlreich." This does not apply to the genus *Cheirodon*, in which genus it is placed by Steindachner, but applies very well to *A. paraguayensis*, a species evidently very closely related to *pulcher*, but which has teeth along the entire maxillary and belongs to the genus *Holoprion* as originally defined. It is more than probable that *pulcher* also belongs here, and it is so ranked.

Range: Guiana, Amazon, and Paraguay, rare in the Uruguay basin.

KEY TO THE SPECIES OF APHYOCHARAX.

- a.* Teeth not along the entire margin of the maxillary. (*Aphyocharax*)
- b.* Dorsal without black.
- c.* Maxillary with many teeth; hooks in the male confined to the lobe of the anal; a humeral spot.
- d.* Mouth very large, the maxillary in fully grown specimens reaching to the third suborbital, 2.5 in the head; snout in the adult 3.5-3.8 in the head, but very little shorter than eye; maxillary-premaxillary border 2.1-2.33 in head; depth 3.5-3.75; middle caudal rays pale.
4. **dentatus** Eigenmann & Kennedy.
- dd.* Mouth moderate, the maxillary not reaching the second suborbital.
- e.* Maxillary with 9-20 teeth extending over more than half the length of the maxillary; scales 37-40.
- f.* Premaxillary with six to eight teeth, mandible with 16-20; middle caudal rays dusky; a well-developed humeral spot; A. 17-19; depth 4.25-4.5; snout over 4 in the head; maxillary 3.25 in head. 5. **alburnus** (Günther).
- ff.* Premaxillary with six teeth, mandible with about thirteen; A. 17; middle caudal rays pale, caudal red in life. 6. **erythrurus** Eigenmann.
- fff.* Maxillary with teeth along about one-third to two-fifths its length; premaxillary with seven teeth, mandible with nine; A. 18; scales 36, 8 with tubes; head 4.5; depth 4.5; middle caudal rays black. 7. **pusillus** Günther.
- cc.* Maxillary with two to four teeth, mouth small; depth 3-3.75; scales 5 or 5.5-30 to 35-4.5 to 6; mandible with nine to ten teeth; hooks in the male on nearly all anal rays; no humeral spot.
8. **anisitsi** Eigenmann & Kennedy.
- ccc.* Maxillary with four teeth; mouth moderate, maxillary reaching to below anterior margin of pupil; depth 4.25; scales 38; A. 17. 9. **avary** Fowler.
- bb.* Dorsal, at least in male, with black. Mouth minute; posterior part of anal margined with black, the black extending obliquely across the lobe; hooks in the male on nearly all anal rays; depth 3; A. 19 or 20; maxillary very short, convex, not reaching eye, with two teeth or none; premaxillary with five to seven teeth; six to nine on the mandible. 10. **rathbuni** Eigenmann.
- aa.* Teeth along the entire margin of the maxillary (*Holoprion*).
- g.* Dorsal plain; a black border or band from the tip of the last anal ray to the lobe, thence obliquely to the anterior rays and forward to near the ventrals; no humeral spot; origin of dorsal behind the middle; a black caudal spot.

- h.* Scales 34; caudal spot not continued to the end of the middle rays. . 11. *paraguayensis* Eigenmann.
hh. Scales 30; caudal spot continued to the end of the middle rays. A. 23. 12. *nattereri* Steindachner.
gg. Dorsal with a black spot; no caudal spot.
i. A black band along the tips of the shorter anal rays and across the middle of the elongate rays;
 A. 27; scales 30. 13. *agassizi* Steindachner.
ii. A small, black spot near the tips of the first few anal rays; A. 22-23; scales 30.
 14. *maxillaris* Ulrey.

4. *Aphyocharax dentatus* Eigenmann & Kennedy. (Plate IV, fig. 1.)

? *Aphyocharax (Chirodon) alburnus* Perugia, Ann. Mus. Civ. Storia Nat. Genova, (2), Vol. XVIII, 1897, p. 25 (Rio Beni; Missioni Mosetenes).

Aphyocharax dentatus Eigenmann and Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 576. (Asunción; Arroyo Trementina); Eigenmann, Ann. Carnegie Mus., Vol. IV, 1907, p. 126 (Corumbá, Puerto Max; Rio Negro; Rio Pilcomayo); Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Paraguay basin.

10032, I. U. M., **type**, 71 mm. and 10033, 10036, 10037, 10038, I. U. M., ten. Asunción. Anisits.

10034 and 10035, I. U. M.; 932a & b, C. M. Aguadas near Arroyo Trementina. Anisits.

10290 and 10187, I. U. M., nine. R. Paraguay, Corumbá. Anisits.

10190, I. U. M., one. Rio Paraguay, Puerto Max. Anisits.

10230, I. U. M., ten. Tributary of the Rio Negro emptying into Rio Pilcomayo. Anisits.

6911a, C. M., one, 37 mm. Asunción, Paraguay. Haseman.

6912a-q, C. M., seventeen, 23-72 mm. R. Paraguay, Caeres, May 26, 1909. Haseman.

1913a-j, C. M., eleven, all females, largest 52 mm. Corumbá, May 9, 1909. Haseman.

6914a-c, C. M., five (one male) 56-64 mm. Corumbá, April 27, 1909. Haseman.

7313a-j, C. M., ten, largest about 72 mm. Villa Hays, April 13, 1909. Haseman.

?7314a-c, C. M., three, largest about 25 mm. Santa Rita. June 12, 1909. Haseman.

Head 4-3.8; depth 3.6-3.75 (3.4-4 in extremes); D. 11; A. 18-22; scales 5.5 to 7-36 to 42-4.5 to 6; 7 to 14 scales with pores; eye 3.5-4 in the head, 1 in snout; interorbital 3-3.33 in the head.

Elongate, compressed-fusiform; dorsal and ventral profiles regularly and about equally arched; preventral area broad, rounded, with a median series of about seventeen scales; predorsal area rounded, with a median series of about fourteen scales, the regularity of the series broken near the middle; occipital process reaching about one-eighth to one-ninth to the dorsal, bordered by two to three scales; skull smooth, slightly convex; fontanels narrow, the frontal fontanel reaching to above

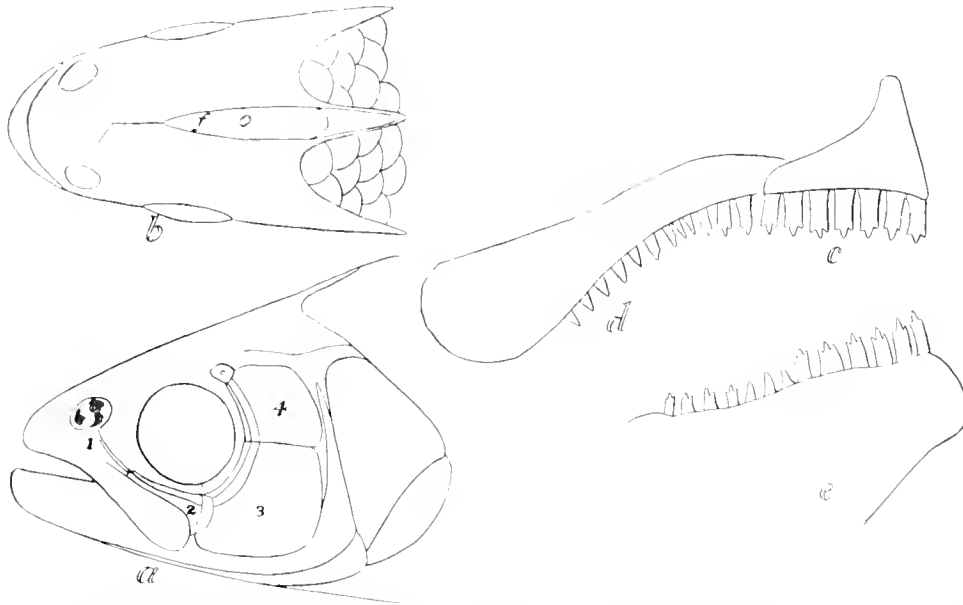


FIG. 6. *Aphyocharax dentatus* Eigenmann & Kennedy. *a*, outline of head, 9 mm. long, showing size of maxillary in a specimen 68 mm. long; 1, 2, 3, suborbitals, 4, 5, postorbitals. *b*, outline of top of head showing frontal (*f*), and occipital (*o*) fontanels. *c*, premaxillary, *d*, maxillary, *e*, mandible, much enlarged, from a specimen 28 mm. long, 10036, I. U. M.

the middle of the eye, its length about two and one-half times in the length of the parietal fontanel without the groove; snout pointed, the mouth large, terminal, the jaws equal; maxillary in adult reaching to the third suborbital; maxillary-premaxillary border two and one-third times in the head, maxillary relatively much shorter in the young; teeth recurved, slender, acutely pointed, those in the front of the jaws with a minute cusp on each side; premaxillary with seven to ten teeth; maxillary with nine to twenty on more than half of its edge; mandible with thirteen to twenty-one teeth; teeth of the premaxillary and of the front of the mandible all of about the same size; third suborbital in contact with the preopercle below and behind; a single postorbital, similar to the third suborbital, its face convex, its posterior margin in contact with the preopercle; upper part of the opercle similar to, but smaller than the postorbital. Gill-rakers 7 + 9.

Origin of dorsal equidistant from tip of snout and base of middle caudal rays or a little nearer the latter; dorsal truncate, tip of third to seventh ray about equal when the fin is half closed; highest ray a little shorter than head; adipose fin small, but well developed; caudal lobes about equal to length of head; origin of anal under end of dorsal, last twelve rays of anal of about the same height, the third to eighth forming a lobe two and a half times as high as the posterior rays, very little longer than snout and eye; ventrals not reaching anal by three or four scales, their origin far in advance of the dorsal; pectorals not reaching ventrals by two to three scales.

Scales everywhere very regularly imbricate, pores developed on seven to fourteen scales and on the last scale of the series above the lateral line series, a long tube on the base of the middle caudal ray; sheath of scales covering the basal fifth of the caudal lobes, the last scale on each lobe largest; anal with not over four scales forming a sheath for the anterior rays; axillary scale large; scales usually with two sub-parallel radials, the circuli on at least the basal part of the exposed portion of the scale prominent above and below.

A diffuse, but quite evident, shoulder-spot; margin of caudal dusky, a silvery lateral band; first dorsal ray dark, a few chromatophores on the membranes from the middle of the first to the tip of the penultimate, forming a very faint, oblique band; bases of some of the rays dusky.

Male with hooks on the third to the eighth anal ray; *i. e.*, on the anal lobe, which is equal to the snout and eye.

This is the largest species of the genus and is abundant in the Paraguay to San Luiz de Caacres.

5. *Aphyocharax alburnus* (Günther).

Chirodon alburnus Günther,¹¹ Proc. Zoöl. Soc. London, 1869, p. 424, fig. 2 (Peruvian Amazons).

Aphyocharax alburnus Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 292; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 292; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

¹¹ Günther's original description is very brief and reads:

"D. 10. A. 20. L. lat. 37. L. transv. 11.

The height of the body is a little more than the length of the head, and one-fourth of the total (without caudal). Upper profile of the head not concave. The pectoral does not extend to the ventral. Teeth scarcely compressed, pointed, with a minute (microscopical) lobe on each side; there are about twelve in the upper and eighteen in the lower jaw. Sides with an ill-defined silvery longitudinal band; the middle caudal rays blackish.

Two and a half inches long."

Range: Amazon basin.

11087, I. U. M., one, 58 mm. Rio Jurua. From British Museum.

6915a-i, C. M., four females, 47-55 mm., six males, 34-43 mm. Santarem, Dec. 6, 9, and 15, 1909. Haseman.

20713a-b, M. C. Z., two, 37 mm., Villa Bella. L. Agassiz. Thayer Expedition.

20813a-f, M. C. Z., six, largest 51 mm. Iça. William James. Thayer Expedition.

20813a-d, C. M., four, largest 39 mm. San Joaquín, Bolivia, Sept. 4, 1909. Haseman.

Head 4.2-4.5; depth 4.2-4.5; D. 11; A. $\frac{17}{3}$, $\frac{18}{3}$, $\frac{19}{1}$; scales 39-40, of which 10-12 with pores; eye 3 in head, snout 4 in head, interorbital slightly larger than eye.

Maxillary always falling short of the third suborbital; maxillary-premaxillary border three times in the head, in the largest specimen; premaxillary with six to eight teeth; maxillary with ten to sixteen teeth on over half the length of the maxillary; mandible with eight large teeth and eight small ones on the side.

Margin of caudal and the middle rays dusky. In all other respects the description of *dentatus* applies to this species.

6. *Aphyocharax erythrurus* Eigenmann.

Aphyocharax erythrurus Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 313, Pl. XLIV, fig. 4 (Rockstone, Crab Falls, and Maripieru Creek, British Guiana.) 1879a, C. M., **type**. 1880a-e, C. M.; 12161, I. U. M., **paratypes**, 28-58 mm. Rockstone. Eigenmann.

1881a, C. M., **paratype**, 29 mm. Maripieru Creek. Grant.

2494a, C. M., **paratype**, 35 mm. Crab Falls. Eigenmann.

Head about 4; depth 3.66-4; D. 10 or 11; A. 17 or 18; scales 5-34 to 37¹²-3; nine to eleven scales with pores; eye a little longer than snout; 3.5 in the head; interorbital 3 in the head.

Maxillary-premaxillary border 2.5-2.75 in the head; six teeth in the premaxillary, twelve to fourteen along the greater part of the maxillary, about thirteen in the dentary. Middle caudal rays pale.

This species is almost identical with *alburnus*, but can readily be distinguished by the pale middle caudal rays and the slightly longer maxillary.

7. *Aphyocharax pusillus* Günther.

Aphyocharax pusillus Günther, Proc. Zoöl. Soc. Lond., 1868, p. 245 (Huallaga; Neberos); Cope, Proc. Acad. Nat. Sci. Phila., 1871, p. 260 (Ambyiaeu); Cope,

¹² And a few on the caudal.

Proc. Am. Philos. Soc., Vol. XVII, 1878, p. 689 (Peruvian Amazon); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 55; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1885, p. 292; ? Boulenger, Ann. & Mag. Nat. Hist. (7) Vol. II, p. 478 (Jurua)¹³; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, 333, fig. 22 (Ambyiaeu, Peruvian Amazon.)

Range: Marañon basin; Madeira basin.

6917a, C. M. 50 mm. Palo Grande Fall, Rio Mamoré, Sept. 30, 1909. Haseman.

6918a-b, C. M. two, larger 58, Berlin, Bolivia, Sept. 15, 1909. Haseman.

6919a, C. M. one, 43 mm. Maciél, Rio Guaporé, July 2, 1909. Haseman.

Head 4.33-4.8; depth 4-4.3; D. 11 or 12; A. 18 or 19; eye 3-3.5 in the head, 1 in snout; interorbital 2.6-3 in the length of the head.

Maxillary-premaxillary border three times in the head, maxillary about four times; maxillary with five to eight teeth on one-third to one-fourth of the margin; premaxillary with seven teeth; mandible with ten to sixteen. Middle caudal rays dark.

This species differs from *alburnus* in the number of maxillary teeth.

8. *Aphyocharax anisitsi* Eigenmann & Kennedy. (Plate III, fig. 6.)

Aphyocharax anisitsi Eigenmann & Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 517 (Asunción; Campo Grande; Arroyos Trementina and Chagalalina); Eigenmann, Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429.

Range: Paraguay basin; Cacequy, Uruguay basin.

10024, 10026, I. U. M.; 936a-b, C. M., fifteen specimens, Campo Grande. Anisits.

6920a-k, C. M., twelve (four males), largest 35 mm., Asunción, March 28, 1909. Haseman.

10028, I. U. M., **type**, 41 mm.; 10027 & 10029, I. U. M., three, Asunción. Anisits.

6921a, C. M., one, 37 mm. Puerto Suarez, Bolivia. Steinbach.

10031, I. U. M., one, Arroyo Trementina. Anisits.

10025, I. U. M., one, Arroyo Chagalalina. Anisits.

6222a-c, C. M., three, largest 32 mm. to base of caudal. Cacequy. R. Ibicuhy, into Uruguay. Haseman.

Head 3.75-4.2; depth 3-3.75; D. 10 or 11; A. $\frac{18}{2}$, $\frac{19}{2}$, $\frac{20}{4}$, $\frac{21}{1}$, $\frac{23}{1}$; scales 30-35,

¹³ I have specimens of *alburnus* from the Jurua sent by the British Museum. It is possible that these are some of the specimens identified as *pusillus* by Boulenger.

6 to 9 with pores; eye 2.75-3.33 in the head, .5-.75 in the snout; interorbital 2.4 in the length of the head; interorbital a very little greater than eye.

About thirteen prefrontal scales, an equal number of predorsal scales; maxillary-premaxillary border three times in the head, maxillary about two-thirds as long as the eye. Premaxillary with six to eight teeth; maxillary with two to four, mandible with nine to ten; mouth small, the maxillary scarcely reaching to eye; pectorals reaching ventrals; origin of dorsal nearer caudal than to tip of snout.

Anal and caudal sometimes margined with dark; chromatophores on the dorsal rays; outer pectoral ray sometimes dark; no humeral spot.

Anal in the male with four, rarely more, hooks on all the rays but the first

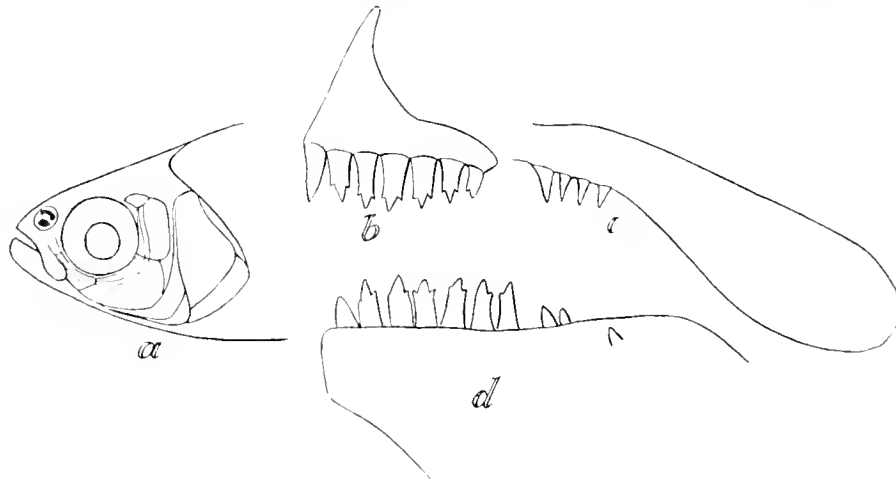


FIG. 7. *Aphyocharax anisitsi* Eigenmann. a, side of head; b, c, d, premaxillary, maxillary, and portion of mandible of a specimen, 10029, I. U. M. 28 mm. to base of caudal.

two and the last, the hooks strongest on the posterior rays and on the middle third of the rays.

While quite similar in general appearance to *dentatus*, this species differs in many ways. It is smaller, deeper, has fewer scales, much fewer maxillary teeth, a smaller mouth and different color. The anal in the male with hooks on practically all the developed rays, is quite different from that of *A. dentatus*, which has hooks on only the rays of the lobe.

9. *Aphyocharax avary* Fowler.

Aphyocharax avary Fowler, Proc. Acad. Nat. Sci., Phila., 1913, p. 532.

Known only from the type, 54 mm. long, from the Madeira River about two hundred miles east of Long. 62° 20', Brazil.

Head 3.87; depth 4.25; D. 13; A. 17; scales forty-two, of which eleven are

with tubes; eleven scales between dorsal and ventrals; nineteen predorsal scales; depth of caudal peduncle 2.4 in the length of the head; height of dorsal 1.25; height of anal 1.66; length of pectoral 1.33; ventral 1.6.

Elongate, slender, fusiform; maxillary reaching to below anterior margin of pupil; teeth conic, each usually with a very small or obsolete pointed basal cusp; maxillary with about four conic teeth.

Origin of dorsal midway between posterior nostril and base of caudal; origin

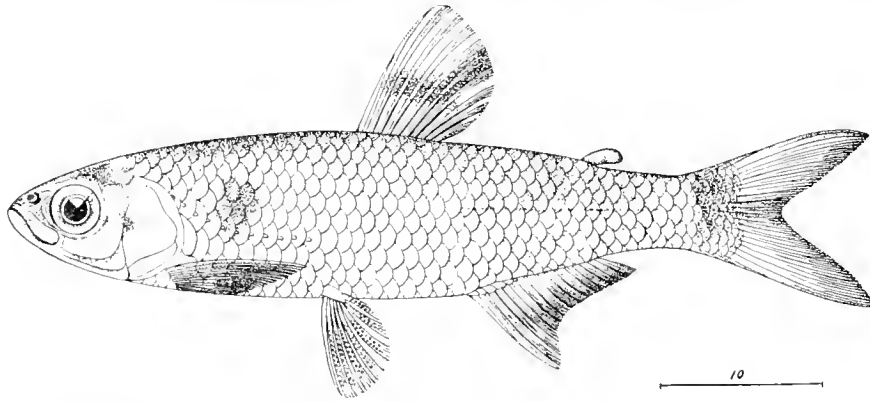


FIG. 8. *Aphyocharax awary* Fowler. (After Fowler, Proc. Acad. Nat. Sc., Phila., 1913, p. 532.)

of anal behind the vertical from the base of the last dorsal rays; origin of ventrals well before the dorsal.

A silvery lateral band; humeral spot crossing third, fourth, and fifth scales of the lateral line; dorsal with a transverse median streak. Anal broadly whitish in front; rest of fin sprinkled with dusky dots, the edge of the fin dark, the dark continued across the anal lobe.

10. *Aphyocharax rathbuni* Eigenmann. (Plate III, fig. 5.)

Aphyocharax alburnus Eigenmann & Kennedy (*non* Günther), Proc. Acad. Nat. Sci., Phila., 1903, p. 517.

Aphyocharax anisitsi (part) Eigenmann and Kennedy, Proc. Acad. Nat. Sci., Phila., 1903, p. 517.

Aphyocharax rathbuni Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 10. (Arroyo Chagalalina, Paraguay); Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Aphyocharax stramineus Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 11 (Arroyo Trementina); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Paraguay basin.

10025, I. U. M., one, 26 mm. to base of caudal. Arroyo Chagalalina, Paraguay basin. J. D. Anisits. **Type of *rathbuni*.**

10030, I. U. M., one, 25 mm. to base of caudal. Arroyo Trementina. J. D. Anisits. **Type of *stramineus*.**

A close comparison of *rathbuni* and *stramineus* in the light of the study of the group of the *Cheirodontinae* makes it quite probable that *stramineus* is the female of *rathbuni*.

No additional material was collected by Haseman.

Head 4; depth 3; D. 11; A. 19 or 20; scales 35, 9 between dorsal and ventrals; eye 2.6-3 in the head, equal to the interorbital; snout about half length of eye.

Elongate, compressed; preventral area rounded, without a distinct median series of scales, of which there are eleven between ventrals and the isthmus; pre-dorsal area rounded, with about fourteen scales, of which about nine in front of the dorsal are in a median series; occipital process very short, reaching about

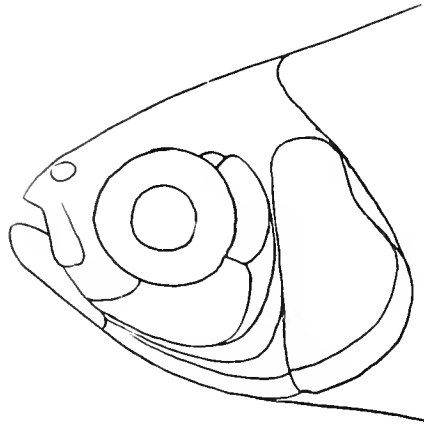


FIG. 9. *Aphyocharax rathbuni* Eigenmann. Greatly enlarged.

one-seventh to the dorsal; frontal fontanel about half as long as the parietal with its groove; second suborbital in contact with the lower limb of the preopercle along its entire margin; a naked wedge behind it; postorbital strong, its margin more convex in the male than in the female, having a naked area around its entire distal margin; lateral line tubes on the postorbital and on the third suborbital strong; mouth very small, the maxillary very short, its margin very convex, not reaching the anterior margin of the eye; premaxillary with about five teeth, maxillary with one to three; mandible with six to nine teeth, the first three rapidly graduate.

Origin of dorsal a little nearer base of caudal than tip of snout; origin of anal under dorsal; anal with a slight lobe, the end of the fin rounded; most of the anal

rays of the male with a few hooks; ventrals reaching to or nearly to the anal; pectorals not reaching to ventrals.

Seven or eight scales with pores; scales firm, mostly with two slightly divergent radial striae; caudal naked, the scales extending but little on the base of the lobes, the last scale on each lobe large; anal naked.

No humeral or caudal spots; back thickly dusted; dorsal dusted like the back; quite black in the male, especially along its base and posterior part; margin of caudal dusky; margin of anal forward to the lobe black or dusky, a narrow dusky band extending obliquely across the lobe to the basal third; opercle with a few chromatophores, largest near its anterior margin; the color everywhere more intense in the male. The color of the anal is evidently much like that of *A. agassizi*.

Closely allied to *A. anisitsi*, the mouth still smaller.

11. *Aphyocharax paraguayensis* sp. nov. (Plate II, fig. 2.)

6906a, C. M. Type, 25 mm. 6907, C. M., paratype, 20 mm. Rio Paraguay, Caeres, May 24, 1909. Haseman.

Head 4; depth 3.5-3.8; D. 10 or 11; A. 22; scales 5 + 29; eye about three in the head, a trifle less than interorbital.

Elongate, dorsal and ventral profiles alike; preventral area rounded, without a distinct median series of scales, about fourteen rows; predorsal area rounded,

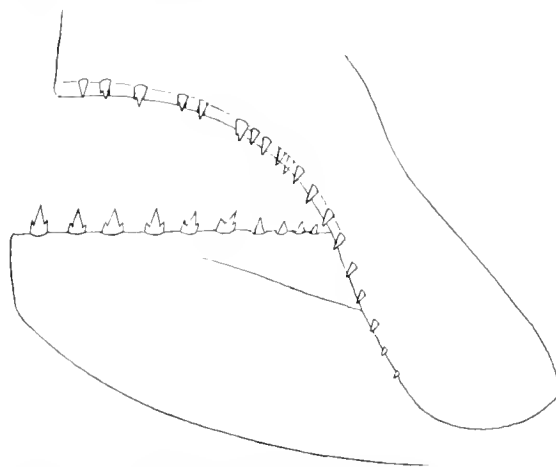


FIG. 10. Dentition of *Aphyocharax paraguayensis* Eigenmann. 6906, C. M.

with a perfect median series of thirteen scales; occipital process nearly equilateral, reaching about one-seventh to the dorsal, bordered by one and one-half scales; frontal fontanel reaching to near anterior margin of eye, but little, if any, shorter than the parietal without the groove; third suborbital in contact with the pre-

opercle in front and behind; a single postorbital, its lower half in contact with the vertical limb of the preopercle, a naked margin behind its upper half; no tubes on the suborbital or postorbital; mouth large, very oblique, the chin entering the profile; the maxillary-premaxillary border a gentle curve, longer than eye; maxillary reaching beyond suture between second and third suborbital; maxillary with thirteen conical teeth along practically its entire margin; premaxillary with six slightly graduate teeth with a small notch on each side near the tip of each tooth; mandible with twelve graduate teeth along the greater part of its margin, similar to those of the premaxillary, the lateral ones simply conic. Gill-rakers 4 + 7.

Origin of dorsal equidistant from tip of snout and near end of middle caudal rays; the highest ray a little shorter than head; origin of anal under anterior part of dorsal; ventrals not quite reaching anal, pectorals a little beyond origin of ventrals.

Each scale with two sub-parallel radial striae dividing the scale into three fields of about equal height; caudal naked; pores on but few scales.

A sub-triangular caudal spot, its base across the entire caudal peduncle, its tip on the basal third of the middle caudal rays; dorsal nearly evenly peppered; sides of head and abdomen silvery; chin, upper lip, and sides peppered, the peppering densest along the back and along the base of the anal, the spots becoming larger along the base of the anterior anal rays, and continued forward to the ventrals; a dark band beginning at the base of the first to fourth anal rays, extends obliquely to the tip of the sixth and along the margin of the succeeding rays; middle caudal rays without chromatophores, the lobes faintly peppered.

12. *Aphyocharax nattereri* Steindachner.

Tetragonopterus diaphanus Cope (part), Proc. Am. Philos. Soc., Vol. XVII, 1878, p. 691 (Peruvian Amazon).

Cheirodon pulcher Steindachner, Flussf. Südam., Vol. IV, 1882, p. 39 (Villa Bella); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 332, fig. 21 (based on Cope's specimens mentioned above).

Cheirodon nattereri Steindachner, Anz. Akad. Wiss., Wien, 1882, p. 180 (Villa Bella); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey (part), Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 291 (Pará); ? Boulenger, Boll. Mus. Univ. Torino, Vol. XIV, 1900 (Urueum, Matto Grosso); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Cheirodon steindachneri Eigenmann & Eigenmann, Proc. U. S. N. M., Vol. XIV, 1891, p. 54.

Range: Amazons from Pará to Peru.

The names *C. pulcher* and *C. nattereri* were proposed for the same species, the latter being substituted by Steindachner for the name *pulcher*, which was pre-occupied. Without knowing that the specific name *nattereri* had been substituted by Steindachner, the name *steindachneri* was also proposed by the writer for the pre-occupied *pulcher*. It is a pure synonym.

It is quite certain that some at least of Uhrey's specimens belong to the genus *Astyanax*. It also seems doubtful whether the specimens figured by Fowler are *A. nattereri*, since they distinctly differ in color. I have no specimens at hand; the description of Steindachner may be in part reproduced:

[P. 39.] "Körperform sehr gestreckt, *Alburnus*-artig. Rücken- und Bauchlinie gleichförmig, äusserst schwach gebogen.

"Seitenlinie unvollständig. Dorsale mit ihrem ersten Strahle eben so weit von der Caudale wie vom hinteren Augenrande entfernt, somit nicht unbeträchtlich weit hinter der Mitte der Körperlänge beginnend. Ventrale vor der Mitte der Körperlänge eingelenkt.

"Grösste Körperhöhe e. $3\frac{1}{2}$ – $3\frac{2}{3}$ mal, Kopflänge e. $3\frac{1}{3}$ – $3\frac{1}{2}$ mal in der Körperlänge enthalten,¹⁴ und der Schnauzenlänge bis zur Kinnspitze gemessen wie der Stirnbreite gleich.

"Kopf nach vorne zugespitzt. Mundspalte sehr schräge gestellt, Unterkiefer nach vorne vorspringend. Kieferzähne einreihig, sehr klein, schlank und zahlreich. Knochen des Augenringes die niedrige Wangengegend vollkommen deckend.

"Dorsale nach oben zugespitzt, an Höhe etwas der Kopflänge nachstehend. Pectorale bis zur Basis der Ventralen zurückreichend, an Länge ein wenig geringer als die Höhe der Rückenflosse.

[P. 40.] "Ventrals mit ihrer Spitze den Beginn der Anale nahezu erreichend.

"Anale in ihrem vorderen Theile mässig lappenförmig erhöht.

"Schuppen klein, ziemlich festsitzend. Die Seitenlinie durchbohrt nur 4–6 Schuppen am Vorderrumpfe.

"Rumpf goldgelb. Humeralfleck ausnahmslos fehlend. Ein intensiv schwarzvioletter, häufig rhombenförmiger Fleck an und vor der Basis der Caudale, nach hinten über die mittleren Caudalstrahlen bis zu deren hinterem Rande sich fortsetzend.

¹⁴ Evidently there is an omission here. Probably in the manuscript Dr. Steindachner had stated that the eye is contained so many times in the head, but the statement was omitted by the printer.

“Ein hellgelber Fleck am oberen und unteren Caudallappen unmittelbar hinter dem Caudalfleck. Ein gleichfalls intensiv violetter Streif am Bauch ein wenig hinter der Insertionsstelle der Ventralen beginnend und sich längs der ganzen Basis der Anale hinziehend. Ein Nebenast dieses Streifens zieht, ein wenig an Breite zunehmend (daher bindenähnlich), von der Basis der 3–4 ersten Analstrahlen schräge nach hinten und unten zum unteren Rande des 6. und 7. Analstrables und bildet hierauf einen schmalen Saum am freien Rande der folgenden Analstrahlen.

“D. 9–10. A. 23. L. lat. c. 30. L. tr. 4/1/3.

“Zahlreiche Exemplare, nur bis zu 25–26 Mm. in der Totallänge, von Villa Bella (Amazonenstrom).”

13. *Aphyocharax agassizi* (Steindachner).

Cheirodon agassizii Steindachner, Flussf. Süd-am., Vol. IV, 1882, p. 38 (Jatuarana);

Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54.

Aphyocharax agassizii Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293.

Holoprion agassizii Eigenmann, Smiths. Misc. Quarterly, Vol. XLV, 1903, p. 145;

Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Jatuarana, Amazon basin.

I have recognized no specimens of this species in the collections at my disposal and add the original description:

“Körperform sehr gestreckt. Seitenlinie unvollständig; ein bräunlichvioletter Fleck am vorderen Theile der oberen Höhenhälfte der Dorsale, höher als lang.

“Rücken- und Bauchlinie sehr schwach gebogen, erstere ein wenig rascher zur Dorsale ansteigend, als letztere bis zur Ventrals sich senkt. Dorsale in der Mitte der Körperlänge und nur wenig hinter der Basis der Ventralen in verticaler Richtung beginnend. Anale im vorderen Theile erhöht, lappenförmig über den Rest der Flosse vorragend. Humeralfleck sehr undeutlich; Caudalfleck fehlend, Kopflänge mehr als $3\frac{1}{2}$ mal, grösste Rumpfhöhe 3mal in der Körperlänge.

“Augendiameter etwas weniger als 3mal, Stirnbreite $3\frac{1}{2}$ mal, Schnauzenlänge gleichfalls $3\frac{1}{2}$ mal in der Kopflänge enthalten. Kieferzähne zahlreich, schlank, verhältnissmässig sehr klein, spitz, mit kurzen Nebenzacken, im Zwischenkiefer einreihig.

“Oberer Theil des Oberkiefers am ganzen vorderen Rande deutlich gezähnt.

“Obere Profillinie des Kopfes grade, nur wenig nach hinten ansteigend.

“Pectorale und Ventrals nach hinten zugespitzt; letztere überragt mit ihrer Spitze den Beginn der Anale bei einem Exemplare nicht unbedeutend, erstere erreicht nur die Basis der Ventralen.

“Dorsale an Höhe einer Kopflänge gleich, Ventrals um die Länge der Schnauze kürzer als der Kopf. Die Seitenlinie durchbohrt 7–8 Schuppen am Rumpfe.

“Der untere Rand der kurzen Analstrahlen ist dunkelvioletts gesäumt, und diese Färbung setzt sich strichförmig horizontal nach vorn fort, so dass der vordere erhöhte Theil der Anale durch diesen violetten Streif der Höhe nach halbirt erscheint. Der vordere lange Randstrahl der Anale (der dritte der ganzen Flosse) zeigt eine milchweisse Färbung.

“Rumpfsseiten goldgelb, silbergraue Seitenbinde nicht scharf abgegrenzt.

“D. 11. A. 27. P. 13 (14). V. S. L. lat. 30 (bis zur Caud.) L. tr. 5/1/3.

“Zwei Exemplare, jedes e. 40 mm. lang, von Jatuarana und ein Geschenk des Herrn Prof. L. Agassiz, dessen Andenken ich diese interessante Art widme.”

14. *Aphyocharax maxillaris* Ulrey.

Aphyocharax maxillaris Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293 (Brazil).

Holoprion maxillaris Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Brazil, definite locality not known, probably from the lower Amazon. This species is known only from the types.

Head 3.5; depth 3–3.5; D. 11; A. 22–23, scales 6 + 24. Eye 2.33 in the head.

Snout very short, the maxillary extending beyond anterior margin of eye; premaxillary with about ten teeth, the median four three-pointed; mandible with a few conical teeth.

Origin of dorsal equidistant from tip of snout and base of caudal; pectorals reaching beyond origin of ventrals; the latter to the anal.

A small circular humeral spot, sometimes reduced to two or three color-cells. A large black spot on the upper half of the first dorsal rays, the tips of these rays white; a small black spot near tip of first few anal rays.

Genus V. PRIONOBrama¹⁵ Fowler.

Prionobrama Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 534 (*madeira*).

Bleptonema Eigenmann, Indiana University Studies, No. 20, 1914, p. 44 (*paraguayensis*).

Type: *Prionobrama madeira* Fowler = *Aphyocharax filigerus* Cope.

General appearance of *Gephyrocharax*. Teeth tricuspid and conical in a single series on mandible, premaxillary, and along entire edge of maxillary; origin of

¹⁵ πρίων = a saw; βράμα = a bream.

dorsal behind the middle, about over the vertical from the origin of the anal; adipose fin well-developed; anal falcate, with fewer than forty rays, its origin nearer caudal than snout, first and second developed rays filigerous, curved; pectorals placed low, long and falcate, their margins nearly along the edge of the compressed belly when the fin is closed; caudal naked; lateral line incomplete; mouth very oblique; profile from tip of snout to near dorsal straight; two post-orbitals, similar to those in *Aphyocharax*, the lower large, the upper minute, sometimes a minute triangular wedge between the third suborbital and the postorbital, representing the lower postorbital of other genera; third suborbital covering the entire cheek; no well-defined pseudotympanum.

KEY TO THE SPECIES OF PRIONOBrama.

- a. Lateral line 35-38; eight or nine scales between ventrals and dorsal; anal rays 29-34.
 15. *paraguayensis* (Eigenmann).
 aa. Lateral line 38-41; nine or ten scales between ventrals and dorsal; anal rays usually 32.
 16. *filigera* (Cope).

15. *Prionobrama paraguayensis* (Eigenmann). (Plate IV, fig. 5.)

Bleptonema paraguayensis Eigenmann, Indiana University Studies, No. 20, 1914, p. 44 (Corumbá).

Range: Uruguay and Paraguay basins.

6884a-b, C. M., two, largest about 50 mm. Corumbá, May 9, 1909. Haseman.

6885a, C. M., one, about 42 mm. Puerto Suarez, May 6, 1909. Haseman.

6886a & b, C. M., two, largest 45 mm. Villa Hays, April 11, 1909. Haseman.

6887a-c, C. M., three, largest 42 mm. Asunción, March 29, 1909. Haseman.

6888a-j, C. M., ten, largest 49 mm. Arequa, April 8, 1909. Haseman.

847, M. C. Z., four, largest 35 mm. Uruguay River. Wyman.

5499, C. M., **type**, 40 mm. to base of caudal; 5499, C. M., **paratypes**, six, largest over 50 mm. Corumbá, April 27, 1909. Haseman.

Head 4.66-5; depth 3.33; D. 10, rarely 11; A. 29-34; lateral line 8 to 11 + 26 to 28 = 35 to 38; eight or nine scales between ventrals and dorsal; eye 3 in the head, about equal to interorbital.

Elongate, compressed, breast with a series of large median scales; belly between pectorals and ventrals trenchant, the margins of the scales of one side bent over the middle line, no median series of scales; predorsal with a median series of about sixteen scales, the series less regular near the occipital process, which extends about one-eighth of the way to the dorsal; skull smooth, convex, frontal fontanel large, triangular, a little more than half the length of the parietal;

second suborbital in contact with both the posterior and the lower limb of the preopercle; mouth very oblique, maxillary-premaxillary border a little more than orbital length; sixteen to twenty teeth on the maxillary, those on the posterior half larger, pointing backward and outward; seven premaxillary teeth; mandible with six or seven tricuspid teeth, the first and last distinctly larger than those between; in addition to these six or seven larger teeth several minute teeth appear posteriorly.

Origin of dorsal a little nearer to base of middle caudal rays than to the eye; origin of anal in front of or under the dorsal; first developed anal ray heavy and much prolonged, the second less so; outer ventral ray filiform; extending beyond the origin of the anal, pectorals to near middle of the ventrals; pectorals placed low, their base oblique, their shortest ray about one-half of the outer ray, which is similar to the outer ventral and first developed anal ray.

Scales everywhere regularly imbricate, with few radial striæ; a series of very small scales along the base of anal, caudal with a few scales at the base of the lobes; axillary scales small.

No definite markings, margin of anal in the male dusky.

16. *Prionobrama filigera* (Cope). (Plate IV, fig. 4.)

Aphyocharax filigerus Cope, Proc. Am. Philos. Soc., 1870, p. 564 (Pebas); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 55; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 334, fig. 23 (Pebas); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Paragoniates mülleri Steindachner, Ichthyol. Beitr., Vol. V, 1876, p. 72 (Obidos).

Prionobrama madeira Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 534, fig. 9. (Tributary of Rio Madeira near Porto Velho, Brazil.)

Bleptonema amazoni Eigenmann, Indiana University Studies, No. 20, 1914, p. 44 (Santarem).

Aphyocharax analis Nichols, Bull. Am. Mus. Nat. Hist., Vol. XXXIV, 1915, p. 127 (Manaos).

Range: Amazons from Pebas to Villa Bella, Madeira basin.

5499a, C. M. **Type** of *amazoni*, 54 mm. 5599a-c, C. M., **paratypes**, 50-55 mm. Santarem. Dec. 9, 1909. Haseman.

21188, M. C. Z.,¹⁶ about 58 mm. Villa Bella, Jan. 1866. L. Agassiz.

21182, M. C. Z., twelve, largest 53 mm. Villa Bella, Jan. 1866. L. Agassiz.

21248, M. C. Z., seven, largest 51 mm. Iça. Jan. 1866. William James.

¹⁶ Anal filament reaching to base of last anal ray. A. 30; l. 39.

- 21231, M. C. Z., two, larger 50 mm. Hyavary. D. Bourget.
 21234, M. C. Z., twenty-one, largest 55 mm. Tabatinga. Bourget.
 6889a, C. M., one, 50 mm. Santarem, Dec. 9, 1909. Haseman.
 6890a-q, C. M., seventeen, largest 50 mm. Santarem, Dec. 15, 1909. Haseman.
 6891a-n, C. M., fourteen, largest 60 mm. Villa Bella, Oct. 5, 1909. Haseman.
 6892a-e, C. M., one, 54 mm. San Joaquin, Sept. 6, 1909. Haseman.
 6923a, C. M., one, 50 mm. San Antonio de Rio Madeira, Nov. 3, 1909. Haseman.

This species is very similar to *paraguayense*.

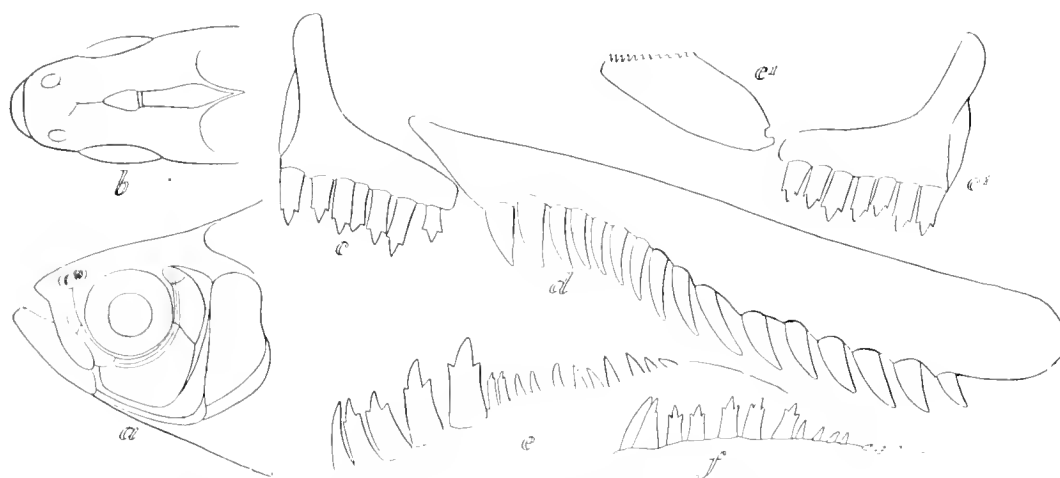


FIG. 11. *Prionobrama filigera* (Cope). *a*, side of head; *b*, top of head; *c*, *d*, *e*, the premaxillary, maxillary and portion of mandible; *c'*, premaxillary of the other side; *c''*, outline of entire mandible showing the extent of dentigerous portion, *f*, another mandible.

The scales are eight to fourteen (usually eleven) + twenty-six to thirty = thirty-eight to forty-one, nine or ten between ventrals and dorsal; the origin of the dorsal is equidistant from the base of the middle caudal rays and the anterior margin of the eye, above the origin of the anal.

Number of anal rays:	31,	32,	34,	35,	36,	37
Number of individuals:	3	9	2	1	1	1

Genus VI. PARAGONIATES¹⁷ Steindachner.

Paragoniates Steindachner, Ichthyol. Beitr., Vol. V, 1876, p. 69.

Type: *Paragoniates alburnus* Steindachner.

Teeth mostly tricuspid, the lateral cusps minute, very much smaller than the median cusp; teeth all in a single series, those of the premaxillary anteriorly

¹⁷ παρά = besides; ἀγωνίατης, ὁ = a nervous person; *Agoniates*, a genus of fishes.

crowded, the second, and sometimes the fourth, more or less crowded out of line with the rest, suggesting an incipient second series; teeth along the entire edge of the maxillary. Origin of dorsal behind the middle; origin of anal about in the middle; adipose fin well-developed; anal fin without a lobe, its margin nearly straight; pectorals placed low, foliate, their margins nearly along edge of belly, when the fin is closed; caudal naked. Lateral line incomplete. Mouth large, oblique. Three postorbitals, covering entire postorbital area, the middle one the largest.

17. *Paragoniates alburnus* Steindachner. (Plate IV, fig. 2.)

Paragoniates alburnus Steindachner, Sb. Akad. Wiss. Wien, LXXIV, Ichthyol. Beitr., Vol. V, 1876, p. 69, pl. VIII, fig. 3 (Teffé); Boulenger, Proc. Zool. Soc., 1887, p. 281 (Canelos); Eigenmann, Report Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 441.

Range: Amazon basin above Teffé.

7315a-b, C. M., two, 70 and 86 mm. Villa Bella, Oct. 5, 1909. Haseman.

7316a, C. M., one, 73 mm. Santarem, Dec. 15, 1909. Haseman.

Steindachner's diagnosis of this species reads:

"Mundspalte sehr lang, hinteres Ende des vollständig bezähnten Oberkiefers bis hinter die Augenmitte bei geschlossenem Munde in verticaler Richtung sich erstreckend. Wangen vollständig von den Knochen des Suborbitalringes überdeckt. Körperhöhe 2-3/4mal, Kopflänge mehr als 4-1/3mal in der Körperlänge, Schnauzenlänge circa 3-2/3mal, Stirnbreite circa 3mal, Augendiameter circa 3mal, Länge der Mundspalte zwischen 1-3/4-1-4/5mal in der Kopflänge enthalten. Pectorale lang, über die Insertionsstelle der Ventrals, letztere über den Beginn der Anale zurückreichend. Fettflosse sehr klein; Dorsale in verticaler Richtung circa über dem 7. oder 8. Analstrahle beginnend. Seitenlinie noch vor dem Beginn der Anale endigend. Kiemenspalte lang; Verbindungshäute der Kiemenstrahlen mit dem Isthmus nicht verwachsen und unter der Kehle noch gespalten. Rechenzähne der Kiemenbogen schlank, locker gestellt. Ein grosser, nicht scharf ausgeprägter, bräunlicher Fleck am Schwanz."

Head 4.75; depth 3; D. 11; A. 44-48; scales 6 or 7-46-4 or 5, thirteen to seventeen with pores; eye a little greater than snout, 3 in the head, equal to, or a little less than, the interorbital; caudal peduncle deeper than long.

Compressed; the ventral profile nearly regularly arched from chin to end of anal; dorsal profile more gently and less regularly arched; pre-ventral area compressed, trenchant, the scales of the two sides narrowly bent over the mid-ventral ridge; about twenty-nine predorsal scales; a regular median series extending from

the dorsal some distance forward, but the scales irregular anteriorly; occipital process short, only one-eighth of the distance from its base to the dorsal, bordered by three scales; frontal fontanel reaching at least to above the anterior margin of the pupil, entirely separating the frontals in the smaller specimen; snout pointed; the mouth large; maxillary slender, extending beyond the suture between the second and third suborbitals; premaxillary with seven teeth; maxillary with about twenty teeth along its entire edge, tricuspid in the largest specimen, in the smaller the upper ones similar to those of the premaxillary, the lower ones conical; dentary with seven to nine tricuspid teeth and about fourteen minute ones on the sides, conical in the smallest specimen, mainly tricuspid in the largest. Gill-rakers 7 + 11.

Origin of dorsal equidistant from tip of snout and a point beyond the tip of the middle caudal rays; height of dorsal about four times in the length; adipose fin small; caudal forked, the lobes 3.5-4 in the length; origin of anal equidistant from the base of the last ray and some portion of the eye; anal without indication of a lobe, its margin slightly convex or straight; ventrals reaching beyond origin of anal; pectorals beyond base of ventrals.

Lateral line developed on thirteen to seventeen scales; scales with one to four radial striæ; scales of the sides continued downward to form an anal sheath of from one to three series of scales free from the fin; scales on the end of the caudal peduncle irregularly arranged; caudal naked; a round or oval spot on the end of the caudal peduncle, not continued on the sides or on the fin. No other definite markings.

Genus VII. LEPTAGONIATES¹⁸ Boulenger.

Leptagoniates Boulenger, Proc. Zoöl. Soc., 1887, p. 281.

Type: *Leptagoniates steindachneri* Boulenger.

Premaxillary, maxillary, and mandible with a single series of tricuspid teeth; origin of anal far in advance of origin of dorsal, equidistant from tip of snout and base of last dorsal ray; lateralline complete; adipose fin small.

I am in doubt whether in the final analysis this genus will remain associated with the Cheirodontinæ.

18. *Leptagoniates steindachneri* Boulenger. (Plate IV, fig. 3.)

Leptagoniates steindachneri Boulenger, *l. c.*, p. 281, pl. XXIII, fig. 3 (Sarayacu, Peru); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 441.

This species is known only from the type, 95 mm. long, in the British Museum. I append the description given by Boulenger, *l. c.*:

¹⁸ λεπτός = thin; *Agoniates*, a genus of fishes.

"D. 10; A. 70; V. 8; P. 12; scales 7-47-7.

"The depth of the body is one-fourth of the total length (without caudal), the length of the head one-sixth. Mandible strongly projecting beyond the mouth; maxillary not reaching below the anterior border of the eye; premaxillary teeth 15, maxillary (on each side) 11, mandibular 14; mandibular teeth largest, maxillary smallest. The diameter of the eye equals nearly two-fifths the length of the head, and exceeds the width of the interorbital space. The pectoral fins reach nearly the extremity of the ventrals, which are small; the dorsal originates above the 23d anal ray. Colourless; sides of head and a lateral band above the lateral line silvery."

Genus VIII. PHANAGONIATES Eigenmann and Wilson.¹⁹

Phanagoniates Eigenmann & Wilson, Indiana University Studies, No. 19, 1914, p. 2.

Type: *Phanagoniates wilsoni* Eigenmann.

Mouth minute, teeth in a single series in each jaw, tricuspid, except in posterior part of maxillary, where they are conical, gill-opening wide, much compressed; chest not trenchant; pectorals large, reaching to middle of ventrals; anal very long, its origin far in advance of the dorsal; dorsal a little behind middle of body. No adipose fin, lateral line incomplete.

19. *Phanagoniates wilsoni* Eigenmann. (Plate V, fig. 1.)

Phanagoniates wilsoni Eigenmann, Indiana University Studies, No. 19, 1914, p. 2.

5354, C. M., **type**, 41 mm.; **paratypes**, 13030, I. U. M. 7, 21-38 mm. Manigru. Charles Wilson.

5355a, C. M., **paratype**, 30 mm. Certegui. Charles Wilson.

5356a, C. M., 13031, I. U. M., **paratypes**, 30 and 37 mm. Rio Truando. Charles Wilson.

Head 4.6; depth 3.33; D. 9; A. 53-55. Scales 7-7 + 34-7 (9 + 35 in one), Eye 2.2 in the head.

Much compressed, dorsal profile highest at origin of dorsal, ventral profile deepest at origin of anal; preventral area rounded, without distinct median series of scales; occipital process about as broad as long; occipital fontanel much wider and twice as long as the parietal, cheeks narrow and long, entirely covered by the second suborbital; the mouth very small, the maxillary not reaching to the eye; lower jaw with nine teeth on each side, premaxillary with six, maxillary with eight,

¹⁹ φανός = bright. The name should have been printed *Phanagoniates* in my paper, Indiana University Studies, No. 19, and I herewith correct the spelling.

the first four tricuspid, the last four conical. The first four forming a continuous series with those of the premaxillary the four conical ones on the distally curved portion of the bone. Gill-rakers about 5 + 8.

Scales thin, the margins obscure, a single row of scales along the base of the anal rays; a few scales along the base of the caudal lobes.

Origin of dorsal slightly behind the middle of body; height of dorsal equal to length of head; caudal lobes about equal to the height of the dorsal; origin of anal about equidistant from the snout and origin of its last third; ventrals small, reaching the anal; pectorals equal to the head less snout, reaching to middle of ventrals.

Translucent, a median dusky band along middle of caudal peduncle, fading out forward and continued narrowly on middle caudal rays; scales of back faintly marked with chromatophores, which become restricted to the margin of the scales on the upper part of the back. Chin and maxillary black, sometimes a dark streak back from upper part of gill-opening.

Genus IX. PARECBASIS²⁰ Eigenmann.

Parecbasis Eigenmann, Indiana University Studies, No. 20, 1914, p. 45.

Type: *Parecbasis cyclolepis* Eigenmann.

Teeth tricuspid, in a single series on anterior part of mandible and premaxillary, none on the maxillary or sides of the mandible; upper margin of the maxillary for its entire length heavy, then passing abruptly into a broad, thin, blade-like expanded portion extending to the convex free margin; sides of mandible raised; adipose fin well-developed; caudal partly sealed; lateral line complete. Origin of the dorsal in front of the middle. Cheeks entirely covered by the third sub-orbital, no apparent pseudotympanum; frontal fontanel very short.

20. *Parecbasis cyclolepis* Eigenmann. (Plate V, fig. 2.)

Parecbasis cyclolepis Eigenmann, Indiana University Studies, No. 20, 1914, p. 45.

Range: Madeira and Amazons.

5495, C. M., **type**, 74 mm.; 5496, C. M., **paratype**, 80 mm. San Antonio de Rio Madeira, Nov. 3, 1909. Haseman. (Two other specimens from the same place taken by the same collector at the same time have been placed in exchange in the Museum of the Indiana University.)

6893a, C. M. 50 mm. to end of lateral line. Santarem, Dec. 9, 1909. Haseman.

6894a-c, C. M., 3, largest 78 mm., San Joaquin, Sept. 6, 1909. Haseman.

²⁰ *παρίςβασις*, ἡ = a going out aside from.

Head 4; depth 2.75-3; D. 11; A. 24-26; scales 6 or 7-38 to 40-5; eye 2.75-3 + in the head, equal to interorbital.

Compressed, fusiform in outline, the dorsal and ventral outlines equally symmetrically curved; prefrontal area rounded, with a nearly complete median series of fourteen scales, predorsal area narrowly rounded with a median series of ten scales; occipital process bordered by four scales, extending one-fourth to dorsal; skull convex in cross-section; frontal fontanel 2.25 in the parietal; third suborbital in contact with both the vertical and horizontal limb of the preopercle, but leaving

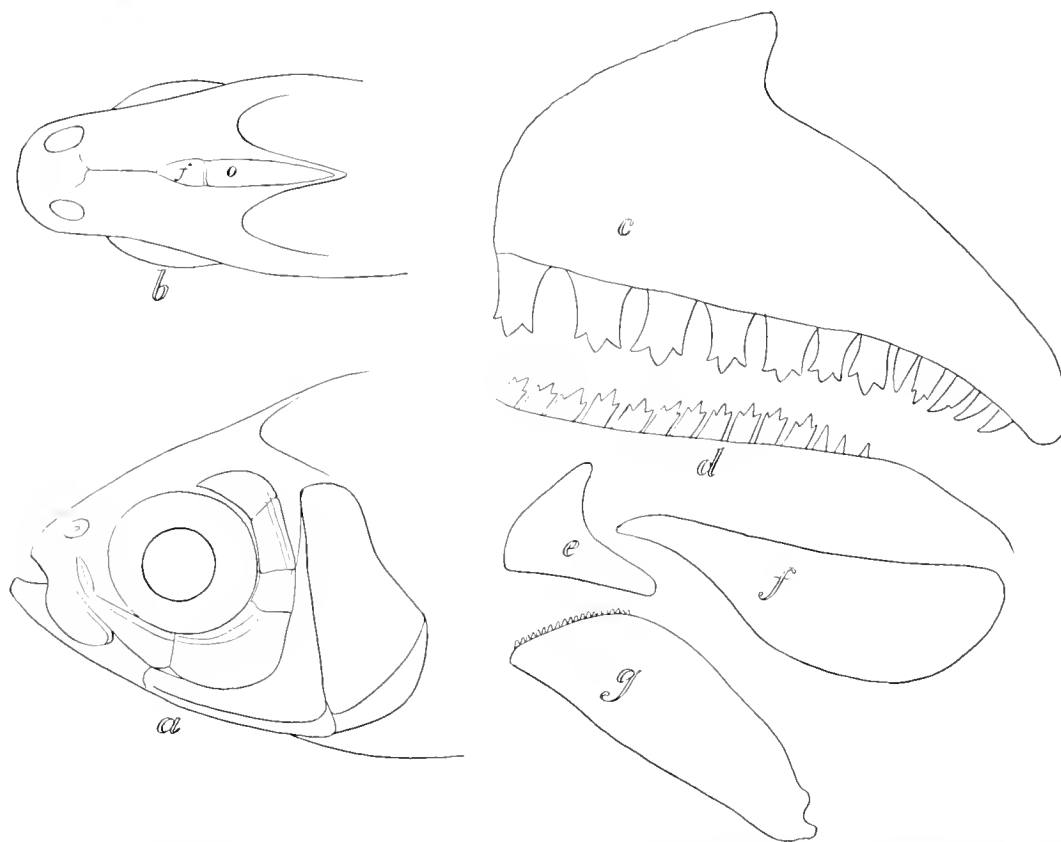


FIG. 12. *Parecbasis cyclolepis* Eigenmann. *a*, outline of head; *b*, outline of top of head, showing frontal (*f*) and occipital (*o*) fontanelles; *c*, premaxillary; *d*, dentary, teeth greatly enlarged; *e*, *f*, *g*, premaxillary, maxillary, and mandible in outline, moderately enlarged.

a narrow angle below its anterior edge; maxillary reaching to just below eye or not quite so far; mouth clupeoid, the premaxillary transverse, without an antero-posterior extent; teeth minute, confined to the premaxillary and but little more than the portion of the mandible in contact with it when the mouth is closed.

Origin of dorsal equidistant from tip of snout and end of adipose or a little nearer the latter; dorsal falcate, its highest ray exceeding length of head; anal

emarginate, its origin below some part of the last dorsal ray, its base greater than length of head; origin of ventral below origin of dorsal, just reaching anal, or a little shorter; pectorals short, just about reaching ventrals.

Scales thin, the margins convex, with many radial striæ; lateral line but little decurved; anal naked; caudal lobes scaled for one-fourth to one-third of their length.

A small, but conspicuous humeral spot, about equal to the size of the pupil, over the fourth scale of the lateral line; middle caudal rays faintly peppered, or a faint dusky streak parallel with the margin in the middle and the upper lobe of the caudal, the rays beyond them dotted.

Genus X. LEPTOBRYCON²¹ gen. nov.

Type: *Leptobrycon jatuaranae* Eigenmann.

Very similar to *Parecbasis*. Anal short, the highest ray, the fourth, extending beyond the tip of the last; lateral line short; mouth very large, the premaxillary very feeble, the maxillary very large, the upper margin thickened; lower jaw scoop-shaped, the sides raised; teeth numerous (fourteen in the premaxillary), feeble, conical, none on the maxillary, or on the raised part of the mandible; cheeks partly naked; postorbitals three, covering most of the postorbital area; no pseudotympanum; both fontanels large; adipose well-developed.

21. *Leptobrycon jatuaranae* Eigenmann sp. nov. (Plate VI, fig. 1.)

20952, M. C. Z., type, 29 mm. to base of caudal. Jatuarana. Navez.

Head 3.75; depth 3.5; D. 11; A. 14; scales ?. Eye 2.5 in the head considerably larger than the interorbital; occipital reaching about one-sixth to the dorsal; frontal fontanel much narrower than the parietal, its length about 1.25 in the length of the parietal; interorbital nearly flat; maxillary very large, slightly longer than the eye, reaching to below the pupil, its front margin quite convex, its proximal margin slightly concave and thickened; premaxillary altogether transverse, each premaxillary with about fourteen minute, apparently conical teeth, without lateral notches. Mandible with minute teeth on its anterior edge, the side of the jaw upturned. Third suborbital narrowly in contact with the preopercle below. A small naked angle below its anterior edge. A narrow naked strip behind it. Gill-rakers 8 + 17, long and slender, the longest more than half length of eye.

Origin of dorsal equidistant from tip of snout and base of caudal; origin of anal behind the vertical from last dorsal ray; base of anal not much longer than eye,

²¹ λεπτός, small, or delicate; *Brycon*, a related genus of the Characidae, from βρῖνω, to eat greedily.

its highest ray reaching beyond tip of last ray; ventrals reaching anal; pectorals small, not reaching ventrals, whose origin is below origin of dorsal. Scales with numerous parallel radial striæ; caudal naked, lateral line incomplete. Scales mostly lost.

Color uniform; a silvery lateral stripe.

This species is readily distinguished from *uruguayana* by its numerous teeth and the very short anal.

This specimen is very small and in bad repair, but its characters are so well marked that there will be no difficulty in recognizing the species.

Genus XI. APHYODITE²² Eigenmann.

Type: *Aphyodite grammica* Eigenmann, Mem. Carn. Mus., Vol. V, 1912, p. 314.

Teeth minute, conical, or but feebly notched, seven on the premaxillary, fifteen or more on the mandible, none on the maxillary; premaxillary feeble, maxillary considerably larger, its outer margin convex; its inner margin concave and slightly thickened; sides of mandible much raised; adipose fin well developed; caudal lobes sealed to near their tips; cheeks covered by the third suborbital; postorbitals in three or four pieces, covering about half the width of the postorbital area, the tubes prominent; frontal fontanel about half as long as the parietal; no pseudotympanum; anal long.

Distinguished from the related genera, *Macropsobrycon*, *Megalamphodus*, and in fact from all the other genera of the subfamily by the sealed caudal.

22. *Aphyodite grammica* Eigenmann.

Aphyodite grammica Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 314, Pl. XLIV, fig. 5 (Konawaruk).

Range: British Guiana.

1882, C. M., **type**, 32 mm.; 12162, I. U. M., **paratypes**, two, 30-32 mm. Konawaruk, Middle Essequibo, British Guiana.

Head 4.5; depth 3.33; D. 11; A. 22; scales 4-7 + 23-3. Eye twice as long as the snout, 2.5 in the head; interorbital a little less than the eye.

Compressed, slender. Head short, compressed, mouth small, oblique; the maxillary not reaching to below the eye, about two-thirds as long as eye; cheeks small, entirely covered by the suborbital below, a naked angle below its anterior margin and a naked border behind it; maxillary margin convex, with three scarcely perceptible teeth, or none. Anal emarginate; ventrals not reaching anal; pectorals

²² ἀφίτη, a small fish; δίτη with the force of *dite* in Aphrodite, *i. e.*, born of, descended from.

not to ventrals. Scales of the back margined with dark; a black median line; some black at base of ventrals and base of anal.

Genus XII. *MACROPSOBRYCON*²³ gen. nov.

Type: *Macropsobrycon uruguayanae* Eigenmann.

Related to *Parecbasis*, but having even fainter dentition, and an incomplete lateral line; related to *Aphyodite*, but with a naked caudal and a well developed pseudotympanum; also to *Leptobrycon*, but with a long anal. It is possible that some of the species of *Megalamphodus* should be placed in this genus.

Teeth minute, conical, or but few of them with a lateral notch; six to eight in the premaxillary, five or six in the front part of the mandible, none on the side of the lower jaws, none on the maxillary, premaxillary feeble, maxillary several times as large, nearly as long as eye, its outer margin very convex, inner margin concave, not thickened; sides of mandible much raised; adipose fin well-developed; caudal apparently naked; cheeks entirely covered by the third suborbital; postorbitals covering about half the width of the postorbital space; frontal fontanel short or medium; a well marked pseudotympanum.

23. *Macropsobrycon uruguayanae*, sp. nov. (Plate VI, fig. 2.)

6895a, C. M., type, 46 mm., paratypes 6896a-d, C. M., four, about 45 mm.
Feb. 1, 1909. Haseman.

6897a, C. M., 26 mm. Uruguayana. Haseman.

Head 4.5; depth 3; D. 11; A. 23-25; scales about 30-33, of which about five are with pores. Eye 3 in head, greater than the very convex interorbital.

Dorsal and ventral profiles both regular, without humps or depressions, the ventral profile a little more arched than the dorsal; preventral area with about thirteen scales; predorsal area narrowly rounded with a median series of about thirteen scales. Occipital process reaching about one-sixth to one-seventh to the dorsal; frontal fontanel as broad, and less than half as long, as the parietal; the skull very convex, the third suborbital in contact with lower limb of the preopercle; without a naked angle under its anterior margin, leaving a wide naked wedge behind its posterior margin; postorbitals narrow and feeble, leaving about half of the postorbital area naked. Gill-rakers 7 + 15 to 17, very long and slender, the longest more than one-half the eye.

Premaxillary very feeble, one specimen examined has six slightly graduate conical teeth, of which only one has a slight notch on one side; another has seven

²³ *μάκροψις* with a long face, *i. e.*, maxillary.

teeth, none of which is notched, and still another has either five or six, none notched; mandibular teeth similar to the maxillary teeth and nearly of the same size.

Origin of dorsal very little nearer base of middle caudal rays than tip of snout; origin of anal under some part of the base of the dorsal, its base longer than head; ventrals just about reaching anal or not quite to anal; pectorals reach to the ventrals, which are inserted in advance of the vertical from front of dorsal.

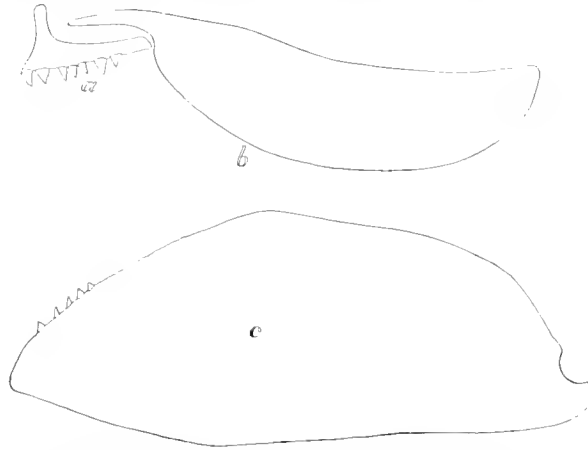


FIG. 13. *Macropsobrycon uruguayana* Eigenmann. 6896 C.M., *a*, *b*, *c*, outlines of premaxillary, maxillary, and mandible.

Scales have been mostly lost, best preserved in smallest specimen; very regularly arranged, and apparently absent from caudal. Interhæmials of caudal peduncle few and feeble.

Color uniform, an ovate dark spot on middle caudal peduncle.

This species has the most feeble dentition of any of the members of the Cheirodontinæ; its conical teeth would place it outside this subfamily, but its relationships are unmistakable.

Genus XIII. MEGALAMPHODUS²⁴ Eigenmann, gen. nov.

Type: *Megalampodus megalopterus* Eigenmann.

Mouth large, teeth in part notched, in part conical, in a single series, seven to eleven on the premaxillary, two to twenty on the maxillary; four to eight tricuspid teeth along front of mandible, minute ones on the sides; all the teeth narrow and pointed, those of front of mandibles, most of those of premaxillary, and usually the upper ones of the maxillary, each with a minute notch on the sides, the rest conical; maxillary teeth few or along almost the entire edge; fontanels both very

²⁴ *μεγαλάμφοδος* = with spacious ways.

large, cheeks below the eye entirely covered, the part behind the eye mostly naked. Form compressed; fins large, origin of anal under dorsal; adipose fin well-developed, anal truncate or with a narrow lobe; caudal naked; lateral line incomplete; scales with a few diverging striæ.

It is quite possible that the species here included in one genus should be distributed to other genera. It is certain that the species selected as the type is generically different from any of the other genera recognized in this paper. As stated above *melanotus* may belong to *Macropsobrycon*, with which the present genus is very closely related.*

KEY TO THE SPECIES OF MEGALAMPHODUS.

- a.* Anal with a narrow lobe, 25-27; depth 2.2-2.4; fourth dorsal reaching caudal; a very conspicuous humeral bar; dorsal dark, without a distinct spot; about twenty maxillary teeth. 24. **megalopterus** Eigenmann.
- aa.* Anal truncate, the rays graduate; dorsal not falcate in the specimens examined. Maxillary with two to six teeth.
- b.* A. 30; depth 2.5; a conspicuous humeral band; most of the dorsal black; anal margined with black. 25. **eques** Steindachner.
- bb.* A. 25-28; depth 3.8; premaxillary with about twelve teeth; maxillary with about four teeth, its length equal to that of the eye; dorsal with a dark spot; a faint humeral spot and a faint caudal spot. 26. **melanotus** Eigenmann.
- bbb.* A. 27-30; depth 3; no humeral spot; upper half of the first five developed rays of the dorsal black; six maxillary teeth. 27. **heteresthes** Ulrey.
- bbbb.* A. 24-26; depth 2.4; sides uniformly dusted or with a narrow humeral bar; all but the first and the last three or four dorsal rays black; caudal and anal margined with black; maxillary with two to six teeth. 28. **micropterus** Eigenmann.

24. **Megalamphodus megalopterus** Eigenmann sp. nov. (Plate VII.)

6806, C. M., **type**, 35 mm. 6807a-b, C. M., **paratypes**, 3, largest 34 mm. Caceres, May 23, 1909. Haseman.

Head 3.5; depth 2.2-2.4; D. 11; A. 25-27; lateral line 32-35, 4 to 6 scales with pores; eye 2.5, slightly greater than interorbital.

Greatly compressed, ventral outline regularly curved; dorsal outline steep to the dorsal, with a slight depression over the eye, base of dorsal very oblique; depth of caudal peduncle equal to its length; predorsal area narrow, with a regular series of nine or ten scales; preventral area broad, covered with two series of scales overlapping along the median line with an occasional scale at their angles. Fontanels both very large, anterior end of frontal fontanel equidistant from tip of snout and its posterior end; parietal fontanel much wider than the frontal; occipital process extending more than one-fourth to the dorsal. Mouth very oblique, maxillary as long as eye, reaching to suture between second and third suborbitals;

*For additional species see Appendix to this article.

premaxillary and maxillary teeth of nearly the same size, about eleven on the premaxillary, about twenty on the maxillary, anterior mandibular teeth considerably larger; eight in front and minute ones on the side, third suborbital with a spur running up behind the eye; a wedge-shaped naked area behind it; post-orbitals obsolete; opercle emarginate above. Gill-rakers 7 + 13, the longest about equal to the pupil.

Origin of dorsal a little nearer to tip of snout than base of caudal, the fourth ray highest, reaching to the middle of the caudal in the type; caudal forked, the lobes longer than head; origin of anal equidistant from base of middle caudal rays and the origin of the dorsal, below middle of dorsal as measured from tip of

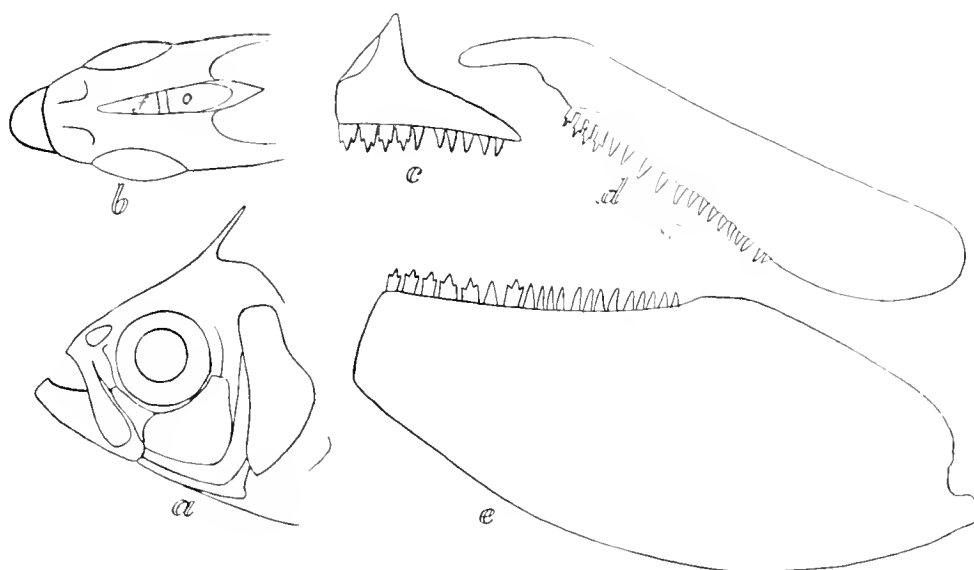


FIG. 14. *Megalamphodus melanopterus* Eigenmann. 6807, C. M., *a*, side of head; *b*, top of head, showing frontal (*f*) and occipital (*o*) fontanels; *c*, *d*, *e*, premaxillary, maxillary, and mandible, much enlarged. The relay teeth in the lower jaw are so numerous that they give the impression of a double row.

snout; anal with a narrow anterior lobe equal to length of head, the rays then of about equal length or decreasing but little to near the end where the fin is rounded; pectorals reaching beyond entire base of ventrals, ventrals to about the seventh anal ray.

Scales thin with few striæ and the rest of the sculpturing very weak; caudal and anal naked, a single series of scales along the base of the anal; pores developed on a very few scales; eleven scales between ventrals and dorsals.

A very conspicuous, large, humeral bar; dorsal and caudal of varying degrees of blackness. Anal dusky.

25. *Megalamphodus eques* (Steindachner).

Cheirodon eques Steindachner, Flussf. Südam., Vol. IV, 1882, p. 37 (Villa Bella; Obidos); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Amazon.

The following is the original description of this species by Steindachner:

“Seitenlinie unvollständig, nur 5–8 Schuppen im vorderen Theile des Rumpfes durchbohrend. Ein querbundenähnlicher, intensiv bräunlichschwarzer Fleck in der Humeralgegend. Ein eben so gefärbter grosser Fleck fast über die ganze Dorsale sich ausbreitend. Anale am ganzen unteren Rande bräunlich punktirt, wie braun gesäumt. Caudalfleck fehlend.

“Die Rückenlinie erhebt sich viel rascher zur Dorsale, als die Bauchlinie sich bis zur Ventrale senkt, und ist bei grösseren Exemplaren auch etwas stärker gebogen als die Bauchlinie. Hinter der Dorsale senkt sie sich minder rasch als die Bauchlinie längs der Analflossenbasis ansteigt.

“Die Dorsale beginnt in der Mitte der Körperlänge, hinter der Einlenkungstelle der Ventralen in verticaler Richtung.

“Die grösste Rumpfhöhe ist $2\frac{1}{2}$ mal, die Kopflänge 3mal in der Körperlänge, der Augendiameter $2\frac{1}{2}$ mal, die Breite der querüber mässig gerundeten Stirne etwas mehr als 3mal in der Kopflänge enthalten und der Schnauzenlänge nachstehend.

“Der obere Theil des vorderen Oberkieferrandes ist, unter der Loupe betrachtet, fein gezähnt. Zwischenkieferzähne einreihig.

“Die Spitze der Ventralen reicht über den Beginn der Anale beträchtlich hinaus, und die der Pectoralen überragt gleichfalls ziemlich bedeutend die Insertionsstelle der Ventralen. Vom 4. oder 5. höchsten Strahle der Anale angefangen nehmen die folgenden Strahlen nur allmähig an Höhe ab, so dass diese Flosse im vorderen Theile nach unten keinen lappenförmigen Vorsprung zeigt.

“Die Höhe der Dorsale gleicht der Kopflänge mit Ausschluss der Schnauze, die Länge der Ventrale steht der Höhe der Dorsale circa um eine halbe Augenzahl nach.

“Rumpf goldgelb, mit zahllosen violetten Pünktchen übersät, die jedoch erst unter der Loupe deutlich unterschieden werden können. (P. 38.) Der Humeralfleck ist schräg gestellt, nach unten und vorn geneigt stets schmal, doch an Breite ein wenig variabel und zuweilen von einer hellen Zone nach vorn und hinten umgeben, scharf abgegrenzt und ausnahmslos tief schwarzbraun. Eine gleich intensive

Färbung zeigt der grosse runde Fleck auf der Dorsale. Längs der mittleren horizontalen Schuppenreihe des Rumpfes liefen bis zum Beginn der Caudale 33 Schuppen.

“D. 11. A. 30. L. lat. 33. L. tr. $6/1\frac{1}{3}$ ♂.

“Das grösste der von uns untersuchten Exemplare ist 30 mm. lang (mit Einschluss der Caudale).

“Fundort: Amazonenstrom bei Villa Bella und Obidos.”

The lengths of the pectoral and ventrals, the shape of the anal, and the color make it very probable that *egues*, which I have not been able to examine in the new light of these studies, belongs to this genus.

26. *Megalamphodus melanotus* (Eigenmann).

Aphyocharax melanotus Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 312 (Rockstone on the Essequibo River, British Guiana).

This species is known only from the specimens originally described.

1877a, C. M. **Type**, 43 mm. Rockstone sand-bank. Eigenmann.

Head 4; depth 3.8; D. 10; A. 25; scales 5-33-2, six with pores. Eye 2.75 in head, interorbital 3.75.

Compressed, preventral and predorsal areas rounded, the latter with a median series of ten scales.

Frontal fontanel not entirely separating the frontals; second suborbital in contact with the preopercle below, a very narrow naked area behind it.

Mouth large, the antero-posterior extent of the premaxillary very short; the maxillary large, with a curved anterior margin, its length about equal to that of the eye; about twelve teeth in each premaxillary; maxillary with about four similar teeth; about twenty teeth on each side of the lower jaw.

Origin of dorsal a little nearer snout than caudal; origin of anal under end of dorsal; ventrals not quite reaching anal, pectorals not quite to ventrals. Scales with a few divergent striæ. Pseudotympanum faintly evident on one side. Four chromatophores, tip of anterior dorsal rays dark.

27. *Megalamphodus heteresthes* (Ulrey).

Aphyocharax heteresthes Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 293 (Brazil); Eigenmann, Report Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Brazil, definite localities not known.

Head 3.33; depth 3; D. 11; A. 27-30; scales about thirty-one. Eye twice the length of the snout, 3.5 in the head.

Maxillary teeth six or seven; premaxillary with six to eight conical teeth and two to four with lateral cusps; mandible with ten conical teeth and four with lateral cusps; maxillary extending considerably beyond the anterior margin of the eye.

Origin of dorsal midway between tip of snout and base of caudal. Pectorals

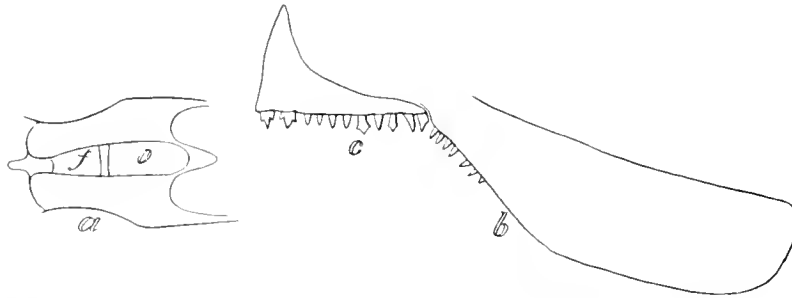


FIG. 15. *Megalamphodus heteresthes* (Ulrey), *a*, top of head, showing frontal (*f*) and occipital (*o*) fontanelles; *b*, maxillary; *c*, premaxillary.

extending beyond tips of the axillary scale; ventrals reaching anal; anal rays graduate.

No humeral or caudal spots, the upper half of the first developed rays of the dorsal black.

28. *Megalamphodus micropterus* sp. nov. (Plate VIII, fig. 1.)

6900a, C. M., **type**, 30 mm. 6901a–q, C. M., **paratypes**, seventeen, largest about 28 mm. Lagoa do Porto, Dec. 24, 1907. Haseman.

6904a, C. M., **paratype**, one, 27 mm. Rio Salitre. Haseman.

6902a–i, C. M., **paratypes**, nine, largest 30 mm. Santa Rita, Jan. 24, 1908. Haseman.

6903, C. M., **paratypes**, thirty-five, largest 32 mm. Pirapora, Dec. 14, 1907. Haseman.

6905a–d, C. M., four in bad state. Boqueirão near mouth of Rio Preto.

This species from the basin of the Rio San Francisco is similar to *eques*, from which it differs at least in the number of anal rays.

Head 3.4; depth 2.4–2.75; D. 11; A. 24–26; scales 5 to 7 + 24 to 27. Eye 2.5, much larger than the interorbital.

Similar to *M. megalopterus* in shape, the back not quite so elevated; predorsal area with nine or ten scales.

Mouth large, the maxillary not quite as long as the eye, not reaching to suture between the second and third suborbitals; premaxillary with seven to nine teeth, of which one or two may be conical, the rest tricuspid; maxillary with two to six

teeth, of which one or more may be conical; mandible with seven or eight tricuspid and five to nine conical teeth; occasionally one of the premaxillary teeth is placed a little in front of the line of the others, suggesting *Hyphessobrycon*; second sub-orbital leaving only a narrow naked wedge behind it; postorbitals very feeble. Gill-rakers 5 + 13.

Origin of dorsal equidistant from tip of snout and base of caudal; dorsal

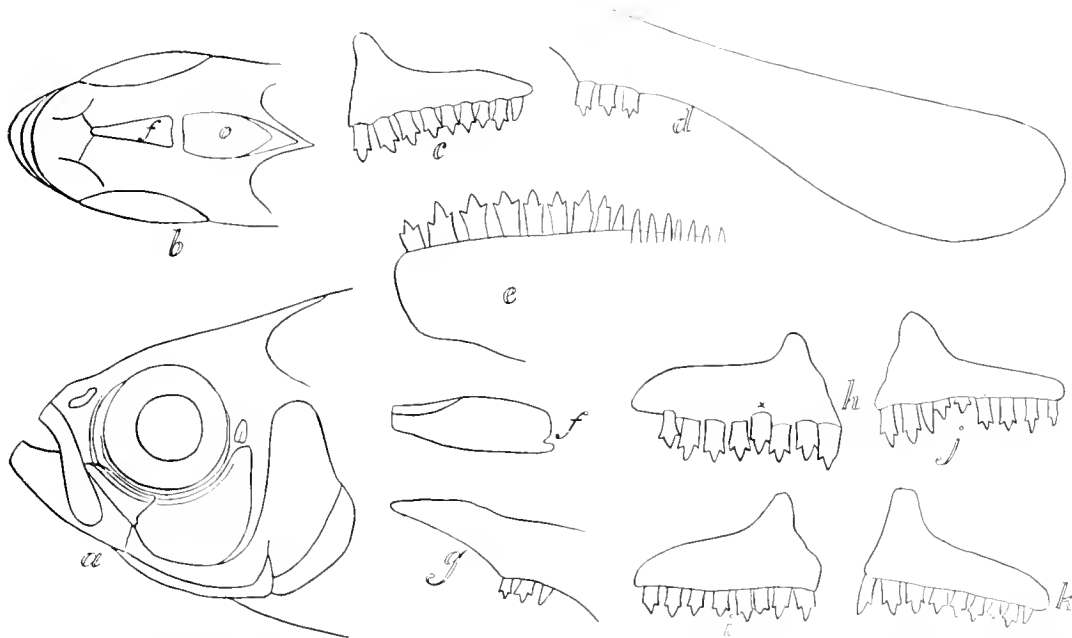


FIG. 16. *Megalumphodus micropterus* Eigenmann. *a*, side of head; *b*, top of head, showing frontal (*f*) and occipital (*o*) fontanelles; *c*, *d*, *e*, premaxillary, maxillary, and mandible of a specimen, 6903, C. M., greatly enlarged; *f*, outline of entire mandible; *g*, portion of a maxillary; *h*, *i*, *j*, *k*, premaxillaries showing the teeth. In fig. *h* there is at *x* a tooth out of line, forming an incipient second series.

pointed, its highest rays, second to fourth, not quite equal to the head in length; caudal lobes not quite equal to the length of the head; origin of anal under middle of dorsal; margin of anal truncate, the rays slightly graduate, no lobe, the highest ray equal to snout and eye; ventrals reaching nearly to, or a little beyond, origin of anal, pectorals to beyond base of ventrals; males with hooks on the third to sixteenth anal rays.

Scales thin with a few divergent radial striae; caudal and anal naked.

Sides (in males?) uniformly dusted, or (in females?) with a distinct humeral band; all but first and last three or four dorsal rays black; caudal and anal margined with black; ventrals and pectorals sometimes tipped with dark.

Genus XIV. MICROSHEMOBRYCON²⁵ gen. nov.

Type: *Microschemobrycon guaporensis* Eigenmann.

General appearance of *Aphyocharax*, the lateral line complete to within four scales of the caudal; three postorbitals, of which the middle one is largest, covering most of the postorbital area; cheeks covered by the third suborbital; maxillary slender, the teeth much crowded, and on less than one-third of its length; teeth narrow, minute, crowded; no pseudotympanum; frontal fontanel moderate; adipose fin moderate; anal base long.

29. *Microschemobrycon guaporensis*, sp. nov. (Plate VIII, fig. 2.)

6910a, C. M., type, about 37 mm. (30.5 to base of caudal). Maciél, Rio Guaporé, July 23, 1909. Haseman.

Head 4; depth 4; D. 11; A. 22; scales 4-33-3, twenty-nine or thirty scales with pores; eye 2.75 in the head, snout 3.4, interorbital 3.

About twelve preventral scales, about nine predorsal scales, occipital process reaching about one-sixth to the dorsal; frontal fontanel not quite 2 in the parietal, its anterior end a little in front of the middle of the eye; mouth large, maxillary-premaxillary border 2.75 in the head; maxillary not nearly reaching third suborbital; teeth all minute, those on the mandible conical, with a minute lateral notch, those on the premaxillary broader; twelve teeth on the premaxillary, twelve on the maxillary on less than one-third its length; twenty-five or more on the mandible. Postorbitals in three pieces, the upper and lower ones minute, the middle one high, less strongly developed than in *Aphyocharax*.

Gill-rakers 6 + 11, long, 2.5 in the eye.

Origin of dorsal a little nearer snout than base of caudal; origin of anal under end of dorsal; ventrals almost reaching anal, pectorals not quite to anal.

Scales well imbricate, firm, without radial striæ; caudal and anal naked.

A series of dots from between the ventrals to the base of the anal and along the root of the anal; some chromatophores on the bases of the caudal rays.

Genus XV. OLIGOBRYCON²⁶ gen. nov.

Type: *Oligobrycon microstomus* Eigenmann.

Teeth heavy, tricuspid, in a single series, very few in number (four on the premaxillary); the maxillary not reaching anterior margin of orbit; the eight teeth of the two premaxillaries in a very shallow crescent, maxillary with one to two teeth;

²⁵ μικροσχημος = small of stature.

²⁶ ὀλιγος = small; *Brycon*, a genus of fishes.

cheeks with a very narrow naked margin; three postorbitals; lateral line incomplete; scales with few divergent radial striæ; caudal naked; adipose well-developed, Interhæmals not evident; no pseudotympanum.

This genus differs from *Aphyocharax* and from *Mixobrycon ribeiroi* in dentition, the size of the mouth, the armature of the cheeks, etc.

30. *Oligobrycon microstomus* sp. nov. (Plate IX, fig. 1.)

6898a, C. M., type, 39 mm.; 6899a, C. M., paratype, 27 mm. Jacarehy, Rio Parahyba, July 15, 1908. Haseman.

Very similar in shape, size of mouth, and general appearance to *Cheirodon interruptus*.

Head 3.5; depth 2.3–2.6; D. 11; A. 24 or 25; scales 7 or 8 + 25, twelve scales

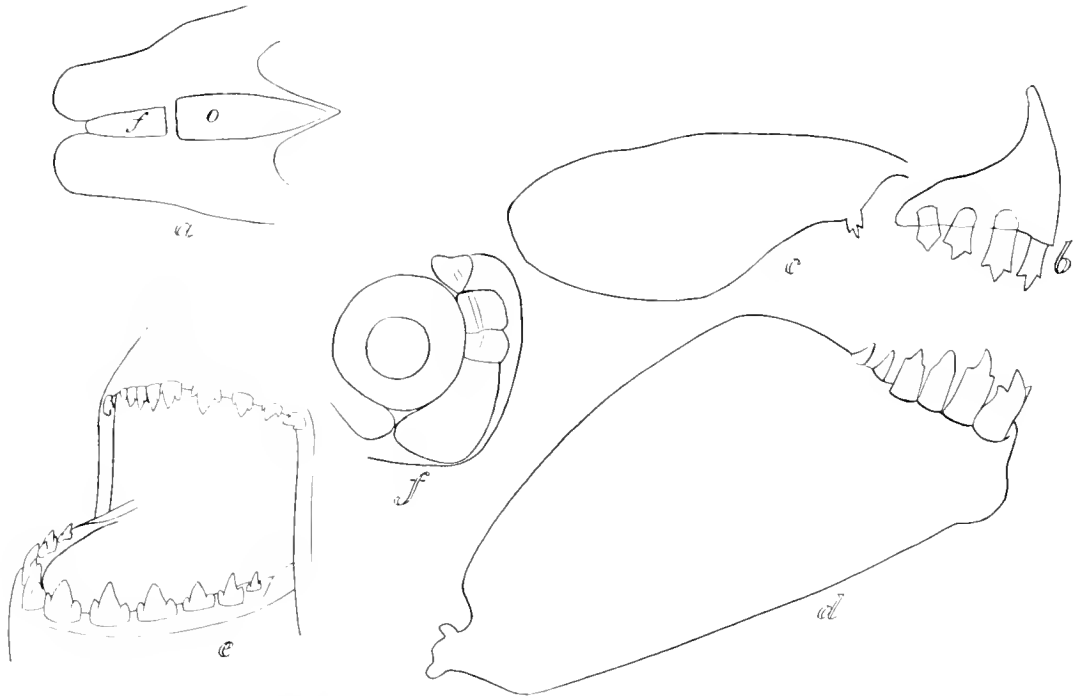


FIG. 17. *Oligobrycon microstomus* Eigenmann. 6699, C. M. a, outline of top of head; b, c, d, premaxillary, maxillary, and mandible enlarged; e, dentition of specimen 6898, C. M.; f, suborbitals and postorbitals of 6699, C.M.

between dorsal and ventrals; eye three times in the head, a little less than interorbital; caudal peduncle as deep as long; base of anal a little longer than head.

Very deep and compressed; dorsal and ventral profiles nearly equally arched; preventral area rounded, without a definite median series of scales; predorsal area with a blunt keel; about eight scales in a median series from the dorsal forward

and three overlapping rows of scales between these and the occipital process; occipital process extending about one-fifth to dorsal, bordered by three scales; frontal fontanel long, pointed, about one-half as long as the parietal with its groove; interorbital nearly flat, very broad; snout blunt, face of maxillary nearly vertical; margin of second suborbital convex, leaving a narrow naked margin of nearly equal width around its entire margin; postorbitals strong, leaving a narrow naked margin; mouth minute; maxillary very broad and short, not reaching to below eye, a little more than half as long as eye; maxillary-premaxillary border about three-fourths as long as eye. Maxillary with one or two minute teeth; premaxillary with four graduate teeth; mandible with six graduate teeth. Gill-rakers 5 + 8, short.

Origin of dorsal equidistant from tip of snout and base of caudal or a little nearer the latter, its height equal to length of head to upper angle of gill-opening; origin of anal under middle or behind middle of dorsal; ventrals just reaching anal; pectorals reaching to ventrals.

Scales very regularly imbricate, those of the belly with many sub-parallel radial striæ, those of the sides with divergent striæ.

A vertical humeral bar crossing the third and fourth scales of the lateral line; an oval spot on the end of the caudal peduncle; region between nape, dorsal, and anal nearly evenly peppered; region forward of a line joining base of ventrals and the humeral spot silvery.

Genus XV. *APHYOCHEIRODON*²⁷ gen. nov.

Type: *Aphyocheiroduon hemigrammus* Eigenmann.

Teeth notched, in a single series, those in the maxillary and premaxillary narrow, with nearly parallel edges, and with three or five cusps, the median one prominent, the lateral ones small; premaxillary teeth about eight to ten in number; maxillary teeth four or five on the upper fourth of the edge of the maxillary. Mandibular teeth much expanded at tip, the margins of neighboring teeth in contact, the tip chisel-shaped, divided into three lobes of equal size, a minute cusp on each side. Mouth large; cheeks partly naked; frontal fontanel very short; adipose fin well developed; caudal naked; lateral line incomplete; scales with a few diverging radial striæ; no pseudotympanum.

It is very probable that there is but little difference between the sexes, the caudal fulera being normal. Only one species is thus far known.

²⁷ ἀφύνη = a small fish; *Cheiroduon*, a genus of this subfamily of fishes.

31. *Aphyocheirodon hemigrammus* sp. nov. (Plate IX, fig. 2.)6802, C. M., **type**, 45 mm. 6803, C. M., **paratypes**, twenty-six, largest 48 mm.

Jaquara, Aug. 18, 1908. Haseman.

6804a-d, C. M., **paratypes**, four; largest 45 mm., Mogy Guassú, Aug. 25, 1908.
Haseman.6805a, C. M., **paratype**, one, 39 mm. Riberão Azul, 12 miles from Tieté, Oct. 7,
1908. Haseman.**Range:** Tieté basin, Jaquara.Head 4; depth about 3; D. 11 rarely 10; A. 23-25 (27 in one); scales usually
34, more rarely 36 or 37; eye 2.5-3 in the head, about equal to the interorbital.

FIG. 18. *Aphyocheirodon hemigrammus* Eigenmann. *a*, outline of head; *b*, *c*, variations in the post-orbitals; *d*, top of head, to show form and location of the fontanels; *e*, premaxillary; *f*, maxillary; *g*, mandible, showing relay teeth at *r* and *p*; *h*, outline of entire mandible, showing teeth-bearing portion at *x*. (All figures much enlarged.)

Compressed, elongate, dorsal and ventral profiles nearly equally arched; pre-ventral area rounded; sometimes a nearly regular median series of twelve scales, sometimes the scales irregular; postventral area rounded; predorsal area rounded, with a median series of about twelve scales; occipital process bordered by two or three scales reaching one-seventh to the dorsal; skull convex above; frontal fontanel very small, the frontals sometimes mesially in contact with the bridge;

parietal fontanel very large; mouth large, the maxillary equal to the eye, not quite reaching the suture between the second and third suborbitals. Third suborbital leaving a naked area around its entire convex free margin; a naked area about half as wide as the postorbital behind the postorbitals. The postorbitals in two or three parts, very variable. Gill-rakers 4 + 10, longest about half the length of the eye.

Premaxillary teeth eight to ten, of nearly uniform size, their margins subparallel, the median cusp more prominent than the lateral; maxillary teeth similar, but smaller than the premaxillary teeth, and with three cusps. Mandibular teeth graduated on the side of the jaw, the anterior six or seven of about equal size, their tips broad, the bases narrowed, the three median points alike, forming a continuous cutting edge, the expanded tips of the teeth being in contact, a minute cusp on each side.

Origin of dorsal equidistant from tip of snout and end of middle series of scales, the dorsal pointed, its height about equal to the length of the head; adipose fin well developed; caudal lobes about equal to length of the head; origin of anal below middle or posterior part of dorsal, its margin distinctly emarginate, the height of the lobe less than the length of the head; ventrals reaching anal; pectorals reaching ventrals.

Scales with a varying number of radiating striæ, everywhere regularly imbricate; caudal naked; no distinct row of scales along the base of the anal; axillary scale very small; eight to ten scales with pores; ten scales between dorsal and ventrals.

A conspicuous black spot occupies the entire width of the caudal peduncle and half the length of the middle caudal rays. A median dusky line associated with a narrow silvery line on posterior half of body. No other markings.

Male scarcely distinguishable from the female, lower caudal fulera not modified.

Genus XVI. *COMPSURA*²³ gen. nov.

Type: *Compsura heterura* Eigenmann.

Closely allied to *Cheirodon*, but differing much in the structure of the male.

Teeth few; multicuspid incisors in a single series; mouth minute; second suborbital in contact with the preopercle below and partly behind; postorbital leaving a naked area behind about half as wide as the bone; adipose fin well-developed; caudal fulera in both sexes covered by scales; a lobe of large scales in the male extending along the base of the middle caudal rays; lateral line incomplete; scales

²³ κομψός = well dressed; ὄυρά = tail.

with a few diverging striæ. All but the three or four last of the divided anal rays of the male with hooks.

32. *Compsura heterura* sp. nov. (Plate X, fig. 1.)

6808, C. M., type ♂, 36 mm. 6809a-k, C. M., paratypes, five males and eight females, largest 37 mm. Queimadas, Rio Itapicuru, March 2, 1908. Haseman.

6810a, C. M., ♂, 31 mm. Barreiras, Lagoa of Rio Grande of Rio San Francisco, Jan. 3 and 4, 1907. Haseman.

6811a-c, C. M., ♂, 32 mm. Santa Rita, Jan. 24, 1908. Haseman.

Range: Rio San Francisco and Rio Itapicuru.

This species with the general appearance of a *Cheirodon* can readily be dis-

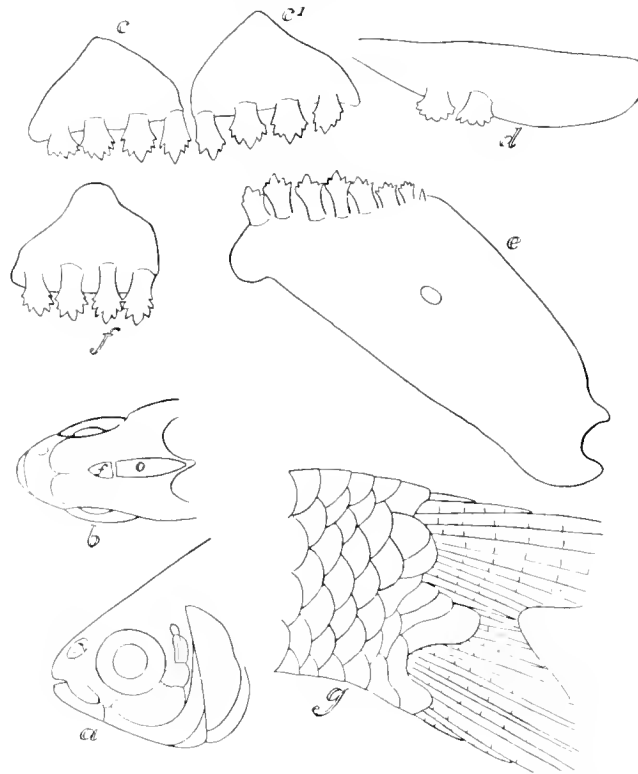


FIG. 19. *Compsura heterura* Eigenmann. a, outline of side of head; b, top of head, showing frontal (f) and parietal, or occipital (o) fontanels; c, c', right and left premaxillaries; d, maxillary; e, mandible of an individual, 6809, C. M., greatly enlarged; f, premaxillary of another individual; g, scaling of the tail of a male, 6808, C. M. (All figures greatly enlarged.)

tinguished by the black upper half of the first dorsal membrane together with the black tip of the dorsal.

Head 4–4.25; depth 2.5–2.75; D. 10 or 11; A. most frequently 19, ranging from 17–20; scales 34–35, rarely 32, eight or nine scales with pores, ten scales between dorsal and ventral; eye 2.6–3 in head, about equal to the interorbital; depth of caudal peduncle about equal to its length.

Compressed, dorsal and ventral outlines evenly and equally curved. Pre-ventral area rounded with a median series of eleven scales; predorsal area rounded with a median series of nine scales, extending to within two scales of the occipital process; occipital process broad and short, reaching about one-seventh to the dorsal, bordered by two and one-half scales on each side; skull convex, frontal fontanel only about one-fourth as long as the parietal; mouth very short and small, maxillary very little, if any, more than half as long as the eye; teeth broad-tipped, five- or seven-pointed, median point largest, projecting; four teeth on the premaxillary, two on the maxillary, eight or nine on the mandible, those on the side of the mandible graduate, the last one may be minute and single pointed, all the rest of the teeth similar in size and shape; third suborbital strong, in contact with the preopercle below and partly behind; postorbitals thin, ill defined, leaving a considerable naked area. Gill-rakers 4 + 8, very short, only about one-fifth as long as eye.

Origin of dorsal a little nearer tip of snout than base of caudal, the fin pointed, the highest ray about equal to the head; adipose fin small; caudal forked, the lobes about equal to the length of the head; origin of anal behind the vertical from the last dorsal ray; anal fin but slightly emarginate, its base little shorter than the head; all but the last three or four of the divided anal rays of the male with seven or eight strong recurved hooks. Pectorals of the male reaching the ventrals; ventrals of the male truncate, reaching the anal, ventrals of the female pointed, not reaching the anal; the pectorals in the female not reaching the ventrals.

Scales thin, regularly imbricate, very few diverging striæ; anal with about three scales forming a sheath at the base of the anal; base of caudal in the male sealed, the scales covering the caudal fulcra and forming a lobe along the middle of the fin.

Tip of dorsal and upper part of membrane between the rudimentary and first full ray black; tip of anal in the male black; a conspicuous triangular caudal spot not quite extending to the end of the middle rays; a black band extending forward to below the dorsal.

Genus XVIII. MIXOBRYCON²⁹ gen. nov.

Type: *Mixobrycon ribeiroi* (Eigenmann).

Closely resembling *Hyphessobrycon*; teeth heavy, few, in a single series; third

²⁹ *μῖξις* = a mixing; *Brycon*, a genus of Characins. Name chosen because the teeth show some of the characters of *Hyphessobrycon*.

suborbital with a wide naked area around its entire border. Postorbital covering nearly the entire postorbital space. Mouth moderate, the maxillary not reaching to the end of the second suborbital; adipose fin well developed; caudal naked; lateral line short; frontal fontanel large, entirely separating the frontals; no pseudotympanum; no prominent interhæmals.

33. *Mixobrycon ribeiroi* (Eigenmann). (Plate X, fig. 2.)

Cheirodon ribeiroi Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 9; Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429. 10229, I. U. M., one, **type**, 35 mm. to base of caudal. Puerto Max, Paraguay, J. D. Anisits.

This species is known only from the type.

Head 3.4; depth 3; D. 11; A. 26; scales 5-33-4, seven scales with pores. Eye 2.5 in the head, greater than interorbital.

Compressed, elongate; preventral area rounded; predorsal area rounded, with a median series of eleven scales; occipital process elongate, pointed, reaching one-

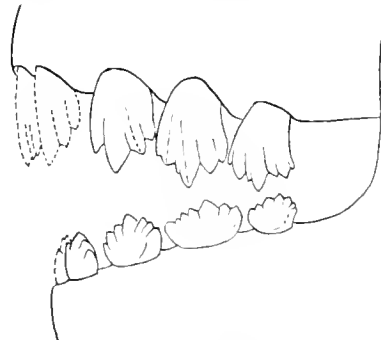


FIG. 20. Dentition of *Mixobrycon ribeiroi* Eigenmann.

fifth to dorsal, bordered by three scales on each side; frontal fontanel long, pointed, 1.5 in the parietal; maxillary long, slender, nearly three-fourths as long as eye; premaxillary with four large, heavy teeth; the second tooth largest, with seven points, the middle point of which is the largest, the base of the tooth much narrower than the tip; the second to fourth teeth graduate; no teeth on the maxillary; mandible with four, heavy, five-pointed, graduate teeth; teeth of side of jaw lost or absent; second suborbital with a wide naked area around its entire margin. Gill-rakers 7 + 11, the longest about one-third as long as eye.

Origin of dorsal very nearly equidistant from tip of snout and caudal; origin of anal under back part of dorsal; only one interhæmal (or none?) on the caudal peduncle; pectorals reaching ventrals, the latter not to anal; adipose fin well-developed.

A large humeral spot over third to fifth scales of lateral line; a dark line from upper part of humeral spot to middle of caudal; caudal spot extending across the entire caudal peduncle, and on middle caudal rays.

Named in honor of Dr. Alipio de Miranda Ribeiro of Rio de Janeiro.

Genus XIX. CHEIRODON³⁰ Girard.

Cheirodon Girard, Proc. Acad. Nat. Sci. Phila., Vol. VII, 1854, p. 199.

Type: *Cheirodon pisciculus* Girard.

Minute fishes ranging from 25 to 60 mm. in length; teeth of the upper and lower jaws similar, with five or more points; usually the tips of the teeth are expanded, more rarely the margins of the teeth are nearly parallel, arranged in a single series; one to three teeth on the maxillary, four to nine teeth on the premaxillary (most frequently five); cheeks usually nearly completely covered by the third suborbital, but with a naked area around its entire border in *C. annæ*; the origin of the dorsal very nearly equidistant from tip of snout and base of middle caudal rays; adipose fin well-developed; origin of anal about under the last dorsal ray; a variable number of the anal rays and sometimes the ventral rays in the males with numerous hooks, the base of the hook-bearing portion of the anal not infrequently at an angle with the base of the normal portion; interhæmal spines of the caudal peduncle variable, those of the male strong, protruding, sometimes ankylosed and sometimes with broad wing-like lateral processes. Scales thin, regularly imbricate, with a variable number of radial striae. Caudal naked, anal with a few scales in a single series at the base of the anterior rays; scales moderate, between thirty to thirty-six in the lateral series, of which not more than twelve have pores. No humeral spot, the covering of the anterior air-bladder very thin, in a triangular pseudotympanum; usually a conspicuous caudal spot, more rarely a dorsal spot.

Range: Amazons, Panama, eastern slope of Colombia, south to the Rio San Francisco, Rio Parahyba, Rio Grande do Sul, and the La Plata basin; western slope of Chili.

No specimens of *Cheirodon pisciculus* are at hand. It is possible that the specimens of *Cheirodon annæ*, listed below, the origin of which is unknown, are in reality the types of *Cheirodon pisciculus*. If so, then the species listed after *C. annæ* are representatives of a genus distinct from *Cheirodon*. If, however, *Cheirodon pisciculus* is distinct from *C. annæ* and agrees with the species which here succeed it, then *C. annæ* should be made the type of a distinct genus. *C. annæ* certainly is not congeneric with the other species of *Cheirodon* here figured. *C. microdon* and

³⁰ χείρ, ἤ = hand; ὀδών, ὄ = tooth.

C. stenodon are also quite distinct from the rest of the species. This is the only genus of Characins reaching the Pacific slope of Chili, where at Puerto Montt it also attains the southernmost latitude recorded for the Characins.

KEY TO THE SPECIES OF CHEIRODON.

- a.* A naked area about the entire distal margin of the third suborbital, very wide behind it; elongate, depth 3 or more in the length; mouth moderate; teeth broad-tipped with narrow bases; anal short, 12-15, the tip of the first developed ray extending beyond the tip of the last; caudal peduncle slender, about twice as long as deep. (Not examined in *C. pisciculus*.)
- b.* Maxillary with two teeth.....31. **pisciculus** Girard.
- bb.* Maxillary with one tooth.....35. **annæ** McAtee.
- aa.* Second suborbital in contact with the preopercle at least below; anal emarginate 17-27.
- e.* Mouth minute or moderate; teeth broad-tipped.
- d.* Fifteen to twenty interhæmals,³¹ extending from near base of last anal ray to caudal, with broad, wing-like lateral processes in the male; a naked area along the entire posterior edge of the third suborbital.
- e.* Three, more rarely two, maxillary teeth; maxillary very little more than half the length of the eye, its margin straight; premaxillary with five teeth; A. 18-19; eighteen to twenty-three interhæmals from near base or behind tip of last anal to caudal; base of anal equals length of caudal peduncle; largest about 25 mm.....36. **insignis** Steindachner.
- ee.* Two maxillary teeth; maxillary about half the length of the eye, its margin but little curved; premaxillary with four teeth; A. 19-24; fifteen to twenty interhæmals, extending from near base of last anal ray to caudal; base of anal much longer than caudal peduncle. Length of largest recorded specimen 39 mm.....37. **parahybæ** Eigenmann.
- eee.* One maxillary tooth; maxillary about half the length of the eye, its margin strongly convex; premaxillary with four or five teeth; A. 17-24; twenty or more interhæmals; extending from near base of last anal ray to caudal. Largest recorded specimen, 60 mm.
38. **interruptus** Jenyns.
39. **monodon** Cope.
40. **ibicuhiensis** Eigenmann.
- dd.* Eight to thirteen interhæmals extending from near tip of last anal ray to caudal; base of anal equals caudal peduncle and middle caudal rays; maxillary scarcely reaching eye; cheeks with a naked wedge behind the second suborbital.
- f.* Dorsal with black spot along the base of the anterior rays; A. 20-22; scales 32-34; premaxillary with four teeth, maxillary with two; a spot across the entire caudal peduncle.
41. **notonielas** Eigenmann.
- ff.* Dorsal without a distinct black spot.
- g.* No caudal spot or other definite markings; premaxillary with five teeth; maxillary with two; about nine weak interhæmals. A. 23; scales 36.....42. **madeiræ** Eigenmann.
- gg.* A large conspicuous caudal spot sometimes continued to the end of the middle rays.
- h.* Anal plain; scales 31-36; premaxillary with four or five teeth, maxillary usually with two; nine to thirteen interhæmals, occupying half the distance between the anal and caudal; A. 19-27.....43. **piaba** Lütken.
- ce.* Mouth moderate; teeth in premaxillary narrow, five to nine in number; maxillary teeth two-thirds to

³¹ See also *insignis*, in which there may be only eight.

three-fourths as long as eye; dorsal with some black; depth 2.8-3; interhæmals of caudal peduncle feeble; third suborbital leaving only a naked wedge behind it.

- i. Three median points of teeth of mandible equal in size; seven to nine teeth in premaxillary; depth 2.8; A. 23-35; maxillary three-fourths as long as eye; seven to nine teeth in premaxillary, two in maxillary. Scales 34-36.44. **microdon** Eigenmann.
- ii. Teeth of lower jaw similar to those of upper, but a little wider, one large median point and two small points on each side; five to seven teeth in premaxillary, two teeth in maxillary; depth 3; A. 18-22; maxillary two-thirds in eye; scales thirty-six or thirty-seven. . . .45. **stenodon** Eigenmann.

34. **Cheirodon pisciculus** Girard. (Plate XVII, fig. 4.)

Cheirodon pisciculus Girard, Proc. Acad. Nat. Sci. Phila., 1854, p. 199; U. S. Nav. Astronom. Exped., Fishes, 1855, p. 249, pl. 34, figs. 4 and 7 (Santiago, Chili); Eigenmann and Eigenmann, U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Chirodon pisciculus Günther, Cat. Fish. Brit. Mus., Vol. V, 1864, p. 332; Steindachner, Zoöl. Jahrbuch., Suppl. IV, 1898, p. 328 (Llanquihue, near Puerto Montt, Chili).

Range: Southern Chili.

I have seen no specimens of this species. The following is an abridgment of Girard's description:

Head 4; depth 3-4; D. 10; A. 14. Eye 3 in the length of the head; depth of caudal peduncle 2.5 in the greatest depth.

Snout short and rounded; eye rather large. Maxillary teeth very small and few. Dorsal fin higher than long. Caudal forked. Anal nearly as deep as long. Ventrals and pectorals slender. Scales proportionately very large, higher than long. A silvery band along the middle of the flanks, margined above with black. Fins unicolor, olivaceous.

A small fish of a rather short appearance, in spite of the slenderness of the peduncle of the tail. Dorsal and ventral lines equally arched. Body very much compressed; mouth small and slightly oblique; maxillary extending to a vertical line immediately in advance of the anterior rim of eye when the mouth is closed. Dentary teeth much larger than those on the intermaxillaries. Their form is flattened, dilated towards their upper edges, which are provided generally with five subconical points, the middle one being the longest, giving them the appearance of digits.

Origin of dorsal nearer base of caudal than tip of snout; dorsal much higher than long, its upper edge rounded or subconvex. The adipose is slender, nearer to the base of the caudal than to the posterior edge of the dorsal and consequently

situated behind the anal. The anal longer than the dorsal, and nearly as long as deep; its exterior edge convex anteriorly, and subconvex posteriorly. Its anterior margin is situated backwards of the posterior edge of the dorsal.

The caudal fin, which constitutes about one-fifth of the total length, is deeply forked posteriorly; its lobes are rather round and only acute at their extremities. The insertion of the ventrals is on the middle of the abdomen, somewhat in advance of the anterior margin of the dorsal. These fins are rather slender, with their tips acute and reaching the vent. The origin of the pectorals is situated near the inferior region of the thoracic belt. These fins are longer and slenderer than the ventrals, their tips almost reaching the origin of the latter fins. Their anterior ray is simple; the central rays are but once bifurcated, and only towards the last third of their length.

The scales are of moderate development, higher than long, subelliptical in shape, sometimes very irregularly so. Ten or eleven longitudinal rows on the line of the greatest depth, and six or seven rows on the peduncle of the tail. The lateral line is not to be seen.

Olivaceous brown; a silver band along the middle of the flanks, extending from the upper angle of the opercular apparatus to the base of the caudal fin. The cheeks, the opercles, and branchiostegal apparatus are silvery. A blackish stripe along the upper edge of the silvery band of the sides. The dorsal region is minutely dotted with blackish, the dots being more particularly crowded upon the outline of the scales. These dots extend to the upper surface of the head, and sparingly to the upper region of the thoracic and abdominal regions; also to the inferior half of the peduncle of the tail. The dorsal, caudal, and anal fins are almost greyish through the accumulation of the above-mentioned dots. The ventrals are unicolor; the pectorals greyish upon their external margin. The abdominal region sometimes exhibits an argentine reflection.

Inhabits the lagoons in the vicinity of Santiago, Chile.

35. *Cheirodon annæ* McAtce. (Plate XI, fig. 1.)

Cheirodon annæ McAtce, Proc. Acad. Nat. Sci. Phila., 1903, p. 515 (South America);

Eigenmann, Reports Princeton Univ. Patagonia, Vol. III, 1910, p. 429.

Habitat: Some unknown locality in South America.

The specimens of this species were received as an exchange from the U. S. National Museum. Their origin is in doubt. It is possible that they are the types of *C. pisciculus*.

4301, I. U. M. 927a-b, C. M. **Type and paratypes**, fifteen. Length of type, 43 mm. South America.

The specimens are soft and have lost their scales. The characters are otherwise well-preserved. If these specimens came from Chile, there is no doubt that they represent *C. pisciculus*, with which they agree in their extremely short anal and their elongate form.

Head 4.2; depth 3.6-4.2; D. 9-12; A. 12-15; scales 32-36, eleven scales between ventrals and dorsal, seven to nine scales with pores; eye 2.8-3.2; depth of caudal peduncle about 2 in its length.

Elongate, little compressed; predorsal and preventral areas rounded, with about (?) fifteen scales; occipital process short, reaching one-eighth to the dorsal;

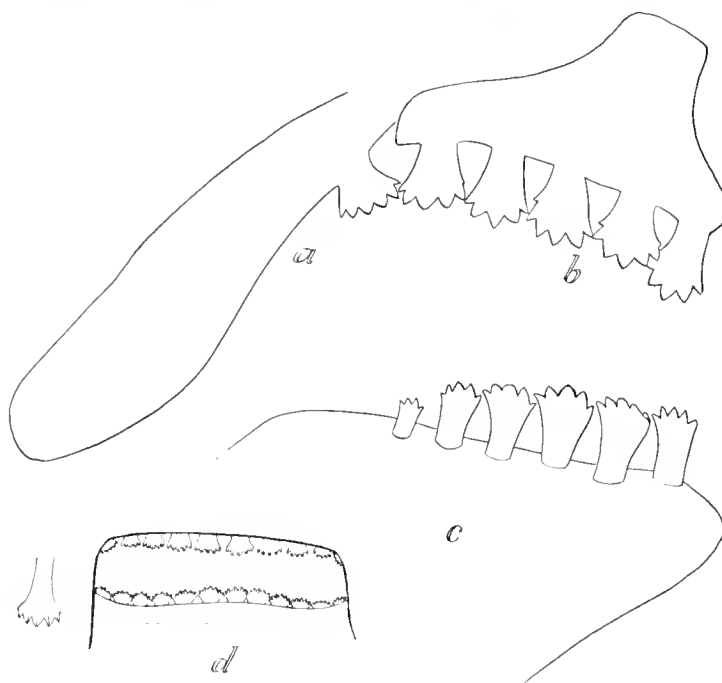


FIG. 21. *Cheirodon annae* McAtee, *a*, maxillary; *b*, premaxillary; *c*, portion of mandible; *d*, dentition seen from in front. 4307, C. M.

frontal fontanel half as long as the parietal; third suborbital very small, leaving a naked area, which is much the widest behind, about its entire distal margin; postorbitals minute, not covering more than one-fourth of the width of the cheek behind the eye; snout blunt, mouth small, maxillary a little over half as long as eye; teeth five- to seven-pointed, the middle point a little prominent, the bases of the teeth much contracted; four or five teeth in the premaxillary, one tooth (absent in two) on the maxillary, mandible with five or six graduated teeth. Gill-rakers $S + 12$, short, about one-third as long as eye.

Origin of dorsal a little nearer caudal than tip of snout, its height a little less than the length of head; adipose fin well-developed; caudal lobes about as long as head; base of anal about equal to snout and eye, considerably less than the length of the caudal peduncle; origin of anal below, or a little behind, the base of the last dorsal rays, first developed ray of the anal extending beyond the tip of the

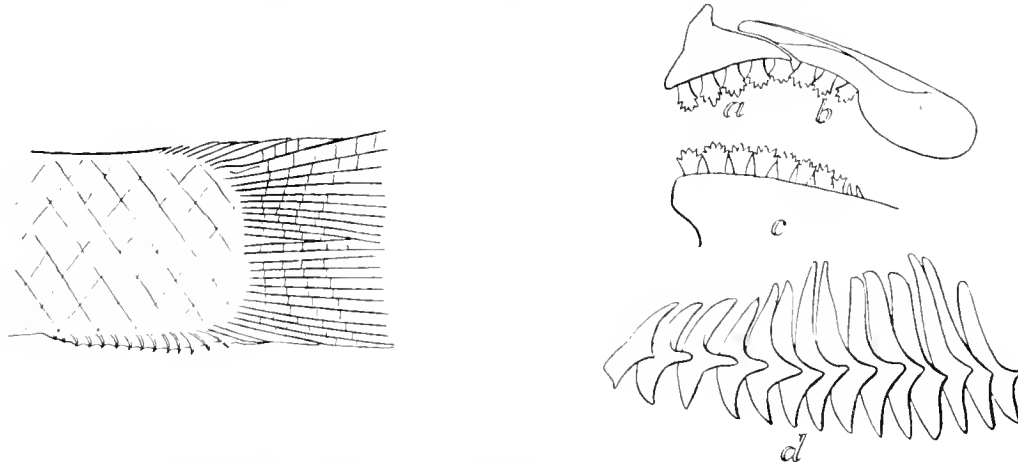


FIG. 22. *Cheirodon annæ* McAtee. Interhæmal spines of ♂.

FIG. 23. *Cheirodon annæ* McAtee. *a*, premaxillary; *b*, maxillary; *c*, portion of mandible; *d*, portion of the interhæmals of ♂.

last ray; ventrals extending to, or a little short of, origin of anal, pectorals to, or a little short of, ventrals.

Thirteen interhæmals on the caudal peduncle of the female, extending four-tenths to base of last anal ray. The spines very strong, with broad lateral processes in the male, extending a little further toward the anal. Scales mostly removed. A distinctly silvery lateral band.

36. *Cheirodon insignis* Steindachner. (Plate XVII, fig. 2.)

Cheirodon insignis Steindachner, Fisch-Fauna Cauca & Flüsse bei Guayaquil, 1880, p. 22, pl. VI, fig. 3 (Cauca); Eigenmann and Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429; Evermann & Goldsborough, Proc. Biol. Soc. Washington, Vol. XXII, p. 98 (Tabernilla, Atlantic slope of Panama Canal Zone).

Cheirodon gorgonæ Evermann & Goldsborough, *l. c.* p. 99. Below the dam at Gorgona, Canal Zone.³²

³² This species is said to differ from *insignis* "in the larger eye, the fewer anal rays and the slightly shorter dorsal rays" as well as in the teeth. The differences found may be tabulated as shown at foot of p. 70:

Range: Magdalena and Atrato basin, Atlantic slope of Panama.

5367, C. M., 13042, I. U. M., many, largest about 25 mm. Truando. Wilson.

726, University of Michigan Museum, two, largest about 28 mm. Marsh at Fundación, Colombia.

Head 4; depth 2.5-3; D. 10 or 11; A. 17-20; scales 28-32, of which about six have pores; eye 3 in head, about equal to interorbital.

Compressed, breast slightly flattened, with a median series of nine or ten scales; predorsal area with about nine scales; occipital process short, reaching about one-sixth to the dorsal; frontal fontanel an equilateral triangle less than one-half as long as the parietal fontanel without the groove; maxillary reaching to below anterior margin of eye; third suborbital covering the entire cheek; premaxillary with five teeth; maxillary with two or three teeth.

Dorsal falcate, sometimes reaching to adipose, its origin in middle of body; anal emarginate, its lobe in the male reaching tip of last ray, not quite tip of last ray in female; ventrals reaching beyond origin of anal in male, the pectorals to the middle third of the ventrals; both fins shorter in the female.

Scales regularly imbricate, largest just above pectorals and ventrals; caudal naked; anal with a single series of scales along its base; ten scales between dorsal and ventrals.

Interhæmals extending from near base or tip of last anal ray to caudal, eight to twenty-three in number, those of the males antrorse and with lateral wings, those of the female slender, their tips not exposed, pointing downward and backward.

A conspicuous caudal spot, surrounded by an unpigmented area; back and sides nearly uniformly punctate; margin of anal and dorsal dark.

37. *Cheirodon parahybæ* sp. nov. (Plate XI, fig. 2.)

6841a, C. M., **type**, 38 mm. 6841b-f, C. M., **paratypes**, six, largest 39 mm.

Campos, June 14, 1908. Haseman.

Head 3.75-4; depth 2.5-2.7; D. usually 11, rarely 10; A. 19-24; scales 34-36, eight or nine with pores; eye 2.5 in the head.

Compressed, preventral area and predorsal areas rounded, the somewhat

	<i>C. insignis</i>	<i>C. gorgone</i>
Head.....	3.6-3.8	3.5-3.8
Depth.....	2.8-3	3-3.2
Eye in the head.....	2.5-2.6	2.2-2.45
Longest dorsal ray in head.....	.8	1
Anal.....	21-22	17-19
Longest anal ray in head.....	1.4-1.8	1.4-1.6

irregular median series consisting of about eleven scales; occipital process short, extending one-seventh to dorsal, bordered by three scales on each side; frontal fontanel half as long as the parietal; second suborbital in contact with the preopercle below, a broad naked area along its entire posterior margin; postorbitals feeble, not covering more than half the width of the postorbital area; maxillary little, if any, more than half as long as eye, slender, its margin not curved; teeth small, slender, contracted at the base, with five points, the middle one being largest; four teeth in the premaxillary, two in the maxillary, seven or eight graduated teeth on the mandible. Gill-rakers about 7 + 10, very short, not quite one-fourth as long as eye.

Origin of dorsal a little nearer tip of snout than base of middle caudal rays or the reverse. Dorsal pointed, its height equal to the length of the head, or a little longer; adipose fin well-developed; caudal lobes much longer than head; origin of anal below the posterior part of the dorsal or behind the vertical from the last ray; fifteen to twenty interhæmal spines, extending from near base of last anal ray to caudal, with broad wings in the male; ventrals about reaching anal, pectorals a little beyond origin of ventrals. Scales thin, regularly imbricate, with few radial striæ; caudal naked, anal with a few scales on the bases of the anterior rays.

A large spot extending across the entire caudal peduncle, not extending on the middle caudal rays.

This species is very similar to *C. piaba* and *C. interruptus*, differing in the size of the naked area of the cheek, the number of interhæmal spines, the length of the maxillary, and the number of maxillary teeth.

38. *Cheirodon interruptus* (Jenyns). (Plate XII, fig. 1.)

Tetragonopterus interruptus Jenyns, Voy. Beagle: Fishes, 1842, p. 127, tab. 23, fig. 4 (Maldonado).

Chirodon interruptus Günther, Cat. Fishes Brit. Mus., Vol. V, 1864, p. 332; Perugia, Ann. Mus. Civ. Storia Nat. Genova, (2), Vol. X, p. 45, 1891 (Rio Plata).

Cheirodon interruptus Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; ? Boulenger, Boll. Mus. Univ. Torino, Vol. XII, 1897 (Tala); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Cheirodon monodon Cope, Proc. Am. Philos. Soc., Vol. XXXIII, 1894, p. 91 (Rio Grande do Sul); Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 332 (Rio Grande do Sul); Eigenmann & Ogle, Proc. U. S. Nat. Mus., Vol. XXXIII, p. 9 (Rio Grande do Sul).

Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.
 Range: Maldonado to Rio Grande do Sul.

The types of *interruptus* came from Maldonado and the specimens collected by Carey at the same place (No. 20698, M. C. Z.) are more than probably *interruptus*. These specimens are specifically distinct from the Paraguayan specimens, heretofore referred to *C. interruptus*. A careful comparison with the excellent fresh specimens from the Paraguay river and others from various places in the San Francisco basin, collected by Haseman, shows that they are so similar, that the Paraguayan form hitherto referred to *interruptus* must be referred to *C. piaba*.

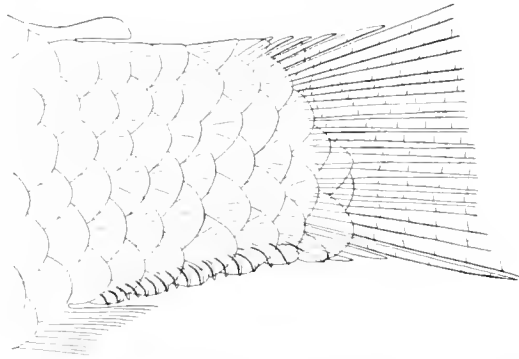


FIG. 24. Interhemals in *Cheirodon interruptus* Jenyns. 6818, C. M.

Specimens from Rio Grande do Sul, the type locality of *C. monodon*, are very similar to *C. interruptus*, and *monodon* may be considered a variety of *interruptus*.

6815a-k, C. M., two males, eleven females, largest 45 mm. Rio Guahyba, Porto Alegre, Rio Grande do Sul. Jan. 21, 1909. Haseman.

6817a-d, C. M., fourteen, largest 40 mm. Santa Maria, Rio Vaccaeahy-Mirim, secondary tributary of the Rio Jacuhy, Rio Grande do Sul. Haseman.

6818a-x, C. M., three males, largest 43 mm., twenty-six females, largest 49 mm. Cachoeira, Rio Jacuhy, Rio Grande do Sul. Jan. 26, 1909. Haseman.

6852a, C. M., one female, 47 mm. Cacequy. Haseman.

846 & 847, M. C. Z., twelve, poor, largest a male about 35 mm. long. Uruguay river. Wyman.

20698, M. C. Z., forty, largest about 60 mm. and 20699, M. C. Z., one, 46 mm. Maldonado. T. G. Carey.

6816a-j, C. M., one male, 42 mm., nine females, largest 52 mm. Cacequy, Rio Ibicuhy, into Rio Uruguay. Jan. 31 & Feb. 1, 1909. Haseman.

This species can readily be distinguished by the naked area behind the third suborbital and by the numerous interhemals. They extend from the anal to the

caudal and number seventeen to twenty-seven, all or only half of which may protrude in the male. The maxillary has but one tooth.

Head 4.5–4.66; depth 2.4–3; D. 11, very rarely 12; A. 17–24; scales $\frac{32}{3}$, $\frac{33}{3}$, $\frac{34}{9}$, $\frac{35}{7}$, $\frac{36}{2}$, in those examined; seven to twelve scales with pores; eye 2.5–3, about equal to interorbital; depth of caudal peduncle 1–1.5 in its length.

Compressed, dorsal and ventral profiles equally arched; prefrontal area flattened, with a median series of about thirteen scales; predorsal area rounded, with thirteen scales; frontal fontanel from half to one-third as long as the parietal; a broad naked area behind the third suborbital, sometimes extending forward a little at the angle of the preopercle, postorbital not half as wide as the naked area behind it; mouth small, maxillary little, if any, longer than half the eye, shortest in specimens from Cacequy and Maldonado, in which its free margin is more convex. Premaxillary with four or five teeth (six in a few premaxillaries); maxillary uniformly with a single tooth (except in one maxillary, which in addition has a minute tooth); five, six, or seven graduate teeth in mandible, the teeth five- to seven-pointed, the base narrower than the tip. Gill-rakers 7 + 12, to 9 + 13, short, the longest not quite a third as long as the eye.

Origin of the dorsal equidistant from tip of snout and base of mid-caudal rays.



FIG. 25. *Cheirodon monodon* Cope. a and b, premaxillary and maxillary with their teeth.

Adipose fin well-developed. Origin of anal about equidistant from snout with last dorsal ray. Pectorals reaching ventrals, the ventrals not quite to the anal, the fourth or fifth to the eighth to fourteenth anal rays of the male with hooks; the ventrals in adult males also with hooks; seventeen or more interhæmals on caudal peduncle, those of male contiguous, with broad lateral processes, especially the anterior ones, their spines projecting from near base of last anal ray.

Scales thin, regularly imbricate, with few to many diverging radial striæ; caudal naked; anal with a few scales in a single series at base of anterior rays.

A silvery lateral stripe; chromatophores variously developed, some specimens from Cacequy are almost free from pigment, except a faint caudal spot; in others the pigment is well-developed, the specimens appearing quite dark, the caudal spot being well defined or more diffuse in outline, not extending upon mid-

caudal rays. The base of the anal in specimens from Porto Alegre, Cachoeira, and Maldonado is but little, if any, longer than the caudal peduncle. In all but one of the Cacequy specimens it is equal to the caudal peduncle and middle caudal rays, and usually contains twenty-two rays, more rarely twenty-one, twenty-three, or twenty-four.

There may be two, possibly three, varieties in the material at hand. If so, they may be distinguished by the following characters:

- a.* Base of anal less than caudal peduncle and middle caudal rays.
- b.* A. 18-23, most frequently 19-20; most frequently 5-5 teeth in the premaxillaries, less frequently, 4-4 or 4-5 or 5-6; base of anal equal to the length of the caudal peduncle. Caudal spot usually well defined. Nos. 6815, 6817, 6818 (Rio Grande do Sul).....39. **monodon** Cope.
- bb.* A. 17-22, most frequently 19; usually 5-5 teeth in the premaxillary; base of anal equal to the length of the caudal peduncle or a little longer. Nos. 846, 847, 20698 and 20699, M. C. Z. (Uruguay river basin).....38. **interruptus** Jenyns.
- aa.* A. 21-24, most frequently 22; 4-4, or 4-5 teeth in the premaxillary; base of anal equal to length of caudal peduncle and middle caudal rays. Caudal spot diffuse. No. 6816 (Cacequy).
40. **ibicuihensis** Eigenmann *var. nov.*

TABLE SHOWING IN DETAIL THE NUMBER OF SPECIMENS WITH THE INDICATED NUMBER OF PREMAXILLARY TEETH AND OF ANAL RAYS.

	Premaxillary Teeth.							Anal Rays.					
	4-4.	4-5.	5-5.	5-6.	6-6.	17.	18.	19.	20.	21.	22.	23.	24.
No. 6818, C. M.	9	4	13	1			2	10	3	2			
No. 6815, C. M.		4	8	1			2	4	2	1	3	2	
No. 6817, C. M.	1	1	1			1			2	1			
No. 20698, M. C. Z.	1	2	21	1	4	1	2	14	8	6	6	1	
No. 6816, C. M.	5	4								2	7	1	1

41. **Cheirodon notomelas**, sp. nov. (Plate XII, fig. 2.)

6812, C. M., **type**, ♀, 35 mm.; 6813a-c, C. M., **paratypes**, nineteen, largest 40 mm. collected in a lake, four miles from Miguel Calmone, Tieté basin. Oct. 11, 1908. Haseman.

6814, C. M., one, 30 mm. Piperão Azul, lake twelve miles from Tieté. Oct. 7, 1908. Haseman.

Head 4; depth 2.5-2.66; D. 10 or 11; A. 20-22; scales usually 33 (32-34), six to eight with pores; eye about 2.5 in the head, equal to the interorbital; depth of caudal peduncle about equal to its length.

Compressed, dorsal and ventral profiles equally curved; preventral area rather flat with a regular median series of eleven scales; predorsal area narrowly rounded with a median series of ten or eleven scales; occipital process broad, reaching one-seventh to dorsal, bordered by two and one-half scales on each side; skull convex;

frontal fontanel an equilateral triangle, not more than one-third as long as the parietal; third suborbital less than half as wide as eye, in contact with the preopercle along the lower limb and the angle of the preopercle, a narrow naked area behind it, and a narrow naked strip behind the postorbitals. Mouth small, the maxillary half as long as eye. Teeth broad-tipped, seven-pointed, the median point prominent, especially in the premaxillary. Four teeth in the premaxillary, two in the maxillary, and seven or eight in the mandible. Gill-rakers $5 + 7$, about one-fourth as long as the eye.

Origin of dorsal equidistant from tip of snout and base of caudal. Dorsal pointed, its height about equal to the length of the head; adipose fin well-developed, caudal lobes a little longer than head; origin of anal a little behind the vertical

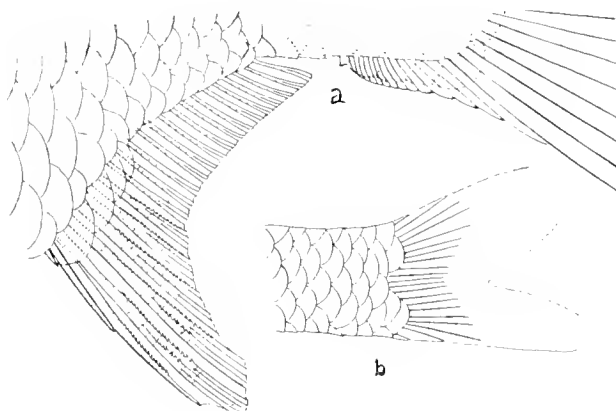


FIG. 26. *Cheirodon notomelas* Eigenmann. *a*, anal and interhemals of a ♀, 6813, C. M.; *b*, details of the arrangement of the scales at the base of the caudal in a ♂, 6813a, C. M.

from the last dorsal ray; tip of highest ray reaching to the base of the last fourth of the base; pectorals reaching ventrals, ventrals not quite to anal.

Scales regularly imbricate, a few scales in a single series along base of anterior anal rays, ten scales between dorsal and ventral, caudal lobes naked.

First dorsal rays and bases of the rest black; a sub-rhomboidal black spot across the entire caudal peduncle, the spot bordered by unpigmented areas in front and behind, the spot not extending to the end of the middle rays; anal dusky, the first rays sometimes black. General color darker than usual in the genus.

Base of the anterior half of the anal of the male as usual for this genus, much more oblique than the base of the rest of the fin; fourth to ninth anal rays of the male much thicker than the rest, with many retrorse hooks along the posterior edges of the middle part of the rays.

42. *Cheirodon madeiræ*, sp. nov. (Plate XIII, fig. 1.)

6847, C. M., one, 34 mm. San Joaquin, Bolivia. Sept. 4, 1909. Haseman.
A small-mouthed species, without color-markings.

Head 4; depth 3; D. 11; A. 23; scales 10 + 24; ten scales between dorsal and ventrals; eye 2.4 in the head; depth of caudal peduncle nearly equal to its length.

Moderately compressed; preventral area rounded, with a median series of twelve scales; predorsal area rounded, with a median series of eleven scales; occipital process extending about one-seventh to the dorsal; skull convex; frontal fontanel a little longer than broad, less than half the length of the parietal; mouth minute, maxillary about half the length of the eye; premaxillary with five teeth, maxillary with two; mandible with broad, seven-pointed teeth, the median point being a little the longer; cheeks covered by the third suborbital, leaving a narrow naked wedge behind; postorbitals nearly covering the entire postorbital area. Gill-rakers 7 + 11.

Origin of dorsal equidistant from tip of snout and base of caudal; origin of anal under posterior part of dorsal. Caudal peduncle with about nine weak interhæmals; ventrals not reaching anal; the pectorals reaching beyond origin of ventrals. Scales as in other species of the genus. No color-markings.

43. *Cheirodon piaba* Lütken. (Plate XIII, fig. 2; Plate XVII, figs. 5-6.)

Cheirodon piaba Lütken, Oevers. Dan. Selsk. No. 3, 1874, p. 134 (Rio das Velhas); Velhas-Flodens Fiske, 1875, p. xiv and p. 219, fig. on p. 221 (Rio das Velhas); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 291; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Tetragonopterus bellottii Ulrey (*non* Steindachner): in part, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 286 (Santarem).

Cheirodon insignis Ulrey (*non* Steindachner): in part, *l. c.* 291 (Brazil); Eigenmann & Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 515 (Arroyo Trementina & Arroyo Pypueu).

Cheirodon calliurus Boulenger, Boll. Mus. Torino, Vol. XV, 1900, p. 370 (Carandasinho near Corumbá. San Lorenzo, Prov. Jujuy, Argentina); Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Cheirodon interruptus Eigenmann & Kennedy (*non* Jenyns), Proc. Acad. Nat. Sci. Phila., 1903, p. 514 (Campo Grande; brook near Arroyo Trementina); Ann. Carnegie Mus., Vol. IV, 1907, p. 126 (Puerto Max); Eigenmann & Ogle, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 9.

Cheirodon micropterus Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 9 (Santarem); Reports Princeton Univ. Exped. Patagonia, Vol. III, p. 429.

Range: Abundant in Rio Paranahyba, Rio San Francisco, upper Paraná, and Paraguay; rare south of these points, and in Amazons.

The very large number of specimens recorded below, most of them in excellent condition, together with the specimens recorded by me in the papers quoted above, enables me to revise the synonymy and bibliography of this species. As stated by Eigenmann & Ogle a comparison of one of the types of *calliurus* with specimens recorded by me as *interruptus* showed that these specimens belong to the same species. At the same time the opinion was expressed that these specimens were probably distinct from *interruptus*. The material at hand shows that the Paraguayan specimens are specifically identical with *C. piaba*, originally recorded from the Rio das Velhas and found abundantly throughout the Rio San Francisco.

The type of *micropterus* is poor, but is very probably also a *C. piaba*.

Aside from the specimens previously recorded, some of which are again enumerated, I have examined many specimens collected by Mr. J. D. Haseman.

6821a-b, C. M., two males, largest 33 mm. Aregúa, Paraguay. April 8, 1909. Haseman.

6822a-g, C. M., seven, two males, 33 and 39 mm., two females, 36 and 39 mm. three females, the largest 30 mm.³³ Corumbá, Paraguay. April 27, 1909. Haseman.

6824a-p, C. M., seven males, largest 38 mm.; nine females, largest 38 mm. Puerto Suarez. May 6, 1909. Haseman.

9984, I. U. M. 933a-b, C. M., ten, largest 42 mm. to base of caudal. Campo Grande. Anisits.

9997 and 10122, I. U. M.; 926a-b, C. M., sixteen, largest 31 mm. to base of caudal. Arroyo Pypucu. Anisits.

6825a-h, C. M., nine, largest 35 mm. Asunción, Paraguay. March 28, 1909. Haseman.

10289, I. U. M., Colonia Gonzales. Anisits.

6826a-b, C. M., two, 21³⁴ and 44 mm. Caceres. May 27, 1909. Haseman.

9985, I. U. M. 953a-b, C. M., thirteen, largest 40 mm. to base of caudal. Arroyo Trementina. Anisits.

6908a-f, C. M., six, 15³⁵-20 mm. Caceres. May 24, 1909. Haseman.

³³ In these smaller specimens and in the two males, the caudal spot extends further on the caudal than in the two larger females.

³⁴ The smaller has only one tooth on the maxillary.

³⁵ In the smallest the color is most profuse and the caudal spot extends to near tip of the middle rays.

- 6823a-u, C. M., twenty-one, largest 39 mm. Lagoa de Parnagua. Jan. 17, 1908. Haseman.
- 6827a-k, C. M., one male, twelve females, largest 43 mm. Rio das Velhas, tributary of Rio San Francisco. May 13, 1908. Haseman.
- 6828a-x, C. M., twenty-one males, largest 38 mm.; thirty-two females, largest 38 mm. Pirapora, Rio San Francisco. Dec. 15, 1907. Haseman.
- 6829a-b, C. M., two. Lagoa Pereira, San Francisco basin. Dec. 23, 1907. Haseman.
- 6830a-b, C. M., two. Lagoa de Porto, San Francisco basin. Dec. 24, 1907. Haseman.
- 6831a-x, C. M., seven males,³⁶ largest 37 mm., twenty-seven females, largest 39 mm. Barreiras, Rio San Francisco. Jan. 4, 1908. Haseman.
- 6832a-g, C. M., seven, largest 31 mm. Boqueirão, near mouth of Rio Preto, San Francisco basin. Jan. 6, 1908. Haseman.
- 6833a-x, C. M., twenty-eight, largest 38 mm. Santa Rita, San Francisco basin. Jan. 26, 1908. Haseman.
- 6834a-e, C. M., five,³⁷ largest 39 mm. Penedo at mouth of Rio San Francisco. March 22, 1908. Haseman.
- 6835a-c, C. M., three. Rio Coite, San Francisco basin. Nov. 6, 1907. Haseman.
- 6846a, C. M., one, 40 mm. Lagoa Salgado, San Francisco basin. Nov. 10, 1907. Haseman.
- 6838a-d, C. M., four, largest 35 mm. Rio Itapicurú, Fazenda de Amaratu, 6 miles north of Bom Fin. Nov. 21, 1907. Haseman.
- 6836a-f, C. M., six, largest 33 mm. Rio de Jacobina, tributary of Rio Itapicurú. A. 19-21. Haseman.
- 6837a-b, C. M., two, largest 39 mm. Queimadas, Rio Itapicurú. March 2, 1908. Haseman.
- 6839a-h, C. M., eight, 39 mm. Alagoinhas, Rio Catu. March 4, 1908. Haseman.
- 6840a, C. M., one, 35 mm. Cachoeira, Rio Paraguassú. April 14, 1908. Haseman.
- 6842a-x, C. M., twenty-five, largest 42 mm. Bebedouro, near Rio Grande and Rio Paraná. Sept. 1, 1908. Haseman.
- 6844a, C. M., one male, 25 mm. Santa Maria, Rio Vaccacahy-Mirim, tributary of the Jacuhy, Rio Grande do Sul. Jan. 29, 1909. Haseman.

³⁶ Color prominent, spot extending to end of middle rays in some. Depth 2.33-2.8.

³⁷ With ripe eggs.

6843a-x, C. M., thirty-five, largest 38 mm. Jaquara, Rio Grande, into Rio Paraná. Aug. 18 and 19, 1908. Haseman.

6845a-e, C. M., five, largest 41 mm. Cacequy, secondary tributary of the Rio Uruguay. Jan. 31, 1909. Haseman.

Head 3.6-4.5; depth 2.25-3; D. 11; A. 19-27 most frequently 22 or 23; scales 31-36, most frequently 33 or 34, 9-12 with spines; eye equal to interorbital, about 2.5 in the head; depth of caudal peduncle 1.25 in its length; base of anal much longer than caudal peduncle.

Compressed, depth very variable, the dorsal and ventral profiles symmetric, nearly equally arched; preventral area flat, with well-marked lateral edges, eleven to thirteen scales in a median series; predorsal area keeled, with ten scales in a median series, which is regular to near the occipital process; occipital process short, extending one-sixth to one-seventh to the dorsal, bordered by two or three scales;

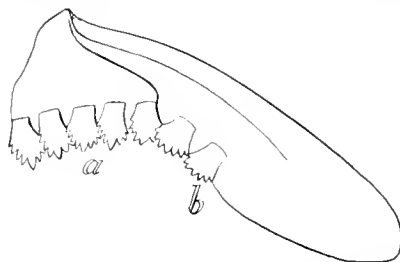


FIG. 27. *Cheirodon piaba* Lütken. a, premaxillary; b, maxillary.

frontal fontanel an equilateral triangle, 2.5-3.5 in the length of the parietal fontanel; interorbital convex; third suborbital covering the entire cheek, or a very narrow naked wedge behind it; lower one of the postorbitals as wide as the third suborbital at its tip, sometimes covering the entire width to the preopercle; the upper postorbital much narrower, leaving a wider naked strip; mouth minute, maxillary not, or barely, reaching the eye, nearly vertical, very little more than half the length of the eye; maxillary with one tooth in three specimens, two teeth in sixty-two specimens, and three teeth in seven specimens examined; premaxillary with five teeth; mandible with about seven teeth; teeth sometimes black-tipped. Gill-rakers about 6 + 11, not over one-fourth as long as eye.

Origin of dorsal equidistant from tip of snout and base of caudal, the highest ray a little over length of head; origin of anal a little behind vertical from base of last dorsal ray; pectorals reaching to, or beyond, origin of ventrals, ventrals not to anal; eight to thirteen rays of the anal (beginning with the second or third) of the male with hooks, base of the hook-bearing portion of the anal, making an angle with the base of the rest of the fin; all but the outer two ventral rays with similar hooks;

base of anal about equal to length of caudal peduncle plus the middle caudal rays; the interhæmals, nine to thirteen in number, occupy four-tenths to six-tenths of the distance between the base of the last anal ray and the caudal, beginning a little behind the tip of the last anal ray. Those of the male without lateral processes, sometimes with a low ridge or keel running along the sides of the anterior ones and ending in a knob in front of them; lower caudal fulera prominent, continuous with the interhæmals. Scales normal.

There is a caudal spot of varying size and intensity, sometimes extending

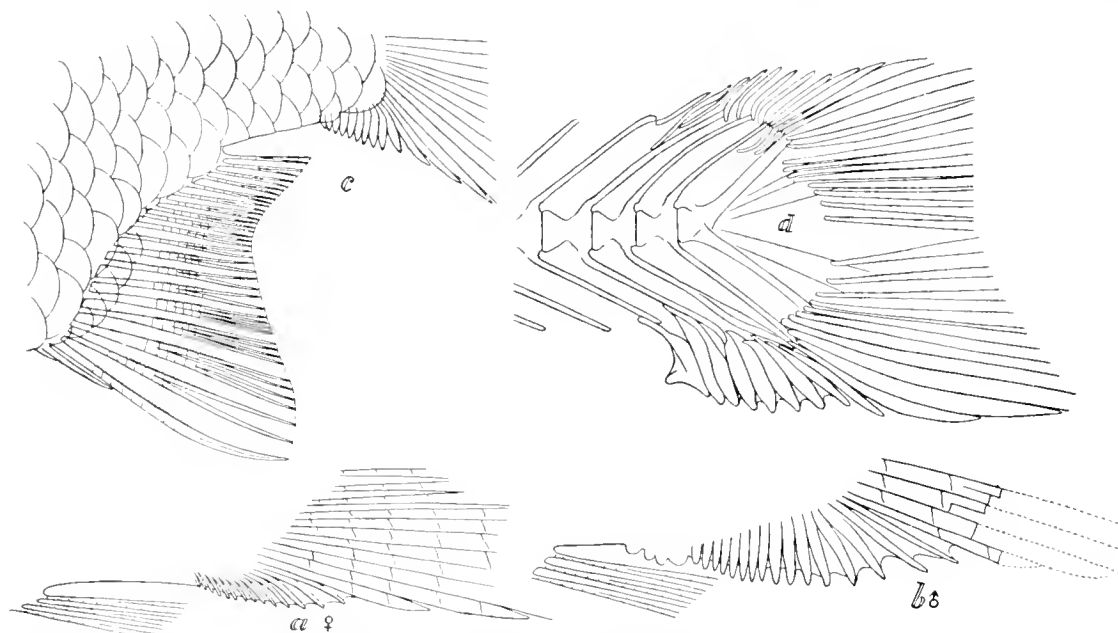


FIG. 28. *Cheirodon piaba* Lütken. *a*, region between anal and caudal in ♀; *b*, Do. in ♂. Lagoa Paranagua, 6823, C. M.; *c*, anal fin and caudal fulera and interhæmals of ♂, 6828, C. M.; *d*, skeleton of fulera and interhæmals of ♂, 6843, C. M. (All figures greatly enlarged.)

entirely across the end of the caudal peduncle, sometimes extending on the middle caudal rays, rarely to their tips; a faint black line overlaid with silvery along the middle of the sides; anterior margin of dorsal dark; general color very pale or quite dark, depending on the nature of the locality from which the specimens came.

It is possible that we should refer to this species a small specimen, 6909, C. M., 15 mm. long, taken in a tributary of the Guaporé about forty miles south of Villa de Matto Grosso.

44. *Cheirodon microdon* sp. nov. (Plate XIV, fig. 1.)

This species is allied to *Cheirodon stenodon* and to *Aphiocheirodon hemigrammus*. 6850, C. M. **Type**, 42 mm. 6851a-b, C. M., **paratypes** two, the larger 41 mm., Caacres, Upper Paraguay, May 24, 1909. Haseman.

Head 4-5; depth 3; D. 11; A. 23-25; scales in a median line are 34-36, of which 10-11 are with pores; ten and one-half scales between dorsal and ventrals. Eye 2.75 in head, very little greater than interorbital.

Compressed, slender; dorsal and ventral profiles nearly equally curved; pre-ventral area flat, with rather well-defined lateral angles, and with a nearly regular median series of twelve scales; predorsal area with a median series of eleven scales; occipital process extending one-sixth to one-seventh to the dorsal, bordered by three scales on each side; frontal fontanel triangular, the sides of the triangle but little longer than the base, about 2.5 in the length of the parietal fontanel; mouth large, maxillary three-fourths as long as eye; teeth five-pointed; the median points

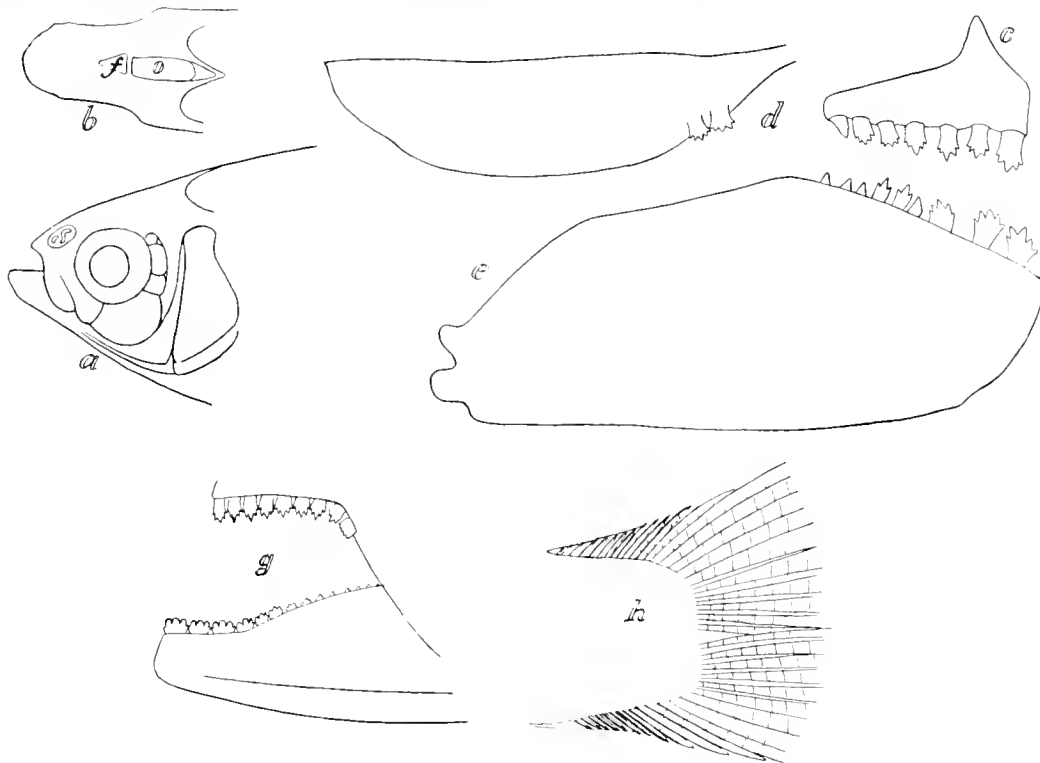


FIG. 29. *Cheirodon microdon* Eigenmann. *a*, outline of side of head; *b*, top of head, showing fontanel; *c*, premaxillary; *d*, maxillary; *e*, maxillary; *g*, dentition; *h*, details of interneurals and interhaemals, 6850, C. M.

of the premaxillary projecting considerably beyond the lateral points, the three median points of the teeth of the lower jaw about equal, the extreme lateral points minute; seven to nine teeth in the premaxillary, two in the maxillary; teeth in front of the lower jaw rapidly graduated from the third to the sixth; sides of lower jaw upturned, with several (about six) minute, conical teeth; third suborbital leaving but a very narrow wedge-shaped naked area behind; postorbitals covering

half to two-thirds of the postorbital area. Gill-rakers 7 + 13, the longest about one-third as long as eye.

Origin of the dorsal very little nearer tip of snout than to middle caudal rays, the highest ray a little greater than the head; adipose fin well developed; origin of anal below the posterior part of dorsal. Ventrals not reaching anal, the pectorals about to the origin of the ventrals.

Scales thin, regularly imbricate, with few diverging radial striae. Caudal naked; anal with a few scales in a single series along base of anterior rays.

Interhamal spines of the caudal peduncle feeble, about eight to ten in number.

A faint caudal spot, not directly continued forward as a dark band; upper part of the anterior dorsal rays dark. A silvery lateral stripe.

The three specimens here described appear to be females. They are probably from an area in which the color-cells do not reach their fullest pigmentation. The species distinctly differs from *C. stenodon* in the character of the teeth.

45. *Cheirodon stenodon*, sp. nov. (Plate XIV, fig. 2.)

6848a, C. M., type, 33 mm., 6849a-x, C. M., paratypes, over thirty, largest 34 mm. Bebedouro, near Rio Grande and Rio Paraná. Sept. 1-5, 1908. Haseman.

A long-jawed, small-toothed, slender species, with feeble interhæmals.

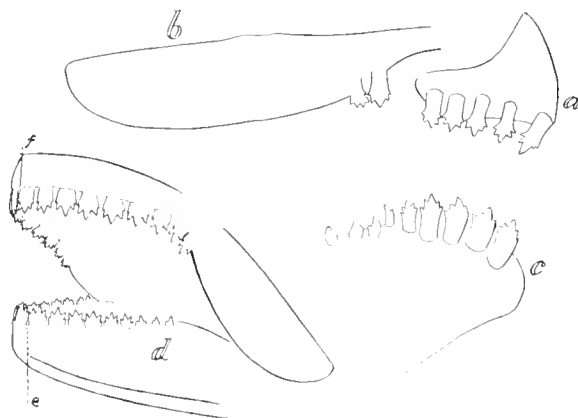


FIG. 30. *Cheirodon stenodon* Eigenmann. *a, b, c*, premaxillary, maxillary, and mandible; *d*, dentition; *e-f*, symphyseal line.

Head 4; depth a little more than 3; D. 10; A. usually 20 or 21, rarely 18, 19, or 22; scales in a median series 36 or 37, rarely 32; six to eleven scales with pores; eight to ten scales between dorsal and ventrals; eye 2.75 in head, equal to the interorbital; depth of caudal peduncle about 1.33 in its length.

Compressed, slender; dorsal and ventral profiles nearly equally curved; pre-ventral area rounded, with a nearly regular median series of twelve to thirteen scales; predorsal area rounded, with a perfect median series of nine to ten scales; occipital process extending one-sixth to one-seventh the distance to the dorsal, bordered by three scales on each side; frontal fontanel equilateral, less than half as long as the parietal; skull convex, smooth between the eyes.

Maxillary comparatively long, at least two-thirds as long as eye, its free margin a little convex; teeth narrow, the sides nearly parallel; a large median point and two small points on each side, those of the front of the lower jaw slightly broader than those of upper jaw; premaxillary teeth five to seven; maxillary teeth two; mandibular teeth six to nine, the first four of nearly equal size, those on sides rapidly graduated, the last ones conical; third suborbital covering the cheek below, leaving only a narrow naked wedge behind it. Postorbitals covering about two-thirds of the width of the postorbital area. Gill-rakers 6 + 12.

Origin of the dorsal equidistant from snout and middle caudal rays, the dorsal pointed, its highest ray about equal to length of head. Adipose fin well-developed. Origin of anal under the vertical from posterior part of the dorsal. The interhæmals of the caudal peduncle weak, very few, about five, if at all developed, not projecting in any of these specimens. Ventral not reaching anal. Pectorals long, reaching to or nearly to the ventrals. None of the anal rays have hooks; it is probable therefore that the specimens are all females.

Scales regularly imbricate, with a few diverging radial striæ; caudal naked. Anal with a few scales along the base of the anterior rays.

Straw-colored, the scales of the back margined with a row of chromatophores; a large triangular caudal spot not extending to the end of the middle rays, continued forward along the middle of the sides as a narrow band to in front of dorsal. Tip of dorsal and membranes between first and second and upper half of second and third dark.

Genus XX. HOLESTHES³⁸ Eigenmann.

Holoshesthes Eigenmann, Smiths. Misc. Coll. Quarterly, Vol. XLV, 1903, p. 144.

Type: *Cheirodon pequiru* Steindachner.

Very similar to *Aphyocheirodon* and *Odontostilbe*.

Teeth notched, in a single series, six or seven in the premaxillary, rather narrow, but little expanded toward tip, more or less ovate, with five to seven notches, of which the median one is a little the larger, the rest being lateral; mandib-

³⁸ ὅλος = complete; ἐσθῆς, ἦ = clothing, in allusion to the complete dentition of the maxillary. I here take opportunity to amend the spelling of this generic name.

ulary teeth much expanded at the tip, with a small basal notch on each side and *three median points* of about the *same size and extent*. Maxillary with few teeth, broad-tipped, the points nearly alike. Mouth moderate; third suborbital in contact with the preopercle below; frontal fontanel short; adipose fin well-developed; origin of anal below end of dorsal; caudal naked; lateral line complete; scales with very few radial striae; interhaemals of the caudal peduncle not projecting.

Minute fishes of southern and eastern Brazil and Paraguay.

KEY TO THE SPECIES OF *HOLESTHES*.

- a.* Dorsal with a large, oblique, black wedge extending from the upper part of the anterior ray toward the middle of the sixth ray; male with the outer ventral and first developed dorsal ray filiform. 46. *pequira* (Steindachner).
aa. Tip of dorsal faintly dusky; interhaemals of the caudal peduncle of the male much stronger than the inter-neurals; outer ventral ray and first dorsal rays not filiform.....47. *heterodon* Eigenmann.

46. *Holesthes pequira* (Steindachner). (Plate XV, fig. 1.)

? *Salmo pequira* Natterer, MS.

Cheirodon pequira Steindachner, Anz. Ak. Wiss. Wien, 1882, p. 180 (Rio Guaporé); Flussf. Süd-am., Vol. IV, 1882, p. 38 (Cujabá); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. IV, 1891, p. 54; Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290; Boulenger, Boll. Mus. Univ. Torino, Vol. XII, 1897 (Caiza; Mission de San Francisco).

Holoshesthes pequira Eigenmann, Smiths. Misc. Coll. Quarterly, Vol. XLV, 1903, p. 144; Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429.

Odontostilbe trementinae Eigenmann and Kennedy, Proc. Acad. Nat. Sci. Phila., 1903, p. 513 (Arroyo Trementina); Eigenmann, Ann. Carnegie Mus., Vol. IV, 1907, p. 125 (Puerto Max); Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Range: Upper Madeira, Paraguay.

In the original description of *pequira* Steindachner states that the entire



FIG. 31. *Holesthes pequira* (Natterer). *a*, maxillary; *b*, premaxillary.

anterior edge of the maxillary is finely dentate and that the caudal spot is very small. If Steindachner's statement is correct then *trementinae* is a valid species

and the type of a distinct genus. But the statement was probably made without microscopic preparations. Furthermore the specimens had been in alcohol for fifty-eight years when the description was prepared and it is possible that they were faded and the caudal spot small in consequence. Except for these two characters the description of *pequirá* applies very well to specimens of *trementina* and indeed in two of the specimens enumerated below the caudal spot is quite small. There is no other species known from the upper Paraguay related to these, which has an oblique bar on the upper part of the dorsal.

Specimens sent me from the British Museum as *pequirá* are *Odontostilbe microcephala*.

7317a, C. M.; 9987, I. U. M., nine, **type** and **paratypes** of *trementina*. Arroyo Trementina. Anisits.

9986 and 9987, I. U. M. Brook near Arroyo Trementina.

6857a-l, C. M., twelve, largest 43 mm. Villa Hays, Paraguay. April 13, 1909. Haseman.

10187, I. U. M., one, Puerto Max. Anisits.

6858a-e, C. M., five,³⁹ largest 31 mm. Asunción, Paraguay. March 28, 1909. Haseman.

6859a, C. M., one, 35 mm. Cáceres, Paraguay. May 27, 1909. Haseman.

6860a-b, C. M., two, largest 43 mm. Corumbá, Paraguay. April 27, 1909. Haseman.

6861a-h, C. M., eight, largest 45 mm. Sapucay, Paraguay. April 2, 1909. Haseman.

6862a-e, C. M., five, largest 56 mm. Cacequy, Rio Ibicuhy. Feb. 1, 1909. Haseman.

6877a-e, C. M., three, largest 55 mm. Santa Maria, Rio Maccacahy Mirim. Jan. 29, 1909. Haseman.

Head 4.5; depth 3-3.5; D. 11; A. $\frac{21}{2}$, $\frac{22}{3}$, $\frac{23}{2}$, $\frac{24}{3}$, $\frac{25}{1}$; scales 6- $\frac{35}{2}$, $\frac{36}{1}$, $\frac{37}{4}$, $\frac{38}{2}$, $\frac{39}{1}$ —4; eye 2.75-3 in the head, equal to, or a little greater than, interorbital; depth of caudal peduncle about 3 in the depth, 1.5 in its own length.

Compressed, elongate; the dorsal and ventral profiles equally arched; the pre-ventral area flat, with a nearly regular median series of thirteen scales; predorsal area rounded or bluntly keeled, with about ten scales; occipital process one-sixth in the distance from its base to the dorsal, bordered by two or three scales; frontal fontanel a little longer than wide, triangular, its length a little more than two in the parietal fontanel; mouth small, the maxillary scarcely reaching to below the

³⁹ Caudal spot minute in two.

anterior margin of the eye. Teeth of the upper jaw narrow, with a large median point and three small points on the side of the tooth; teeth of lower jaw much wider, broad-tipped, with five points, three of these of equal size and prominence, the lateral points minute and much below level of the other three; maxillary usually with two or three teeth, rarely four; premaxillary teeth six and six or six and seven; mandible with about six notched, graduated, teeth followed on the side with about three minute, conical teeth; second suborbital and lower postorbital leaving but a narrow, naked area between them and the vertical limb of the preopercle. Gill-rakers 7 + 12.

Origin of dorsal equidistant from tip of snout and some distance behind tip of adipose, its height little greater than length of head. The first ray in the male prolonged into a filament, which sometimes reaches the adipose fin. Anal emarginate, its origin below the base of the last dorsal ray, base equal to length of head and about one-fourth of pectoral; ventral usually not reaching anal, its outer ray sometimes (in some males) filiform, reaching beyond origin of anal; origin of ventrals in front of the vertical from the first dorsal ray; pectorals not quite reaching ventrals in female, a little beyond their base in some males; no prominent interhæmals in males or females; about seven (beginning with the first fully developed) rays of the anal of the male with hooks.

Scales thin, regularly imbricate, with few if any radial striæ; caudal naked; a small sheath at the base of the anterior anal rays; lateral line but little decurved.

Distinguished from the other members of the genus by the large dorsal spot, which is wedge-shaped from the upper part of the first fully developed dorsal ray (the second) to the middle of the sixth or seventh ray; sometimes a minute black spot near the middle of the first fully developed anal ray; caudal peduncle usually with a large, conspicuous spot, which extends a little way on the middle caudal rays and usually upward and downward across the entire caudal peduncle. The caudal spot more rarely (6858a-b) very small, circular. A well-defined silvery lateral band.

The specimens from the province of Rio Grande do Sul, Nos. 6862 and 6877, are larger than the rest. The caudal spot is restricted, ovate, but faintly extended upward and downward. They are slenderer, depth 2.33-2.66; with the six interhæmals and nine interneurals of the caudal peduncle of the male equally well-developed.

As there is still a little doubt about their identity, I add the original description of *pequirá* as given by Steindachner, *l. c.*:

(P. 38) "Seitenlinie vollständig; Körperform sehr gestreckt. Bauchlinie bis

zur Ventrale bald mehr, bald minder bedeutend gebogen und in der Regel ein wenig schwächer zur Bauchflosse abfallend, als die nur sehr wenig gebogene Rückenlinie zur Dorsale ansteigt. Dorsale in der Mitte der Körperlänge, hinter der Basis der Ventralen (in verticaler Richtung) beginnend. Silberfarbige Seitenbinde unterhalb der Dorsale bis zur Caudale scharf ausgeprägt, weiter nach vorn an den Rändern verschwommen. Caudalfleck *sehr klein*, doch deutlich sichtbar. Humeralfleck in der Regel fehlend, oder nur äusserst schwach angedeutet. Eine durch starke Anhäufung dunkler Punkte gebildete schräge Binde in der oberen Hälfte der Dorsale.

“Stirn querüber gewölbt. Mundspalte sehr klein. *Oberkiefer am ganzen vorderen Rande sehr fein gezähnt.*”

“Leibeshöhe $3\frac{1}{4}$ mal, Kopflänge $3\frac{3}{4}$ mal in der Körperlänge; Augendiameter $2\frac{2}{3}$ – $2\frac{3}{4}$ mal, Stirnbreite nahezu 3mal, Schnauzenlänge fast 4mal in der Kopflänge enthalten.

(P. 39) “Die Höhe der Dorsale erreicht eine Kopflänge; die stark zugespitzten Caudallappen sind merklich länger als der Kopf. Die Spitze der Ventrale reicht genau bis zum Beginn der Anale, die der Pectoralen nahezu bis zur Basis der Ventralen. Rumpf hell goldgelb, gegen die Bauchseite herab hellgelb.

“D. 11. A. 22. L. lat. 35–36 (bis zur Basis d. Caudal.). L. tr. $6\frac{1}{4}$.”

“Zahlreiche Exemplare bis zu 38 mm. Länge, von J. Natterer im Jahre 1824 (Send. VIII, Nr. 59) im Cuyaba gesammelt, und *Salmo pequirá* genannt.”

47. *Holesthes heterodon* sp. nov. (Plate XV, fig. 2.)

Range: Rio San Francisco to Rio Ribeiro.

6875a, C. M., type, female. 48 mm. Jaguara, Rio Grande emptying into Rio Paraná, August 18, 1908. Haseman.

Paratypes all of the following:

6876a–x, C. M., twenty-seven, largest 49 mm. Jaguara, Aug. 18, 1908. Haseman.

6864a–p, C. M., sixteen, largest 50 mm. Sete Lagoas, May 5, 1908. Haseman.

6865a–x, C. M., twenty-six, largest 50 mm. Bebedouro near Rio Grande and Rio Paraná, Sept. 1, 1908. Haseman.

6866a–h, C. M., eight, largest 38 mm. Pirapora, Dec. 5, 1908. Haseman.

6867a, C. M., one, 36 mm. Rio das Velhas, May 18, 1908. Haseman.

6868a–e, C. M., five, largest 38 mm. Lagoa Pereira, Dec. 23, 1907. Haseman.

6869a–c, C. M., three, largest about 41 mm. Rio Zinga, Nov. 7, 1907. Haseman.

6870a, C. M., one, 28 mm. Barreiras, Lagoa of Rio Grande, San Francisco basin, Jan. 3 or 4, 1908. Haseman.

6871a-o, C. M., fifteen, largest 46 mm. São João del Rei, May 17, 1908. Haseman.

6872a-d, C. M., four, largest about 48 mm. São João del Rei, May 17, 1908. Haseman.

6874a, C. M., one, 38 mm. Penedo, March 22, 1908. Haseman.

6873a, C. M., one, 40 mm. Queimadas, Rio Itapicuri, March 2, 1908. Haseman.

6878a, C. M., one, 48 mm. Iporanga, Dec. 1, 1908. Haseman.

This species is very closely allied to *pequira*, differing in the characters noted in the key. It is almost identical in characters with *Odontostilbe microcephala*.

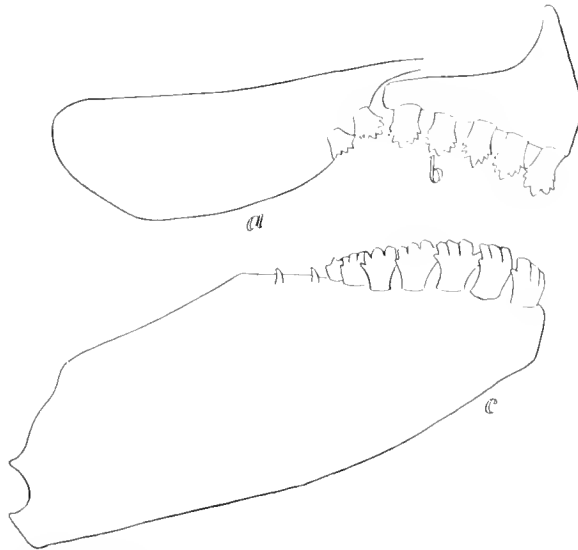


FIG. 32. *Holesthes heterodon* Eigenmann. a, maxillary; b, premaxillary; c, mandible.

Head 4.25-4.75; depth 3-3.5; D. 11, very rarely 10; A. 19-24 most frequently 20 in specimens from Jaguará and Bebedouro; most frequently 22 in specimens from Pirapora and Sete Lagoas of the San Francisco basin. Scales 5 or $6-\frac{3}{4}$, $\frac{3}{5}$, $\frac{3}{15}$, $\frac{3}{3}$ -4 (35 being more frequent in the specimens from the San Francisco; 36 more frequent in specimens from Jaguará and Bebedouro). Eye 3 in head, equal to interorbital; depth of caudal peduncle 2.5 in the depth, 1.5-1.75 in its length.

Compressed, elongate; the dorsal and ventral profiles equally arched; pre-ventral area flat or rounded, with about thirteen scales; predorsal rounded, with

ten to twelve scales in a series which is regular, except at about the sixth scale from the occipital process; occipital process about one-sixth in the distance to the dorsal; bordered by two or three scales; frontal fontanel a little longer than wide, a little more than twice the length of the parietal; maxillary reaching to below anterior margin of eye; teeth as in *C. pequirã*, premaxillary teeth in those examined $\frac{5-5}{5}$, $\frac{6-6}{7}$, $\frac{5-6}{4}$, $\frac{6-7}{1}$; maxillary teeth ranging from one to four most frequently two and two in San Francisco specimens, most frequently three and three in Jaguarã and Bebedouro specimens; mandible with about six graduate teeth and a few minute ones on the side; third suborbital and lower postorbital leaving but a very narrow naked strip behind them. Gill-rakers 6 or 7 + 11 or 12.

Origin of dorsal about equidistant from tip of snout and the interneurals of the caudal peduncle, distinctly behind the vertical, from the origin of the ventrals; origin of anal under base of last dorsal ray. Dorsal rays of male not prolonged; height of dorsal a little greater than length of head; base of anal a trifle longer than height of dorsal; the first five or six fully developed anal rays of the male broad, with hooks; the ventral profile from origin of anal to caudal concave; ventrals usually just reaching anal in male; pectorals just reaching ventrals, these fins a little shorter in the female; ventral rays of the male with some hooks below.

Scales thin, regularly imbricate with a few widely divergent radial striae. Caudal naked; anal with a very rudimentary sheath at the base of the anterior rays.

Lateral line complete, except in one specimen from Sete Lagoas and in nine specimens from Jaguarã, in which the pores were:

Left.	Right.
4-3-3-2-1-23	4-3-3-3-4-3-$\frac{11}{22}$-1-4-8
36	34-2
10-3-1-1-1-6-12-2	14-5-4-3-9
37	4-2-29-2
10-2-6-3-4-6-5-?	13-2-3-1-1-2-3-1-8-2
30-2-1-2-1	4-5-5-6-5-2-9-?
16-2-17	34+(?)
2-21-5-3-3-2	7-5-7-2-15
? (10-2-4)-2-13	7-3-5-4-17-1
8-3-2-2-3-1-10-4-4	5-3-6-1-1-1-1-1-13-1-3

The heavy-faced figures indicate scales with pores. It is seen that many sorts of breaks occur. The pores may not be developed in front, at the end, or at any point along the lateral line, and at different points on the two sides.

An ovate spot at the end of the caudal peduncle, continued a little way on the middle rays; tip of dorsal variously dusky, a distinct narrow, silvery, lateral band.

Genus XXI. ODONTOSTILBE⁴⁰ Cope.

Odontostilbe Cope, Proc. Am. Phil. Soc., 1870, p. 566.

Type: *Odontostilbe fugitiva* Cope.

Teeth notched, in a single series, those of the premaxillary and mandible similar, with a large median point and smaller lateral points; maxillary with a few broad-tipped teeth; third suborbital in contact with the pre-opercle below; adipose fin well-developed; origin of anal under end of dorsal; caudal naked; lateral line complete; scales with few radial striæ; interhæmals feeble, not projecting.

Minute fishes found from Panama and Trinidad to the La Plata and the Peruvian Amazon.

But few of the species of this genus are distinguishable at sight. *O. melandeta* may be distinguished by the absence of a proper caudal spot; *paraguayensis* and *madeira* by their deep form, they are quite similar; *drepanon* by its filamentous fin-rays. *O. microcephala* and *fugitiva* are very similar. *O. hastata* stands quite alone, but looks like *microcephala*. *O. microcephala* differs from *Holcsthes heterodon* largely in the structure of the teeth of the lower jaw.

It is possible that *O. hastata* and *O. melandeta* do not belong to this genus.

KEY TO THE SPECIES OF ODONTOSTILBE.

- a. Caudal in the male with a pouch covered by scales just below the shortest rays at the middle. Eye 3; A. 18-21; rays of lower caudal lobe of male with retrorse hooks, an intense well circumscribed spot on the caudal peduncle. 48. **hastata** Eigenmann.
- aa. Caudal naked in the male.
- b. A large conspicuous caudal spot; teeth large; 5-7 in the premaxillary, 1-4 in the maxillary.
- c. Male with the outer ventral and first developed dorsal rays filamentous. D. 10 to 12. 49. **drepanon** Fowler.
- cc. Male without filamentous rays.
- d. Dorsal with 10 or 11 rays.
- e. Depth about 3.25; A. 22-34; scales 35 to 37; mouth minute, maxillary half the length of the eye. 50. **fugitiva** Cope.
- ee. Depth 3 to 4; A. 18-22, scales 34-37; mouth moderate, maxillary more than half the length of the eye. 51. **microcephala** Eigenmann.
- eee. Depth 2.5 to 2.75; A. 22-25; scales 33 or 34; caudal spot indistinct. 52. **pulchra** Gill.
- eeee. Depth 2.6 to 3; A. 21-24; scales 32-35; mouth minute. Maxillary half the length of the eye. 53. **paraguayensis** Eigenmann & Kennedy.

⁴⁰ ὀδούς, ὀ = tooth; στίλβη, ἦ = a lamp, possibly in allusion to the brilliant teeth.

- dd.* Dorsal with 12 or 13 rays; depth 2 $\frac{1}{2}$ to 3; A. 23-24; scales 34 to 37; mouth minute; maxillary half the length of the eye.....54. *madeiræ* Fowler.
- bb.* No distinct caudal spot; caudal peduncle narrowly margined with dark; depth 3.6; A. 21; scales 34 or 35; premaxillary with 10 to 14 teeth, maxillary with 4 to 7.....55. *melandeta* Eigenmann.

48. *Odontostilbe hastata* Eigenmann. (Plate XVI, fig. 1.)

Odontostilbe hastatus Eigenmann, Indiana University Studies, No. 18, 1913, p. 27.

Range: Magdalena and Atrato basins.

5703, C. M., **type**, ♂, 40 mm.; **paratypes**, twenty-five, largest 37 mm.

5104 a-j, C. M. 12861a-j, I. U. M., Soplaviento. Eigenmann.

5365a, C. M., Certegui. Rio Quito, into Atrato. Wilson.

5387a-f, C. M., 13079, I. U. M., many, Rio Atrato at Quibdo. Wilson.

5366a-x, C. M., 13045, I. U. M., many, Rio Truando, into Atrato. Wilson.

Head 4 +; depth 2.8-3.25; D. 11; A. most frequently 19 (18-21); scales

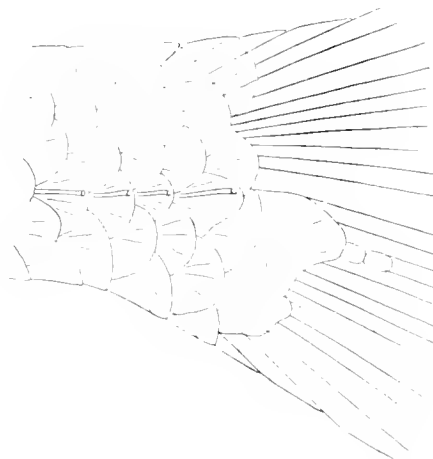


FIG. 33. *Odontostilbe hastata* Eigenmann. Caudal scales of ♂.

5.5-32 to 35-3; eye 3 in the head, equal to interorbital. Most nearly like *Odontostilbe paraguayensis*, but much slenderer.

Compressed; dorsal and ventral profiles equally arched; pre-ventral area rounded, with about eleven scales; post-ventral and pre-dorsal areas narrowly rounded, the latter with a regular median series of about ten scales; occipital process short and broad, its length one-sixth of the length from its base to the dorsal, bounded by three scales on each side; frontal fontanel variable, an equilateral triangle as wide as, and half as long as, the parietal fontanel, or quite minute; skull convex; snout blunt, the mouth comparatively large; maxillary-premaxillary nearly as long as the eye; five teeth in the premaxillary, two or three in the maxil-

lary; four broad-tipped, seven-pointed teeth in the dentary in front and with as many as four graduated teeth on the side. Second suborbital covering the entire cheek. About ten rakers on the lower arch of the gill.

Dorsal pointed, its highest ray longer than head, reaching to within two or three scales of the adipose, its origin about equidistant from tip of snout and caudal; middle caudal rays very short; a pouch on the caudal of the male just below the middle rays covered with scales; in the male the rays of the lower caudal lobe with retrorse hooks, similar to those of the five anterior anal rays in the male; anal short, its margin subtruncate (very slightly emarginate), its rays graduate, the tip of the highest (the third) reaching to last fourth or to base of the last ray; anal base 3.75–4.6 in the length, its origin behind the vertical from the last dorsal ray; origin of ventrals in front of the vertical from the anterior dorsal ray, about reaching the anal; pectorals not quite reaching ventrals or slightly beyond their base.

Scales thin, regularly imbricate, with as many as ten radial striæ; lateral line complete, nearly straight; anal sheath consisting of a single row of scales along the bases of the anterior rays; caudal naked, except for a basal sheath on the lower lobe of the male and the peculiar scales just below the middle rays in the male.

Scales of the back margined with dark; margins of the myotomes above the anal marked with chromatophores; no humeral spot; a silvery band; a conspicuous black spot on the end of the caudal peduncle, rounded in front, pointed on the bases only of the middle caudal rays; peduncle in front of the spot without chromatophores. Orange in life above and behind caudal spot.

One specimen from the Calamar Cienega, 32 mm., C. M. No. 5105, and three, the largest 30 mm., C. M. No. 5106, I. U. M., No. 12862, may belong to this species. Chromatophores are limited to the dorsal region and to along the base of the anal; the caudal spot is smaller, oval.

49. *Odontostilbe drepanon* Fowler.

Odontostilbe drepanon Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 529. (Tributary of the Madeira river near Porto Velho.)

Range: Madeira basin.

This species is known from the types only. It is quite possible that it will prove to be synonymous with *O. fugitiva*.

Head 3.25; depth 3-1.6; D. 10; A. 24; scales 6-38-5; 9 predorsal scales; eye 3.25 in the length of the head, maxillary 3.5; interorbital 2.87; depth of caudal peduncle 2.66.

Elongate, well compressed; mouth small, terminal; lips moderate; maxillary not reaching eye; teeth with five to seven points, maxillary with two teeth; sub-orbital completely covering cheek. Origin of dorsal midway between tip of snout and tip of adipose; third dorsal ray prolonged and filamentous, nearly to origin of the adipose; origin of anal behind base of dorsal, third ray longest, thence gradually

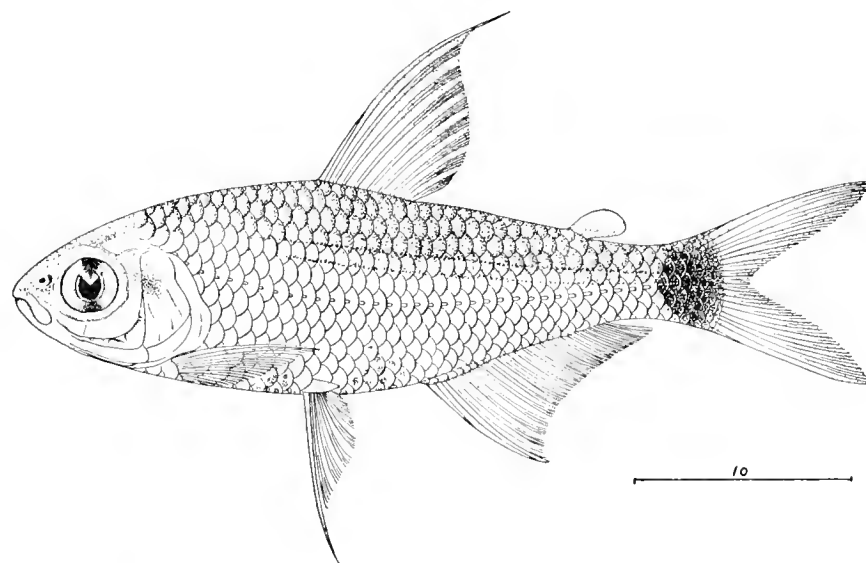


FIG. 34. *Odontostilbe drepanon* Fowler. (After Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 529.)

diminishing; pectorals reaching ventrals; origin of ventrals in front of dorsal, first ray produced in a filament, which extends beyond the origin of anal.

Base of caudal with a dusky blotch a little larger than the eye, not continued to the end of the middle rays. No humeral spot. Fins all pale.

50. *Odontostilbe fugitiva* Cope.

Odontostilbe fugitiva Cope, Proc. Am. Philos. Soc., 1870, p. 566, fig. (Pebas); Eigenmann and Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Eigenmann, Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 429. *Cheirodon fugitiva* Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290. (Lower Amazon.)

Range: Amazon basin.

6863a-d, C. M., four, largest 41 mm. San Antonio de Rio Madeira. Nov. 3, 1909. Haseman.

Head 4.5; depth 3.25-3; D. 11; A. 22 or 23; scales 37. Eye 2.75-3 in the head, .6 in snout, equals interorbital; depth of caudal peduncle 3 in the depth, 1.4 in its own length. Gill-rakers 7 + 12.

51. *Odontostilbe microcephala* Eigenmann.

Odontostilbe microcephalus Eigenmann, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 10.

Range: Paraguay and Upper Paraná basins.

11086, I. U. M., **type**, 46 mm. 11086, I. U. M., **paratype**, 45 mm. Rio Pileomayo, Bolivia. Exchange with British Museum.

6854a-e, C. M., five, largest about 80 mm. (the caudal is broken), the longest on record for the genus. Rio Tieté at Salto Avandava below the falls. Sept. 15, 1908. Haseman.

6855a-p, C. M., sixteen, largest 33 mm. Rio Tieté, Salto Avandava above the falls. Sept. 14, 1908. Haseman.

6856a, C. M., one, 38 mm. Asunción. March 28, 1909. Haseman.

Readily distinguished from the other members of the genus by the teeth, by the elongate form and prominent caudal spot.

Head 4-4.6; depth 3-4; D. usually 11, rarely 10; A. $\frac{18}{1}$, $\frac{20}{1}$, $\frac{21}{2}$, $\frac{22}{2}$; scales

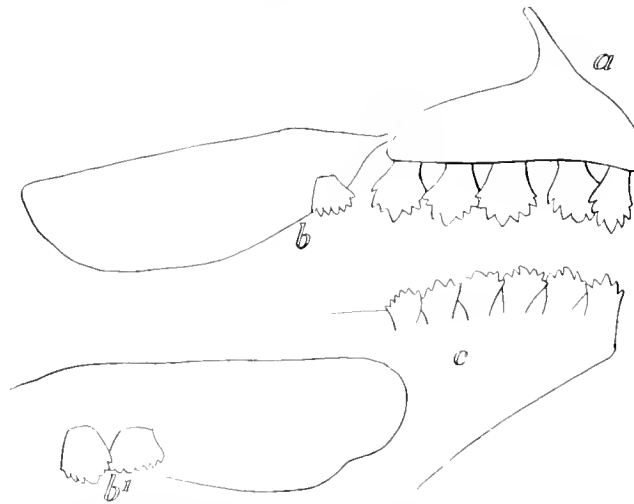


FIG. 35. *Odontostilbe microcephala* Eigenmann. *a*, premaxillary; *b*, maxillary; *b*¹ left maxillary of another individual; *c*, mandible. (All figures greatly enlarged).

$6-\frac{31}{2}$, $\frac{35}{2}$, $\frac{36}{3}$, $\frac{37}{1}$ -4 or 5; eye 2.5-3 in the head, equal to or a little greater than the interorbital, .6-.9 (in largest) in the snout; depth of the caudal peduncle 2.33-3 in the depth, .4 of its own length.

Elongate; dorsal and ventral profiles similar; preventral area flat, with a regular median series of fifteen scales; predorsal area rounded, with a median series of eleven scales. Occipital process one-fifth to one-eighth in the distance to the dorsal; frontal fontanel about 2.5 in the parietal; second suborbital and the

postorbitals leaving a very narrow naked area between them and the upper limb of the preopercle. Snout pointed, maxillary scarcely reaching to origin of eye, its length about .6 or .7 that of the eye; usually two maxillary teeth, rarely one or three; premaxillary and mandibular teeth similar, their margins rounded, the median cusp slightly the larger, five, very rarely six, teeth in the premaxillary; mandibular teeth eight to ten; the premaxillary teeth slightly directed backward, the teeth in the largest specimen (6854a) are much broader, more symmetrical, and the differences between the points are very slight, the smallest specimen, from the same locality has fewer points and the median point is distinctly more prominent. Gill rakers 7 + 10.

Origin of dorsal a little nearer end of adipose than to tip of snout; highest dorsal ray equals length of head; adipose fin well-developed; origin of anal below tip or middle of last dorsal ray, the fin emarginate, its base equalling length of head or a little more; tip of ventrals to the anal or to the third scale in front of it; origin of ventrals under, or slightly in advance of, the origin of the dorsal; the pectorals to the ventrals, or to the third scale in front of them.

Scales thin, regularly imbricate; lateral line but little decurved; caudal naked; anal with a few scales forming a sheath in front.

A silvery lateral band ending in a large, oval spot on the caudal peduncle, which extends a little upon the middle caudal rays and sometimes entirely across the end of the peduncle.

52. *Odontostilbe pulchra* (Gill.) (Plate XVII, fig. 1.)

Pocilurichthys pulcher Gill, Ann. Lyc. Nat. Hist., Vol. VI, 1858, p. 59 (Trinidad).

Cheirodon (Odontostilbe) pulcher Lütken, Overs. Dan. Selsk., 1874, p. 236.

Odontostilbe pulcher Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 54; Eigenmann, Reports Princeton Univ. Exped. Patagonia, Vol. III, 1910, p. 429.

Cheirodon pulcher Ulrey, Ann. N. Y. Acad. Sci., Vol. VIII, 1895, p. 290.

Chirodon pulcher Regan, Proc. Zool. Soc. London, 1906, p. 385 (Trinidad).

Range: Trinidad.

As far as known this species is confined to the Island of Trinidad. I have seen no specimens.

The following description is compiled from Regan's account:

Head 4.5–4.66; depth 2.5–2.75; D. 11; A. 23–25; scales 5.5–32 to 34–3.5–4.5, 4.5–5.5 between lateral line and anal. Snout .5 in the head, eye 2.5, interorbital 2.25.

Maxillary extending to the vertical from the anterior margin of eye. Origin of dorsal equidistant from snout and base of caudal, its height greater than head.

Pectorals extending to ventrals, origin of ventrals in advance of dorsal, extending nearly to the anal. Caudal peduncle as long as deep.

Olivaceous, sides silvery, or a silvery longitudinal stripe from operculum to base of caudal; an indistinct dark humeral spot; a blackish spot at the base of caudal, ending posteriorly in a point and margined with yellow above and below; dorsal and anal pink.

53. *Odontostilbe paraguayensis* Eigenmann & Kennedy. (Plate XVI, fig. 2; plate XVII, fig. 3.)

Odontostilbe paraguayensis Eigenmann & Kennedy, Proc. Acad. Sci. Phila., 1903, p. 512 (Asunción; Arroyo Trementina); Eigenmann, Ann. Carnegie Museum, Vol. IV, 1907, p. 125 (Corumbá); Reports Princeton Univ. Patagonia, Vol. III, 1910, p. 429.

Range: Paraguay basin.

9988, I. U. M., type, 40 mm. Asunción. J. D. Anisits.

10111, I. U. M., three, 40 mm. Arroyo Trementina. J. D. Anisits.

10178, I. U. M., five, Corumbá. J. D. Anisits.

6853a-m, C. M., fourteen, 22-39 mm. Asunción, March 29, 1909. J. D. Haseman.

This is the deepest of the species of *Odontostilbe*, greatly differing from the type, *O. fugitiva*, in depth.

Head 3.75-4.5; depth adult female 2.6, adult male 3; D. 11; A. 21-24; scales 6-32 to 35-4; eye 2.66-3 in head, about equal to interorbital; depth of caudal peduncle 2.66-3.25 in the greatest depth.

Compressed; dorsal and ventral profiles about equally curved, the depth increasing rapidly to the origin of dorsal and tapering to the slender caudal peduncle; pre-ventral area flat, with well marked lateral angles, with a perfect median series of eleven to thirteen scales, or but one scale disarranged; predorsal area keeled with about nine scales; occipital process pointed, reaching about one-fourth to the dorsal; skull smooth, convex, frontal fontanel a nearly equilateral triangle about one-third as long as the parietal fontanel without the groove; third suborbital leaving naked only a small wedge of the cheek behind its upper angle; postorbitals very thin, leaving this area practically naked; mouth small, maxillary reaching to, or not quite reaching, the vertical from the anterior margin of the eye, about half as long as eye; premaxillary with five or six sub-ovate teeth, each with a

prominent median cusp and four, rarely five, more or less graduate cusps on each side, the two edges of the teeth not quite symmetric; maxillary with two or three broad teeth; mandible with eight graduate teeth, the anterior ones very wide at the tip, contracted at the base, with a prominent median point and three or four slightly graduate points on each side of it, the tips of the lateral points forming a slight curve beyond which the median point projects somewhat, the median cusp at least twice as wide as the two cusps on either side of it; the edges of the teeth overlapping more and more toward the sides of the jaw. Gill-rakers 6 + 10.

Origin of dorsal about equidistant from tip of snout and tip of adipose, its height equal to the length of the head; adipose well-developed; caudal lobe a little longer than head; origin of anal about under vertical from tip of last dorsal ray, its margin nearly straight from the ninth ray, its base about equal to the head. Origin of ventrals about equidistant from snout, with the origin of the dorsal just reaching anal, or falling short of it by one scale; pectorals not quite reaching ventrals.

Lateral line nearly straight; scales everywhere regularly imbricate; caudal naked; anal with a few scales at the base of the anterior lobe; about six feeble interhemals; caudal in male without hooks or special scales.

A silvery lateral band; a conspicuous caudal spot, not continued to the middle of the central caudal rays; anterior margin of dorsal membrane dark.

54. *Odontostilbe madeiræ* Fowler.

Odontostilbe madeiræ Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 527 (tributary of the Rio Madeira near Porto Velho).

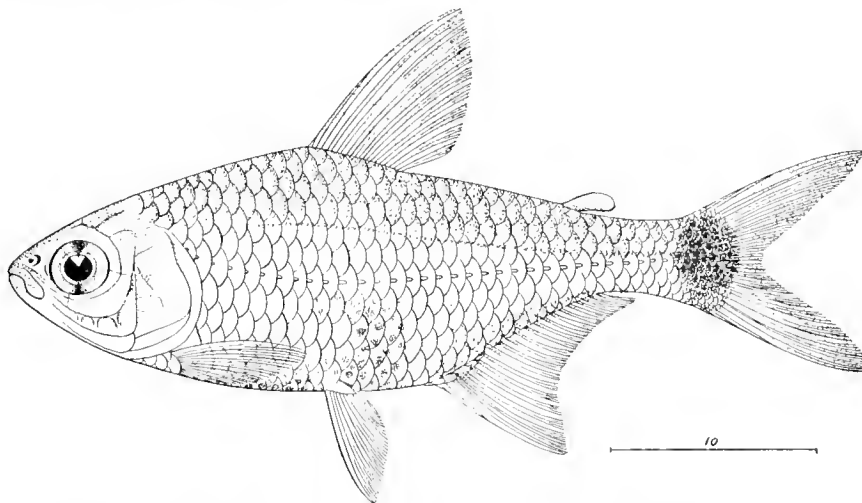


FIG. 36. *Odontostilbe madeiræ* Fowler. (After Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 527.)

Range: Madeira basin.

This species is known from the types only. It may be synonymous with *O. paraguayensis*.

Head 3.6; depth 2-7/8; D. 12; A. 23; scales 6-37-4; 11 predorsal scales; eye 3-1/8 in the head, maxillary 3-1/8, interorbital 3; height of dorsal 1; height of anal 1.4; depth of caudal peduncle 2.5; pectoral 1.25; ventral 1.4.

Compressed, elongately ovoid; mouth short, jaws thin; lips thin; maxillary reaching the eye; teeth broad, with seven denticles, of which the median largest; maxillary with two similar teeth; suborbitals entirely covering cheek.

Dorsal inserted nearly midway between tip of snout and end of adipose; origin of anal close behind vertical from end of dorsal, lowest edge of anal emarginate; ventrals inserted slightly behind origin of dorsal, extending to anal.

Margin of scales of back dusted, a patch of dusky dots above base of anal. Base of caudal with a large rounded spot about as large as eye. A dark line concurrent with vertebral axis from behind shoulder to caudal.

55. *Odontostilbe melandeta* Eigenmann.

Odontostilbe melandetus Eigenmann, Mem. Carnegie Mus., Vol. V, 1912, p. 312, Plate XLIV, fig. 3 (British Guiana, probably Rockstone on the Essequibo river).

Range: British Guiana.

1878, C. M., type, 27 mm.; 12160, I. U. M., two, paratypes, 27 and 35 mm.

British Guiana. Eigenmann.

Known only from the types. This species is more cylindrical, its scales firmer, its teeth smaller. It is quite possible that it represents the type of a distinct genus.

Head 3.75; depth 3.6; D. 10; A. 21; scales 4-34 or 35-3. Eye 2.5-2.7 in the head, interorbital but little narrower than the eye.

Minute, compressed, head bluntish, mouth terminal; a median series of ten scales in front of the dorsal. Maxillary very slender, reaching to below the eye; maxillary-premaxillary border as long as the eye; ten to fourteen teeth on the premaxillary, four to seven on the maxillary.

Scales very regularly imbricate, with concentric, but without longitudinal striæ; lateral line complete, scarcely decurved; anal naked; base of caudal with a few scales.

Gills well-developed; anal deeply emarginate; pectorals not quite reaching ventrals, ventrals not reaching anal.

No chromatophores on the sides; scales of the back with marginal series of chromatophores; a series of black specks along the base of anal; caudal peduncle margined with black.

APPENDIX.

Since the foregoing pages were sent to press the author has discovered among the material collected by Mr. Henn during his explorations in Ecuador an additional species, a description of which follows:

56. **Megalamphodus ecuadorensis** sp. nov.

13628, I. U. M. **Type**, about 28 mm., 20.5 mm. to base of caudal. Naranjito, Rio Chan Chan, Ecuador. Henn.

Of this species, the only one of the subfamily found on the Pacific slope of the northern half of South America, I have but a single, poorly preserved specimen. Head 3.4; depth about 3; D. ?; A. 23; Scales ?; eye 3 in the head, a little greater than the interorbital.

Compressed; dorsal and ventral outlines equally curved. Fontanels very large, the frontal fontanel entirely separating the frontal bones; third suborbital having only a narrow naked ridge behind it. Mouth large, the maxillary-premaxillary border longer than the eye. Seven or eight premaxillary teeth, which are slightly graduate; maxillary with two small teeth (on one side at least); mandible with about fifteen teeth, of which the first four or five are nearly equal in size, larger than the premaxillary teeth, the rest rapidly diminishing in size. Origin of the dorsal a little behind the middle, 12 mm. from the tip of the snout, 10.5 mm. from the base of the middle caudal rays; origin of anal on vertical from origin of dorsal; height of dorsal very nearly equal to length of head; pectorals extending beyond the base of ventrals, ventrals beyond origin of the anal. The scales are small. A well-defined, vertical humeral spot; margin of anal dark.

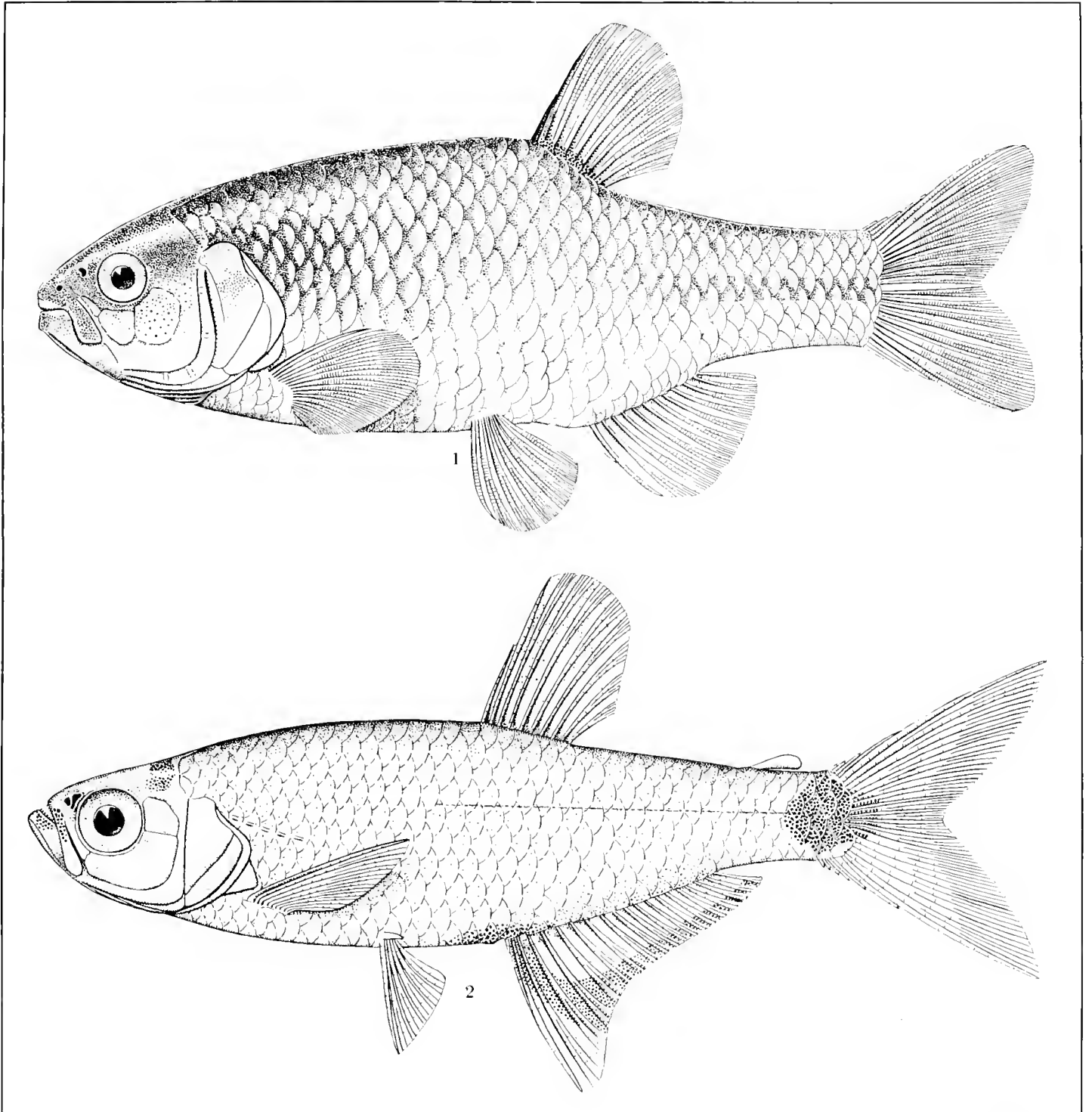
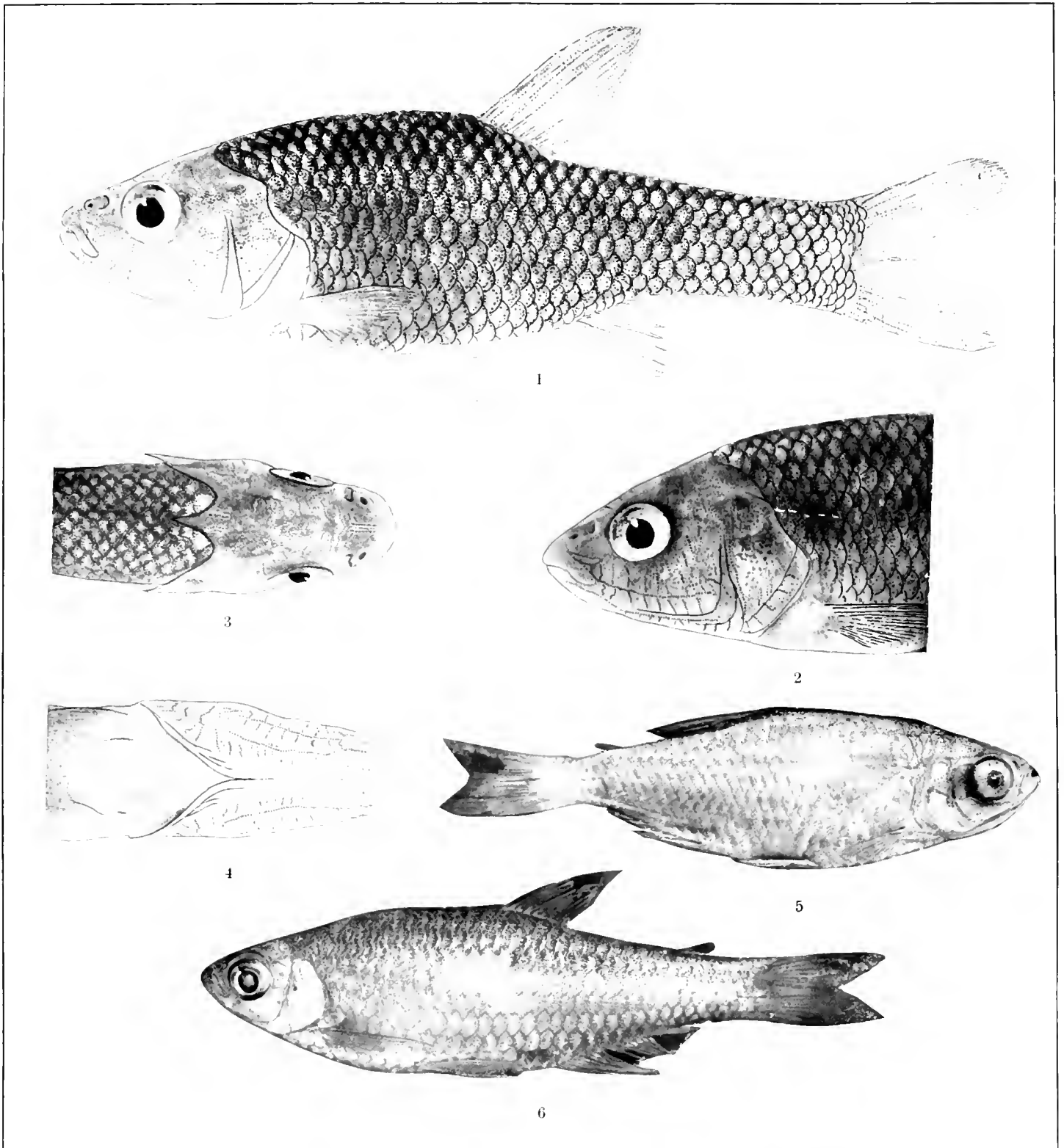


FIG. 1. *Grundulus bogotensis* (HUMBOLDT). 5084, C. M., 76 mm. Vicinity of Bogotá.

FIG. 2. *Aphyocharax paraguayensis* EIGENMANN. Type. 6096, C. M., 25 mm. Cáceres.



- FIG. 1. *Spintherobolus papilliferus* EIGENMANN. Type. 3882, C. M., 41 mm. Alto da Serra.
 FIG. 2. *Spintherobolus papilliferus* EIGENMANN. 3883a, C. M.
 FIG. 3. *Spintherobolus papilliferus* EIGENMANN. 3883a, C. M.
 FIG. 4. *Spintherobolus papilliferus* EIGENMANN. 3883a, C. M.
 FIG. 5. *Aphyocharax rathbuni* EIGENMANN. (Type of *A. stramineus* Eigenmann.) 10030, I. U. M. 25 mm. to base of caudal. Arroyo Trementina.
 FIG. 6. *Aphyocharax anisitsi* EIGENMANN & KENNEDY. Type. 10028, I. U. M., 41 mm. Asunción.

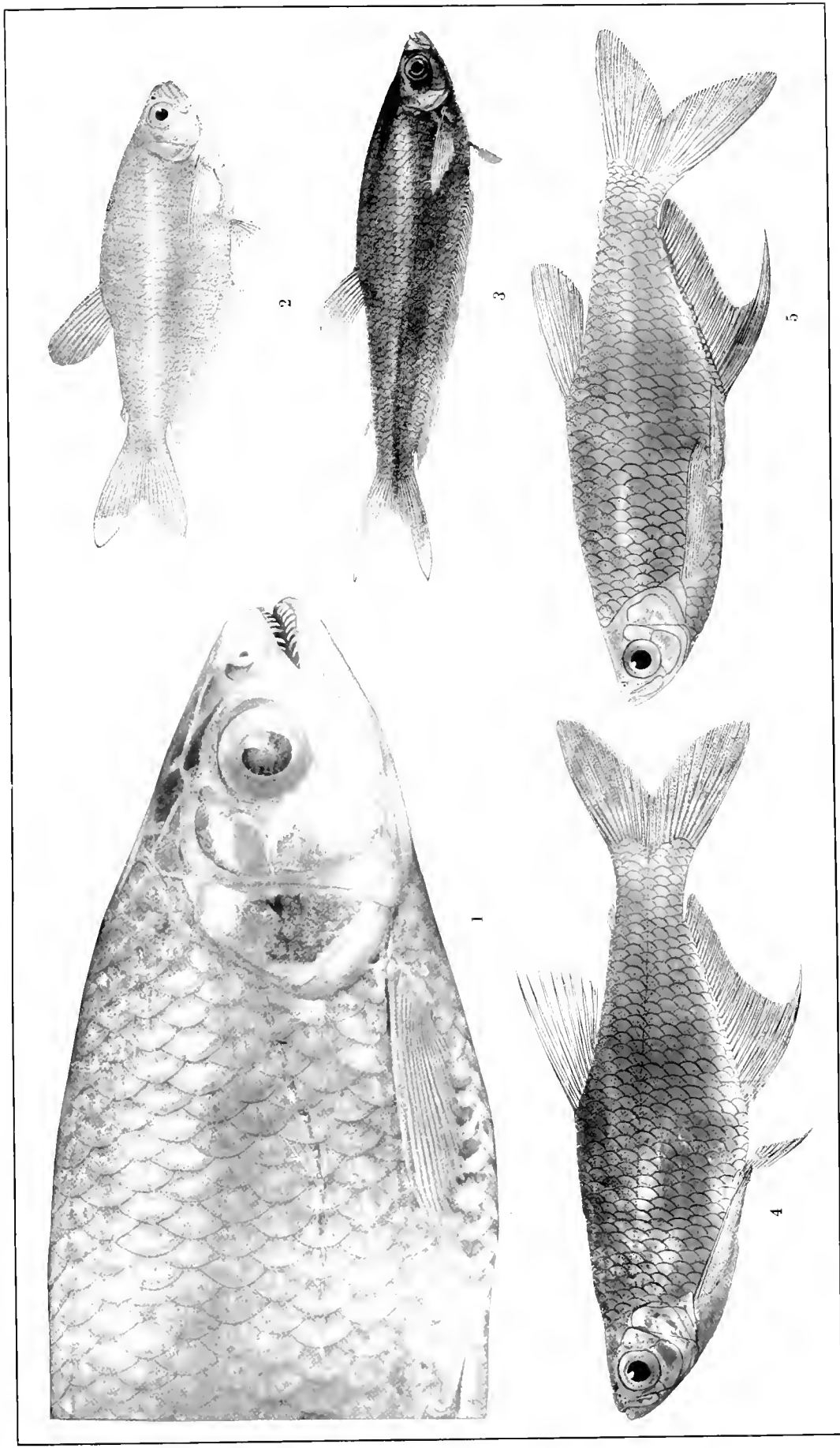


FIG. 1. *Aphycheilichthys dentatus* EIGENMANN & KENNEDY. Type. 10032, I. U. M., 71 mm. Asunción.
FIG. 2. *Paragoniates alburnus* STEINDACHNER. (After Steindachner.) 77 mm.
FIG. 3. *Leptagoniates steindachneri* Boulenger. (After Boulenger.) 95 mm.
FIG. 4. *Prionobrama filigerus* (Cope). 5497, C. M., 54 mm. Santaren.
FIG. 5. *Prionobrama paraguayensis* (Eigenmann). 5499, C. M. Corumbá.

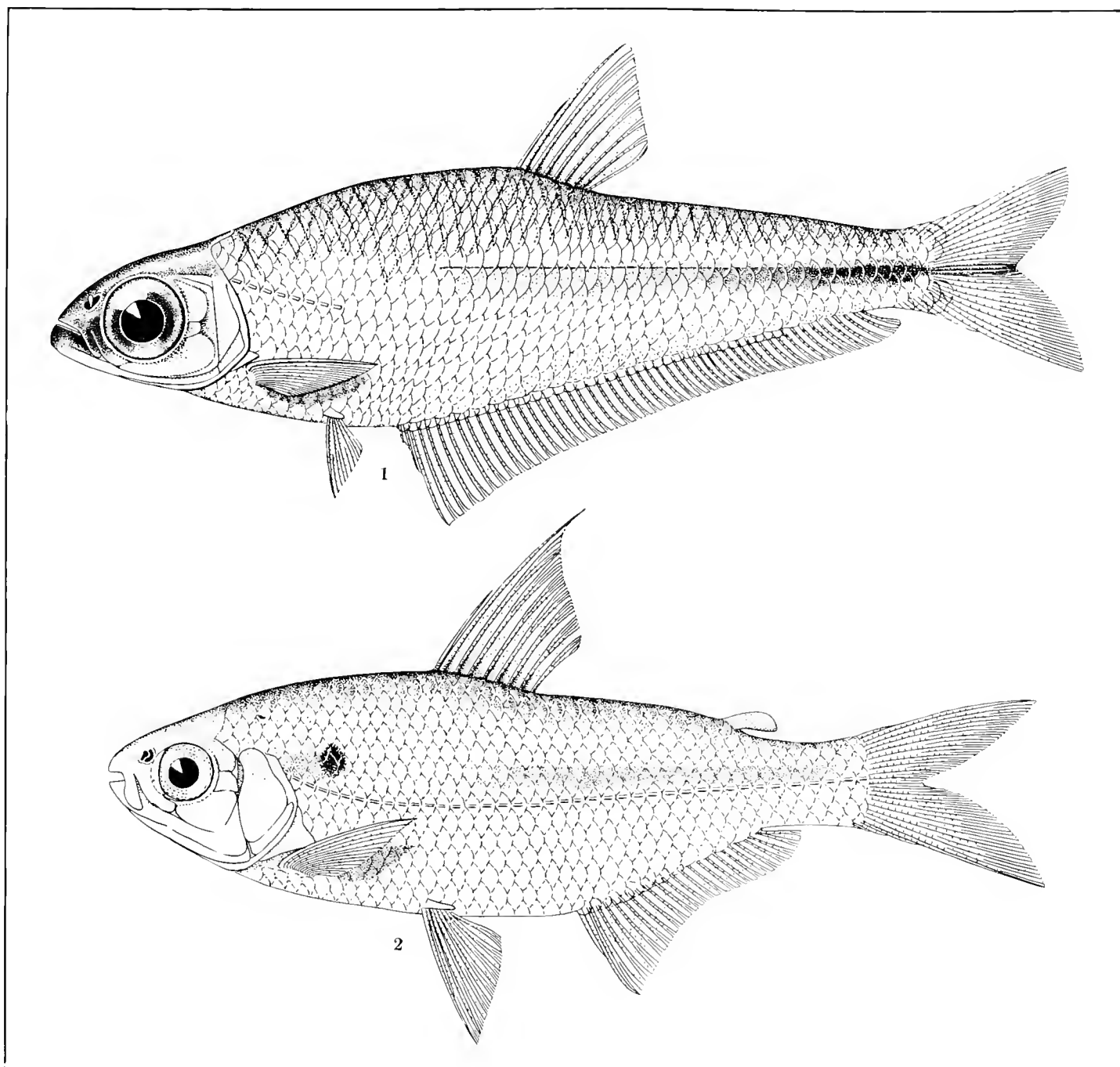


FIG. 1. *Phanagoniates wilsoni* EIGENMANN. Type. 5354, C. M., 41 mm. Manigru.

FIG. 2. *Parecbasis cyclolepis* EIGENMANN. Type. 5495, C. M., 74 mm. San Antonio de Rio Madeira.

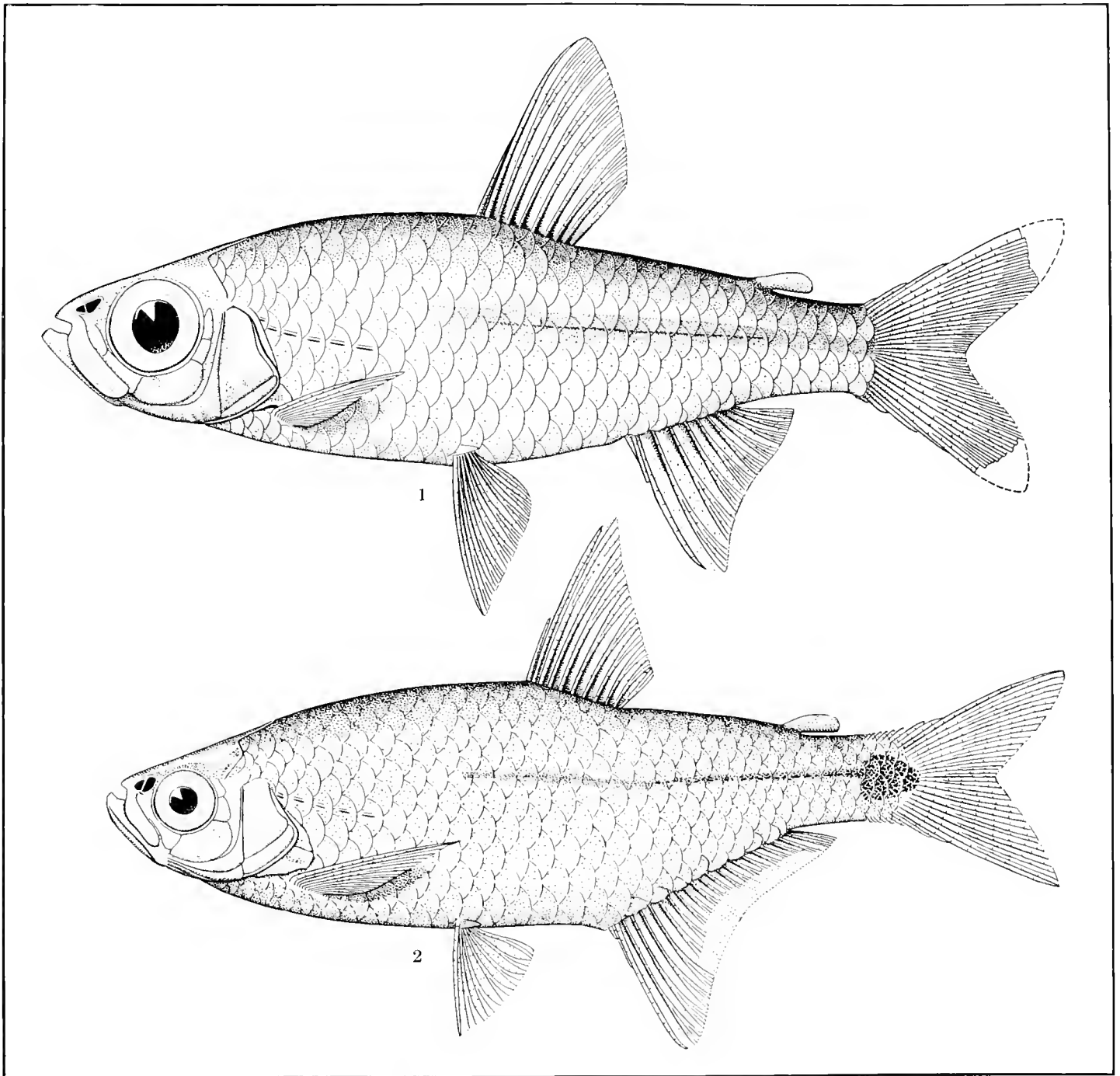
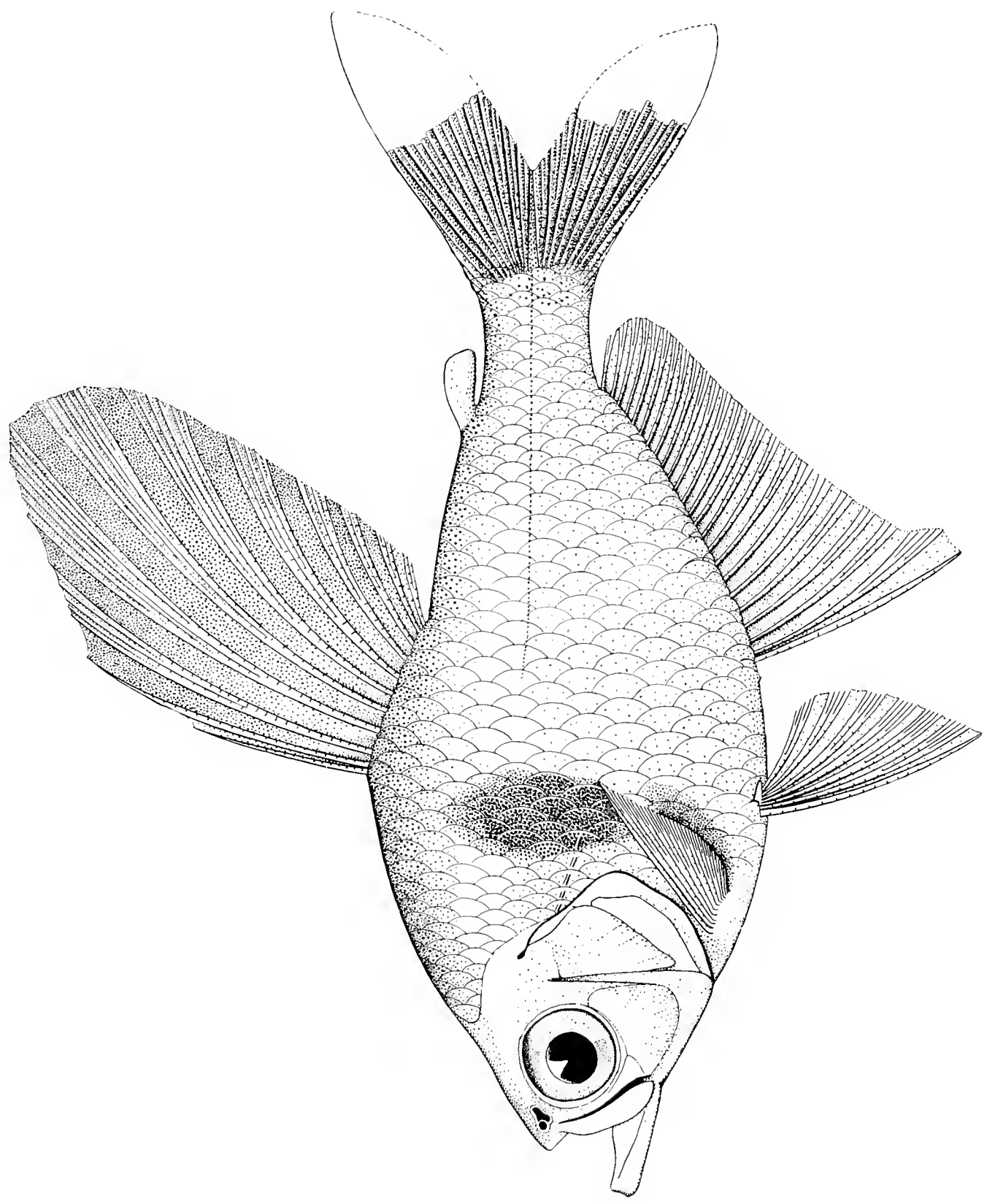


FIG. 1. *Leptobrycon jatuarana* EIGENMANN. Type. 20952, M. C. Z., 29 mm. to base of caudal. Jatuarana.
FIG. 2. *Macropsobrycon uruguayana* EIGENMANN. Type. 6895, C. M., 46 mm. Caequy.



Megalampodus megalopterus EIGENMANN. Type. 6806, C. M., 35 mm. Caceres.

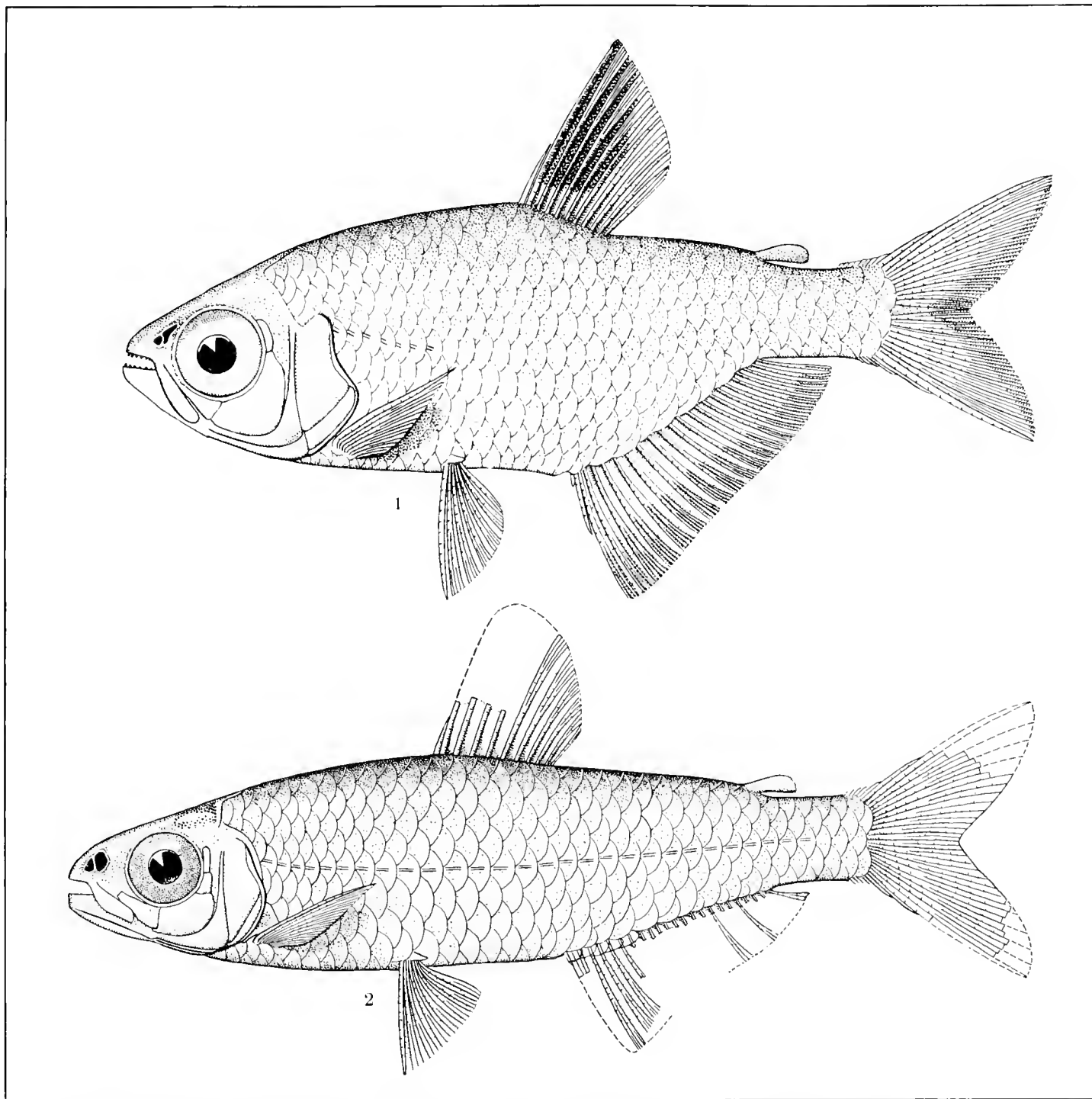


FIG. 1. *Megalamphodus micropterus* EIGENMANN. Type. 6900, C. M., 30 mm. Lagoa do Porto, Basin Rio S. Francisco.
FIG. 2. *Microchemobrycon guaporensis* EIGENMANN. Type. 6910, C. M., about 37 mm. Maciél.

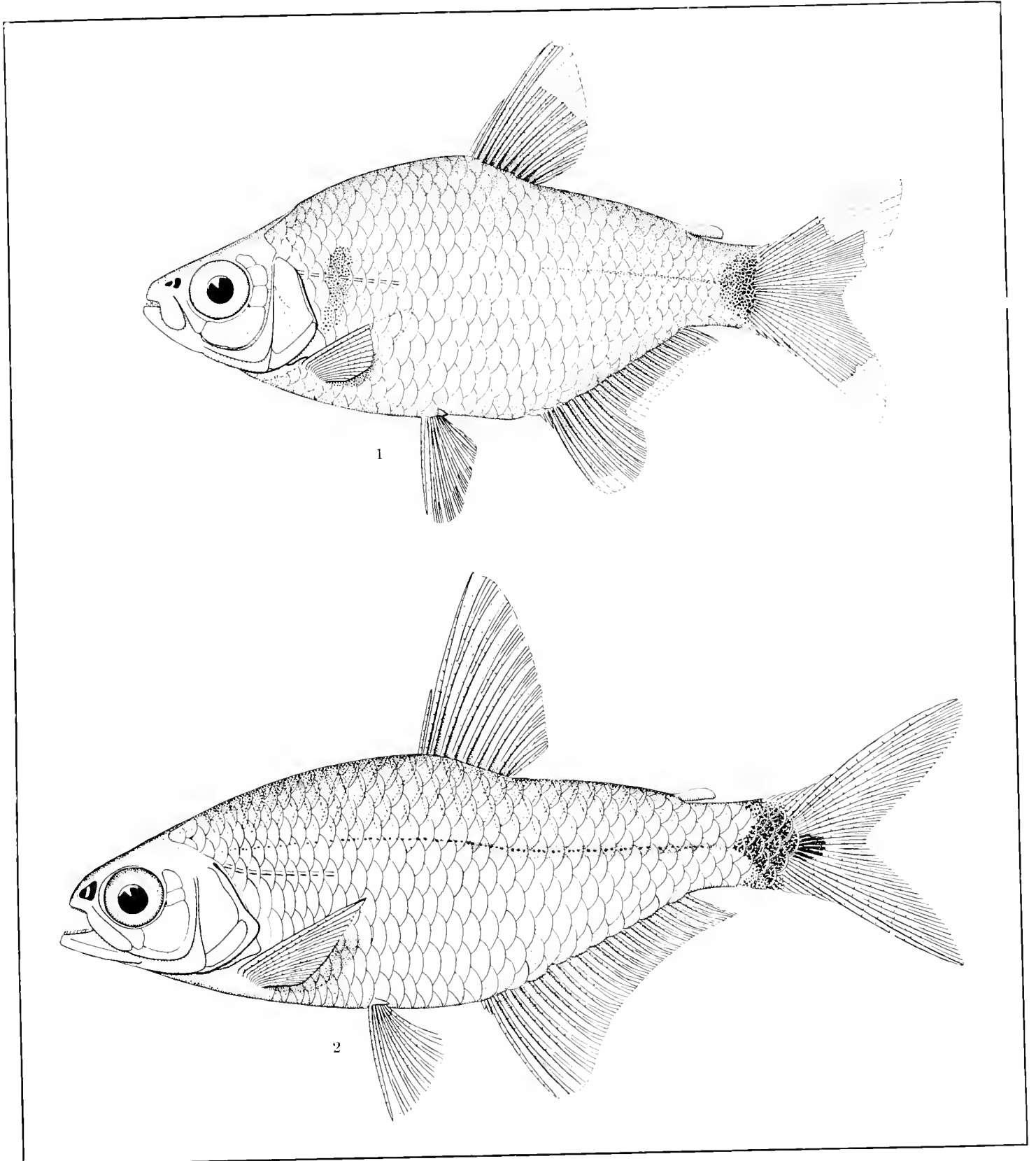


FIG. 1. *Oligobrycon microstomus* EIGENMANN. Type. 6898, C. M., 39 mm. Jacarehy, Rio S. Francisco.
FIG. 2. *Aphyocheirodon hemigrammus* EIGENMANN. Type. 6802, C. M., 45 mm. Jacquara.

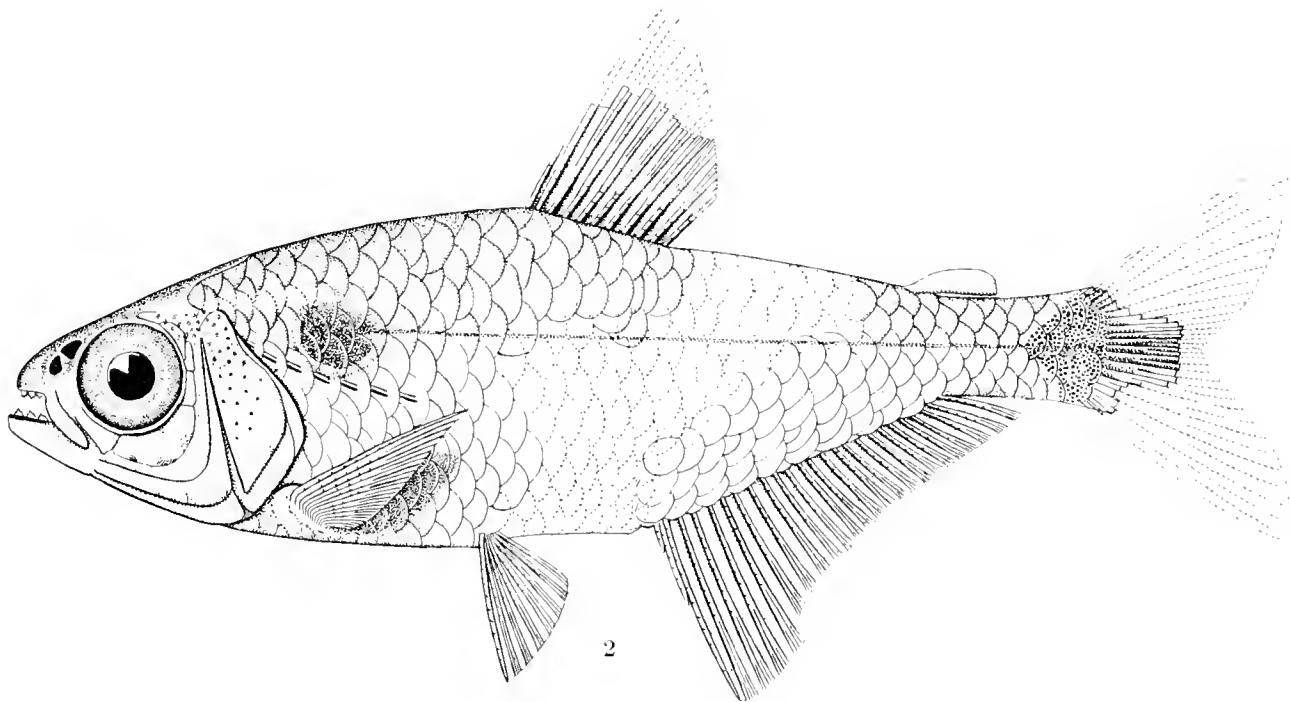
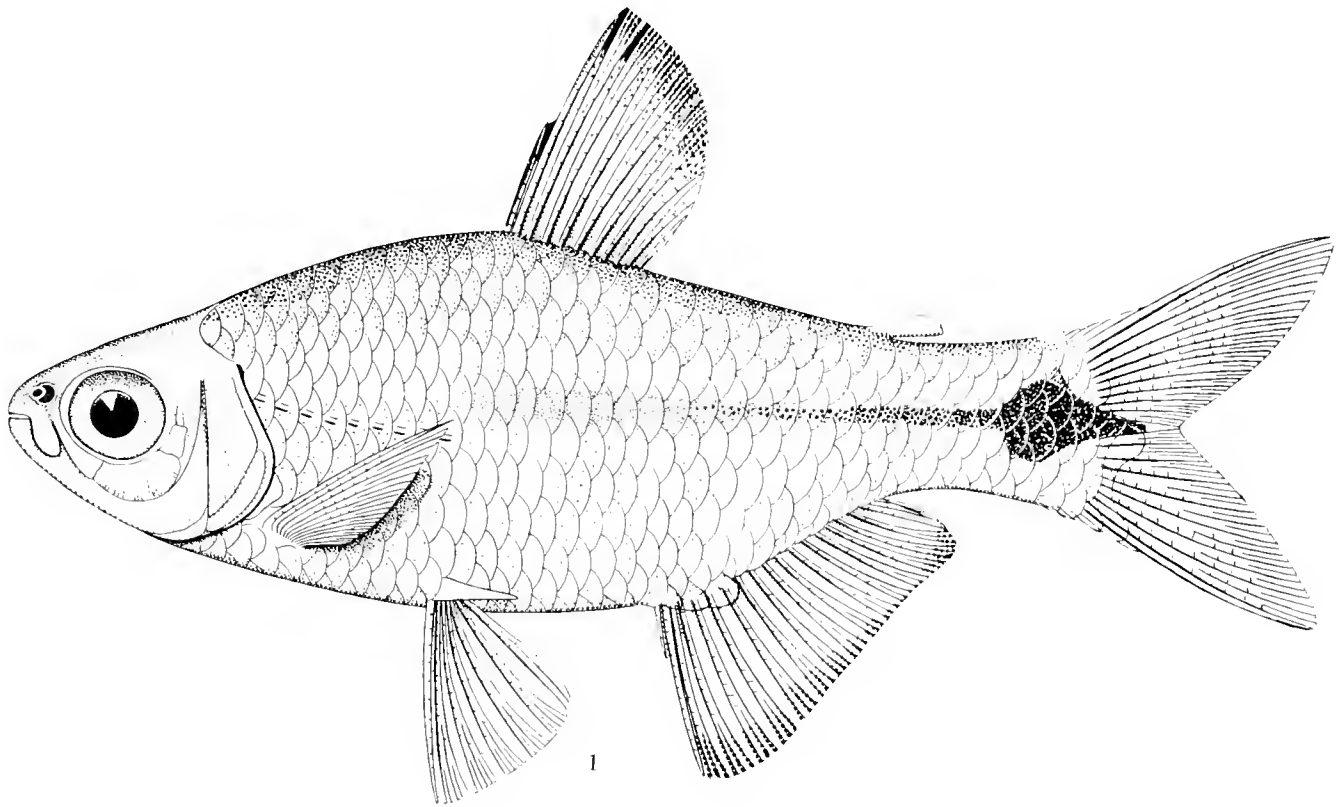


FIG. 1. *Compsura heterura* EIGENMANN. Type, ♂. 6808, C. M., 36 mm. Queimadas Rio Itapicuerú.
FIG. 2. *Mixobrycon ribeiroi* EIGENMANN. Type. 10229, I. U. M., 35 mm. to base of caudal. Puerto Max, Paraguay.

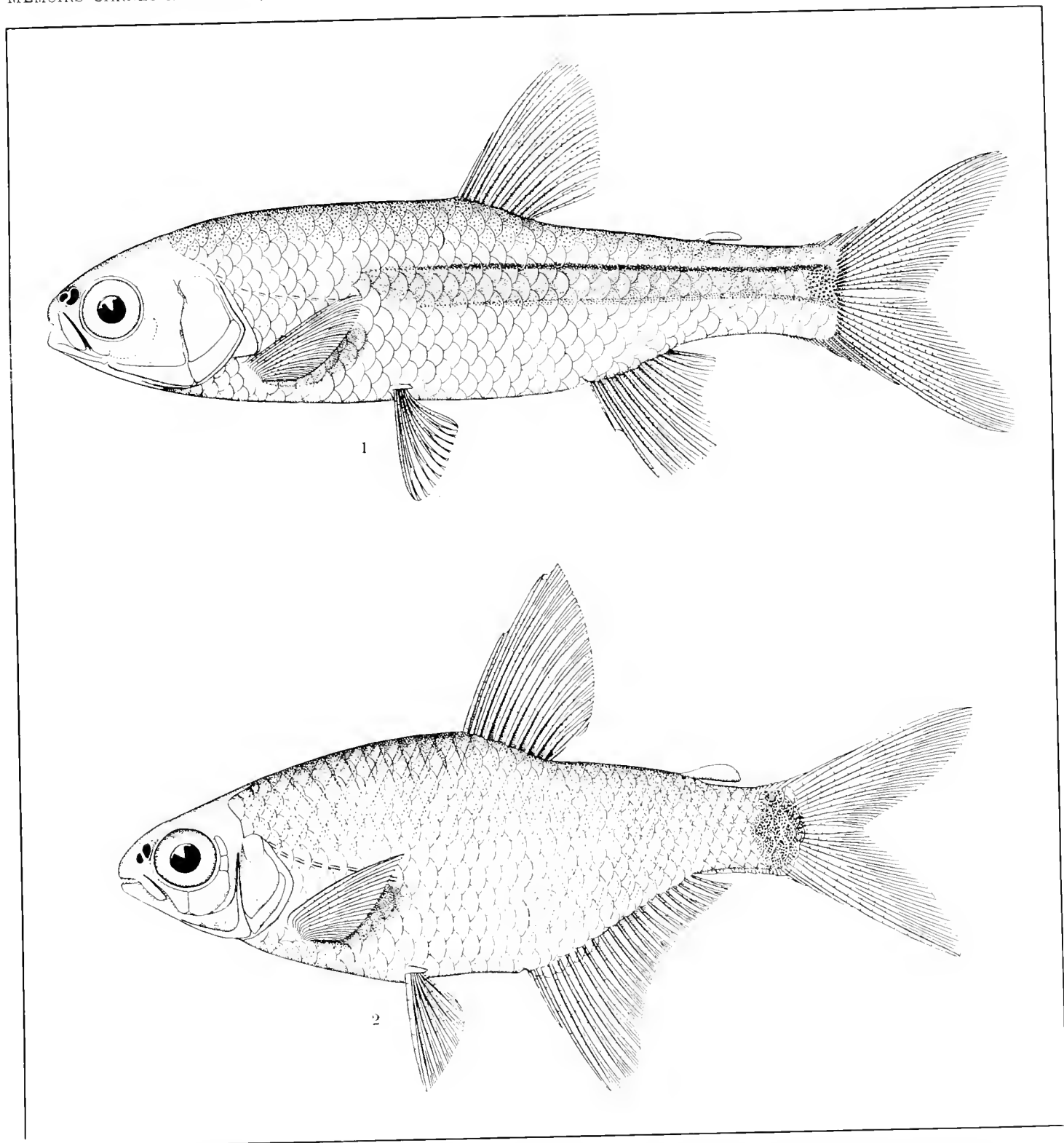


FIG. 1. *Cheirodon anna* McATEE. 4301, I. U. M., 41 mm. S. America. Exact locality unknown.
FIG. 2. *Cheirodon paratyba* EUGENMANN. Type. 6841, C. M., 38 mm. Campos, on R. Paratyba.

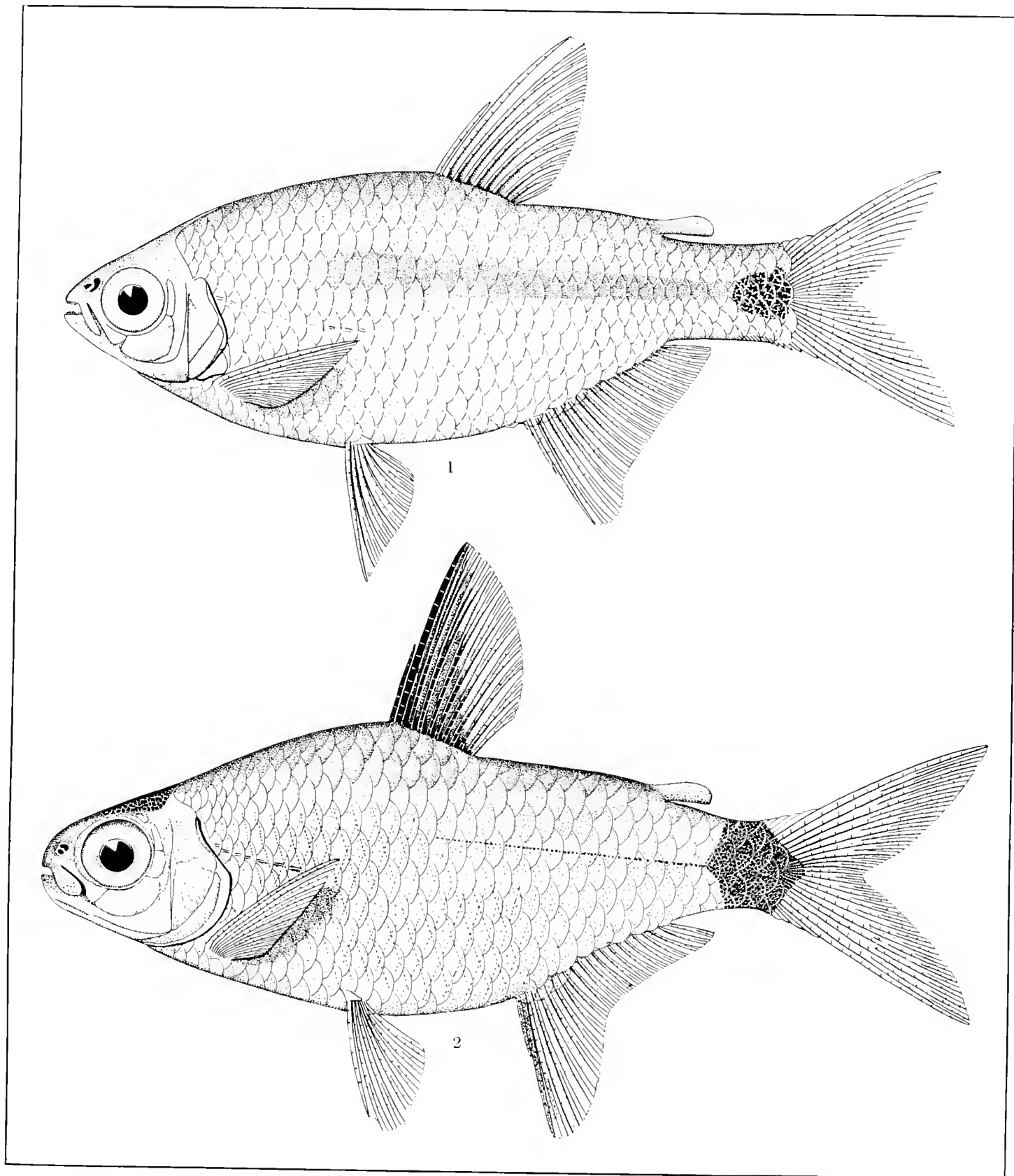


FIG. 1. *Cheirodon interruptus* JENYNS, ♀. 6818, C. M., 44 mm. Cachocira, R. Jacuhy, R. Grande do Sul.
FIG. 2. *Cheirodon notomelas* EIGENMANN. Type, ♀. 6812, C. M., 35 mm. Miguel Calmon.

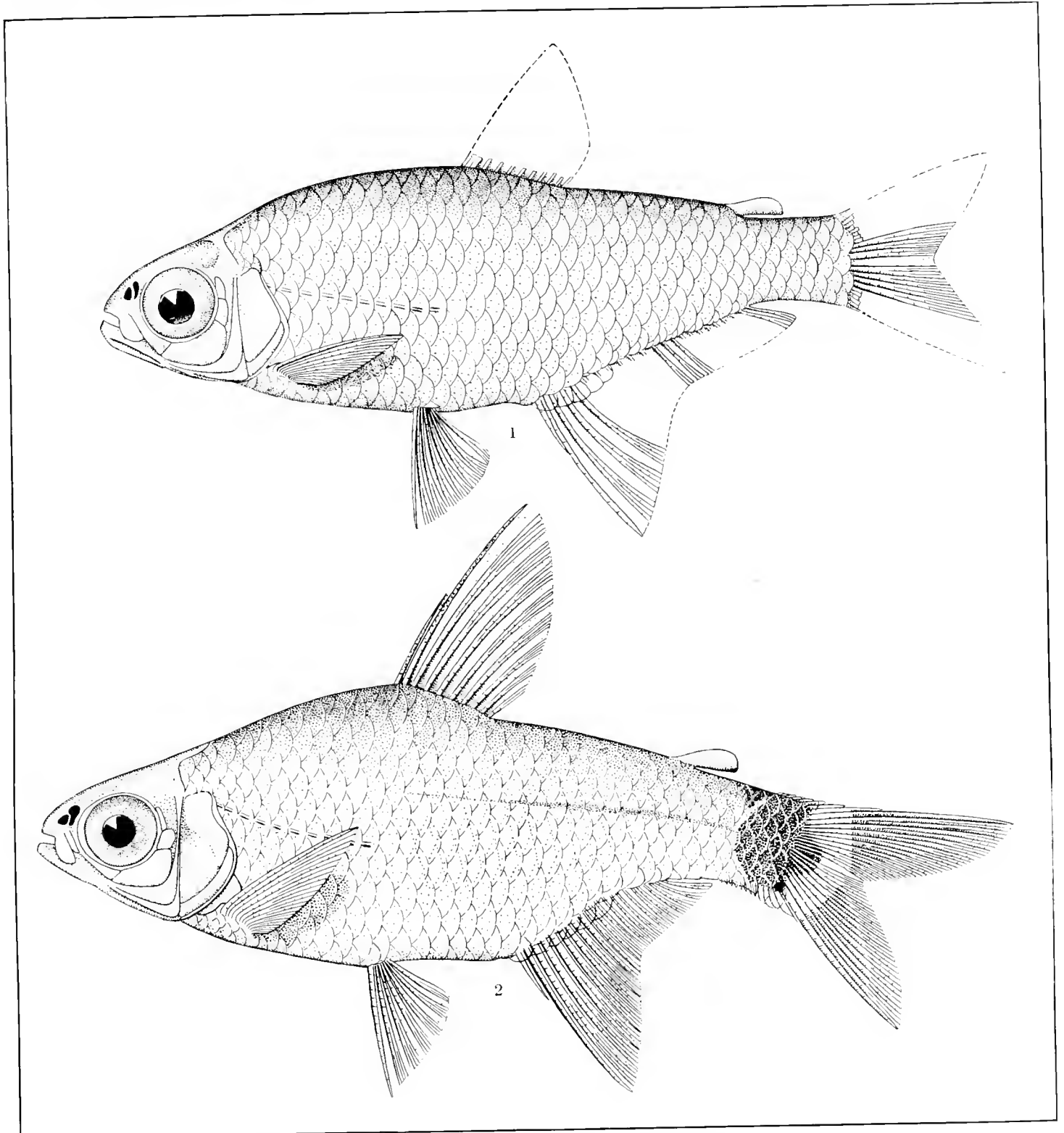


FIG. 1. *Cheirodon madcini* EIGENMANN. Type. 6847, C. M., 32 mm. San Joaquín.
FIG. 2. *Cheirodon piaba* LÜTKEN, ♂. 6822, C. M., 40 mm. Corumbá.

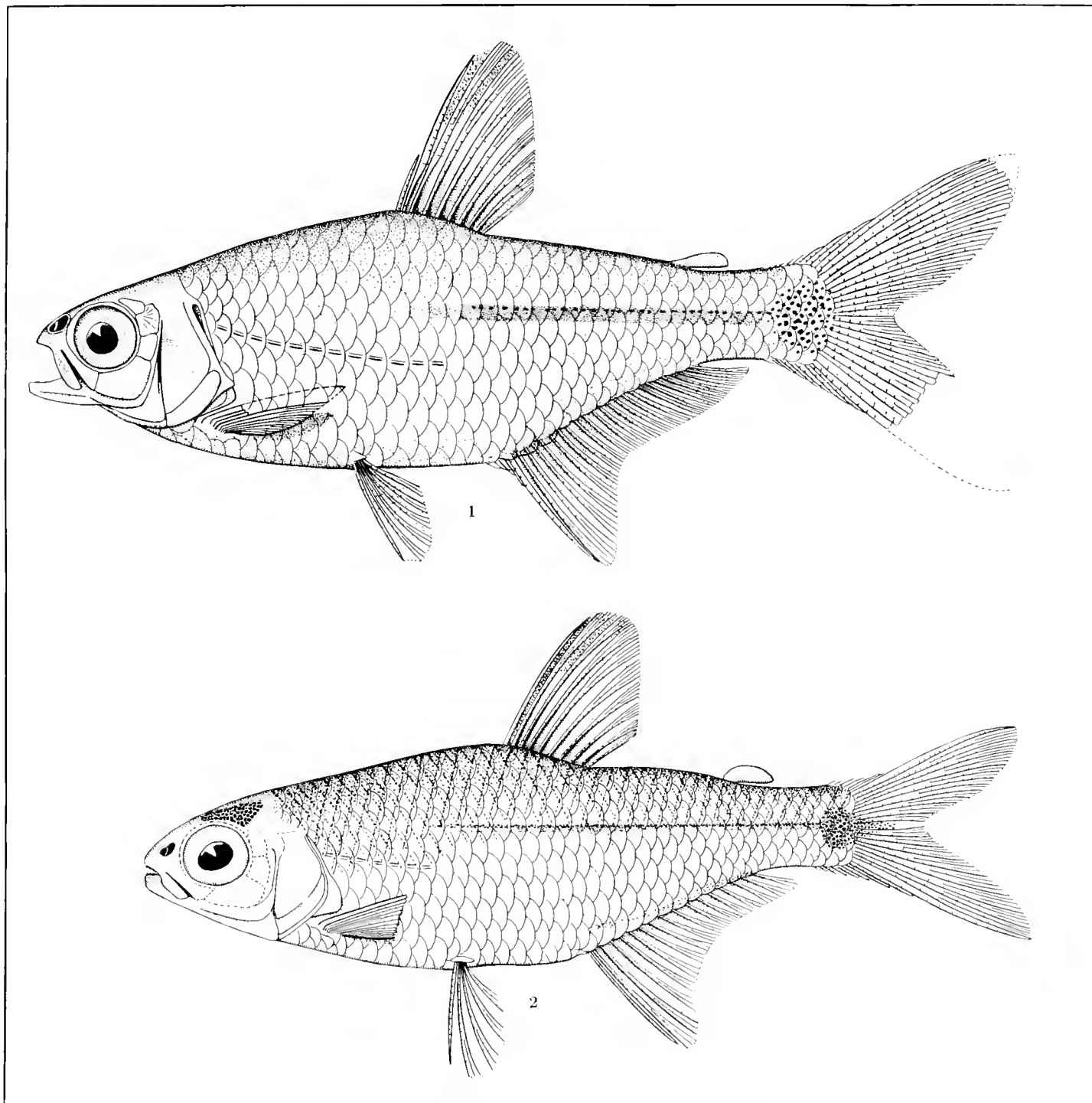


FIG. 1. *Cheirodon microdon* EIGENMANN. Type, ♀. 6850, C. M., 42 mm. Caceres.
FIG. 2. *Cheirodon stenodon* EIGENMANN. Type. 6848, C. M., 33 mm. Bebedouro.

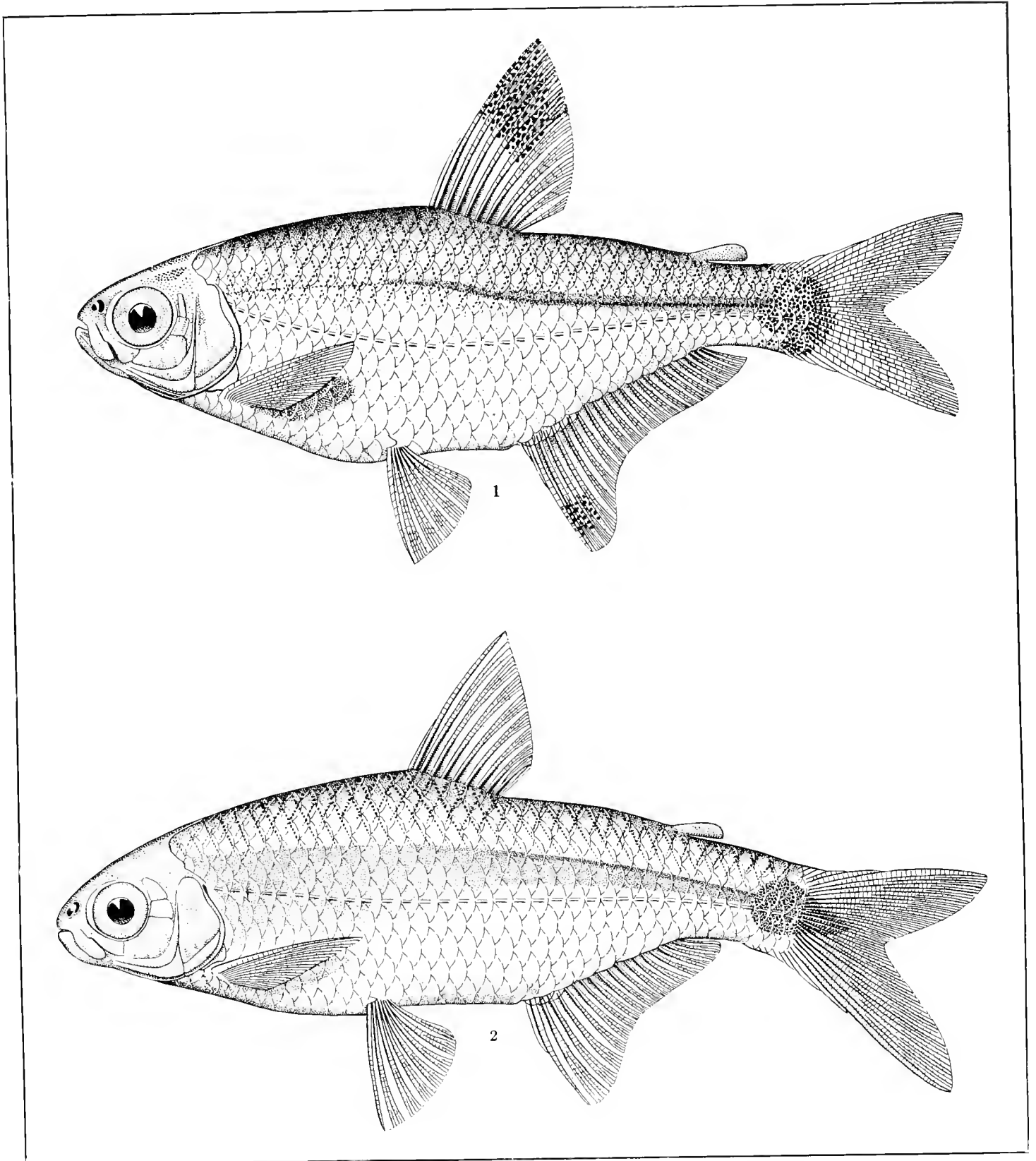


FIG. 1. *Holesthes pequirá* (Steindachner). 6857, C. M., 44 mm. Villa Hays.

FIG. 2. *Holesthes heterodon* EIGENMANN. Paratype. 6876, C. M., about 46 mm. Jaguará.

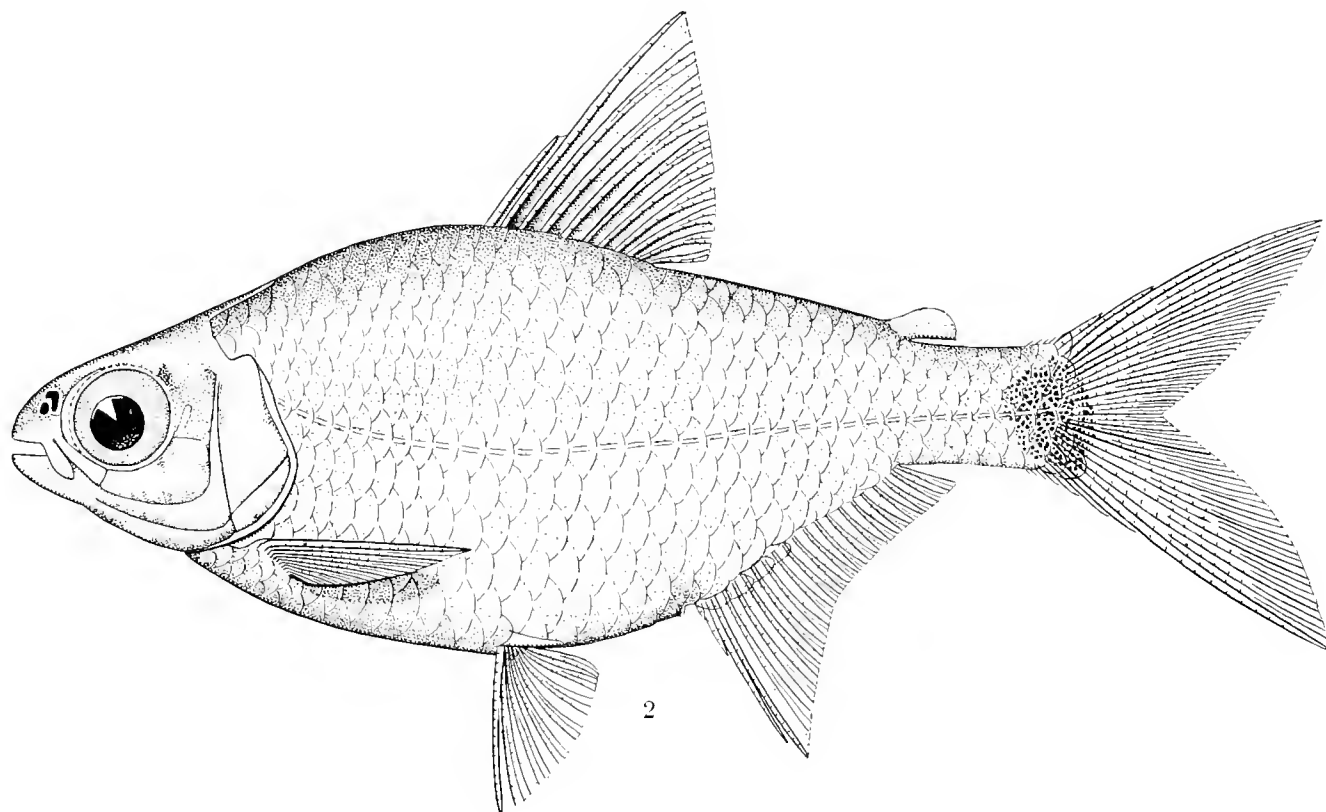
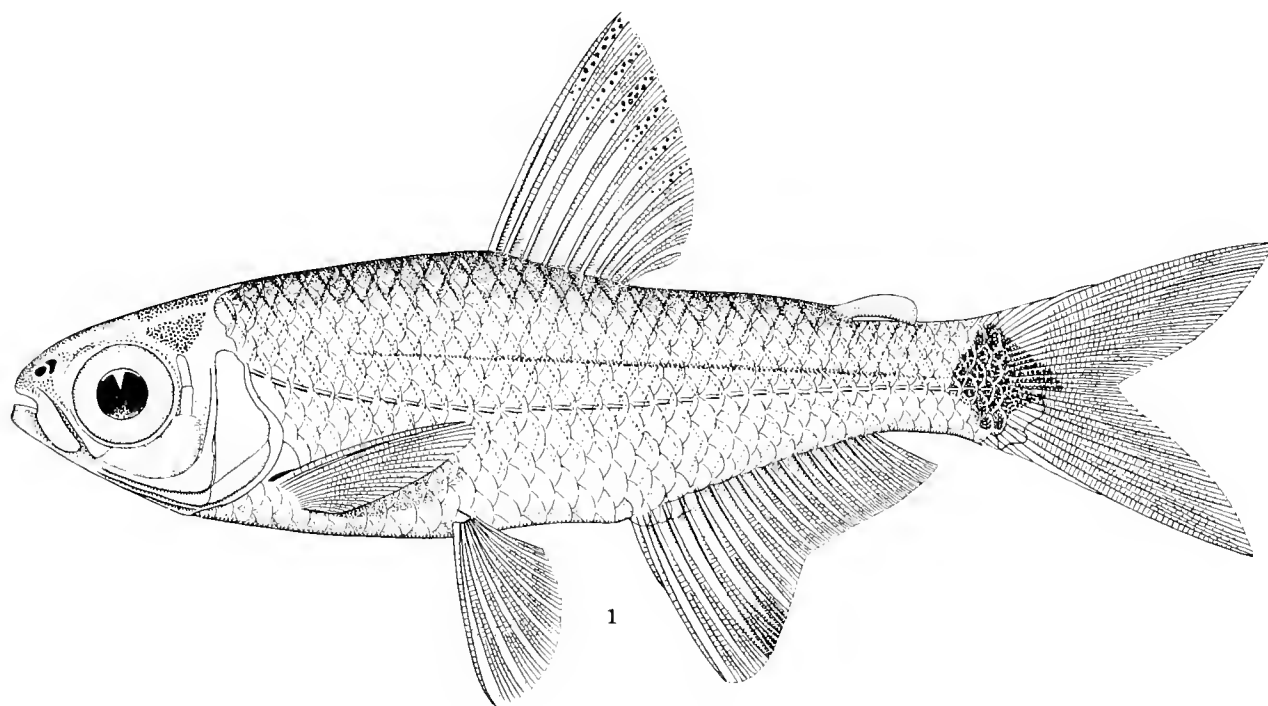
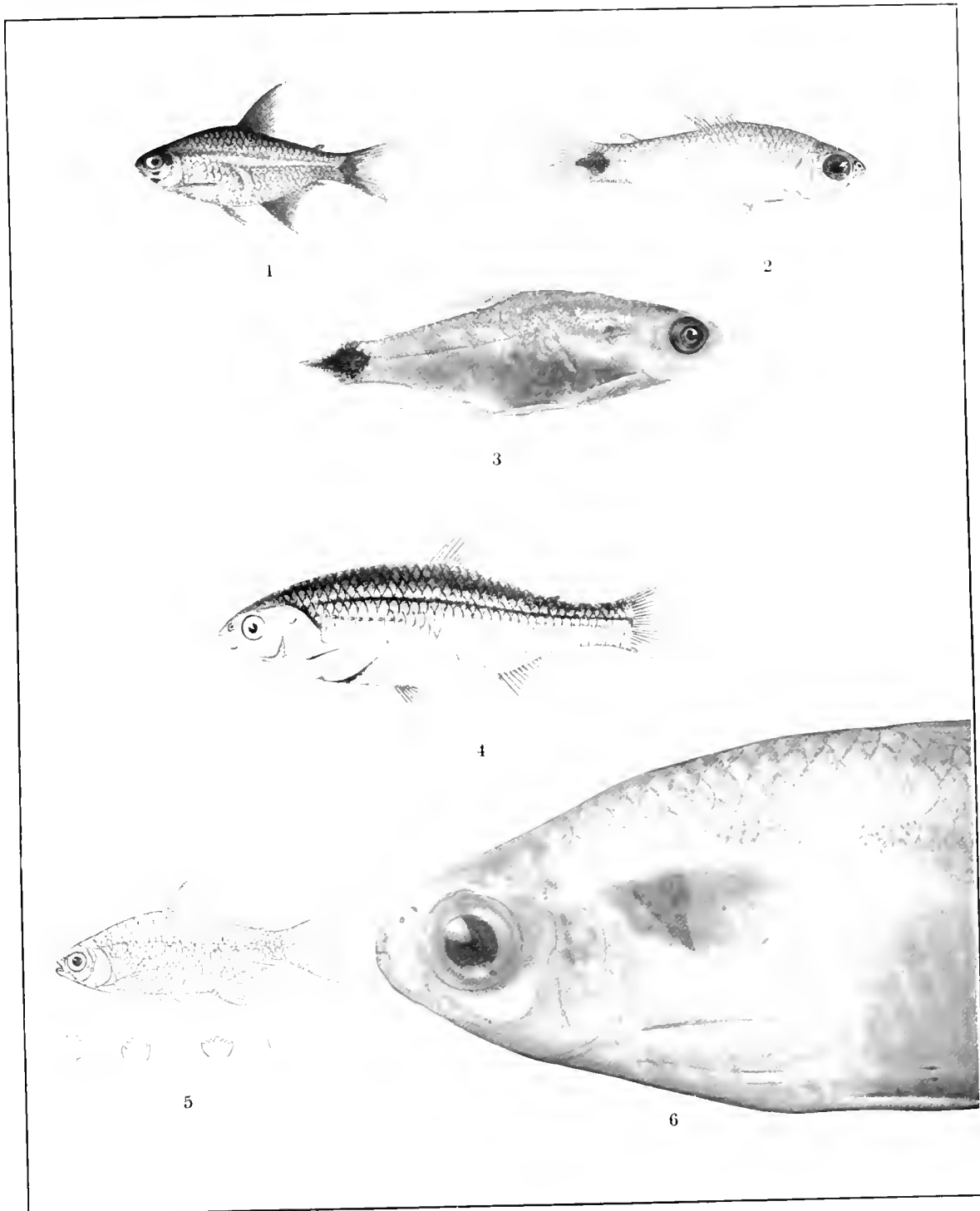


FIG. 1. *Odontostilbe hastata* EIGENMANN. 5366, C. M., 30 mm. Rio Truando, Colombia.
FIG. 2. *Odontostilbe paraguayensis* EIGENMANN & KENNEDY. 6853, C. M., 36 mm. Asunción.



- FIG. 1. *Odontostilbe pulchra* (Gill). (After Regan.)
 FIG. 2. *Cheirodon insignis* STEINDACHNER. (After Steindachner.)
 FIG. 3. *Odontostilbe paraguayensis* EIGENMANN & KENNEDY. 10178, I. U. M.
 FIG. 4. *Cheirodon pisciculus* GIRARD. (After Girard.)
 FIG. 5. *Cheirodon piaba* LÜTKEN. (After Lütken.)
 FIG. 6. *Cheirodon piaba* LÜTKEN. 10121, I. U. M. (Greatly enlarged to show the pseudo-tympanum.)

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Nos. 1-12. See preceding lists. (<i>Out of print.</i>)	16. Osteology of <i>Psittaci</i> . SHUFELDT35
12. Skeleton of <i>Titanotherium dispar</i> . HATCHER.. \$.35	17. Annotated Catalogue of Genus <i>Partula</i> . H. H. SMITH 1.25
13. Fore Limbs and Manus of <i>Brontosaurus</i> . HATCHER ..... .60	18. Two New Bahaman Lepidoptera. HOLLAND ... .10
14. The Trachodontidæ. HATCHER ..... .25	19. <i>Elosaurus Parvus</i> . PETERSON & GILMORE .... .15
15. New Pennsylvania Thorns. ASHE ..... .25	20. Boundary Controversy Between Pennsylvania and Virginia, 1748-1785. CRUMRINE ..... .30

MEMOIRS
 OF THE
 CARNEGIE MUSEUM.

VOL. VII.

NO. 2.

THE FOSSIL TURTLES OF THE UINTA FORMATION.

BY CHARLES W. GILMORE.

The finest and most complete assemblage of the remains of fossil turtles as yet secured from the Upper Eocene of the Uinta formation has been brought together in the Carnegie Museum through the activities of its various expeditions to Utah. By the kindness of Dr. William J. Holland, the Director of the Museum, I have been permitted to study this collection, and the present paper presents the results of my investigations.

The collection comprises more than fifty individuals, and was made by field-parties conducted by Messrs. Earl Douglass and O. A. Peterson and as an incidental part of their search of the Uinta exposures for the remains of extinct mammals. An important feature of this collection is the determination of the exact geological horizons in which the specimens were found, thus establishing a firm foundation for future correlative work.

The chelonian fauna of the Uinta formation is of peculiar interest, since it marks the last appearance of several forms which had their beginning, so far as our present records go, in the Upper Cretaceous and Lower Tertiary. Of the six genera recognized in the present collection from the Uinta formation only three, *Anosteira*, *Amyda*, and *Testudo*, are known to pass upward into the younger Tertiaries. *Anosteira* is known from the Lower Oligocene of England, *Amyda* reappears in the Miocene of the Atlantic coast, while *Testudo* is found in the overlying Oligocene. It appears that the Uinta thus marks an important stage in the history of the chelonian life of the Upper Eocene.

The Baënidæ make their last appearance. The Dermatemydidæ are rep-

resented for the first time by the single genus and species *Anosteira ornata* Leidy. The Emydidae, suggestive of swampy conditions, in the number of species are the most abundant turtles in the present collection. Seven species have been recognized and larger collections will doubtless add several more to the list. The soft-shelled river-turtles, Trionychidae, indicative of flowing water, are represented by at least three species, one of which is as large as the existing Asiatic species. The presence of true land-tortoises, Testudinidae, is represented by three species of the genus *Hadrianus*, which includes tortoises some of which attain a length of more than three feet, and the genus *Testudo* by a single species, the first recorded occurrence, in North America, of this genus below the Oligocene. The discovery of the fossil remains of the lizard-like reptile *Glyptosaurus* in the Uinta according to Osborn¹ "hints as to the Floridan or south temperate conditions of climate."

There were a considerable number of specimens in the collection which were too fragmentary for specific determination, and in two instances at least I am inclined to the opinion, that, had better material been available, distinctive characters would have been found to show the presence of additional species new to the fauna.

I take this opportunity to protest most emphatically against the establishment of new species of turtles based upon inadequate specimens, for it certainly cannot serve any useful purpose to burden the literature with a lot of useless and meaningless names. The difficulties encountered in the present study, in recognizing to which species certain specimens belonged, when almost perfect individuals were at hand, shows the futility of naming scraps with which subsequently discovered material can never with absolute confidence be identified. There are perhaps some few exceptions, for occasionally a fragmentary specimen is found which shows a sculpture, or some character of such striking peculiarity, as to make it stand out distinctly from all previously described forms. The present study has demonstrated that a considerable variation within the limits of a species is to be expected, and, until the range of these variations is determined, it is quite useless to describe new forms based upon some small part of the carapace or plastron, which shows some slight difference from described forms, when the very next specimen discovered may have these same features and yet have other characters to be found in an adequate specimen, which show it to belong to a well-established species.

I wish also to protest against the practice of naming species simply because the specimen comes from a formation from which the genus to which it belongs has not previously been recognized. In other words it is assumed that 'it is not

¹ Osborn, H. F., "Age of Mammals," 1910, p. 160.

likely that a species known from a lower horizon continues over into a higher horizon,' therefore a hunt for characters to separate it from the other species of the genus is instituted, with the result that minor differences are magnified to represent specific differences, when, had the specimen come from a formation in which species of the genus were already known, it would in all probability have found a resting-place within one of the described species.

In order to facilitate comparisons of the descriptions here given with those of other described forms I have closely followed the order of arrangement used by Hay in his monographic study of the fossil turtles of North America.

At this point I wish to acknowledge the assistance rendered me while this paper was in the course of preparation. First of all I express my gratitude to Dr. W. J. Holland for his hearty coöperation at all times, for the privilege granted me of studying this fine collection of fossil turtles, and for his editorial oversight of the work. I am under obligations to Dr. W. D. Matthew, of the American Museum of Natural History, New York, for the loan of type-specimens, and to Dr. O. P. Hay, to whom, because of his wide knowledge of the turtles, I am especially indebted for invaluable advice upon numerous occasions. The text-figures were made by the well-known artist, Mr. Rudolph Weber, the photographs are by Mr. Arthur Coggeshall, of the Carnegie Museum.

GEOLOGICAL OCCURRENCE.

All of the specimens considered in the present paper are from the Uinta formation as exposed in the Uinta Basin at the southern base of the Uinta Mountains, and from that part of the basin which lies within Uinta County, Utah. The geological positions of the various specimens as here given were taken from the original field-labels which accompanied each specimen, so that these determinations are wholly the work of Messrs. Earl Douglass and O. A. Peterson, whose long experience in the field insures the accuracy of their observations.

In 1895 the Uinta formation was divided by Peterson² into three levels, or horizons, designated as follows, A (Lower), B (Middle), and C (Upper) Uinta.

The remains of turtles have now been found in all three horizons, though judging from the present collection, individuals occur most abundantly in Horizon B, but the number of species recognized in the collection is about evenly divided between Horizons B and C. Up to the present time only one species is known from Horizon A. Douglass³ has pointed out that "the lower portions of these deposits may be, and probably are, contemporaneous with portions of deposits in the

² Peterson, O. A., Bull. Amer. Mus. Nat. History, VII, 1895, p. 74.

³ Douglass, Earl, Bull. Geol. Soc. of America, vol. 25, 1914, p. 418.

Bridger and Washakie Basins and with other deposits elsewhere." If this be the true condition, it may to some extent account for the presence of many species common to the two formations.

Below is given a list of the identified species occurring in each of the three subdivisions of the Uinta formation.

HORIZON A (LOWER UINTA).

Baëna inflata sp. nov.

HORIZON B (MIDDLE UINTA).

<i>Baëna arcuosa</i> Leidy,	<i>E. hollandi</i> sp. nov.,
<i>B. emiliæ</i> Hay,	<i>E. uintensis</i> Hay,
<i>B. inflata</i> sp. nov.,	<i>Hadrianus utahensis</i> sp. nov.,
<i>B. platyplastrum</i> sp. nov.,	<i>Testudo uintensis</i> sp. nov.,
<i>B. gigantea</i> sp. nov.,	<i>Amyda egregia</i> Hay,
<i>Echmatemys callopyge</i> Hay,	<i>A. scutumantiquum</i> (Cope).

HORIZON C (UPPER UINTA).

<i>Baëna emiliæ</i> Hay,	<i>Hadrianus corsoni</i> (Leidy),
<i>Echmatemys douglassi</i> sp. nov.,	<i>H. robustus</i> sp. nov.,
<i>E. depressa</i> sp. nov.,	<i>Anosteira ornata</i> Leidy,
<i>E. obscura</i> sp. nov.,	<i>Amyda</i> sp.,
<i>E. pusilla?</i> Hay,	<i>Glyptosaurus</i> sp. indet.

Six genera and twenty species are recognized in the present collection, whereas in 1908, at the time Doctor O. P. Hay published his "Fossil Turtles of North America" only four genera and five species were accredited to the Uinta formation. These were as follows:

<i>Baëna emiliæ</i> Hay,	<i>Hadrianus tumidus</i> Hay,
<i>Echmatemys callopyge</i> Hay,	<i>Amyda crassa</i> Hay.
<i>E. uintensis</i> Hay,	

The two latter species have not been recognized in the present collection, although each of the others is represented by from two to six individuals, so that altogether six genera and twenty-two species of fossil turtles have now been found in the Uinta formation. The known geological range of these species is graphically shown in the accompanying table.

GEOLOGICAL RANGE OF RECOGNIZED SPECIES.

Name.	Wasatch.	Bridger.				Uiuta.			Oligocene.
		A	B	C	D	A	B	C	
Baënidæ:									
<i>Baëna arenosa</i> Leidy,	×		×		×		×		
<i>B. emiliae</i> Hay,							×	×	
<i>B. inflata</i> sp. nov.,						×	×		
<i>B. platyplastra</i> sp. nov.,							×		
<i>B. gigantea</i> sp. nov.,							×		
Dermatemydidae:									
<i>Anosteira ornata</i> Leidy,		×	×	×					×
Emydidae:									
<i>Echmatemys callopyge</i> Hay,							×		
<i>E. douglassi</i> sp. nov.,									×
<i>E. hollandi</i> sp. nov.,							×		
<i>E. depressa</i> sp. nov.,									×
<i>E. obscura</i> sp. nov.,									×
<i>E. pusilla?</i> Hay,			×						×
<i>E. uintensis</i> Hay,							×		
Testudinidae:									
<i>Hadrianus corsoni</i> (Leidy),			×						×
<i>H. utahensis</i> sp. nov.,									×
<i>H. robustus</i> sp. nov.,									×
<i>Testudo uintensis</i> sp. nov.,							×		
Trionychidae:									
<i>Amyda egregia</i> Hay,					×		×		
<i>A. erassa</i> Hay,							×		
<i>A. scutumantiquum</i> (Cope),			×				×		
Lacertilia:									
<i>Glyptosaurus</i> sp. indet.,			×					×	×

SUMMARY OF MATERIAL FORMING THE COLLECTION OF TURTLES FROM THE UINTA FORMATION IN THE CARNEGIE MUSEUM.

	Catalog No.	Geol. Horizon.
Baënidæ:		
<i>Baëna arenosa</i> Leidy,	2356	B.
<i>B. emiliae</i> Hay,	2159	B.
<i>B.</i> "	3243	B.
<i>B.</i> "	3253	C.
<i>B.</i> "	3257	B, or C.
<i>B.</i> "	3443	B lower.
<i>B.</i> "	3444	B lower.
<i>B. gigantea</i> sp. nov.,	3441	B lower.
<i>B. inflata</i> sp. nov.,	3406	A.
<i>B.</i> "	3137	B.
<i>B.</i> "	3442	B lower.
<i>B. platyplastra</i> sp. nov.,	3227	B.
<i>B.</i> sp. indet.,	2372	B.
<i>B.</i> " "	3246	?
<i>B.</i> " "	3255	B.
<i>B.</i> " "	3247	?
<i>B.?</i> " "	3271	B.
<i>B.?</i> " " (skull)	2956	C.
<i>B.</i> " "	3447	B lower.

Dermatemydidae:		
<i>Auostreira ornata</i> Leidy,	2954	C.
Emydidae:		
<i>Echmatemys callopyge</i> Hay,	2157	B.
<i>E. " "</i>	2371	B.
<i>E. douglassi</i> sp. nov.,	3244	C?
<i>E. depressa</i> sp. nov.,	2936	C.
<i>E. hollandi</i> sp. nov.,	3249	B.
<i>E. obscura</i> sp. nov.,	3252	C.
<i>E. psilla?</i> Hay,	3282	C.
<i>E. nintensis</i> Hay,	3270	B.
<i>E. " "</i>	2158	B, or C.
<i>E. " "</i>	2397	B?
<i>E. sp. indet.,</i>	2393	B.
<i>E. " "</i>	2361	B.
<i>E. " "</i> (skull and neck)	2387	B.
Testudinidae:		
<i>Hadrianus corsoni</i> (Leidy),	3403, 3404	C.
<i>H. robustus</i> sp. nov.,	3342	C.
<i>H. utahensis</i> sp. nov.,	2343	B, or C.
<i>H. sp. indet.,</i>	2376	B.
<i>H. " "</i>	3256	B, or C.
<i>Testudo nintensis</i> sp. nov.,	2331	B.
Trionychidae:		
<i>Amyda egregia</i> Hay,	3254	B.
<i>A. " "</i>	3258	B.
<i>A. scutumantiquum</i> (Cope),	3272	B.
<i>A. " "</i>	3330	?
<i>A. sp. indet.,</i>	3254	B.
<i>A. " "</i>	3177	C.
<i>A. " "</i>	2981	C.
<i>A. " "</i>	3260	C.
<i>A. " "</i>	3134	B.
<i>A. " "</i>	3050	C.
<i>A. " "</i>	3019	B.
<i>A. " "</i>	3245	C.
<i>A. " "</i>	3285	C.
<i>Incerte sedis:</i>		
Gen. and sp. indet.,	2394	B.
" " " "	2374	B.
Fragments of <i>Baena</i> , <i>Amyda</i> , etc.,	3250	C.
Gen. and sp. indet.,	2982	C.
" " " "	2395	B.
" " " "	3445	B?
Anguicide:		
<i>Glyptosaurus</i> sp. indet.,	3405	C.

Family BAËNIDÆ Cope.

In the present collection from the Uinta formation of Utah nineteen specimens were sufficiently well preserved to be identified as pertaining to the genus *Baëna*. These were found in all three subdivisions of the Uinta, being distributed as follows: one specimen, *Baëna inflata*, from Horizon A; thirteen from Horizon B; two from horizon C; and three for which the data for the horizon were uncertain, or not given.

Five species of this genus are now recognized as occurring in the Uinta formation, three of which are here described as new. Only one of the recognized species, *Baëna arenosa*, is found to occur in other geological epochs, and no member of this family is known to range above the Uinta.

Genus BAËNA Leidy.

1. *Baëna arenosa* Leidy.

Plate XVIII, fig. 1; text-fig. 1.

Baëna arenosa LEIDY, Proc. Acad. Nat. Sci. Phila., 1870, p. 123; U. S. Geol. Surv. Wyoming, etc., 1870 (1871), p. 367; U. S. Geol. Surv. Montana, etc., 1871 (1872), p. 368; Contrib. Ext. Vert. Fauna West. Terrs., 1873, pp. 161, 343, pl. 13, figs. 1-3; ?pl. 15, figs. 1-5; pl. 16, figs. 8, 9.—COPE, ?Append. LL of Ann. Report Chief of Engineers, 1875, p. 96; ?Wheeler's Surv. 100th Merid., 1877, p. 52, pl. 24, fig. 32.—BAUR, Proc. Acad. Nat. Sci. Phila., 1891, p. 426.—HAY, Bibliog. and Cat. Foss. Vert. N. A., 1902, p. 437; Foss. Turtles of N. A., 1908, pp. 67-71, pl. 12; pl. 13, fig. 1; pl. 14, figs. 1-3, text-figs. 44-51.
Baëna affinis LEIDY, Ann. Report U. S. Geol. Surv. Wyoming, etc., 1870 (1871), p. 367.

This species is represented in the collection by a single specimen, Cat. No. 2356. Collected by Earl Douglass and party, June 18, 1908, from Horizon B, Uinta formation, Upper Eocene, east of Dragon-Vernal road between White and Green Rivers, Uinta Basin, Uinta County, Utah.

The specimen consists of a fairly complete carapace, lacking the posterior borders and the peripherals of both sides, the plastron lacks portions of both anterior and posterior lobes. It represents an individual of approximately the same size as the type of the species (Cat. No. 103, U. S. National Museum), with which it has been carefully compared. This comparison shows several differences, but such as exist are not considered of sufficient importance to separate the specimens specifically. The sculpture of the carapace is rough and uneven, consisting

of various longitudinal, transverse and oblique ridges, especially within the areas of the vertebral scutes, this part of the carapace being fairly smooth in the type.

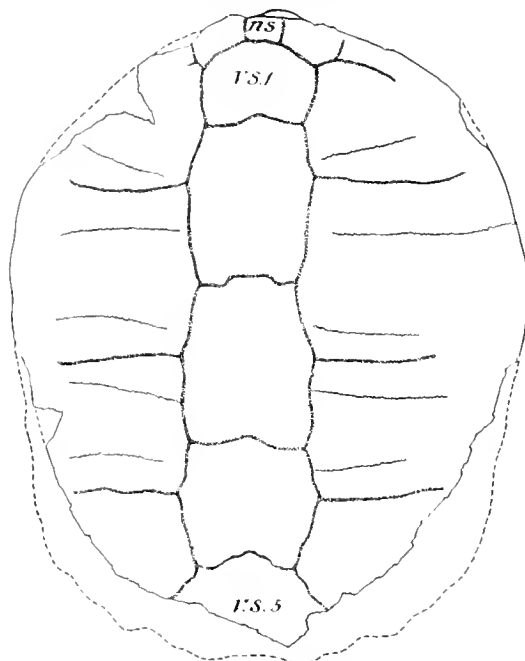


FIG. 1. Carapace of *Baëna arenosa* Leidy. C. M. No. 2356. $\times \frac{1}{4}$. ns., neural scute; v.s. 1-v.s. 5, vertebral scutes one and five.

In the measurements of the vertebral scutes it also differs from the type, but agrees almost exactly with the type of *Baëna affinis* Leidy, which is now regarded by Hay, following Leidy and Cope, as being a synonym of *B. arenosa*. The vertebral areas of this type are also in accord with the present specimen. In order to show the close agreement of the present individual with the above-mentioned specimens a table giving the comparative measurements of the vertebral scutes of each is herewith appended.

COMPARATIVE MEASUREMENTS OF VERTEBRALS.

	Length.			Width.		
	No. 2356.	Type of <i>B. arenosa</i> .	Type of <i>B. affinis</i> .	No. 2356.	Type of <i>B. arenosa</i> .	Type of <i>B. affinis</i> .
1	44	—	50	57	—	72
2	76	77	73	62	73	61
3	76	74	73	64	77	64
4	60	61	60	68	78	63
5	—	68	55	88	96	75

Since the anterior portion of the carapace is missing in the type of the species and in all subsequently discovered specimens the complete anterior margin in the

present specimen is therefore worthy of brief description. The nuchal scute is small, having a length of 12 mm., and a transverse diameter of 17 mm. The median part of the anterior border projects slightly beyond the general contour of the shell. The nuchal is flanked on either side by small rectangular marginals. The arrangement and proportions of the scutes in front of the first vertebral are very similar to those of *Baëna antiqua* Lambe.

This specimen shows many of the sutures between the costals, but on the median dorsal surface their complete coalescence renders it impossible to differentiate the neurals. There are no supernumerary costal scutes on either side of the first vertebral such as found in many species of this genus and occasionally in individuals pertaining to the present species.

The plastron agrees almost exactly with the type in size and proportions, and especially in the sculpture of the surface and the course of the various sulci. The accompanying table gives a comprehensive comparison of the principal measurements of the plastra.

COMPARATIVE MEASUREMENTS OF PLASTRA.

	No. 2356.	Type of <i>B. arenosa</i> .	Type of <i>B. affinis</i> .
Width of bridge.....	145	140	125
Length of anterior lobe.....	82	77	77
Width of anterior lobe.....	108	107	104
Width of posterior lobe.....	96	98	114

The discovery of the present specimen in the Uinta formation of Utah increases somewhat the known geographical as well as the geological range of *Baëna arenosa*. The type of the species is from the Bridger deposits at the junction of the Big Sandy and Green rivers in southeastern Wyoming. Hay⁴ has identified this species from the Washakie, the uppermost division of the Bridger. The type of *B. affinis* is from level B, of the Bridger, which represents the middle of that formation. Both Cope and Hay have identified specimens from the Wasatch of New Mexico as pertaining to this species, these being the most ancient known at the present time. With a geological range beginning in the Wasatch and ending in the middle of the Uinta, *Baëna arenosa* enjoys the distinction of having the widest geological distribution of any species of the genus.

2. *Baëna emiliæ* Hay.

Baëna emiliæ HAY, O. P., Fossil Turtles of North America, 1908, pp. 80-81, Pl. XX, fig. 1; text-figs. 67, 68.

Six specimens in the present collection are identified as pertaining to *Baëna*

⁴ Hay, O. P., "Fossil Turtles of North America," Pub. Carnegie Institution, Washington, 1908, pp. 67-68.

emilia Hay. The better preserved specimen, C. M. No. 3443, consists of a nearly complete carapace and plastron, the former lacking small portions of the hinder borders posterior to the inguinal notches. The missing margin of the right side was apparently lost in life, as shown by the healed condition of the bone at this point. The specimen was collected by Earl Douglass during the season of 1915 at Wagon-bound Bend, on White River, Uinta County, Utah, from the lower part of Horizon B. It will be seen from the table of comparative measurements given below that this specimen has about the same dimensions as the type of the species. It differs, however, in the more angularly rounded contour of the front lobe, a feature in which it also is different from three of the other specimens here referred to this species. Whether this difference represents a sexual character, or is only an individual variation, I am unable to determine.

In many respects the present specimen is very close to the type of *Baëna clara* from the Bridger formation, but the great length of the third vertebral scute, as compared with the others of the series, is regarded by Hay as one of the chief distinguishing characters of the species, and together with the much shorter posterior lobe, as compared with the longer lobe in *B. clara*, appears to show that its closest affinities are with the present species.

An anterior portion of a carapace and plastron, C. M. No. 3253, on account of its close general resemblance to the specimen discussed above, is provisionally referred to the same species. This specimen is from Horizon C of the Uinta formation and is the only individual in the collection, referred to the present species, which is positively known to have come from that horizon, all of the others having been found in strata belonging to Horizon B. It was collected by Earl Douglass two or three miles west of Well No. 2, Uinta County, Utah.

A third specimen, C. M. No. 2159, consisting of a complete plastron and the entire central part of the carapace, but lacking portions of both sides, is also referred to this species. It was collected by Earl Douglass in 1908, in the Devil's Playground, Uinta Basin, Uinta County, Utah, from Horizon B (near top) or C (near base).

A fourth individual, C. M. No. 3243, has a nearly complete carapace and plastron, the latter lacking the posterior lobe. It was collected by Messrs. Earl Douglass and J. T. Goetschius, October 2, 1908, about one mile northeast of Well No. 2, "near first gap," Uinta County, Utah, from Horizon B.

The fifth specimen, C. M. No. 3257, consists of a carapace and plastron, the former lacking some of the posterior border. This turtle also was collected by Earl Douglass and J. T. Goetschius, July 30, 1908, south of Kennedy's Hole and

west of the Dragon-Vernal road, Uinta Basin, Uinta County, Utah, from Horizon B, or C.

The sixth specimen, C. M. No. 3244, consists of the greater part of the carapace and plastron. The carapace has portions of the rim missing on both the anterior and posterior ends, the plastron lacks the anterior lobe. The specimen was collected by Earl Douglass in 1915, at Wagon-hound Bend on White River, Uinta County, Utah, from the lower part of Horizon B.

The type of *Baëna emiliae* is in the American Museum of Natural History, and was collected by Mr. O. A. Peterson in 1884, from the middle Uinta of Utah. Geologically therefore all of the known specimens, including the type, two other specimens referred to the species by Hay, and the six specimens under consideration, came from approximately the same horizon, and from neighboring localities.

It may be shown hereafter, when larger collections shall have been made, that more than one species is represented by the six specimens here referred to *B. emiliae*. When compared with one another there are differences which appear to divide them into three groups, as follows: Nos. 2159 and 3243, having relatively narrower vertebral scutes and narrower plastral lobes and bridges than the type, or other specimens here referred to *B. emiliae*; Nos. 3244 and 3257, having wider vertebral scutes and a more depressed shell than the type; and No. 3443 with a wider and more angularly rounded anterior lobe, larger intergulars, and narrower pectorals. The latter specimen in all of these particulars is different not only from the type, but from all of the other specimens discussed above, with the exception of the fragmentary specimen No. 3253, which, in so far as the two can be compared, appears to be very close to No. 3443. In nearly all other respects these specimens agree closely with the type of the species. The differences enumerated above are not considered important enough to warrant the separation of these turtles into distinct species. When the considerable sexual and individual differences observable in a series of living turtles of one species and from one locality are considered, it appears to me that the specimens before me are well within the limits of a given species. I am inclined to the belief that specimens Nos. 2159 and 3243 may be females of this species, but as to this I cannot be certain. The discovery of more material may possibly show that more than one species is represented in these specimens, but at this time, especially in the light of a recent examination of a large series of living turtles, I do not feel justified in the establishment of new species on such slender distinguishing characters as have been observed. For the present, at least, I refer all the six specimens to *Baëna emiliae* Hay.

In order to place on record the proportional variations within the species I have prepared the table of comparative measurements given below:

COMPARATIVE MEASUREMENTS OF VERTEBRALS.

	Length.					Width.						
	Type.	No. 3443.	No. 3244.	No. 3257.	No. 2159.	No. 3243.	Type.	No. 3443.	No. 3244.	No. 3257.	No. 2159.	No. 3243.
1	55	53	—	51	47	38	68	73	—	85	65	63
2	80	81	—	82	71	77	63	79	71	87	64	56
3	92	96	97	89	87	88	75	82	80	90	68	63
4	70	69	74	72	69	67	78	77	80	91	69	65
5	70	62	52	—	—	62	98	101	90	—	—	96

COMPARATIVE MEASUREMENTS OF CARAPACE AND PLASTRON.

	Type.	No. 3443.	No. 3244.	No. 3257.	No. 2159.	No. 3243.
Greatest length of carapace	368	364	365 ^e	375 ^e	328	366
“ width “	294	292	310	310	—	260
“ length of plastron	320	307	—	310 ^e	300	—
“ “ anterior lobe	80	76	—	75	77	73
“ width “	110	105	106	105	102	98
“ length posterior lobe	83	84	80	98 ^e	80	—
“ width “	122	114	119	117	108	105
Width of bridge	160	150	149	146	140	146

^e, estimated.

3. *Baëna inflata* sp. nov.

Plate XIX; text-figs. 2 and 3.

Type: C. M. No. 3406, consisting of a carapace and plastron, the former lacking the posterior end back of the middle of the fourth vertebral, the latter a small portion of the anterior lobe; collected by O. A. Peterson in 1912.

Locality: McCook Canyon, White River, Uinta County, Utah.

Horizon: Horizon A (near top), Uinta formation, Upper Eocene.

The type of this species is but little crushed and, except for the parts which are missing, is in a beautiful state of preservation. The surface of the carapace and plastron are everywhere covered with fine pustular elevations, forming a shagreened surface. The pustules on the carapace are coarser than those on the plastron. The surface of the carapace is also somewhat uneven, and laterad to the second, third, and fourth vertebrae there are some heavy longitudinal wrinklings. These are most numerous laterally at the junction of the third and fourth vertebrae. The pustular ornamentation of the carapace appears to be very similar to that of *Baëna sima* Hay, but not so coarse.

The greatest length of the shell is estimated to have been about 400 mm.; its greatest width at the center is 310 mm. In outline the front of the shell is evenly,

but broadly, rounded, resembling in its general contour *B. sima* Hay. The shell is flat transversely in the region of the vertebral scutes, but from one border to the other it is broadly convex. One of the distinctive features of this species is the decided transverse inflation or swelling of the mid-costal region, which gives the shell the appearance of being puffed out on the sides. This swelling lies largely within the areas of the second costal scutes, and it is to this feature that the specific name refers.

Over the posterior legs the margins of the shell begin to flare outward and slightly upward, and at this point the border is heavy and rounded but becomes thinner posteriorly. In front of the axillary notches the border has a thickness of 31 mm., but rapidly thins toward the center, where it measures only 8 mm., the edge being obtusely rounded. The bones of the carapace are so thoroughly coösfified that but few of the sutures can now be made out. The sulci, however, can in most instances be clearly traced.

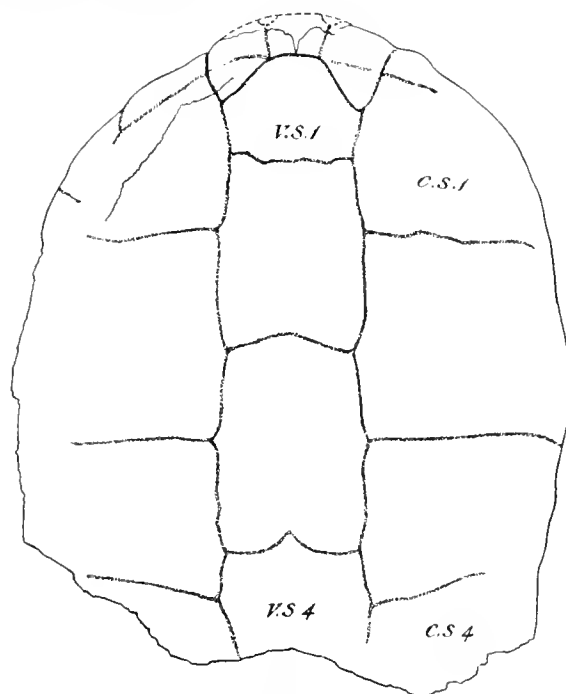


FIG. 2. Carapace of *Baëna inflata*. C. M. No. 3406, Type. *C.S. 1*, *C.S. 4*, costal scutes one and four; *V.S. 1*, *V.S. 4*, vertebral scutes one and four. One-fourth natural size.

The vertebrals as in nearly all Eocene Baënidæ are longer than wide. The sides of the vertebrals, excepting the first, which is hexagonal with a very narrow anterior end, are bracket-shaped. It will be observed, that, as in *Baëna emilia*, the third vertebral is the longest of the series. Along the center of vertebrals two,

three, and four is a narrow low ridge, on either side of which are parallel grooves much as in *B. emiliae*. The principal dimensions of the vertebrals as well as those of a second individual, C. M. No. 3442, referred to this species, are given in the accompanying table.

DIMENSIONS OF VERTEBRALS.

	Length.		Width in front.		Greatest width.	
	Type.	No. 3442.	Type.	No. 3442.	Type.	No. 3442.
1	61	53	28	75	72	75
2	90	92	62	63	74	77
3	99	98	62	64	78	81
4	—	90	68	70	78	81
5	—	—	—	53	—	—

The nuchal scute is rectangular, being about 17 mm. long and 30 mm. wide on the free border. It is bordered on either side, as shown in specimen No. 3442, by small triangular first marginals. The second marginal has its greatest width

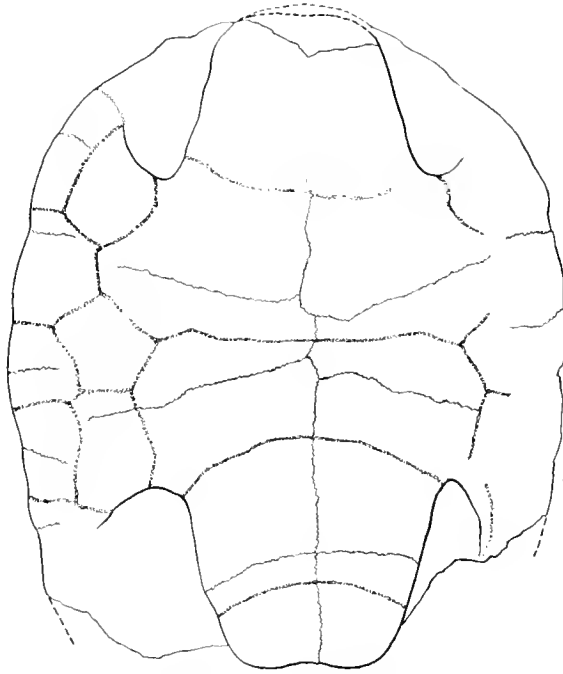


FIG. 3. Plastron of *Baëna inflata* C. M. No. 3406, Type, restored after C. M. No. 3442. One-fourth natural size.

(36 mm.) on the free border. The first vertebral is bordered on either side by small triangular supernumerary costal scutes, though there is no indication of these in specimen No. 3442.

It is estimated that the plastron had a total length of about 365 mm. It is

slightly convex transversely throughout its length, and this convexity on the bridge area continues evenly to the borders of the shell, so that these borders stand 36 mm. above the level of the plastron at the center. The anterior lobe has its greatest width (135 mm.) at the base; and at a point half-way to the anterior end it measures 99 mm. The sides of the lobe converge gradually from the base to the anterior end, which appears to have been rounded. The width of the bridge is 175 mm.

The posterior lobe is tongue-shaped, shallowly, but broadly notched. Its length on the midline is 97 mm., with a width at the base of 139 mm. The notch has a depth of 6 mm. at the center.

Excepting those of the anterior lobe all of the sulci and sutures on the plastron can be clearly made out. The mesoplastrals widen rapidly on either side of the midline. At the center the right scute measures 51 mm. The width of the right hypoplastral at the center is 104 mm.; of the left hypoplastral 91 mm. The xiphoplastrals are 62 mm. wide on the midline. The pectorals meet on the midline for a distance of 75 mm.; the abdominals for 49 mm.; the femorals for 80 mm.; the anals for 47 mm.

On the right side are three inframarginal scutes, the form of which is well shown in Fig. 3.

A second specimen, C. M. No. 3442, belonging apparently to this species, was collected by Earl Douglass in 1915 from the lower part of Horizon B of the Uinta formation, at Wagon-hound Bend on White River, Uinta County, Utah. This turtle consists of a carapace and plastron, both of which have small portions missing from their posterior ends. In size, general contour, and the dimensions of the dermal scutes, the specimen closely resembles the type. The inflation of the sides of the carapace, which forms such a conspicuous feature in the type, is almost entirely wanting in this individual. Its absence may be attributed in part, at least, to crushing, for both sides in this respect have somewhat suffered. There are also no supernumerary costal scutes at either side of the first vertebral, and in their absence the first vertebral is tetragonal, whereas in the type it is hexagonal with the narrow end in front. This specimen shows small triangular first marginals on either side of the nuchal, and in the drawing of the type (Fig. 2), this region, which is missing, has been restored after this specimen. It also gives the complete form of the anterior lobe (See Fig. 3), which in its general contour closely resembles *Baëna sima* Hay.

The greater part of an anterior lobe, C. M. No. 3137, which was collected by Earl Douglass in the strata of Horizon B of the Uinta formation, near Well No. 2, Uinta Basin, Utah, in 1908, is regarded as belonging to *Baëna inflata*. It is from

an individual having the same proportions as the type, and shows on the dorsal surface the triradiate shape of the entoplastron (See Fig. 4, 1). The entoplastron

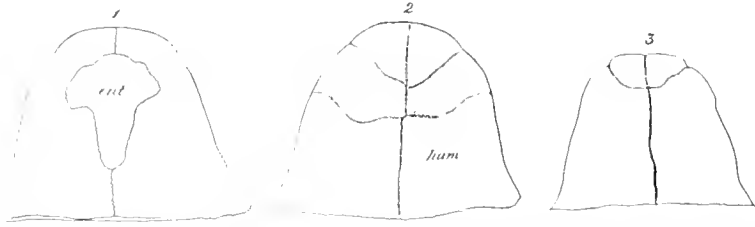


FIG. 4. Anterior lobes of *Baëna inflata*. 1, and 2, superior and inferior views of C. M. No. 3437, *ent.*, entoplastron; *hum.*, humeral scute. 3, inferior view of anterior lobe of C. M. No. 3442. All figures one-fourth natural size.

has a length of at least 50 mm.; a width of 44 mm. Transversely the lower surface of the lobe is broadly convex. On the dorsal surface immediately posterior to the anterior border the bone is scooped out by a shallow transverse depression. The lateral borders are bevelled off almost perpendicularly, while in front the border is rounded. The bone along the borders has a thickness of 13 mm., in front of the center of only 9 mm., at the middle on the posterior broken border of 21 mm.

4. *Baëna gigantea* sp. nov.

Plate XX, figs. 1 and 2; text-figs. 5, 6, and 7.

Type: C. M. No. 3441, consisting of nearly a complete shell. The carapace lacks portions of the posterior margins on either side of the middle, a small section of the right anterior border, and the peripherals of the right side above the bridge. The plastron has the greater part of the posterior lobe missing. Collected by Earl Douglass, in 1915.

Locality: Wagon-hound Bend, on White River, Uinta County, Utah.

Horizon: Lower part of Horizon B, Uinta formation, Upper Eocene.

The type of the present species is the largest species of the genus as yet discovered. It is estimated that the carapace had an axial length of about 535 mm. The greatest width, which is near the center, is about 420 mm. The bones of the carapace are all thoroughly coössified and only the sutures defining the right half of the mesoplastron can be detected and then only with difficulty. The shell is oval in outline, in this respect resembling *Baëna clara* Hay, though the oval is somewhat more elongate than in that species. The carapace has been slightly crushed on the right side, as may be seen by examining Plate XX, fig. 1.

The front of the carapace is decidedly projecting. The missing posterior

borders render it impossible to determine the character of the scallops on the hinder end. The surfaces of both the carapace and plastron are roughened with coarse pustular elevations, though these are more sparsely placed than in either *Baëna sima* or *B. inflata*. With the exception of this pustular roughening the surfaces are comparatively smooth, there being no longitudinal ridges or grooves, such as are commonly found in many species of this genus from the Eocene. The vertebral areas are also free from median ridges and channels.

The nuchal scute resembles in outline that of *Baëna hatcheri*. It has a fore-and-aft diameter of about 58 mm., and a transverse diameter of 88 mm. The

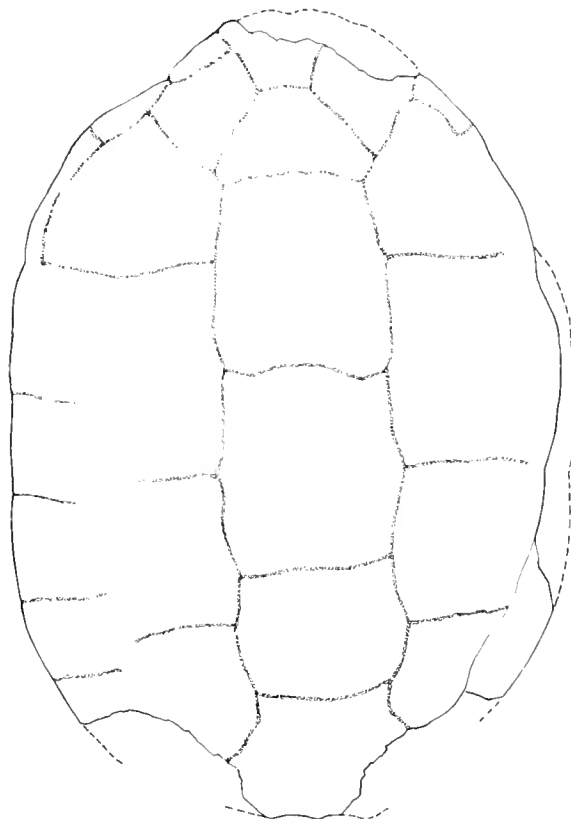


FIG. 5. *Baëna gigantea*, carapace of C. M. No 3441, Type. About one-fifth natural size.

unusual length of the nuchal appears to be one of the distinctive features of this species. All of the sulci are distinctly impressed. At the left side of the nuchal is a subrectangular first marginal, which has a length on the free border of 43 mm. The total number of peripherals cannot be determined from this specimen.

There are the usual five vertebrals and these are relatively wide, and differ from those of all other Eocene Baënidæ, except *B. emilia*, in having the fourth considerably wider than long. The sides of the vertebrals posterior to the first are

only slightly bracket-shaped. The first is hexagonal, very narrow in front, in this respect closely resembling the first in *Baëna inflata*. The surfaces within the first, second, and third vertebral areas are flattened, but the fourth and fifth are transversely broadly convex. The principal dimensions of the vertebrals are given in the accompanying table.

DIMENSIONS OF VERTEBRALS.

	Length.	Width in front.	Greatest width.
1	58	34	98
2	122	87	105
3	126	96	113
4	88	94	106
5	102 ^e	88	152 ^e

^e, estimated.

As in *Baëna riparia* Hay and *B. hatcheri* Hay, there are five costal scutes. A small supernumerary scute is situated on each side of the first vertebral, showing a difference from the former species by bordering on the nuchal, whereas in *B. riparia* these scutes are not in juxtaposition.

On the plastron only the sutures defining the mesoplastron on the right side

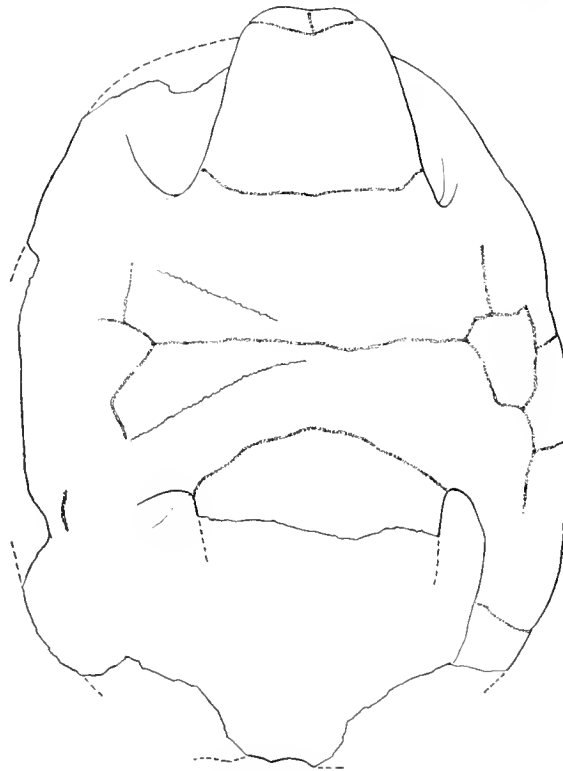


FIG. 6. *Baëna gigantea*, plastron. Type, C. M. No. 3441. About one-fifth natural size.

are traceable, and these show them to be narrow at the midline (18 mm.), but expanding toward their outer extremities where the width is 112 mm. The anterior lobe is elongated antero-posteriorly, and turns upward with a well-defined sweep toward the carapace, as shown in Fig. 7. Its greatest length is 137 mm.; its greatest width 170 mm. at the base; at a point half-way to the tip measuring 117 mm. in width. The sides of this lobe gradually converge from the base to near the anterior end, which rounds in with a shallow but broad median emargination on the anterior end. The posterior lobe is largely missing, though enough of the base remains to show that it had a width of 160 mm. The width of the bridge is 190 mm.

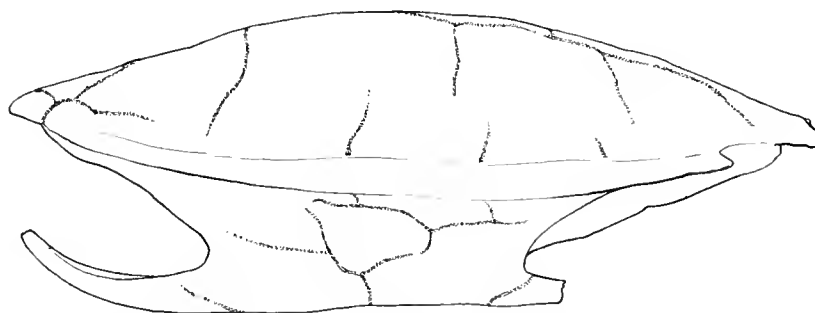


FIG. 7. *Baëna gigantea*, lateral view of the carapace and plastron, C. M. No. 3441. Type specimen, one-fifth natural size.

The sulci defining the intergular scutes cannot be traced. The intergulars meet on the midline for a distance of 29 mm.; the humerals 112 mm.; the pectorals 97 mm.; the abdominals 55 mm. The number of inframarginals on the bridge cannot be determined in this specimen.

This species may be distinguished from all others of the genus by its larger size, the great length of the nuchal scute, and differences in the relative dimensions of the vertebral scutes. The contour of the anterior lobe of the plastron, its greater relative length, and especially its decided upward curvature are all features which serve to distinguish this species. In the presence of five costal scutes the type of this species agrees with several species of the genus, especially *Baëna riparia* and *B. hatcheri*, but it differs from those forms by the decidedly longer nuchal scute and in the apparent absence of marginal scutella. In the greater length of the third vertebral this specimen is like *B. emiliae* from the same formation, but the greater relative widths of all of the vertebrae and especially the shortness of the fourth, together with other differences to be observed in the plastron, at once distinguish it from that species.

5. *Baëna platyplastra* sp. nov.

Plate XVIII, fig. 2; text-fig. 8.

Type: C. M. No. 3227, consisting of a plastron lacking the anterior portion of the anterior lobe, matrix cast of the carapace, at either end of which remain a few fragmentary parts of the carapace. Collected by Earl Douglass and J. F. Goetschius, August 5, 1908.

Locality: Northeast of Well No. 2, Uinta Basin, Uinta County, Utah.

Horizon: Horizon B, Uinta formation, Upper Eocene.

The type specimen represents one of the larger species of the genus. It is distinguished from all other described species of *Baëna* by the extremely flat and thin plastral bones with sculptured inferior surfaces. Its large size and the absence of a median emargination on the posterior lobe are features which also assist in distinguishing this species.

The ornamentation of the plastron consists of low ridges and shallow furrows, the former being short, sometimes straight, but usually bent or anastomosing. The effect of the whole may be best expressed as resembling a coarse, shagreened

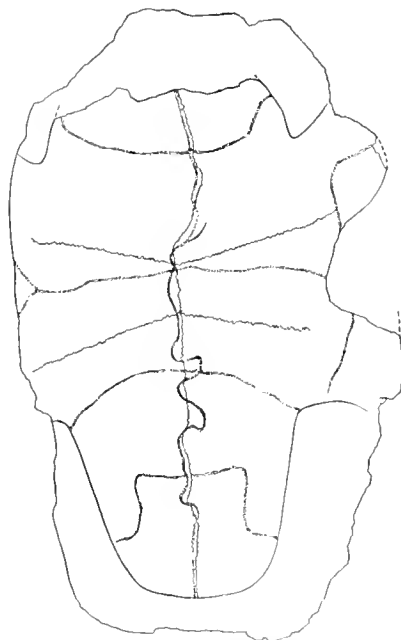


FIG. 8. Plastron of *Baëna platyplastra*, C. M. No. 3227. Type, one-fourth natural size.

leather. The sutures in the type have all coalesced, but their courses are indicated by ridges crossing them at right angles. These cross-ridges are especially pronounced on the median suture between the axillary notches.

It is estimated that the entire shell had a length of about 495 mm., and a height at the center of about 170 mm. The plastron had a length of about 420 mm. The anterior lobe at the base is 156 mm. wide. The bridge is 180 mm. wide.

The posterior lobe has a width at the base of 152 mm., and a length of 128 mm. The lateral borders of the lobe are nearly straight and converge nearly the entire length of the lobe, there being a slight constriction at the anal-femoral sulcus. The posterior end of this lobe is broadly but evenly rounded and without median emargination. At the anal-femoral sulcus the transverse measurement is 107 mm.

The mesoplastrals are solidly coössified with the contiguous bones and their boundaries can only be determined by the ridges which cut them at right angles. At the midline these bones have a width of 33 mm., at their outer ends they expand to 55 mm. in width.

As in *Baëna sima* Hay, the median sulcus runs a very tortuous course, as is well shown in Fig. 8. The pectorals meet on the median line for a distance of 77 mm.; the abdominals for 70 mm.; the femorals for 68 mm.; the anals for 85 mm. The anal-femoral sulcus runs in from the border a short distance, then turns abruptly forward, then again turns at right angles toward the median line to meet the scute of the opposite side. In the shape of the anal scutes it resembles *Baëna arenosa* and more especially *B. clara*.

Owing to the damaged condition of the bridges the number of inframarginal scutes cannot be determined.

Family DERMATEMYDIDÆ Gray.

The family Dermatemydidae is represented now for the first time in the Uinta formation by the single genus and species, *Anosteira ornata* Leidy. This is the latest recorded occurrence of this genus for North America, although in England it is known to range upward into the Lower Oligocene.

GENUS ANOSTEIRA Leidy.

6. *Anosteira ornata* Leidy.

Anosteira ornata LEIDY, Proc. Acad. Nat. Sci. Phila., 1871, p. 102; Ann. Report U. S. Geol. Surv. Montana, etc., 1871 (1872), p. 370; Contrib. Ext. Fauna West. Terrs., 1873, pp. 174, 341, pl. XVI, figs. 1-6.—HAY, Bibliog. and Cat. Foss. Vert. N. A., 1902, p. 447; Bull. Amer. Mus. Nat. Hist., XXII, 1906, p. 157, figs. 2, 3; Fossil Turtles of North America, 1908, pp. 279-281, Pl. XLIII, figs. 1, 2; text-figs. 352-354.

Anostira ornata COPE, Ann. Report U. S. Geol. Surv. Wyoming, etc., 1872 (1873), p. 621; Amer. Naturalist, vol. XVI, 1882, p. 989, fig. 7; Vert. Tert. Form. West, 1884, p. 128.—DOLLO, Bull. Mus. Roy. Belgique, IV, 1886, p. 93, Pl. XI, figs. 7, 8.

A fragmentary specimen, No. 2954, collected by O. A. Peterson August 24, 1912, from Horizon C, Uinta formation, on White River near Ouray, Uinta County, Utah, is provisionally identified as pertaining to the above genus and species. This specimen consists of the articulated nuchal, first and second neurals, with portions of the abutting costals of both sides, parts of several disarticulated costals, eleven peripherals, several of which are complete. The plastron is represented by the right hypoplastron lacking a portion of its outer extremity and many fragmentary parts.

The specimen has been carefully compared with the figures and descriptions given by Leidy and Hay, and especially with one of Leidy's cotypes No. 4062, now in the U. S. National Museum, and, with the exception of slight differences in size, it agrees closely in nearly all respects. The present specimen is of about the same size as one individual in the American Museum of Natural History described and figured by Hay in his Turtles of North America, but is considerably smaller than the cotype of Leidy mentioned above.

All of the specimens described by Leidy are supposed to have come from the lower portion of Horizon B in the Bridger as exposed in the neighborhood of old Fort Bridger, Wyoming. The specimen described by Hay in the publication cited is from the third division of Horizon C of the Bridger on Henry's Fork, Wyoming. The discovery of the specimen considered here now extends the geological range of this species into the uppermost horizon of the Uinta formation.

The nuchal has a length of 15 mm., a width on the free border of 23 mm. The free border is subaeute and is not so deeply excavated in front as in the specimen figured by Leidy. The thickness of the nuchal at the midline is 5 mm.

The first neural has a length of 13 mm., and a greatest width of 6 mm. The bone is coffin-shaped with the widest end forward. The second neural is 9 mm. long, and only 4 mm. wide.

All of the bones of the carapace are delicately sculptured, though those of the anterior part of the shell appear less distinct than in most of the described specimens. The few costals present show the usual low undulating ridges crossing them at right angles to their shorter diameters. This sculpture is most distinct toward their outer ends. The peripherals have their upper and lower surfaces ornamented by the usual sharp ridges and pustular elevations.

The few sulci discernible are narrow and delicately impressed. As in previously described specimens the intramarginal sulci on the nuchal and anterior peripherals cannot be traced. The first vertebral has a greatest width of 26 mm., whereas in the specimen described by Hay it is only 18 mm. The sulcus forming the posterior boundary of the first vertebral crosses the first neural as in other described specimens. The costal sulcus on the second costal is near the center of that bone, while in the specimen described by Hay it is very close to the posterior border.

The right hypoplastron is 21 mm. long on the midline, and has a thickness of 5.5 mm. The sculpture on the lower surface of this bone is made up of fine ridges arranged in a radiating pattern. There is no evidence of epidermal scutes on any of the plastral bones found with this specimen.

Cope has recognized this species from the Upper Green River beds, so that the evidence at hand shows that this species ranges from the lowest horizon in the Bridger deposits to the highest horizon in the Uinta formation, the uppermost Eocene.

Family EMYDIDÆ Gray.

Genus ECHMATEMYS Hay.

In 1908 Hay⁵ recognized nineteen species as pertaining to the genus *Echmatemys*. Since that time he has described one new form,⁶ so that with the four new species described in the present paper, twenty-four species have been recognized from the fossiliferous deposits of North America. Seven of these have now been found in the Uinta formation and increased collections will doubtless show the presence of several more. The discovery in the present collection of *Echmatemys septaria* (Cope) leads to the belief that still other species known in the older Wasatch and Bridger beds, will sooner or later be found to continue into the uppermost Eocene.

6. *Echmatemys callopyge* Hay.

Plate XXI; text-figs. 9 and 10.

Echmatemys callopyge HAY, Fossil Turtles of North America, 1908, 340-342, Pl. LII, figs. 1, 2; text-figs. 447, 448.

Two specimens in the Carnegie Museum are identified as belonging to this species. The better preserved specimen, No. 2371, was collected by Earl Douglass in 1908, from Horizon B, "above second sandstone with small artiodactyls,"

⁵ "Fossil Turtles of North America," 1908, p. 298.

⁶ Proc. U. S. National Museum, XXXV, 1908, pp. 164-166.

Uinta formation, Upper Eocene, east of Dragon-Vernal road between White and Green rivers, Uinta Basin, Uinta County, Utah. The second specimen, No. 2157, was also collected by Douglass from the same geological horizon near Well No. 2, in the Uinta Basin. Like the type, both of these specimens have the carapace somewhat crushed over toward the left side. The type of the species is said by Hay to have come from the middle Uinta, and it appears probable that all of these specimens were found at about the same geological level.

Hay considered the very narrow first vertebral as the chief distinguishing character for separating this species from the others of the genus, but both of the

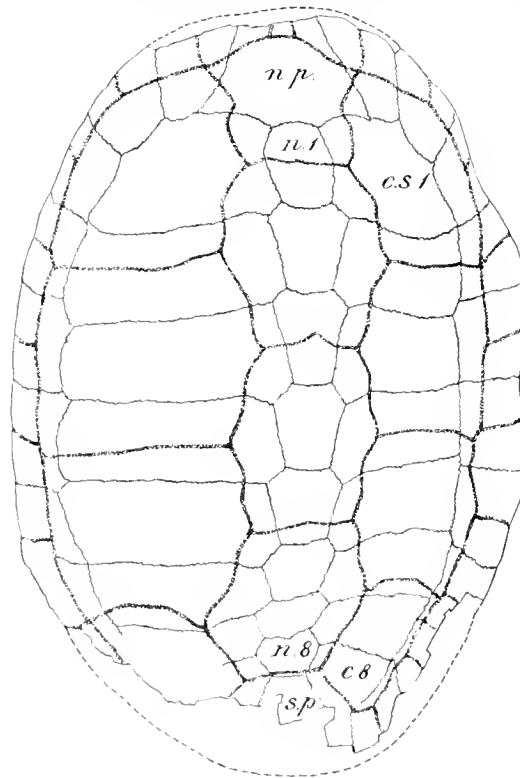


FIG. 9. *Echmatemys colopyge* Hay. Carapace of C. M. No. 2371. One-fourth natural size. *c. 8*, costal plate; *c.s. 1*, first costal scute; *n. 1*, and *n. 8*, neurals one and eight; *n.p.*, nuchal plate; *s.p.*, suprapygals.

specimens before me have this scute relatively wider than in the type, although in nearly all other respects, as is shown by the table of comparative measurements, the specimens are remarkably similar. So far as the width of the first vertebral is concerned these specimens are intermediate between the type of the present species and the figured specimen of *Echmatemys septaria* (Cope), as illustrated by Hay, *Fossil Turtles of North America*, Fig. 415, p. 320. The type of the latter species is in the U. S. National Museum (No. 4088), and consists of a fairly complete

plastron, a portion of the central part of the carapace, including the third, fourth, and fifth neurals with portions of the second, third, and fourth costals: and a small piece of the fifth, sixth, and seventh costals with abutting peripherals. It was collected in the badlands of South Bitter Creek, Wyoming, from the beds of the Washakie Basin.

I have carefully compared the specimens before me with the above mentioned type and except for differences in size, find them, so far as they can be contrasted, remarkably similar. The broad, hatchet-shaped anterior lobe so characteristic of *Echmatemys septaria* is duplicated in these specimens.

In the type of *Echmatemys callopyge* the front two-thirds of the first vertebral lies wholly within the lateral borders of the nuchal plate, and, although relatively wider, this is also true of specimen C. M. No. 2157, but specimen C. M. No. 2371 has the antero-lateral angles of the first vertebral extending across the lateral sutures of the nuchal. In a specimen identified by Hay as pertaining to *Echmatemys septaria* (See Fossil Turtles of North America, Fig. 415, p. 320) the first vertebral extends entirely over the lateral boundaries of this plate. From the intermediate condition observed in the present specimens, the first vertebral would appear to be subject to considerable variation and therefore its narrowness cannot be relied upon as a constant specific difference. Specimen C. M. No. 2371

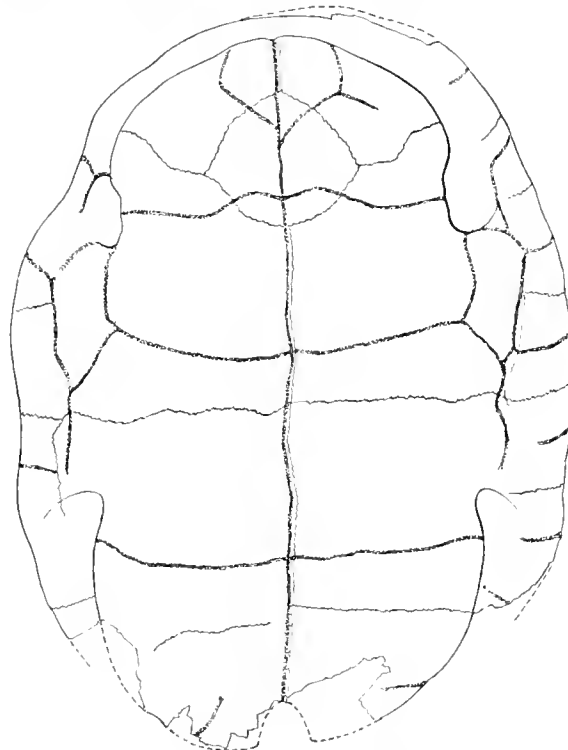


FIG. 10. *Echmatemys callopyge* Hay. Plastron of C. M. No. 2371. One-fourth natural size.

has the surface of the carapace smooth, with the exception that, as in the type of *E. septaria*, it is relieved by faint striations and growth lines, these being especially apparent within the areas of the vertebral scutes.

MEASUREMENTS OF NEURALS.

No.	Type.	Length.		Type.	Width.	
		No. 2157.	No. 2371.		No. 2157.	No. 2371.
1	52	50	50	33	35	36
2	43	—	40	39	—	41
3	58	—	43	43	—	39
4	41	41	38	37	38	34
5	41	26	35	44	—	41
6	30	—	29	40	—	39
7	29	25	25	45	—	40
8	28	—	23	34	—	35

MEASUREMENTS OF VERTEBRALS.

No.	Type.	Length.		Type.	Width.	
		No. 2157.	No. 2371.		No. 2157.	No. 2371.
1	75	81	77	52	71	77
2	89	90±	85	85	87	86
3	88	96	87	82	95	76
4	96	—	86	87	100	84
5	71	—	—	100±	—	—

PRINCIPAL MEASUREMENTS CARAPACE AND PLASTRON.

	Type.	No. 2157.	No. 2371.
Greatest length of carapace.....	438	420±	415
Greatest width of carapace.....	270	276	279
Greatest height of carapace.....	153	160	133
Nuchal, greatest length.....	68	69	66
Nuchal, greatest width.....	90	86	80
First marginal, greatest length.....	40	43	40 ^e
First marginal, greatest height.....	32	34	28
Plastron, greatest length.....	410	422	370
Anterior lobe, greatest length.....	116	125	107
Anterior lobe, width at base.....	174	180	176
Posterior lobe, greatest length.....	135	140	—
Posterior lobe, width at base.....	198	205	195
Bridge, width.....	155	165	162
Lip, width.....	38	44	45
Entoplastron, width.....	52	66	75
Gulars, meet on the midline.....	72	67	58
Humeral, meet on the midline.....	35	34	36
Pectorals, meet on the midline.....	74	76	73
Abdominals, meet on the midline.....	110	114	102
Femorals, meet on the midline.....	38	41	33
Anal, meet on the midline.....	66	62	—

Had *E. callopyge* not been established, I should have unhesitatingly referred both of the specimens discussed above to *Echmatemys septaria* (Cope). For the

present, however, it will serve all purposes to assign them to the established Uinta species, until the discovery of additional Bridger material shall definitely determine whether two distinct species are represented by this material, or whether *E. callopyge* Hay shall become a synonym of the earlier described *E. septaria* (Cope).

In order to place on record the variation within the species, some of the principal measurements of the two specimens here considered as compared with those of the type of the species are given in the preceding table.

7. *Echmatemys uintensis* Hay.

Echmatemys uintensis HAY, Fossil Turtles of North America, 1908, pp. 342, 343. Pl. LIII, figs. 1, 2.

The above species is represented in the Carnegie Museum collections by three specimens. The better preserved specimen, C. M. No. 3270, consists of a carapace and plastron, the former lacking a portion of the posterior end and a considerable part of the costals and peripherals of the right side. The plastron is complete. This specimen was collected by Earl Douglass, May 25, 1908, from Red Bluff Wash, on the road from Bonanza to Kennedy's Hole, Uinta Basin, Utah, from Horizon B, "transition beds. First sandstone above red layer," Uinta formation, Upper Eocene.

The second specimen, No. 2158, consists of a carapace lacking most of the costals and peripherals of the left side, was collected by Earl Douglass, August 22, 1908, two or three miles below Well No. 2, from Horizon B, Uinta formation, as exposed in the Uinta Basin, Utah.

The third specimen, No. 2397, consists of considerable portions of the carapace and plastron of a large individual, both of which are rather fragmentary. This specimen was collected by Messrs. Earl Douglass and J. F. Goetschius, August 17, 1908, from Horizon B, "grey beds below red and grey beds," Badlands south of Kennedy's Hole, Uinta County, Utah.

This species is based upon a beautifully preserved specimen, No. 11,198, in the paleontological collection of Princeton University. It was collected in 1891 from the middle Uinta, on White River, Utah, and until the discovery of the present specimens was the only known representative of the species.

The specimens before me add but little to our knowledge of the species, but I believe it important to give at this time their principal dimensions as compared with the type in order to show the variations within the species.

COMPARATIVE MEASUREMENTS OF NEURALS.

No.	Type.	Greatest length.			Type.	Greatest width.		
		No. 3270.	No. 2158.	No. 2397.		No. 3270.	No. 2158.	No. 2397.
1	60	59	57	—	45	43	47	—
2	43	55	45	—	42	48	56	—
3	50	55	61	69	42	44	54	55
4	50	47	48	59	43	44	45	52
5	34	—	45	53	47	41	48	60
6	30	—	—	38	42	—	45	59
7	20	—	—	28	50	—	—	64
8	25	—	—	37	30	—	—	—

COMPARATIVE MEASUREMENTS OF VERTEBRALS.

No.	Type.	Greatest length.			Type.	Greatest width.		
		No. 3270.	No. 2158.	No. 2397.		No. 3270.	No. 2158.	No. 2397.
1	70	88	81	—	112	82	100	—
2	115	111	99	120	102	77	88	114
3	94	102	100	117	81	80	80	94
4	78	—	—	110	94	—	98	120
5	86	—	—	—	132	—	—	—

COMPARATIVE MEASUREMENTS OF THE PLASTRON.

	Type.	No. 3270.	No. 2397.
Greatest length, plastron.....	460	480	515 ^e
Greatest width, plastron.....	295	390 ^e	—
Length, anterior lobe.....	120	135	—
Width, anterior lobe at base.....	200	240	—
Width of lip.....	65	90	—
Length of entoplastron.....	70	90	—
Greatest width of entoplastron.....	95	96	—
Length of posterior lobe.....	150	154	185
Width of posterior lobe at base.....	200	230	240
Depth of posterior median notch.....	16	19	20 ^e
Width of notch.....	55	55	—
Epiplastrals meet on midline.....	44	43	—
Hyoplastrals meet on midline.....	125	108	114
Hypoplastrals meet on midline.....	120	136	160 ^e
Xiphiplastrals meet on midline.....	80	95	100
Gulars meet on midline.....	57	68	—
Humeral meet on midline.....	40	47	—
Pectorals meet on midline.....	73	90	—
Abdominals meet on midline.....	115	110	—
Femorals meet on midline.....	70	82	—
Anal meet on midline.....	52	65	—

^e, estimated.

S. *Echmatemys douglassi* sp. nov.

Plate XXII; text-figs. 11 and 12.

Type: C. M. No. 3244, consisting of a somewhat damaged carapace with a complete plastron. The carapace lacks portions of the peripheral borders of the front and sides in addition to several small areas out of the costal and neural regions. Collected by Earl Douglass, May 25, 1908.

Locality: South Branch of Red Bluff Wash, above the well on the road between Bonanza and Kennedy's Hole, Uinta Basin, Uinta County, Utah.

Horizon: Lower portion Horizon B, "Transition Beds" (Peterson), "in sandstone same as No. 28,"⁷ Uinta formation, Upper Eocene.

The carapace, although crushed over toward the left side, shows the shell to be elongated with the median portion high and vaulted. The surface of the shell is smooth. The peripherals behind the inguinal notches are moderately thin with acute edges and with a tendency to flare upward. The sulci are narrow, but

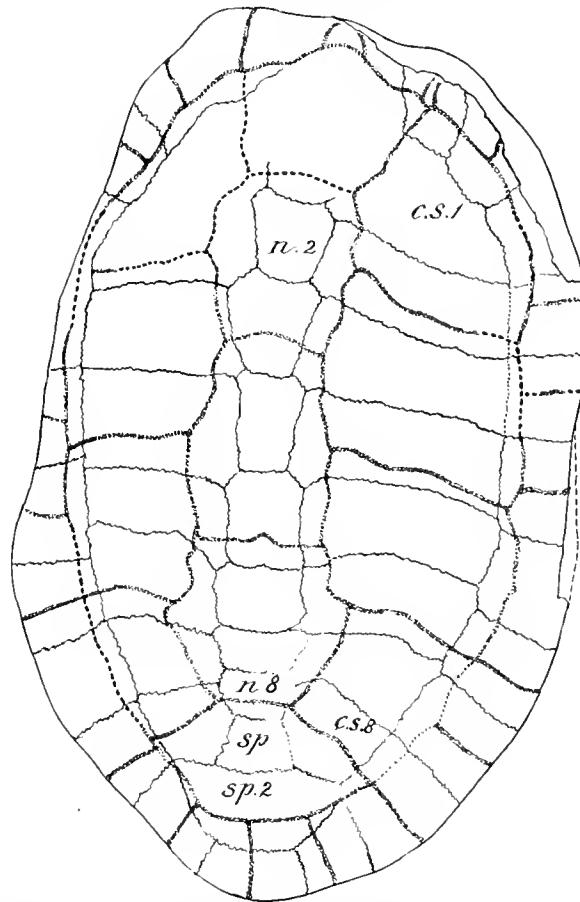


FIG. 11. *Echmatemys douglassi*. Carapace of the type, C. M. No. 3244. One-fourth natural size. *c.s. 1*, *c.s. 8*, costals one and eight; *n. 2*, *n. 8*, neurals two and eight; *sp.*, suprapygals; *sp. 2*, second suprapygals.

deeply impressed. The total length of the carapace in a straight line is about 470 mm. Its width is 300 mm., its height at the center is about 186 mm.

The nuchal scute is wedge-shaped with the narrow end forward. Some of the anterior margin of this bone is missing so its length cannot be given. The posterior end has a greatest width of 22 mm.

⁷ No. 28 is C. M. catalog No. 3270 and is identified as *Echmatemys uintensis* Hay.

The first neural is represented by the posterior end only, the second to the sixth inclusive are complete, the seventh and eight are only partially preserved. In general the neurals are hexagonal with their broadest ends forward. The anterior ends of the second to the fifth are concave. There is no indication of a carina on any of the neurals. Their principal dimensions are given in the table below:

No.	Length.	Width.
2.....	40.....	45
3.....	45.....	42
4.....	48.....	35
5.....	47.....	41
6.....	32.....	44
7.....	24.....	44e
8.....	29.....	—

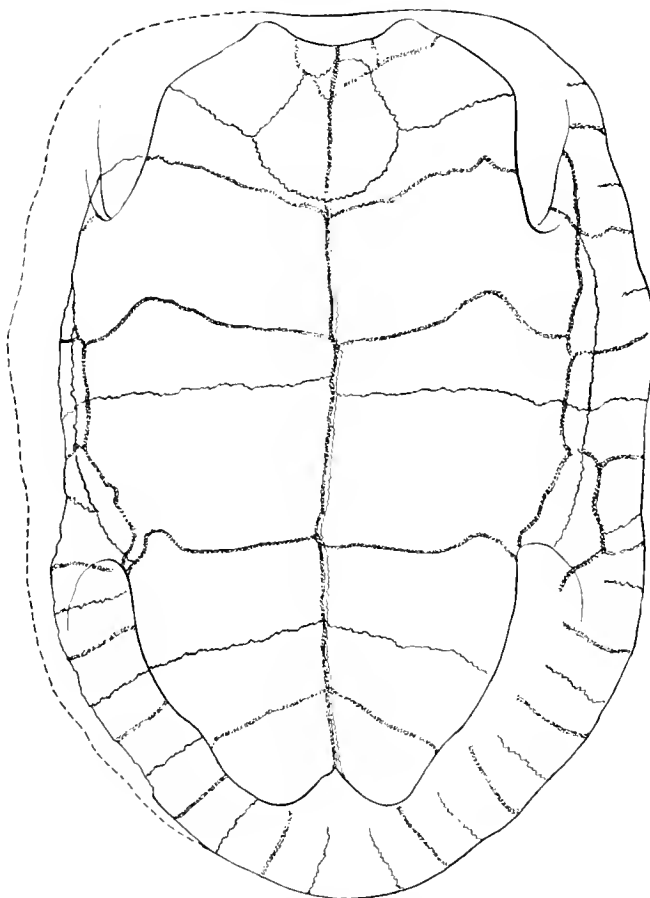


FIG. 12. *Echmatemys douglassi*. Plastron of type, C. M. No. 3244. One-fourth natural size.

There are as usual eight costals. These vary but little in the width of their proximal and distal ends. The fifth on the right side has a length of 144 mm.; the first at the suture with the second a length of 123 mm.

The peripherals are high. On the right side immediately posterior to the inguinal notch they extend upward 74 mm. above the margin of the shell; the most posterior one 45 mm.; the most anterior one 56 mm. above the margin.

The suprapygal is 41 mm. long. The second suprapygal is 52 mm. long, and 93 mm. across the middle, and 42 mm. where it joins the pygal. The pygal has a length of 32 mm., a width of 55 mm. The posterior boundary of the fifth vertebral crosses the second suprapygal 20 mm. anterior to its posterior margin. Both the pygal and second suprapygal are strongly arched above the tail.

The vertebral scutes are long. The sides of the median three are slightly bracket-shaped, the fourth, as in *Echmatemys uintensis* Hay, is strongly urn-shaped. The dimensions of the vertebrae are given in the accompanying table.

DIMENSIONS OF VERTEBRAE.

No.	Length.	Width in Front.	Greatest Width.
1	80 ^e	97	97
2	93	—	77 ^e
3	98	53	69
4	90	66	92
5	63	—	117

^e, estimated.

There appear to be twelve marginals in the complete series of one side, and some rise to the proximal ends of the peripherals. On the right side the eighth peripheral is crossed by the marginal sulcus 21 mm. below the costo-peripheral suture. The most posterior marginal scute is 53 mm. high from the margin of the shell.

The plastron is perfectly preserved and characters observed in the plastron show the distinctness of *Echmatemys douglassi* from all other described forms. The plastron has a maximum length of 407 mm. At the center it measures 374 mm. in length. The front of the anterior lobe is broadly and deeply emarginated, the emargination lying between two toothed projections which extend forward at either side, as is well shown in Fig. 12. On account of this emargination there is no well-defined lip. The anterior lobe is broad and at its base measures 190 mm. with a length at the center of 95 mm. The length therefore is exactly 50 per cent. of the width. The lateral borders of the lobe in front of the axillary notches are slightly concave, then expanding a little to the posterior ends of the epiplastra, then turning inward to the toothed projections at either side of the lip. The latter is wide, measuring 94 mm., which is nearly one-half of the total width of the lobe.

The posterior lobe has a greatest length at the center of 130 mm.; a width at the base of about 199 mm. The hinder lobe is considerably constricted at the anal-

femoral sulcus, and from this point posteriorly the lateral borders converge quite rapidly to the posterior end, which is deeply notched. The great breadth of the lobes in *E. douglassi* leaves but little space for the exit of the limbs, and in front the exit is still further closed by the upward curve of the anterior lobe as in *E. callopyge* Hay. Transversely the plastron is angularly concave, but how much of this depression may be attributed to *postmortem* causes it is impossible to determine. It may be largely sexual, and in that case this specimen would represent a male.

The entoplastron is pear-shaped and extends forward to within 11 mm. of the anterior margin of the lobe, a most unusual position in the Emydidae. The length of the entoplastron is 79 mm.; its width 71 mm. The bridge has a width of 167 mm. In this specimen, as shown in Fig. 12, there are intergular scutes, which overlap the entoplastron. On the left side the gular-humeral sulcus follows the usual course, reaching the margin of the lobe immediately posterior to the toothed projection marking the external boundary of the lip. On the right side, however, there is no trace of this sulcus. Intergulars are not known in any other member of the Emydidae, and it may be that the scutes here designated as intergulars are the gulars, and that the extra scute on the left side is supernumerary. Even should that be the case, the position of the sulcus crossing the border on the mesiad side of the toothed projection is unusual, and probably constitutes an individual variation, the true condition of which can only be cleared up by the discovery of additional specimens pertaining to this species.

The pectorals do not reach the entoplastron, but at the center pass 6 mm. behind it. They have their greatest width of 60 mm. at the center. The humerals meet along the midline for a distance of 65 mm.; the abdominals for 98 mm.; the femorals for 68 mm.; and the anals for 55 mm.

The hyoplastrals are 85 mm. wide antero-posteriorly at the midline, the left being slightly more. Each extends laterally about 132 mm. The hypoplastrals meet on the midline for a distance of 122 mm.; the xiphiplastrals for a distance of 83 mm. The notch between their hinder ends is 20 mm. deep, with a greatest width of 50 mm.

In the general shape and contour of the shell this species closely resembles *Echmatemys stevensoniana* (Leidy), from the Bridger beds of Wyoming. It differs from that species, however, in the deep emargination of the anterior lobe and the failure of the pectoral scutes to reach the entoplastron.

Echmatemys douglassi is distinguished from all described species of the genus by the deep emargination of the anterior median border of the anterior lobe; by the short and wide anterior lobe, the length of which at the center is only fifty per cent.

of the width at the base, and by the close proximity of the anterior end of the entoplastron to the border of the lip. In the unusual proportions of the anterior lobe it most nearly resembles *E. arethusa* Hay from the Bridger beds, but is at once distinguished from it by the concave lip, as contrasted with the projecting lip of the former species. In having the humero-pectoral sulcus pass behind the entoplastron this species is distinguished from all other species of the genus with the exception of *E. lativertebalis* (Cope), *E. megalax* (Cope), and *E. rivalis* Hay.

This species is dedicated to Mr. Earl Douglass, who collected the type specimen, as well as the greater number of specimens comprised in this collection of turtles.

9. *Echmatemys hollandi* sp. nov.

Plate XXIII, fig. 1; text-fig. 13.

Type: C. M. No. 3249, consisting of a considerable portion of the carapace, lacking the posterior and the greater part of the peripherals and costals of the left side and the outer halves of most of the remaining peripheral and marginal

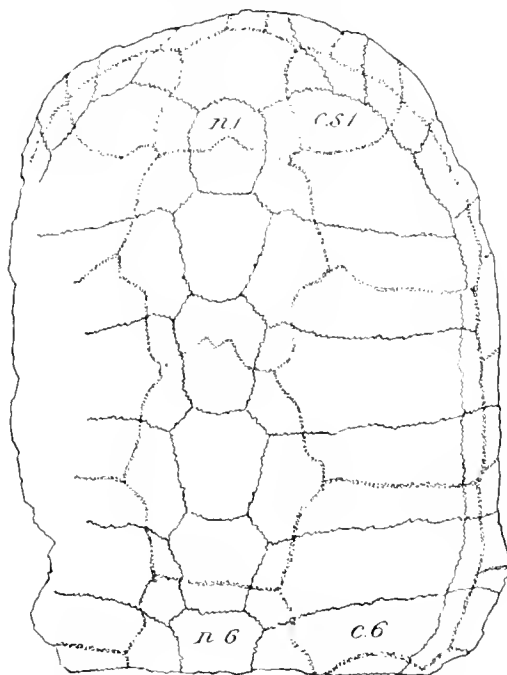


FIG. 13. *Echmatemys hollandi*. Carapace of the type, C. M. No. 3249. One-third natural size. *c. 6*, sixth costal; *c.s. 1*, supernumerary or first costal scute; *n. 1*, *n. 6*, first and sixth neurals.

bones. A considerable part of the plastron is present but the under surface is so badly shattered that nearly all traces of the sutures and sulci have been obliterated. The impression remaining in the matrix, however, gives some idea of the shape and dimensions of the anterior and posterior lobes. Collected by Earl Douglass, 1908.

Locality: Skull Butte, southwest of Well No. 2, Uinta Basin, Uinta County, Utah.

Horizon: Horizon B, Uinta formation, Upper Eocene.

The carapace is elongated oval being more broadly rounded in front than *Echmatemys callopyge* Hay. The median portion is high and vaulted. The length of the carapace is estimated to have been about 360 mm.; its width about 260 mm. The height at the center is 133 mm. The surface of the shell is smooth. The sulci are narrow, but well impressed.

The nuchal plate has the anterior border missing, so that its greatest length cannot be determined. It has a greatest width of 82 mm., and where the lateral sutures cross the costo-marginal sulcus it is 57 mm. wide.

The neurals back of the first are all hexagonal with the anterior ends concave. Those preserved are all longer than broad. On either side of the anterior end of the first neural are hollowed out depressions which give this bone the appearance of being bluntly ridged anteriorly, but otherwise there is no indication of carinae.

No.	Dimensions of Neurals.		No.	Dimensions of Vertebral Scutes.		
	Length.	Width.		Length.	Width in Front.	Greatest Width.
1	45	30	1	65	46	55
2	40	36	2	80	50	77
3	41	35	3	87	40	72
4	38	35	4	—	49	73
5	38	36				
6	—	36				

The peripherals appear to have been high, but on account of the damaged condition of the borders it is not possible to give their extent.

Six costals are present in this specimen, the first having a greatest antero-posterior diameter of 63 mm.; a greatest length of 96 mm. On the upper anterior half of the first costal there is a low, rounded, obtuse elevation or horn-like projection, which at once distinguishes this species from all other described forms. The other costals show nothing unusual. The third has a greatest length of 106 mm. The costo-peripheral suture between the third and fourth passes about 17 mm. mesiad of the costo-marginal sulcus.

The first vertebral scute is unusually narrow, in this respect resembling *E. callopyge* Hay. The sides of those posterior to the first are strongly urn-shaped. The anterior end of the third is especially narrow and pointed, and extends well forward into the second. The dimensions of the vertebrals are given in the table. On either side of the first vertebral are supernumerary costal scutes, and it is largely within their boundaries that the horn-like elevations, described above, arise.

The area of the first costal scute is much reduced, but it is still in contact with the first vertebral. Supernumerary costals are not unusual in the Baënidæ, though I am not aware of their having been found before in the genus *Echmatemys*. When present, they are usually confined to one side, seldom are they symmetrically paired as in the present specimen.

The plastron is exceedingly thick and heavy. At the center it measures 30 mm. in thickness. Though much of the anterior and posterior lobes are missing the impressions remaining in the matrix show the plastron to have had a greatest length of about 315 mm.

The entoplastron though only partially preserved, has a greatest width of 50 mm. Its length cannot be determined.

The bridge has a width of about 145 mm.

There is no suggestion of a notch in the posterior lobe, shown by the impression in the matrix, but it is not possible to state positively that such did not exist. Judging from the impression left by the anterior lobe the lip was thick and broad, with an abrupt depression on the dorsal surface some 35 mm. posterior to the anterior border. The anterior end of this lobe was probably within the forward end of the carapace.

The pair of horn-like protuberances on the front of the carapace, the presence of a pair of supernumerary costal scutes on either side of the first vertebral serve to distinguish this specimen from all other described species of the genus, and I therefore take great pleasure in naming it *Echmatemys hollandi* for Dr. William J. Holland, Director of the Carnegie Museum, in recognition of his activities in the field of vertebrate paleontology.

10. *Echmatemys obscura* sp. nov.

Plate XXIV; text-figs. 14 and 15.

Type: C. M. No. 3252, consisting of a carapace, lacking the posterior end back of the sixth neural; and the plastron, lacking the lip and a small portion of the extremity of the posterior lobe. Collected by Earl Douglass, August 17, 1908.

Locality: Devil's Play Ground, south of Kennedy's Hole, Uinta Basin, Uinta County, Utah.

Horizon: Horizon C, "gray beds below red and gray beds," Uinta formation, Upper Eocene.

Except for the parts missing from the posterior end of the carapace, the type specimen is well preserved and all of the sutures and sulci are clearly displayed. The carapace is broadly rounded in front with a wide, but shallow, emargination of

the nuchal border. The median portion is high and vaulted. The length of the carapace is estimated to have been about 390 mm., its breadth is 286 mm., its height at the center is 130 mm. The plastron is broad, and, like many other species of the genus *Echmatemys*, there is but little space in front of the axillary notches for the exit of the limbs. The margins of the carapace forward of the axillary notches are thickened and rounded, but forward it thins rapidly, coming to an obtuse edge along the median anterior border. The peripherals of this region do not flare upward, though those immediately posterior to the inguinal notches show a tendency to do so.

The carapace is smooth, except that the median costal areas are crossed antero-posteriorly by a series of wide, parallel, wavy, flattened ridges. In a line 12 mm. long three of these ridges may be counted. This ornamentation is inconspicuous unless the light strikes the surfaces at the proper angle. It is the obscure nature of this ornamentation which has suggested the specific name.

The nuchal plate is unusually long and narrow. At the point of its greatest transverse diameter the sides are considerably within the boundaries of the first vertebral. The length of the nuchal is 65 mm.; its greatest transverse diameter is 51 mm.; the free border measures 40 mm. The nuchal surface is without median elevation. *Echmatemys obscura* is the only species of the genus which has the nuchal plate longer than wide.

All of the neurals posterior to the first are broadly hexagonal, and all posterior to the first are broader than long. The second and third have the anterior end concave, those posterior being straight. Their principal measurements are given in the accompanying table.

DIMENSIONS OF NEURALS.

No.	Length.	Width.
1.....	47.....	35
2.....	38.....	40
3.....	43.....	43 ^c
4.....	39.....	47
5.....	31.....	41
6.....	—.....	44

^c, estimated.

The costals posterior to the first alternate in having the distal ends slightly wider and narrower than the proximal ends.

The peripherals are moderately high, the first extending inward from the border 50 mm., the seventh 58 mm.; the eighth 55 mm. The border above the bridge is heavy and rounded, but posterior to the inguinal and anterior to the

axillary notches the borders thin rapidly toward the center. The costoperipheral sutures pass along the median sides of the shell on an average of about 17 mm. mesiad of the marginal sulcus. Beyond the bridges the sutures and sulci in some

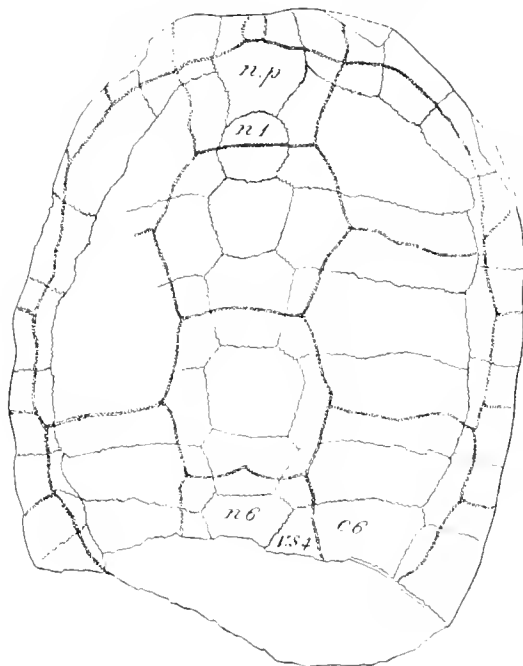


FIG. 14. *Echmatemys obscura*. Carapace of type, C. M. No. 3252. One-fourth natural size. *n. 1*, *n. 6*, neurals one and six; *n.p.*, nuchal plate; *v.s. 4*, fourth vertebral scute; *c. 6*, sixth costal.

places approach one another as close as 4 mm., and in other places are distant as much as 30 mm.

The nuchal scute is narrow, measuring 8 mm. on the free border. It is 15 mm. long antero-posteriorly.

The vertebral scutes are wider than long, the second being especially wide. The sides of those back of the first are bracket-shaped. Their dimensions are given in the accompanying table.

DIMENSIONS OF VERTEBRALS.

No.	Length.	Width in Front.	Greatest Width.
1	75	87	87
2	83	58	102
3	79	60	81
4	—	58	—

The costo-marginal sulci run below the costo-peripheral sutures. The sulci on both carapace and plastron are narrow and moderately impressed.

The plastron in life had a length of about 372 mm. The posterior end is

narrow, but deeply notched. The length of the anterior lobe is about 100 mm.; its width at the base is about 162 mm. The length is therefore only 61 per cent. of the width. From the axillary notch the free border runs straight forward for a short distance then curves in regularly to the epiplastral lip, which is missing in

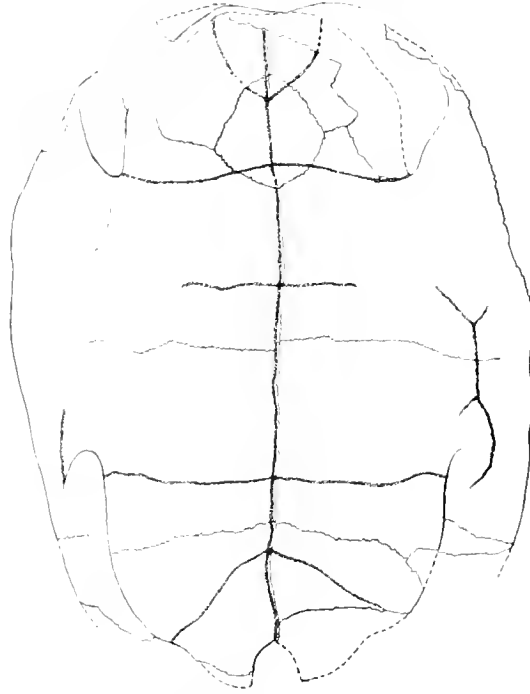


FIG. 15. *Echmatemys obscura*. Type, C. M. No. 3252. Plastron. One-fourth natural size.

this specimen. This free border is relatively thin and acute, thickening somewhat as it approaches the lip. The lip appears to have been about 50 mm. wide.

The entoplastron has a length of about 60 mm. and a width of 55 mm. It is crossed by the humero-pectoral sulcus, and is also overlapped by the gular scutes. It is pear-shaped in outline, in this respect resembling the entoplastron of *Echmatemys douglassi*. The bridge is 150 mm. in width.

The length of the posterior lobe is 120 mm. Its width at the base is 191 mm. The length is therefore 62 per cent. of the width. The free borders are slightly contracted at the femoral-abdominal sulcus, and again at the femoral-anal sulcus; from which point the border turns in rapidly toward the center. The posterior lobe is terminated posteriorly by rather sharp projecting points on either side of the narrow, but rather deep, median notch. It is estimated that the notch had a depth of 30 mm. The posterior borders of the lobe are acute. At the center of the notch the bone has a thickness of 5 mm.

The anterior lobe curves upward toward the carapace much as in *Echmatemys*

septaria. The plastron is flat, but in an unerushed specimen the bridges would doubtless curve upward to the margin of the shell. In this specimen they are but little above the level of the plastron.

The hyoplastrals meet on the midline for a distance of 80 mm.; the hypoplastrals for 97 mm.; the xiphiplastrals for 66 mm.

The gular scutes along the midline are about 52 mm. long; the humerals 37 mm.; the pectorals 63 mm.; the abdominals 101 mm.; the femorals 48 mm.; and the anals 53 mm.

Echmatemys obscura is distinguished from all species of the genus, in which the nuchal region is known, by the extreme narrowness of the nuchal plate, it being the only species known, in which the nuchal plate is longer than wide. From *Echmatemys cibollensis*, *E. megaulax*, and *E. euthneta* (the nuchal region of all three being unknown) the present species is distinguished: from the former by having the gulars overlapping the entoplastron; and from the latter two by having the gular-humeral sulcus crossing the rear portion of the entoplastron. This species is further distinguished by the greater relative widths of the neurals and especially the vertebrae. The obscure, but characteristic, ornamentation of the costal region of the carapace will also aid in recognizing this species.

11. *Echmatemys depressa* sp. nov.

Plate XXIII, fig. 2; text-fig. 16.

Type: C. M. No 2936, consisting of the carapace, lacking much of the anterior margin, the peripherals, and outer halves of the costals of the left side, and most of the peripherals posterior to the inguinal notch of the right side. The plastron is represented by a few fragments only, though the impression in the matrix gives some idea of its proportions. Collected by O. A. Peterson, August 5, 1912.

Locality: Six miles east of Myton, Uinta County, Utah.

Horizon: Horizon C, Uinta formation, Upper Eocene.

Although the open sutures of the type specimen give evidence of the immaturity of the individual, it appears to represent one of the smaller species of the genus *Echmatemys*. I was first inclined to regard it as referable to the genus *Palaeotheca* on account of its small size and the presence of a dorsal keel, but a comparison with the types of the two species pertaining to that genus (*Palaeotheca terrestris* Cope, and *P. polycypha* Cope) both of which are in the U. S. National Museum, shows differences which lead me to believe that it can with greater propriety be referred to the genus *Echmatemys*. The apparent absence of a second suprapygal and the extremely wide vertebrae may with other characters to be observed in a more perfect specimen show its distinctness from that genus.

In a straight line the shell has a greatest estimated length of 135 mm.; at the center a greatest width of 115 mm. Though depressed, the upper shell is broadly convex in all directions, dropping off rather more rapidly toward the back than toward the front. The upper surface of the carapace is smooth, the sulci lightly impressed, and nowhere are scutal growth lines to be observed.

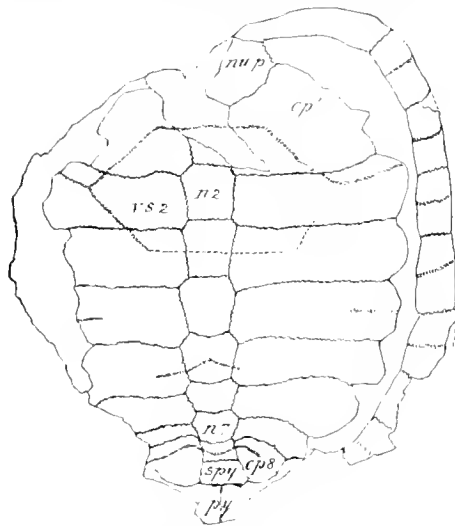


Fig. 16. Carapace of *Echmatemys depressa*. Type. C. M. No. 2936. One-half natural size. *c.p.* 8, costal plates one and eight; *n. 2*, *n. 7*, neurals two and seven; *nu.p.*, portion of nuchal plate; *py*, pygal; *spy*, suprapygals; *v.s. 2*, second vertebral scute.

The nuchal is only partially preserved, but this portion shows that it had a greatest width of 26 mm. and was obtusely keeled at the center. The anterior border, as shown in Fig. 16, is missing.

There are eight neurals, all of which are hexagonal, with the exception of the first and eighth, the latter being subrectangular in outline. All have their anterolateral angles truncated, which serves at once to distinguish this form from *Echmatemys pusilla* Hay, which has the postero-lateral angles of the neurals truncated. The neurals gradually decrease in size from front to back, and, excepting the first and third, all are broader than long, as shown in the accompanying table. The second and third neurals are sharply keeled on their posterior and anterior ends respectively, as are the fourth and fifth, while the sixth, seventh and eighth are keeled their entire lengths. The keel on the suprapygals is very low and hardly discernible.

All of the costals of the right side are present and perfectly preserved. They are of moderate thickness with pointed distal ends which articulated with the peripherals by gomphosis. Portions of the buttresses preserved in the matrix indicate that they articulate with the costals considerably above the costo-peripheral suture.

DIMENSIONS OF NEURALS.

No.	Length.	Width.
1.....	17.....	12
2.....	13.....	16
3.....	14.5.....	14
4.....	13.5.....	14
5.....	13.5.....	14
6.....	11.....	14
7.....	10.....	12
8.....	9.....	10

The peripherals of the right side above the bridge and somewhat forward of the axillary notch are perfectly preserved, and, as in *Echmatemys pusilla* Hay, have a sharp carina beginning on the third peripheral and continuing backward across the bridge to the hinder peripherals. The fifth peripheral has a width of 19 mm.; the sixth of 18 mm.; the seventh of 20 mm.; the eighth of 18 mm. The lateral peripherals from the edge of the carapace to their proximal extremities have a length of 14 mm., becoming narrower toward the front of the shell.

The sulci on most parts of the carapace are very obscure, being traceable only here and there, though where they cross the neurals somewhat plainer than elsewhere. The boundaries of the second vertebral can be partially determined, and these indicate a very wide scute having at the center angularly pointed outer borders. The second vertebral has a greatest width at the center of 58 mm.; an estimated length of about 32 mm. There were four costal scutes. The costal-marginal sulcus appears to have followed closely the course of the costo-peripheral suture. The supracaudal scute is divided. The second suprapygal is absent in this specimen.

The impression in the matrix shows the hypoplastron to have a greatest width at the midline of 41 mm. The width of the posterior lobe at the base is about 60 mm. Its greatest length was about 47 mm. It cannot be determined whether this lobe was notched on the midline. At the center the plastron has a greatest width of 84 mm. The bridge has a width of about 58 mm. The inguinal buttresses rise well above the costo-peripheral sutures and articulate with both the fifth and sixth costals.

Echmatemys depressa is distinguished from all other species of the genus by the greater relative widths of the vertebral scutes, the absence of a second suprapygal, and the presence of a dorsal keel. From *Echmatemys megalax* (Cope), which also has a dorsal keel the present species is to be distinguished by having the sulci less deeply impressed and in having the costo-marginal sulcus follow the

course of the costo-peripheral suture whereas in the former it crosses the peripherals on their upper third.

12. *Echmatemys pusilla?* Hay.

Echmatemys pusilla HAY, Fossil Turtles of North America, 1908, pp. 337-339, text-figs. 445, 446.

A small turtle, C. M. No. 3282, collected by Messrs. Earl Douglass and Clarence Wilson, November 1, 1911, southeast of Ouray, Uinta County, Utah, from Horizon C of the Uinta formation, Upper Eocene, is referred with some doubt to *Echmatemys pusilla* Hay. The very fragmentary nature of the present specimen renders its generic and specific affinities difficult of positive determination, but after a careful comparison of this specimen with the type of *E. pusilla*, kindly loaned me by Dr. W. D. Matthew, of the American Museum of Natural History, I am convinced of the very close relationships of the two specimens, even though the discovery of more perfect material may eventually demonstrate their specific distinctness.

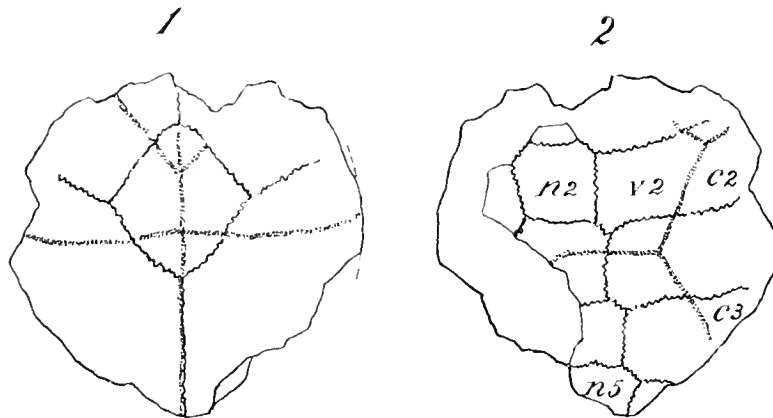


FIG. 17. Portions of the carapace and plastron of *Echmatemys pusilla?* Hay. C. M. No. 3282. (1), plastron; (2), carapace. *c2*, *c3*, costals two and four; *n2*, *n5*, neurals two and five; *v2*, vertebral scute two. Natural size.

This specimen consists of the anterior lobe of the plastron lacking the lip, a small portion of the carapace consisting of the second neural complete, and portions of the third, fourth, and fifth neurals with the upper portions of abutting costals, as shown in Fig. 17. The second neural is hexagonal in outline and measures 9.5 mm. in length, with a greatest width of 10 mm.; the third is 12 mm. long and 13 mm. wide; the fourth is 13 mm. long. The second vertebral has its greatest width of about 35 mm. at the center. The scutal areas of the carapace are plainly grooved by the lines of growth of the scutes. These lines of growth are also present in the type of the species.

The entoplastron, as in the type, is long, narrow, and pointed in front. Its greatest length is 19 mm., its greatest width 16 mm. It is overlapped by both the gulars and pectorals. The specimen before me also agrees with the type in the great width of the pectorals behind the entoplastron. These scutes reach backward to the hypoplastral suture, a condition not known in any other species of the genus. At the point where the pectoro-humeral sulcus crosses the free borders the lobe has a width of 48 mm. The free border of the lobe is thin and acute, being bevelled off on the upper surface.

The most important dissimilarity between the two specimens here discussed appears to be in the wide vertebrals and in the shape of the neurals, those of the type having the postero-lateral angles truncated, whereas in the specimen from the Uinta formation the antero-lateral angles of the third, fourth, and fifth are thus cut off. The second neural is octagonal in the type, hexagonal in No. 3282. In the shape of the anterior lobe of the plastron, the long pointed entoplastron overlapped by the gulars and crossed well forward by the pectoro-humeral sulcus and the extremely wide pectorals reaching backward nearly to the hyo-hypoplastral suture these specimens show a remarkably close resemblance.

Family TESTUDINIDÆ Gray.

The family Testudinidæ is represented in the collection of chelonian remains from the Uinta formation in the Carnegie Museum by the two genera *Hadrianus* Cope and *Testudo* Linnaeus, the former genus by three, the latter by but one species. Four species of *Hadrianus* are now recognized as occurring in the Uinta formation. The discovery of *Testudo* in the Upper Eocene is of interest as being the first time this genus has been found below the Oligocene in North America. In the Fayum deposits (Upper Eocene) of northern Africa, however, the genus *Testudo* has been recognized by Andrews from well-preserved specimens, which in several respects closely resemble the species here described.

Genus HADRIANUS Cope.

13. *Hadrianus corsoni* (Leidy).

Plate XXV, fig. 1; text-fig. 18.

Testudo corsoni LEIDY, Proc. Acad. Nat. Sci. Phila., 1871, p. 154; Contrib. Extinct Vert. Fauna West. Terrs., 1873, pp. 132, 339, Pl. XI, figs. 1, 2; Pl. XV, fig. 7; Pl. XXIX, figs. 2-4; Pl. XXX, figs. 1-4.

Hadrianus octonarius COPE, Palæont. Bull. No. 2, 1872; Vert. Tert. Form. West., 1884, p. 140, Pl. XX, figs. 1-4.

Hadrianus corsoni COPE, U. S. Geol. Surv. Terrs., 6th Ann. Rept., 1872 (1873), p. 631; HAY, Bibliog. and Cat. Foss. Vert. N. A., 1902, p. 450; Fossil Turtles of North America, 1908, pp. 376-380, Pl. LX, LXI; text-figs. 473-479.

A large specimen in the present collection is identified as belonging to the above genus and species, and represents the first recorded occurrence of *Hadrianus corsoni* in the Uinta formation. This specimen consists of a complete plastron, the peripherals of the right side above the bridge, and a few fragments of the carapace. It was collected by O. A. Peterson, August 5, 1912, six miles east of Myton, Uinta County, Utah, from Horizon C of the Uinta formation, Upper Eocene. It bears the C. M. Catalog No. 3403.

The length of the plastron at the center is 740 mm.; the greatest length over all 775 mm.; the greatest breadth about 490 mm. The posterior lobe is deeply and widely notched and the anterior lobe is terminated in front by a wide spade-like lip which projects prominently from the general contour of the lobe.

Hadrianus corsoni was based upon the anterior portion of a plastron consisting of the complete lip and lobe back to and including a small portion of the anterior end of the entoplastron. A comparison of the specimen before me with the type shows striking similarities in the contour of the lobe and lip, and especially of the wide anterior end of the entoplastron, which appears peculiar to this species. The lip has a transverse width at the base of 162 mm., which is greater than that of the type, or of any subsequently discovered representative of this species. It projects 45 mm. beyond the point where the gular-humeral sulcus crosses the free border. This measurement is slightly greater than in the type, but less than in the type of *Hadrianus octonarius* Cope, now regarded by Hay as being a synonym of the present species. The anterior border of the lip is subacute, nearly straight, but slightly notched on the midline as in the type. The upper surface of the lip is slightly convex along the midline, with shallow longitudinal depressions on either side. The lower surface is flat, but I am inclined to believe it would have been broadly convex in life.

The anterior lobe is 345 mm. wide at the base, with a length of 252 mm. Along the free borders on the upper surface the bone is bevelled off to an acute edge that becomes obtusely rounded in front of the axillary notches. The lip on the superior surface extends backward 67 mm.

The entoplastron is unusually broad and angular in front. In the figures of the type the suture limiting the anterior border of the entoplastron runs nearly straight across the median line, then turns abruptly backward and outward. In the specimen here considered the anterior border is inclined more posteriorly, as

in the type of *H. octonarius*, but it has the same angular turn backward and outward as in the type of the genus and species. The length of the entoplastron on the

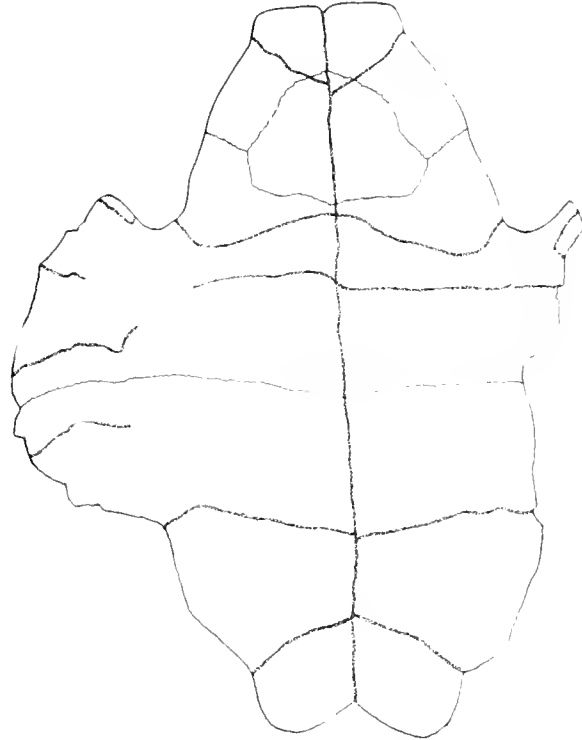


FIG. 18. *Hadrianus corsoni* (Leidy). Plastron of C. M. No. 3403. One-eighth natural size.

midline is 155 mm.; its width 184 mm. It is overlapped slightly by the gular scutes, but is not crossed by the humero-pectoral sulcus.

The bridge is 290 mm. wide.

The length of the posterior lobe is 234 mm.; its width at the inguinal notches 386 mm. The free edges of the lobe are subacute, except in front of the notches, where it is rounded. The width of the posterior notch is about 135 mm.; its depth about 35 mm. There is no perceptible ridge leading back from the inguinal buttresses until a point midway between the buttress and the posterior end of the lobe is reached, where the surface is concave mesiad, thus causing the ridge to stand out quite prominently. On the outside of this ridge the surface is bevelled off steeply near the buttress, but less and less so posteriorly, until on the posterior outer angle of the xiphiplastral projections the slope is very gentle. The surfaces of these projections are rugosely roughened as in the type of *H. octonarius* (No. 2186, U. S. National Museum), which they resemble in shape and size.

The hyoplastron on the midline has a width of 195 mm. The arrangement of

the plastral scutes is not greatly different from that of other Testudinidæ. The gulars have a length on the midline of 90 mm.; pectorals of 60 mm.; abdominals of 255 mm.; femorals of 95 mm.; anals of 86 mm. The principal dimensions and proportions of specimen C. M. No. 3403, as compared with other specimens identified as pertaining to *Hadrianus corsoni* Leidy, are given in the table below.

	C. M. No. 3403.	<i>Hadrianus corsoni</i> A. M. N. II. No. 6027.	Type of <i>H. octonarius</i> U. S. N. M. No. 2186.
Greatest length of plastron	778	550	740
Greatest length anterior lobe	252	175	247
Greatest width anterior lobe	345	246	360
Width of bridge	290	215	285
Greatest length posterior lobe	234	157	240
Greatest width posterior lobe	386	240	330
Length of entoplastron	155	115	125
Width of entoplastron	184	134	160
Width of lip	162	118	135
Width of bridge to width of anterior lobe	81 $\frac{c}{o}$	87 $\frac{c}{o}$	79 $\frac{c}{o}$
Width of anterior lobe to its length	72 $\frac{c}{o}$	71 $\frac{c}{o}$	68 $\frac{c}{o}$
Width of bridge to length of posterior lobe	80 $\frac{c}{o}$	73 $\frac{c}{o}$	84 $\frac{c}{o}$

14. *Hadrianus robustus* sp. nov.

Plate XXV, fig. 2; text-fig. 19.

Type: C. M. No. 3342, consisting of the anterior half of the plastron, collected by Earl Douglass, July 30, 1908.

Locality: Near Kennedy's Hole, Uinta Basin, Uinta County, Utah.

Horizon: Horizon C, Uinta formation, Upper Eocene.

The specimen upon which the present species is based represents one of the larger species of the genus. Those parts present are in a good state of preservation, and all of the sutures and sulci can be clearly traced. It is assigned provisionally to the genus *Hadrianus*, until such time as the discovery of a more perfect specimen makes it possible to determine its true generic affinities.

The anterior lobe is 220 mm. long, and at the base 285 mm. wide. The length thus being 77 per cent. of the width, whereas in *Hadrianus corsoni* it is only 71 and in *H. majusculus* 68 per cent. The lip in this species is especially prominent and exceedingly heavy, having a thickness at the center of 46 mm. At the base it measures 123 mm. in width, and near the anterior end 117 mm. From the point where the gular-humeral sulcus crosses the free border the lip extends forward 52 mm. The anterior border of the lip is transversely broadly convex, and bluntly bevelled dorso-ventrally, the longer bevel being on the lower side. On the superior surface the lip extends posteriorly 100 mm., at this point the surface descends perpendicularly, decreasing by one-half the total thickness of the plastron. Slightly

posterior to this drop on the visceral surface there is a sharp median ridge on the midline which measures longitudinally 65 mm. The free borders of the anterior lobe are bevelled off from the superior surface to a sharp edge, which becomes obtusely rounded at the base of the lip.

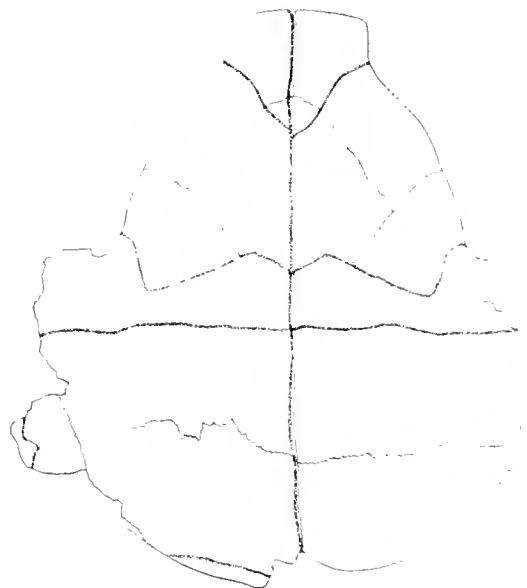


FIG. 19. *Hadrianus robustus*. Anterior half of the plastron. Type, C. M. No. 3342. One-sixth natural size.

The entoplastron is pointed in front and wide behind. It is 134 mm. long, and 147 mm. wide. The gular scutes overlap the anterior end.

In front of the axillary notch the plastron has a thickness of 29 mm.; immediately posterior to the entoplastron of 16 mm.; and at the junction of the hyo-hyoplastron at the center, of 15 mm. This latter measurement in the type of *Hadrianus tumidus* Hay is only 9 mm. The gular scutes have their greatest extent of 114 mm. antero-posteriorly. Within the area of the gular scutes the surface of the lip is swollen out somewhat below the level of the epiplastral areas bordering it. The superior surface of the lip anteriorly is broadly convex, but flattens toward the posterior end.

The humerals meet on the midline for 105 mm.; the pectorals for 40 mm.; the abdominals for at least 205 mm. The sulci are broad and deeply impressed. The humero-pectoral sulcus begins just in front of the axillary notch and extends inward and backward for a short distance, then curves forward to the entoplastron, again turning backward to the midline, skirting, but not crossing, the entoplastron.

The pectoral scutes have quite a different shape from any of the described species of the genus. They are narrow (28 mm.) mesiad of the axillary notch

gradually widening to a point a little beyond where the sulcus first reaches the entoplastron, which measures 63 mm. antero-posteriorly, then again narrowing to the midline, where it has a fore-and-aft extent of 40 mm. The pectoro-abdominal sulcus runs straight across the plastron as in *Hadrianus corsoni*.

The hyo-hyoplastral suture runs a very tortuous course across the plastron. The hyoplastrals meet on the midline for a distance of 136 mm. The hyoplastrals at the center have a transverse width of 400 mm.

The pectoral scutes on the midline are less than one-fifth the width of the abdominals, and following Hay's analysis of the various species of the genus this proportion would be sufficient to show the specific distinctness of the present specimen. In the proportions of these scutes the present species is nearest *Hadrianus tumidus* Hay, which is also from the Uinta formation, and in which the pectoral scutes are less than one-third as wide as the abdominals at the center, but it is distinguished from that species by having a thicker plastron and by the different form of the pectoral scutes, and the greater width posteriorly of the entoplastron. From *H. majusculus* and *H. corsoni* the difference in the proportions of the length to the breadth of the anterior lobe will help to separate the present form; that is to say in *Hadrianus robustus* the length is 77 per cent. of the width at the base, while it is 68 and 71 per cent. respectively in the other two species mentioned above.

15. *Hadrianus utahensis* sp. nov.

Plate XXVI, fig. 1; text-fig. 20.

Type: C. M. No. 2343, consisting of the plastron and portions of the peripherals above the bridge on the right side. The anterior portion of the lip, and parts of the margins of both anterior and posterior lobes are missing. Collected by Earl Douglass, July 30, 1908.

Locality: South of Kennedy's Hole, Uinta Basin, Uinta County, Utah.

Horizon: Horizon B or C, Uinta formation, Upper Eocene.

The plastron of the type specimen is estimated to have had a greatest length of about 520 mm., and a greatest width at the center of 320 mm. The anterior lobe is about 175 mm. long and 300 mm. wide at the base. The width of the lip, where the gular sulci cross the free border, is 110 mm. The plastron is quite concave, indicating that the specimen was in all probability a male.

While every thing indicates that the lip extended well forward, it probably continued the general contour of the lobe. The free borders of the lobe are subacute, being bevelled off from the upper surface, so that the edge is nearly on a level with the ventral surface of the plastron. At the center on the broken border

the lip is 22 mm. thick, but posteriorly it increases to 27 mm., behind which the plastron is deeply excavated. On the upper surface of the lip there is a slight median elevation. Transversely the whole lip is broadly convex rounding down at the sides to a subacute edge.

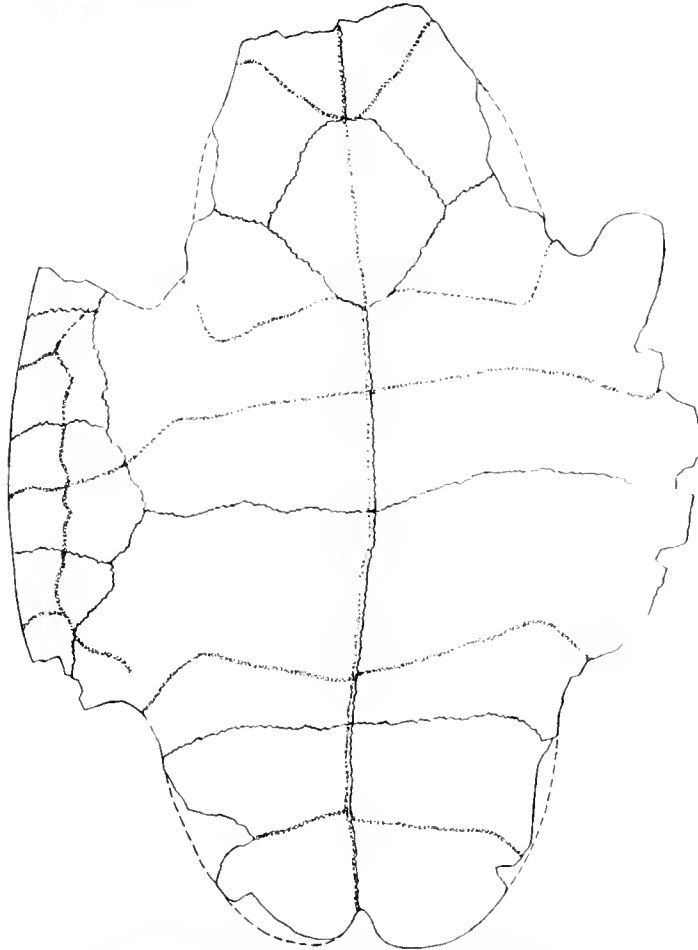


FIG. 20. Plastron of *Hadrianus utahensis*. Type. C. M. No. 2343. One-fourth natural size.

The entoplastron is rhombic in form, being 97 mm. long and 95 mm. wide. The gular scutes reach, but do not overlap, this bone. In this respect this specimen differs from all of the described species of the genus. The bridge has a greatest width of 210 mm.

The posterior lobe has a greatest length of about 140 mm.; a greatest width of 230 mm. at the inguinal notches. The posterior lobe is shallowly notched on the midline. This notch has a greatest depth of 10 mm. Immediately behind the inguinal notches the borders of the lobe have a thickness of 27 mm. and are rounded dorso-ventrally. The border at the anal sulcus is 18 mm. thick. The free border of the entire lobe a short distance posterior to the inguinal notches is bevelled off

from the dorsal surface to a subacute edge. There is no ridge leading back from the buttresses as in *H. tumidus* Hay. In front of the notch on the dorsal surface the plastron is transversely shallowly concave. The plastral buttresses are relatively heavy.

The hyoplastrals meet on the midline for a distance of 108 mm.; hypoplastrals for 120 mm.; xiphiplastrals for 107 mm.

The sulci on the plastron are relatively narrow but well impressed. The gular sulci run forward and outward from the center, but, as they approach the border, suddenly turn outward and then backward continuing in this direction over the border upon the dorsal surface and fading out at the base of the lip. The sulcus limiting the humerals behind runs backward and slightly inward from the border in front of the axillary notch for a short distance, then turns inward and forward to the posterior boundary of the entoplastron, but does not cross it. The pectorals occupy 41 mm. of the midline, and have a least diameter antero-posteriorly of 29 mm. The abdominals meet on the midline for a distance of 155 mm.; the femorals for 75 mm.; anals for 58 mm. The plastron at the center has a thickness of only 7 mm.

The peripherals turn abruptly upwards at the sides of the shell. The sulci between the plastron and peripheral bones on the bridge, although broadly interdigitative, run quite a straight course antero-posteriorly. The fifth and sixth peripherals have a width of 64 mm. Their length on account of the missing upper extremities cannot be determined.

The present specimen is assigned provisionally to the genus *Hadrianus*, though later it may be found, when more perfect specimens are available, that it belongs to *Testudo*. It is distinguished from the described species of the genus by the narrow and relatively shallow notch on the posterior lobe; the rounded and thickened ends of the xiphiplastrals, and by having the bridge longer relative to the length of the hinder lobe. In *Hadrianus majusculus* the posterior lobe is 85 per cent. of the length of the bridge; in *H. tumidus* 77 per cent.; in *H. corsoni* 73 per cent.; and in the present specimen only 66 per cent.

Genus TESTUDO Linnæus.

16. *Testudo uintensis* sp. nov.

Plate XXVII; text-figs. 21 and 22.

Type: C. M. No. 2331, consisting of a carapace and plastron, the latter almost perfectly preserved, the former lacking the peripherals of the right side, and the

anterior portion of the nuchal plate. Collected by Earl Douglass and party, July 30, 1908.

Locality: South of Kennedy's Hole, and about one hundred rods west of Dragon-Vernal road, Uinta Basin, Uinta County, Utah.

Horizon: Horizon B or C, Uinta formation, Upper Eocene.

In form the carapace of this tortoise is broad, of moderate height and strongly arched in all directions. As now preserved the shell is somewhat more flattened than it would have been in life. The posterior end is not so broad as in *Hadrianus* but is more evenly rounded as in many species of *Testudo*. The areas covered by the vertebral scutes are decidedly convex. The few anterior peripherals present suggest that the front was little, if at all, emarginated on the median line. All of the sutures remain distinct and the sulci can be clearly traced, so there can be no question raised as to their proper interpretation in the figures. The carapace has a length of about 360 mm.; a breadth of 300 mm.

The neurals and costals are highly differentiated. In this species there are only seven neurals, as in *Testudo ammon* Andrews, but whether this represents a constant character in this species or only an individual variation, as in *T. ammon*, must await the discovery of additional specimens. The first neural is especially elongated and oval; the second and sixth octagonal; the third tetragonal; the fourth, fifth, and seventh being hexagonal. All of the neurals are longer than wide, whereas in *Hadrianus*, *Styemys* and most of the species of *Testudo* the neurals are wider than long. The dimensions of the neurals and costals are given in the accompanying table.

No.	Dimensions of Neurals.		No.	Dimensions of Costals.	
	Length.	Width.		Width of Proximal End.	Width of Distal End.
1	44	23	1	44	68
2	39	30	2	28	47
3	33	25	3	43	30
4	31	29	4	30	60
5	34	28	5	37	14
6	39	32	6	21	49
7	31	24	7	20	22
			8	20	35

There are two suprapygals, the anterior being bifurcate and enclosing between its right and left limbs the lozenge-shaped second suprapygal. The first has a diameter antero-posteriorly at the center of 32 mm., a breadth of 88 mm.; the second is 30 mm. in length and 48 mm. in width.

The pygal is wedge-shaped, the narrower truncated end being posterior, the anterior end is notched for the second suprapygal. The under side is transversely

concave, the upper slightly convex in the same direction. The free edge is acute with a faint median projection, the whole forming a convex covering for the tail that apparently projected but little below the level of the carapace.

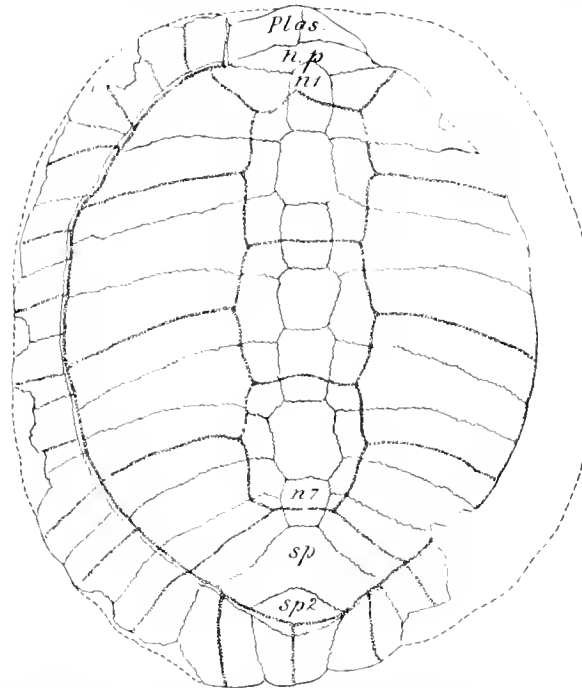


FIG. 21. *Testudo uirtensis*. Carapace of the type, C. M. No. 2331. One-fourth natural size. *n.p.*, nuchal plate; *n1* and *n7*, first and seventh neurals; *plas.*, lip of plastron; *sp.*, suprapygals; *sp2.*, second suprapygals.

The costal plates are alternately wide and narrow, reaching as high a degree of differentiation in this respect as any species of the genus. The diameters of their proximal and distal ends are given in the accompanying table.

The nuchal plate is largely missing, as well as nearly all of the peripherals of the right side. Those of the left side have suffered some damage, so that their exact dimensions can not always be determined. They are however of moderate length with thin acute edges on front and back, becoming slightly obtuse along the sides. There are eleven peripherals in the complete series. The greatest thickness of the ninth peripheral, the thickest of any of the posterior members, is 16 mm. The second, measured at the suture with the first, is 16 mm. thick.

The plastron has a total length of 332 mm. The width of the anterior lobe at its base is 150 mm. It has a length of 104 mm. The lip does not extend beyond the border of the carapace, and it projects but little beyond the general contour of the lobe. The lower surface of the lobe is flat, while the upper is bevelled off from back toward the front, forming rather a sharp anterior border. On the upper

surface of the lip on either side of the low median ridge there are shallow longitudinal depressions, which run forward to the slight emarginations at either side of the center. At the gular-humeral sulcus the lateral border of the lobe is slightly emarginate. The upper surface, 57 mm. back from the front of the lip, is almost perpendicularly excavated, thus reducing the plastron from 21 mm. to 10 mm. in thickness. The posterior lobe is 90 mm. long; and is 163 mm. wide at the base. The posterior notch is 50 mm. wide and 23 mm. deep. At the inguinal notch the

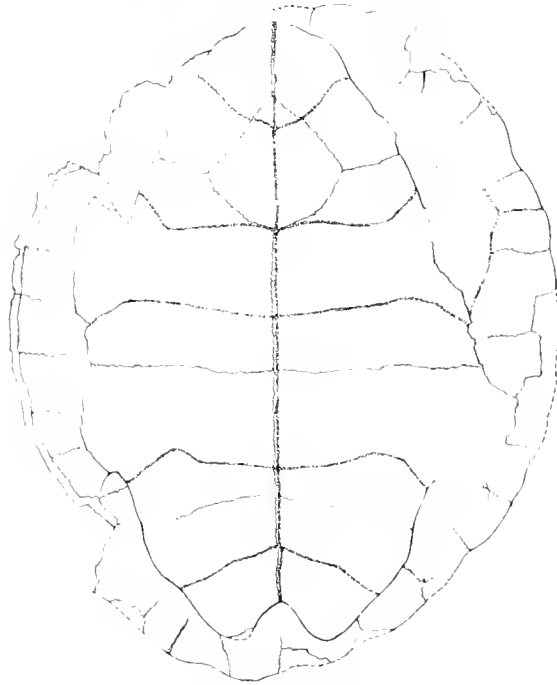


FIG. 22. *Testudo uintensis*. Plastron of type, C. M. No. 2331. One-fourth natural size.

edge of the lobe forms a wall 22 mm. high. This wall diminishes in height posteriorly, so that at the anal-femoral sulcus it measures 15 mm. in height. The outer face of this wall slopes off rather gradually to the subacute lateral edge, while the inner edge slopes abruptly to the inner level of the floor of the carapace. The entoplastron is rhombic in form, 68 mm. long on the midline, and 69 mm. wide. The hyoplastra meet along the midline for a distance of 74 mm.; the hypoplastra for 69 mm.; and the xiphiplastra for 55 mm.

The bridge is 135 mm. wide. The plastron is quite concave and at least suggests that this individual was a male.

The gular scutes overlap the entoplastron and on the midline have a length of 57 mm. The humerals at the middle are 53 mm. long; the pectorals 46 mm.; abdominals 80 mm.; femorals 42 mm.; and anals 28 mm.

The vertebral scutes are longer than wide, their dimensions are given in the table.

DIMENSIONS OF VERTEBRAL SCUTES.

No.	Length.	Width.
1.....	.64.....	.100
2.....	.74.....	.62
3.....	.66.....	.63
4.....	.68.....	.57
5.....	.66.....	.116

The costal scutes are wide, their outer ends joining the marginals at the costo-peripheral suture. The costo-marginal sulcus appears to follow closely the course of the costo-peripheral suture. The humero-pectoral sulcus touches the entoplastron, but does not cross it.

The supracaudal scute is divided as in *Hadrianus*.

A comparison of the type of the present species with the upper Eocene tortoise, *Testudo ammon* Andrews, from the Fayum deposits of Egypt, shows some striking resemblances. Both *Testudo uintensis* and *T. ammon* are distinguished from all other species of the genus by the octagonal shape of the second and sixth neurals, whereas the usual arrangement is for the second and fourth neurals to be octagonal. Both types agree in having seven neurals, although other specimens referred to *T. ammon* by Andrews have the normal number of eight, and it may be found that there is a similar variation in the present species.

Hay^s comments upon *Testudo ammon* as follows: "Dr. A.[C]E.[W] Andrews (Surv. Dept., Pub. Works Ministry, Geol. Survey, Egypt, 1903; Tert. Vert. Fayum, Egypt, 1906, p. 278, pl. 24) has described a land-tortoise from the Upper Eocene of Egypt to which he has given the name *Testudo ammon*. If a true *Testudo*, it is the oldest known. The published figures show that the neurals are variable in form, but the relationships to typical *Testudo* are so close that it may be accepted as belonging to this genus. In some respects it appears to be intermediate between *Testudo* and *Hadrianus*."

The above remarks would apply equally well to the species here described. Up to this time the oldest known *Testudo* found in North America is from the Lower Oligocene. Two species having been described, *Testudo brontops* Marsh, and *T. exornata* Lambe.

If, as has been inferred, *Testudo* has derived its ancestry from *Hadrianus*, the intermediate characters observed in the present specimen are fully in accord with its geological position. The axillary and inguinal buttresses rising but little above

^s "Fossil Turtles of North America," 1908, p. 368.

the costo-peripheral suture, and the presence of a divided supracaudal scute, indicate its relationship with the genus *Hadrianus*, as now understood and defined. On the other hand, the greatly reduced heads of the ribs, and especially the high degree of differentiation reached by the neural and costal bones show its affinities to *Testudo*.

In an attempt to find characters other than those used to separate the three important genera constituting the family Testudinidæ I have determined the width of the bridge as compared to the total length of the plastron in all available specimens pertaining to the genera *Hadrianus*, *Styemys*, and *Testudo*, and find the average to be as follows: In *Hadrianus* the bridge is thirty-eight per cent. of the length of the plastron; in *Styemys* it is forty-nine per cent., and in *Testudo* forty-four per cent. In *Testudo uintensis* it is forty per cent. thus again demonstrating its intermediate stage of development between *Hadrianus* and *Testudo*.

Cope assigned as the principal character distinguishing *Hadrianus* from the other genera of the Testudinidæ, "a divided supracaudal scute," and this would perhaps appear a good reason for assigning the present specimen to that genus if it were not known that three living species of the genus *Testudo* as recognized by Boulenger, also have this scute divided. In the definition of the genus *Testudo* the lip is "usually projecting abruptly from the general contour of the lobe." The present specimen, however, is one of the exceptions, resembling the Oligocene *Testudo amphithorax* in this respect.

It will be seen from this brief discussion that the present means of separating the genera *Hadrianus* and *Testudo* is very unsatisfactory, and it would perhaps be best to combine them until clean cut characters are found, to show that there are two distinct genera.

Family TRIONYCHIDÆ Bell.

The soft shelled Trionychidæ are represented in the present collection by thirteen specimens of the genus *Amyda*, four of which have been identified specifically. These pertain to two species, hitherto known only from the Bridger formation. Two fragmentary specimens, C. M. Nos. 2396 and 3285, judging largely from the character of the sculpturing of the parts of the carapace present, appear to represent undescribed species, but on account of their inadequate nature I refrain from naming them. The genus *Amyda* is now represented in the Uinta formation by the following species, *Amyda crassa* Hay, *A. egregia* Hay and *A. scutumantiquum* (Cope).

Genus *AMYDA* Oken.17. *Amyda egregia* Hay.

Amyda egregia HAY, Fossil Turtles of North America, 1908, p. 531, plate 107, figs. 1-3, text-fig. 691.

A specimen (C. M. No. 3254), collected by Earl Douglass from Horizon B, of the Uinta formation, three or four miles northeast of Well 2, Uinta Basin, Utah, in 1908, is identified as belonging to *Amyda egregia* Hay. This specimen consists of the articulated nuchal, the greater portion of the first neural, the first, second, third, fourth, fifth, and sixth costals, all, excepting the first, lacking portions of their upper extremities. In the matrix on the left side are the free ends of the second, third and fourth costal ribs. These appear to be in their proper positions in relation to the other parts of the shell which are preserved, and serve to give some idea of the width and general contour of the carapace. The shell is broadly rounded in front and considerably arched transversely. The width is estimated to have been about 465 mm. The nuchal has a transverse extent of 255 mm. and measures 52 mm. antero-posteriorly. Hay states that the latter measurement in the type of the species is but 22 mm., although the figure published by him shows it to be at least 42 mm. As in the type specimen the outer end of the nuchal overlaps the free end of the rib of the first costal. The first neural at the anterior end is 40 mm. wide. The sculpture of the carapace is coarse. On the inner ends of the costals the pits and ridges form a honeycomb arrangement, but on their outer fourths the ridges and pits are arranged in rows across the costals, toward their ends on some of the costals the honeycomb pattern again prevails, on others the rows persist to the smooth bevelled border.

In the form of the anterior end of the carapace, with slight emargination of the border at the sutural junction of the nuchal, and the close resemblance of the sculpture of the carapace, this specimen is in close agreement with the type of the species. The chief differences observed are the considerably larger size of the present specimen and the sloping bevel of the smooth ends of the costals, as contrasted with the abrupt bevel of the type.

A second specimen, C. M. No. 3255, in this collection consisting of many fragments of the neurals and costals is provisionally referred to this species. This specimen is from Horizon B, Uinta formation, and from the same locality as the individual previously discussed. It was collected by Dr. W. J. Holland, and Earl Douglass in 1908.

The type of *Amyda egregia* Hay is from the lower Washakie beds south of Hay-

stack Mountain, Wyoming, so that the discovery of the present specimens in the Uinta formation of Utah, considerably extends the geological as well as the geographical range of this species.

18. *Amyda scutumantiquum* (Cope).

Plate XXVI, fig. 2.

Trionyx scutumantiquum COPE, 6th Ann. Report U. S. Geol. Surv. Terr., 1872 (1873), p. 617; Amer. Naturalist, XVI, 1882, p. 988, fig. 6; Vert. Tert. Form. West., 1884, pp. 118, 121, Pl. XVI, figs. 1, 1a; Hay, Bibliog. and Cat. Foss. Vert. N. A., 1902, p. 454.

Amyda scutumantiquum HAY, Amer. Geologist, 35, 1905, p. 336; Fossil Turtles of North America, 1908, pp. 521, 522, plate 100, figs. 2-4, plate 101, fig. 1; text-figs. 676, 677.

A very large specimen C. M. No. 3272 (see plate XXVI, fig. 2), consisting of a considerable part of the anterior two-thirds of the carapace, is identified as pertaining to the above genus and species. This specimen was collected by Earl Douglass May 25, 1908, from the lower portion of Horizon B, "transition beds sandstone," Uinta formation, Upper Eocene, as exposed on the south branch of Red Bluff Wash, above the well on the stage-road between Bonanza and Kennedy's Hole, Uinta County, Utah.

This specimen lacks all of the carapace posterior to the fifth costals, the anterior border and left end of the nuchal, and small portions here and there of the costals forward of the sixth. The sandstone matrix containing the impressions of the seventh and eighth costals fortunately is preserved and serves to give a fairly accurate idea of the dimensions of the entire shell.

In form the carapace is broadly oval with the length slightly exceeding the breadth. The greatest width, as in the type, appears to have been at the middle. The extreme width is about 530 mm.; the length, at the very least, was 570 mm. The shell is broadly arched from the lateral borders to beyond the middle of the costal plates. Along the middle of the back there is a pronounced longitudinal depression which is deepest at about the middle of the shell.

The nuchal extends on each side of the midline about 180 mm.; its width on account of the missing anterior border cannot be given. At the center on the broken border the nuchal has a thickness of 23 mm. Its outer end is bevelled off toward the front and outer extremity. The length of the nuchal is .74 the width of the shell, whereas the type of the species is .76 (not .80 as stated by Hay).

The first neural is exceedingly large, being 93 mm. long and 50 mm. wide toward the front. The others present diminish in size posteriorly. The second, third, and fourth are coffin-shaped, with the widest end posterior, as is usual in the species of this genus. The principal dimensions of the neurals are given in the table.

No.	Length.	Width.
1.....	.....93.....	.....50
2.....	.....62.....	.....41
3.....	.....59.....	.....38
4.....	.....58.....	.....34

All of the costal plates except the first grow wider toward their outer ends. The expansion of the outer end of the second, as in the type, is especially pronounced. In the angulation of the free border of the second costal it resembles that of *Amyda salebrosa* Hay, more nearly than the type of the present species. At their free ends all of the costals preserved are bevelled off to a sharp edge, except at the point where the rib projects. None of the projecting ribs are preserved, so that the distance they extend beyond the free border cannot be determined. Near their outer ends at the sutural borders the costals have a thickness of from 5 to 9 mm. The width of the proximal and distal ends of the costals are given in the table.

No.	Width of Proximal End.	Width of Distal End.
1.....	.....91.....	.....62
2.....	.....58.....	.....103
3.....	.....63.....	.....79
4.....	.....58.....	.....79
5.....	.....59.....	.....84 _e

e, estimated.

The surface of the carapace is ornamented with the usual pits and ridges, there being two pits in a line 10 mm. long, and occasionally three. They are large and distinct, forming a honeycomb arrangement along the middle and on the proximal halves of the costal plates, becoming smaller and less deeply impressed toward the front. In small areas here and there at points about the middle of the costals the pits are arranged in rows across the short diameters of the plates. On the distal portions of the costals the pits are smaller and less deeply impressed, thus forming a very distinct pattern, and, as the smooth band is approached, the ridges show a tendency to break up into tubercles. Nowhere are the ridges wider than the pits.

Except for the considerably greater size of the specimen, and slight differences in the general distribution of the large and small pits the present individual agrees very closely with the type. The latter is from the Bridger beds on Cottonwood

Creek, in Wyoming, and the specimen here described is the first record of the occurrence of this species in the Uinta formation.

A second specimen, C. M. No. 3330, was collected by Earl Douglass in 1908, near the region of Well No. 2, Uinta Basin, Uinta County, Utah. It comes from the Uinta formation (horizon not given) and consists of fragments of costal plates having sculptured surfaces which are identical with those of the specimen discussed above, and is therefore regarded as pertaining to the present species.

Order **SQUAMATA.**

Suborder *SAURIA.*

Family **ANGUIDÆ.**

Genus **GLYPTOSAURUS** Auct.

19. **Glyptosaurus** sp. indet.

A specimen, C. M. No. 3405, consisting of the greater part of the parietal with other fragments of the skull and lower jaws, and a few shields, is identified as pertaining to the lizard-like reptile *Glyptosaurus*. It was collected by O. A. Peterson, August 24, 1912, on White River near Ouray, Uinta Basin, Utah, from Horizon C, Uinta formation, Upper Eocene.

The few osseous shields present are evidently from the trunk of the body. These are oblong quadrate, with a smooth, thinned out anterior end, which is overlapped by the next plate of the series. The lateral borders are roughened for sutural union. The external surface, excepting the smooth area mentioned above, is ornamented with small rounded tubercles closely arranged in more or less concentric rows. The cranial shields on the parietal are of irregular sizes with their surfaces ornamented much in the same manner as the trunk-shields.

This specimen may represent an undescribed species, but at the present time, on account of the very unsatisfactory type specimens upon which the nine described species have been based, it is impossible to make adequate comparisons, so that the specific determination of the present specimen must await the thorough revision of the species of the genus. It is of interest, however, as recording for the first time the occurrence of the genus *Glyptosaurus* in the Uinta formation, and also from the fact that it occurs intermediate geologically between the oldest known specimens from the Bridger described by Marsh, and the youngest specimen discovered and described by Douglass from the Oligocene.⁹

⁹ Douglass, Earl, "Some Oligocene Lizards," *Annals of the Carnegie Museum*, IV, 1908, pp. 278-283.

Nine species of the genus have been described from the deposits of North America. Geologically these are arranged as follows:

<i>Glyptosaurus montanus</i> Douglass.	Lower White River, Oligocene.
<i>Glyptosaurus</i> sp. <i>indet.</i>	Uinta formation, Upper Eocene.
<i>Glyptosaurus sylvestris</i> Marsh. <i>G. nodosus</i> Marsh. <i>G. ocellatus</i> Marsh. <i>G. princeps</i> Marsh. <i>G. brevidens</i> Marsh. <i>G. rugosus</i> Marsh. <i>G. sphenodon</i> Marsh. <i>G. anceps</i> Marsh.	Bridger, Eocene.

EXPLANATION OF PLATES.

PLATE XVIII.

- FIG. 1. Carapace of *Baëna arenosa* Leidy. C. M. No. 2356. One-half natural size.
FIG. 2. Plastron of *Baëna platyplastra*. Type. C. M. No. 3227. One-third natural size.

PLATE XIX.

- FIG. 1. Carapace of *Baëna inflata*. Type. C. M. No. 3406.
FIG. 2. Plastron of the same. Both figures one-third natural size.

PLATE XX.

- FIG. 1. Carapace of *Baëna gigantea*. Type. C. M. No. 3441.
FIG. 2. Plastron of the same. Both figures one-fourth natural size.

PLATE XXI.

- FIG. 1. Carapace of *Echmatemys callopyge* Hay. C. M. No. 2371.
FIG. 2. Plastron of the same. Both figures one-third natural size.

PLATE XXII.

- FIG. 1. Carapace of *Echmatemys douglassi*. Type. C. M. No. 3244.
FIG. 2. Plastron of the same. Both figures one-third natural size.

PLATE XXIII.

- FIG. 1. Carapace of *Echmatemys hollandi*. Type. C. M. No. 3249. Viewed from the right side. One-half natural size.
FIG. 2. Carapace of *Echmatemys depressa*. Type. C. M. No. 2936. Natural size.

PLATE XXIV.

- FIG. 1. Carapace of *Echmatemys obscura*. Type. C. M. No. 3252.
FIG. 2. Plastron of the same. Both figures one-third natural size.

PLATE XXV.

FIG. 1. Plastron of *Hadrianus corsoni* (Leidy). C. M. No. 3403. One-fifth natural size.

FIG. 2. Plastron of *Hadrianus robustus*. Type. C. M. No. 3342. One-third natural size.

PLATE XXVI.

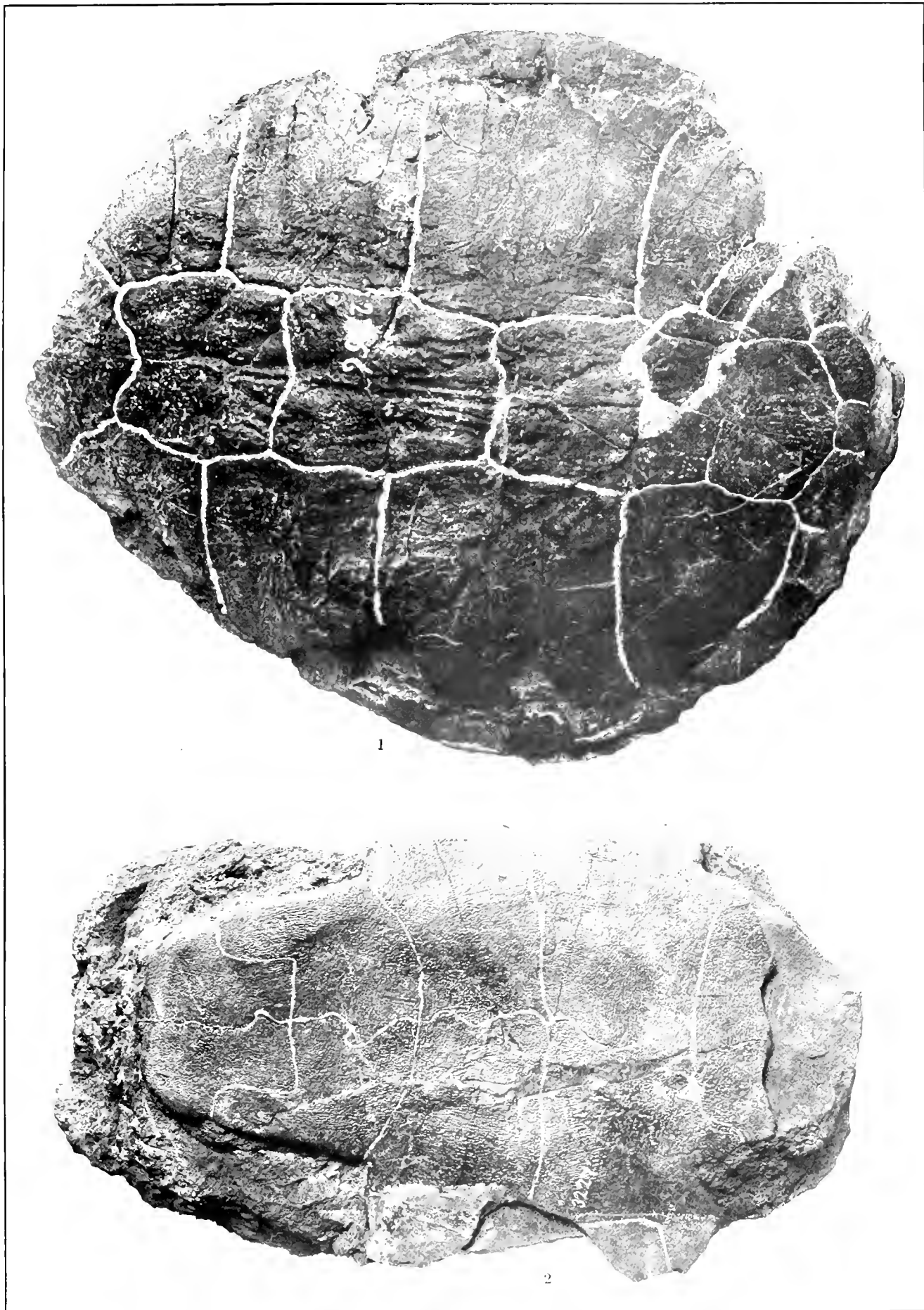
FIG. 1. Plastron of *Hadrianus utahensis*. Type. C. M. No. 2343. One-fourth natural size.

FIG. 2. Carapace of *Amyda seutumantiquum* (Cope). C. M. No. 3272. One-fourth natural size.

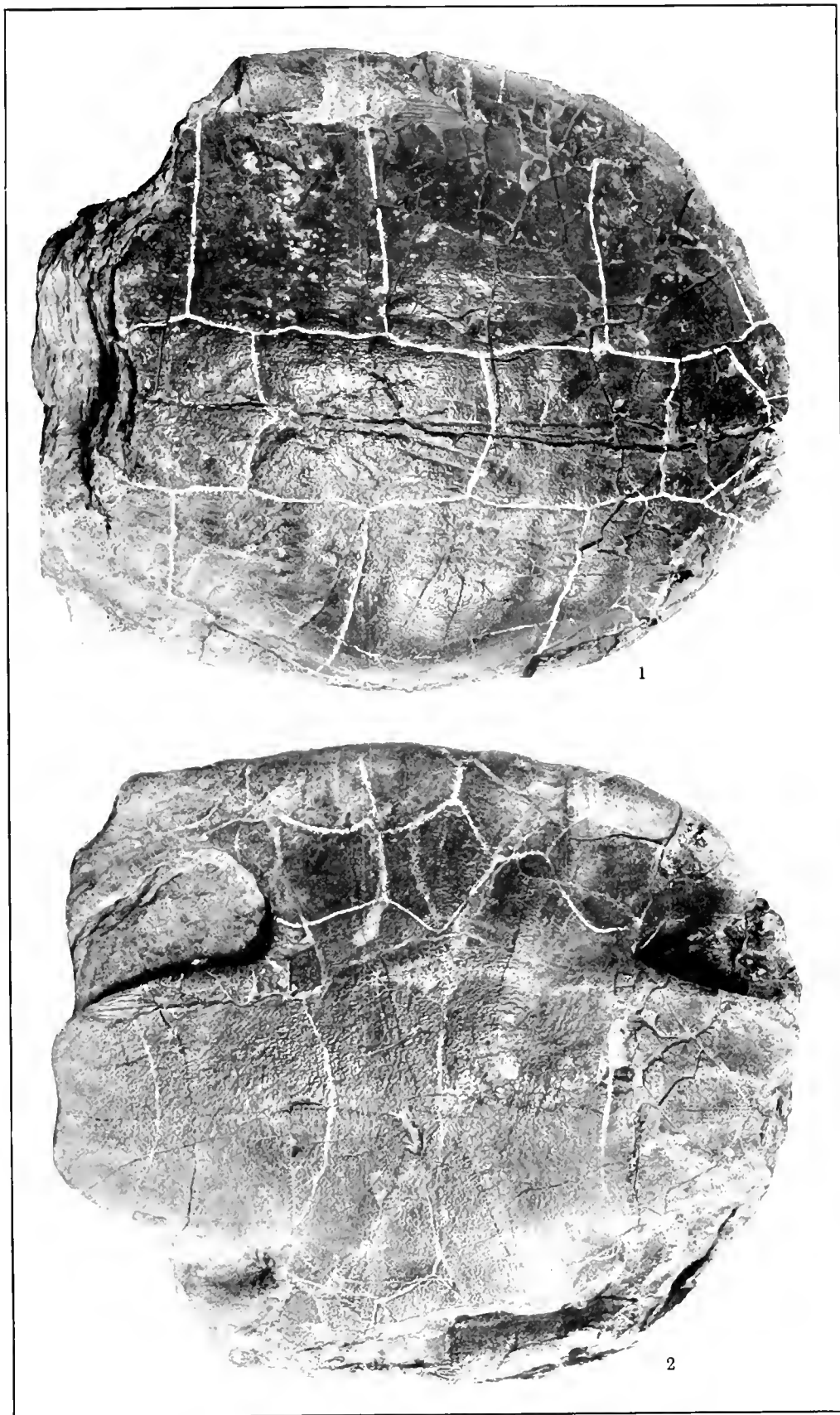
PLATE XXVII.

FIG. 1. Carapace of *Testudo uintensis*. Type. C. M. No. 2331.

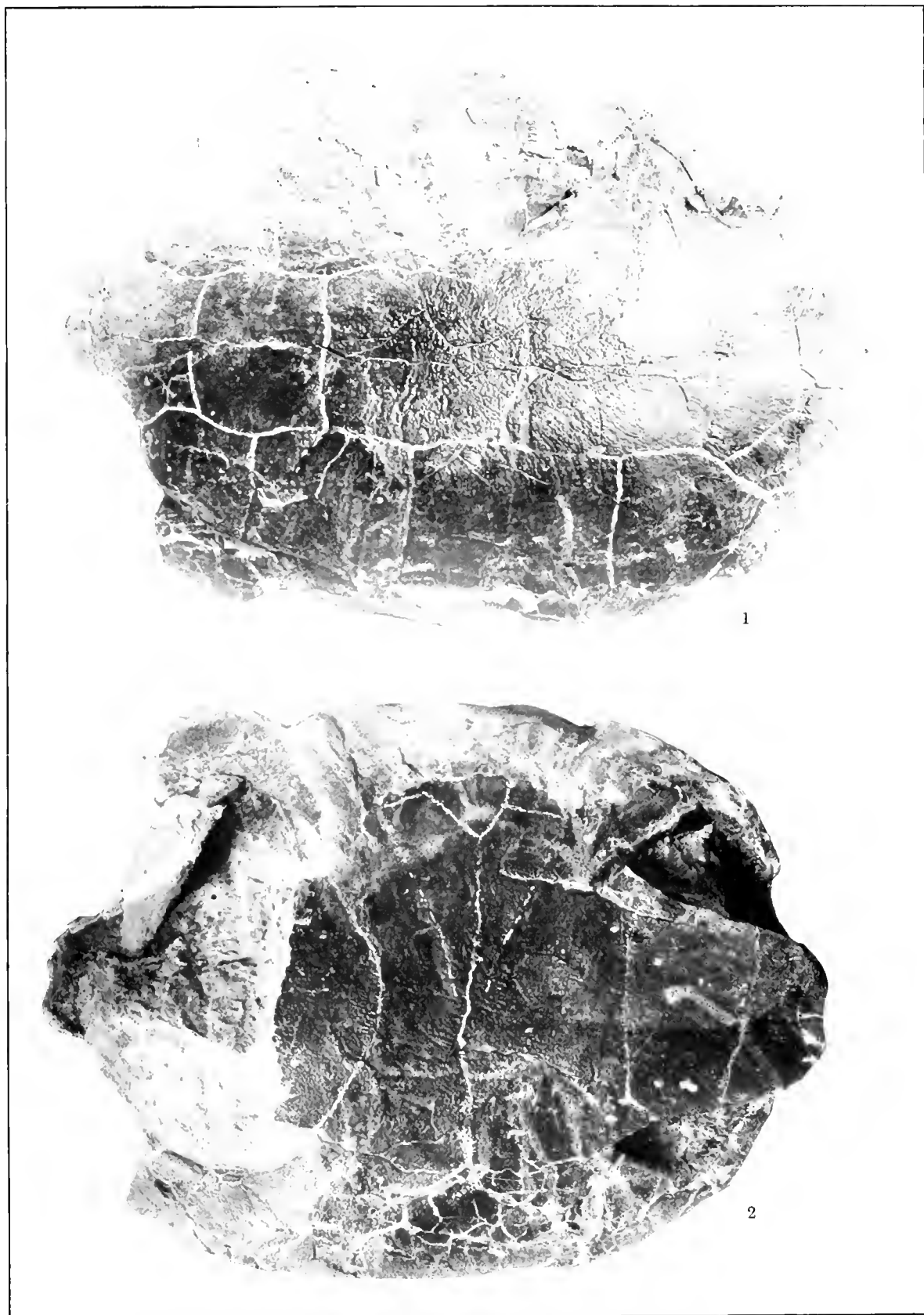
FIG. 2. Plastron of the same. Both figures one-half natural size.



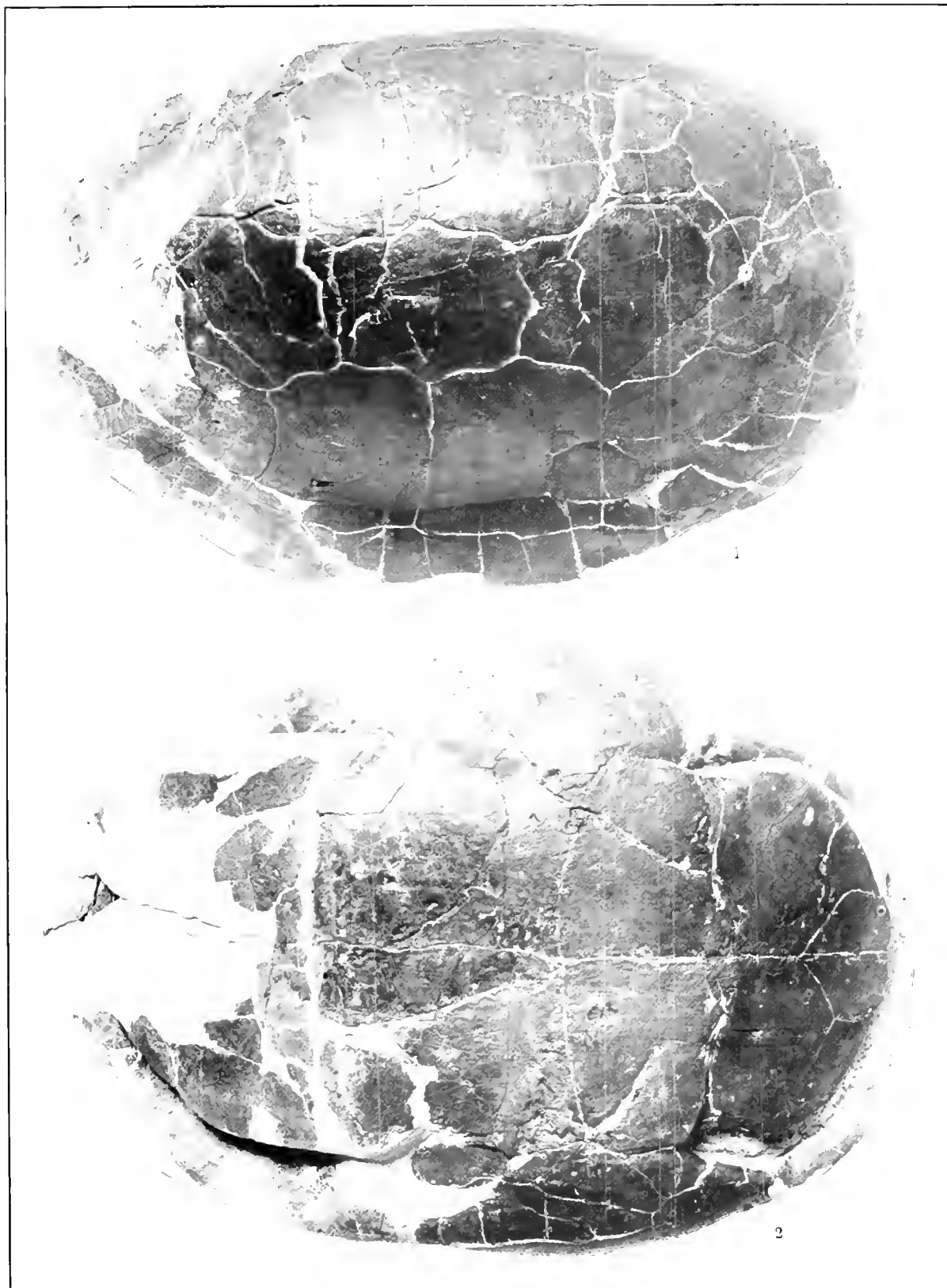
1. CARAPACE OF *Baëna arenosa* LEIDY. C. M. No. 2356. $\times \frac{1}{2}$.
2. PLASTRON OF *Baëna platyplastra* GILMORE. TYPE, C. M. No. 3227. $\times \frac{1}{3}$.



1. CARAPACE OF *Baïna inflata* GILMORE. TYPE, C. M. No. 3406. $\times \frac{1}{3}$.
2. PLASTRON OF DO. $\times \frac{1}{3}$.

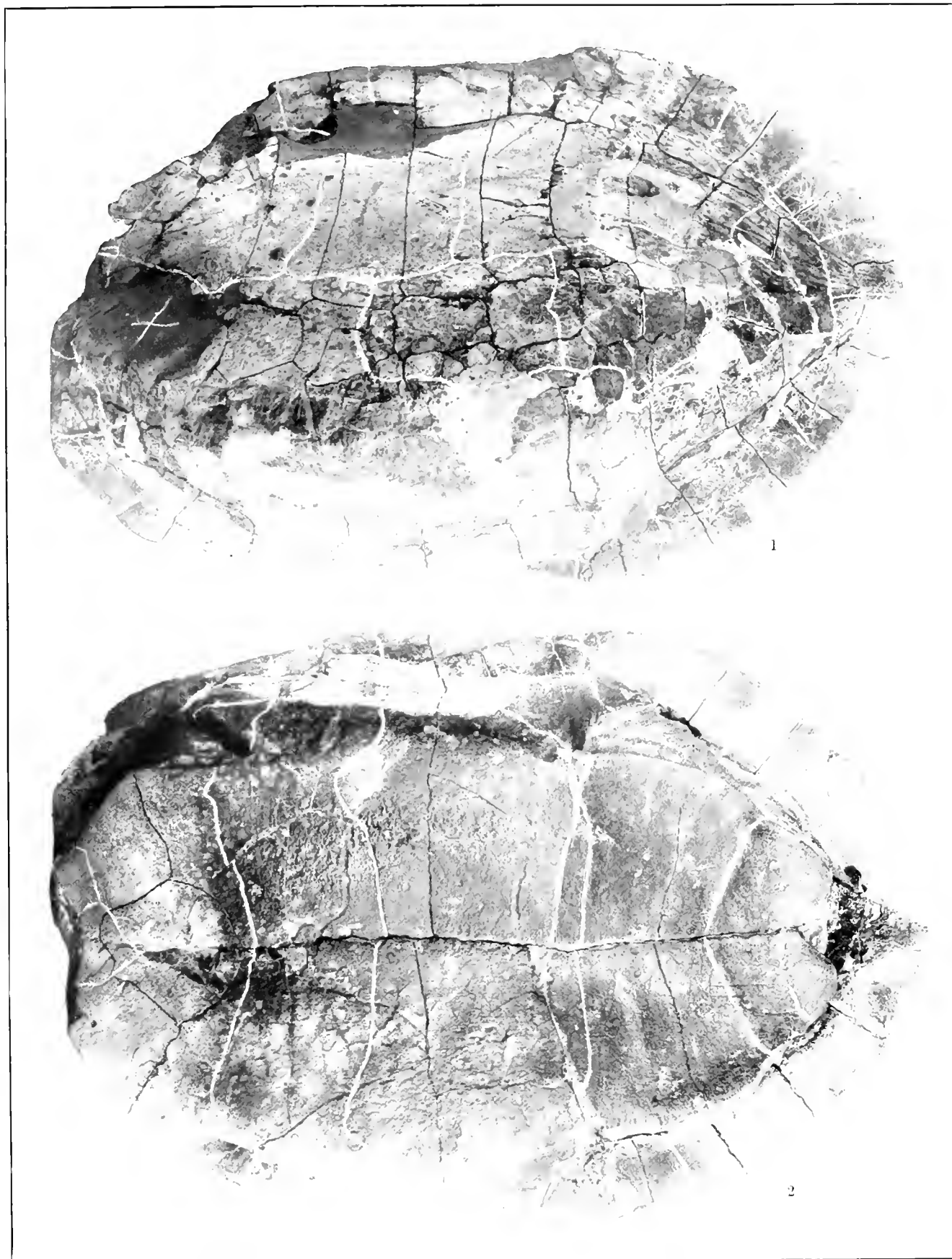


1. CARAPACE OF *Baëna gigantea* Gilmore. TYPE, C. M. No. 3441. $\times \frac{1}{2}$.
2. PLASTRON OF SAME. $\times \frac{1}{4}$.

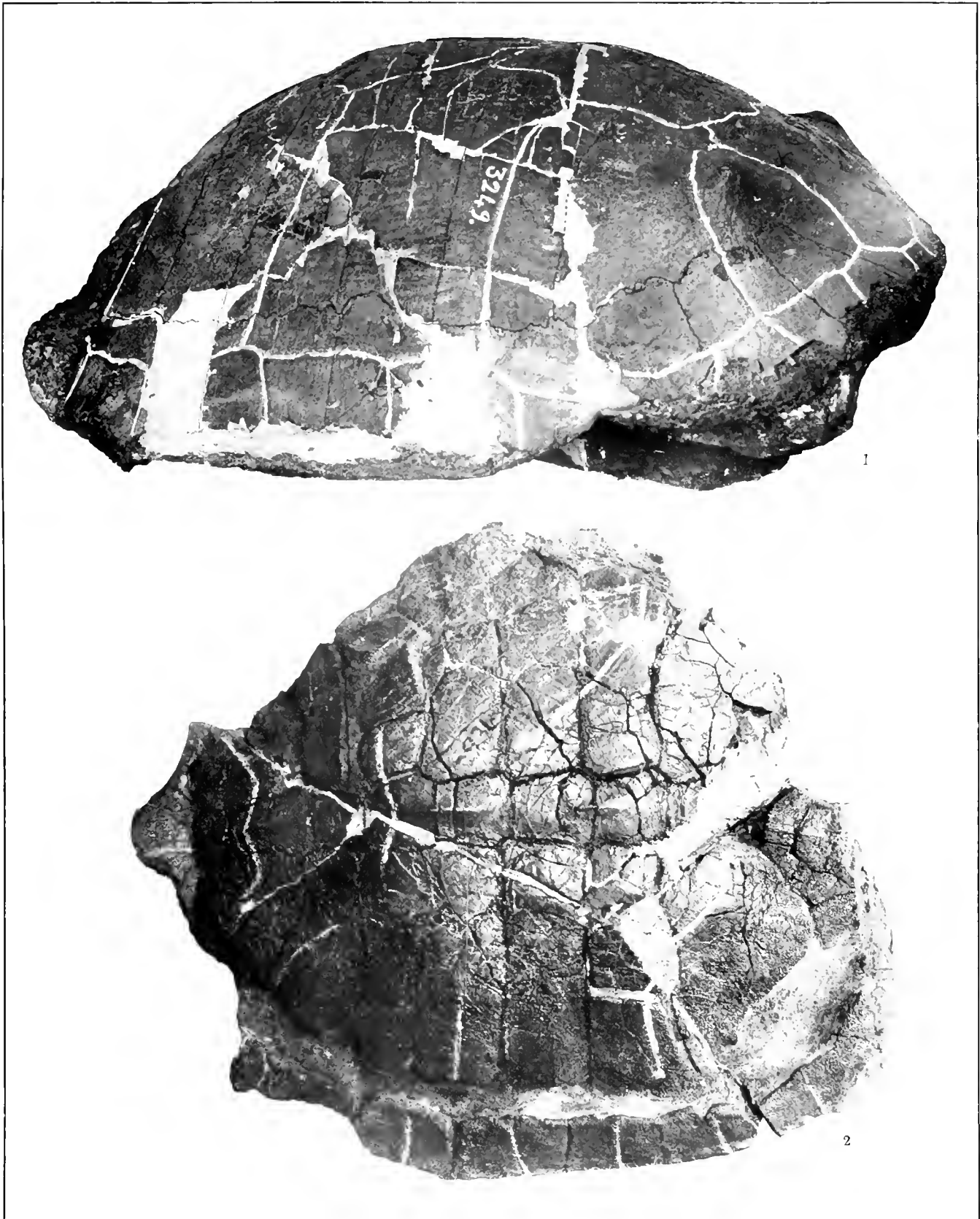


1. CARAPACE OF *Echmatemys callopyge* HAY. C. M. No. 2371. $\times \frac{1}{3}$.

2. PLASTRON OF SAME. $\times \frac{1}{3}$.

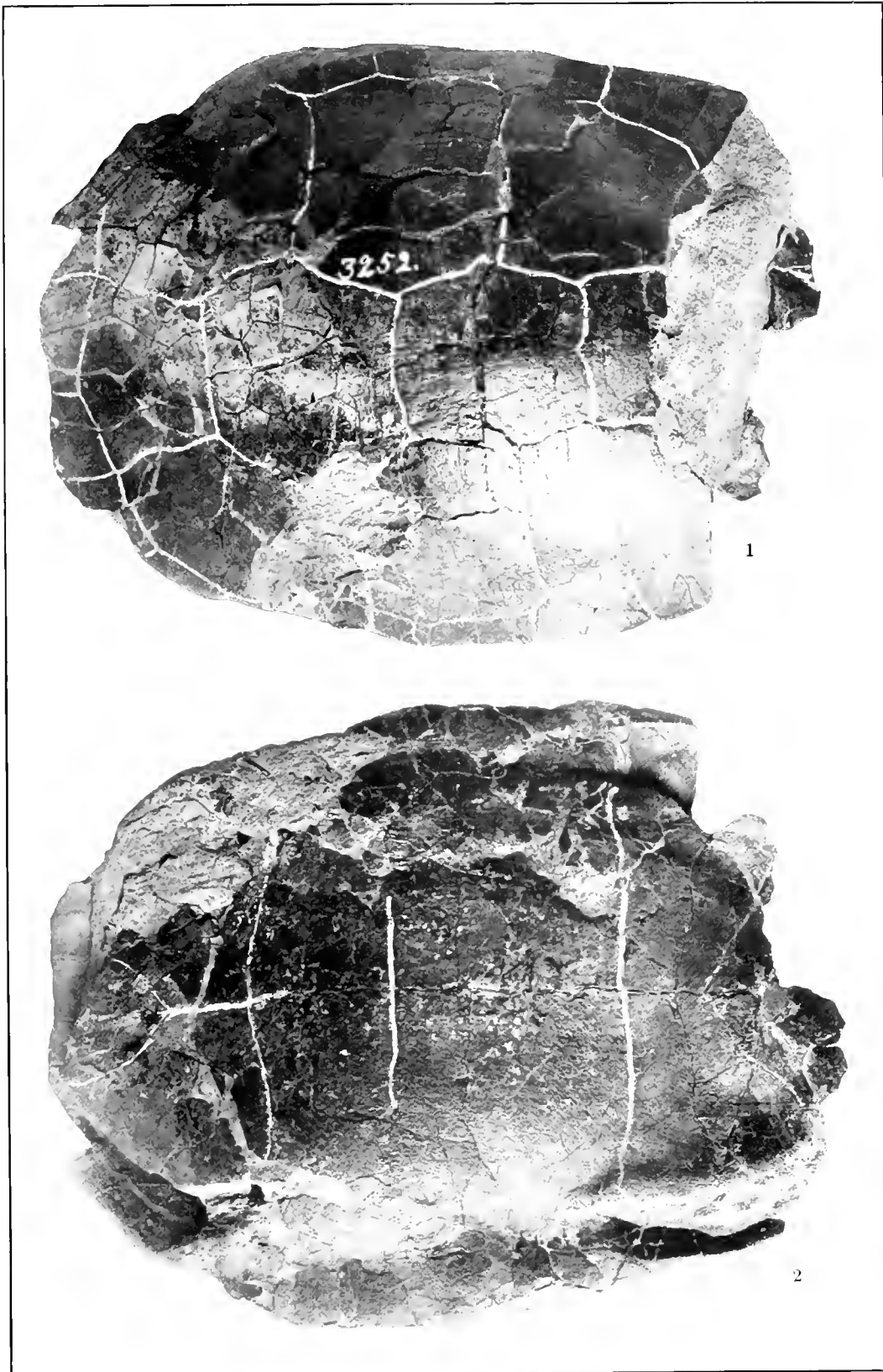


1. CARAPACE OF *Echinatemys douglassi* GILMORE. TYPE, C. M. No. 3244. $\times \frac{1}{3}$.
2. PLASTRON OF SAME. $\times \frac{1}{3}$.

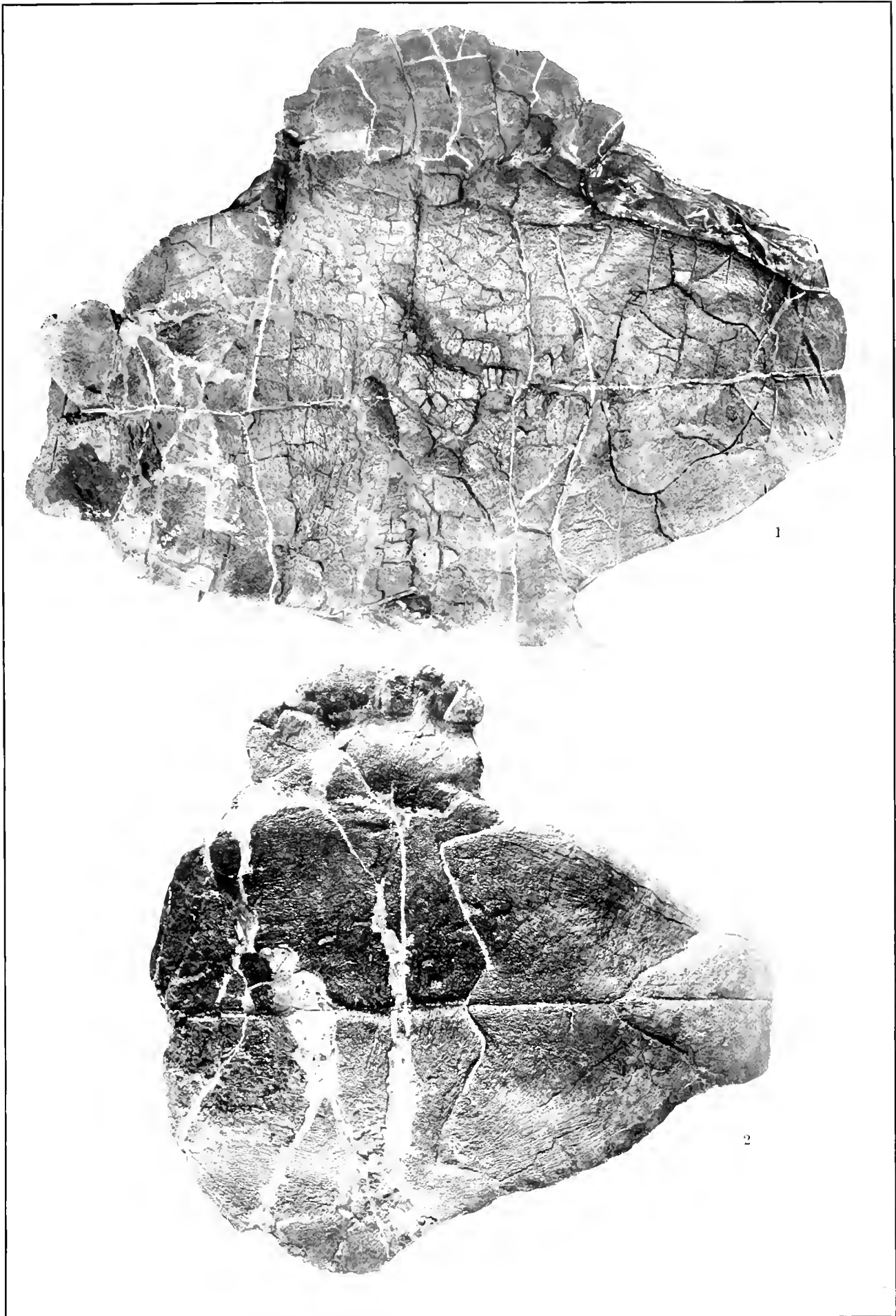


1. CARAPACE OF *Echmatemys hollandi* GILMORE. TYPE, C. M. No. 3249. $\times \frac{1}{2}$.
2. CARAPACE OF *Echmatemys depressa* GILMORE. TYPE, C. M. No. 2936. $\times \frac{1}{4}$.





1. CARAPACE OF *Echmatemys obscura* GILMORE. TYPE, C. M. NO. 3252. $\times \frac{1}{3}$.
2. PLAGSTRON OF SAME. $\times \frac{1}{3}$.



1. PASTRON OF *Hadrianus corsoni* (LEIDY). C. M. No. 3403. $\times \frac{1}{5}$.
2. PASTRON OF *Hadrianus robustus* GILMORE. TYPE, C. M. No. 3342. $\times \frac{1}{3}$.

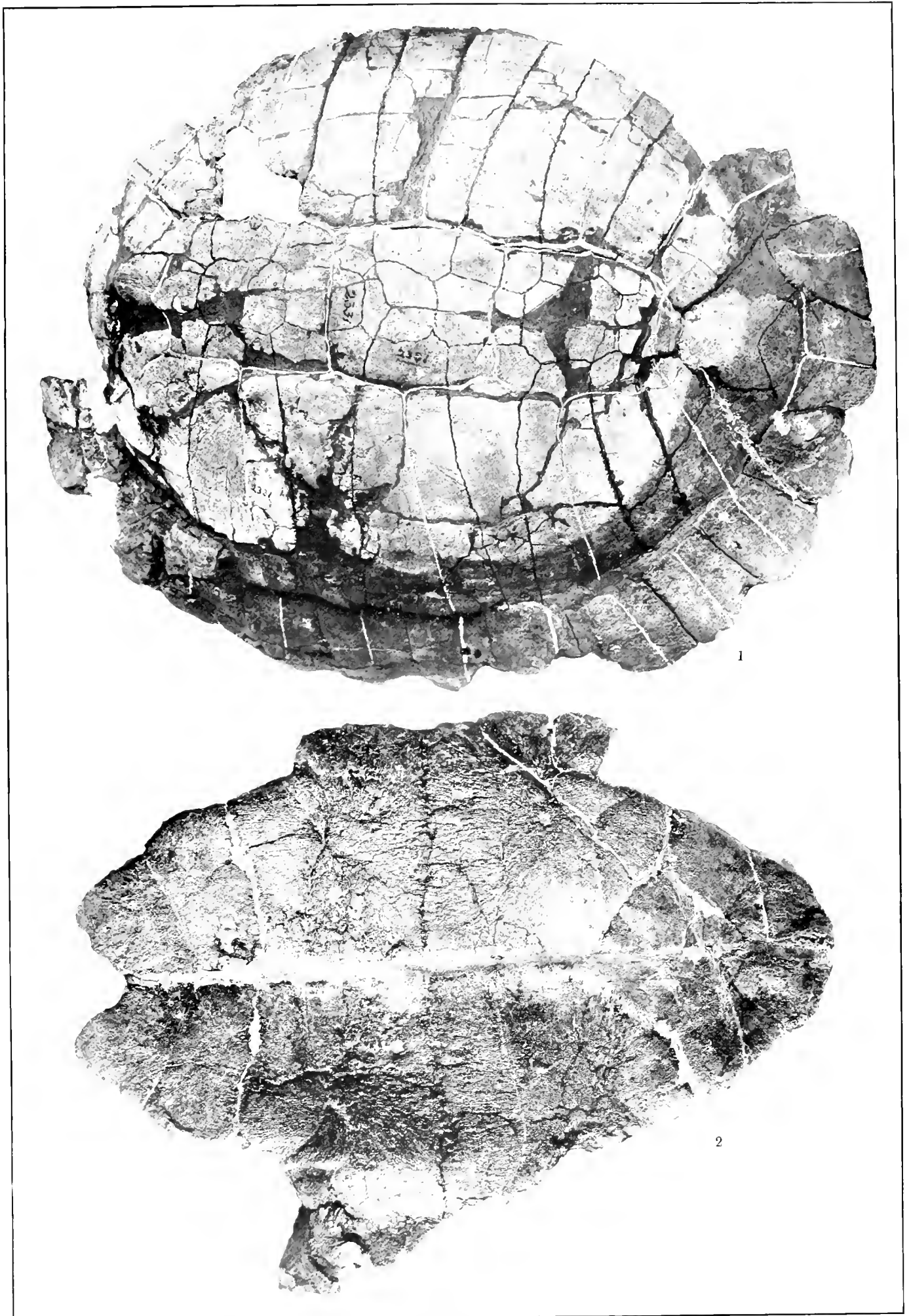


1



2

1. PASTRON OF *Hadrianus utahensis* GILMORE. TYPE, C. M. No. 2343. $\times \frac{1}{4}$.
2. CARAPACE OF *Amyda scutumantiquum* (COPE). C. M. No. 3272. $\times \frac{1}{4}$.



1. CARAPACE OF *Testudo nintensis* GILMORE. TYPE, C. M. No. 2331. $\times \frac{1}{2}$.
2. PLASTRON OF SAME. $\times \frac{1}{2}$.

21. Minute Book of the Virginia Court Held at Fort Dunmore (Pittsburgh) for the District of West Augusta, 1775-1776. CRUMRINE . . . . .	.90	56. Meryocochærus, etc. DOUGLASS.	
22. Minute Book of the Virginia Court Held for Yohogania County, first at Augusta Town (now Washington, Pa.), and afterward on the Andrew Heath Farm near West Elizabeth, 1776-1780. CRUMRINE	2.25	57. New Merycoidodonta. DOUGLASS. (Nos. 56 and 57 sold together.)	1.00
23. Minute or Order Book of the Virginia Court Held for Ohio County, Virginia, at Black's Cabin (Now West Liberty, W. Va.), &c. CRUMRINE	1.50	58. Further Collections of Fishes from Paraguay. EIGENMANN, MCATEE, and WARD	1.25
24. The Records of Deeds for the District of West Augusta, Virginia, for the Court Held at Fort Dunmore, &c. CRUMRINE	1.75	59. Undetermined Element in the Osteology of the Mosasauridæ. HOLLAND . . . . .	.20
25. Astropecten (?) montanus, &c. DOUGLASS . . . . .	.10	60. Gasteropoda of the Chazy. RAYMOND	1.35
26. Astrodon (Pleurocelus) in the Atlantosaurus Beds of Wyoming. HATCHER. (<i>Out of Print.</i>)		61. Occurrence of Wynea Americana in Pa. JENNINGS . . . . .	.05
27. Osteology of the Limicolæ. SHUFELDT	1.00	62. Account of Pleistocene Fauna Discovered at Frankstown, Pa. HOLLAND . . . . .	.10
28. New Vertebrates from the Montana Tertiary. DOUGLASS	1.25	63. Vertebrate Fossils from the Vicinity of Pittsburgh, Pa. CASE . . . . .	.15
29. New Genus and Species of Tortoise from the Jurassic of Colorado. O. P. HAY . . . . .	.10	64. Illænidæ from the Black River Limestone near Ottawa, Canada. RAYMOND and NARRAWAY . . . . .	.20
30. Osteology of Oxydactylus. PETERSON	1.00	65. Rhinoceroses from the Oligocene and Miocene of North Dakota and Montana. DOUGLASS . . . . .	.25
31. Birds of Erie and Presque Isle. TODD . . . . .	.75	66. Fossil Horses from North Dakota. DOUGLASS . . . . .	.30
32. J. B. Hatcher. By W. J. HOLLAND . . . . .	.15	67. Oligocene Lizards. DOUGLASS . . . . .	.20
33. Tropicoleptus Fauna at Canandaigua Lake, etc. RAYMOND. (<i>Out of print.</i>)		68. The Type of Stenomylus gracilis. PETERSON . . . . .	.25
34. Two Turtles from the Judith River Beds of Montana. O. P. HAY. (<i>Out of print.</i>)		69. New Species of Birds from Costa Rica, etc. CARRIKER . . . . .	.10
35. Preliminary List of Hemiptera of Western Pennsylvania. WIRTNER. (<i>Scarce.</i>) . . . . .	.50	70. Costa Rican Formicariidæ. CARRIKER . . . . .	.05
36. Trilobites of the Chazy Limestone. RAYMOND	1.00	71. Vertebrate Fossils from the Fort Union Beds. DOUGLASS . . . . .	.45
37. Crawfishes of Western Pennsylvania. ORTMANN	1.00	72. List of the Lepidoptera of Western Pa., etc. ENGEL	1.25
38. The Geology of Southwestern Montana. DOUGLASS . . . . .	.40	73. Fauna of Upper Devonian in Montana. Fossils of Red Shales. RAYMOND . . . . .	.60
39. New Crocodile from the Jurassic of Wyoming. HOLLAND . . . . .	.10	74. New Species of Procamelus from Upper Miocene of Montana. DOUGLASS . . . . .	.30
40. Procambarus, a New Subgenus of the Genus Cambarus. ORTMANN . . . . .	.15	75. Sections of the Conemaugh Series between Pittsburgh and Latrobe, Pa. RAYMOND . . . . .	.35
41. Presentation of Reproduction of Diplodocus Carnegiei to the British Museum. HOLLAND . . . . .	.15	76. List of the Unionidæ of Western Pa. ORTMANN . . . . .	.50
42. Birds Collected near Mombasa by William Doherty. HOLLAND . . . . .	.20	77. Geological Reconnaissance in North Dakota, Montana, and Idaho. DOUGLASS	1.00
43. Hyoid Bone in Mastodon Americanus. HOLLAND . . . . .	.10	78. Botanical Survey of Presque Isle. JENNINGS	2.75
44. Additions to Flora of Allegheny County, Pa. JENNINGS . . . . .	.15	79. Sesqui-Centennial (Pittsburgh) Relics. STEWART . . . . .	.45
45. New Species of Kneiffia. JENNINGS . . . . .	.05	80. Dromomeryx, New Genus of American Ruminants. DOUGLASS . . . . .	.30
46. Occurrence of Triglochis palustris in Pa. JENNINGS . . . . .	.05	81. Fossils from Glacial Drift and Devonian and Mississippian near Meadville, Pa. MILLARD . . . . .	.10
47. New Species of Ibidium. JENNINGS . . . . .	.10	82. New Species of Helodus. EASTMAN . . . . .	.05
48. Agate Spring Fossil Quarry. PETERSON . . . . .	.10	83. Charles Chauncey Mellor. HOLLAND . . . . .	.15
49. Two New Birds from British E. Africa. OBERHOLSER . . . . .	.05	84. Reports of Expedition to British Guiana, etc. EIGENMANN . . . . .	.50
50. The Chazy Formation and Its Fauna. RAYMOND	1.50	85. Reports of Expedition to British Guiana, etc. DURBIN . . . . .	.25
51. A New American Cybele. NARRAWAY and RAYMOND . . . . .	.15	86. Odonata of the Neotropical Region, Exclusive of Mexico and Central America. CALVERT	2.25
52. Plastron of the Protostegina. WIELAND . . . . .	.15	87. Deinonychus hatcheri, a New Genus and Species of Crocodile. HOLLAND . . . . .	.20
53. New Species of Testudo from the Miocene, etc. O. P. HAY . . . . .	.25	88. Reports on Expedition to British Guiana, etc. BLOSSER . . . . .	.15
54. Miocene Beds of W. Nebraska and E. Wyoming and Their Vertebrate Fauna. PETERSON	1.00	89. Description of Some New Titanotheres from the Uinta. DOUGLASS . . . . .	.25
55. New Species of Lonicera from Pa. JENNINGS . . . . .	.05	90. Annotated List of the Birds of Costa Rica including Cocos Island. CARRIKER	3.00
		91. Geology of the Coast of the State of Alagôas, Brazil. BRANNER . . . . .	.40
		92. Fossil Fishes from the Bituminous Shales at Riacho Doce, Alagôas, Brazil. JORDAN . . . . .	.55
		93. Ordovician Trilobites, No. II. Asaphidæ from the Beekmantown. RAYMOND . . . . .	.35
		94. Ordovician Trilobites, No. III. RAYMOND & NARRAWAY . . . . .	.35

95. Ordovician Trilobites, No. IV. RAYMOND . . . . .	.40	133. Osteology of Lasiopyga and Callithrix, etc. SHUFELDT . . . . .	.25
96. Fishes from Irkutsk, Siberia. JORDAN and THOMPSON . . . . .	.30	134. New Rhynchocephalian from Solenhofen. GRIER . . . . .	.15
97. South American Tetrigidae. BRUNER	1.00	135. Scales of South American Characinid Fishes. COCKERELL . . . . .	.25
98. Fauna of the Allegheny and Conemaugh Series in Western Pa. RAYMOND . . . . .	.30	136. Skeleton of Platigonus Leptorhinus. PETERSON . . . . .	.10
99. Ichthyological Survey About the San Juan Islands, Washington. STARKS . . . . .	.75	137. Lichens Collected in the Thunder Bay District, Ontario. R. HEBER HOWE, JR. . . . .	.10
100. New Species of Pygidium. EIGENMANN . . . . .	.10	138. Preliminary List of Fossil Plants in the Roof of the Pittsburgh Coal. GRIER . . . . .	.10
101. The Brachiopoda and Ostracoda of the Chazy. RAYMOND . . . . .	.50	139. Undescribed Remains of the Uinta Titanotheres Dolichorhinus. PETERSON . . . . .	.15
102. A New Camel from the Miocene of Western Nebraska. PETERSON . . . . .	.15	140. Triassic Fishes Belonging to the Catopteridae and Semionotidae. EASTMAN . . . . .	.15
103. Skeleton of Stenomylus hitchcocki, etc. PETERSON . . . . .	.15	141. Osteology of Promerycochoerus. PETERSON . . . . .	.40
104. Skeleton of Diceratherium cooki. PETERSON . . . . .	.15	142. Correction of a Generic Name. PETERSON . . . . .	.05
105. Carnegie Museum Expedition to Central South America, 1907-1910. HOLLAND . . . . .	.15	143. Skull of Bison Crassicornis. HOLLAND . . . . .	.10
106. Report Upon the Expedition of the Carnegie Museum to Central South America. HASEMAN & EIGENMANN . . . . .	.25	144. Serrasalminæ and Mylinæ. EIGENMANN . . . . .	.50
107. New Species of Fishes, etc., from Central South America. HASEMAN . . . . .	.50	145. Heads and Tails: Notes on Sauropod Dinosaurs. HOLLAND . . . . .	.15
108. Annotated Catalog of Cichlid Fishes from Central South America. HASEMAN	1.25	146. Dipterous Remains from Upper Devonian of Colorado. EASTMAN . . . . .	.10
109. New Species of Fishes from the Rio Iguassu. HASEMAN . . . . .	.65	147. Notes on Tropical American Tettigonoidea (Locustodea). BRUNER	1.65
110. Ornithology of the Bahama Islands. TODD & WORTHINGTON . . . . .	.75	148. New Species of Tortoise from Jurassic of Utah. GILMORE . . . . .	.15
112. South American Acridoidea. I. BRUNER	1.00	149. Fauna of Upper Devonian in Montana. HAYNES . . . . .	.45
113. Species of Hasemania, Hyphessobrycon, and Hemigrammus. ELLIS . . . . .	.25	150. New Sphagebranchus from Bahamas. EIGENMANN . . . . .	.07
114. New Characins in the Carnegie Museum. EIGENMANN . . . . .	.30	151. Marine Fishes from Colombia and Ecuador. WILSON . . . . .	.15
115. Jurassic Saurian Remains Ingested within Fish. EASTMAN . . . . .	.20	152. Apareiodon, a New Genus of Characid Fishes. EIGENMANN . . . . .	.18
116. Autograph Letter of U. S. Grant to Edwin M. Stanton. HOLLAND . . . . .	.15	153. New and Rare Fishes from S. American Rivers. EIGENMANN . . . . .	.25
117. Albert J. Barr. By W. J. HOLLAND . . . . .	.10	154. Three New Species of Characid Fishes. EIGENMANN & HENN . . . . .	.12
118. Seventeen New Neotropical Birds. TODD . . . . .	.25	155. The Species of Salminus. EIGENMANN . . . . .	.7
119. Dr. David Alter, the First Discoverer of Spectrum Analysis. HOLLAND . . . . .	.10	156. South American Pœciliid Fishes. HENN . . . . .	.40
120. Two Mummy Labels. ALLEN . . . . .	.10	157. A New Species of Apatosaurus. HOLLAND . . . . .	.7
121. The Families and Genera of Najades. ORTMANN	1.00	158. Birds of the Isle of Pines. TODD . . . . .	.70
122. Group of Stenomylins in the Carnegie Museum. PETERSON . . . . .	.25	159. Reptiles and Amphibians of the Isle of Pines. BARBOUR . . . . .	.20
123. Tertiary Fish-remains from Spanish Guinea. EASTMAN . . . . .	.25	160. Land and Fresh Water Shells of the Isle of Pines. HENDERSON . . . . .	.20
124. Plated Nematognaths. ELLIS . . . . .	.65	161. Pelecypoda of the Chazy. RAYMOND . . . . .	.45
125. New Species of Cambarus from the Isle of Pines. ORTMANN . . . . .	.15	162. S. American Crickets, Gryllotalpoidea and Ache-toidea. BRUNER	1.30
126. Sedum Carnegiei, a New Species of the Family Crassulaceæ, etc. HAMMET . . . . .	.10	163. Preliminary Catalog of N. American Sphæri-ida. STERKI . . . . .	.75
127. Two New Species of Fishes from Peru. EIGENMANN . . . . .	.15	164. Directions for Collecting Sphæriidae and Aquatic Gastropods. STERKI . . . . .	.10
128. South American Locusts (Acridoidea). II. BRUNER . . . . .	.75	165. Lepidoptera of the Isle of Pines. HOLLAND . . . . .	.50
129. Revision of the Genus Chæmepelia. TODD . . . . .	.85	166. Odonata of the Isle of Pines. KAHL . . . . .	.15
130. New Genus and Species of Abyssinian Rodents. CHILDS FRICK . . . . .	.20	167. A Trip to Islands in Lake Erie. GOODRICH . . . . .	.15
131. New Titanotheres from the Uinta. PETERSON . . . . .	.20	168. Land-Shells of Islands at Western End of Lake Erie, etc. CLAPP . . . . .	.20
132. Small Titanotheres from the Lower Uinta. PETERSON . . . . .	.10	169. Orthoptera of the Isle of Pines. HOLLAND & KAHL . . . . .	.15

MEMOIRS
OF THE
CARNEGIE MUSEUM.

VOL. VII.

No. 3.

W. J. HOLLAND, EDITOR.

A CATALOG OF THE OPHIDIA FROM SOUTH AMERICA
AT PRESENT (JUNE, 1916) CONTAINED IN THE
CARNEGIE MUSEUM WITH DESCRIPTIONS
OF SOME NEW SPECIES

By LAWRENCE EDMONDS GRIFFIN.

PITTSBURGH.

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REPRINTS FROM THE ANNALS OF THE CARNEGIE MUSEUM

Nos. 1-12. See preceding lists. (<i>Out of print.</i>)	16. Osteology of <i>Psittaci</i> . SHUFELDT35
12. Skeleton of <i>Titanotherium dispar</i> . HATCHER.. \$.35	17. Annotated Catalogue of Genus <i>Partula</i> . H. H. SMITH 1.25
13. Fore Limbs and Manus of <i>Brontosaurus</i> . HATCHER ..... .60	18. Two New Bahaman Lepidoptera. HOLLAND ... .10
14. The <i>Trachodontidæ</i> . HATCHER ..... .25	19. <i>Elosaurus Parvus</i> . PETERSON & GILMORE ..... .15
15. New Pennsylvania Thorns. ASHE25	20. Boundary Controversy Between Pennsylvania and Virginia, 1748-1785. CRUMRINE30

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A CATALOG OF THE OPHIDIA FROM SOUTH AMERICA AT PRESENT
(JUNE, 1916) CONTAINED IN THE CARNEGIE MUSEUM
WITH DESCRIPTIONS OF SOME NEW SPECIES.

BY LAWRENCE EDMONDS GRIFFIN.

The recent reptilia in the Carnegie Museum represent collections made at various times and places by collectors, who incidentally in connection with other undertakings preserved such specimens belonging to this class as came to hand. No systematic collecting of these animals was undertaken by any of the expeditions which have gone out from the Carnegie Museum to the American tropics, except by Mr. G. A. Link, Sr., in the Isle of Pines. The collection made by Mr. Link has already been reported upon in the Annals of this Museum.¹ Although the collections have been acquired for the most part as the result of somewhat desultory collecting, they nevertheless include a considerable number of interesting species, some of which appear to be new to science.

Many specimens were preserved by Mr. John D. Haseman during his extensive travels in South America from 1907 to 1910. For a brief outline of the journeyings of Mr. Haseman the reader is referred to the articles published in the seventh volume of the Annals of the Carnegie Museum.² Mr. Haseman went to

¹ "The Reptiles and Amphibians of the Isle of Pines." By Thomas Barbour, Annals Carnegie Museum, Vol. X, 1916, pp. 297-308, Pl. XXVIII.

² W. J. Holland, "The Carnegie Museum Expedition to Central South America, 1907-1910," Annals of the Carnegie Museum, VII, 1910-1911, pp. 283-286.

John D. Haseman, "A Brief Report upon the Expedition of the Carnegie Museum to Central South America," *l. c.*, pp. 287-299.

C. H. Eigenmann, "A List of Localities at which Mr. Haseman Collected," *l. c.*, pp. 299-314.

South America primarily to collect fishes. Incidentally he preserved a considerable number of such reptilia as he encountered. The localities at which he obtained reptilia are given herewith in alphabetical order:

- Arequa, Paraguay.
- Asumpcion, Bolivia.
- Bom Jesus de Lapa, Bahia, Brazil.
- Cacequy (Rio Ibicuhy into Uruguay) Rio Grande do Sul, Brazil.
- Cidade de Matto Grosso, Brazil.
- Entre Rios, Minas Geraes, Brazil.
- Jacarehy, Rio Parahyba, São Paulo, Brazil.
- Lagoa de João Pereira, near Barra, Rio São Francisco, Minas Geraes, Brazil.
- Mogy das Cruces, Rio Tieté, São Paulo, Brazil.
- Muniz Freire, Espiritu Santo, Brazil.
- Penedo, Alagoas, Mouth of Rio São Francisco, Brazil.
- Piracicaba, Rio Paraña, São Paulo, Brazil.
- Puerto Suarez, Eastern Bolivia (near Corumbá).
- Rio Doce, Minas Geraes, Brazil.
- Rio de Janeiro, Brazil.
- Rio Mamoré, Bolivia, below the mouth of the Rio Guaporé.
- Santarem, Brazil.
- São Antonio de Guaporé, Matto Grosso, Brazil.
- São Cruz, Campos de Matto Grosso, Brazil.
- São João del Rey, Minas Geraes, Brazil.
- São Luis de Cáceres, Rio Paraguay, Matto Grosso, Brazil.
- São Matias, Bolivia.
- Sete Lagoas (into Rio das Velhas, into Rio São Francisco), Minas Geraes, Brazil.
- Urucum Mountains, Matto Grosso, Brazil.
- Villa Bella, Bolivia.
- Xiririca, Rio Ribeira de Iguape, São Paulo, Brazil.

Mr. and Mrs. H. H. Smith collected in the Province of Santa Marta, Colombia, from 1898 to 1901. The snakes contained in their collections were taken at Bonda (150 ft. alt.); Cacagualito (1,500 ft.); Minea (2,000 ft.); Masinga (2,000 ft.); Valparaíso (4,500 ft.); Las Nubes (4,500 ft.); El Libano (6,000 ft.).³ The labels in their collections usually give the month in which the specimen was captured, but very rarely the year. It is probable, however, that most of the reptiles of the Smith Collection were taken in the year 1901.

³The localities at which Mr. and Mrs. H. H. Smith collected in Colombia are described in the *Annals of the Carnegie Museum*, Vol. VI, 1909, pp. 74-76.

The snakes cataloged by me under the Department Numbers 1841 to 1873 are without original data or field-labels, but they are positively known to have been received from South America, and are undoubtedly a part of the collections of H. H. Smith from northern Colombia.

The collections sent in by Señor Don José Steinbaeh were all taken in the Department of Santa Cruz de la Sierra, Provincia del Sara, Bolivia, except a small part of his sendings, which are labelled as from Puerto Suarez, Bolivia. Only two definite localities are given on his labels, Santa Cruz de la Sierra, and Las Juntas. The altitudes given range from 250 to 450 meters above sea-level.

A small collection of snakes made by Mr. Thomas LeBoutelier was given to the Museum in 1909 by Mrs. A. Marshall Bell of Pittsburgh. It is unfortunate that the maker of this collection was not careful in labelling the specimens. Most of them have no other locality than "South America" assigned to them, while in a few cases the locality given is manifestly incorrect.

Miss Lola Vance collected a few reptiles at Tarma, Peru. The altitude of this place is 6,000 feet.

A few serpents were also collected by Mr. J. O. Kerby at Massasão and Prinquima on the Amazon, and donated by him to the Carnegie Museum.

For the greater convenience of those who may refer to this paper I have arranged the species of each genus in alphabetical order, when more than one species is listed, and the genera of each family and subfamily are also arranged in like manner. In the statistical tables I have introduced some modifications of customary usage. Under "upper labials" the figure outside of the parenthesis indicates the total number of shields, while the figures within the parenthesis tell which supralabials are in contact with the eye. The formula for the temporals is written with a comma, instead of with the plus-sign. When there is a difference in the number or arrangement of the shields of the left and right sides, both are given, the formula for the left side being always written above that for the right side.

Class **REPTILIA.**

Order *SQUAMATA.*

SUBORDER SERPENTES.

Family TYPHILOPIDÆ.

Genus *Helminthophis* Peters.

1. *Helminthophis bondensis* sp. nov.

Rostral half the width of the head, rounded posteriorly, forming a broad suture with the frontal, extending to a line connecting the posterior margins of

the eyes; frontal broader than the rostral, but little longer than the diameter of the eye, in contact with the prefrontal and the ocular; prefrontal in contact with frontal, ocular, and subocular; no preoculars; a subocular; eye under the posterior and lower part of the ocular; four upper labials, the first the largest, second and third in contact with the subocular, the second also in contact with the upper nasal, which reaches the subocular. Twenty-two scale-rows around the body; diameter of body contained forty-five times in the length. Tail shorter than broad, ending in a point, but without spine.

Brown, each scale darker in the center; a little lighter beneath. Tip of head lighter with fine brown markings.

This species resembles *H. albirostris* Peters more closely than any other. It is distinguished by having one, instead of two suboculars, by the position of the eye under the ocular shield, and by the second upper labial being separated from the prefrontal by the nasal.

Type, ♂, No. 216, Carnegie Museum Catalog of Ophidia; Bonda, Colombia: H. H. Smith (coll.), May.

COUNTS AND MEASUREMENTS.

Scale-rows.....	22
Upper labials.....	4
Preoculars.....	0
Suboculars.....	1
Diameter of body.....	4 mm.
Total length.....	180 mm.
Length of tail.....	2 mm.

Genus *Typhlops* Oppel.

2. *Typhlops reticulata* (Linnæus).

Anguis reticulata LINNÆUS, Syst. Nat., Ed. XII, I, 1766, p. 391.

Typhlops reticulatus BOULENGER, Cat. Snakes, I, 1893, p. 27.

The collection contains two specimens of this species:

No. 17, ♂, Province del Sara, Bolivia, Elev. 350 M., Steinbach coll., Feb., 1911.

No. 334, ♀, Villa Bella, Bolivia, Haseman coll., Oct. 8, 1909.

COUNTS AND MEASUREMENTS.

	(No. 17.)	(No. 334.)
Scale-rows.....	20	20
Upper labials.....	4	4
Preoculars.....	1	1
Total length in mm.....	257	334
Length of tail in mm.....	8.5	4
Diameter in mm.....	8	8

Family BOIDÆ Gray.

Genus *Boa*⁴ Linnæus.

3. *Boa cooki* (Gray).

Corallus cookii GRAY, Zoöl. Misc., 1842, p. 42.

Corallus cookii BOULENGER, Cat. Snakes, I, 1893, p. 99.

The five specimens in the collection are listed as follows:

No. 137, ♂, Bonda, Colombia, Elev. 150 ft., Smith coll., June.

No. 139, ♂, Bonda, Colombia, Elev. 150 ft., Smith coll., Sept. 6 (in house).

No. 142, ♂, Bonda, Colombia, Elev. 150 ft., Smith coll., June.

No. 204, ♀, Bonda, Colombia, Elev. 150 ft., Smith coll., July.

No. 1860, ♂, South America (Colombia, H. H. Smith).

COUNTS AND MEASUREMENTS.

	(No. 137.)	(No. 139.)	(No. 142.)	(No. 204.)	(No. 1860.)
Anal.	1	1	1	1	1
Scale-rows.	43	39	43	42	41
Gastrosteges.	270	269	270	272	271
Urosteges.	116	114	114	115	114
Total length in mm.	904	1,596	1,395	567	593
Length of tail in mm.	170	328	290	112	110

4. *Boa hortulana* (Linnæus).

Coluber hortulanus LINNÆUS, Mus. Ad. Frid., 1754, p. 37.

Boa hortulana LINNÆUS, Syst. Nat., Ed. XII, 1766, I, p. 374.

Corallus hortulanus BOULENGER, Cat. Snakes, I, 1893, p. 101.

The two specimens in our possession are the following:

No. 370, ♂, Entre Rios, Brazil, Haseman coll., June 4, 1908.

No. 371, Entre Rios, Brazil, Haseman coll., June 4, 1908 (head only).

COUNTS AND MEASUREMENTS.

	(No. 370)
Anal.	1
Scale-rows.	53
Gastrosteges.	266
Urosteges.	109
Total length in mm.	1,616
Length of tail in mm.	300

⁴ See Stejneger, Proc. U. S. Nat. Mus., XXIV, 1902, p. 184.

Genus *Constrictor* Laurenti.5. *Constrictor constrictor* (Linnaeus).

Boa constrictor LINNÆUS, Syst. Nat., Ed. XII, 1766, I, p. 373.

Boa constrictor BOULENGER, Cat. Snakes, I, 1893, p. 117.

The specimens in the collection of the Carnegie Museum are listed as follows:

- No. 238, ♂, South America, LeBoutelier Collection.
 No. 239, South America, LeBoutelier Collection (head only).
 No. 240, South America, LeBoutelier Collection (head only).
 No. 241, ♂, South America, LeBoutelier Collection.
 No. 242, South America, LeBoutelier Collection (head only).
 No. 243, ♂, South America, LeBoutelier Collection.
 No. 1782, ♀, Bonda, Columbia, H. H. Smith coll., (Skin).
 No. 1859, ♂, South America, J. H. Smith coll.
 No. 2022, ♂, Cacagualito, Colombia, Mrs. H. H. Smith.

COUNTS AND MEASUREMENTS.

	(No. 238.)	(No. 241.)	(No. 243.)	(No. 1782.)	(No. 1859.)	(No. 2022.)
Anal.	1	1	1	1	1	1
Scale-rows. . .	95	85	85	86	85	88
Gastrosteges. .	237	233	243	235	239	246
Urosteges. . .	53	60	54	51	62	57
Total length in mm.	542	514	576	1,600	578	727
Length of tail in mm.	55	56	60	175	64	90

Genus *Epicrates* Wagler.6. *Epicrates cenchria* (Linnaeus).

Boa cenchria LINNÆUS, Mus. Ad. Frid., II, 1764, p. 41; Syst. Nat. Ed. XII, 1766, I, p. 374.

Epicrates cenchris BOULENGER, Cat. Snakes, I, 1893, p. 94.

No. 26, ♂, Las Juntas, Bolivia, Elev. 50 M., José Steinbach coll., Dec. 1913.

No. 115, ♂, Santa Cruz de la Sierra, José Steinbach coll.

No. 136, ♂, Minca, Colombia, Elev. 2,000 ft., H. H. Smith coll., June.

No. 320, ♂, Urucum Mts., Matto Grosso, Brazil, Haseman coll., May 2, 1909.

COUNTS AND MEASUREMENTS.

	(No. 26.)	(No. 115.)	(No. 136.)	(No. 320.)
Anal.	1	1	1	1
Scale-rows. . .	46	43	46	44
Gastrosteges. .	257	233	243	234
Urosteges. . .	56	46	53	51
Total length in mm.	593	1,154	390	557
Length of tail in mm.	65	103	43	58

6a. *Epicrates cenchria* var. *fusca* (Gray).

Cliftia fusca GRAY, Catalogue, 1849, p. 99.

Epicrates cenchris, var. B, BOULENGER, Cat. Snakes, I, 1893, p. 96.

No.	Sex.	Locality.	Elevation.	Collector.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Total Length in Mm.	Length Tail in Mm.
1861		S. America		H. H. Smith	1	50	247	50		
2025	♂	Cacagualito, Colombia.	1,500 ft.	Mrs. H. H. Smith	1	49	247	49	1,790	160

Genus *Eunectes* Wagler.

7. *Eunectes murinus* (Linnæus).

Boa murina LINNÆUS, Syst. Nat., Ed. XII, 1766, I, p. 374.

Eunectes murinus BOULENGER, Cat. Snakes, I, 1893, p. 115.

No.	Sex.	Locality.	Collector.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Preocul-lars.	Postocul-lars.	Total Length in Mm.	Length Tail in Mm.
217	♀	S. America	LeBoutelier	1	54	239	69	17	1	2	725	98
218	♀	"	"	1	60		71	17	1	3	685	98
219	♀	"	"	1	58	248	63	16	1	2	700	89
220	♀	"	"	1	63	247	68	16	1	4	687	95
221	♀	"	"	1	62		58	15	1	3	590	74
222	♀	"	"	1	62	248	66	17	1	3	570	76
223	♀	"	"	1	58		65	15	1	3	600	82
224	♀	"	"	1	54	241	67	16	1	2	707	101
225	♀	"	"	1	58	240	68	17	1	3	723	102
226	♀	"	"	1	65	247	69	16	1	4	617	83
228	♀	"	"	1	58	244	70	16	1	3	728	101
229	♀	"	"	1	62	242	70	17	1	3	728	100
230	♀	"	"	1	56	254	64	16	1	3	700	97
231	♀	"	"	1	57	246	67	17	1	2	725	97
232	♀	"	"	1	66	255	67	16	1	3	620	77
233	♀	"	"	1	60	244	67	16	1	2	716	100
234	♀	"	"	1	62	246	68	18	1	4	698	99
235	♀	"	"	1	60	242	69	15	1	2	702	101
236	♀	"	"	1	60	245	69	17	1	2	720	105
237	♀	Chile (?)	"	1	60	240	66	16	1	3	706	91

8. *Eunectes notæus* Cope.

Eunectes notæus COPE, Proc. Acad. Nat. Sci. Philada., 1862, p. 70.

Eunectes notæus BOULENGER, Cat. Snakes, III, 1896, p. 594.

The only specimen of this species at present in the collection (No. 379) was taken by Mr. John D. Haseman near Santarem, in a swamp between the Rio Amazonas and Tapajos, on Dec. 7, 1909. When captured the snake was found to have a bird in its stomach. It is a female.

COUNTS AND MEASUREMENTS.	
Anal.	1
Scale-rows.	48
Gastrosteges.	227
Urosteges.	49+
Upper labials.	14
Preoculars.	1
Postoculars.	3
Total length in mm.	1,280
Length of tail in mm.	143

Family COLUBRIDÆ Boulenger.

SERIES A. AGLYPHA.

Subfamily COLUBRINÆ Boulenger.

Genus *Aporophis* Cope.9. *Aporophis flavifrenatus* (Cope).

Lygophis flavifrenatus COPE, Proc. Acad. Nat. Sci. Philada., 1862, p. 80.

Aporophis flavifrenatus BOULENGER, Cat. Snakes, II, 1894, p. 158.

This species is represented in the collection by a single individual (No. 363) taken by J. D. Haseman on February 1, 1909, at Cacequy, Rio Grande do Sul. It is a female.

COUNTS AND MEASUREMENTS.	
Anal.	1/1
Scale-rows.	17
Gastrosteges.	156
Urosteges.	77/77
Upper labials.	8(4.5)
Preoculars.	1
Postoculars.	2
Temporals.	1, 2
Total length in mm.	638
Length of tail in mm.	162

10. *Aporophis lineatus* (Linnæus).

Coluber lineatus LINNÆUS, Mus. Ad. Frid., 1754, p. 30, Pl. XII, fig. 1, and Pl. XX, fig. 1; Syst. Nat., Ed. XII, 1766, I, p. 582.

Aporophis lineatus BOULENGER, Cat. Snakes, II, 1894, p. 158.

There are at hand two specimens of this species, one (No. 5) taken in the Province del Sara, Bolivia, by José Steinbach in January, 1912, the other (No. 346) taken by Haseman at Bom Jesus de Lapa, Bahia, Brazil. Both specimens are females.

COUNTS AND MEASUREMENTS.

	(No. 5.)	(No. 346.)
Anal.....	1/1	1/1
Scale-rows.....	19	19
Gastrosteges.....	165	171
Urosteges.....	77/77	71/71
Upper labials.....	8(4.5)	8(4.5)
Preoculars.....	1	1
Postoculars.....	2	2
Temporals.....	1, 2	1, 2
Total length in mm.....	675	300
Length of tail in mm.....	178	68

11. *Aporophis melanocephalus* sp. nov.

Maxillary teeth about twenty, followed after a considerable interspace by two enlarged, compressed teeth below the posterior border of the eye; mandibular teeth subequal. Head narrow, not much wider than neck; snout narrow, high; eye large, pupil round. Body cylindrical, ventrals rounded; scales smooth, without pits, in fifteen rows. Rostral broader than deep, visible from above; internasals as long as wide, almost as long as the prefrontals; frontal once and a half as long as broad, sides straight and nearly parallel, longer than its distance from the end of the snout, considerably shorter than the parietals; nostril between two nasals; loreal considerably deeper than long; one preocular; two postoculars; temporals 1, 2; eight upper labials, the fourth and fifth bordering the eye; five lower labials in contact with the anterior chin-shields, which are as long as the posterior.

Back and sides of body and tail uniform dark brown; each scale has a dark brown center and light brown edge. The upper surface of the head is nearly black, this color shading into the brown of the body on the neck. A black vertebral stripe five scale-rows wide joins the black of the occiput. A black lateral stripe partly covering the second and third rows of scales extends from the temples along the neck. These three stripes quickly merge into the brown body color. Close to the head they are separated by white lines one scale-row wide, which become darker as they are followed caudad, and also soon merge into the color of the body. There is a small white spot back of the eye on the outer part of the parietal, and a similar spot in front of the eye on the lateral part of the prefrontal. The upper lip and ventral surfaces of the head and body are white, without dark markings.

The type, No. 18, of the Catalog of the Reptilia in the Carnegie Museum, is a female, taken at Las Juntas, Bolivia, 250 M. above sea-level, by José Steinbach in December, 1913. It is unique.

COUNTS AND MEASUREMENTS.	
Anal.	1/1
Scale-rows.	15
Gastrosteges.	144
Urosteges.	72/72
Upper labials	8(4.5)
Preoculars.	1
Postoculars.	2
Temporals.	1, 2
Total length in mm.	291
Length of tail in mm.	47

Genus *Atractus* Wagler.

12. *Atractus badius* (Boie).

Brachyorrhos badius BOIE, Isis, 1827, p. 540.

Atractus badius BOULENGER, Cat. Snakes, II, 1894, p. 308.

The two specimens at hand were taken by H. H. Smith, one, No. 201, a male, at Minca at an elevation of 2,000 ft. above sea-level, the other, No. 215, a female, at El Libano at an elevation of 6,000 ft. Both localities are in the Province of Santa Marta, Colombia. The female specimen was taken in May, the male in July. The latter specimen has lost the tip of the tail.

	COUNTS AND MEASUREMENTS.	
	(No. 201.)	(No. 215.)
Anal.	1	1
Scale-rows.	17	17
Gastrosteges.	152	146
Urosteges.	30/30+	28/28
Upper labials.	7(3.4)	7(3.4)
Preoculars.	0	0
Postoculars.	2	2
Temporals.	1, 2	1, 2
Total length in mm.	270+	442
Length of tail in mm.	32	49

No. 201 is uniform dark brown above, with about forty pairs of small light spots making a row on either side of the back. The belly is nearly covered with dark brown, square, or oblong, spots. The frontal shield is longer than wide.

No. 215 is reddish brown above, with transverse black spots which show a tendency to produce bars, but are too irregular to actually do so. Each scale of the ventral surface carries two lateral and one or two median large, black spots, the whole forming two definite lateral stripes and a less definite median one.

13. *Atractus tæniatus*⁵ sp. nov. (Plate XXVIII, figs. 1-3.)

Eight maxillary teeth. Symphysials separated from the chin-shields by the first lower labials. Snout broad, rounded; rostral considerably broader than deep, the part visible from above as long as the suture between the internasals; internasals very small, pentagonal, the combined width of the internasals and posterior nasals (with which the internasals are in contact) being just equal to the width of the prefrontals; prefrontals as broad as long, entering the orbit; frontal once and a quarter as broad as long, longer than the prefrontals, as long as its distance from the end of the snout, much shorter than the parietals; loreal twice as long as deep, entering the orbit; two postoculars, the lower very small, both in contact with the anterior end of the parietal; temporals narrow, 1, 2; six upper labials, the third and fourth entering the orbit, the third to the last once and one-half to twice as long as deep; four lower labials in contact with each of the single pair of chin-shields, which are twice as long as broad.

Dark brown above, with a darker vertebral stripe; a light bar across the temporals and parietals; edge of upper lip light (white?); white below, chin spotted with brown, and a large brown spot occupying the center of each gastrosteg, forming a midventral brown stripe; urosteges irregularly spotted with brown.

This species resembles *A. roulei* Despax; the two are compared below.

<i>A. tæniatus.</i>	<i>A. roulei.</i>
Rostral wider than deep, portion visible from above considerable.	Rostral as wide as deep, little visible from above.
Internasals pentagonal.	Internasals subtriangular.
Prefrontals as long as broad, shorter than the frontal.	Prefrontals almost as wide as long, as long as the frontal.
Frontal once and a quarter as broad as long.	Frontal once and a half as broad as long.
Loreal twice as long as deep.	Loreal twice as long as deep.
Two postoculars.	One postocular.
Pupil round.	Pupil subelliptic.
Four lower labials in contact with chin-shields.	Three lower labials in contact with chin-shields.
Six upper labials.	Six upper labials.
Scales in fifteen rows.	Scales in fifteen rows.
Light band across head.	No light band across head.
Urosteges lightly spotted with brown.	Urosteges uniformly brown.
Scale formula, 1-15-152-24/24	Scale formula, 1-15-154-22 22

The type, which is unique, is No. 117 of the Catalog of Reptiles in the Carnegie

⁵ *ταβία* = a fillet, or head-band.

Museum. It was taken by José Steinbach near Santa Cruz de la Sierra, Bolivia. The collector failed on his label to indicate the date of capture. It is a male.

COUNTS AND MEASUREMENTS.

Anal.....	1
Scale-rows.....	15
Gastrosteges.....	152
Urosteges.....	24/24
Upper labials.....	6
Preoculars.....	0
Postoculars.....	2
Temporals.....	1, 2
Total length in mm.....	218
Length of tail in mm.....	22

Genus *Elaphe* Fitzinger.14. *Elaphe corais* (Boie).

Coluber corais BOIE, Isis, 1827, p. 537.

Coluber corais BOULENGER, Cat. Snakes, II, 1894, p. 31.

The Carnegie Museum possesses three examples of this species (Nos. 143, 144, and 149) all of which were captured by H. H. Smith, in the month of June at Bonda, Province of Santa Marta, Colombia. No. 144 is a female, No. 149 is a male; the sex of No. 143 I have been unable to determine.

COUNTS AND MEASUREMENTS.

	(No. 143.)	(No. 144.)	(No. 149.)
Anal.....	1	1	1
Scale-rows.....	17	17	17
Gastrosteges.....	212	214	203
Urosteges.....	81/81	82/82	88/88
Upper labials.....	8(4.5)	9(5.6)	8(4.5)
Preoculars.....	1	1	1
Postoculars.....	2	2	2
Temporals.....	2, 2	2, 2	2, 2
Total length in mm.....	1,762	1,582	1,832
Length of tail in mm.....	375	353	422

15. *Elaphe dichroa* (Peters).

Herpetodryas dichroa PETERS, Mon. Berl. Akad., 1863, p. 284.

Coluber dichrous BOULENGER, Cat. Snakes, II, 1894, p. 30.

The only example of this species at present in the Museum is No. 329, which was taken by J. D. Haseman at Entre Rios, Brazil, on June 4, 1908. It is a female.

COUNTS AND MEASUREMENTS.

Anal.	1/1
Scale-rows.	15
Gastrosteges.	181
Urosteges.	96,96
Upper labials.	8(3.4.5)
Preoculars.	1
Postoculars.	2
Temporals.	2, 2
Total length in mm.	402
Length of tail in mm.	100

Genus *Dimades* Gray.16. *Dimades plicatilis* (Linnæus).

Coluber plicatilis LINNÆUS, Mus. Ad. Frid., 1754, p. 23, Pl. VI, fig. 1; Syst. Nat., Ed. XII, 1766, I, p. 376.

Dimades plicatilis BOULENGER, Cat. Snakes, II, 1894, p. 186.

The single specimen we have is No. 378 of the Catalog of Reptiles in the Carnegie Museum. It was taken by J. D. Haseman at Santarem, Brazil, on December 7, 1909. It is a female, and was captured under a log in the forested lowlands between the Amazon and Tapajos rivers in the act of brooding forty-eight eggs, five of which together with one of the unhatched young were collected by Mr. Haseman and are preserved as C. M. No. 354. Mr. Haseman states that "Sueury" and "Suecurujaba" are the local names of this serpent.

The shells of the eggs are membranous, thin, and white. The eggs measure 35 mm. in length and 25 mm. in width. Considering the advanced stage of development of the young, there is still a large amount of yolk in the eggs. These eggs seem to have passed through about half of the period of incubation. The unhatched young is 160 mm. long; the length of its tail is 35 mm. The central portion of the back, three scales wide, is light brown; on each side is a dark brown stripe covering the third scale row and the contiguous half of the scale row on either side. A row of small dark dots lies on each side of the vertebral stripe. The intervals between the dorsal and lateral bands, and the ventral surface, are white. The adult female has well-defined lateral dark stripes on the same scale rows as the young, but the dorsal surface between these is uniformly colored except for the two rows of small dark brown spots. The ventral surface of the adult bears four rows of large brown dots.

COUNTS AND MEASUREMENTS.

Anal.	1/1
Scale-rows	15
Gastrosteges	139
Urosteges	37/37
Upper labials	7(3)
	8(3.4)
Preoculars	1
Postoculars	2
Temporals	1, 1
Total length in mm.	1,373
Length of tail in mm.	194

Genus *Coronella* Laurenti.17. *Coronella micropholis* (Cope).

Lampropeltis micropholis COPE, Proc. Acad. Nat. Sci. Philada., 1860, p. 257.

Coronella micropholis BOULENGER, Cat. Snakes, II, 1894, p. 203.

The specimen, which is a female (No. 2036), was taken by Mrs. H. H. Smith at Caagualito, Colombia.

COUNTS AND MEASUREMENTS.

Anal.	1
Scale-rows	23
Gastrosteges	228
Urosteges	43/43
Upper labials	7(3.4)
Preoculars	1
Postoculars	2
Temporals	2, 2
Total length in mm.	732
Length of tail in mm.	128

Genus *Drymobius* Cope.18. *Drymobius bifossatus* (Raddi).

Coluber bifossatus RADDI, Mem. Soc. Ital. Modena, XVIII, (Fis.) 1820, p. 333.

Drymobius bifossatus BOULENGER, Cat. Snakes, II, 1894, p. 10.

The collection possesses two specimens:

No. 127, ♀. From Santa Cruz de la Sierra, Bolivia. (Steinbach coll.)

No. 381, ♂. From Rio de Janeiro, Brazil. (Haseman coll., July 1, 1908.)

The color of the skin of No. 127 is almost uniform.

COUNTS AND MEASUREMENTS.

	(No. 127.)	(No. 381.)
Anal.	1 1	1/1
Scale-rows	15	15
Gastrosteges	179	167
Urosteges		97/97
Upper labials	8(4.5)	8(4.5)
Preoculars	1	1
Postoculars	2	2
Temporals	2, 2	2, 2
Total length in mm.		1,638
Length of tail in mm.		455

19. *Drymobius boddaerti* (Santzen).

Coluber boddaerti SENTZEN, Meyer's Zoöl. Archiv, II, 1796, p. 59.

Drymobius boddaerti BOULENGER, Cat. Snakes, II, 1894, p. 11.

There are twenty specimens in the collection, all of which are presumed to have come from Colombia, and to have been collected by Mr. and Mrs. H. H. Smith, except one (No. 29) which was taken by José Steinbach at Las Juntas, Bolivia. Nos. 176-183 inc., and No. 186 are from Bonda, where they were captured by the Smiths in 1901 at dates ranging from May to September. Nos. 202-203 were taken by the same parties at Valparaiso, Colombia (elev. 4,500 ft.); Nos. 2006, 2009, and 2020 at Caecagualito, Colombia (elev., 1,500 ft.) by Mrs. H. H. Smith. Nos. 1866-1868 inclusive, and Nos. 1872-1873 are a part of a collection, which, as stated in the introductory pages of this paper, had no field data attached to it, but are known to have been sent in by Mr. H. H. Smith while laboring in Colombia.

Both anterior and posterior temporals are frequently divided into two or three scales in longitudinal series.

Nos. 202 and 203 are young specimens of the variety *rappii*. The prevailing color of the upper surface is dark brown. Numerous white bars cross the back, alternating with a series of shorter white bars on each side which reach the ventral surface. The labials are black-margined; the chin and throat are checkered with black and white. No. 2006 is uniform olive-green above, shading to brown on the tail; the lower surface is white, with faint cloudy markings on the chin and throat. No. 2020 is brown above, with faintly defined darker stripes along the middle of the back and each side. The vertebral band is outlined by a black line in the posterior part of the body. The lateral stripes become darker and more distinct on the tail.

COUNTS AND MEASUREMENTS.

No.	Number.	Anal.	Scale-rows.	Gastrosteges.	Urosteges.	Upper Labials.	Preoculars.	Postoculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.	Sex.
	176.....	1/1	17	198	120/120	9(4.5.6)	1	2	2, 2	1,364	402	♀
	177.....	1/1	17	172	97/97	9(4.5.6)	1	2	2, 2	916	268	♀
	178.....	1/1	17	189	96/96	9(4.5.6)	1	2	2, 2	1,140	305	♀
	179.....	1/1	17	191	86/86	9(4.5.6)	1	2	2, 2	1,180	288	♀
	180.....	1/1	17	188	94/94	9(4.5.6)	1	2	2, 2	1,165	307*	♀
	181.....	1/1	17	174	100/100	9(4.5.6)	1	2	2, 2	925	265	♂
	182.....	1/1	17	175	95/95	9(4.5.6)	1	2	2, 2	1,023	287	♂
	183.....	1/1	17	188	118/118	9(4.5.6)	1	2	2, 2	1,222	367	♂
	186.....	1/1	17	186	88/88	9(4.5.6)	1	2	2, 2	975	242	♀
	29.....	1/1	17	193	53/53	9(4.5.6)	1	2	2, 2	802	137*	♀
	202.....	1/1	17	179	55/55	9(4.5.6)	1	2	2, 2	384	67*	♂
	203.....	1/1	17	194	118/118	9(4.5.6)	1	2	2, 2	505	152	♂
	1866.....	1/1	17	180	82/82	9(4.5.6)	1	2	2, 2	985	240	♀
	1867.....	1/1	17	187	94/94	9(4.5.6)	1	2	2, 2	1,005	266	♀
	1868.....	1/1	17	188	94/94	9(4.5.6)	1	2	2, 2	1,030	307	♀
	1872.....	1/1	17	198	121/121	9(4.5.6)	1	2	2, 2	1,133	343	♀
	1873.....	1/1	17	196	119/119	9(4.5.6)	1	2	2, 2	1,270	372	♀
	2006.....	1/1	17	189	118/118	9(4.5.6)	1	2	2, 2	826	250	♀
	2009.....	1/1	17	189	.....	9(4.5.6)	1	2	2, 2	1,020	93*	♀
	2020.....	1/1	17	185	93/93	9(4.5.6)	1	2	2, 2	1,110	287	♀

* Tip of tail lost.

20. *Drymobius rhombifer* (Günther).

Coryphodon rhombifer GUENTHER, P. Z. S., 1860, p. 236.

Drymobius rhombifer BOULENGER, Cat. Snakes, II, 1894, p. 14.

The collection contains four specimens as follows:

No. 188, ♀, Minca, Colombia, 2,000 ft. (H. H. Smith coll.), July. Skin.

No. 213, ♀, Bonda, Colombia, 150 ft. (H. H. Smith coll.), June.

No. 1865, ♀, Colombia, S. America (H. H. Smith coll.).

No. 1871, ♂, Colombia, S. America (H. H. Smith coll.). Tip of tail lost.

No. 213 has, in addition to the ordinary markings, a brown spot in the center of each gastrosteges, all together making a midventral stripe. Each of these specimens possesses a greater number of urosteges than is given for the species in Boulenger's Catalog, *i. e.* 84 to 96.

COUNTS AND MEASUREMENTS.

Number.	Anal.	Scale-rows.	Gastrosteges.	Urosteges.	Upper Labials.	Preoculars.	Postoculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
188	1/1	17	151	100/100	9(4.5.6)	1	2	2, 2		
213	1/1	17	160	102/102	9(4.5.6)	1	2	2, 2	474	130
1865	1/1	17	157	100/100	9(4.5.6)	1	2	2, 2	375	103
1871	1/1	17	152	97/97*	9(4.5.6)	1	2	2, 2	1,272	385

* Tip of tail lost.

Genus *Helicops* Wagler.21. *Helicops angulata* (Linnaeus).

Coluber angulatus LINNÆUS, Mus. Ad. Frid., 1754, p. 23. Pl. XV, fig. 1; Syst. Nat., Ed. XII, 1766, I, p. 377.

Helicops angulatus BOULENGER, Cat. Snakes, I, 1893, p. 278.

The only specimen in the Museum (No. 279) is a male from the LeBoutelier collection, which simply bears the label "South America."

COUNTS AND MEASUREMENTS.

Anal.	1/1
Scale-rows	19
Gastrosteges	117
Urosteges	74/74
Upper labials	9(4)
	8(4)
Preoculars	1
Postoculars	2
Temporals	2, 4
Total length in mm.	300
Length of tail in mm.	88

22. *Helicops carinicauda* (Wied) var. *infratæniata* Jan.

Coluber carinicaudus WIED, Beitr. Naturgesch. Bras., I, 1825, p. 300, Plate.

Helicops infratæniatus JAN, Arch. Zoöl. Anat. Phys., III, 1865, p. 245 and Icon. Gén., 28, Pl. III, fig. 3 (1868).

Helicops carinicauda, var. B, BOULENGER, Cat. Snakes, I, 1893, p. 277.

No. 355, ♂, Cacequy, Rio Grande do Sul (Haseman coll.), Jan. 31, 1909.

COUNTS AND MEASUREMENTS.

Anal.	1/1
Scale-rows	19
Gastrosteges	128
Urosteges	61/61
Upper labials	8(3.4)
	8(4)
Preoculars	1
Postoculars	2
Temporals	1, 2
Total length in mm.	543
Length of tail in mm.	128

23. *Helicops leopardina* (Schlegel).

Homalopsis leopardina SCHLEGEL, Phys. Serp., II, 1837, p. 358.

Helicops leopardinus BOULENGER, Cat. Snakes, I, 1893, p. 278.

The Museum possesses eleven examples of this species, as follows:

- No. 25, ♂. Las Juntas, Bolivia, coll. J. Steinbach, December, 1913.
 No. 321, ♂. Puerto Suarez, Bolivia, coll. J. D. Haseman, May 7, 1909.
 No. 322, ♀. São Antonio de Guaporé, coll. J. D. Haseman, July 4, 1909.
 No. 323, ♂. Puerto Suarez, Bolivia, coll. J. Steinbach, Jan., 1909.
 No. 324, ♂. Aregua, Paraguay, coll. J. D. Haseman, April 7, 1909.
 No. 325, ♂. Puerto Suarez, Bolivia, coll. J. D. Haseman, May 6, 1909.
 No. 326, ♂. Puerto Suarez, Bolivia, coll. J. D. Haseman, May 6, 1909.
 No. 327, ♀. São Luiz de Cáceres, coll. J. D. Haseman, May 25, 1909.
 No. 338, ♂. Santarem, Brazil, coll. J. D. Haseman, Dec. 7, 1909.
 No. 357, ♂. Santarem, Brazil, coll. J. D. Haseman, December 15, 1909.
 No. 358, ♂. Santarem, Brazil, coll. J. D. Haseman, December 15, 1909.

The hypapophyses of the posterior trunk vertebrae of *H. leopardina* are variably developed. Some specimens show scarcely a keel, some a well-developed plate, some an intermediate condition. No. 338 has no loreal shields; the loreal is absent on the left side of No. 357, and the right nasal of this specimen is in contact with the preocular.

COUNTS AND MEASUREMENTS.

Num-ber.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
No. 321.	1/1	19	114	74/74	8(4)	1	2	{2, 2 (1, 2	430	136
" 322.	1/1	19	115	62/62	8(3.4)	1	2	1, 2	245	65
" 323.	1/1	19	112	73/73	8(4)	2	2	1, 2	420	129
" 324.	1/1	19	119	64/64	8(4)	{1 (2	2	{2, 2 (1, 2	196	48
" 325.	1/1	19	116	68/68	8(1)	1	2	2, 2	295	82
" 326.	1/1	21	112	64/64	8(4)	1	2	2, 2	261	72
" 327.	1/1	19	119	72/72	8(4)	1	2	{2, 2 (1, 2	365	97
" 338.	1/1	19	120	87/87	8(3.4)	1	2	{2, 3 (1, 2	294	95
" 357.	1/1	19	117	89/89	8(4)	{1 (2	2	1, 2	568	201
" 358.	1/1	19	115	72/72	8(4)	{1 (2	2	{2, 2 (1, 2	354	105
" 25.	1/1	19	122	83/83	8(4)	1	2	1, 2	300	96

24. *Helicops modesta* Günther.

Helicops modestus GUENTHER, Ann. & Mag. Nat. Hist. (3), VII, 1861, p. 425.

Helicops modestus BOULENGER, Cat. Snakes, I, 1893, p. 277.

The specimens at hand are listed as follows:

No. 335, ♂, collected by J. D. Haseman at Jacarehy, São Paulo, Brazil, July 15, 1908.

No. 336, ♂, collected by J. D. Haseman at Jacarehy, São Paulo, Brazil, July 15, 1908.

No. 348, ♀, collected by J. D. Haseman at Mogy das Cruzes, São Paulo, July 20, 1908.

No. 349, ♂, collected by J. D. Haseman at Mogy das Cruzes, São Paulo, July 20, 1908.

Nos. 348 and 349 are uniform black above, with no traces of stripes. The scales of the anterior half of the body scarcely show traces of keels, which are poorly developed in the posterior half. These two specimens were captured with a seine in the Rio Tieté. Nos. 335 and 336 are reddish brown above, with three darker stripes. They were taken in a pond near the Rio Parahyba.

No. 348 has no traces of hypapophyses on the posterior trunk vertebræ; the hypapophyses of these vertebræ of No. 349 are only low keels.

COUNTS AND MEASUREMENTS.

	(No. 335.)	(No. 336.)	(No. 348.)	(No. 349.)
Anal.	1/1	1/1	1/1	1/1
Scale-rows	19	19	19	19
Gastrosteges	121	125	120	125
Urosteges	70/70	54/54	59/59	55/55
Upper labials	8(3.4)	8(4)	8(4)	8(4)
Preoculars	1	1	1	{ 1
				{ 2
Postoculars	2	2	2	2
Temporals	{ 2, 2	2, 2	2, 2	{ 2, 3
	{ 2, 3			{ 2, 2
Total length in mm.	381	285	316	587
Length of tail in mm.	111	65	73	121

25. *Helicops polylepis* Günther.

Helicops polylepis GUENTHER, Ann. Mag. N. H. (3), VII, 1861, p. 426.

Helicops polylepis BOULENGER, Cat. Snakes, I, 1893, p. 280.

No. 319, ♂, Santarem, Brazil, J. D. Haseman coll., December 12, 1909.

No. 328, ♂, São Luiz de Cáceres, J. D. Haseman coll., May 25, 1909.

No. 360, ♂, Santarem, Brazil, J. D. Haseman coll., December 9, 1909.

No. 2038, ♂, São Antonio de Guaporé, J. D. Haseman coll., July 30, 1909.

Specimen No. 2038 was taken in the Rio Guaporé, and according to Haseman's note is called locally "Cobra de Agua." It presents some variations from the description given by Boulenger. The rostral is separated from the internasal by the nasal. The frontal is once and two-thirds as long as broad, as wide in front as behind, with perfectly straight and parallel sides. It is shorter than its distance from the end of the snout, and shorter than the parietals. The anterior chin-shields are longer and considerably larger than the posterior. There are no keels on the scales of the outer row except in the posterior fourth of the trunk, and on the tail. The color of the lower surface is dark brown, with only a few widely separated small yellow spots. This appears to be the largest specimen of the species which has been recorded.

Specimens 319, 328, and 360 agree more nearly, but not entirely, with Boulenger's description. The eye of all is longer than one-half the frontal shield; this character is either more variable than usual or depends to some extent upon the treatment of the specimen. The lower surfaces of Nos. 319 and 360 are almost black, with round white (originally yellow?) spots on one or both extremities of most of the gastrosteges, forming conspicuous rows. The lower surface of No. 328 presents only a few small and indistinct light spots. The dorsal surface of this specimen is darker than that of any of the others, with more distinct black markings. The three middle rows of dorsal spots tend in all the specimens to run into each other and produce a pattern of diagonal crossing lines.

Hypapophyses are not present at all on the posterior trunk vertebrae of two of these specimens, and are scarcely indicated in the others.

No. 319 was found under a barrel on the bank of the Amazon. No. 360 was caught in a fish net in the Amazon. A small fish was found in the stomach of No. 328.

COUNTS AND MEASUREMENTS.

	(No. 319.)	(No. 328.)	(No. 360.)	(No. 2038.)
Anal.	1/1	1/1	1/1	1/1
Scale-rows	23	25	23	25
Gastrosteges	131	119	130	122
Urosteges	71/71	70/70	79/79	28/28*
Upper labials	8(4)	8(4)	8(3,4) (8(4)	8(4)
Preoculars	1	1	1	1
Postoculars	2	2	2	2
Temporals	1, 2	1, 2	1, 2 2, 4	2, 3
Total length in mm.	309	344	407	940
Length of tail in mm.	83	96	116	127*

* Tip of tail lost.

Genus *Herpetodryas* Boie.

26. *Herpetodryas carinatus* (Linnæus).

Coluber carinatus LINNÆUS, Mus. Ad. Frid., 1754, p. 31; Syst. Nat., Ed. XII, 1766, I, p. 384.

Herpetodryas carinatus BOULENGER, Cat. Snakes, II, 1894, p. 73.

No. 2, ♂, Province del Sara, Bolivia, Steinbach coll. (elev. 400 M.), Sept., 1911.

No. 3, ♀, Province del Sara, Bolivia, Steinbach coll. (elev. 350 M.), Jan., 1912.

No. 150, ♂, Bonda, Colombia, H. H. Smith coll. (elev. 150 ft.), June.

No. 367, ♂, Villa Bella, Bolivia, J. D. Haseman coll., Oct. 7, 1909.

Nos. 2 and 3 belong to the variety *flavolineatus* Jan. Nos. 150 and 367 are of the variety *bicarinatus* (Wied).

COUNTS AND MEASUREMENTS.

	(No. 2.)	(No. 3.)	(No. 150.)	(No. 367.)
Anal.....	1/1	1/1	1/1	1/1
Scale-rows.....	12	12	12	12
Gastrosteges.....	153	155	157	152
Urosteges.....	130/130	120/120	126/126	136/136
Upper labials.....	9(4.5.6)	9(4.5.6)	{ 8(4.5) 9(5.6)	9(4.5.6)
Preoculars.....	1	1	1	1
Postoculars.....	2	2	2	2
Temporals.....	1, 2	1, 1	1, 2	{ 1, 2 { 1, 1
Total length in mm.....	1067	937	1605	1330
Length of tail in mm.....	405	366	521	455

27. *Herpetodryas fuscus* (Linnæus).

Coluber fuscus LINNÆUS, Mus. Ad. Frid., 1754, p. 32, Pl. XVII, fig. 1; Syst. Nat., Ed. XII, 1766, I, p. 383.

Herpetodryas fuscus BOULENGER, Cat. Snakes, II, 1894, p. 75.

No. 365, ♂, Villa Bella, Bolivia, J. D. Haseman coll., October 8, 1909.

No. 1428, ♂, "Massasao, River Amazon" *vide* J. O. Kerby, who presented it to the Museum.

No. 1428 belongs to the variety *saturninus* (Linnæus).

COUNTS AND MEASUREMENTS.

	(No. 365.)	(No. 1428.)
Anal.....	1	1
Scale-rows.....	10	10
Gastrosteges.....	150	156
Urosteges.....	129/129	120/120
Upper labials.....	9(4.5.6)	9(4.5.6)
Preoculars.....	1	1
Postoculars.....	2	2
Temporals.....	1, 1	1, 1
Total length in mm.....	702	385
Length of tail in mm.....	350	128

Genus *Leptophis* Bell.28. *Leptophis ahætulla* (Linnæus).

Coluber ahætulla LINNÆUS, Syst. Nat., Ed. XII, 1766, I, p. 387.

Leptophis liocercus BOULENGER, Cat. Snakes, II, 1894, p. 113.

The Carnegie Museum possesses four specimens.

No. 23, ♀, Las Juntas, Bolivia, 250 M., J. Steinbach coll., December, 1913.

No. 268, ♀, South America, LeBoutelier coll.

No. 314, ♂, Puerto Suarez, J. Steinbach coll., December, 1908.

No. 366, ♂, Villa Bella, Bolivia, J. D. Haseman coll., October 10, 1909.

Nos. 23, 314, and 366 have lost the tips of their tails. A right loreal is present in the case of No. 268. No. 366 was found to have the intestines stuffed with winged termites, and the stomach of No. 314 contained four small frogs.

COUNTS AND MEASUREMENTS.

	(No. 23.)	(No. 268.)	(No. 314.)	(No. 366.)
Anal.....	1/1	1/1	1/1	1/1
Scale-rows.....	15	15	15	15
Gastrosteges.....	166	160	166	158
Urosteges.....	129/129*	145/145		145/145*
Upper labials.....	8(4.5)	9(5.6)	8(4.5)	9(5.6)
Preoculars.....	1	1	1	1
Postoculars.....	2	2	2	2
Temporals.....	1, 2	1, 2	1, 2	1, 2
Total length in mm.....	846	1170	1100	1338
Length of tail in mm.....	430*	437	150*	514*

* End of tail lost.

29. *Leptophis bocourti* Boulenger.

Leptophis bocourti BOULENGER, P. Z. S., 1898, p. 116.

This species is represented by but a single specimen, No. 2011, which was collected by Mrs. H. H. Smith at Cacagualito, Colombia (elev. 1,500 ft.). It is a female.

The specimen agrees well with Boulenger's description, except in the greater number of gastrosteges and the smaller number of urosteges. The terminal shield, or spine, of the tail is formed normally, yet the tip of the tail is thicker than is usual in the genus. It is therefore possible that the tip has been amputated and healed, and that the reduced number of urosteges of this specimen is thus accounted for. The color is a uniform, very dark green on the upper surface, without the dots and lines which Boulenger describes; light green below, except the lower jaw, which is yellow, with a green border covering about half of the lower labials.

COUNTS AND MEASUREMENTS.

Anal.....	1/1
Scale-rows.....	15
Gastrosteges.....	179
Urosteges.....	103/103
Upper labials.....	8(4.5)
Preoculars.....	1
Postoculars.....	2
Temporals.....	1, 2
Total length in mm.....	1212
Length of tail in mm.....	355

30. *Leptophis nigromarginatus* (Günther).

Ahatulla nigromarginata GUENTHER, Ann. & Mag. Nat. Hist. (3), XVIII, 1866, p. 28.

Leptophis nigromarginatus BOULENGER, Cat. Snakes, II, 1894, p. 112, Pl. III, fig. 3.

There are two females of this species in the collection, which were received from Mr. J. O. Kerby, and have attached to them labels which indicate that they were taken at Pranquina on the Amazon River. They bear the Catalog Numbers 2007 and 2008. The tip of the tail of No. 2007 has been lost.

COUNTS AND MEASUREMENTS.

	(No. 2007.)	(No. 2008.)
Anal.....	1/1	1/1
Scale-rows.....	15	15
Gastrosteges.....	158	162
Urosteges.....	111/111	157/157
Upper labials.....	8(4.5)	9(5.6) 8(4.5)
Preoculars.....	1	1
Postoculars.....	2	2
Temporals.....	1, 1	1, 1
	1, 2	1, 2
Total length in mm.....	940	1077
Length of tail in mm.....	317	392

31. *Leptophis occidentalis* (Günther).

Ahatulla occidentalis GUENTHER, P. Z. S., 1859, p. 412.

Leptophis occidentalis BOULENGER, Cat. Snakes, II, 1894, p. 111, Pl. III, fig. 2.

The Carnegie Museum has five specimens of this species listed as follows:

No. 140, ♀, Bonda, Colombia, H. H. Smith coll., June.

No. 141, ♀, Bonda, Colombia, H. H. Smith coll., August.

No. 1095, ♀, Bonda, Colombia, H. H. Smith coll., August 25.

No. 1869, ♂, Colombia, H. H. Smith coll.

No. 1870, ♀, Colombia, H. H. Smith coll.

COUNTS AND MEASUREMENTS.

	(No. 110.)	(No. 141.)	(No. 1095.)	(No. 1869.)	(No. 1870.)
Anal.	1/1	1/1	1/1	1/1	1/1
Scale-rows.	15	15	15	15	15
Gastrosteges	184	177	176	168	183
Urosteges.	158/158	164/161	146/146	152/152	158/158
Upper labials.	8(4.5)	8(4.5)	8(4.5) 9(5.6)	9(5.6)	8(4.5)
Preoculars.	1	1	1	1	1
Postoculars.	2	2	2	2	2
Temporals.	1, 2	1, 2	1, 2	1, 2	1, 2
Total length in mm.	1323	1486	1463	1800	1475
Length of tail in mm.	460	575	505	621	504

32. *Leptophis rostralis* Lönnberg.

Leptophis rostralis LÖNNBERG, Ann. & Mag. Nat. Hist. (7), X, 1902, p. 458.

No. 1862 is the only specimen as yet representing this species in the Carnegie Museum. It is slightly defective, having lost the end of the tail. It is a female, and was undoubtedly taken by H. H. Smith in Colombia.

The specimen agrees with Lönnberg's description in all the principal features, though showing some variation. The principal divergence is that in our specimen the preocular is in contact with the frontal. The portion of the rostral visible from above equals one-half the length of the internasals. The internasals are almost (five-sixths) as long as the prefrontals. The frontal is considerably longer than its distance from the end of the snout, but shorter than the parietals. The anterior chin-shields are shorter than the posterior. The color of the upper surface is a uniform dark brown without any visible markings. The upper lip and the lower surface of the head are whitish. The scales of the ventral surface appear to have been dark green; the posterior margin of each is light. The specimen has not been well preserved to show color, and the loss of the data regarding it is unfortunate. The number of gastrosteges exceeds that of the type.

COUNTS AND MEASUREMENTS.

Anal.	1/1
Scale-rows.	15
Gastrosteges.	180
Urosteges.	86/86*
Upper labials.	9(5.6) 8(4.5)
Preoculars.	1
Postoculars.	2
Temporals.	1, 2
Total length in mm.	373
Length of tail in mm.	94*

* Tip of tail lost.

Genus *Liophis* Wagler.

33. *Liophis albiventris* (Jan).

Liophis reginæ, vars. *albiventris* and *quadrilineata* JAN, Arch. Zoöl. Anat. Phys., II, 1863, p. 294; Icon. Gén., 16, 1866, Pl. VI, figs. 2 and 3.

Liophis albiventris BOULENGER, Cat. Snakes, II, 1894, p. 130.

This species is represented by a single male specimen from the LeBoutelier collection, which has been assigned the Catalog Number 278. The label attached to it by the collector states that it came from Sipan, South America.

COUNTS AND MEASUREMENTS.	
Anal.	1/1
Scale-rows	17
Gastrosteges	153
Urosteges	74/74
Upper labials	8(4.5)
Preoculars	1
Postoculars	1
Temporals	1, 2
Total length in mm.	495
Length of tail in mm.	127

34. *Liophis almadensis* (Wagler).

Natrix almadensis WAGLER, in Spix, Serp. Bras., 1824, p. 30, Pl. X, fig. 3.

Liophis almadensis BOULENGER, Cat. Snakes, II, 1894, p. 134.

No. 112, ♂, Santa Cruz de la Sierra, Bolivia, J. Steinbach collector.

No. 352, ♂, São João del Rey, Minas Geraes, Brazil, J. D. Haseman coll., May 17, 1908.

COUNTS AND MEASUREMENTS.		
	(No. 112.)	(No. 352.)
Anal.	1/1	1/1
Scale-rows	19	19
Gastrosteges	158	161
Urosteges	60/60	70/70
Upper labials	8(4.5)	8(4.5)
Preoculars	1	1
Postoculars	2	2
Temporals	1, 2	1, 2
Total length in mm.	352	485
Length of tail in mm.	71	103

35. *Liophis elæoides* sp. nov.

Tail $5\frac{1}{2}$ to $6\frac{1}{3}$ times in total length. Eye large, its length being equal to the distance from the front of the eye to the middle of the nostril; head broad and flat; snout bluntly pointed. Rostral broader than deep, visible from above; internasals

as long as broad or longer, as long as, or longer than, the prefrontals; frontal once and a quarter to once and a half as long as broad, shorter than its distance from the rostral (this is true of the mature specimens, the frontal of small specimens is longer than its distance from the end of the snout); frontal as long as, or shorter than, the parietals; loreal deeper than long; one pre- and two postoculars; temporals 1, 2; eight upper labials, the fourth and fifth bordering the orbit; five lower labials in contact with the anterior chin-shields which are as long as, or longer than, the posterior.

Scales in 19 rows: gastrosteges 160-167, obtusely angulate laterally; anal divided; urosteges in 49-54 pairs.

Uniform dark green above, this color extending to the outer ends of the gastrosteges. During life the color is undoubtedly of an olive tone, due to the color of the horny scales, most of which are rubbed off in our specimens. There are no spots, nor light or dark edges to scales; neither have the young a dark nuchal band. The lower surface is a uniform yellowish white. The upper lip is light green, lighter than the upper part of the head, but not white. (Type, C. M. Cat. Rept., No. 32.)

The Museum has fourteen specimens of this species, all of which were collected by Mr. José Steinbach in the Provincia del Sara, Bolivia, and most of them bear the label Santa Cruz de la Sierra. They bear in the Catalog of Reptiles of the Museum the numbers 32 (type), 44, 59, and 91-102 inclusive. All after No. 32 are regarded as paratypes. The type has a label giving the date of capture as February, 1913. No. 59 is labelled as having been taken in October, 1911. No dates are given on any of the other labels.

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
	32.	♂-♀	1/1	19	163	49/49	8(4.5)	1	2	1, 2	612	102
	44.	♂-♀	1/1	19	164	50/50	8(4.5)	1	2	1, 2	400	69
	59.	♂-♀	1/1	19	160	49/49	8(4.5)	1	2	1, 2	615	109
	91.	♂-♀	1/1	19	162	50/50	8(4.5)	1	2	1, 2	255	41
	92.	♂-♀	1/1	19	162	54/54	8(4.5)	1	2	1, 2	541	95
	93.	♂-♀	1/1	19	165	54/54	7(4.5)	1	2	1, 2	522	94
	94.	♂-♀	1/1	19	167	49/49	8(4.5)	1	2	1, 6	680	106
	95.	♂-♀	1/1	19	163	53/53	8(4.5)	1	2	1, 2	315	50
	96.	♂-♀	1/1	19	164	49/49	8(4.5)	1	2	1, 2	475	83
	97.	♂-♀	1/1	19	163	50/50	8(4.5)	1	2	1, 2	425	73
	98.	♂-♀	1/1	19	161	49/49	8(4.5)	1	2	1, 2	393	65
	99.	♂-♀	1/1	19	162	50/50	8(4.5)	1	2	1, 2	612	97
	100.	♂-♀	1/1	19	162	52/52	8(4.5)	1	2	1, 2	297	48
	102.	♂-♀	1/1	19	161	50/50	8(4.5)	1	2	1, 2	242	40

36. *Liophis melanostigma* (Wagler).

Natrix melanostigma WAGLER, in Spix, Serp. Bras., 1824, p. 17, Pl. IV, fig. 2.

Liophis melanostigma BOULENGER, Cat. Snakes, II, 1894, p. 142.

No. 340, ♀, Xiririca, Rio Ribeira, J. D. Haseman coll., December 10, 1908.

This is the only representative of this species in the Museum at the present time.

A black zigzag band occupies the vertebral region. The lower parts of the sides are black, this lateral band being broken into large spots on the neck. A light brown band separates the dorsal and lateral dark stripes. The third and fourth rows of scales are marked by an indistinct series of small white spots. A pair of conspicuous white spots lies on the nape just behind the occiput.

Internasals slightly longer than broad; frontal twice as long as broad, considerably longer than its distance from the end of the snout, shorter than the parietals.

COUNTS AND MEASUREMENTS.

Anal.....	1/1
Scale-rows.....	17
Gastrosteges.....	149
Urosteges.....	86/86
Upper labials.....	9(4.5.6)
	8(3.4.5)
Preoculars.....	1
Postoculars.....	2
Temporals.....	1, 2
Total length in mm.....	770
Length of tail in mm.....	241

37. *Liophis melanotus* (Shaw).

Coluber melanotus SHAW, Zoölogy, III, 1802, p. 534.

Liophis melanotus BOULENGER, Cat. Snakes, II, 1894, p. 134.

The Carnegie Museum possesses three examples of this species, as follows:

No. 214, ♀, Bonda, Colombia, H. H. Smith coll., June, 1901.

No. 1863, ♂, South America. (No doubt collected by H. H. Smith in Colombia.)

No. 1864, ♂, South America. (No doubt collected by H. H. Smith in Colombia.)

Specimen 214 has a row of black spots covering the tips of the second row of scales in the anterior half of the trunk. The others show traces of the same markings.

COUNTS AND MEASUREMENTS.

	(No. 214.)	(No. 1863.)	(No. 1864.)
Anal.	1/1	1/1	1/1
Scale-rows.	17	17	17
Gastrosteges.	158	155	152
Urosteges.	58/58	36/36*	59/59
Upper labials.	8(4.5)	8(4.5)	8(4.5)
Preoculars.	1	1	1
Postoculars.	2	2	2
Temporals.	1, 2	1, 2	1, 2
Total length in mm.	434	470	356
Length of tail in mm.	85	65*	80

* End of tail lost.

38. *Liophis pœcilogyrus* (Wied).

Coluber pœcilogyrus WIED, Beitr. Naturgesch. Bras., I, 1825, p. 371, Plate.

Liophis pœcilogyrus BOULENGER, Cat. Snakes, II, 1894, p. 131.

There are fourteen specimens at hand, which are referable to this species. Seven of them come from the Provincia del Sara, Bolivia, and were collected by José Steinbach, who neglected except in two cases to indicate the date of capture. They are listed as follows:

- No. 7, ♂, Provincia del Sara, Bolivia, J. Steinbach, Jan., 1912.
- No. 53, ♀, Provincia del Sara, Bolivia, J. Steinbach, Jan., 1913.
- No. 105, ♀, Santa Cruz de la Sierra, J. Steinbach.
- No. 106, ♀, Santa Cruz de la Sierra, J. Steinbach.
- No. 111, ♂, Santa Cruz de la Sierra, J. Steinbach.
- No. 113, ♂, Santa Cruz de la Sierra, J. Steinbach.
- No. 274, ♂, South America, LeBoutelier Collection.
- No. 275, ♀, South America, LeBoutelier Collection.
- No. 277, ♂, South America, LeBoutelier Collection.
- No. 312, ♂, Santa Cruz de la Sierra, J. Steinbach.
- No. 332, ♂, Entre Rios, Brazil, J. D. Haseman, June 4, 1908.
- No. 333, ♂, Cidade de Matto Grosso, J. D. Haseman, July 1, 1909.
- No. 351, ♂, Entre Rios, Brazil, J. D. Haseman, June 4, 1908.
- No. 359, ♀, Penedo, Alagoas, Brazil, J. D. Haseman, March 22, 1908.

Specimens No. 7, 53, 105, 106, 113, and 312, from the Province del Sara, Bolivia, are all very dark on the upper surface, and uniformly colored. The edges of the dorsal and lateral scales are black, the centers olive. When the surface of a

specimen is dry, the scales appear brownish with an iridescent sheen. The scales of the upper surface of the head are similarly light brown or olive with dark margins. The upper labials are white. The lower surface is either entirely white, or some of the gastrosteges have more or less complete black anterior margins. Nos. 7 and 113, young specimens, are as uniformly marked as the older ones. There is no nuchal collar, nor are any transverse bars visible. The length of the tail of these specimens is contained $6\frac{3}{8}$ to 7 times in the total length. The number of gastrosteges and urosteges varies within very narrow limits and about the minimum for *L. pacilogyrus*. It is possible that the specimens represent a well defined subspecies.

I feel doubtful about the identification of No. 111. No pits are visible on the scales, and the length of the tail is contained six and one-half times in the total length. The dorsal scales are mostly black, but some are white, or white-edged, so arranged as to form numerous narrow light cross-bars or reticulations. Most of the gastrosteges are entirely or partly brown.

COUNTS AND MEASUREMENTS.

No.	Sex.	Anal.	Scale-rows.	Gastrosteges.	Urosteges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
No. 7	♂	1/1	19	149	41/41	8(4.5)	1	2	1, 2	277	42
" 53	♀	1/1	19	148	38/38	8(4.5) 7(3.1)	1	2	1, 2	510	71
" 105	♀	1/1	19	142	42/42	8(4.5)	1	2	1, 2	535	77
" 106	♀	1/1	19	146	46/46	8(4.5)	1	2	1, 2	512	80
" 111	♀	1/1	19	148	44/44	8(4.5)	1	2	1, 2	251	39
" 113	♂	1/1	19	146	41/41	8(4.5)	1	2	1, 1, 2	225	33
" 274	♂	1/1	19	160	61/61	8(4.5)	1	2	1, 2	697	142
" 275	♀	1/1	19	174	57/57	8(4.5)	1	2	1, 2	882	145
" 277	♂	1/1	19	157	54/54	8(4.5)	1	2	1, 2	480	83
" 312	♂	1/1	21	141	38/38	8(4.5)	1	2	1, 2	494	69
" 332	♂	1/1	19	162	62/62	8(4.5)	1	2	1, 2	275	52
" 333	♂	1/1	19	153	43/43	8(4.5)	1	2	1, 2	285	40
" 351	♂	1/1	19	167	56/56	8(4.5)	1	2	1, 2	513	90
" 359	♀	1/1	19	153	49/49	8(4.5)	1	2	1, 2	800	132

39. *Liophis reginae* (Linnæus).

Coluber reginae LINNÆUS, Mus. Ad. Frid., 1754, p. 24, Pl. XIII, fig. 3; Syst. Nat., Ed. XII, 1766, p. 378.

Liophis reginae BOULENGER, Cat. Snakes, II, 1894, p. 137.

The Carnegie Museum has three specimens of this species, No. 19, ♂, No. 24, ♀, and No. 27, ♂, which were taken by José Steinbach at Las Juntas, Bolivia, in December, 1913.

COUNTS AND MEASUREMENTS.

	(No. 19.)	(No. 24.)	(No. 27.)
Anal.	1/1	1/1	1/1
Scale-rows	17	17	17
Gastrosteges	140	149	146
Urosteges	70/70	71/71	76/76
Upper labials	8(4.5)	8(4.5)	8(4.5)
Preoculars	1	1	1
Postoculars	2	2	2
Temporals	1, 2	1, 2	1, 2
Total length in mm.	201	729	612
Length of tail in mm.	46	182	162

40. *Liophis viridis* Günther.

Liophis viridis GÜNTHER, Ann. & Mag. Nat. Hist. (3), IX, 1862, p. 58, Pl. IX, fig. 2.

Liophis viridis BOULENGER, Cat. Snakes, II, 1894, p. 135.

The specimens in the Carnegie Museum are listed as follows:

No. 281, ♂, South America, LeBoutelier collection.

No. 316, ♀, Lagoa de João Pereira, Brazil, J. D. Haseman coll., December 23, 1907.

No. 344, ♀, Bom Jesus de Lapa, Bahia, Brazil, J. D. Haseman coll.

No. 344 is defective, having in part lost its tail.

COUNTS AND MEASUREMENTS.

	(No. 281.)	(No. 316.)	(No. 344.)
Anal.	1/1	1/1	1/1
Scale-rows	19	19	19
Gastrosteges	182	198	192
Urosteges	72/72	76/76	41/41*
Upper labials	8(4.5)	8(4.5)	8(4.5)
Preoculars	1	1	1
Postoculars	2	2	2
Temporals	1, 2	1, 2	1, 2
Total length in mm.	402	597	528
Length of tail in mm.	85	125	70*

* Tip of tail lost.

Genus *Lystrophis* Cope.41. *Lystrophis histricus* (Jan).

Heterodon histricus JAN, Arch. Zoöl. Anat. Phys., II, 1863, p. 224.

Lystrophis histricus BOULENGER, Cat. Snakes, II, 1894, p. 152.

The only specimen of this species in the possession of the Carnegie Museum (No. 331) was taken at São Matias, Bolivia, by J. D. Haseman, May 7, 1909. It is a male.

Snout, to level of eyes, brown; a darker brown band across the eyes, followed by another, which is interrupted in the middle, and ends on each side back of the

mouth. The bands across the head are separated by very narrow light lines. The chevron-shaped band of the nape is broad and almost joins the parietal bands. The remainder of the upper surface of the body is crossed by similar brown, black-edged, chevron-shaped bands, which almost reach the gastrosteges and are separated by slightly narrower light bars. A small dark spot lies in the center of each light bar between the ventral ends of the dark bands. There are a few faint dark spots on the light ventral surface. The total number of dark bands, including the nuchal and tail bands, is twenty-six.

COUNTS AND MEASUREMENTS.

Anal	1/1
Scale-rows	19
Gastrosteges	142
Urosteges	31/31
Upper labials	7(3.4)
Preoculars	1
Postoculars	2
Temporals	1, 2
Total length in mm.	176
Length of tail in mm.	21

42. *Lystrophis semicinctus* (Duméril & Bibron).

Heterodon semicinctus DUMÉRIL & BIBRON, *Erp. Gén.*, VII, 1854, p. 774.

Lystrophis semicinctus BOULENGER, *Cat. Snakes*, II, 1894, p. 153.

There are fifteen specimens of this species in the collection, all taken by José Steinbach in the Province del Sara, Bolivia. It is worthy of note that in the case of the specimen bearing the catalog number 85 both loreals enter the orbit below the preocular. The list of species is as follows:

- No. 12, ♀, Provincia del Sara, J. Steinbach coll., Feb., 1911.
- No. 14, ♂, Provincia del Sara, J. Steinbach coll., Feb., 1911.
- No. 15, ♂, Provincia del Sara, J. Steinbach coll., Feb., 1911.
- No. 31, ♀, Provincia del Sara, J. Steinbach coll., Feb., 1913.
- No. 33, ♂, Provincia del Sara, J. Steinbach coll., Sept., 1913.
- No. 36, ♀, Provincia del Sara, J. Steinbach coll., Sept., 1913.
- No. 39, ♂, Provincia del Sara, J. Steinbach coll., Sept., 1913.
- No. 51, ♂, Provincia del Sara, J. Steinbach coll., Jan., 1913.
- No. 84, ♂, Santa Cruz de la Sierra, José Steinbach coll.
- No. 85, ♂, Santa Cruz de la Sierra, José Steinbach coll.
- No. 86, ♂, Santa Cruz de la Sierra, José Steinbach coll.
- No. 87, ♀, Santa Cruz de la Sierra, José Steinbach coll.

No. 88, ♀, Santa Cruz de la Sierra, José Steinbach coll.

No. 89, ♀, Santa Cruz de la Sierra, José Steinbach coll.

No. 90, ♂, Santa Cruz de la Sierra, José Steinbach coll.

COUNTS AND MEASUREMENTS.

Num-ber.	Sex.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length of Tail in Mm.
No. 12.....	♀	1/1	21	151	27/27	8(4.5)	1	2	1, 2	416	45
" 14.....	♀	1/1	21	154	35/35	8(4.5)	2	2	1, 2	426	58
" 15.....	♂	1/1	21	151	35/35	{8(5) 7(4.5)}	2	2	1, 2	488	65
" 31.....	♀	1/1	21	155	25/25	8(4.5)	2	2	1, 2	516	57
" 33.....	♀	1/1	21	151	27/27	{9(4.5) 8(4.5)}	1	2	1, 2	178	17
" 36.....	♀	1/1	21	151	31/31	8(4.5)	1	2	1, 2	488	53
" 39.....	♀	1/1	21	155	30/30	8(4.5)	1	2	1, 2	175	19
" 51.....	♀	1/1	21	151	32/32	8(4.5)	2	2	1, 2	270	32
" 84.....	♀	1/1	21	149	28/28	8(4.5)	1	2	1, 2	237	25
" 85.....	♀	1/1	21	153	37/37	8(4.5)	1	2	1, 2	148	18
" 86.....	♂	1/1	21	156	36/36	8(4.5)	{2 1}	{2 2}	1, 2	235	27
" 87.....	♀	1/1	21	150	26/26	8(4.5)	1	2	1, 2	178	19
" 88.....	♀	1/1	21	140	25/25	8(4.5)	2	2	1, 2	217	22
" 89.....	♀	1/1	21	158	31/31	{8(5) 8(4.5)}	1	2	1, 2	526	59
" 90.....	♂	1/1	21	150	36/36	8(4.5)	2	2	1, 2	500	70

Genus *Phrynonax* Cope.

43. *Phrynonax fasciatus* (Peters).

Spilotes fasciatus PETERS, Mon. Berl. Akad., 1869, p. 443.

Phrynonax fasciatus BOULENGER, Cat. Snakes, II, 1894, p. 21.

This species is represented by a single specimen taken by Mrs. H. H. Smith at Caacagualito, Colombia, in May, 1901. It is a female and bears the number 2026 in the Catalog of Reptiles in the Carnegie Museum.

COUNTS AND MEASUREMENTS.

Anal.....	1
Scale-rows.....	23
Gastrosteges.....	209
Urosteges.....	116, 116
Upper labials.....	8(4.5, 6) 7(4.5)
Preoculars.....	1
Postoculars.....	2
Temporals.....	2, 2
Total length in mm.....	1240
Length of tail in mm.....	299

Genus *Rhadinæa* Cope.44. *Rhadinæa merremi* (Wied).

Coluber merremii WIED, Reise Bras., II, 1821, p. 121.

Rhadinæa merremii BOULENGER, Cat. Snakes, II, 1894, p. 168.

The Carnegie Museum has two specimens, bearing the Catalog Nos. 350 and 353, both of which were captured by Mr. J. D. Haseman at Entre Rios, Brazil, on June 4, 1908. They are males.

COUNTS AND MEASUREMENTS.

	(No. 350.)	(No. 353.)
Anal.	1/1	1/1
Scale-rows.	17	17
Gastrosteges.	145	145
Urosteges.	47/47	44/44
Upper labials.	8(4.5) 9(4.5.6)	8(4.5)
Preoculars.	1	1
Postoculars.	2	2
Temporals.	1, 2	1, 2
Total length in mm.	842	175
Length of tail in mm.	147	31

45. *Rhadinæa occipitalis* (Jan).

Enicognathus occipitalis JAN, Arch. Zoöl. Anat. Phys., II, 1863, p. 267.

Rhadinæa occipitalis BOULENGER, Cat. Snakes, II, 1894, p. 175.

The only specimen we possess is a female (C. M. No. 6) which was caught by Mr. José Steinbach in the Province del Sara, Bolivia, at an elevation of 350 M. in January, 1912.

COUNTS AND MEASUREMENTS.

Anal.	1/1
Scale-rows.	15
Gastrosteges.	181
Urosteges.	70/70
Upper labials.	8(3.4.5)
Preoculars.	1
Postoculars.	2
Temporals.	1, 2
Total length in mm.	507
Length of tail in mm.	119

46. *Rhadinæa orina* sp. nov.

Eighteen small maxillary teeth followed after a short interspace by two much larger. Eye rather large. Length of parietals equal to their distance from the

internasals (in one case slightly more); rostral a little broader than deep, visible from above; internasals broader than long, or as long as broad, much shorter than the prefrontals; frontal once and two-thirds to twice as long as wide, longer than its distance from the end of the snout, shorter than the parietals; loreal once and a half to twice as deep as long; one preocular and two postoculars; temporals 1, 2; eight upper labials, the fourth and fifth bordering the orbit; five lower labials in contact with the anterior chin-shields, which are as long as, or (usually) considerably longer than, the posterior.

Scales in seventeen rows; anal divided; gastrosteges 156 to 161; urosteges in 52-60 pairs. Length of tail five and one-third to six times in the total length.

Olive above, the scales tipped or margined with black. The younger specimens have a chevron-shaped black band crossing the back of the head, the point lying on the parietal shields, and the ends passing just behind the angle of the mouth. This is followed by a rather distinct narrow light nuchal collar, behind which are a number of distinct narrow dark bands separated by much narrower light spaces. On the posterior part of the trunk and on the tail are four indistinct, longitudinal, dark stripes, two being dorsal and one along the middle of each side. The upper surface of the head is dark brown. The upper lip and the lower surface are yellowish, the anterior margins of the gastrosteges are brown, the brown line being widest at the outer ends of the scales. The markings are most distinct in the younger specimens. The older ones are nearly uniform olive above, and yellowish beneath, with only faint traces of the dark bars on the anterior part of the body and of the lines on the posterior extremity.

This species is very closely related to *R. merremi*.

Type, C. M. No. 264; paratypes, C. M. Nos. 263, 265, 266, 267.

The specimens belonging to this species form a part of the LeBoutelier Collection presented to the Museum by Mrs. A. Marshall Bell, and are labelled as from "the Sierras of Bolivia."

COUNTS AND MEASUREMENTS.

	(No. 263 ♀.)	(No. 264 ♂.)	(No. 265 ♀.)	(No. 266 ♂.)	(No. 267 ♂.)
Anal	1/1	1/1	1/1	1/1	1/1
Scale-rows	17	17	17	17	17
Gastrosteges	161	157	156	157	159
Urosteges	60/60	55/55	55/55	55/55	52/52
Upper labials	8(4.5)	8(4.5)	8(4.5)	8(4.5)	8(4.5)
Preoculars	1	1	1	1	1
Postoculars	2	2	2	2	2
Temporals	1, 2	1, 2	1, 2	1, 2	1, 2
Total length in mm.	336	337	274	235	243
Length of tail in mm.	63	60	50	43	41

Genus *Spilotes* Wagler.

47. *Spilotes pullatus* (Linnæus).

Coluber pullatus LINNÆUS, Mus. Ad. Frid., 1754, p. 35, Pl. XX, fig. 3; Syst. Nat., Ed. XII, 1766, p. 388.

Spilotes pullatus BOULENGER, Cat. Snakes, II, 1894, p. 23.

The eight specimens we possess were all taken in Colombia by Mr. H. H. Smith. They are listed as follows:

- No. 145, Bonda, Colombia, elev. 150 ft., June.
- No. 146, ♀, Bonda, Colombia, elev. 150 ft., June.
- No. 147, ♂, Bonda, Colombia, elev. 150 ft., August.
- No. 148, ♂, Bonda, Colombia, elev. 150 ft., June.
- No. 187, ♀, Bonda, Colombia, elev. 150 ft., August.
- No. 1781, ♂, Masinga, Colombia, elev. 2,000 ft., August 16.
- No. 2039, ♂, Bonda, Colombia, elev. 150 ft., June.
- No. 2040, ♀, Minca, Colombia, elev. 2,000 ft., July 27, 1899.

COUNTS AND MEASUREMENTS.

Num-ber.	Sex.	Annl.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
No. 145 . . .			16		114/114	8(4.5) 9(5.6)	1	2	2, 1 1, 1	1,930	527
" 146 . . .	♀	1	18	226	122/122	8(4.5)	1	2	1, 1	1,880	450
" 147 . . .	♂	1	16	215	129/129	8(4.5)	1	2	2, 1	2,135	571
" 148 . . .	♂	1	16	210	122/122	7(3.4)	1	2	1, 1	1,875	528
" 187 . . .	♀	1	16	223	121/121	7(3.4)	1	2	1, 1	760	184
" 1781 . . .	♂	1	16	213	117/117	8(4.5)	1	2	1, 1	2,010	562
" 2039 . . .	♂	1	16	231	117/117	7(3.4)	1	2	1, 1	532	125
" 2040 . . .	♀	1	16	220	113/113	8(4.5)	1	2	1, 1	520	116

Genus *Tropidodipsas* Günther.

48. *Tropidodipsas spilogaster* sp. nov. (Plate XVIII, figs. 4-6.)

Maxillary short, the thirteen or fourteen maxillary teeth decreasing a little in front and more behind; the posterior mandibular teeth decrease gradually. Head very distinct from neck; eye large, its length equal to the distance from the front of the orbit to the center of the nostril, protuberant, with a small vertically elliptic pupil. Body cylindrical, slender; scales smooth, without pits.

Rostral much broader than deep, just visible from above; nasal divided; internasals a trifle more than half as long as the prefrontals; prefrontals entering the orbit; frontal as broad as long, shorter than its distance from the end of the

snout, much shorter than the parietals, twice as wide as the supra-ocular; supra-ocular much broader behind than in front; loreal oblong, once and a fifth to once and a half as long as deep, entering the orbit; no preocular; one crescentic postocular; temporals 1, 2; seven upper labials, the third and fourth entering the orbit; two pairs of short chin-shields, the anterior a little the longer and as broad as long, the posterior broader than long.

Scales smooth, in 15 rows; anal entire; gastrosteges 147-157; urosteges in 44 to 47 pairs.

Upper surface reddish brown, with a dorsal series of black spots narrowly margined with white; the anterior three or four spots are several times as large as the others and extend upon the edges of the gastrosteges. Between the first and second, and the second and third spots, the interspaces are almost white (red in life?). The sides of the body and tail bear smaller and more numerous black spots which may reach to the edges of the gastrosteges. The scales of the lighter areas are finely stippled with brown and black.

A black fleur-de-lys-like marking on the parietals and frontals (on specimen 47 a nearly uniform dark rounded spot); lips, chin, and lower surface white (pink in life?) with black dots; most of these on specimen 42 are very small, but on 47 they are nearly all large square checks. The urosteges are nearly covered by black checks.

The type (C. M. No. 42) and the paratype (C. M. No. 47) were both collected in the Province del Sara, Bolivia, at an elevation of 350 meters, by Mr. José Steinbach, the former in November, the latter in December, of the year 1912. Both specimens are males.

COUNTS AND MEASUREMENTS.

	(No. 42 ♂.)	(No. 47 ♂.)
Anal.	1	1
Scale-rows	15	15
Gastrosteges	147	157
Urosteges.	44/44	47/47
Upper labials.	7(3.4)	6(3.4) 7(3.4)
Preoculars	0	0
Postoculars	1	1
Temporals	1, 2	1, 2
Total length in mm.	297	288
Length of tail in mm.	56	51

Genus **Xenodon** Boie.

49. **Xenodon colubrinus** Günther.

Xenodon colubrinus GUENTHER, Catalog of Colubrine Snakes, 1858, p. 55.

Xenodon colubrinus BOULENGER, Cat. Snakes, II, 1894, p. 146.

The only representative of this species is a specimen which is derived from the LeBoutelier collection (C. M. No. 280) and which has no other indication of the locality than the label "South America." It is a male.

COUNTS AND MEASUREMENTS.

Anal.	1
Scale-rows	19
Gastrosteges	147
Urosteges	43/43
Upper labials	8(4.5)
Preoculars	1
Postoculars	2
Temporals	1, 2
Total length in mm.	436
Length of tail in mm.	58

50. **Xenodon merremi** (Wagler).

Ophis merremii WAGLER, in Spix, Serp. Bras., 1824, p. 47, Pl. XVII.

Xenodon merremii BOULENGER, Cat. Snakes, II, 1894, p. 150.

There are three specimens at hand, all of which are females. They are cataloged as follows:

C. M. No. 52, ♀, Prov. del Sara, Bolivia, J. Steinbach coll., January, 1913.

C. M. No. 56, ♀, Prov. del Sara, Bolivia, J. Steinbach coll., October, 1911.

C. M. No. 315, ♀, Puerto Suarez, Bolivia, J. Steinbach coll., January, 1909.

COUNTS AND MEASUREMENTS.

	(No. 52.)	(No. 56.)	(No. 315.)
Anal.	1/1	1	1/1
Scale-rows	19	19	19
Gastrosteges	151	146	152
Urosteges	32/32	35/35	36/36
Upper labials	7(3.4)	7(3.4)	7(4)
Preoculars	{1	1	{1
Postoculars	{1 {3 {2	3	{1 {2 {3
Temporals	1, 2	1, 2	1, 2
Total length in mm.	740	835	514
Length of tail in mm.	78	102	59

The anal of No. 56 is single, but shows indications of a fusion of two scales. This specimen has only four lower labials in contact with the anterior chin-shields.

51. *Xenodon neuwiedi* Günther.

Xenodon neuwiedi GUENTHER, Ann. & Mag. Nat. Hist. (3), XII, 1863, p. 354, Pl. V, fig. C.

Xenodon neuwiedi BOULENGER, Cat. Snakes, II, 1894, p. 148.

No. 1234, ♂, no data.

No. 1235, ♂, no data.

COUNTS AND MEASUREMENTS.

	(No. 1234.)	(No. 1235.)
Anal.	1/1	1/1
Scale-rows	21	21
Gastrosteges	169	168
Urosteges	59/59	64/64
Upper labials	8(4.5)	8(4.5)
Preoculars	1	1
Postoculars	2	2
Temporals	1, 2	1, 2
Total length in mm.	330	478
Length of tail in mm.	54	83

52. *Xenodon severus* (Linnaeus).

Coluber severus LINNÆUS, Mus. Ad. Frid., 1754, p. 25, Pl. VIII, fig. 1; Syst. Nat., Ed. XII, 1766, I, p. 379.

Xenodon severus BOULENGER, Cat. Snakes, II, 1894, p. 149.

The only specimen in the collection is a male (C. M. No. 128) taken by José Steinbach at Santa Cruz de la Sierra, Bolivia. Mr. Steinbach furnished no date upon his label.

	(No. 128.)
Anal.	1
Scale-rows	21
Gastrosteges	133
Urosteges	37/37
Upper labials	8(4.5)
Preoculars	{ 2 1
Postoculars	{ 2 3
Temporals	1, 2
Total length in mm.	385
Length of tail in mm.	48

SERIES B. OPISTHOGLYPHA.

Subfamily DIPSADOMORPHINÆ Boulenger.

Genus *Clelia* (Oxyrhopus) Fitzinger.53. *Clelia bitorquata* (Günther).

Tachymenis bitorquatus GUENTHER, Ann. & Mag. Nat. Hist. (4), IX, 1872, p. 19.

Oxyrhopus bitorquatus BOULENGER, Cat. Snakes, III, 1896, p. 104, Pl. VI, fig. 1.

The four specimens of this species in the Museum are listed as follows:

C. M. No. 272, ♀, "South America," LeBoutelier Collection.

C. M. No. 343, ♂, Bom Jesus de Lapa, Bahia, Brazil, J. D. Haseman coll., no date.

C. M. No. 369, ♂, Piracicaba, J. D. Haseman coll., Sept. 7, 1908.

C. M. No. 376, ♀, Tarma, Peru, Miss Lola Vance coll., no date.

Nos. 272, 343, and 369 have black cross-bands arranged in threes the entire length of the body and tail. No. 376 has two black bands on the neck, two sets of threes on the anterior part of the body, traces of a third set, and the remainder of the upper surface (originally) red with black tipped scales.

COUNTS AND MEASUREMENTS.

	(No. 272.)	(No. 343.)	(No. 369.)	(No. 376.)
Anal.	1	1	1	1
Scale-rows.	19	19	19	19
Gastrosteges.	208	206	205	207
Urosteges.	76/76	63/63	70/70	75/75
Upper labials.	8(4.5)	8(4.5)	8(4.5)	8(4.5)
Preoculars.	1	1	1	1
Postoculars.	2	2	2	2
Temporals.	2, 3	2, 3	2, 3	2, 3
Total length in mm.	808	656	1150	574
Length of tail in mm.	152	111	200	110

54. *Clelia clælia* (Daudin).

Coluber clælia DAUDIN, Rept., VI, 1803, p. 330, Pl. LXXVIII.

Oxyrhopus clælia BOULENGER, Cat. Snakes, III, 1896, p. 108.

C. M. No. 330, ♂, Entre Rios, Brazil, J. D. Haseman coll., June 4, 1908.

C. M. No. 380, ♂, Rio Mamoré, Bolivia, J. D. Haseman coll., Sept. 19, 1909.

In specimen No. 330 there is no loreal.

COUNTS AND MEASUREMENTS.

	(No. 330.)	(No. 380.)
Anal	1	1
Scale-rows	19	19
Gastrosteges	239	230
Urosteges	76/76	77/77
Upper labials	7(3.4)	7(3.4)
Preoculars	1	1
Postoculars	2	2
Temporals	2, 3	2, 3
Total length in mm.	623	1,857
Length of tail in mm.	99	320

55. *Clelia doliata* (Duméril & Bibron).

Oxyrhopus doliatus DUMÉRIL & BIBRON, Erp. Gén., VII, 1854, p. 1020.

Oxyrhopus doliatus BOULENGER, Cat. Snakes, III, 1896, p. 106.

The collection contains one male of this species, which formed a part of the LeBoutelier Collection, and, as was the case with all of the specimens in that collection, has no definite locality-label, being simply marked as from "South America." The tip of the tail of the specimen has been lost.

Eye nearly one-half its distance from the end of the snout; the portion of the rostral visible from above one-half as long as its distance from the frontal; frontal once and a quarter as long as broad, a little shorter than its distance from the end of the snout, and a very little shorter than the parietals.

Broad black cross-bands extending to the gastrosteges, posteriorly making complete annuli. These are much broader than the light interspaces, almost touching along the middle of the back, narrower on the sides, though still wider than the light bands. The markings are intermediate between varieties A and B of Boulenger (*loc. cit.*).

COUNTS AND MEASUREMENTS.

	(No. 273.)
Anal	1
Scale-rows	19
Gastrosteges	201
Urosteges	*
Upper labials	8(4.5)
Preoculars	1
Postoculars	2
Temporals	2, 3
Total length in mm.	835
Length of tail in mm.	60*

* Tip of tail lost.

56. *Clelia euprepa* sp. nov. (Plate XXVIII, figs. 7-9.)

Thirteen solid maxillary teeth followed after a short space by two slightly enlarged grooved fangs. Eye large, its length three-fifths to two-thirds of the distance from the eye to the tip of the snout. Snout broad, rounded, scarcely projecting beyond the lower lip. Rostral one-half as deep as broad, the portion visible from above one-half or less the length of the internasal; internasals two-thirds as long as the prefrontals; frontal once and a third as long as wide, pentagonal, longer than its distance from the end of the snout, shorter than the parietals; loreal once and a half to nearly twice as long as deep; one preocular, just reaching the top of the head, separated from the frontal; two postoculars; temporals 2, 3 (2, 2 on the left side of No. 109); eight upper labials, the third, fourth, and fifth bordering the orbit. The third upper labial touches the edge of the orbit by its corner only. Nine lower labials, four in contact with the anterior chin-shields, which are longer than the posterior.

Nineteen rows of scales; anal undivided; gastrosteges 225-230; urosteges in 94-105 pairs.

The body and tail bear narrow, irregular black rings, separated by narrower white spaces which are probably bright red in life. The outlines of the black markings are extremely irregular, many being united by diagonal black bars, while others are broken along the back. Very few of the ventral shields of the dark rings are completely black, the color extending half or two-thirds across a shield and then stopping abruptly. Most of the light dorsal and lateral scales are tipped with brown. The scales of the upper surface of the head and the lower labials are black in the center with light (red ?) edges. A large white (red ?) spot crosses the nape just behind the parietals.

Type, C. M. No. 109; paratype, C. M. No. 108.

The Museum possesses two males of this species, collected by José Steinbach at Santa Cruz de la Sierra, Bolivia, and numbered as above.

COUNTS AND MEASUREMENTS.

	(No. 108.)	(No. 109.)
Anal.....	1	1
Scale-rows.....	19	19
Gastrosteges.....	230	225
Urosteges.....	105/105	94/94
Upper labials.....	8(3.4.5)	8(3.4.5)
Preoculars.....	1	1
Postoculars.....	2	2
Temporals.....	2, 3	{ 2, 2 2, 3
Total length in mm.....	577	797
Length of tail in mm.....	135	170

57. *Clelia peruviana* sp. nov.

Eleven subequal solid maxillary teeth followed after a short space by two slightly enlarged grooved fangs. Eye small, two-fifths as long as its distance from the end of the snout. Snout rounded, scarcely projecting beyond the lower lip. Rostral two-thirds as deep as broad, the portion visible from above equal to the suture between the internasals, not quite one-third the distance between it and the frontal; internasals one-half as long as the prefrontals; frontal once and one-fifth as long as broad, as long as its distance from the end of the snout, a little shorter than the parietals; loreal once and two-thirds as long as deep; one preocular, separated, but not widely, from the frontal, and reaching the upper surface of the head; two postoculars; temporals 2, 3; eight upper labials, the fourth and fifth entering the orbit; four lower labials in contact with the anterior chin-shields, which are longer than the posterior.

Scales in 19 rows; anal entire; 179 gastrosteges; 70 pairs of urosteges.

Top of the head orange, with a dark patch on the frontal and parietals. The back and sides of the anterior third of the body are uniform black. Back of this the body is marked by broad black rings separated by narrow light (red?) spaces in which each scale is tipped or margined with black. The black annuli are a little narrower below than above. In the posterior part of the body and tail the lower surface is almost entirely black. Passing forward, the black color becomes limited more and more to the posterior margins of the ventral shields. The gastrosteges of the anterior quarter have only their outer edges black-margined. The under surface of the head, the lips, and the throat are uniformly yellowish.

The type (C. M. No. 377) is unique. It is a male, and was collected at Tarma, Peru, by Miss Lola Vance, who neglected to give the date of capture.

COUNTS AND MEASUREMENTS.

(No. 377.)

Anal.	1
Scale-rows.	19
Gastrosteges.	179
Urosteges.	70/70
Upper labials	S(4.5)
Preoculars.	1
Postoculars.	2
Temporals.	2, 3
Total length in mm.	691
Length of tail in mm.	148

58. *Clelia petolaria* (Linnæus).

Coluber petolarius LINNÆUS, Mus. Ad. Frid., 1754, p. 35, Pl. IX, fig. 2; Syst. Nat., Ed. XII, 1766, I, p. 387.

Oxyrhopus petolarius BOULENGER, Cat. Snakes, III, 1896, p. 101.

The specimens in the Carnegie Museum are listed as follows:

C. M. No. 22, ♂, Las Juntas, Bolivia, elev. 250 M., Steinbach coll., Dec., 1913.

C. M. No. 75, ♀, Santa Cruz de la Sierra, Bolivia, Steinbach coll.

C. M. No. 107, ♂, Santa Cruz de la Sierra, Bolivia, Steinbach coll.

C. M. No. 110, ♂, Santa Cruz de la Sierra, Bolivia, Steinbach coll.

The specimen No. 107 is slightly defective, having lost the tip of its tail. Nos. 22, 107, and 110 have broad black bars across the back; the abdomens are uniformly light.

No. 22 has nineteen bars, three to four times as wide as the light interspaces. No. 107 has nineteen bars, two to three times as wide as the interspaces. No. 110 has 28 bars, three to four times as wide as the very narrow interspaces.

COUNTS AND MEASUREMENTS.

	(No. 22.)	(No. 75.)	(No. 107.)	(No. 110.)
Anal.....	1	1	1	1
Scale-rows.....	19	19	19	19
Gastrosteges.....	197	200	205	200
Urosteges.....	S2/S2	S0/S0	54/54*	S5/S5
Upper labials.....	S(4.5)	S(4.5)	S(4.5)	S(4.5)
Preoculars.....	1	1	1	1
Postoculars.....	2	2	2	2
Temporals.....	2, 3	2, 3	2, 3	2, 3
Total length in mm.....	313	164	633	255
Length of tail in mm.....	63	38	54*	54

* Tip of tail lost.

59. *Clelia rhombifer* (Duméril & Bibron).

Oxyrhopus rhombifer DUMÉRIL & BIBRON, Erp. Gén., VII, 1854, p. 1018.

Oxyrhopus rhombifer BOULENGER, Cat. Snakes, III, 1896, p. 103.

C. M. No. 11, ♂, Provincia del Sara, Bolivia, Steinbach coll, March, 1912.

C. M. No. 45, ♂, Provincia del Sara, Bolivia, Steinbach coll., December, 1912.

C. M. No. 57, ♂, Provincia del Sara, Bolivia, Steinbach coll., December, 1911.

C. M. No. 64, ♂, Provincia del Sara, Bolivia, Steinbach coll., December, 1911.

C. M. No. 65, ♂, Provincia del Sara, Bolivia, Steinbach coll., December, 1911.

C. M. No. 66, ♂, Provincia del Sara, Bolivia, Steinbach coll., December, 1911.

COUNTS AND MEASUREMENTS.

Num-ber.	Sex.	Anal.	Scale-rows.	Gastrosteges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
No. 11	♂	1	19	196	75/75	8(4.5)	1	2	2, 3	580	125
" 45	♂	1	19	201	87/87	8(4.5)	2	2	2, 2	375	80
" 57	♂	1	19	203	69/69	8(3.4.5)	1	2	2, 3	661	118
" 64	♂	1	19	206	66/66	8(4.5)	1	2	2, 3	633	117
" 65	♂	1	19	195	77/77	8(4.5)	1	2	2, 3	336	68
" 66	♂	1	19	198	77/77	8(3.4.5)	1	2	2, 3	615	130

60. *Clelia trigemina* (Duméril & Bibron).

Oxyrhopus trigeminus DUMÉRIL & BIBRON, *Exp. Gén.*, VII, 1854, p. 1013.

Oxyrhopus trigeminus BOULENGER, *Cat. Snakes*, III, 1896, p. 104.

The only specimen we have at present is a female from the LeBoutelier Collection, which is simply labelled as from "South America." C. M. No. 271.

Frontal a trifle shorter than its distance from the tip of the snout, much shorter than the parietals. The triads of dark brown bars are widely separated, but the individual bars in each are close and not very distinctly marked, as the intervening red scales are heavily colored with dark brown.

COUNTS AND MEASUREMENTS.

(No. 271.)

Anal.	1
Scale-rows	19
Gastrosteges	199
Urosteges	64/64
Upper labials	8(4.5)
Preoculars	1
Postoculars	2
Temporals	2, 3
Total length in mm.	688
Length of tail in mm.	120

Genus *Pseudoboa* Schneider.61. *Pseudoboa coronata* Schneider.

Pseudoboa coronata SCHNEIDER, *Hist. Amph.*, II, 1801, p. 286.

Oxyrhopus coronatus BOULENGER, *Cat. Snakes*, III, 1896, p. 111.

The species is represented in the collection by a male (C. M. No. 116) taken at Santa Cruz de la Sierra by José Steinbach, who failed to give any further information.

Eye two-fifths as long as the snout; frontal slightly broader than long, shorter than its distance from the end of the snout; anterior chin-shields a little shorter

than the posterior; pits of scales extremely small and difficult to see. The color (in alcohol) is very light, almost white above, except for the dark brown on the front of the head and the nape.

COUNTS AND MEASUREMENTS.

	(No. 116.)
Anal	1
Scale-rows	17
Gastrosteges	191
Urosteges	76
Upper labials	7(3.4)
Preoculars	1
Postoculars	2
Temporals	2, 2
Total length in mm.	297
Length of tail in mm.	64

Genus *Erythrolamprus* Wagler.

62. *Erythrolamprus æsculapii* (Linnæus).

Coluber æsculapii LINNÆUS, Mus. Ad. Frid., 1754, p. 29, Pl. XI, fig. 2; Syst. Nat., Ed. XII, 1766, I, p. 380.

Erythrolamprus æsculapii BOULENGER, Cat. Snakes, III, 1896, p. 200.

There are fourteen specimens of this species in the collection. All belong to the variety having double annuli. The upper surface of the head is largely black, without distinct bands. The specimens are cataloged as follows:

- C. M. No. 129, ♂, Valparaiso, Colombia, H. H. Smith coll., April.
- C. M. No. 130, ♀, Bonda, Colombia, H. H. Smith coll., May.
- C. M. No. 131, ♀, Bonda, Colombia, H. H. Smith coll., June.
- C. M. No. 132, ♀, Bonda, Colombia, H. H. Smith coll., May.
- C. M. No. 133, ♀, Bonda, Colombia, H. H. Smith coll., June.
- C. M. No. 134, ♀, Bonda, Colombia, H. H. Smith coll., May.
- C. M. No. 135, ♂, Bonda, Colombia, H. H. Smith coll., May.
- C. M. No. 270, ♀, South America, LeBoutelier Collection.
- C. M. No. 342, ♀, Entre Rios, Brazil, J. D. Haseman coll., June 4, 1909.
- C. M. No. 1096, ♂, Bonda, Colombia, H. H. Smith coll., August.
- C. M. No. 1841, ♀, South America, LeBoutelier Collection.
- C. M. No. 1842, ♀, South America, LeBoutelier Collection.
- C. M. No. 1843, ♀, South America, LeBoutelier Collection.
- C. M. No. 2035, ♂, Cacagualito, Colombia, Mrs. H. H. Smith coll., no date given.

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
No. 129	...	♂	1/1	15	192	60/60	7(3.4)	{2 1	2	1, 2	507	83
" 130	...	♀	1/1	15	188	47/47	7(3.4)	1	2	1, 2	516	70
" 131	...	♀	1/1	15	193	52/52	7(3.4)	{1 2	2	1, 2	867	130
" 132	...	♀	1/1	15	185	47/47	7(3.4)	1	2	1, 2	804	120
" 133	...	♀	1/1	15	193	37/37	7(3.4)	1	2	1, 2	798	87
" 134	...	♀	1/1	15	190	48/48	7(3.4)	1	2	1, 2	859	113
" 135	...	♂	1/1	15	201	61/61	7(3.4)	2	2	1, 2	780	146
" 270	...	♀	1/1	15	193	36/36	7(3.4)	1	2	1, 2	558	58
" 342	...	♀	1/1	15	203	48/48	7(3.4)	1	2	1, 2	756	96
" 1096	...	♂	1/1	15	195	59/59	7(3.4)	2	2	1, 2	784	131
" 1841	...	♀	1/1	16	191	3/3*	7(3.4)	1	2	1, 2	709	5*
" 1842	...	♀	1/1	15	179	51/51	7(3.4)	1	2	1, 2	842	125
" 1843	...	♀	1/1	15	192	51/51	7(3.4)	{1 2	2	1, 2	810	115
" 2035	...	♂	1/1	15	192	60/60	7(3.4)	1	2	1, 2	732	128

* The tail is lost.

Genus *Himantodes* Duméril & Bibron.63. *Himantodes cenchoa* (Linnaeus).

Coluber cenchoa LINNÆUS, Syst. Nat., Ed. XII, 1766, I, p. 389.

Himantodes cenchoa BOULENGER, Cat. Snakes, III, 1896, p. 84.

The specimens in the Carnegie Museum are cataloged as follows:

C. M. No. 189, ♀, Bonda, Colombia, H. H. Smith coll., September 1.

C. M. No. 190, ♂, Bonda, Colombia, H. H. Smith coll., June.

C. M. No. 362, ♂, Muniz Freire, Espiritu Santo, Brazil, Haseman coll., June 18, 1908.

C. M. No. 375, ♂, Tarma, Peru, Miss Lola Vance coll., no date.

COUNTS AND MEASUREMENTS.

	(No. 189.)	(No. 190.)	(No. 362.)	(No. 375.)
Anal.	1/1	1/1	1/1	1/1
Scale-rows.	17	17	17	17
Gastrosteges.	243	236	240	237
Urosteges.	145/145	142/142	167/167	157/157
Upper labials.	8(4.5)	8(4.5)	8(4.5)	8(3.4.5)
	8(3.4.5)	8(3.4.5)		9(4.5.6)
Preoculars.	1	1	2	2
		2	2	
Postoculars.	2	2	2	2
			3	
Temporals.	2, 3	2, 3	2, 2, 3	2, 3
	3, 3		2, 3	3, 3
Total length in mm.	902	820	1285	1057
Length of tail in mm.	251	240	381	334

Genus **Tantilla** Baird & Girard.64. **Tantilla melanocephala** (Linnæus).

Coluber melanocephalus LINNÆUS, Mus. Ad. Frid., 1754, p. 24, Pl. XV, fig. 2;
Syst. Nat., Ed. XII, 1766, I, p. 378.

Homalocranium melanocephalum BOULENGER, Cat. Snakes, III, 1896, p. 215.

The only example of this serpent which we possess is a male, taken by Mr. J. D. Haseman at Santa Cruz, in the province of Matto Grosso, Brazil, on June 22, 1909. It bears the catalog number 337.

COUNTS AND MEASUREMENTS.

	(No. 337.)
Anal.	1/1
Scale-rows	15
Gastrosteges	152
Urosteges	63/63
Upper labials	7(3.4)
Preoculars	1
Postoculars	2
Temporals	1, 1
Total length in mm.	180
Length of tail in mm.	43

65. **Tantilla semicineta** (Duméril & Bibron).

Homalocranium semicineta DUMÉRIL & BIBRON, Erp. Gén., VII, 1854, p. 862.

Homalocranium semicineta BOULENGER, Cat. Snakes, III, 1896, p. 219.

The specimens in the Carnegie Museum are cataloged as follows:

No. 200, ♀, Bonda, Colombia, H. H. Smith coll., August.

No. 210, ♂, Bonda, Colombia, H. H. Smith coll., June.

No. 1094, ♂, Bonda, Colombia, H. H. Smith coll., August.

No. 1844, ♀, South America, Mr. and Mrs. H. H. Smith coll., no date.

No. 2024, ♀, Caecagualito, Colombia, Mrs. H. H. Smith, no date.

No. 2037, ♂, Caecagualito, Colombia, Mrs. H. H. Smith, no date.

Nos. 200, 210, 2024, 2037, and 1844 are all dark brown above with narrow white bars or half-bars. The lower surfaces are white. The tip of the snout is yellow touched with brown; there is a yellow spot on the lip behind the eye. The stomach of no. 1094 contained a centipede 153 mm. long.

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
200	...	♀	1/1	15	178	59/59	7(3.4)	1	2	1, 1	482	98
210	...	♂	1/1	15	170	68/68	7(3.4)	1	2	1, 1	465	110
1094	...	♂	1/1	15	170	64/64	7(3.4)	1	2	1, 1	425	95
1844	...	♂	1/1	15	180	13/13*	7(3.4)	1	2	1, 1	437	22*
2024	...	♂	1/1	15	175	10/10*	7(3.4)	1	2	1, 1	448	17*
2037	...	♀	1/1	15	172	57/57	7(3.4)	1	2	1, 1	200	41

* Tip of tail lost.

Genus *Leptodeira* Fitzinger.66. *Leptodeira annulata* (Linnæus).*Coluber annulatus* LINNÆUS, Mus. Ad. Frid., 1754, p. 34, Pl. VIII, fig. 2.*Leptodira annulata* BOULENGER, Cat. Snakes, III, 1896, p. 97.

We have twenty-one specimens of this snake, fifteen from Bolivia, and six from Colombia. The Bolivian specimens were all taken in the Province del Sara by J. Steinbach, and the Colombian specimens by Mr. and Mrs. H. H. Smith. In the following table the first fifteen numbers are those of the Bolivian examples,

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Sub-oculars.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
9	...	♀	1/1	19	188	61/61*	8(3.4.5)	0	2	2	1, 2	675	138*
37	...	♀	1/1	19	189	73/73	8(3.4.5)	0	1	2	1, 2	413	85
70	...	♂	1/1	19	191	87/87	9(4.5.6)	0	1	2	1, 2	502	122
71	...	♀	1/1	19	187	73/73	7(3.4)	0	1	2	1, 2	645	138
72	...	♂	1/1	21	189	80/80	8(4.5)	1	1	2	1, 2	680	150
73	...	♂	1/1	19	170	74/74	8(4.5)	1	1	2	1, 2	680	148
74	...	♂	1/1	19	186	92/92	8(4.5)	0	1	2	1, 2	245	49
76	...	♂	1/1	19	196	55/55*	8(4.5)	1	1	2	1, 2	603	105*
77	...	♂	1/1	19	196	85/85	8(4.5)	1	1	2	1, 2	485	111
78	...	♂	1/1	19	190	87/87	7(3.4)	0	1	2	1, 1	610	150
79	...	♀	1/1	19	184	24/24*	8(4.5)	1	1	2	1, 2	555	52*
80	...	♀	1/1	19	189	90/90	(head injured)	1	1	2	1, 2	705	178
81	...	♀	1/1	19	191	73/73*	8(4.5)	1	2	2	1, 1	700	140*
82	...	♂	1/1	19	191	85/85	8(4.5)	1	1	2	1, 2	480	118
83	...	♂	1/1	19	191	84/84	8(3.4.5)	0	1	2	1, 2	616	155
191	...	♂	1/1	21	180	88/88	8(4.5)	1	1	2	1, 2	561	154
192	...	♂	1/1	21	178		8(4.5)	2	2	2	1, 1	502	71*
193	...	♂	1/1	21	178	93/93	8(4.5)	1	2	2	1, 2	491	132
194	...	♂	1/1	19	173		8(4.5)	1	2	2	1, 2	520	75*
205	...	♂	1/1	21	177	88/88	8(4.5)	1	2	2	1, 2	404	103
2023	...	♂	1/1	21	176	79/79	8(4.5)	1	2	2	1, 2	805	181

* Tip of tail lost.

and the last six represent the material from Colombia. The Colombian material was collected from June to September at Bonda, except No. 2023, which was taken at Cacagualito. No dates accompany the specimens received from Mr. Steinbach, except in the case of No. 9, which was taken in January, and No. 37, which bears the label "August, 1913."

Genus *Oxybelis* Wagler.

67. *Oxybelis acuminatus* (Wied).

Coluber acuminatus WIED, Abbild. Nat. Bras., 1822, and Beitr. Nat. Bras., I, 1825, p. 322.

Oxybelis acuminatus BOULENGER, Cat. Snakes, III, 1896, p. 192.

The specimens in the Carnegie Museum are cataloged as follows:

- No. 41, ♂, Provincia del Sara, Bolivia, Steinbach coll., November, 1912.
- No. 171, ♀, Bonda, Colombia, H. H. Smith coll., 1901.
- No. 172, ♀, Bonda, Colombia, H. H. Smith coll., June, 1901.
- No. 173, ♀, Bonda, Colombia, H. H. Smith coll., July, 1901.
- No. 174, ♂, Bonda, Colombia, H. H. Smith coll., July, 1901.
- No. 175, ♀, Bonda, Colombia, H. H. Smith coll., August, 1901.
- No. 184, ♀, Bonda, Colombia, H. H. Smith coll., August, 1901.
- No. 1845, ♂, Colombia, H. H. Smith.
- No. 1846, ♀, Colombia, H. H. Smith.
- No. 1847, ♀, Colombia, H. H. Smith.
- No. 1848, ♂, Colombia, H. H. Smith.
- No. 1849, ♂, Colombia, H. H. Smith.
- No. 1850, ♂, Colombia, H. H. Smith.
- No. 2010, ♀, Cacagualito, Colombia, Mrs. H. H. Smith.

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
	41	♂	1/1	17	186	158/158	9(4.5.6)	1	2	1, 2	1,083	434
	171	♀	1/1	17	185	161/161	9(4.5.6)	1	2	1, 2	1,165	458
	172	♀	1/1	17	179	159/159	9(4.5.6)	1	2	1, 2	1,390	550
	173	♀	1/1	17	182	153/153	9(4.5.6)	1	2	1, 2	1,020	388
	174	♂	1/1	17	182	170/170	9(4.5.6)	1	2	1, 2	1,172	472
	175	♀	1/1	17	183	153/153	9(4.5.6)	1	2	1, 2	1,136	435
	184	♀	1/1	17	189	159/159	9(4.5.6)	1	2	1, 2	1,260	481
	1845	♂	1/1	17	...	166/166	9(4.5.6)	1	2	1, 2	1,240	483
	1846	♀	1/1	17	185	160/160	9(4.5.6)	1	2	1, 2	1,090	318
	1847	♀	1/1	17	179	146/146	9(4.5.6)	1	2	1, 2	1,180	445
	1848	♂	1/1	17	180	173/173	9(4.5.6)	1	2	1, 2	1,105	454
	1849	♂	1/1	17	184	159/159	9(4.5.6)	1	2	1, 2	1,128	441
	1850	♂	1/1	17	183	159/159	9(4.5.6)	1	2	1, 2	455	162
	2010	♀	1/1	17	176	159/159	8(4.5)	1	2	1, 2	1,194	471

68. *Oxybelis fulgidus* (Daudin).

Coluber fulgidus DAUDIN, Rept., VI, 1803, p. 352, Pl. LXXX.

Oxybelis fulgidus BOULENGER, Cat. Snakes, III, 1896, p. 191.

The only specimen we have is a female taken at Caacualito, Colombia, by Mrs. H. H. Smith. It is C. M. No. 2027.

COUNTS AND MEASUREMENTS.

(No. 2027.)

Anal	1/1
Scale-rows	17
Gastrosteges	208
Urosteges	158/158
Upper labials	10(5.6.7)
Preoculars	1
Postoculars	2
Temporals	1, 2
Total length in mm.	1708
Length of tail in mm.	592

Genus *Philodryas* Wagler.69. *Philodryas nattereri* Steindachner.

Philodryas nattereri STEINDACHNER, Sitzber. Ak. Wien, LXII, 1870, p. 345, Pl. VII, figs. 1-3.

Philodryas nattereri BOULENGER, Cat. Snakes, III, 1896, p. 134.

A single male, captured by J. D. Haseman at Bom Jesus de Lapa, Bahia, Brazil. No other information accompanies the specimen. It bears the number 345 in the Catalog of the Museum.

Brown above, darkest on the head and neck. Faint brown lines run along the centers of the first and fourth rows of scales on each side of the body.

COUNTS AND MEASUREMENTS.

(No. 345.)

Anal	1
Scale-rows	21
Gastrosteges	209
Urosteges	132/132
Upper labials	8(4.5)
Preoculars	1
Postoculars	2
Temporals	2, 2
Total length in mm.	540
Length of tail in mm.	166

70. *Philodryas olfersi* (Lichtenstein).

Coluber olfersii LICHTENSTEIN, Verz. Doubl., 1823, p. 104.

Philodryas olfersii BOULENGER, Cat. Snakes, III, 1896, p. 129.

The specimens in the Carnegie Museum are listed as follows:

- No. 10, ♂, Provincia del Sara, Bolivia, Steinbach coll., March, 1912.
- No. 13, ♂, Provincia del Sara, Bolivia, Steinbach coll., February, 1911.
- No. 16, ♂, Provincia del Sara, Bolivia, Steinbach coll., February, 1911.
- No. 62, ♂, Provincia del Sara, Bolivia, Steinbach coll., October, 1911.
- No. 101, ♂, Santa Cruz de la Sierra, Bolivia, Steinbach, no date.
- No. 103, ♂, Santa Cruz de la Sierra, Bolivia, Steinbach, no date.
- No. 269, ♂, Brazil, LeBoutelier Collection.
- No. 374, ♂, Tarma, Peru, Miss Lola Vance coll., no date.

COUNTS AND MEASUREMENTS.

No.	Sex.	Anal.	Scale-rows.	Gastrosteges.	Urosteges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
No. 10	♂	1/1	19	189	108-108	8(4.5)	1	2	1, 2	491	138
" 13	♂	1/1	19	193	103-103	8(4.5)	2	2	1, 2	1,275	299
" 16	♂	1/1	19	188	112-112	8(4.5)	1	2	1, 2	570	166
" 62	♂	1/1	19	185	80/80*	8(4.5)	1	2	1, 2	496	120*
" 101	♂	1/1	19	192	96/96	8(4.5)	1	2	1, 2	407	99
" 103	♂	1/1	19	188	112-112	8(4.5)	1	2	1, 2	960	282
" 269	♂	1/1	19	176	104-104	8(4.5)	1	2	1, 1, 2	900	255
" 374	♂	1/1	19	189	72/72*	8(4.5)	1, 1	2, 3	1, 2	480	108*

* Tip of tail lost.

71. *Philodryas schotti* (Schlegel).

Xenodon schottii SCHLEGEL, Phys. Serp., II, 1837, p. 91, Pl. III, figs. 8 and 9.

Philodryas schotti BOULENGER, Cat. Snakes, III, 1896, p. 130.

The only example of this species at hand is a female (No. 104) taken by Mr. José Steinbach at Santa Cruz de la Sierra, Bolivia.

COUNTS AND MEASUREMENTS.

	(No. 104.)
Anal.	1/1
Scale-rows.	19
Gastrosteges.	193
Urosteges.	99/99
Upper labials.	7(3.4)
Preoculars.	1
Postoculars.	2
Temporals.	1, 2
Total length in mm.	1515
Length of tail in mm.	379

Genus *Rhinostoma* Duméril & Bibron.72. *Rhinostoma guianense* (Troschel).

Heterodon guianensis TROSCHEL, in Schomburgk, Reise Brit. Guian., III, 1848, p. 653.

Rhinostoma guianense BOULENGER, Cat. Snakes, III, 1896, p. 114.

There are thirteen examples of this species in the Museum of which it may be confidently asserted that they were all secured in Colombia by Mr. and Mrs. H. H. Smith, when engaged in collecting in that part of the world. All the specimens which have locality labels attached came from Bonda, and the dates of those upon which there are records of the time of capture show that they were taken from April to the first week in September.

Nos. 211, 212, 1857, and 1858 are of the light-colored variety with a dark brown collar on the nape.

COUNTS AND MEASUREMENTS.

Num-ber.	Sex.	Anal.	Scale-rows.	Gastro-steges.	Ven-steges.	Upper Labials.	Pre-oculars.	Post-oculars.	Temporals.	Total Length in Mm.	Length Tail in Mm.
No. 163...	♀	1	19	200	61/61	8(4.5)	{1 2	{2 2	2, 3	916	151
" 164...	♂	1	19	196	57/57	8(4.5)	{1 1	{1 2	2, 3	835	134
" 165...	♂	1	19	201	63/63	8(4.5)	1	2	2, 3	825	140
" 166...	♂	1	19	199	60/60	8(4.5)	1	2	2, 3	836	140
" 167...	♂	1	19	191	69/69	8(4.5)	{1 1	{4 3	2, 3	611	124
" 168...	♂	1	19	206	62/62	8(4.5)	1	2	2, 3	956	157
" 169	♂	1	19	185	70/70	{9(5.6) 8(4.5)	1	3	{3, 4 2, 3	553	114
" 170...	♂	1	19	197	57/57	8(4.5)	1	2	2, 3	554	86
" 211...	♂	1	19	199	55/55+5	8(4.5)	1	2	2, 3	375	58
" 212...	♂	1	21	192	73/73	{9(4.5,6) 8(4.5)	1	2	3, 3	344	62
" 1856...	♂	1	19	201	52/52+6	8(4.5)	1	2	2, 3	540	83
" 1857...	♂	1	19	193	70/70	8(4.5)	1	2	2, 3	442	80
" 1858*	335*	65*

* Mutilated.

Genus *Tachymenis* Wiegmann.73. *Tachymenis peruviana* Wiegmann.

Tachymenis peruviana WIEGMANN, Nov. Acta Ac. Leop.-Carol., XVII, I, 1835, p. 252, Pl. XX, fig. 1.

Tachymenis peruviana BOULENGER, Cat. Snakes, III, 1896, p. 118.

The specimen (C. M. No. 347) is a female, and was collected by Mr. J. D. Haseman at Bom Jesus de Lapa, Bahia, Brazil.

COUNTS AND MEASUREMENTS.

(No. 347.)

Anal.	1/1
Scale-rows.	19
Gastrosteges.	146
Urosteges.	48/48
Upper labials.	8(4.5)
Preoculars.	1
Postoculars.	2
Temporals.	2, 3
	2, 2
Total length in mm.	193
Length of tail in mm.	33

Genus *Thamnodynastes* Wagler.

74. *Thamnodynastes nattereri* (Mikan).

Coluber nattereri MIKAN, Delect. Faun. Flor. Bras., 1820, Plate.

Thamnodynastes nattereri BOULENGER, Cat. Snakes, III, 1896, p. 116.

C. M. No. 48, ♂, Provincia del Sara, Bolivia, José Steinbach coll., Dec., 1912.

C. M. No. 339, ♂, Santarem, Brazil, J. D. Haseman coll., December 7, 1909.

C. M. No. 361, ♀, Rio Doce, J. D. Haseman coll., May 20, 1908.

No. 339 was captured in the water of a swamp between the Rio Tapajos and the Amazon. All except the two outer rows of scales are strongly keeled. It conforms to the characters of *T. nattereri* except that there are seventeen instead of nineteen rows of scales. No. 361 was captured in a mill-race.

COUNTS AND MEASUREMENTS.

	(No. 48.)	(No. 339.)	(No. 361.)
Anal.	1/1	1/1	1/1
Scale-rows.	19	17	19
Gastrosteges.	156	148	155
Urosteges.	74/74	76/76	64/64
Upper labials.	8(4.5)	8(4.5)	8(3.4.5)
			8(4.5)
Preoculars.	1	2	1
Postoculars.	2	2	2
Temporals.	2, 3	2, 3	2, 3
Total length in mm.	568	588	581
Length of tail in mm.	142	156	112

SERIES C. PROTEROGLYPHA.

Subfamily ELAPINÆ Boulenger.

Genus *Elaps* Schneider.75. *Elaps colombianus* sp. nov.

Seven upper labials, third and fourth bordering the orbit; snout broad and rounded, not projecting; sixth and seventh labials the largest of the series; rostral just visible from above, much broader than deep; internasals much shorter and narrower than prefrontals; first lower labials in contact behind the symphyseal; posterior nasal in contact with the preocular. Eye two-thirds to three-quarters as long as its distance from the mouth; frontal once and a quarter to once and two-fifths as long as broad, much broader than the supraoculars, slightly shorter than its distance from the end of the snout (longer than this distance in the young specimen No. 2031), much shorter than the parietals; parietals longer than their distance from the internasals; one pre- and two postoculars; temporals 1, 1; third upper labial larger than the fourth; four lower labials in contact with the anterior chin-shields, which are a little shorter than the posterior.

Scales in 15 rows; anal divided; gastrosteges 187–207; urosteges in 33–44 pairs.

Body with 12 to 14 black rings, three to four scales wide, edged with narrow yellow rings one scale wide; the latter margined with narrow irregularly outlined black rings. The last are variably developed, from a row of scales tipped with black, to two or three rows of all black scales. The red interspaces are more than twice as long as the length of the black triads, with usually black tipped scales. Top of the head black from snout to parietals; posterior edges of parietals, the temporals, fifth, sixth, and part of seventh upper labials crossed by a yellow band, which passes partly or completely around the lower jaw and is widest at the sides of the head. Anterior half of lower jaw black. The first black annulus is separated from the parietals by not more than one scale. A narrow black ring is only faintly indicated behind this first or nuchal annulus. The last annulus of the body crosses the anal scales. On the tail are four to six black annuli, separated by narrow red spaces, in which all the scales may be black-margined, or the central scales are black, forming a narrow black bar which may extend only to the sides or across the lower surface of the tail. The tail pattern is, thus, a broad black annulus, a narrow red ring, a narrow black cross-bar or ring, a narrow red ring, a broad black annulus, etc.

This species seems not distantly related to *Elaps fulvius* (Linnæus).

Type, C. M. No. 197; paratypes, C. M. Nos. 198, 2031, 2033.

There are four specimens representing this species in our collection, which are cataloged as follows:

- No. 197, ♀, Minca, Colombia, H. H. Smith coll., June.
- No. 198, ♀, Bonda, Colombia, H. H. Smith coll., June.
- No. 2031, ♂, Cacagualito, Colombia, Mrs. H. H. Smith, no date.
- No. 2033, ♀, Cacagualito, Colombia, Mrs. H. H. Smith, no date.

COUNTS AND MEASUREMENTS.

	(No. 197.)	(No. 198.)	(No. 2031.)	(No. 2033.)
Anal.	1/1	1/1	1/1	1/1
Scale-rows.	15	15	15	15
Gastrosteges	207	206	187	203
Urosteges	33/33	36/36	44/44	33/33
Upper labials.	7(3.4)	7(3.4)	7(3.4)	6(2.3) 7(3.4)
Preoculars.	1	1	1	1
Postoculars.	2	2	2	2
Temporals.	1, 1	1, 1	1, 1	1, 1
Total length in mm.	623	508	343	597
Length of tail in mm.	56	55	44	64
Annuli	13+5	12+4	12+6	14+5

76. *Elaps corallinus* Wied.

Elaps corallinus WIED, N. Acta Ac. Leop.-Carol., XI, 1820, p. 198, pl. IV.

Elaps corallinus BOULENGER, Cat. Snakes, III, 1896, p. 420.

There are four specimens in the collection, as follows:

- C. M. No. 199, ♂, Cacagualito, Colombia, H. H. Smith coll., Oct. 3, 1901.
- C. M. No. 261, ♀, LeBoutelier Collection, South America.
- C. M. No. 341, ♀, São Antonio de Guaporé, J. D. Haseman coll., August 5, 1909.
- C. M. No. 1236, ♂, no data.

COUNTS AND MEASUREMENTS.

	(No. 199.)	(No. 261.)	(No. 341.)	(No. 1236.)
Anal.	1/1	1/1	1/1	1/1
Scale-rows.	15	15	15	15
Gastrosteges.	191	200	213	195
Urosteges	47/47	43/43	29/29	44/44
Upper labials.	7(3.4)	7(3.4)	7(3.4)	7(3.4)
Preoculars.	1	1	1	1
Postoculars.	2	2	2	2
Temporals.	1, 1	1, 1	1, 1	1, 1
Total length in mm.	373	597	637	605
Length of tail in mm.	55	83	52	82
Annuli	14+7	16+6	24+6	15+6

77. *Elaps frontalis* Duméril & Bibron.

Elaps frontalis DUMÉRIL & BIBRON. *Exp. Gén.*, VII, 1854, p. 1223.

Elaps frontalis BOULENGER, *Cat. Snakes*, III, 1896, p. 427.

This species is represented by a female (No. 356) taken at Sete Lagoas by Mr. J. D. Haseman, May 4, 1908.

COUNTS AND MEASUREMENTS.

	(No. 356.)
Anal.....	1/1
Scale-rows.....	15
Gastrosteges.....	226
Urosteges.....	21/21
Upper labials.....	7(3.4)
Preoculars.....	1
Postoculars.....	2
Temporals.....	1, 1
Total length in mm.....	726
Length of tail in mm.....	38

78. *Elaps hollandi** sp. nov. (Plate XXVIII, figs. 10-12.)

Seven upper labials, third and fourth bordering the orbit, the sixth largest, seventh next in size; rostral just visible from above; internasals about half as long as the prefrontals; first lower labials in contact behind the symphysial; posterior nasal in contact with the preocular. Eye slightly longer than its distance from the mouth; frontal considerably shorter than the parietals, shorter than its distance from the end of the snout, once and a half as long as broad, hexagonal, considerably wider than the supraocular; parietals longer than their distance from the internasals; rostral nearly twice as broad as deep; one pre- and two postoculars; temporals 1, 1, both large and broad; four lower labials in contact with the anterior chinshields, which are shorter than the posterior. Tail short, rather bluntly pointed.

Scales in 15 rows; anal divided; gastrosteges 185-204; urosteges in 17-22 pairs.

Body and tail with black annuli arranged in threes, a few of the scales of the interspaces tipped with black. The central black annulus is little wider than the other two, covering four to five and a half gastrosteges while the narrower annuli cover three to four. On No. 206 the three annuli of the tail are similar to those of the body; on No. 207 there are but two caudal annuli. The upper and lower surfaces of the head are black as far as the fourth series of scales back of the parietals; the black of the upper surface is broken by a narrow yellow band passing

* Named in honor of Dr. W. J. Holland, Director of the Carnegie Museum, whose kind interest has stimulated so many scientific workers.

from lip to lip just behind the eyes. This band covers most of the fifth and sixth upper labials, the upper postocular, the anterior temporal, the back of the supraoculars and frontal, and the anterior third of the parietals. The center of the chin is light.

There are two specimens in the collection, cataloged as follows:
 C. M. No. 206, type, ♂, Bonda, Colombia, H. H. Smith coll., June, 1901.
 C. M. No. 207, paratype, ♀, Bonda, Colombia, H. H. Smith coll., June, 1901.

COUNTS AND MEASUREMENTS.

	(No. 206.)	(No. 207.)
Anal.....	1/1	1/1
Scale-rows.....	15	15
Gastrosteges.....	185	204
Urosteges.....	22/22	17/17
Upper labials.....	7(3.4)	7(3.4)
Preoculars.....	1	1
Postoculars.....	2	2
Temporals.....	1, 1	1, 1
Total length in mm.....	366	318
Length of tail in mm.....	30	17
Sets of annuli.....	7+1	8+1

79. *Elaps mipartitus* Duméril & Bibron.

Elaps mipartitus DUMÉRIL & BIBRON, *Exp. Gén.*, VII, 1854, p. 1220.

Elaps mipartitus BOULENGER, *Cat. Snakes*, III, 1896, p. 431.

C. M. No. 208, ♀, Valparaiso, Colombia, H. H. Smith, April, 1901.

C. M. No. 209, ♀, Las Nubes, Colombia, H. H. Smith, December, 1901.

Our specimens differ from Boulenger's diagnosis is not having the anterior temporal scale noticeably narrowed. In No. 209 the anterior and posterior temporal shields are fused into one. In both specimens the frontal shield lacks a little of being as long as its distance from the tip of the snout.

The head is black to back of the eyes, the black patch including all or nearly all of the fourth upper labial, and half of the supraoculars and frontal. The yellow band extends to the posterior ends of the parietals. The chin is yellow with scattered, irregularly shaped, dark flecks. The following is copied from the field label:

"This snake when alive has the head and tail almost precisely alike—bright red. It coils up with its head underneath its tail and threatens with its tail."

COUNTS AND MEASUREMENTS.

	(No. 208.)	(No. 209.)
Anal.	1/1	1/1
Scale-rows.	15	15
Gastrosteges.	252	249
Urosteges.	27/27	24/24
Upper labials.	7(3.4)	7(3.4)
Preoculars.	1	1
Postoculars.	2	1
		2
Temporals.	1, 1	1
Total length in mm.	361	477
Length of tail in mm.	26	32

80. *Elaps narducci* Jan.

Elaps narducci JAN, Arch. Zoöl. Anat. Phys., II, 1863, p. 222.

Elaps narducci BOULENGER, Cat. Snakes, III, 1896, p. 433.

C. M. No. 8, ♀, Provincia del Sera, Bolivia, 350 M., Steinbach coll., Jan., 1912.

C. M. No. 114, ♂, Santa Cruz de la Sierra, Bolivia, Steinbach coll.

Some variability in the proportions of the head shields of this species may be deduced from the published descriptions. In our specimen No. 8 the width of the frontal is equal to that of the supraocular, and the posterior chin-shields are longer than the anterior. In No. 114 the frontal is much wider than the supraocular, and the anterior chin-shields are the longer.

COUNTS AND MEASUREMENTS.

	(No. 8.)	(No. 114.)
Anal.	1/1	1/1
Scale-rows.	15	15
Gastrosteges.	316	279
Urosteges.	18/18	26/26
Upper labials.	7(3.4)	7(3.4)
Preoculars.	1	1
Postoculars.	2	2
Temporals.	1, 1	2, 1
		1, 1
Total length in mm.	541	467
Length of tail in mm.	21	30

81. *Elaps princeps* Boulenger.

Elaps princeps BOULENGER, Ann. Mag. Nat. Hist. (7), Vol. XV, 1905, p. 456.

C. M. No. 126, ♂, Santa Cruz de la Sierra, Bolivia, Steinbach coll.

This snake was collected at the same place and by the same person as the

original specimens described by Boulenger. Our specimen is considerably larger than any of those, but otherwise is very like them. The Carnegie Museum specimen differs structurally only in that the eye is slightly larger (three-quarters as long as its distance from the mouth); the frontal is once and a quarter as long as broad, and the parietals are a little longer than their distance from the internasals.

COUNTS AND MEASUREMENTS.

(No. 126.)

Anal.....	1/1
Scale-rows.....	15
Gastrosteges.....	221
Urosteges.....	22/22
Upper labials.....	7(3.4)
Preoculars.....	1
Postoculars.....	2
Temporals.....	1, 2
Total length in mm.....	1602
Length of tail in mm.....	65

Family AMBLYCEPHALIDÆ Günther.

Genus *Cochliophagus* Duméril & Bibron.

82. *Cochliophagus catesbyi* (Sentzen).

Coluber catesbyi SENTZEN, Meyer's Zoöl. Archiv, II, 1796, p. 66.

Leptognathus catesbyi BOULENGER, Cat. Snakes, III, 1896, p. 449.

C. M. No. 20, ♂, Las Juntas, Bolivia, Steinbach coll., Dec., 1913.

C. M. No. 21, ♂, Las Juntas, Bolivia, Steinbach coll., Dec., 1913.

C. M. No. 28, ♂, Las Juntas, Bolivia, Steinbach coll., Dec., 1913.

C. M. No. 2034, ♂, Brazil, no data.

COUNTS AND MEASUREMENTS.

	(No. 20.)	(No. 21.)	(No. 28.)	(No. 2034.)
Anal.....	1	1	1	1
Scale-rows.....	13	13	13	13
Gastrosteges.....	176	179	175	193
Urosteges.....	94/94	78/78	87/87	93/93
Upper labials.....	{9(4.5.6) 8(3.4.5)}	8(4.5)	{8(4.5.6) 8(4.5)}	8(4.5)
Preoculars.....	2	2	2	2
Postoculars.....	1	2	2	2
Temporals.....	1, 2	1, 2	1, 2	1, 2
Total length in mm.....	530	208	186	747
Length of tail in mm.....	141	50	45	197*

* Tip of tail lost.

Family VIPERIDÆ Bonaparte.

Subfamily CROTALINÆ Oppel.

Genus *Lachesis* Daudin.83. *Lachesis lanceolatus* (Lacépede).*Coluber lanceolatus* LACÉPEDE, Serp., II, 1789, pp. 80, 121, Pl. V, fig. 1.*Lachesis lanceolatus* BOULENGER, Cat. Snakes, III, 1896, p. 535.

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex	Anal.	Scales Pous.	Gastro-steges.	Uro-steges.	Upper Labials.	Scales between Supra-oculars.	Scales between Subocul-lar and Labials.	Total Length in Mm.	Length Tail in Mm.
No. 43	43	♀	1	23	181	60/60	8	7	1	550	72
" 121	121	♂	1	23	185	66/66	8	6	1	690	101
" 159	159	♂	1	25	214	70/70	7	8	1	395	57
" 244	244	♂	1	27	196	53/53	7	6	1	1,045	116
" 245	245	♂	1	25	190	63/63	7	7	1	805	110
" 246	246	♂	1	23	202	65/65	8	7	1	820	115
" 247	247	♀	1	25	191	60/60	7	8	1	960	137
" 248	248	♂	1	25	187	58/58	7	6	1	840	130
" 249	249	♂	1	27	180	51/51	7	6	1	885	108
" 250	250	♂	1	25	188	...	7	7	1	840	...*
" 252	252	♂	1	23	208	54/54	8	7	1	832	91
" 253	253	♂	1	25	181	61/61	7	10	2	923	130
" 254	254	♂	1	25	184	62/62	7	7	1	705	105
" 255	255	♂	1	25	185	59/59	7	7	1	975	143
" 257	257	♂	1	25	184	63/63	7	6	1	857	123
" 258	258	♂	1	27	...	...	...	...	...	880	118
" 313	313	♂	1	25	182	62/62	8	7	1	535	74
" 372	372	♂	1	27	190	62/62	7	6	1	595	80
" 373	373	♂	1	23	184	56/56	...	...	...	369	47
" 2019	2019	♂	1	25	218	69/69	7	6	1	565	76

* Tip of tail lost.

The twenty specimens of this species in the collection are cataloged as follows:

C. M. No. 43, ♀, Provincia del Sara, Bolivia, 350 M., Steinbach coll., December, 1912.

C. M. No. 121, ♂, Santa Cruz de la Sierra, Bolivia, Steinbach coll.

C. M. No. 159, ♂, Bonda, Colombia, 150 ft., H. H. Smith coll., August.

C. M. No. 244, ♂, South America, LeBoutelier Collection.

C. M. No. 245, ♂, South America, LeBoutelier Collection.

C. M. No. 246, ♂, South America, LeBoutelier Collection.

C. M. No. 247, ♀, Chili, LeBoutelier Collection.

C. M. No. 248, ♂, Colombia, LeBoutelier Collection.

C. M. No. 249, ♂, Brazil, LeBoutelier Collection.

C. M. No. 250, ♂, Venezuela, LeBoutelier Collection.

- C. M. No. 252, ♀, Peru, LeBoutelier Collection.
 C. M. No. 253, ♂, Paraguay, LeBoutelier Collection.
 C. M. No. 254, ♂, Paraguay, LeBoutelier Collection.
 C. M. No. 255, ♂, Paraguay, LeBoutelier Collection.
 C. M. No. 257, ♂, Montevideo, Uruguay, LeBoutelier Collection.
 C. M. No. 258, ♂, Argentina (?), LeBoutelier Collection.
 C. M. No. 313, ♀, Santa Cruz de la Sierra, Bolivia, Steinbach coll.
 C. M. No. 372, ♂, Tarma, Peru, Miss Lola Vance coll.
 C. M. No. 373, Tarma, Peru, Miss Lola Vance coll.
 C. M. No. 2019, ♂, Cacagualito, Colombia, 1500 ft., Mrs. H. H. Smith coll.

84. *Lachesis lansbergi* (Schlegel).

Trigonocephalus lansbergii SCHLEGEL, Mag. de Zoöl., 1841, Rept. pl. I.

Lachesis lansbergii BOULENGER, Cat. Snakes, III, 1896, p. 546.

There are eighteen specimens of this species in the collection all of which came from the Province of Santa Marta in Colombia, although the last four mentioned in the following list have no data accompanying them. These belong to the lot, the numbers of which run from C. M. No. 1841 to 1873, mentioned in the introductory notes.

- C. M. No. 151, ♂, Bonda, Colombia, H. H. Smith coll., July.
 C. M. No. 152, ♀, Bonda, Colombia, H. H. Smith coll., May.
 C. M. No. 153, ♂, Bonda, Colombia, H. H. Smith coll., May.
 C. M. No. 154, ♀, Bonda, Colombia, H. H. Smith coll., August 31.
 C. M. No. 155, ♂, Bonda, Colombia, H. H. Smith coll., August 29.
 C. M. No. 156, ♀, Bonda, Colombia, H. H. Smith coll., June.
 C. M. No. 157, ♀, Bonda, Colombia, H. H. Smith coll., May.
 C. M. No. 158, ♀, Bonda, Colombia, H. H. Smith coll., June.
 C. M. No. 160, ♀, Bonda, Colombia, H. H. Smith coll., May.
 C. M. No. 185, ♂, Bonda, Colombia, H. H. Smith coll., August.
 C. M. No. 1093, ♀, Bonda, Colombia, H. H. Smith coll., August.
 C. M. No. 1851, ♂, South America (Colombia) (Mr. & Mrs. H. H. Smith coll.).
 C. M. No. 1852, ♀, South America (Colombia) (Mr. & Mrs. H. H. Smith coll.).
 C. M. No. 1853, ♀, South America (Colombia) (Mr. & Mrs. H. H. Smith coll.).
 C. M. No. 1855, ♂, South America (Colombia) (Mr. & Mrs. H. H. Smith coll.).
 C. M. No. 2016, ♀, Cacagualito, Mrs. H. H. Smith coll., no date.
 C. M. No. 2017, ♂, Cacagualito, Mrs. H. H. Smith coll., no date.
 C. M. No. 2018, ♀, Cacagualito, Mrs. H. H. Smith coll., no date.

Our Colombian series of *L. lansbergi* compels a modification of the formula of the species to include a wider variability, as follows:

Scales in 23-27 rows; anal single; gastrosteges 147-159; urosteges 28-36, as shown by the accompanying table.

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex.	Anal.	Scale-rows.	Gastrosteges.	Uro-steges.	Upper Labials.	Scales between Supra-oculars.	Scales between Suboculars and Labials.	Total Length in Mm.	Length Tail in Mm.
No. 151	...	♂	1	25	158	34	9	6	1	376	45
" 152	...	♂	1	25	152	32	9	5	1	412	49
" 153	...	♂	1	25	155	35	9	5	1	317	38
" 154	...	♂	1	25	153	35	9	5	1	440	56
" 155	...	♂	1	23	147	33	9	4	1	374	44
" 156	...	♂	1	25	147	28	10	3	1	288	27
" 157	...	♂	1	25	159	31	9	6	1	301	32
" 158	...	♂	1	23	153	33	9	6	1	399	47
" 160	...	♂	1	23	153	29	9	4	1	254	24
" 185	...	♂	1	25	154	31	9	5	1	452	53
" 1093	...	♂	1	25	152	31	9	5	1	570	62
" 1851	...	♂	1	25	158	28	9	6	1	...	...
" 1852	...	♂	1	25	158	28	9	5	1	290	26
" 1853	...	♂	1	25	151	29	9	5	1	409	41
" 1855	...	♂	1	25	151	31	9	5	1	196	19
" 2016	...	♂	1	23	154	34	9	4	1	436	55
" 2017	...	♂	1	23-24	154	36	9	5	1	225	23
" 2018	...	♀	1	25	151	32	9	5	1	420	50

* Mutilated.

85. *Lachesis mutus* (Linnæus).

Crotalus mutus LINNÆUS, Syst. Nat., Ed. XII, 1766, I, p. 373.

Lachesis mutus BOULENGER, Cat. Snakes, III, 1896, p. 533.

We have but one specimen representing this species in the collection (C. M. No. 125). It consists only of the head and tail of a very large individual, collected by José Steinbach at Santa Cruz de la Sierra, Bolivia.

86. *Lachesis newiedi* (Wagler).

Bothrops newiedi WAGLER, in Spix, Serp. Bras., 1824, p. 56, Pl. XXII, fig. 1.

Lachesis newiedi BOULENGER, Cat. Snakes, III, 1896, p. 542.

The specimens in the collection are listed as follows:

No. 1, ♂, Province del Sara, Bolivia, J. Steinbach coll., Sept., 1911.

No. 4, ♀, Province del Sara, Bolivia, J. Steinbach coll., Jan., 1912.

No. 34, ♂, Province del Sara, Bolivia, J. Steinbach coll., Sept., 1913.

No. 35, ♂, Province del Sara, Bolivia, J. Steinbach coll., Sept., 1913.

- No. 38, ♂, Province del Sara, Bolivia, J. Steinbach coll., Sept., 1913.
 No. 40, ♀, Province del Sara, Bolivia, J. Steinbach coll., Sept., 1913.
 No. 46, ♀, Province del Sara, Bolivia, J. Steinbach coll., Dec., 1912.
 No. 49, ♂, Province del Sara, Bolivia, J. Steinbach coll., Dec., 1912.
 No. 50, ♂, Province del Sara, Bolivia, J. Steinbach coll., Jan., 1913.
 No. 54, ♀, Province del Sara, Bolivia, J. Steinbach coll., Jan., 1913.
 No. 55, ♀, Province del Sara, Bolivia, J. Steinbach coll., Oct., 1911.
 No. 58, ♀, Province del Sara, Bolivia, J. Steinbach coll., Oct., 1911.

COUNTS AND MEASUREMENTS.

No.	Num-ber.	Sex.	Anal.	Scale-rows.	Gastro-steges.	Uro-steges.	Upper Labials.	Scales between Supra-oculars.	Scales between Subocul-ars and Labials.	Total Length in Mm.	Length Tail in Mm.
	No. 1	♂	1	23	169	48/48	8	6	{ 2 1	442	61
	" 4	♀	1	25	170	45/45	9	8	2	827	93
	" 34	♂	1	24	172	49/49	8	7	1	288	40
	" 35	♂	1	25	171	41/41	8	6	1	467	55
	" 38	♂	1	25	178	45/45	8	6	2	775	83
	" 40	♀	1	24	180	46/46	{ 8 9	7	1	438	52
	" 46	♀	1	25	166	41/41	{ 7 8	5	2	138	48
	" 49	♂	1	25	177	53/53	8	8	2	410	53
	" 50	♂	1	25	175	50/50	8	8	{ 1 2	558	84
	" 54	♀	1	23	174	51/51	8	8	2	548	70
	" 55	♀	1	25	179	49/49	8	7	2	264	34
	" 58	♀	1	27	183	42/42	8	5	2	502	53
	" 60	♂	1	25	180	53/53	8	6	1	580	83
	" 61	♂	1	25	181	45/45	8	8	2	630	82
	" 67	♀	1	23	170	49/49	8	6	1	365	50
	" 68	♂	1	23	171	50/50	8	8	2	334	45
	" 69	♂	1	25	179	46/46	8	7	2	277	33
	" 119	♂	1	25	184	49/49	8	8	2	455	57
	" 120	♀	1	25	176	45/45	10	7	2	334	29
	" 122	♀	1	23	167	51/51	8	7	1	897	109
	" 123	♀	1	23	175	45/45	{ 7 8	7	{ 1 2	314	40
	" 317	♂	1	23	174	52/52	8	7	2	380	52
	" 318	♂	1	23	184	47/47	8	5	2	425	49
	" 364	♀	1	25	171	43/43	8	9	{ 1 2	815	80

- No. 60, ♂, Province del Sara, Bolivia, J. Steinbach coll., Oct., 1911.
 No. 61, ♂, Province del Sara, Bolivia, J. Steinbach coll., Oct., 1911.
 No. 67, ♀, Province del Sara, Bolivia, J. Steinbach coll., Oct., 1911.
 No. 68, ♂, Province del Sara, Bolivia, J. Steinbach coll., Oct., 1911.
 No. 69, ♂, Province del Sara, Bolivia, J. Steinbach coll., Oct., 1911.
 No. 119, ♂, Province del Sara, Bolivia, J. Steinbach coll., no date.
 No. 120, ♀, Province del Sara, Bolivia, J. Steinbach coll., no date.

- No. 122, ♀, Province del Sara, Bolivia, J. Steinbach coll., no date.
 No. 123, ♀, Province del Sara, Bolivia, J. Steinbach coll., no date.
 No. 317, ♂, Asumpcion, Bolivia, J. D. Haseman coll., June 14, 1909.
 No. 318, ♂, Campos de Matto Grosso, Braz., Haseman coll., June 20, 1909.
 No. 364, ♀, São João del Rey, Minas Geraes, Brazil, Haseman, no date.

87. *Lachesis peruvianus* Boulenger.

Lachesis peruvianus BOULENGER, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 334.

The Museum has only one example of this species, a female (C. M. No. 373), which was collected by Miss Lola Vance at Tarma, Peru (elev. 6,000 ft.).

COUNTS AND MEASUREMENTS.

	(No. 373.)
Anal.....	1
Scale-rows.....	23
Gastrosteges.....	184
Urosteges.....	5 + 51/51
Upper labials.....	7
Total length in mm.....	369
Length of tail in mm.....	47

Genus *Crotalus* Linnaeus.

88. *Crotalus terrificus* (Laurenti).

Caudisona terrifica Laurenti, Syn. Rept., 1758, p. 93.

Crotalus terrificus Boulenger, Cat. Snakes, III, 1896, p. 573.

There are thirteen specimens of this species in the collection, as follows:

- C. M. No. 30, ♀, Provincia del Sara, Bolivia, José Steinbach, February, 1913.
 C. M. No. 63, ♀, Provincia del Sara, Bolivia, José Steinbach, October, 1911.
 C. M. No. 118, ♀, Santa Cruz de la Sierra, Bolivia, Steinbach, no date.
 C. M. No. 124, Santa Cruz de la Sierra, Bolivia, Steinbach, head only, mutilated.
 C. M. No. 161, ♀, Bonda, Colombia, H. H. Smith, May.
 C. M. No. 162, ♀, Bonda, Colombia, H. H. Smith, May.
 C. M. No. 259, ♂, Argentina, LeBoutelier Collection.
 C. M. No. 276, ♀ juv., South America, LeBoutelier Collection.
 C. M. No. 1854, ♂, South America, H. H. Smith Coll. (?).
 C. M. No. 2012, ♂, Cacagualito, Colombia, Mrs. H. H. Smith.
 C. M. No. 2013, ♀, Cacagualito, Colombia, Mrs. H. H. Smith.
 C. M. No. 2014, ♀, Cacagualito, Colombia, Mrs. H. H. Smith.
 C. M. No. 2015, ♀, Cacagualito, Colombia, Mrs. H. H. Smith.

COUNTS AND MEASUREMENTS.

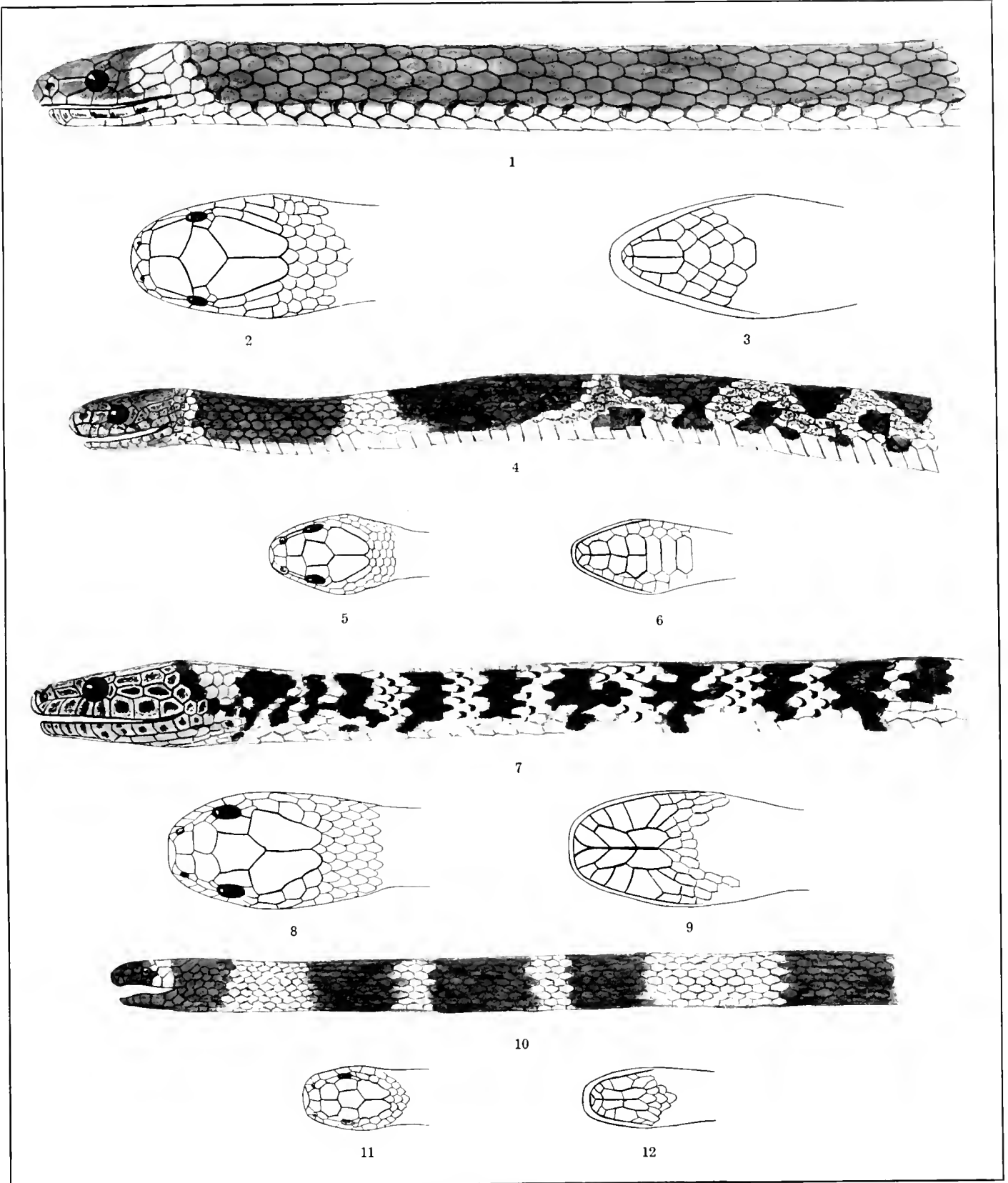
Number.	Anal.	Scale-rows.	Gastrosteges.	Urosteges.	Upper Labials.	Scale-rows Between Supraoculars.	Scale-rows Between Eye and Supralabials.	Total Length in Mm.	Length of Tail in Mm.	Remarks.
30	1	27	161	27+2/2	13	2	3	620	52	Four rattles.
63	1	29	176	19+2/2	11	3	3	598	46	Three rattles.
118	1	29	175	21+1/1	14	5	4	376	30	One rattle.
124					13	3	4			Head only.
161	1	29		25+3/3	14	3	3	1180+	178	Ten rattles.
162	1	27		23+1/1	13	3	3	1100	100	Skin.
259	1	27	173	20+1/1	14	3	3	1149	115	Nine rattles.
276	1	27	176	22+2/2	16	2	3	295	23	Young.
1854	1	29	170	29+1/1	17	3	3	364	36	Young.
2012	1	25	161	30	13	3	3	390	41	One rattle.
2013	1	29	174	27+1/1	14	3	3	420	37	One rattle.
2014	1	25	168	30+1/1	15	3	3	410	43	One rattle.
2015	1	29	179	30+1/1	14	3	3	390	40	One rattle.

In addition to the specimens cataloged above there are contained in the Carnegie Museum three specimens which were received in the LeBoutelier Collection, which are very probably wrongly attributed to the localities given on the original labels. One is a specimen of *Natrix fasciata fasciata* (Linnaeus), C. M. No. 262, labeled as having been obtained in the "sierras of Bolivia." This species has been found as far south as Costa Rica, but has never been reported hitherto from any point south of that country, and in view of the careless labeling of the LeBoutelier Collection I hesitate to record the species as having been actually obtained at the locality indicated.

There are also two specimens of *Agkistrodon piscivorus* (Lacépède), C. M. Nos. 251 and 260, the first labeled "Peru," the second labeled "Brazil." The occurrence of this ophidian in the localities cited is more than doubtful.

EXPLANATION OF PLATE XXVIII.

- Fig. 1. *Atractus taniatus* Griffin. Type, C. M. No. 117. × 4.
FIG. 2. Do. Dorsal View of Head. × 4.
FIG. 3. Do. Ventral View of Head. × 4.
FIG. 4. *Tropidodipsas spilogaster* Griffin. Type, C. M. No. 5085. × 2.
FIG. 5. Do. Dorsal View of Head. × 2.
FIG. 6. Do. Ventral View of Head. × 2.
FIG. 7. *Clelia cuprepa* Griffin. Type, C. M. No. 109. × 2.
FIG. 8. Do. Dorsal View of Head. × 2.
FIG. 9. Do. Ventral View of Head. × 2.
FIG. 10. *Elaps hollandi* Griffin. Type, C. M. No. 206. × 2.
FIG. 11. Do. Dorsal View of Head. × 2.
FIG. 12. Do. Ventral View of Head. × 2.



SOUTH AMERICAN OPHIDIA.

21. Minute Book of the Virginia Court Held at Fort Dunmore (Pittsburgh) for the District of West Augusta, 1776-1776. CRUMRINE90
22. Minute Book of the Virginia Court Held for Yohogania County, first at Augusta Town (now Washington, Pa.), and afterward on the Andrew Heath Farm near West Elizabeth, 1776-1780. CRUMRINE	2.25
23. Minute or Order Book of the Virginia Court Held for Ohio County, Virginia, at Black's Cabin (Now West Liberty, W. Va.), &c. CRUMRINE	1.50
24. The Records of Deeds for the District of West Augusta, Virginia, for the Court Held at Fort Dunmore, &c. CRUMRINE	1.75
25. <i>Astropecten</i> (?) <i>montanus</i> , &c. DOUGLASS10
26. <i>Astrodon</i> (<i>Pleurocelus</i>) in the <i>Atlantosaurus</i> Beds of Wyoming. HATCHER. (<i>Out of Print.</i>)	
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41. Presentation of Reproduction of <i>Diplodocus Carnegiei</i> to the British Museum. HOLLAND15
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94. Ordovician Trilobites, No. III. RAYMOND & NARRAWAY35

95. Ordovician Trilobites, No. IV. RAYMOND40	133. Osteology of Lasiopyga and Callithrix, etc. SHUFELDT25
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120. Two Mummy Labels. ALLEN10	157. A New Species of Apatosaurus. HOLLAND7
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122. Group of Stenomylins in the Carnegie Museum. PETERSON25	159. Reptiles and Amphibians of the Isle of Pines. BARBOUR20
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NO. 4.

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PIMELODELLA AND TYPHLOBAGRUS

By CARL H. EIGENMANN.

PITTSBURGH.

PUBLISHED BY THE AUTHORITY OF THE BOARD OF TRUSTEES OF THE
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PIMELODELLA AND TYPHLOBAGRUS.¹

BY CARL H. EIGENMANN.

(PLATES XXIX-XXXV.)

Pimelodella and *Typhlobagrus* are two closely related genera of Siluridæ of the fresh waters of South America. *Pimelodella* is a widely distributed genus with many species. *Typhlobagrus* is an offshoot from *Pimelodella*. Eyes have disappeared in this genus and it is confined, so far as known, to the caves near Iporanga in southeastern Brazil.

Pimelodella Eigenmann & Eigenmann.

Pseudorhamdia STEINDACHNER (*non* Bleeker), Sb. Akad. Wiss. Wien, LXXIV, 1876, Süßwasserf. Südöstl. Bras., III, p. 46 (*lateristriga*).

Pimelodella EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci., (2), I, 1888, p. 131; Occasional Papers Cal. Acad. Sci., I, 1890, pp. 99 and 147.

Type, *Pimelodus cristatus* Müller & Troschel.

Nares remote; teeth villiform, in bands; gill-membranes free from the isthmus; dorsal short, with a feeble, pungent spine; anal short, with 11-15 rays; pectoral with a strong pungent spine variously armed with thorn-like teeth on its posterior (inner) edge; a long, adnate, adipose fin; caudal fin deeply forked, one or the other lobe frequently wider, or longer; well-developed maxillary barbels reaching to end of pectoral, or beyond the caudal; two pairs of mental barbels, sometimes in a nearly straight line; a frontal and a parietal fontanel, the latter reaching to the

¹ Contribution from the Zoölogical Laboratory of Indiana University, No. 154.

base of the occipital process, which is narrow and reaches, or nearly reaches, the plate in front of the dorsal; humeral process spine-like; roof of mouth without teeth; head covered with thin skin.

Distribution.—All rivers from Buenos Aires to Guiana and Venezuela and to the base of the Andes (1,800 feet in places); west of the Andes from northern Peru to the Chagres river in Panama.

DISTRIBUTION OF PIMELODELLA AND TYPHLOBAGRUS.

	Rio S. Francisco.	Rio Itapicuri.	Rio Paro to Rio de Janeiro.	Rio de Janeiro to Paranaqua.	Drainage Basin Lago de Patos.	Uruguay Basin.	La Plata Basin.	Upper Parana Basin.	Paraguay Basin.	Rio Guaporé to Rio Madeira.	Amazon Basin of Brazil.	Marañon Basin (Peruvian Part of Amazon Basin).	Paranahyba Basin.	Guiana.	Orinoco Basin.	Magdalena Basin.	Chagres Basin, Eastern Panama.	Pacific Side of Panama.	Rio San Juan.	Rio Dagua.	Rio Patia and Northwestern Ecuador.	Basin of Guayaquil Bay.	Northwestern Peru.
<i>P. serrata</i>										+													
<i> cristata</i>		+								+	+	+		+									
<i> steindachneri</i>																							
<i> gracilis</i>							+		+	+	+				+								
<i> avanhandave</i>								+															
<i> rocca</i>												+											
<i> pirucnsis</i>												+											
<i> buckleyi</i>												+											
<i> pectinifera</i>			+																				
<i> hasemani</i>										+	+												
<i> cyanostigma</i>												+											
<i> megalops</i>																+							
<i> brasiliensis</i>			+																				
<i> laticeps</i>									+														
<i> australis</i>					+	+																	
<i> notomelas</i>									+														
<i> meta</i>																+							
<i> boliviana</i>										+													
<i> lateristriga</i>	+		+																				
<i> vittata</i>	+		+																				
<i> itapicurucnsis</i>		+																					
<i> macturki</i>															+								
<i> eigenmanni</i>			+																				
<i> hartti</i>			+																				
<i> transitoria</i>				+				+															
<i> meeki</i>									+														
<i> griffini</i>										+													
<i> mucosa</i>									+	+													
<i> grisea</i>																			+	+	+		
<i> modesta</i>																					+		
<i> yuncensis</i>																							+
<i> chugresi</i>															?	+	+	+					
<i> elongata</i>																					+	+	
<i> cutania</i>																			+	+	+		
<i>T. kronci</i>				+																			
	2	1	7	2	1	1	1	3	5	6	4	5	1	3	3	1	1	1	2	2	4	1	1

The species of this well-marked genus differ from each other in the length of the adipose fin, the length of the barbels, the length of the pectoral spine, the

armature of the pectoral spine, the shape of the caudal lobes, and a number of other minor characters.

The length of the barbels in the same species differs with age. In the young the barbels are relatively short. They grow disproportionately longer with the growth of the fish and then lag behind again in their increase in length. The length of the barbels of the same species not only differs with age, but sometimes also with locality. The pectoral spines also vary somewhat with growth. With age the thorns increase in number by the addition of new ones toward the tip and come to occupy a larger portion of the length of the spine. The spine increases in length by the addition of new sections at the end which are marked off by notches or hooks on the outer margin of the spine. As the color and the size of the eye also vary with age and with locality, and, as all of these characters vary independently, the defining of species of *Pimelodella* becomes a delicate and difficult task. The following definitions, especially as far as they concern species of the Amazon Basin, are therefore more or less tentative.

Most of the species are small. The largest species of the Atlantic slope is *P. cristata* with a recorded length of 340 mm. The largest species from the Pacific slope is *P. cutania* of which I have examined specimens 188 mm. long.

The following notes may help to identify the species. Species in which the barbel extends to caudal arc: *gracilis*, *notomelas*, *serrata*, *mucosa*, *boliviana*.

Species in which the pectoral spine is smooth or very feebly serrate are: *rocae*, *filamentosa*, *eigenmanni*, *mecki*, *vittata*, *buckleyi*, *boliviana*, *cutania*, *notomelas*, *metæ*, *itapicurucensis*, *hartti*.

Species in which the pectoral thorns are moderate are: *cristata*, *gracilis*, *avanhandavae*, *purucensis*, *laticeps*, *australis*, *vittata*, *mucosa*.

Species in which the pectoral thorns are very strong are: *lateristriga*, *serrata*, *hasemani*, *mucosa*, *chagresi*, *macturki*, *megalops*, *modesta*, *grisea*, *pectinifera*, *cyano-stigma*, *transitoria*.

KEY TO THE CIS-ANDEAN SPECIES OF PIMELODELLA.²

- a. Head without conspicuous mucous pores.
 - b. Adipose fin usually less than three in the length, extending beyond the tip of the anal fin.
 - c. Pectoral spine with strong teeth both in front and behind; maxillary barbel extending beyond base of anal or caudal. 1. *serrata* Eigenmann.
 - cc. Pectoral spine with moderate thorns on the posterior margin, but slightly serrate or roughened along the anterior margin.
 - d. Lower caudal lobe much broader than the upper, upper lobe not produced, the lower frequently the longer; lateral band if present narrow, linear; 13-14 teeth

² The species found east of the eastern Andes of Colombia and the Atlantic slope of Ecuador and southward. See in this connection *P. chagresi*, p. 253.

- on the posterior face of the pectoral in specimens 83 mm. long, about 20-30 much more feeble ones in large specimens, the more distal thorns sometimes with a broad base and a long free outer edge; maxillary barbels reaching origin, or beyond tip of adipose. 2. *cristata* (Müller & Troschel).
- dd.* Caudal lobes subequal, always longer than the head; 18-29 thorns on the posterior face of the pectoral spine; maxillary barbels reaching tip of adipose or beyond tips of middle caudal rays; adipose fin 2.33 in the length; pectoral spine about equal to the dorsal spine, sometimes shorter; dorsal spine 1-1.25 in the head. 3. *steindachneri* Eigenmann.
- ddd.* Upper caudal lobe normally greatly prolonged, but subequal in the young, not much narrower than the lower lobe; maxillary barbel always extending at least beyond base of anal; lateral band, if present, broad; pectoral spine a little longer or a little shorter than the dorsal spine with a variable number of strong teeth on over half its posterior margin. 4. *gracilis* (Cuvier & Valenciennes).
- dddd.* Upper caudal lobe not produced; maxillary barbels reaching to tip of ventrals or to middle of anal; about 11 teeth on the pectoral spine; adipose fin 2.75-3.25 in the length. 5. *avanhandavae* Eigenmann.
- ddddd.* Upper caudal lobe not greatly produced; maxillary barbel reaching beyond tip of ventrals; numerous minute teeth on the pectoral spine; lateral band ill-defined. 6. *rocca* Eigenmann.
- ddddd.* Upper caudal lobe not prolonged beyond the lower; maxillary barbels reaching origin of ventrals; pectoral spine smooth in front, with about nine thorns on the inner margin, the largest a little more than half the greatest width of the spine. No lateral band. 7. *puruensis* Fowler.
- ccc.* Pectoral spine smooth or but slightly roughened behind; upper caudal lobe prolonged; maxillary barbels reaching anal; lateral band narrow, well defined; dorsal spine equals pectoral spine. 8. *buckleyi* (Boulenger).
- bb.* Adipose fin 3 or more than 3 in the length. (See also number 3).
- c.* Dorsal spine not produced into a filament.
- f.* Pectoral spine with thorns along all but the very tip of the posterior margin; interorbital three-fourths as wide as eye.
- g.* Maxillary barbel extending to the origin of the adipose fin, nearly to tip of ventral; pectoral spine equals length of head; eye 4 in the head, interorbital 5. 9. *pectinifera* Eigenmann & Eigenmann.
- gg.* Maxillary barbel extending beyond base of anal; pectoral spine much shorter than head; eye 3.33 in the head, interorbital 5.5; inner pectoral thorns large; a narrow dark band. 10. *hasemani* Eigenmann.
- ggg.* Maxillary barbel extending to end of the adipose; pectoral spine minutely serrate within and without. 11. *cyanostigma* Cope.
- ff.* Pectoral spine with 18 or fewer teeth, except in the very old.
- h.* Eye large, 2.5 in the head; interorbital much smaller than the eye, 5.5 in the head; lower caudal lobe much the longer; pectoral spine but little shorter than the head; maxillary barbel reaching origin or end of base of anal. 12. *megalops* Eigenmann.
- hh.* Eye smaller, more than 3 in the head.
- i.* D. I.7; pectoral spine reaching ventrals, which reach to the anal. 13. *brasiliensis* Steindachner.

- ii. D. I.6 or I.7; interorbital 3-3.5 in the head; adipose 4-4.3 in the length; barbels reaching tip of the depressed dorsal or middle of anal; pectoral spine equals head without opercle, its posterior face smooth on the distal four-tenths, 10 or 11 small thorns on the proximal six-tenths.
- j. Maxillary barbel reaching tip of depressed dorsal.
14. *laticeps* Eigenmann.
- jj. Maxillary barbel extending to end of ventral or middle of anal.
15. *australis* Eigenmann.
- iii. D. I.6; interorbital smaller than the eye, except in one specimen of *itapicuruensis*.
- k. Dorsal with a black wedge entering the fin from the middle in front, or with a hyaline base followed by black and shading to the tip of the fin.
- l. Maxillary barbel reaching middle of caudal; pectoral spine a little longer than snout and eye, with very few feeble teeth on its posterior face; adipose 3 in the length; interorbital 3.5-4 in the head.
16. *notomelas* Eigenmann.
- ll. Maxillary barbel reaching anal; pectoral spine equals snout and eye, the dorsal spine equals snout and half the eye; adipose 3-3.25 in the length; interorbital 4-5 in the head. . . 17. *metæ* Eigenmann.
- lll. Dorsal with a black blotch on its middle anterior portion; maxillary barbel extending to middle of ventrals or to near anal; adipose 3.6-4 in the length; eye 4.5-5 in the head, interorbital about equal to the eye; upper caudal lobe the longer. See No. 26, *meeki* Eigenmann.
- kk. Dorsal without a black blotch, its tip usually dark.
- m. Maxillary barbel extending to near base or beyond tip of caudal; interorbital 3.5-4.7 in the head.
- n. Pectoral spine equals head less opercle, with 12-21 strong teeth on the posterior face; adipose 3.66 in the length; interorbital 3.75 in the length of the head; length of adipose equals its distance from the dorsal spine or very little more; anal extends to or beyond tip of adipose. See No. 28, *mucosa* Eigenmann.
- mm. Pectoral spine a little longer than snout and eye, with 7 scarcely perceptible teeth on its posterior face. Adipose 3 in the length; interorbital 4.3-5 in the head; dorsal dark; a basal light bar through it. 18. *boliviana* Eigenmann.
- mm. Maxillary barbel extending to or beyond the origin of the anal.
- o. Maxillary barbel extending beyond tip of anal; pectoral spine equals head without opercle; width of head equals snout and eye. Eye 3.25 in the head; snout a little longer than postorbital portion of head; interorbital 5.5 in the length of the head; distance between snout and dorsal fulcrum 3.2 in the length; width of occipital process 3 in its length; pectoral spine with 14 very strong graduate

teeth on the basal two-thirds of its posterior margin, about 5 hooks in front. (Based on specimen from Penedo 72 mm. long to base of caudal.)

19. *lateristriaga* (Müller & Troschel).

oo. Maxillary barbel extending to the adipose or middle of anal; pectoral spine terete, curved, 1-1.25 in the head; width of head 1.33 in its length; eye 4 in head, 1.5 in the snout, about equal to the interorbital; pectoral thorns much smaller than in *P. lateristriaga*. 20. *vittata* (Kröyer).

ooo. Maxillary barbel extending to origin of anal; pectoral spine equals snout and eye; width of head equals snout and three-fourths of the eye; eye 3.25 in the head; snout a little longer than postorbital portion of the head; interorbital 5 in the length of the head; distance between snout and dorsal fulcrum 3.4 in the length; dorsal spine nearer snout than anal; width of occipital process 3.5 in its length; pectoral spine with very feeble teeth on the basal half of its posterior margin, 12 hooks in front. (Based on specimen from Queimadas 72 mm. long to base of caudal.) 21. *itapicuruensis* Eigenmann.

oooo. Maxillary barbel reaching origin or end of base of anal; pectoral spine equals snout and eye or a little longer; eye 3.33-4, in middle of the head; interorbital 4.5; distance between snout and dorsal fulcrum about 3 in the length; pectoral spine with twelve long recurved thorns along the middle of its posterior margin.

22. *macturki* Eigenmann.

ooooo. Maxillary barbel extending beyond origin of anal; pectoral spine equals snout and eye, with about 7 very strong hooks. See No. 32, *chagresi* (Steindachner).

oooooo. Maxillary barbel extending beyond origin of anal; pectoral spine equals head less one-half of opercle; width of head 1.4 in its length; eye 3.5-4 in the head; interorbital 4.4-5.33 in the head; center of eye in center of head; dorsal spine equidistant from snout and anal; width of occipital process 3 in its length; pectoral spine with feeble teeth not more than one-fifth or one-sixth the width of the spine. Caudal not split between the middle rays. (Based on the types 130-180 mm. long, from Rio Parahyba.)

23. *eigenmanni* Boulenger.

mmm. Maxillary barbel not extending to the anal.

p. Maxillary barbel extending slightly beyond origin of ventrals; pectoral spine equals length of head less opercle; width of head a little greater than snout and eye; eye 4 in the head; snout equals postorbital part of head; interorbital 4.5 in the head; distance between snout and the process not

quite reaching the dorsal plate; pectoral spine with about 9 feeble spines on its posterior margin, about 9 hooks in front, the upper ones sharp, the lower obscure. (Based on specimen from Rio Doce 72 mm. long to base of caudal.)

24. *hartti* (Steindachner).

pp. Maxillary barbels extending to end of ventrals;³ pectoral spine equals length of head without opercles; width of head equals snout and eye; eye 4 in the head; snout longer than postorbital portion of head; interorbital 5 in the length of the head; distance between snout and dorsal fulcrum 3 in the length; width of occipital process 3 in its length; pectoral spine with 12 very strong graduate teeth on over half of its posterior margin, about 5 hooks in front; adipose 3.4 in the length. (Based on a specimen from Xiririca 91 mm. long to base of caudal.) 25. *transitoria* Ribeiro.

ppp. Maxillary barbel extends to middle of ventrals (on one side of the paratype to near anal); pectoral spine equals snout and eye or shorter; width of head equals length of head without opercles; eye 4.5-5 in the head; snout longer than postorbital portion of head; interorbital 5 in the head; distance between snout and dorsal fulcrum 2.8 in the length; width of occipital process 3 in its length; pectoral spine with 12 very feeble teeth on the basal half of the posterior face; 9-11 recurved hooks near the tip in front; adipose 3.6-4 in the length (largely based on a specimen from Sapina 89 mm. long, and on the types). 26. *mecki* Eigenmann.

ee. Dorsal spine frequently prolonged into a filament extending considerably beyond the rest of the fin; interorbital 5 in the head; maxillary barbel reaching tip of ventrals or shorter; pectoral spine with 9-11 teeth on the basal two-thirds of the posterior face; adipose 3.5-4.5 in the length. 27. *griffini* Eigenmann.

aa. Lower cheeks and mandible with conspicuous cavities; lower caudal lobe the longer; maxillary barbel reaching to near origin or middle of caudal; pectoral spine with straight, feeble teeth on its posterior surface; eye 3.5-4.5 in the head; adipose extending a very little beyond tip of anal.

28. *mucosa* Eigenmann & Ward.

1. *Pimelodella serrata* sp. nov. (Plate XXIX, fig. 1).

6967a C. M., type, 67 mm. 6966a C. M., paratype, 110 mm., San Joaquin, Bolivia, Sept. 5, 6, 1909. Haseman.

Distinguished by its numerous pectoral thorns and the length of the barbels.

Head 3.9-4.33; depth about 7. D. 1.6; A. 1.3; eye 4-4.2 in head, equal to or slightly greater than interorbital; snout a little greater than postorbital; maxillary barbels extending to the end of the base of the anal or beyond the base of the caudal; postmental barbels to the tip of the pectoral. Adipose about 2.5 in the length.

³ To end of base of anal in No. 6979.

Dorsal spine straight, slender, equal to length of head less opercle, 17 minute teeth on the upper two-thirds of the posterior surface, the anterior margin smooth; pectoral spine heavy, little longer than dorsal spine; 18-21 strong retrorse teeth along nearly the entire posterior margin, longest near the middle of the spine; 25-50 shorter, mostly antrorse teeth along all but a short space near the tip along the anterior face. Caudal lobes nearly equal, about 3.5 in the length.

Occipital process of nearly the same width throughout, firmly united with the dorsal plate. No color-markings.

2. *Pimelodella cristata* (Müller & Troschel) (Plate XXIX, fig. 2).

Pimelodus cristatus MÜLLER & TROSCHER, in Schomb. Reisen in Brit. Guiana, III, 1848, p. 628 (Takutu and Mahu Rivers); Horæ Ichth., III, 1849, p. 4 (Essequibo); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, 117 (Guiana; Essequibo; River Capin; Para); VAILLANT, Bull. Soc. Philom. (7), 1880, p. 152 (Calderon); STEINDACHNER, Flussfische Süd-am., IV, 1882, p. 4 (Rio Huallaga); ? PERUGIA, Ann. Mus. Genova (2), X, 1891, p. 631 (Tucuman).

Pimelodella cristata EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), I, 1888, p. 132 (San Gongallo; Avary; Villa Bella; Jutahy; Tapajos; Rio Mucuri;⁴ Tabatinga; Hyavary; Coary); Occasional Papers Cal. Acad. Sci., I, 1890, p. 150; Proc. U. S. Nat. Mus., XIV, 1891, p. 29; EIGENMANN & BEAN, Proc. U. S. Nat. Mus., XXXI, 1907, p. 660 (Amazon); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 388; Mem. Carnegie Mus., V, 1912, p. 168 (Tumatumari; creek below Potaro Landing; Rockstone; Kona-waruk; below Packeo Falls; Twoca Pan); FOWLER, Proc. Acad. Nat. Sci. Phila., 1915, p. 214 (type of *ophthalmicus*).

Pimelodus agassizii STEINDACHNER, Sb. Akad. Wiss. Wien, LXXIV, 1876, Flussf. Südöstl. Bras., III, p. 56, footnote (Essequibo).

Pimelodus (Pseudorhamdia) wesslii STEINDACHNER, Sb. Akad. Wiss. Wien, LXXIV, 1876, Süßwasserf. Südöstl. Bras., II, p. 56 (Essequibo).

Rhamdia wesslii RIBEIRO, Faun. Bras., Peixes, IV, 1912, p. 268.

Pimelodus ophthalmicus COPE, Proc. Am. Phil. Soc., XVII, 1876, p. 675 (Upper Amazon).

Habitat.—Guiana, Amazon Basin to the Huallaga, and the Guaporé. Rio Mucuri.

My reference in former papers of Schomburgk's *insignis* to this species is wrong.

⁴In three of the four specimens from Santa Cruz, Rio Mucuri (No. 7412 Mus. Comp. Zool.) the caudal is considerably longer than in specimens from the Amazon, 4-4.5 in the length. The upper caudal lobe is usually narrower and more pointed than the lower.

- 6933a C. M., 127 mm., San Joaquín, Bolivia, September 4, 1909. Haseman.
 6934a C. M., 131 mm., Villa Bella, Oct. 5, 1909. Haseman.
 6936a-f C. M., 77-220 mm., Santarem, Dec. 8, 9, 1909. Haseman.
 6937a-c⁵ C. M., 85-258 mm., Maciél, Rio Guaporé, July 23, 1909. Haseman.
 ???? Field M., 94 mm. to base of caudal, Serra da Lua, near Boa Vista, Amazon.
 M. P. Anderson and R. N. Becker.
 7586a M. C. Z., 154 mm., Rio Puty, Paranahyba basin. Thayer Expedition.
 7475a⁶ M. C. Z., 232 mm., Coary. Thayer Expedition.
 7492a⁷ M. C. Z., 265 mm., Tapajos. Thayer Expedition.
 7541a-b M. C. Z., 127 and 152 mm., São Gonçallo. Thayer Expedition.
 7412a-d⁸ M. C. Z., 232-305 mm., Santa Cruz, Rio Mucuri. Thayer Expedition.
 7444a⁹ M. C. Z., 300 mm., Villa Bella. Thayer Expedition.
 7576a-b¹⁰ M. C. Z., 66-103 mm., Iça. Thayer Expedition.
 7569a¹¹ M. C. Z., 95 mm., Hyavary. Thayer Expedition.

3. *Pimelodella steindachneri* nom. nov.

Pimelodella wesslii EIGENMANN & EIGENMANN (*non* Steindachner), Proc. Cal. Acad. Sci. (2), Vol. I, 1888, p. 132 (Cudajas; Pará; Marajo; Rio Madeira; Rio Puty; Santarem); Occasional Papers, Cal. Acad. Sci., I, 1890, p. 152; EIGENMANN, Rep. Princeton Univ. Exped. Patagonia, III, 1910, p. 389.
Habitat.—Amazon Basin.

The species described by Steindachner as *P. wesslii* from the Essequibo is identical with *P. cristata* (Müller & Troschel) from the same place. It is doubtful whether the specimens enumerated by E. and E. in the papers quoted above belong to the same species, and they are here set apart under a new name. The species, if distinct, is very closely related to *P. gracilis* and *P. cristata*. Its caudal is more like that of *gracilis*. Its maxillary barbel is longer than that of *cristata*.

⁵ Maximum number of pectoral thorns 30.

⁶ Pectoral thorns 24.

⁷ Pectoral thorns 22.

⁸ a. 232 mm., pectoral thorns 25, upper caudal lobe 39 mm., lower 44, maxillary barbel to end of base of anal. b. 262 mm., pectoral thorns 24, upper caudal lobe 52 mm., lower 51, maxillary barbel to middle of base of anal. c. 300 mm., pectoral thorns 32, caudal broken, maxillary barbel not to origin of the anal. d. 305 mm., pectoral thorns 29, upper caudal lobe 57 mm., lower 60 mm., maxillary barbel beyond tip of anal.

⁹ Pectoral thorns 25, upper caudal lobe 45 mm., lower lobe 55 mm., maxillary barbel to middle of base of anal.

¹⁰ Pectoral thorns 14 and 11, maxillary barbel beyond base of anal in the larger specimen, to near tip of the caudal *a* in the smaller.

¹¹ Pectoral thorns 17, maxillary barbel extending beyond caudal.

The pectoral thorns are 17, 18, 22, and 23 in different specimens, the largest number being found in 7542 M. C. Z. from Manacapurú. It is quite possible that most of the specimens from north of the Paraguay basin heretofore referred to *P. gracilis* really belong to this species. The specimens at present in the Museum of Comparative Zoölogy are:

7566a-b. 95-126 mm. to base of caudal, Maues, Rio Madeira. Thayer Expedition.

7487a.¹² 190 mm., Para. Thayer Expedition.

7472a. 172 mm., Cudajas. Thayer Expedition.

7567a. 137 mm., Santarem. Thayer Expedition.

7588a. 154 mm., Rio Puty. Thayer Expedition.

7542a. 212 mm., Manacapurú. Thayer Expedition.

4. *Pimelodella gracilis* (Cuvier & Valenciennes).

Pimelodus gracilis CUVIER & VALENCIENNES, His. Nat. Poiss., XV, 1840, p. 181 (Buenos Ayres; Paraná at Corrientes); VALENCIENNES, Voy. d'Orbigny, Vol. V, 1847, Poissons, p. 6, plate II, fig. 5; KNER, Sb. Ak. Wiss. Wien, XXVI, 1857, p. 418 (Caiçara, Mattogrosso; Rio Guaporé; Cujaba); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 121; BOULENGER, Trans. Zoöl. Soc., 1896, p. 27 (Descalvados).

Pimelodus (Pseudorhamdia) gracilis? STEINDACHNER, Flussfische Süd-am., I, 1879, p. 9 (Orinoco near Ciudad Bolivar).

Pimelodella gracilis EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci., (2), I, 1888, p. 132 (Goyaz); ? Occasional Papers Cal. Acad. Sci., I, 1890, p. 153; Proc. U. S. Nat. Mus., XIV, 1890, p. 29; Ann. Carnegie Mus., IV, 1907, p. 114, pl. XXXII, fig. 2 (Corumbá; Laguna Ypagarai); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Rhamdia gracilis RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 269.

Pimelodus lateristriga BOULENGER (*non* Müller & Troschel), Trans. Zoöl. Soc. Lond., 1896, p. 27 (Descalvados).

Pimelodus (Pimelodella) tenuiphorus REGAN, Ann. and Mag. Nat. Hist. (7), XII, 1903, p. 625 (Descalvados).

Habitat.—La Plata Basin; Uruguay Basin; ? Amazon; ? Orinoco. More abundant in the La Plata Basin than elsewhere.

In 6947 the maxillary barbel in specimens between 78 and 112 mm. long extends beyond the base of the caudal; in the specimens 97 mm. long to the end of the

¹² In this specimen the dorsal spine is very high, equal to the length of the head. Pectoral thorns 22.

lower lobe. In the largest specimens it extends a little beyond the base of the anal. The pectoral spine in the smallest has 9 spines on half of the length, 12 in the next in size, 15 in the next (125 mm.), 24 on the largest on all but the distal fourth of the spine. The lateral band extends from snout to caudal. The back is similar in color to the band, the space between the back and the lateral band being lighter in color. In the most highly developed the upper caudal lobe is 2.5 in the length; the distance between snout and dorsal fulcrum 3.4 in the length.

SPECIMENS EXAMINED.

Catalogue Number.	Length in Mm.	Location.	Date.	Collector.
6941a C. M.	100	Villa Bella, Amazon	Oct. 5, 1909	Haseman
6942a-b C. M.	74-103	San Joaquin, Bolivia	Sept. 4, 1909	Haseman
6943a C. M.	77	Asuncion, Rio Paraguay	Mar. 29, 1909	Haseman
6944a-f C. M.	58-135	Corumba, Paraguay Basin	Apr. 28, May 2, 1909	Haseman
6945a-g C. M.	35-110	Rio Jauru, Paraguay Basin	June 2, 4, 1909	Haseman
6946a-e C. M.	75-110	San Luiz de Caceres, Paraguay Basin	May 24, 1909	Haseman
6947a-h C. M.	82-180	Villa Hays, Rio Paraguay	Apr. 13, 1909	Haseman
10133a I. U. M.	About 70	Corumba		Anisits
10792a I. U. M.	About 160	Parana, Entre Rios		von Ihering
10200a I. U. M.	About 170	Laguna Ypagarai, Paraguay		Anisits
6961a-b C. M.	67- 68	Arequa, Paraguay	April 8, 1908	Haseman
6935a-i C. M.	55-140	Uruguayana	Feb. 5 and 7, 1909	Haseman
6939a C. M.	100	Rio Paranahyba (into Parana) at bridge to Goyaz	Aug. 14, 1908	Haseman

The size of the pectoral teeth varies greatly with the locality, the maxillary barbel to a less extent. In 6939, 100 mm. long, it extends about to the end of the base of the anal.

Only one of the twelve specimens recorded by E. & E. from Goyaz (S196 M. C. Z.) is still extant. I am in doubt whether we were correct in referring it to *P. gracilis*. The caudal is broken off near the base so that it cannot be determined whether it possesses one of the most characteristic features of the species, the prolonged upper caudal lobe. The maxillary barbel extends only to near the tip of the ventrals and is therefore much shorter than in typical specimens of *P. gracilis*. The eye is smaller than in the average given for the twelve specimens by E. & E., otherwise their description holds. The pectoral spines measured from above average slightly longer than the snout and eye. The dorsal spine is slightly less in length than the snout and eye; it is smooth in front and only very slightly roughened behind. The pectoral spine has nineteen thorns, the longest one being one third the width of the spine.

A large series of similarly preserved specimens are necessary to properly define this and the preceding species, if the two are really different.

5. *Pimelodella avanhandavæ* sp. nov. (Plate XXIX, fig. 3).

6969a C. M., type, 85 mm., 6970a-x C. M., paratypes, 57-96 mm., Rio Tieté at Salto Avanhandava, above the fall, Sept. 14, 1908. Haseman. 7062a-g, 56-77 mm., same place, Sept. 15, 1908.

Habitat.—Tieté Basin.

Very similar to *P. gracilis* and characterized by the long adipose and comparatively short barbels.

Head 4.5; depth 5.6; D. I.6; A. 11-12; eye 4-4.25 in the head; interorbital 4; adipose 2.75-3.25 in the length. Maxillary barbel extending nearly to tip of ventrals or the middle of anal; postmental beyond base of pectoral; pectoral spine equal to or a little longer than snout and eye; dorsal spine a little less than snout and eye; about 11 thorns, half as wide as the spine along the basal .7 of the posterior margin of the pectoral spine, 4-6 recurved hooks and numerous tubercles along the anterior margin; a narrow dark band along the middle of the sides, faintly continued on the head; a hyaline band through the basal half of the dorsal.

6. *Pimelodella roccæ* Eigenmann MS.

Pimelodella roccæ EIGENMANN, Mem. Comp. Zoöl., 1917, (Unpublished April, 1917) (Lower Urubamba Valley).

Habitat.—Urubamba Valley.

7. *Pimelodella puruensis* Fowler.

Pimelodella puruense FOWLER, Proc. Acad. Nat. Sci. Phila., 1915, p. 214, fig. 4 (Peruvian Amazon).

This species is known only from the type, which is 52 mm. long. It is quite possible that it is the young of one of the other known species.

8. *Pimelodella buckleyi* (Boulenger).

Pimelodus lateristriga (*non* Müller & Troschel) COPE, Proc. Acad. Nat. Sci. Phila., 1871, p. 270 (Ambyiaeu River).

Pimelodus buckleyi BOULENGER, Proc. Zoöl. Soc., 1887, p. 275, pl. XX, fig. 1 (Canelos).

Pimelodella buckleyi EIGENMANN, Reports Princeton Univ. Exp. Patagonia, III, 1910, 389.

Pimelodella copei FOWLER, Proc. Acad. Nat. Sci. Phila., 1915, p. 216, fig. 5 (based on Cope's specimens of *lateristriga*).

Habitat.—Marañon Basin.

Boulenger was the first to recognize that Cope's specimens belonged to a species distinct from *P. lateristriga*. There is little doubt but that *P. copei* is a synonym of *P. buckleyi*. The *P. buckleyi* of E. & E. is a distinct species called *P. Eigenmanni* by Boulenger, and *P. Eigenmanniorum* by Ribeiro.

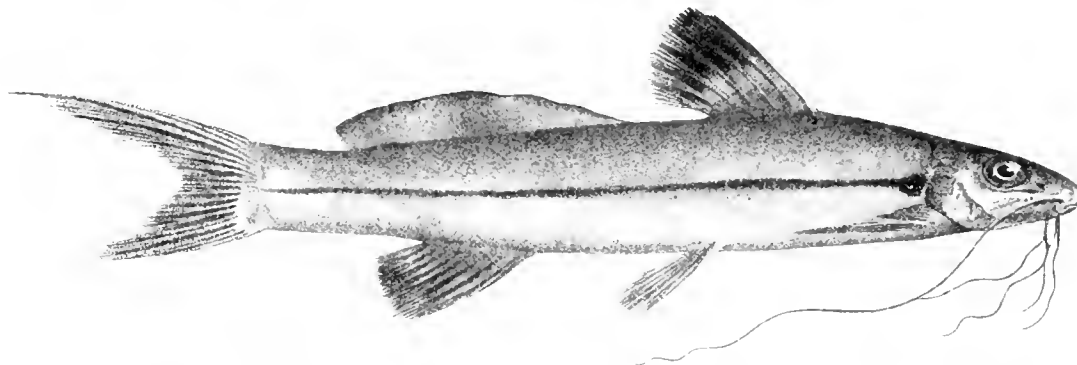


FIG. 1. *Pimelodella buckleyi* (Boulenger). Reproduced from P. Z. S. London, 1887, Pl. XX, fig. 1.

Known from two specimens from Canelos 150 mm. long and now in the British Museum, and two specimens 160 mm. long collected by Hauxwell in the Ambiyacu and now in the collections of the Philadelphia Academy of Sciences.

9. *Pimelodella pectinifera* Eigenmann & Eigenmann.

Pimelodella pectinifer EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), I, 1888, p. 132 (Campos); Occasional Papers Cal. Acad. Sci., I, 1890, p. 154; Proc. U. S. Nat. Mus., XIV, 1891, p. 29; EIGENMANN, Reports Princeton Univ. Exp. Patagonia, III, 1910, p. 389.

Rhamdia pectinifer RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 270.

This species is known only from the types from the Parahyba Basin.

10. *Pimelodella hasemani* sp. nov. (Plate XXX, fig. 7).

Pimelodella lateristriga EIGENMANN & EIGENMANN (part), Occasional Papers Cal. Acad. Sci., I, 1890, p. 156 (the specimens in the M. C. Z. and I. U. M. enumerated below).

Habitat.—Madeira and Amazon Basin.

6968a C. M., type, 81 mm., San Antonio de Rio Madeira. Haseman.

4259a-c I. U. M., largest 57 mm., Iça. William James.

7577 M. C. Z., fifty, largest 67 mm., Iça. William James.

7579-7581 M. C. Z., twelve, largest 72 mm., Obidos. William James.

7502 M. C. Z., three, largest 51 mm., Obidos. Col. Bentos.

7572 M. C. Z., one, 64 mm., Jutahy. James Thayer and Talisman.

Head 4.5; depth 6.6; D. 1.6; A. 12; eye 3.33 in the head, interorbital 5.5; center of eye a little behind the middle of the head; adipose 3.5 in the length. Maxillary barbel extending to middle of adipose on one side, to near its end on the other. Distance between snout and dorsal fulcrum 3.2 in the length; dorsal spine a little more than snout and eye. Pectoral spine very little longer than dorsal spine, with 16–18 recurved teeth on about the basal three-fourths of the posterior face of the spine. Anterior face with 4 hooks near the tip and about 40 short teeth along the rest of the spine. Humeral spine extending considerably beyond the middle of the pectoral spine. Lower caudal lobe longer than the head. Occipital process of the same width throughout, its width 3 in the length. A narrow, dark, lateral band; dorsal without a light band.

11. *Pimelodella cyanostigma* (Cope).

Rhamdia cyanostigma COPE, Proc. Am. Phil. Soc., 1870, p. 569 (Pebas); EIGENMANN & EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1891, p. 164.

Pimelodus cyanostigma COPE, Proc. Am. Phil. Soc., 1878, p. 675.

Pimelodella cyanostigma FOWLER, Proc. Acad. Nat. Sci. Phila., 1915, p. 218. (Note on the relationship.)

Habitat.—Marañon Basin.

Known only from the types. A specimen in the Field Museum, originally about 65 mm. long, collected by Anderson and Becker at Boa Vista, Serra da Lua, Feb., 1913, may belong to this species. The pectoral spines have been broken off, and a definite identification is impossible.

12. *Pimelodella megalops* Eigenmann.

Pimelodella megalops EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 389; Mem. Carnegie Mus., Vol. V, 1912, p. 169, plate XV, fig. 2 (Tumatumari, Potaro River; Crab Falls, Essequibo River).

Habitat.—Near mouth of the Potaro River, British Guiana.

13. *Pimelodella brasiliensis* (Steindachner).

Pimelodus (Pseudorhamdia) brasiliensis STEINDACHNER, Sb. Ak. Wiss. Wien, LXXIV, 1876, Süßwasserf. Südöstl. Bras., III, p. 50, pl. VII (Rio Parahyba).

Pimelodella brasiliensis EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci., (2), I, 1888, p. 133; Occasional Papers Cal. Acad. Sci., I, 1890, p. 162; Proc. U. S. Nat. Mus., XIV, 1891, p. 29; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Rhamdia brasiliensis RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 275. Known only by the types from the Rio Parahyba.

14. *Pimelodella laticeps* sp. nov. (Plate XXX, fig. 2).

6957a C. M., type, 62 mm., 6958a-c C. M., paratypes, 75-90 mm., Sapucay, Paraguay, April 2, 1909. Haseman.

Head 4; depth about 4.66; D. I.6 in two, I.7 in the other two; A. 14 or 15; eye in middle of the head, 4.33-5; interorbital very broad, 3-3.5 in the head; maxillary barbel reaching nearly to tip of the depressed dorsal or slightly beyond it; postmental slightly beyond base of last pectoral ray.

Adipose fin 4-4.3 in the length, the space between the dorsal equal to eye and snout; pectoral spine equal to head without the opercle; 7 recurved notches in the distal four tenths of the anterior face, the proximal portion with minute

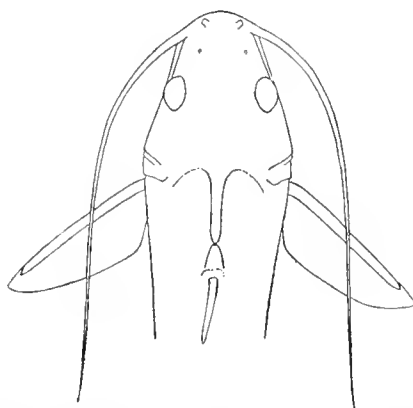


FIG. 2. *Pimelodella laticeps* Eigenmann. Dorsal view of head, $\times 2$.

tubercles; posterior face smooth opposite the notches of the anterior face and with 10-11 small thorns, the largest about half the width of the spine on the basal six-tenths of the spine. Dorsal spine equals snout and eye, with very few faint recurved notches near the tip in front, otherwise smooth; a large dusky blotch behind the gill-opening, a dark band along the middle of the sides from below the dorsal to the caudal; dorsal dusky; a hyaline band through the basal half of the fin; a dark stripe along the middle of the back.

15. *Pimelodella laticeps australis* var. nov.

Pimelodus lateristriga BOULENGER, Proc. Zoöl. Soc., 1891, p. 232 (Rio Grande do Sul).

Pimelodella lateristriga EIGENMANN, Ann. N. Y. Acad. Sci., VII, 1894, p. 632.

6950 C. M., type, 75 mm., 6951a-s C. M., 50-87 mm., Uruguayana, Feb. 5, 1909. Haseman.

6952a-p C. M., 52-76 mm., Cacequy, Rio Ibicuy, into the Rio Uruguay, Feb. 13, 1909. Haseman.

6953a-b C. M., 55 mm., Cachoeira, Rio Jacuhy, into Lago de Patos, Jan. 26, 1909.

Haseman.

6954a-d C. M., 53-60 mm., Porto Alegre, Rio Grande do Sul, Jan. 19, 1909. Haseman.

man.

4876a-c I. U. M., 97-123 mm., Rio Grande do Sul. Von Ihering.

Habitat.—Basins of the Uruguay and of the Lago de Patos.

These specimens have longer barbels than the ones from Sapucay and are much lighter in color, the dark along the back being interrupted at the dorsal plate and the end of the dorsal, the occipital process is also much lighter than the area bordering it. Only one of these specimens has the dorsal 1.7, the rest all 1.6. A. $\frac{12}{1}$, $\frac{13}{1}$, $\frac{15}{1}$; the maxillary barbel always longer, extending to end of ventral or middle anal. Adipose fin 3.75-4.25.

16. *Pimelodella notomelas* sp. nov. (Plate XXX, fig. 3).

6955 C. M., type, 51 mm.; 6956a-f C. M., paratypes, 37-53 mm., San Luiz de Caeres, May 24-27, 1909. Haseman.

6971a-d C. M., 35-60 mm., Rio Jauru, June 2-4, 1909. Haseman.

Habitat.—Upper Paraguay Basin.

Distinguished by the black spot on the dorsal.

Head 4.2; depth 4.5-5; D. 1.6; A. 12 or 13; eye 3-3.5 in the head, a little greater than the interorbital; maxillary barbel extending to tip of middle caudal rays or a little shorter, postmental barbel to near tip of pectoral; adipose 3 in the length, its origin in advance of the tip of the dorsal; dorsal spine slender with a few retrorse hooks near the tip in front, its height not quite equal to snout and eye; pectoral spine very little greater than snout and eye, with a very few short, feeble teeth behind; caudal very deeply forked, the lobes equal, about 3 in the length; a black wedge through middle of dorsal, the black on the first three membranes forming a conspicuous blotch, otherwise plain. No lateral band.

17. *Pimelodella metæ* sp. nov. (Plate XXXI, fig. 1).

13768a I. U. M., 48 mm., Quebrada Cramalote, Villavicencio. Gonzales.

7441a C. M., type, 77 mm., Rio Negro, Villavicencio. Gonzales.

7442a-b C. M., 13769a-c I. U. M., 80-100 mm., Barrigona, Rio Meta. Gonzales.

Habitat.—Upper Meta of the Orinoco Basin.

Head 4.8; depth over 6; eye 4 in the head, intraorbital 4-5; D. 1.6; A. 11 or 12; depth of caudal peduncle equal to postorbital part of head. Maxillary barbel almost or quite reaching origin of anal; outer mental barbel to middle of pectoral

or a little farther. Adipose fin 3-3.25 in the length; upper caudal lobe distinctly the longer, 3 in the length; dorsal spine equals snout and half the eye; pectoral spine equals snout and eye, with numerous recurved notches in front, very few feeble teeth or smooth along posterior face. A narrow, well-defined, lateral streak from eye to caudal; base of dorsal hyaline, then black, shading to the tip of the rays.

This species is closely allied to *P. buckleyi*, in which the dorsal and pectoral spines are of equal length, and to *P. notomelus* with a much longer barbel.

18. *Pimelodella boliviana* sp. nov. (Plate XXXI, fig. 2).

6964a C. M., type, 90 mm. over all, Santa Cruz de la Sierra, Bolivia. Steinbach.
6965a C. M., 67 mm. to base of caudal, Prov. del Sara, Jan.-Oct., 1911. Steinbach.

Habitat.—Central Bolivia; Madeira Basin.

Head 4.5-4.6; depth 6.3-6.5; D. 1.6; A. 13; eye 3.75 in the head; interorbital 4.3-4.7; eye in middle of the head; adipose fin 3 in the length; maxillary barbel extending to or beyond the base of the caudal; outer mental to or near to tip of pectoral; pectoral spine a little longer than snout and eye; dorsal spine less than snout and eye. Pectoral spine with 10 retrorse hooks along the distal half of the anterior margin, about 7 scarcely perceptible thorns on the posterior margin; caudal 3.5 in the length; a narrow band from snout to end of middle of caudal rays, heaviest just behind gill-openings. Dorsal dusky except along base.

19. *Pimelodella lateristriga* (Müller & Troschel).

Pimelodus lateristrigus MÜLLER & TROSCHER, *Horæ Ichthyol.*, III, 1849, p. 3 (Brazil).

Pimelodus lateristriga GÜNTHER, *Cat. Fish. Brit. Mus.*, V, 1864, p. 118 (Brazil); ? HENSEL, *Wieg. Arch.*, 1870, I, p. 69 (Porto Alegre); STEINDACHNER, *Sb. Ak. Wiss. Wien*, LXXIV, 1876, *Süsswasserfische Südöstl. Bras.*, III, p. 45 (Rio Parahyba; Rio Doce; Rio Jequintinhonha; Cannavieras; Muriahe and Rio Janeiro); VAILLANT, *Bull. Soc. Philom.* (7), IV, 1880, p. 52 (Calderon).

Pseudorhandia lateristriga LÜTKEN, *Velhas-Flodens Fiske*, *Dan. Vidensk. Selsk. Skr.*, 1875, p. 171, fig. (Rio das Velhas).

Pimelodella lateristriga EIGENMANN & EIGENMANN (part), *Proc. Cal. Acad.* (2), I, 1888, p. 133 (Santa Clara; Rio Mucuri; Rio Doce; Cannavieras; San Matheos; Mendez; Rio Trombetas); *Occasional Papers Cal. Acad. Sci.*, I, 1890, p. 156; *Proc. U. S. Nat. Mus.*, XIV, 1891, p. 29; EIGENMANN, *Reports Princeton Univ. Exped. Patagonia*, III, 1910, p. 389.

? *Rhamdia lateristriga* RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 271 (Calderão, Amazonas).

Habitat.—Amazon Basin; especially eastern Brazil from the Rio São Francisco to Rio de Janeiro.

A number of references to the name *lateristriga* have been distributed among the species to which they actually belonged.

Of this species there appear to be specimens from the Rio São Francisco:

6982*a-c* C. M., 37–85 mm., Penedo, near mouth of the Rio São Francisco, March 20, 1908. Haseman.

6983*a-c* C. M., 45–55 mm., Joazeiro, Nov. 28, 1907. Haseman.

6987*a-c* C. M., 71–82 mm., Lagoa Pereira, Dec. 23, 1907. Haseman.

and specimens from the Rio Parahyba:

6981*a* C. M., 60 mm., São João da Barra, June 23, 1908. Haseman.

6984*a-d* C. M., 70–95 mm., Campos near the mouth of the river, June 15, 1908.

6985*a* C. M., 72 mm., Lagoa Feia, a swamp on a sugar plantation south of the mouth of the Parahyba.

From the Rio Itapemirim we have the following lot:

6986*a-f* C. M. 60–71 mm., Muniz Freire, June 18, 1908. Haseman.

Of the above No. 6981 has the barbels extending to the middle of the base of the anal. The pectoral spine is equal to the head less the opercle and has 11 teeth on the basal three-fourths of the spine; the teeth are graduated from the second, which is longer than the spine is wide. Width of occipital process 4.5 in the length; caudal 4 in the length; lateral band faint. With this 6984 and 6985 agree in almost every particular; the lateral band is sometimes conspicuous, continued on both head and caudal. Those nearest them in the character of pectoral spines are 6986. The barbels extend to near the tips of the ventrals or a little beyond them. The pectoral spine is equal to the snout and eye and has 6–8 teeth on the basal two-thirds of the posterior face; the teeth are graduated from the last, or the one next to the last, and the longest is greater than the width of the spine; width of occipital process 3–4 in its length; lateral band well defined, continued on head and caudal.

In 6982 and 6983 the maxillary barbel extends to the middle of the base of the anal or beyond, on one side of one individual approaching the caudal. The pectoral spine is equal to the snout and eye, plus or minus, and has 9 or 10 spines in 6983 and 11–14 in 6982; teeth not as wide as the spine, on the basal half or two-thirds of the posterior face. In the smallest they are graduated from the tip to

the base, in the larger from the middle both ways. Width of occipital process 4 in its length. Caudal 4 in the length. Lateral band variable, continued or not continued to snout and on the tail.

In 6987 the teeth of the pectoral spines, 7 in the smallest, 12 in the two larger, are distinctly smaller than in 6982, but they are otherwise very similar, and the teeth are much larger than in the specimens from the Itapicuru = *itapicuruensis*.

20. *Pimelodella vittata* (Kröyer).

Pseudorhamdia vittata (KRÖYER) LÜTKEN, Velhas-Flodens Fiske; Dan. Vidensk. Selsk. Skr., 1874, p. 34 (Rio das Velhas); I. c., 1875, p. 173, with fig.

Pimelodella vittata EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), I, 1888, p. 133; Occasional Papers Cal. Acad. Sci., I, 1890, p. 159 (Rio São Francisco; Minas Geraes, São Matheo; Rio Jequitinhonha); Proc. U. S. Nat. Mus., XIV, 1891, p. 29; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Rhamdia vittata RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 272 (Rio das Velhas; Jaguará).

Habitat.—Eastern Brazil from the Rio São Francisco to São Matheo.

Mr. Haseman secured no specimens recognized as belonging to this species.

4258 I. U. M., 69 mm., Rio São Francisco, Thayer Expedition.

21. *Pimelodella itapicuruensis* sp. nov. (Plate XXXI, fig. 3).

6974a C. M., type, 80 mm.; 6974b-m, paratypes, 72-104 mm., Queimadas, Rio Itapicuru, March 2, 1908. Haseman.

6938a C. M., 76 mm., Rio de Jacobina into Rio Itapicuru, Nov. 9, 1907. Haseman.

6940a-c C. M., 61-74 mm., Bom Fin, Rio Itapicuru, 6 miles north of Fazenda Amaratu, Nov. 2, 1908. Haseman.

6975a-b C. M., Agua Branca, into Itapicuru, Nov. 6, 1907. Haseman.

Habitat.—Rio Itapicuru, Eastern Brazil.

Head 4.3-4.5; depth 6.5-7.5; D. 1.6; A. 12; eye 3.26-3.5; width of head 1.5 in its length, depth of head at base of occipital process 1.66 in its length; adipose 2.8-3.33; usually a little over 3 in the length; maxillary barbel extending to caudal in one, to end of adipose in one, to tip of pectorals in another, usually to some point above the base of the anal. Dorsal spine nearer the snout than anal; distance between tip of snout and dorsal fulcrum 3.33-3.16 in the length. Dorsal spine slender, not equal to snout and eye; about 8 hooks in front, slightly roughened behind; pectoral spine about equal to snout and eye, with 8-12 short teeth along

the basal half or six-tenths of its posterior margin; sharp hooks along the distal portion of its anterior face; pectoral not nearly reaching ventrals, which are inserted below the end of the dorsal; ventrals not nearly reaching anal the tip of which does not extend to the end of the adipose; humeral spine reaching middle of pectoral spine; upper caudal lobe much longer; a distinct band from snout to caudal; base of dorsal hyaline.

6974*m* differs in having the dorsal 1.7; the adipose very short, 6 in the length, but extending beyond the tip of the anal; caudal lobes nearly equal in length, the upper 3.75 in the length. Eye larger than in specimens of *P. vittata* in the Museum of Comparative Zoölogy.

22. *Pimelodella macturki* Eigenmann.

Pimelodella macturki EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 389; Mem. Carnegie Mus., Vol. V, 1912, p. 170, plate XVI, fig. 1 (Creek in Mora Passage, trenches at Morowhanna, and Georgetown).

Habitat.—British Guiana near the coast.

23. *Pimelodella eigenmanni* Boulenger.

Pimelodella buckleyi EIGENMANN & EIGENMANN (*non* Boulenger), Oceas. Papers Cal. Acad. Sci., I, 1890, p. 158 (Rio Parahyba; Macacos).

Pimelodella eigenmanni BOULENGER, Proc. Zoöl. Soc. London, 1891, p. 232 (based on *P. buckleyi* of Eigenmann & Eigenmann); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Rhamdia eigenmanniorum RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 213. Based on Eigenmann & Eigenmann *l. c.*

Habitat.—Eastern Brazil.

Head 4.5–5; depth 5.5–6.5; D. 1.6; A. 12–14 in the head, eye 3.5–4 in the head, in middle of the head; interorbital 1.33 in the eye, 5.3–6 in the head; maxillary barbel extending to the origin of the anal; postmentals to middle of pectoral; dorsal spine equidistant from snout and anal, its height 1.33 in the head; adipose 3.4–4 in the length, its distance from the dorsal equals the base of the latter. Caudal lobes of equal width, the upper longer, 4 in the length. Anal rounded; pectoral spine a little less than the length of the head, with teeth which are not more than one-fifth or one-sixth the width of the spine. A dark lateral band.

24. *Pimelodella hartti* Steindachner.

Pimelodus hartti STEINDACHNER, Sb. Akad. Wiss. Wien, LXXIV, 1876, Süßwassf. Südöstl. Bras., III, p. 53 (Rio Parahyba).

Pimelodella hartti EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci., (2), I, 1888, p. 133; Occasional Papers Cal. Acad. Sci., I, 1890, p. 158; Proc. U. S. Nat. Mus., XIV, 1891, p. 29; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Rhamdia hartti RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 270.

Habitat.—Eastern Brazil in Rio Doce and Rio Parahyba.

6973a-x C. M., 42–100 mm., Rio Doce, May 24, 1908. Haseman.

This species is allied to *lateristriga*. The barbels are shorter, the pectoral spine with much more feeble teeth behind, and the head is more depressed and broader. The snout is rounded, the mouth inferior.

25. *Pimelodella transitoria* (Ribeiro) = *lateristriga*?

Rhamdia transitoria RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 274 (R. Alambary, Iporanga).

6976a-d C. M., 110–about 130 mm., Xiririca, Rio Ribeira do Iguape, Dec. 5–8, 1908. Haseman.

6977a-f C. M., 35–106 mm., Morretes, on Rio Marunhy, into Rio Nhundiaquara into ocean at Paranagua, Jan. 2, 1909. Haseman.

6979a C. M., 115 mm., Piracicaba, Rio Tieté, Sept. 9, 1908. Haseman.

Habitat.—Southeastern Brazil.

These specimens representing the *P. transitoria* of Ribeiro can scarcely be separated from *P. lateristriga*. The largest are, however, larger than the largest of the typical *P. lateristriga*. The left maxillary extends to the end of the ventrals in the four specimens of 6976, in two others to the middle of the ventrals, and a little beyond the tip of the ventrals; the pectoral spine is about as long as the head less the opercle and provided with about 13 long recurved teeth along the basal three-fifths of the spine. The tip of the dorsal is dark.

In 6979 the maxillary barbel extends to the end of the base of the anal. In the largest of 6977 it extends just about to the middle of the ventrals; eye 4–4.5; interorbital 4.66–5.

26. *Pimelodella meeki* Eigenmann. (Plate XXXII, figs. 1–2).

Pimelodella eigenmanni MEEK (*non* Boulenger), Proc. Biol. Soc. Washington, XVIII, 1905, p. 241 (São Paulo, Brazil).

Pimelodella meeki EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389 (São Paulo).

Habitat.—Rio Tieté, São Paulo, Brazil.

6980a-c C. M., 87–117 mm., Sapina, Rio Tieté, São Paulo, July 23, 1908. Haseman.

6978a-y C. M., 37-51 mm., Mogy das Cruzes, Rio Tieté, July 19, 1908. Haseman.

Allied to *P. lateristriga* and *P. transitoria*.

Head 4.25; depth 5; D. 1.6; A. 11; eye 4.5 in the head; interorbital equals eye; maxillary barbel reaching a little beyond base of ventrals; adipose 3.8 in the length; caudal 5; distance from snout to dorsal fulcrum 3 in the length; fins all small; pectoral spine equals snout and eye; 11 hooks on over half of the distal anterior face of the spine; 12 feeble teeth not over one-third as wide as the spine on a little over half of the posterior face of the spine; pectoral fin equals length of head less opercle; ventral fin equals snout and half the eye; base of anal equals length of snout; dorsal spine equals snout and half eye; a well-developed band from snout to caudal.

27. *Pimelodella griffini* sp. nov. (Plate XXXII, fig. 3).

6962 C. M., type, 87 mm.; 6963a-c C. M., paratypes, 55-88 mm., mountain rills near Sapucay, Paraguay, April 2, 1909. Haseman.

Distinguished by the filamentous dorsal ray.

Head 4-4.5; depth 5-5.5; depth of caudal peduncle one-half of greatest depth; D. 1.6; A. 13 counting everything; eye 1.6 in snout, 4 in head; 8 in interorbital; adipose 3.5-4.5 in the length; maxillary barbel reaching tip of ventrals or shorter; outer mentals but little if any beyond base of pectoral. Dorsal spine about equal to the pectoral spine, prolonged into a filament, spine and filament sometimes equal one-third of the length, the filamentous portion being sometimes longer than the spine. Pectoral spine with 9-11 spinules on the basal two-thirds of the posterior edge; the anterior edge with retrorse hooks near the tip and minute serrations the rest of the way; dorsal spine nearly smooth; upper caudal lobe the longer, the lower as long as the head; a dark band from anterior nares to end of middle caudal rays.

One specimen has a light band through the dorsal, the dorsal 1.7; the eye less than the interorbital.

28. *Pimelodella mucosa* Eigenmann & Ward. (Plate XXXIII, fig. 1).

Pimelodella lateristriga (non Müller & Troschel) EIGENMANN, part.¹³ Ann. Carnegie Mus., IV, 1907, p. 114 (Villa Rica).

Pimelodella mucosa EIGENMANN & WARD, Ann. Carnegie Mus., IV, 1907, p. 114, plate XXXII, fig. 1; EIGENMANN, Reports Princeton Univ. Exp. Patagonia, III, 1910, p. 389.

¹³ One of the small specimens referred to *Pimelodella lateristriga* seems to belong to this species; the others certainly do not.

Habitat.—Paraguay Basin.

10125 I. U. M., type, 126 mm., Bahia Negra, Paraguay, Anisits.

10200 I. U. M., part, 50 mm., Villa Rica, Anisits.

6959a C. M., 135 mm., Puerto Suarez, Paraguay, May 7, 1909. Haseman.

6960a-f C. M., 63-86 mm., Laguna Ypacary, Arequa, Paraguay, April 7, 1909. Haseman.

6972a C. M., 112 mm., near Berlin, Bolivia, Rio Mamoré, Sept. 14, 1909. Haseman.

Very similar to *P. gracilis* but the adipose distinctly shorter, the tip of the anal extending to or beyond the tip of the adipose.

Head 4; depth 5; D. 1.6; A. 10-12; eye 3.5-4.5 in the head; interorbital 3.75-4; maxillary barbel to within an orbital diameter of the caudal or middle of caudal; adipose 3-3.66 in the length. Pectoral spine equal to length of head less opercle, with 5-9 recurved hooks near tip in front, these followed by about 30-40 tubercles, most of which are antrorse; 11-21 recurved teeth along most of the posterior margin; dorsal spine equal to snout and half of the eye. Caudal deeply forked, the lower lobe broader and longer, 3.5 in the length; the tip of the anal extends to or beyond the vertical from the tip of the adipose. A well-developed lateral band, heaviest behind the gill-opening. The maxillary barbel extends to near the base of the caudal and may extend beyond its tip. Eye 4 + in the head; interorbital equal to the eye. The adipose is 3-3.66 in the length.

KEY TO THE TRANS-ANDEAN SPECIES OF PIMELODELLA.¹⁴

- a. Upper caudal lobe about equal to head in length; pectoral spine with thorns for more than two-thirds its length.
- b. Basal four-fifths of pectoral spine with very strong hooks on its posterior face, the hooks of the distal half longer than the width of the spine at its base. Dorsal spine with a few teeth on its posterior face. Adipose fin 4.25-5 in the length, pectoral spine very little longer than snout and eye, maxillary barbel reaching to somewhere about the ventrals. Head 4.25; depth 5; D. 1.6; A. 11-12. 29. *grisea* Regan.
- bb. Basal three-fourths or four-fifths of the pectoral spine with hooks along its posterior face, the hooks less than the width of the spine, posterior face of dorsal spine rough; adipose fin $3\frac{1}{4}$ - $3\frac{1}{2}$ in the length, pectoral spine about equal to snout and eye. Maxillary barbels reaching somewhere about middle of adipose, shorter in the young. Head 4.8, depth 5.5; D. 1.6; A. 12; a sharply defined lateral band. 30. *modesta* (Günther).
- bbb. Basal two-thirds of the pectoral spine with eight (6-8 *vide* Steind.) hooks; posterior face of dorsal spine smooth; adipose fin 2.66 in the length; pectoral spine very little less than snout and eye; maxillary barbel reaching the last third of the ventrals; head 4.33; depth 5; D. 1.6; A. 12; no sharply defined lateral band. 31. *yuncensis* Steindachner.

¹⁴ This account is extracted from the MS. of my forthcoming monograph on the fishes of Colombia. It was prepared in collaboration with Mr. Homer G. Fisher.

- aa. Upper caudal lobe much longer than the lower, much longer than head.
- c. Distal one-third or one-fourth of pectoral spine without hooks, the hooks strong.
- d. Adipose fin 3-3.5 in the length; pectoral spine equal to length of snout and eye; maxillary barbels reaching beyond the base of anal. Head 4.5-4.8; depth 5-6; D. 1.6; A. 11-12.
32. *chagresi* (Steindachner).
- dd. Adipose fin 2.66-2.75 in the length, pectoral spine a little longer than snout and eye, maxillary barbel reaching beyond origin of anal. Head 4.75; depth 5.5; D. 1.6; A. 11.
33. *elongata* (Günther).
- cc. Distal half of inner face of pectoral spine without hooks; adipose fin 3.25-3.5 in the length; pectoral spine equal to head less half or whole of opercle; maxillary barbels reaching beyond tip of ventrals in the small or anal in the large; head 4-4.66; depth 5.5; D. 1, 6; A. 11-12.
34. *cutania* Regan.

29. *Pimelodella grisea* Regan. (Plate XXXIII, fig. 2).

Pimelodella griseus REGAN, Ann. and Mag. Nat. Hist., Ser. 7, Vol. XII, 1903, p. 625 (Northwestern Ecuador); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389; REGAN, Ann. and Mag. Nat. Hist., Ser. 8, Vol. XII, 1913, p. 467 (Rio San Juan).

6751*a-j* C. M., 13588, I. U. M., 41, largest 165 mm., Rio Dagua at Cordova. Eigenmann.

6752*a* C. M., 13589, I. U. M., 2, 152 and 155 mm., San Juan half-way between Puerto Negria and Istmina. Eigenmann.

13598 I. U. M., 1, 116 mm., Istmina. Eigenmann.

Habitat.—San Juan River, Colombia, south to Northern Ecuador.

30. *Pimelodella modesta* (Günther).

Pimelodus modestus GÜNTHER, Proc. Zoöl. Soc. Lond., 1860, p. 239, pl. X, fig. C (Esmeraldas); Cat. Fishes Brit. Mus., V, 1864, p. 117 (Esmeraldas); Fish. Cent. Amer., 1866, p. 393 (Rio Chagres, Esmeraldas).

Pimelodella modestus EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci., (2), Vol. I, 1888, p. 133 (name); Occasional Papers Cal. Acad. Sci., I, 1890, p. 155 (rivers of Western Ecuador); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Habitat.—Patia, River of southern Colombia to the Chone River in Ecuador.

6743*a-e* C. M., 13574 I. U. M., 42, largest 122 mm., Chone, Ecuador. Henn.

6744*a-l* C. M., 13575 I. U. M., 19, largest 72 mm., Portovicio. Henn.

6745*a-i* C. M., 13583 I. U. M., 54, largest 140 mm., San Lorenzo, Rio Telembi, Jan. 14, 1913. Henn and Wilson.

6746*a-i* C. M., 13584 I. U. M., 57, largest 135 mm., Patia, between Magui and Telembi. Henn.

- 6747*a-d* C. M., 13585 I. U. M., 7, largest 117 mm., Telembi above Barbacoas, Jan. 13, 1913. Henn and Wilson.
- 6748*a-c* C. M., 3, largest 125 mm., Telembi, above Barbacoas, Jan. 15, 1913. Henn and Wilson.
- 6750*a-c* C. M., 13587 I. U. M., Creeks above Barbacoas, Jan. 17, 1913. Henn and Wilson.
- 6764*a-i* C. M., 13597 I. U. M., Patia, at mouth of Rio Guaitara. Henn.
- 6749*a-l* C. M., 13586 I. U. M., 21, largest 137 mm., Telembi, 8 miles above Barbacoas, Jan. 16, 1913. Henn and Wilson.

31. *Pimelodella yuncencis* Steindachner.

Pimelodella yuncencis STEINDACHNER, Denksehr. K. Akad. Wiss. Wien, LXXII, 1912, p. 47 (Pacasmayo, Peru); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Rhamdia gilli STARKS, Proc. U. S. Nat. Mus., XXX, 1906, p. 769, pl. LXV, fig. 1 (Rio Eten, Peru); EIGENMANN, l. c., p. 389.

Field Mus., 74 mm., April 2, 1912. Osgood.

Habitat.—Northwestern Peru.

The single specimen at my disposal has the following characters: Head 4.33; depth 5; D. 1.6; A. 12; eye 4.66 in the head, interorbital 3.66; pectoral spine nearly equal to snout and eye, with 8 thorns on the basal two-thirds of its posterior margin; maxillary barbel reaching to last third of the ventrals; nearly uniform dusky, without lateral band; fontanel a very narrow slit; occipital process not quite reaching the dorsal plate.

This species greatly resembles *P. avanhandavae*, which, however, has a broader fontanel and the occipital process meeting the dorsal plate.

32. *Pimelodella chagresi* (Steindachner). (Plate XXXIII, fig. 3).

Pimelodus (*Pseudorhamdia*) *chagresi* STEINDACHNER, Sb. Ak. Wien, LXXIV, Ichthyol. Beitr., IV, 1876, p. 34 (Rio Chagres and its tributary, near Obispo).

Pimelodella chagresi EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), I, 1888, p. 134 (Obispo River); Occasional Papers Cal. Acad. Sci., I, 1890, p. 160 (Rio Chagres and its tributaries); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Habitat.—Both slopes of Panama, Atrato, and Magdalena Basins. ? Rio Meta Basin.

6753*a* C. M., 1, 145 mm., Tambo. Wilson.

- 13590 I. U. M., 1, 7 mm., Certegui. Eigenmann.
 6754*a-d* C. M., 13591 I. U. M., 7, largest 96 mm., Bernal Creek. Eigenmann.
 6755*a-c* C. M., 13592 I. U. M., 5, largest 103 mm., Quibdo. Wilson.
 6756*a* C. M., 1, 21 mm., Truando. Wilson.
 13599 I. U. M., 1, 63 mm., Puerto Wilches. Eigenmann.
 6765*a-i* C. M., 13600 I. U. M., 18, largest 69 mm., Peñas Blanca. Eigenmann.
 6766*a* C. M., 51 mm., Villavieencio? (Loc. 7). Gonzales.
 6767*a-f* C. M., 13543 I. U. M., largest 55 mm., Apulo. Gonzales.
 6768*a-b* C. M., 13544 I. U. M., largest 467 mm., Girardot. Eigenmann.
 6769*a* C. M., 1, 63 mm., Honda. Eigenmann.

If 6766 from Villavieencio belongs to this species, this species is found both east and west of the Andes. But it is a small specimen and the positive identification across the Andes may be left till larger specimens are available for examination.

Meek & Hildebrand found this species to be abundant on both slopes of the central range in Panama.

33. *Pimelodella elongata* (Günther).

Pimelodus elongatus GÜNTHER, Proc. Zool. Soc. Lond., 1860, p. 238, pl. X, fig. B (fresh waters of Esmeraldas); Cat. Fish. Brit. Mus., V, 1864, p. 118 (Esmeraldas).

Pimelodella elongatus EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), I, 1888, p. 133 (name); Occasional Papers Cal. Acad. Sci., I, 1890, p. 155 (rivers of Western Ecuador); EIGENMANN, Princeton Univ. Exped. Patagonia, III, 1910, p. 389.

Habitat.—Rivers of Western Ecuador.

- 6741*a-b* C. M., 13572 I. U. M., 5, longest 92 mm., Vinces, Ecuador. Henn.
 6742*a* C. M., 13572 I. U. M., 3, longest 81 mm., Colimes, Ecuador. Henn.

34. *Pimelodella eutænia* Regan. (Plate XXXIV, fig. 7).

Pimelodella eutænia REGAN, Ann. and Mag. Nat. Hist. (8), Vol. XII, 1913, p. 466 (Rio San Juan).

Habitat.—San Juan, Dagua, and Patia Basins of Western Colombia.

- 6757*a-j* C. M., 18593 I. U. M., 66, largest 157 mm., Istmina. Wilson.
 6758*a* C. M., 160 mm., San Juan at mouth of Rio Cucurrupi. Henn.
 6759*a-b* C. M., 2, larger 126 mm., Condoto. Wilson.
 6760*a-j* C. M., 13594 I. U. M., 32, largest 170 mm., Cisnero. Eigenmann.
 6761*a-j* C. M., 13595 I. U. M., 42, largest 188 mm., San Lorenzo, Rio Telembi. Henn and Wilson.

6762a C. M., 1, 150 mm., Caldas. Eigenmann.

6763a-d C. M., 13596 I. U. M., 8, largest 150 mm., Barbacoas. Henn and Wilson.

Typhlobagrus Ribeiro.

Typhlobagrus RIBEIRO, Kosmos, No. 1, January, 1907.

Type, *Typhlobagrus krontei* Ribeiro.

In all characters but the eyes like *Pimelodella*. The eyes lost.

35. *Typhlobagrus krontei* Ribeiro. "Ceguinho."

Typhlobagrus krontei RIBEIRO, Kosmos, No. 1, January, 1907; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 387; RIBEIRO, Fauna Bras., Peixes, IV, 1912, p. 250, Pl. XLII, figs. 2, 2A and 2B (Cavernas das Areiras, Iporanga, São Paulo); HASEMAN, Ann. Carnegie Mus., VII, 1912, p. 323 (Cavernas das Areiras).

7443a-x C. M., 23, 74-202 mm., Caverna das Areiras, Nov. 28, 1908. Haseman.

Head 4-4.2; depth about 5.5; D. usually 1.6, in one case, 1.7; A. 12-15 (usually 14). Maxillary barbel reaching to near middle of ventrals in youngest and oldest, sometimes a little longer or a little shorter, postmentals a little beyond base of pectoral. Fontanel narrow, extending to base of occipital crest, which reaches to dorsal plate, width of occipital crest nearly 4 in its length. Dorsal spine half or a little more than half the length of the head, a little less than the length of the pectoral spine; 8-14 moderate-sized thorns on the pectoral spine. Adipose fin about 3.75 in the length, its tip extending beyond the tip of the anal; caudal lobes of about equal width, the upper lobe the longer by .25 or .2 of the length of the head.

A distinct trace of a dark lateral band on some of the specimens; margin of dorsal sometimes dusky.

The region of the eye varies. No trace of an eye or optic nerve can be noticed in ordinary dissections of the alcoholic material at my disposal. The skin over the vanished eye is invaginated in various degrees, a distinct free orbital margin being quite evident in some specimens, less distinctly so in others. They appear as though the eye had been removed without greatly altering the region of the skin over them.

Ribeiro says: "Dentre os exemplares que tivemos em mãos, um possui um olho desenvolvido.

"Este facto prova perfeitamente a reversão, por herança, á um caracter de seus antepassados; o organo mede 4 millimetros no maior diametro e o peixe 150 millimetros.

“Essa predominancia hereditaria, tão frisante aqui, é certamente um documento de valor para a theoria genealogica, quando se vê que em 35 outros exemplares de todos os tamanhos, apenas uma estricte fenda indica a posição que outr’ora occupou esse importantissimo orgão. No exemplar que nós dissecámos, não conseguimos encontrar, siquer, vestigios do nervo optico e o seu logar estava, ao contrario, occupado pelo grosso ramo nervoso do barbilhão maxillar.”

It seems evident from the fact that the skin and the bones near the eye have undergone little or no change, while the eye has vanished but occasionally develops, that the process of its degeneration was very rapid.

EXPLANATION OF PLATES.

PLATE XXIX.

- FIG. 1. *Pimelodella serrata* Eigenmann. Type, C. M. No. 6967, 67 mm. San Joaquin, Bolivia.
- FIG. 2. *Pimelodella eristata* (Müller & Troschel). I. U. M. No. 12064, 176 mm. Below Potato Landing.
- FIG. 3. *Pimelodella avanhandava* Eigenmann. Type, C. M. No. 6969, 85 mm. Salto Avanhandava.

PLATE XXX.

- FIG. 1. *Pimelodella hasemani* Eigenmann. Type, C. M. No. 6968, 81 mm. San Antonio de Madeira.
- FIG. 2. *Pimelodella laticeps* Eigenmann. Type, C. M. No. 6957, 62 mm. Sapucay, Paraguay.
- FIG. 3. *Pimelodella notomelas* Eigenmann. Type, C. M. No. 6955, 51 mm. Caceres,

PLATE XXXI.

- FIG. 1. *Pimelodella mcta* Eigenmann. Type, C. M. No. 7141, 77 mm. Rio Negro, Villavicencio.
- FIG. 2. *Pimelodella boliviana* Eigenmann. Type, C. M. No. 6964, 90 mm. Santa Cruz de la Sierra.
- FIG. 3. *Pimelodella itapicuruensis* Eigenmann. Type, C. M. No. 6974. Rio Itapicuru.

PLATE XXXII.

- FIG. 1. *Pimelodella mecki* Eigenmann. Type, Field M. No. 3400. São Paulo.
- FIG. 2. *Pimelodella mecki* Eigenmann. C. M. No. 6980, 117 mm. São Paulo.
- FIG. 3. *Pimelodella griffini* Eigenmann. Type, C. M. No. 6962, 87 mm. Sapucay, Paraguay.

PLATE XXXIII.

- FIG. 1. *Pimelodella mucosa* Eigenmann. C. M. No. 6959, 135 mm. Puerto Suarez.
 FIG. 2. *Pimelodella grisea* Regan. I. U. M. No. 148 mm. Cordova, Rio Dagua.
 FIG. 3. *Pimelodella chagresi* (Steindachner). U. S. N. M., about 145 mm.

PLATE XXXIV.

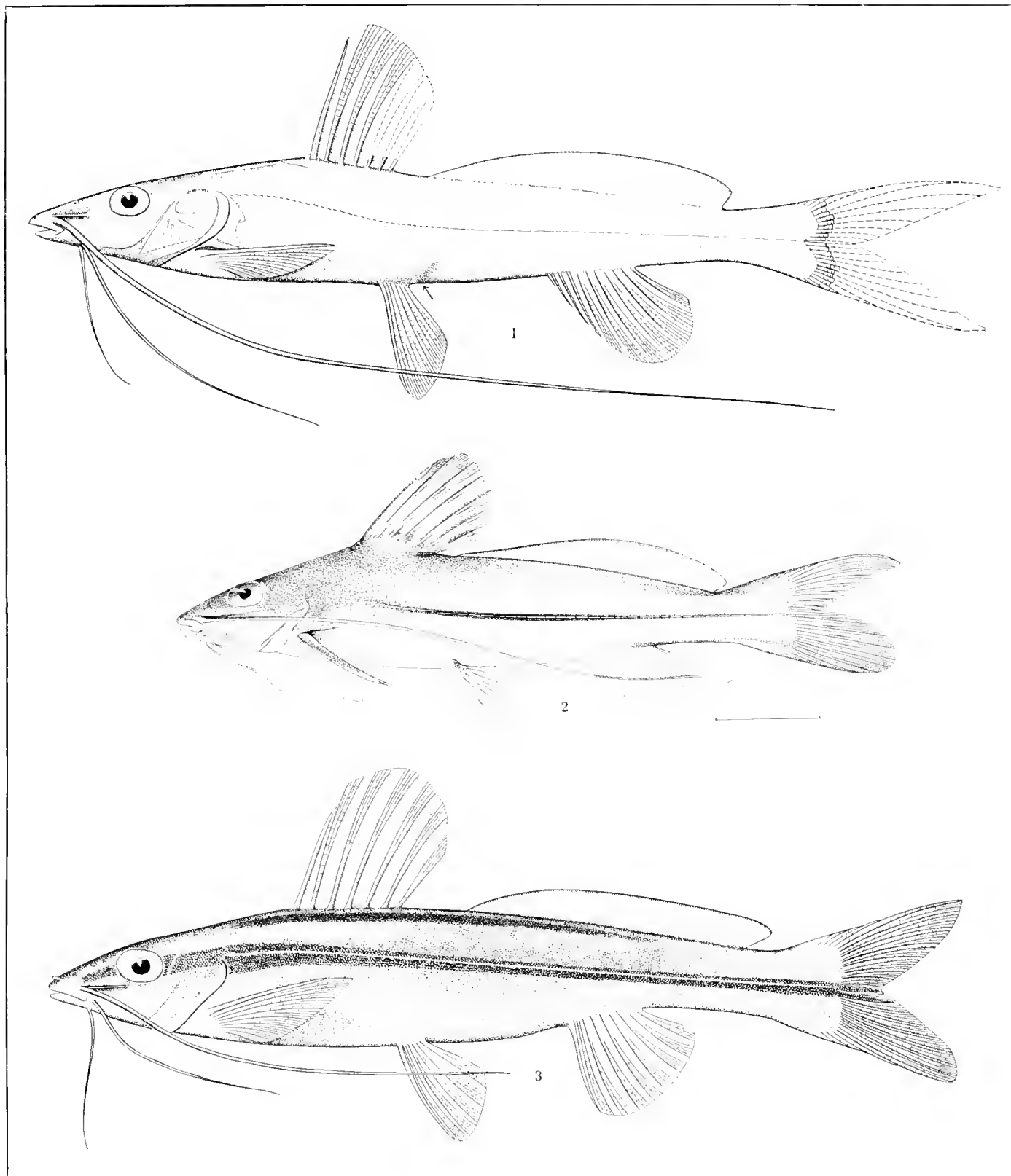
- FIG. 1. *Pimelodella cutania* Regan. I. U. M. No. 13593, 147 mm. Istmina.
 FIG. 2. *Typhlobagrus kronci* Ribeiro. C. M. No. 7443, 146 mm. Caverna das Areiras.

PLATE XXXV.

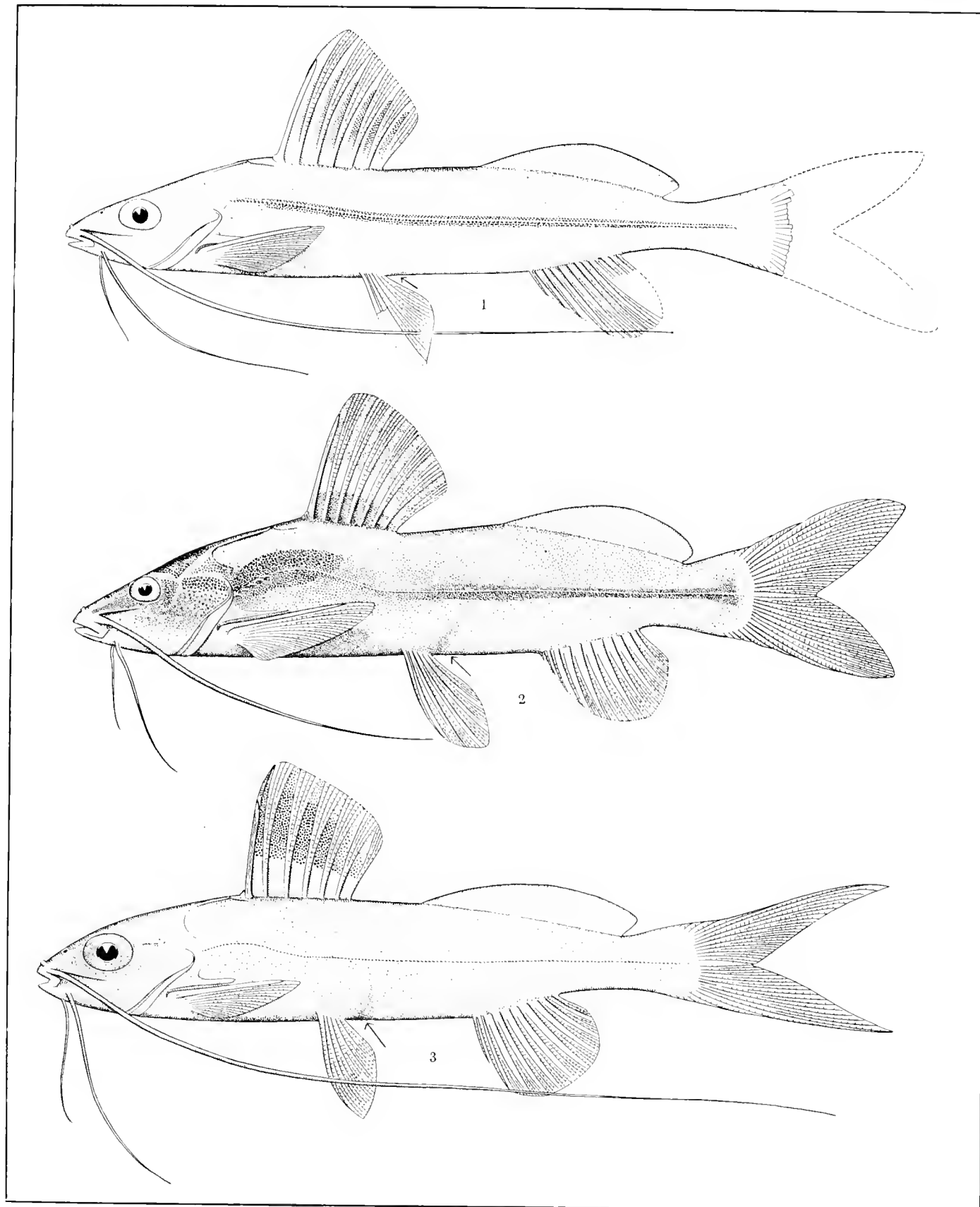
(Figures 1-44, left pectoral spines of various species of *Pimelodella* as seen from above. Figures 3, 5, 6, 7, 10, 11, 16, 18, 19, 21, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, and 38 are camera sketches drawn to the same scale.)

	Length of Spine in mm.	Length of Specimen in mm.
FIG. 1. <i>Pimelodella serrata</i> Eigenmann. Type, C. M. No. 6966		110
FIG. 2. <i>P. hasemani</i> Eigenmann. Type, C. M. No. 6968		81
FIG. 3. <i>P. hasemani</i> Eigenmann. I. U. M. No. 4259	7	57
FIG. 4. <i>P. mucosa</i> Eigenmann. C. M. No. 6959		135
FIG. 5. <i>P. mucosa</i> Eigenmann. I. U. M. No. 10200	6	50
FIG. 6. <i>P. mucosa</i> Eigenmann. Type, I. U. M. No. 10125	20	126
FIG. 7. <i>P. rocae</i> Eigenmann. Type, in M. C. Z.	21	144
		(to base of caudal)
FIG. 8. <i>P. arandave</i> Eigenmann. Type, C. M. No. 6969		85
FIG. 9. <i>P. laticeps</i> Eigenmann. C. M. No. 6958	12	89
FIG. 10. <i>P. transitoria</i> (Ribeiro). C. M. No. 6976	16	118
FIG. 11. <i>P. lateristriga</i> (Müller and Troschel). C. M. No. 6982	14	93
FIG. 12. <i>P. itapicuruensis</i> Eigenmann. Type, C. M. No. 6974		80
FIG. 13. <i>P. meeki</i> Eigenmann. Type, Field M. No. 3400	14	12
FIG. 14. <i>P. meeki</i> Eigenmann. C. M. No. 6980	12	105
FIG. 15. <i>P. eigenmanni</i> Boulenger. M. C. Z. No. 7510	25	168
FIG. 16. <i>P. vittata</i> (Kröyer). I. U. M. No. 4258	9	60
FIG. 17. <i>P. vittata</i> (Kröyer). M. C. Z. No. 7576	10	90
FIG. 18. <i>Typhlobagrus kronci</i> Ribeiro. C. M. No. 7443	22	160
FIG. 19. <i>T. kronci</i> Ribeiro. C. M. No. 7443	11	105
FIG. 20. <i>Pimelodella griffini</i> Eigenmann. Type, C. M. No. 6962		87
FIG. 21. <i>P. meta</i> Eigenmann. C. M. No. 7442	10	95

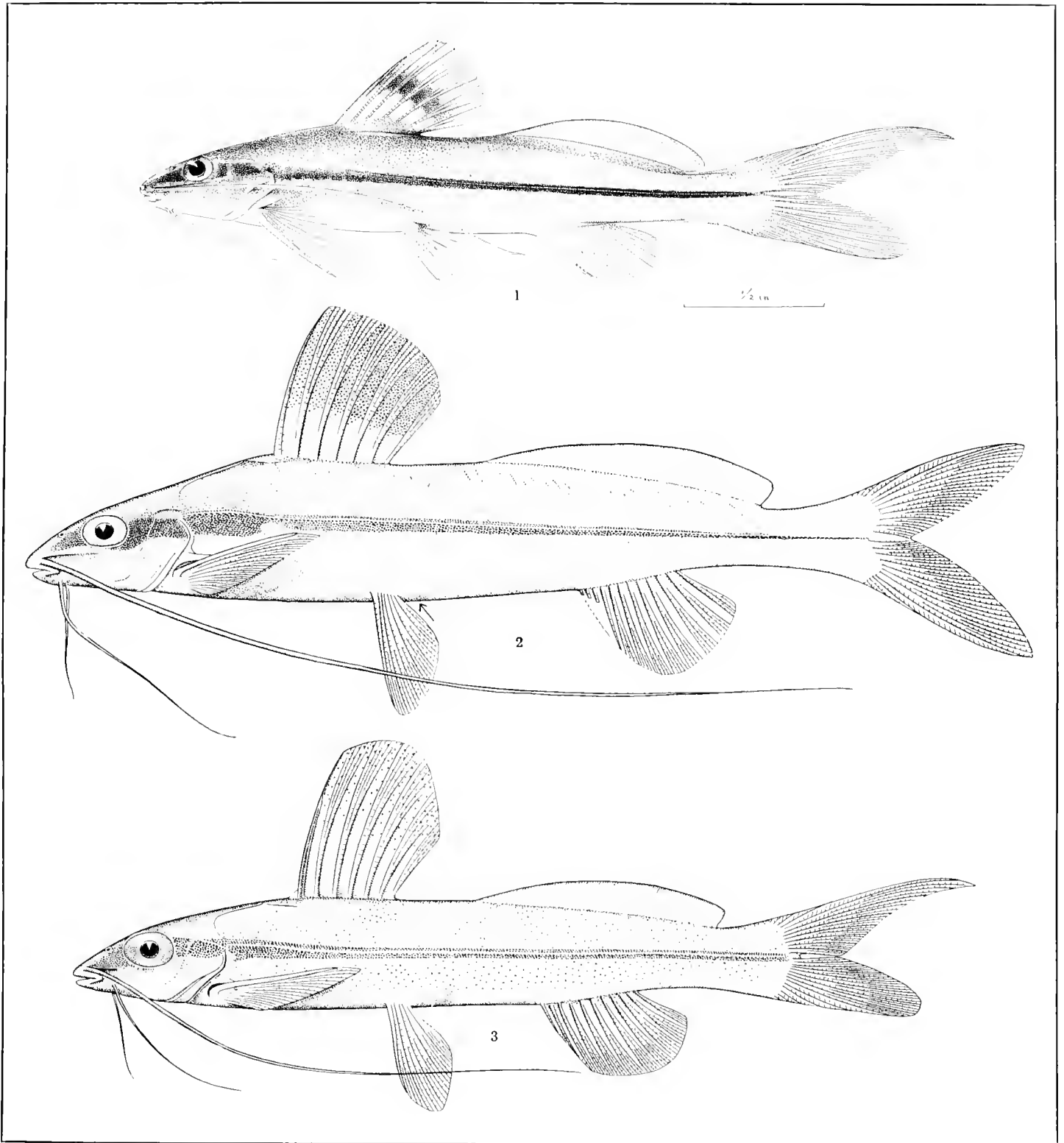
FIG. 22.	<i>P. meta</i> Eigenmann. Type, C. M. No. 7441.....	8	77
FIG. 23.	<i>P. yuncensis</i> Steindachner. In Field Mus.....	8	74
FIG. 24.	<i>P. chagresi</i> (Steindachner). In U. S. N. M.....	8	70
FIG. 25.	<i>P. chagresi</i> (Steindachner). In U. S. N. M.....	14	143
FIG. 26.	<i>P. pectinifer</i> Eigenmann. M. C. Z. No. 7508.....		190
FIG. 27.	<i>P. macturki</i> Eigenmann. I. U. M. No. 12068.....	9	71
FIG. 28.	<i>P. megalops</i> Eigenmann. I. U. M. No. 12066.....	12	95
FIG. 29.	<i>P. hartli</i> (Steindachner). C. M. No. 6973.....	14	101
FIG. 30.	<i>P. boliviana</i> Eigenmann. Type, C. M. No. 6964.....		90
FIG. 31.	<i>P. griffini</i> Eigenmann. C. M. No. 6963.....	10	90
FIG. 32.	<i>P. grisea</i> Regan. I. U. M. No. 13588.....	19	163
FIG. 33.	<i>P. grisea</i> Regan. I. U. M. No. 13588.....	13	115
FIG. 34.	<i>P. modesta</i> (Günther). I. U. M. No. 13583.....	16	130
FIG. 35.	<i>P. cutania</i> Regan. I. U. M. No. 13593.....	8	67
FIG. 36.	<i>P. cutania</i> Regan. I. U. M. No. 13593.....	18	144
FIG. 37.	<i>P. gracilis</i> (Cuvier and Valenciennes). I. U. M. No. 10205.....	19	160
FIG. 38.	<i>P. cristata</i> (Müller and Troschel). I. U. M. No. 12064.....	25	204
FIG. 39.	<i>P. cristata</i> (Müller and Troschel). C. M. No. 6936...		92
FIG. 40.	<i>P. cristata</i> (Müller and Troschel). C. M. No. 6936...		77
FIG. 41.	<i>P. notomelas</i> Eigenmann. C. M. No. 6956.....	6	53
FIG. 42.	<i>P. steindachneri</i> Eigenmann. M. C. Z. No. 5767.....	17	136
FIG. 43.	<i>P. steindachneri</i> Eigenmann. M. C. Z. No. 7472.....	20	175
FIG. 44.	<i>P. steindachneri</i> Eigenmann. M. C. Z. No. 7542.....	27	213



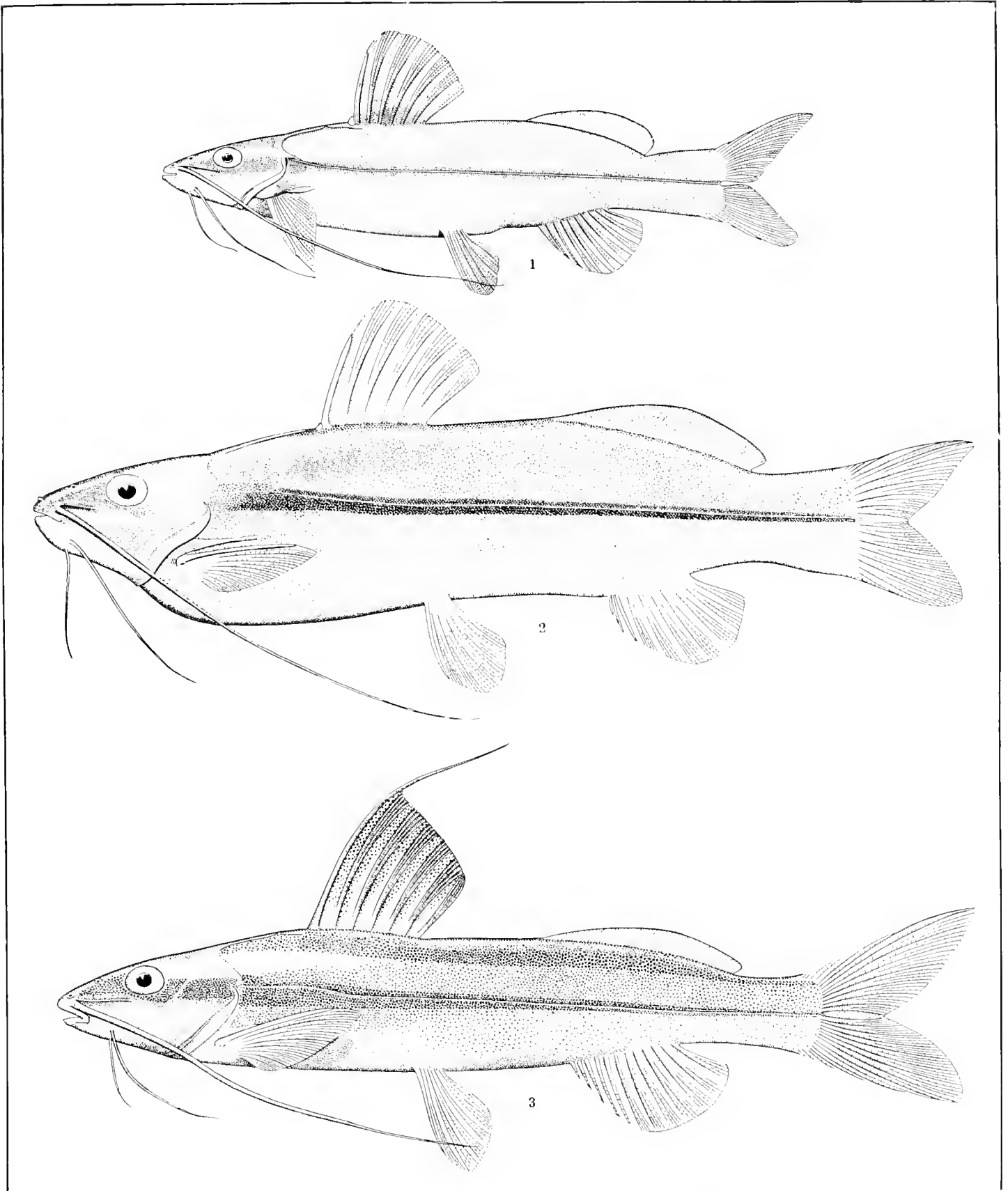
1. *Pimlodella serrata* EIGENMANN. TYPE, C. M. No. 6967, 67 MM. SAN JOAQUIN, BOLIVIA.
2. *Pimlodella cristata* (MÜLLER & TROSCHEL). I. U. M. No. 12064, 176 MM. CREEK BELOW POTARO LANDING, GUIANA.
3. *Pimlodella avanhandava* EIGENMANN. TYPE, C. M. No. 6969, 85 MM. SALTO AVANHANDAVA.



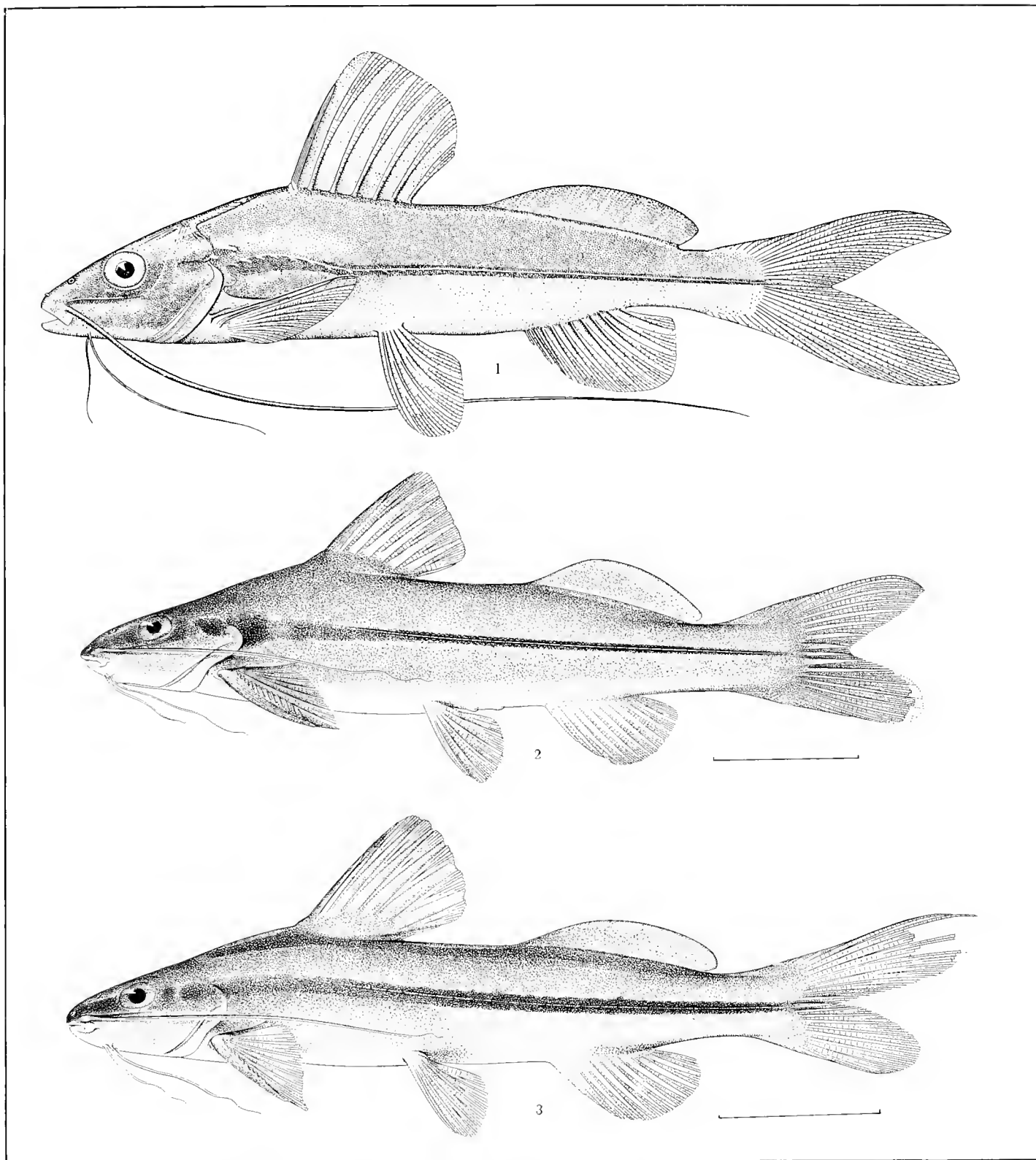
1. *Pimlodella hasemani* EIGENMANN. TYPE, C. M. No. 6968, 81 MM. SAN ANTONIO DE RIO MADEIRA.
2. *Pimlodella laticeps* EIGENMANN. TYPE, C. M. No. 6957, 62 MM. SAPUCAY, PARAGUAY.
3. *Pimlodella notomelas* EIGENMANN. TYPE, C. M. No. 6955, 51 MM. SAN LUIZ DE CACERES.



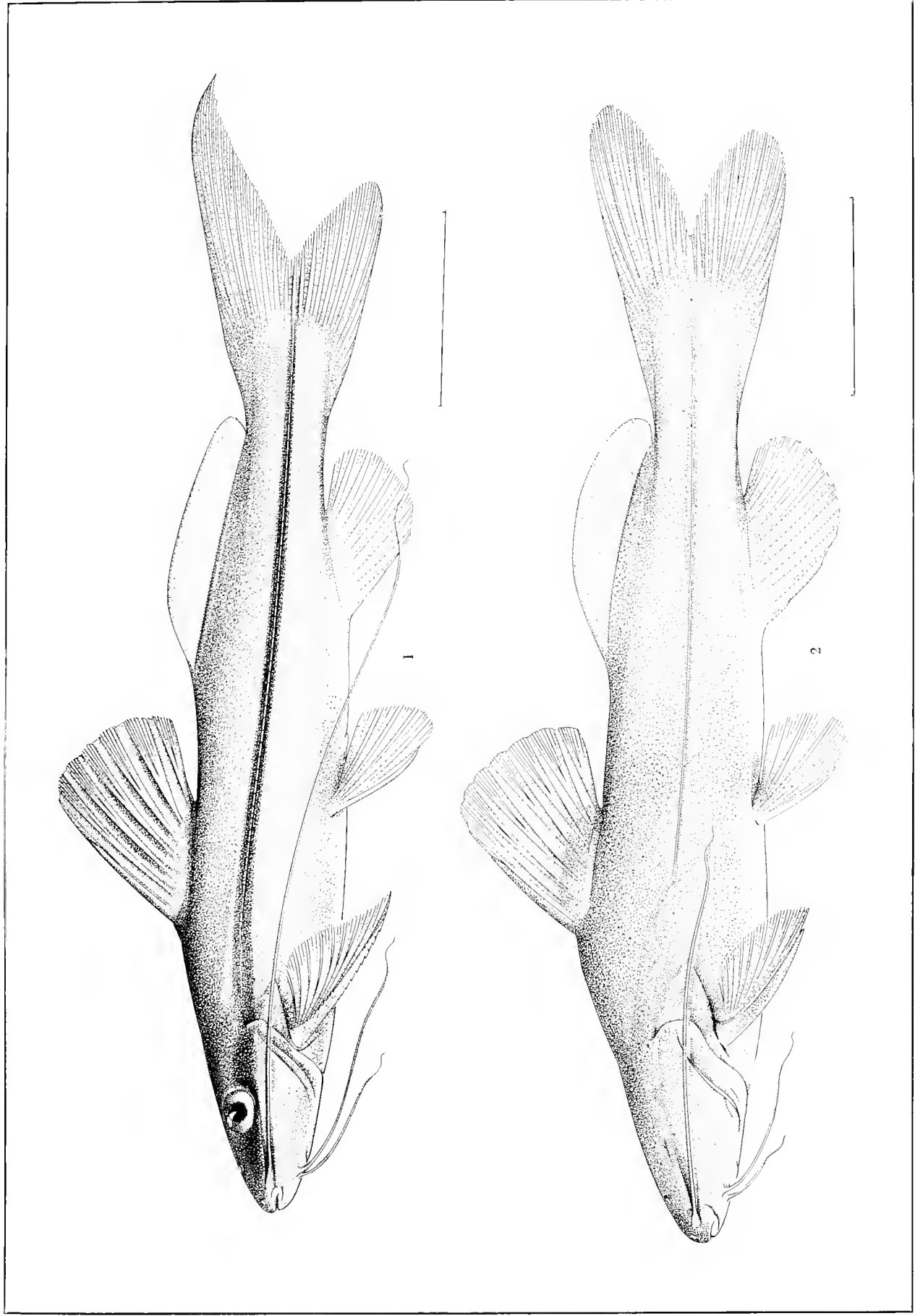
1. *Pimelodella meta* EIGENMANN. TYPE, C. M. No. 7141, 77 MM. RIO NEGRO, VILLAVICRUS S.
2. *Pimelodella boliviana* EIGENMANN. TYPE, C. M. No. 6961, 90 MM. SANTA CRUZ DE LA SIERRA, BOLIVIA.
3. *Pimelodella itapicuruensis* EIGENMANN. TYPE, C. M. No. 6974, 77 MM. QUEIMADAS, R. ITAPICURU.



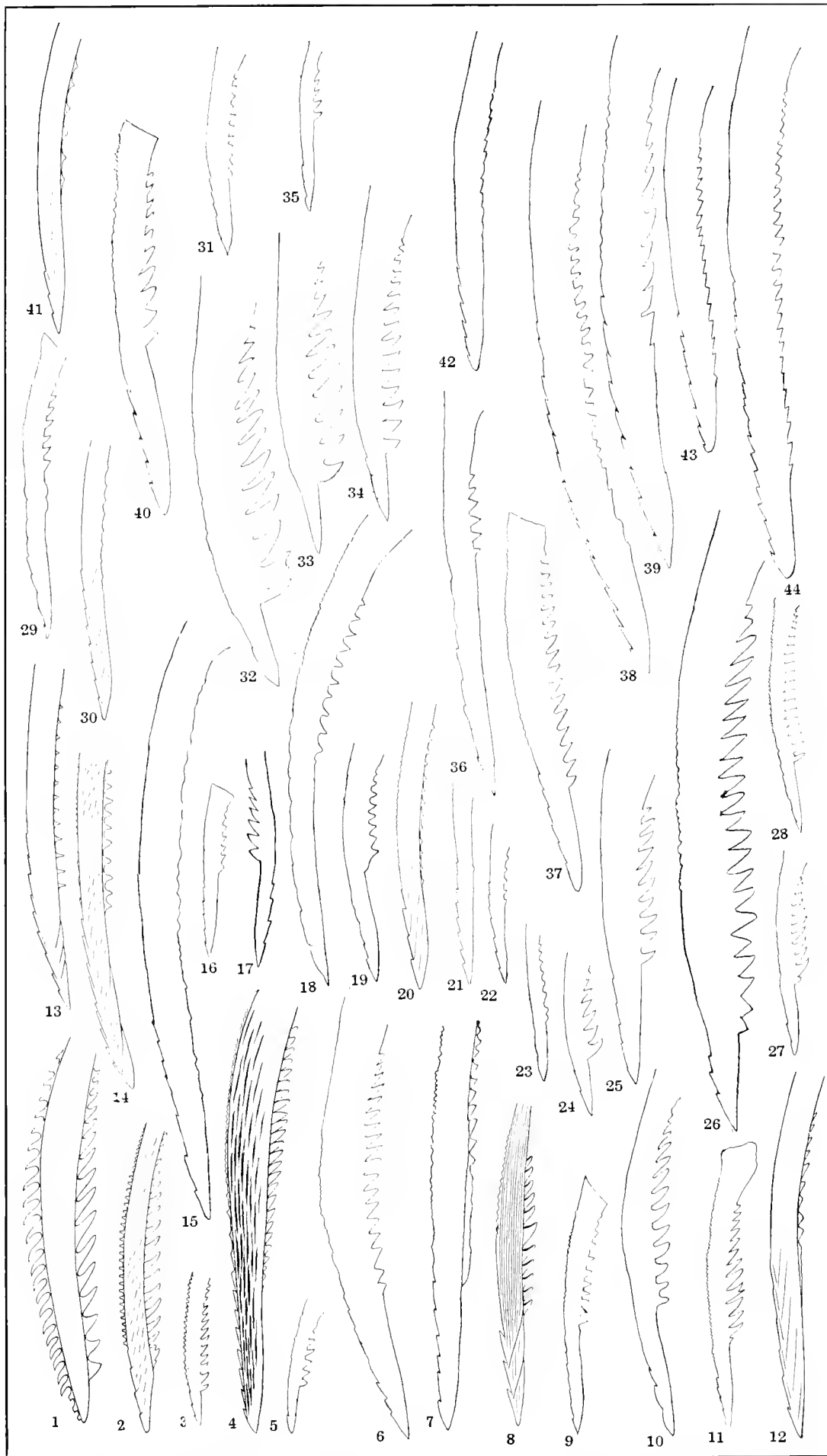
1. *Pimelodella meeki* EIGENMANN. TYPE, FIELD MUS. NO. 3400, 120 MM. SÃO PAULO.
2. *Pimelodella meeki* EIGENMANN. C. M. NO. 6980, 117 MM. SAPINA, SÃO PAULO.
3. *Pimelodella griffini* EIGENMANN. TYPE, C. M. NO. 6962, 87 MM. SAPUCAY, PARAGUAY.



1. *Pimelodella mucosa* EIGENMANN. C. M. No. 6959, 135 MM. PUERTO SUAREZ, PARAGUAY.
2. *Pimelodella grisea* REGAN. I. U. M. No. 13588, 148 MM. CORDOVA, RIO DAGUA.
3. *Pimelodella chayresi* (STEINDACHNER). U. S. N. M. ABOUT 145 MM. MONTE LIRIA, C. Z.



1. *Pimelodella cutania* REGAN. I. U. M. No. 13593, 147 MM. ISTMINA.
2. *Typhlobagrus kronoi* RIBEIRO. C. M. No. 7443, 146 MM. CAVERNA DAS AREIRAS.



PECTORAL SPINES OF SPECIES OF *Pimelodella*, VIEWED FROM ABOVE AND GREATLY MAGNIFIED.
(See explanation at end of text.)

21. Minute Book of the Virginia Court Held at Fort Dunmore (Pittsburgh) for the District of West Augusta, 1775-1776. CRUMRINE90	56. Meryocochærus, etc. DOUGLASS.	
22. Minute Book of the Virginia Court Held for Yohogania County, first at Augusta Town (now Washington, Pa.), and afterward on the Andrew Heath Farm near West Elizabeth, 1776-1780. CRUMRINE	2.25	57. New Merycoidodonts. DOUGLASS. (Nos. 56 and 57 sold together.)	1.00
23. Minute or Order Book of the Virginia Court Held for Ohio County, Virginia, at Black's Cabin (Now West Liberty, W. Va.), &c. CRUMRINE	1.50	58. Further Collections of Fishes from Paraguay. EIGENMANN, MCATEE, and WARD	1.25
24. The Records of Deeds for the District of West Augusta, Virginia, for the Court Held at Fort Dunmore, &c. CRUMRINE	1.75	59. Undetermined Element in the Osteology of the Mosasauridæ. HOLLAND20
25. Astropecten (?) montanus, &c. DOUGLASS10	60. Gasteropoda of the Chazy. RAYMOND	1.35
26. Astrodon (Pleurocœlus) in the Atlantosaurus Beds of Wyoming. HATCHER. (<i>Out of Print.</i>)		61. Occurrence of Wynea Americana in Pa. JENNINGS05
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28. New Vertebrates from the Montana Tertiary. DOUGLASS	1.25	63. Vertebrate Fossils from the Vicinity of Pittsburgh, Pa. CASE15
29. New Genus and Species of Tortoise from the Jurassic of Colorado. O. P. HAY10	64. Illænidæ from the Black River Limestone near Ottawa, Canada. RAYMOND and NARRAWAY20
30. Osteology of Oxydactylus. PETERSON	1.00	65. Rhinoceroses from the Oligocene and Miocene of North Dakota and Montana. DOUGLASS25
31. Birds of Erie and Presque Isle. TODD75	66. Fossil Horses from North Dakota. DOUGLASS30
32. J. B. Hatcher. By W. J. HOLLAND15	67. Oligocene Lizards. DOUGLASS20
33. Tropidoleptus Fauna at Canandaigua Lake, etc. RAYMOND. (<i>Out of print.</i>)		68. The Type of Stenomylus gracilis. PETERSON25
34. Two Turtles from the Judith River Beds of Montana. O. P. HAY. (<i>Out of print.</i>)		69. New Species of Birds from Costa Rica, etc. CARRIKER10
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37. Crawfishes of Western Pennsylvania. ORTMANN	1.00	72. List of the Lepidoptera of Western Pa., etc. ENGEL	1.25
38. The Geology of Southwestern Montana. DOUGLASS40	73. Fauna of Upper Devonian in Montana. Fossils of Red Shales. RAYMOND60
39. New Crocodile from the Jurassic of Wyoming. HOLLAND10	74. New Species of Procamelus from Upper Miocene of Montana. DOUGLASS30
40. Procambarus, a New Subgenus of the Genus Cambarus. ORTMANN15	75. Sections of the Conemaugh Series between Pittsburgh and Latrobe, Pa. RAYMOND35
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		94. Ordovician Trilobites, No. III. RAYMOND & NARRAWAY35

95. Ordovician Trilobites, No. IV. RAYMOND40	133. Osteology of Lasiopyga and Callithrix, etc. SHUFELDT25
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120. Two Mummy Labels. ALLEN10	157. A New Species of Apatosaurus. HOLLAND7
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130. New Genus and Species of Abyssinian Rodents. CHILDS FRICK20	167. A Trip to Islands in Lake Erie. GOODRICH15
131. New Titanotheres from the Uinta. PETERSON20	168. Land-Shell of Islands at Western End of Lake Erie, etc. CLAPP20
132. Small Titanotheres from the Lower Uinta. PETERSON10	169. Orthoptera of the Isle of Pines. HOLLAND & KAHL15

15,716

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OF THE
CARNEGIE MUSEUM.

VOL. VII.

No. 5.

W. J. HOLLAND, EDITOR.

THE PYGIDIIDAE, A FAMILY OF SOUTH
AMERICAN CATFISHES

By CARL H. EIGENMANN.

PITTSBURGH.

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15. New Pennsylvania Thorns. ASHE25	20. Boundary Controversy Between Pennsylvania and Virginia, 1748-1785. CRUMRINE30

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VOL. VII.

No. 5.

THE PYGIDIIDÆ, A FAMILY OF SOUTH AMERICAN CATFISHES.¹

BY CARL H. EIGENMANN.

(PLATES XXXVI-LVI.)

INTRODUCTION.

The *Pygidiidæ* are a family of South American catfishes distinguished externally by the absence of an adipose fin and by the posterior position of the dorsal. Most of them are even more readily distinguished by the presence of spines or thorns on the opercle and interopercle, by twin barbels at the angle of the mouth, and by the absence of all mental barbels. Other characters of the catfishes may be present or absent, and by addition, subtraction, or modification of characters, various subfamilies have been formed. A description of the characteristic structures is given on pages 276-279. The basal habit of all the members of the family is that of burrowing. The opercular and interopercular spines are an adaptation to their habit of insinuation, which is at the root of the commensalism, parasitism, and worse, to which some highly specialized members of the family are addicted.

Nematogenys from central Chile, the only representative of the *Nematogenyinae*, is probably more nearly like the ancestors of the *Pygidiidæ* than the other living representatives of the family. It recalls the *Siluridæ* by having a pungent pectoral spine, serrated on its posterior margin, by having but one barbel at the angle of the mouth (the remaining subfamilies having two), by having a pair of mental barbels,

¹ Contribution from the Zoölogical Laboratory of Indiana University, No. 164.

and by the absence of opercular and interopercular spines, which are present in the other subfamilies. Its dorsal is farther forward than in the other members of the family, again in this respect approaching the *Siluridae*. It resembles the rest of the *Pygidiidae* in lacking an adipose fin and in the case of some specimens by having a nasal barbel. I am not able to speak with certainty of its air-bladder.²

The principal subfamily is that of the *Pygidiinae*. In addition to the main characteristics of the family, the members of the subfamily have a barbel on the anterior nostril, the gill-membranes are free from the isthmus, the teeth are in bands. The genera of the *Pygidiinae* differ but little from each other. *Eremophilus*, found on the plains of Bogotá, has lost its ventrals; *Hatcheria*, living in the Andes of Argentina and Chile, has an elongate dorsal fin, *Scletonema* from the Uruguay has modified maxillaries and maxillary barbels. The main genus, *Pygidium*, with sixty-three species, is found everywhere in the mountains and sparingly in the lowlands. It attains the highest altitudes and flourishes in Lake Titicaca, where it is a food-fish of importance. The only food-fish at Bogotá is the closely related *Eremophilus*, "El Capitan." Seventy-one of the known species of the family belong to the subfamily *Pygidiinae*.

² The genus *Pariolius* may be related to *Xenotogenys*, but it is more likely to be related to *Phreatobius*, *Heptapterus*, *Myoglanis*, *Leptorhamdia* (for *Leptoglanis* which is pre-occupied), etc. The only specimen recorded has been lost.

I. PARIOLIUS* Cope.

Pariolius, COPE, Proc. Acad. Nat. Sci. Phila., 1871, p. 289.

Type.—*Pariolius armillatus* Cope.

Similar to *Pygidium*; no nasal barbel; a single barbel at the angle of the mouth; two pairs of mental barbels; no armature on the opercles; gill-openings wide; teeth brush-like; origin of the dorsal behind that of the ventrals; anus under dorsal; anal short.

Little can be said about the relationship of this genus until its skull and air-bladder are examined. It appears to be closely related to some members of the *Pimelodinae*. There are no specimens available for examination. It is known only from the type of the species, and that has been lost.

Habitat.—Basin of Peruvian Amazon.

Pariolius armillatus COPE, *l. c.* (Ambyiaeu); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), 11, 1889, p. 50; Occasional Papers Cal. Acad. Sci., 1, 1890, p. 321; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 398.

"Head flat rounded, eyes small, superior, covered by the skin. Head 1.5 times in length to basis of caudal fin. Depth at D. 1. one-half length to basis pectoral fin; width of head two-thirds the same distance. Interorbital width 3.66 times in length of head. Maxillary and external mental barbels extending beyond basis of pectoral; inner mental barbel one-half the same. Radii D. 7; P. 8; V. 6; A. 11; caudal acuminate. Skin entirely smooth."

* I am not sure of the origin of this generic name. Is it from the proper name Parioli, or from *πάραιολίζω* = *to trick*, hence a trickster or simulator, or from *παρά* = *with*, and *αίολος* = *speckled*?

Nearest the *Pygidiinæ* are the *Parciodontinæ*, which lack a nasal barbel. The teeth are very peculiar and in a single series (See Fig. 21) and the gill-membranes are attached. But one species is known. The *Nematogenyinae*, *Pygidiinæ*, and *Parciodontinæ* are free-living, and have a terminal or subterminal mouth and pointed or incisor teeth.

The *Stegophilinæ*, *Vandelliinæ*, and *Tridentinæ* differ widely from the members of the above-mentioned subfamilies in structure and habit. They are all small or minute; the mouth is inferior; the head flat below; the lower barbel at the angle of the mouth is minute. The jaws are weak, the teeth absent or slender. The gill-opening, in all but *Acanthopoma*, is greatly restricted, which, put in terms of habit, means that the mouth is suctional. Some of them are parasites, or commensals.

The *Tridentinæ* differ in having the anal fin much longer than the others. Nothing is known of their habits and they are so small (the largest known specimen is but 27 mm. long) that it is a wonder that any of them have arrived in the bottles of the naturalist.

In the *Vandelliinæ* the teeth are reduced to a minimum, and the rami of the lower jaw do not meet in the middle. The differences between the genera are minute, but well marked. The habits of these fishes, as well as those of the next subfamily, are discussed below.

The *Stegophilinæ* have a very large number of minute teeth in definite series in both jaws. The rami of the lower jaw meet in the middle. The genus *Acanthopoma* stands out in that its gill-membranes, while united, are free from the isthmus. The genus, *Henonemus*, is well marked by the small number of opercular spines. *Ochmacanthus* has numerous accessory caudal rays above and below, which make the tail look like that of a tadpole. The remaining genera, *Stegophilus*, *Homodiatus*, and *Pseudostegophilus*, might well be united. They differ from each other largely in the position of the ventrals, the shape of the caudal, and in the number of accessory rays.

HABITS.

The habits, as well as the distribution, of various members of the *Pygidiidæ* have been derived from the general tendency of the catfishes to get under banks, under logs, out of the way, and out of sight. This general tendency has been modified into the specialized, insinuating habit of the *Pygidiidæ*, for which the opercular spines and the eel-like body are adaptations.

On the plains of Bogotá the Indians secured the largest specimens of *Eremophilus* by thrusting their arms to the bottom of holes in the banks of streams. At Honda I found one species buried in the sand in the bottom of the stream. It

would dart from its hiding place as I raked my fingers through the sand, to dart into the sand again much like a lancelet or young lamprey, or to dodge under a rock. Mr. E. B. Williamson wrote me that he noticed another species clinging to the vertical sides of a waterfall. It looked like a water-weed, but he found by watching closely that every little while the supposed weed would move up the wall a short distance, and by using his butterfly-net he secured specimens. It is this habit assisted by the opercular spines that accounts for the fact that the species of the genus *Pygidium* are found in every mountain-stream.

The habit of insinuating themselves into crevices is undoubtedly also the starting point of the habit of resorting to the gill-cavities and probably other organs of larger fishes. There is a widely distributed belief among the Indians of the Amazon Valley, that fishes called "Candirú" enter the urethrae of bathers. Some travelers who have had this habit reported to them have simply dismissed the matter as absurd. Others have made attempts to identify the fish with results that have not always been fortunate. The native name, Candirú, is applied to some fishes (*Cetopsis* of the *Cetopsidæ*) at least a foot long, and at least two inches thick, as well as to minute slender fishes, species of *Vandellia*, which might enter the urethra without violating the law that the greater cannot enter the less. The habit has been attributed to the large *Cetopsis*, to *Parciodon*, more moderate in size and yet too large, and to some species of *Vandellia* and to *Acanthopoma*. It is, of course, possible that the young of the larger Candirús have the urinophilous habit. It is also possible that the Indians consider the small Candirús (species of *Vandellia*) as the young of the larger Candirús, members of the genus *Cetopsis*, which according to the classification adopted, belong to a different family. The habit is also physically possible for the species of *Tridens*, of *Miuroglanis*, of *Paravandellia*, *Stegophilus*, *Branchioica*, and for some of the minute species or young of *Pygidium*. However, these have not been indicated as being Candirús. As far as I am able to find, the first notice of the peculiar habit is given by Spix (*Selecta Genera et Species Piscium*, 1829, p. viii), who says of *Cetopsis*:

De alio pisce hominibus infesto nonnulla afferre debeo, quem Brasilienses CANDIRÚ, Hispani in provincia Maynas degentes CANERO nuncupant. Singulari enim instinctu incitatur in ostia excretoria corporis humani intrandi, quae quum igitur in iis, qui in flumine lavant, attingit, summa cum violentia irrepit, ibeque carnem morsu appetens, dolores, imo vitae periculum affert, Urinae odore hi pisciculi valde alliciuntur, quam ob causam accole intraturi flumen amazonum, ejus sinus hac peste abundant, preputium ligula constringunt, et a mingendo abstinent. Pertinet hic piscis ad Cetopseos, quod depinximus, genus; at nescio, an descriptarum specierum (*C. candirú* et *C. caecutiens*) individua juniora, an tertiae ejusdem speciei minoris individua crudeli hoc instinctu a natura sint donata.

I am indebted to Professor Selatie E. Stout for the following translation:

I should briefly mention another fish which is dangerous to man. The Brazilians call it CANDIRÚ; the Spaniards in Maynas³ call it CANERO. It is impelled by a curious instinct to enter the excretory openings of the human body. Whenever it comes in contact with these openings of persons bathing in the stream, it violently forces its way in, and having entered, it causes constant pain, and even danger of life, by biting the flesh. These fishes are greatly attracted by the odor of urine. For this reason, those who dwell along the Amazon, when about to enter the stream, whose bays abound with this pest, tie a cord tightly around the prepuce and refrain from urinating. This fish belongs to *Cetopsis*, a genus which I have already described. But I do not know whether it is the younger individuals of the two species which I have described (*C. candirú* and *C. cocutiens*), or whether a third species of smaller fishes has been given this cruel instinct by nature.

The habit here described by Spix in reality belongs to fishes of which he did not secure specimens.

In 1808, Domingo Vandelli, professor of natural history at Lisbon, sent Lacépède three small fishes, which he placed with the *Loricariidæ*. They were described by Valenciennes (Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XVIII, 1846, p. 386, pl. 547) as *Vandellia cirrhosa*, and placed in their *Esoces*. Nothing was said of the habits, and even the habitat of the specimens was unknown. The identification of *Vandellia* with the urinophilous habit came later.

Castelnau in his *Animaux d'Amérique du Sud, Poissons*, 1855, says of his *Trichomycterus pusillus* = *Parciodon microps* Kner:

Cette espèce est, de la part des pêcheurs de l'Araguay, l'objet d'un préjugé des plus singuliers, ils prétendent qu'il est très dangereux d'uriner en rivière: car, disent ils, ce petit animal s'éclance hors de l'eau et pénètre dans l'urèthre en remontant le long de la colonne liquide.

As this species reaches a length of at least six inches and a corresponding thickness, Castelnau was probably mistaken in the species acting in this remarkable manner.

It seems that Paul Marcoy (*Voyage à travers l'Amérique du Sud*, Vol. II, p. 145-147) gives an account with a figure of a Candirú. I have not seen this book, but Lütken says: "Etude de Candirú signeret med den Rejsendes Initialer, er en fuldstandig Umulighed, hvad den saa skal forstille" (*Vidensk. Meddel. Naturh. Foren. Kjöbenhavn*, 1891, p. 60).

Lange "In the Amazon Jungle," p. 214, says:

In fact, throughout the Amazon this little worm-like creature, called the kandiroo, is so omnipresent that a bath-house of a particular construction is necessary. The kandiroo is usually

³ Probably Mainá, an Igarapé tributary to the Amazon, near the Rio Negro; or a province of Peru with Moyobamba for its capital.

three to four inches long and one-sixteenth in thickness. It belongs to the lampreys, and its particular group is the Myxinos or slime-fish. Its body is coated with a peculiar mucus. It is dangerous to human beings, because when they are taking a bath in the river it will approach and with a swift, powerful movement penetrate one of the natural openings of the body, whence it can be removed only by a difficult and dangerous operation.

A small but hard and pointed dorsal fin acts as a barb and prevents the fish from being drawn back. While I was in Remate de Males the local doctor was called upon to remove a kandiroo from the urethra of a man. The man subsequently died from the hemorrhage following the operation.

The Candirú does not belong to the lampreys and its particular group is not Myxinos. The lampreys are not found in the Amazon Valley. Its dorsal fin is neither hard nor pointed, and hence cannot act as a barb to prevent the fish from being withdrawn. The retrorse spines on the interopercle and opercle are the obstacles which would prevent it from being withdrawn.

The question naturally arises: Is Lange more trustworthy in his account of the habit than in his account of the structure and relationship of the Candirú?

The only known specimen of *Acanthopoma annectens*, another Candirú, seems to have been collected by Gustav Wallis. In an article, "Mittheilung von C. Müller über die Reise von Gustav Wallis" in *Die Natur, Zeitung von P. Ule u. K. Müller*, XIX, No. 23, p. 180, mention is made of the habits of presumably this species, though it may have been drawn from the general report given the traveler concerning the Candirú. Lütken quotes:

In diesen noch so wenig bekannten Gewässern, namentlich im Huallága, beobachtete der Reisende (G. W.) einen Fisch, den ich der Aufmerksamkeit der Wissenschaft ganz besonders empfehlen will. Man nennt ihn dort den Candiru und fürchtet ihn mit Recht ebensowohl für das Gebiet des Wassers, wie man für das des Landes die Moskitos und Ameisen fürchtet. An sich selbst ist es nur ein kleines, kaum .75 Spannen langes Ding von welsartigem Körperbau, mit breitem, abgerundetem Kopfe, auf dem die beiden Augen ziemlich dicht neben einander liegen, während die beiden Brustflossen flügelartig dicht unter ihm sich ausbreiten und der übrige Körpertheil keilförmig zulauft. Den Rücken ziert eine dunklere Färbung mit undeutlich verlaufenden Flecken, so dass das Geschöpfchen an sich selbst kaum irgendwie durch eine hervorragende Eigenthümlichkeit ausgezeichnet ist. Eine umso schrecklichere Plage ist es für den Badenden, eine Art Blutegel nämlich, der mit unglaublicher Schwimffertigkeit jenem zu Leibe geht, ihm überall sehröpfkopfähuliche Wunden beibringt und, wenn es ihm gelungen, sich dadurch an dem Körper festzusetzen, in der Wunde ein Nadelbündel ausspreizt, an dem er wie an Widerhaken sich derart festklammert, dass er nur durch eine schmerzhaft Operation aus dem Körper entfernt werden kann. Diese Unart des Fisches ist umso grösser und gefährlicher als er am liebsten die geheimsten Körpertheile aussucht; man erzählt sich Fälle, die bei der Operation mit dem Tode endeten. Ich werde dafür Sorge tragen, dass dieser seltsame Fisch, den ich in Spiritus vor mir habe, in die rechten wissenschaftlichen Hände gelangt und seinen wissenschaftlichen Namen empfängt, den er noch nicht hat.

Boulenger (*Proc. Zool. Soc. London*, 1897, p. 901) says of *Vandellia cirrhosa*, the urinophilous Candirú, *par excellence*:

The "Candyrú," as the fish is called, is much dreaded by the natives of the Jurua district, who, in order to protect themselves, rarely enter the river without covering their genitalia by means of a sheath formed of a small coconut-shell, with a minute perforation to let out urine, maintained in a sort of bag of palm-fibers suspended from a belt of the same material. The fish is attracted by the urine, and when once it has made its way into the urethra, cannot be pulled out again, owing to the spines which arm its opercles. The only means of preventing it from reaching the bladder, where it causes inflammation and ultimately death, is to instantly amputate the penis; and at Tres Unidos, Dr. Bach had actually examined a man and three boys with amputated penis as a result of this dreadful accident. Dr. Bach was therefore satisfied that the account given of this extraordinary habit of the "Candyrú" is perfectly trustworthy. Mr. Boulenger further showed a photograph, taken by Dr. Bach, of two nude Indians wearing the protective purse.

It is to be noted here that this evidence is only circumstantial. Dr. Bach did not himself operate or help to operate to remove the Candirú and a much simpler operation than amputation would be sufficient to remove it.

The literature on the evil repute of members of the *Pygidiidae* has been reviewed by Pellegrin. In *Bulletin Société Philomathique de Paris* (10), I, 1909, pp. 101-104 [5-8 of the reprint], he says:

Le Dr. C. Jobert qui accomplit au Brésil, en 1877, un voyage où il rassembla des matériaux ichthyologiques considérables, a consacré à la question du Candiru un mémoire des plus documentés, où il n'admet pas sans réserve les déclarations du praticien américain cité par G. A. Boulenger. 'Le Dr. Bach,' écrit-il, 'n'a pas vu le petit Poisson in situ; la chose est regrettable et, cette fois encore, nous ne sortons pas du cercle de la légende.'

Toutefois, le Dr. Jobert rapporte les dires d'un médecin très estimé de Belem (Pará), le Dr. Castro, qui lui affirma avoir extrait de l'urèthre d'une négresse un petit Candiru qui y avait pénétré pendant la miction, alors qu'elle se baignait en rivière.

Mais ce qui fait le grand intérêt de l'article du Dr. Jobert, ce sont les renseignements qu'il a pu lui-même recueillir sur place au Brésil au sujet des Candirus.

Les Paraenses en distinguaient deux espèces, l'une petite, qui s'introduirait dans l'urèthre des baigneurs, l'autre de plus grande taille, 'trop grande pour tenter ces mêmes opérations, mais redoutable par les blessures qu'elle fait sur n'importe quelle partie du corps. On donne à cette dernière le nom de *Candiru de Cavallo* et les indigènes prétendent qu'elle attaque les chevaux pendant la baignade.' Au sujet de celle-ci il rapporte en outre les faits suivants:

'Un jour, à un mille environ en aval de Para, je voulus me baigner sans souci des Candirus qu'on m'assurait être très abondants en cet endroit. Je n'étais pas dans l'eau depuis cinq minutes que je ressentis dans le région lombaire, au ventre, sur le côtés de la poitrine, comme de légers coups de griffes qui se succédaient rapidement. Voyant l'eau se teinter de rouge autour de moi, je me hâtai de regagner le rivage et je constatai que, dans le région où j'avais éprouvé la sensation

de ces coups de griffe, le sang s'échappait de blessures en scarifications parallèles, qui eussent pu être attribuées à un instrument, tant elles étaient régulières; elles constituaient des groupes de 5 à 6 lignes, longues d'un centimètre au plus et très rapprochées; je n'ai pas cherché à apprécier a profondeur, mais ces blessures très étroites saignaient abondamment.⁷

Les Poissons qui ont attaqué ainsi le Dr. Jobert appartiennent suivant moi, incontestablement au genre *Vandellia*, peut-être même à l'espèce *Vandellia Wieneri*. Si l'on se reporte à la description donnée plus haut de la bouche et de l'appareil operculaire, on s'expliquera ainsi facilement le fonctionnement de ces divers organes; on comprendra aisément que la demi-couronne de dents en crochet placée en avant de la bouche, dents *susceptibles d'un certain degré d'érection et au nombre de 5 à 6 principales* produit ces *scarifications parallèles, régulière et en groupe de 5 à 6 lignes*. Les épines interoperculaires du dessous de la tête, aussi un peu érectiles, peuvent également, dans une certaine mesure, déchirer les téguments, mais elles doivent surtout servir à la fixation. Quant aux épines operculaires du dessus de la tête, elles me semblent plutôt, étant donnée la direction de leur pointe, destinées à faciliter la progression de l'animal et à empêcher tout recul lorsqu'il s'engage dans un conduit étroit, par exemple entre les lamelles branchiales des *Platy-stomes*.

Sans vouloir trancher la question de la pénétration des *Vandellies* dans l'urèthre, pour laquelle je ne puis apporter des documents nouveaux, il me paraît tout au moins démontré en rapprochant les détails anatomiques que j'ai pu constater sur les *Vandellia Wieneri*, des observations faites sur lui-même au Brésil par le Dr. Jobert, que les *Candirus*, véritables Poissons-sangsues, ne sont pas, ainsi que le pensait Günther, de simples commensaux des grands Siluridés sur lesquels ils vivent habituellement; leurs dents et leurs épines operculaires et interoperculaires permettent non seulement de se fixer sur les branchies de leur hôte, mais aussi de faire des blessures amenant un écoulement de sang abondant qu'une disposition spéciale leur permet d'ingurgiter. Enfin à l'état libre, comme la constaté le Dr. Jobert, les *Vandellies* ne craignent pas de s'attaquer à l'Homme, dont elles percent les téguments, ce qu'elles font aussi certainement sur certains Mammifères domestiques. Il y a lieu en terminant de noter que les dents volumineuses peu nombreuses, en forme de crochets acérés de la mâchoire supérieure, sont particulières au genre *Vandellia*, qu'elles sont absentes dans les genres voisins *Stegophilus* Reinhardt et *Acanthopoma* Lütken, où elles sont remplacées par une bande de très nombreuses petites dents acérées.⁴

Les *Vandellies* représentent donc, chez les Siluridés, le dernier terme de la spécialisation en vue d'un parasitisme des plus caractérisés.

That fishes found in the Amazon Valley and called *Candirú* are a nuisance is certain. Whether the widely prevalent belief that the *Candirú* is tropic to urine, and consequently has a tendency to enter the urethra, or whether the *Candirú*'s tendency to burrow leads it accidentally to enter the urethra, are all matters that must for the present remain in debate. A very interesting subsidiary question is, whether, if *Candirú*s are tropic to urine they do not also enter the

⁴ While members of the *Stegophilini* have bands of minute teeth uniform in size in the upper jaw there are frequently a few elongate, slender teeth in the middle of the upper jaw, which are similar and correspond to those of *Vandellia*.

urethræ of aquatic mammals and of large fishes. Further study may demonstrate that some species of *Candirús* have become parasitic in the bladders of large fishes and aquatic mammals. These are all questions that may legitimately be taken up by future expeditions.

The first of the commensals or parasites of this family to be described is the *Stegophilus insidiosus* of Reinhardt. Reinhardt secured all of his specimens from the gills of the giant catfish of the Rio das Velhas, a tributary of the Rio San Francisco. Haseman secured one specimen of this fish from the sandy island opposite Januaria, near the mouth of the Rio San Francisco. The fish therefore may and does live in the open as well as in the gill-cavities of larger fishes.

The account of *Stegophilus insidiosus* Reinhardt, given by the author of the genus and species, which was published in 1858 (Cf. *Naturhistorisk Forenings Videnskabelige Meddelelser*, Copenhagen, 1858, reprint, pp. 1-19, Pl. II) possesses great interest. Professor Reinhardt having been repeatedly informed that a large species of catfish, belonging to the genus *Pseudolatystomus* and known by the natives as *Sorubim*, protects its young by carrying them in its gills, determined, if possible, to verify the statement. An English translation of a portion of his narrative is here given:

It deeply interested me to ascertain with exactness the circumstances under which this peculiar method of protection takes place, and also to examine the young at the time when they make use of it. I therefore offered the fishermen in the vicinity of Lagoa Santa, where I was staying at the time, a good sum if they would bring me a *Sorubim* with some of its young in the gill-cavities. Finally on February 27, 1852, a fisherman brought me one, in the gills of which he said there should be a little "young one." On examination I indeed found there a young fish, hardly an inch long, which was already dead, although the *Sorubim* still showed faint signs of life. The little fish looked so unlike the big one that I was astonished, and upon finding out that the old fish was a male I was strengthened in my doubt as to their relationship. When the same fisherman two days later again brought a male *Sorubim* with a young one, which looked exactly like the first, but was about three times longer, it became clear to me that these two small fishes could in no wise be what it was claimed they were. On the other hand they recalled to me the picture I carried in my mind of a *Trichomycterus* which I had obtained one year previously from the Rio das Velhas under the name of *Cambeja*, or *Bagre molle*. I naturally concluded that the fisherman in order to get the reward offered, had brought me the young of this *Cambeja* and was passing them off as the young of the *Sorubim*. I complained to his face about this procedure, and, though I did not obtain any confession from him, I nevertheless had no doubt that I had been made the victim of a swindle. During the few weeks I still remained in Lagoa Santa before starting on my homeward journey to Europe, nothing happened to induce me to think otherwise.

Upon my return home, as soon as I could get access to the literature, and could make a direct comparison between the supposed young of the *Sorubim* and the *Cambeja*, I at once saw that I had made a mistake in assuming that the former were the young of the latter. In short these

so-called young of the Sorubim were the little fishes which I have had the honor of exhibiting to the Society. The whole matter became more involved and enigmatical to me, because it appeared that the fisherman, if he had been really guilty of an intended fraud, had for this purpose made use of a fish which was so rare that I had never found it, although I had collected great quantities of the various small fishes in the waters around Lagoa Santa; in fact a fish which I was forced to conclude to be as difficult to obtain as the real young of the Sorubim. In 1854, when I again visited Brazil, the solution of the riddle was one of my especial aims. Soon after I arrived at Lagoa Santa in the latter part of November I indeed reached the solution much more quickly than I had expected, and in the following manner:

A person from the vicinity of Lagoa Santa, but not the same one, who almost three years before had brought me the first *Stegophilus*, came to the village on a Sunday in the middle of December to attend mass according to the custom of the country. He brought with him on this occasion a Sorubim, which before he went to church he sold to a Frenchman who had a shop in the town. When mass was over he returned to get his pay, and watched the shopkeeper cut the fish into pieces. He remarked that when the fish had been pulled out of the water there had been five young in its mouth, of which two had remained inside. The shopkeeper looked and actually found the remaining "young," and was kind enough, as he knew the matter would interest me, to immediately bring them to me and relate the circumstances.

At the very first glance at the so-called "young" I saw to my surprise that *again Stegophili had been brought me as the young of the Sorubim*. That deception should again be at the bottom of the matter appeared in the highest degree improbable. It could hardly be thought of, except upon the assumption that the person who had sold the last Sorubim was in collusion with the fisherman who during my previous stay, three years before, had brought me the first two *Stegophili*. How could it be explained that both had conceived the idea of passing off the very same fish as the young of the Sorubim, and that a fish, which has no particular resemblance to the latter? But, even if there had been collusion, would it not have been more likely that the first party concerned would have come directly to me with his "Sorubim young," instead of leaving it to be more or less of a chance whether or not they should fall into my hands? Even if a trick, prearranged to allay a possible suspicion, were thinkable, nevertheless it was hard to believe that under the existing conditions the parties involved would have taken the time and the trouble to deceive me, unless they had expected to reap advantage from their effort. If a trick had been planned in the present case it was entirely aimless, as no pay was either asked, or given, for these last "young Sorubim"; and neither the last person, nor any one else, came at a later date to offer me "Sorubim young." There was therefore left for me no other alternative than to conclude that I had been unjust in my suspicion in the case of the fisherman who on the occasion of my previous stay had brought me the first *Stegophili*. In other words, this little fish in reality passes into and abides in the gill-cavities of the Sorubim. Its presence there has through an easily explained misinterpretation on the part of the common people given rise in Minas to the story about the Sorubim's care for its young.

The second species, *Branchioica bertonii*, known to inhabit the gill-cavities of larger fishes, is recorded in the present volume. It really belongs to the *Vandellinae*. One specimen was sent me several years ago by Sñ. A. de W. Bertoni from Puerto

Bertoni, Paraguay. Later he sent me two more specimens, all three having been taken from the gills of a large characin, *Piaractus brachypomus*.

Ribeiro, of the National Museum of Rio de Janeiro, caught another very similar member of this subfamily, *Paravandellia*, among the water-weeds of the stream near San Luis de Caeceres, in the Upper Paraguay basin.

With fishes as rare as these and as small as these, the question arises whether two species are really different, or whether the described differences are due to the fact that one worker uses a hand lens, and the other a binocular dissecting microscope with an arc spot-light. The results of the two instruments are comparable to the effects produced by an old-fashioned cannon and a modern forty-two centimeter howitzer. *Branchioica* and *Paravandellia* may prove to be synonymous.

DISTRIBUTION (Plates XXXVI–XXXIX.)

In considering the distribution of the fresh-water fishes of South America I found, among other things (*Proc. U. S. Nat. Mus.*, XIV, 1891, p. 18) "that genera of many species usually have a wide distribution, and conversely, genera of wide distribution usually have many species." With one exception the number of species of any genus of the *Pygidiidæ* varies directly with the greatness of the area over which it is distributed. Some genera consist of but one species, and that restricted to but one, or a few neighboring localities. As far as known, *Eremophilus* is all but confined to the plateau of Bogotá, *Scleronema* to the center of the Uruguay basin, *Acanthopoma* to a part of the Huallaga basin, *Stegophilus* to the Upper San Francisco basin, *Paravandellia* to the Upper Paraguay basin, *Branchioica* to the Lower Paraguay basin. The genera with more than one species invariably have a wider distribution. *Homodiatus*, with two species, is limited to the lower and central La Plata basin, *Henonemus*, with four species, to the Amazon basin, *Hatcheria*, with six species, to the Andes of central and southern Argentina and Chile, and *Pygidium*, with sixty-three species, is found in all the mountain streams from the Tuyra in southern Panama to central Chile and central Argentina, in the mountain streams from Rio Grande do Sul to the Rio São Francisco, and sparingly in the lowlands of Guiana and Brazil. The only exception to the general rule is *Ochmacanthus*, with three species, ranging from Guiana to Paraguay.

The *Pygidiinæ* are mountain forms, and while they are found in lowlands near the mountains, we find the optimum in the plains of Bogotá and in Lake Titicaca. They are sometimes the last species to succumb in the struggle with adverse conditions found in high altitudes, and they range further south (to latitude 47° 30'), than any other tropical American fishes.

The *Stegophilina*, *Vandelliina* and *Tridentina* are essentially lowland forms, although some species reach considerable elevations.

CHRONOLOGY.

The first species of the *Pygidiidae* discovered was taken by Humboldt at Bogotá, and described in 1805 (*Recueil d'Observations de Zoologie*, etc., pp. 17-19, pl. VI) as *Eremophilus mutisii*.

The habit of one of the species was next described by Spix in 1829, but attributed to a member of another family. See page 262.

The most prominent genus was first described by Meyen (Reise, I, p. 475, *Wiegm. Arch. Naturg.*, 1835, II, p. 269) as *Pygidium*. I have at diverse times defended the name, *Pygidium*, as against the name *Trichomycterus* and its variations.

The various generic names and their present equivalents are given in the following table:

Name Proposed.	Proposed in	Present Equivalent.
<i>Eremophilus</i> Humboldt	1805	<i>Eremophilus</i> Humboldt.
<i>Trichomycterus</i> Cuvier & Valenciennes	1805	<i>Eremophilus</i> Humboldt.
<i>Trichomycterus</i> Valenciennes	1833	<i>Pygidium</i> Meyen.
<i>Vandellia</i> Cuvier & Valenciennes	1846	<i>Vandellia</i> Cuvier & Valenciennes.
<i>Thrychomycterus</i> Cuvier & Valenciennes	1846	<i>Pygidium</i> Meyen.
<i>Thrichomycterus</i> Girard	1855	<i>Pygidium</i> Meyen.
<i>Parciodon</i> Kner	1855	<i>Parciodon</i> Kner.
<i>Centrophorus</i> Kner	1855	<i>Parciodon</i> Kner.
<i>Stegophilus</i> Reinhardt	1858	<i>Stegophilus</i> Reinhardt.
<i>Astemomycterus</i> Guichenot	1860	<i>Parciodon</i> Kner.
<i>Pariodon</i> Günther	1864	<i>Parciodon</i> Kner.
<i>Trachypoma</i> Giebel	1871	<i>Eremophilus</i> Humboldt.
<i>Tridens</i> Eigenmann & Eigenmann	1889	<i>Tridens</i> Eigenmann & Eigenmann.
<i>Pseudostegophilus</i> Eigenmann & Eigenmann	1889	<i>Pseudostegophilus</i> Eigenmann & Eigenmann
<i>Miuroglanis</i> Eigenmann & Eigenmann	1889	<i>Miuroglanis</i> Eigenmann & Eigenmann.
<i>Acanthopoma</i> Lütken	1891	<i>Acanthopoma</i> Lütken.
<i>Homodiatus</i> Eigenmann & Ward	1907	<i>Homodiatus</i> Eigenmann & Ward.
<i>Henonemus</i> Eigenmann & Ward	1907	<i>Henonemus</i> Eigenmann & Ward.
<i>Hatcheria</i> Eigenmann	1909	<i>Hatcheria</i> Eigenmann.
<i>Ochmacanthus</i> Eigenmann	1912	<i>Ochmacanthus</i> Eigenmann.
<i>Gyrinurus</i> Ribeiro	1912	<i>Ochmacanthus</i> Eigenmann.
<i>Paravandellia</i> Ribeiro	1912	<i>Paravandellia</i> Ribeiro.
<i>Cobitoglanis</i> Fowler	1914	<i>Henonemus</i> Eigenmann.
<i>Urinophilus</i> Eigenmann	1917	<i>Urinophilus</i> Eigenmann.
<i>Branchioica</i> Eigenmann	1917	<i>Branchioica</i> Eigenmann.

LOCATION OF THE TYPES AND SPECIMENS IN THE MUSEUMS OF THE WORLD.

The species are, for the most part, but little known. Over forty of the ninety-five recorded species are known only from the types, which are widely scattered. Ten or twelve of the types are in Vienna, two are in Berlin, eleven or twelve in Paris, eleven in London, one in Torino, Italy, two possibly in Munich, one in the University of Leipzig, two in Copenhagen, three presumably in Santiago, Chile, three in Buenos Aires, five in Rio de Janeiro, two in Córdoba, Argentina, one in the Field Museum, two in the Philadelphia Academy of Sciences, eight in the Museum of Comparative Zoölogy at Harvard, eight in Indiana University, twenty-four in the Carnegie Museum, one in Princeton University. The Carnegie Museum possesses forty-six species, Indiana University is next in line with thirty-two species, and the Museum of Comparative Zoölogy comes third with twenty species.

The distribution of the known specimens in the various museums of the world is given in the following table:

	Vienna Museum,	Berlin Museum,	Paris Museum,	British Museum,	Santiago,	Buenos Aires,	Rio de Janeiro,	Univ. of Michigan,	Field Museum,	Acad. Nat. Sc. Phila.	U. S. National Museum,	Museum Comp. Zoölogy,	Indiana University,	Carnegie Museum,
1. <i>Nematogenys incrimis.</i>			type									+		
2. <i>Scleronema operculatum</i>														type
3. <i>Hatcheria patagoniensis</i> ⁵													+	+
4. <i>Hatcheria maculata</i>			type		?							+	+	+
5. " <i>tilcombi</i>											+		type	
6. " <i>arcolatum</i>			type	+		+						+		
7. " <i>burmeisteri</i>				+		type								
8. " <i>macraei</i>												type		+
9. <i>Pygidium marmoratum</i>														
10. <i>Pygidium pallidum</i>					type?									
11. " <i>tigrinum</i>					type?									
12. " <i>tenuis</i> ⁶					type?									
13. " <i>cordubensis</i> ⁶				+										
14. " <i>spgazzinii</i>						type								
15. " <i>borcllii</i> ⁷				type		+								
16. " <i>eichorniarum</i>							type							+

⁵ Type in Princeton University.
⁶ Types in Córdoba, Argentina?
⁷ Types in Mus. Univ. Torino, Italy?

	Vienna Museum.	Berlin Museum.	Paris Museum.	British Museum.	Santiago.	Buenos Aires.	Rio de Janeiro.	Univ. of Michigan.	Field Museum.	Acad. Nat. Sc. Phila.	U. S. National Museum.	Museum Comp. Zoology.	Indiana University.	Carnegie Museum.
17. <i>Pygidium rojanum</i>						type								
18. " <i>heterodon-</i> <i>tum</i>													type	
19. <i>Pygidium fuscum</i>		type												
20. " <i>cigenmanni</i>												type		
21. " <i>cellatum</i> . . .				type										
22. " <i>dispar</i>		type										+		
23. " <i>punctula-</i> <i>tum</i>			type									+	+	
24. <i>Pygidium taczanowskii</i>	type	+	type									+	+	
25. " <i>rivalatum</i>			type	+						+		+	+	
26. " <i>pocyanum</i>										type				
27. " <i>fassli</i>	type													
28. " <i>barbouri</i>												type	+	+
29. " <i>orojiv</i>											+	type	+	+
30. " <i>quechuorum</i>	type													
31. " <i>laticeps</i> ⁸ . . .	type?												+	+
32. " <i>stellatum</i> . . .													+	type
33. " <i>chapmani</i>													+	type
34. " <i>tanium</i> ⁸	type?												+	+
35. " <i>calicose</i>													+	type
36. " <i>latidens</i>													type	
37. " <i>mla</i>													type	
38. " <i>stramineum</i>													+	type
39. " <i>unicolor</i>				type										
40. " <i>kueri</i>	type												+	
41. " <i>merida</i>				type									+	
42. " <i>bogotensi</i>								+					+	type
43. <i>Pygidium nigroma-</i> <i>culatum</i>				type				+					+	+
44. <i>Pygidium banncaui</i>													+	type
45. " <i>spilosoma</i> . . .				type									+	+
46. " <i>dorsostri-</i> <i>atum</i>													+	type
47. <i>Pygidium venulosum</i>	type													
48. " <i>latistri-</i> <i>atum</i>														type
49. <i>Pygidium striatum</i>									type		+		+	+
50. " <i>regani</i>													type	
51. " <i>retropinnu</i>				type										
52. " <i>guianense</i>														type
53. " <i>conradi</i>													+	type
54. " <i>gracilior</i> . . .														type
55. " <i>amazoni-</i> <i>cum</i>	type													
56. <i>Pygidium hasemani</i> . .													+	type
57. " <i>nigricans</i>			type											
58. " <i>ihcingi</i>													type	+
59. " <i>zonatum</i>														type
60. " <i>proops</i>							type							+
61. " <i>paolucci</i>														type
62. " <i>reinhardti</i>														type
63. " <i>davisi</i>														type

⁸ Types possibly in Munich.

	Vienna Museum	Berlin Museum	Paris Museum	British Museum	Santiago	Buenos Aires	Rio de Janeiro	Univ. of Michigan	Field Museum	Acad. Nat. Sc. Phila.	U. S. National Museum	Museum Comp. Zoology	Indiana University	Carnegie Museum
64. <i>Pygidium immaculatum</i>												type		+
65. <i>Pygidium vermiculatum</i>														type
66. <i>Pygidium alternatum</i>													+	type
67. " <i>goldii</i>				type										
68. " <i>brasiliense</i>				?			+					+		+
69. " <i>italiava</i>							type							
70. " <i>triguttatum</i>														type
71. " <i>punctatissimum</i>			type											
72. <i>Pygidium minutum</i>				type										
73. " <i>santa-rita</i>														type
74. <i>Ercmophilus mutisii</i>			type										+	+
75. <i>Parciodon microps</i>	type		+				+			+				
76. <i>Pseudostegophilus nemurus</i>				type								+		+
77. <i>Homodiatus anisitsi</i>													type	
78. " <i>maculatus</i>	type													+
79. <i>Henonemus macrops</i>	type													+
80. " <i>punctatus</i>				type									+	+
81. " <i>taxis-tigma</i>										type				
82. <i>Henonemus intermedius</i>												type		
83. <i>Stegophilus insidiosus</i> ⁹														+
84. <i>Acanthopoma annectens</i> ¹⁰														
85. <i>Ochmacanthus bathrachostoma</i>							type							+
86. <i>Ochmacanthus reinhardti</i>	type													+
87. <i>Ochmacanthus flabeliferus</i>													+	type
88. <i>Vandellia cirrhosa</i>			type	+			+					+		+
89. " <i>plazai</i>			type				+					+		+
90. " <i>wieneri</i>			type											
91. " <i>hasemani</i>														type
92. " <i>sanguinea</i>														type
93. <i>Paravandellia oxypetala</i>							type							
94. <i>Branchioica bertoni</i>													type	+
95. <i>Tridens melanops</i>												type	+	
96. " <i>brevis</i>												type		
97. <i>Miuroglanis platycephalus</i>												type		

⁹ Types in Copenhagen.

¹⁰ Types in the collection of Professor Leuckhart.

SOURCES OF THE MATERIAL EXAMINED.

In 1890 Mrs. Eigenmann and myself published a revision of the *Pygidiidae* as part of the general monograph on the Nematognathi of South America (Occasional Papers California Academy of Sciences, Vol. I, 1890, pp. 316-347). Our account was based on the material in the Museum of Comparative Zoölogy, which was collected during the Nathaniel Thayer Expedition to Brazil, 1865-1866, during the U. S. Naval Astronomical Expedition to the Southern Hemisphere, across the Andes from Lima, 1849-1852, during the Hassler Expedition at Santiago, Chile, and Callao, Peru, and during Alexander Agassiz's Expedition of 1875 to Lake Titicaca. I have freely drawn on this monograph, which describes some species, which have not been duplicated.

From time to time Mr. J. D. Anisits and Sr. A. de W. Bertoni have sent collections to Indiana University from Paraguay, containing, among other things, the types of *Homodictus* and *Branchioica*. Similarly collections were sent from São Paulo by Messrs. Hermann and Rudolph von Ihering.

The collections made by the late J. B. Hatcher for Princeton University were received and reported upon by me in Vol. III of the Reports of the Princeton University Expedition to Patagonia.

Miss Lola Vance made a small but valuable collection, containing specimens of *Pygidium oroya*, near Tarma, Peru.

The Yale-National Geographic Society Expedition to Peru collected a few specimens in the Urubamba Valley, which are being reported upon in the Bulletin of the Museum of Comparative Zoölogy.

I collected several species in British Guiana, which were described in the Memoirs of the Carnegie Museum, V, 1912.

Mr. Thomas Barbour collected *Pygidium barbouri* in the Beni River in Bolivia.

Several specimens, some of them new, were purchased for the collection of Indiana University from W. F. H. Rosenberg, London.

By far the greater and most valuable collections were secured in Ecuador and Colombia, and in Brazil, Uruguay, Paraguay and the Argentine.

The collections from Colombia were made by several field-parties. I collected between Bogotá and Buenaventura and at Istmina. Mr. Arthur W. Henn collected between Buenaventura and Istmina. Mr. Henn also collected in the upper valley of the Patia and southward in the Andes of Ecuador. Mr. Manuel Gonzales collected in Colombia along the routes from Bogotá west to Honda, north to Mogotes, and east to Barrigona, securing a wealth of material. Messrs. A. S. Pearce, M. A. Carriker, Jr., and Alexander Grant Ruthven collected in the Sierra

Nevada de Santa Marta for the University of Michigan, and Mr. E. B. Williamson secured specimens for me in the Sierra Nevada, and in other places in Colombia.

Mr. J. D. Haseman, who collected for the Carnegie Museum, secured many species, especially between the Rio São Francisco and Buenos Aires, as well as in the upper Paraguay basin and in the Amazon.

At one time or another I have examined all of the seventy-one species preserved in American Museums, fifty-eight species in the Indiana University Museum and the Carnegie Museum being under my immediate charge. Nine of the eighteen known genera and forty-three of the ninety-five known species were described by me during the course of my study.

I have attempted to collect what is known of the members of the family. I hope the result will help the next one who undertakes the study of the group and stimulate the collection of additional specimens and facts of the commensal or parasitic members of the family.

THE ZOÖLOGICAL POSITION OF THE PYGIDIIDÆ.

PHYLUM PISCES Artedi.

Class TELEOSTOMI Bonaparte.

SUPERORDER OSTARIOPHYSI Sagemehl.

Order PLECTOSPONDYLI Cope.

Family: PYGIDIIDÆ Eigenmann & Eigenmann.

Subfamilies:

NEMATOGENYINÆ Günther.

PYGIDIINÆ Eigenmann & Eigenmann.

PAREIODONTINÆ Eigenmann.

STEGOPHILINÆ Günther.

VANDELLINÆ Eigenmann.

TRIDENTINÆ Eigenmann.

SYNONYMY.

= *Siluroidei Trichomycteriformes* BLEEKER, Nederl. Tijdschr. Dierk., I, 1863, p. 112.

> *Siluridae Opisthoptera* GÜNTHER, Cat. Fish. Brit. Mus., V, 1864, p. 4 and p. 271.

< *Siluridae Branchicolæ* GÜNTHER, *l. c.*, p. 4 and p. 276.

= *Trichomycteridae* GILL, Arrangement of Families of Fishes, 1872, p. 19.

< *Pygidiidae* EIGENMANN & EIGENMANN, Am. Nat., July, 1888, p. 649; Occasional Papers California Academy Sciences, I, 1890, p. 316.

< *Pygidiidae* GILL, Mem. Nat. Acad. Sci., VI, 1893, p. 132.

< *Trichomycteridae* REGAN, Ann. & Mag. Nat. Hist. (8), VIII, 1911, p. 57.
 = *Trichomycteridae* RIBEIRO, Archivos do Museu Nacional, XVI, 1912, p. 219.

LIMITS OF THE FAMILY PYGIDIIDÆ. (Plates XL and XLI.)

Günther, in his "Catalogue of the Fishes of the British Museum," V, 1864, pp. 271-277, arranges the then known members of the *Pygidiidae* under three "Groups," belonging to two of his eight Subfamilies of the *Siluridae*. His seventh Subfamily, the *Siluridae Opisthoptera*, consists of his Fifteenth Group, the *Nematogenyina* (*Heptapterus* and *Nematogenys*) and the Sixteenth Group, the *Trichomycterina* (*Trichomycterus* (= *Pygidium*), *Eremophilus*, *Pariodon*). His Eighth Subfamily, the *Siluridae Branchicola*, consists of his Seventeenth Group, the *Stegophilina* (*Stegophilus* and *Vaudellia*).

The genus *Heptapterus*¹¹ included in his Fifteenth Group, was shown by us in the *American Naturalist*, July, 1888, p. 648, to "have no real affinity with the *Pygidiidae*."

We do not now feel justified in joining the *Cetopsina* to the family.

The *Pygidiidae*, as here understood, are the *Pygidiina* (exclusive of *Pariolius* and the *Stegophilina* of the family, as described by Eigenmann & Eigenmann, in the *American Naturalist*, July, 1888, and Occasional Papers of the California Academy of Sciences, I, 1890. The species known at the time, thirty-six in number, belonging to eight genera, were reviewed in the last named paper. The *Cetopsina*, included in the papers mentioned, constitute a distinct family. Regan (*Ann. & Mag. Nat. Hist.* (8), VIII, 1911, p. 574) has united the *Pygidiina* and *Stegophilina* in his *Trichomycterina* of his *Trichomycteridae* = *Pygidiidae*. The family includes the South American Nematognaths without an adipose fin, with the dorsal over or behind the ventrals; posterior air-bladder obsolete; the anterior minute, in two lateral parts, enclosed in bony capsules with a complete osseous floor, united to the exoccipital and epiotic bones proximally and to the suprascapula distally; neural spine of the coalesced vertebrae very low, not as high as that of the vertebrae following them; parapophysis of the vertebrae following the capsule short; skull depressed, entirely closed in front, without an open space between the osseous roof of the mouth and the ethmoid; vomer and palatines weak, without teeth; clavicles wide, scoop-shaped, meeting below. The place of the adipose fin sometimes occupied in part by numerous accessory caudal rays; none of the fin-rays modified into spines; nares remote from each other, the anterior one frequently provided with a barbel; the maxillary ending in a short barbel; the lower lip usually ending in

¹¹ Related to *Heptapterus* is the genus *Phreatobius*, for an account of which see the Appendix to this paper.

another shorter barbel just beneath the maxillary barbel; this lower labial barbel is sometimes very minute and has been overlooked in describing some species of *Henonomus* and *Pseudostegophilus*, and in some species of other genera.

Mental barbels, characteristic of many Nematognaths, are lacking, except in *Nematogenys*. Thorn-like spines firmly attached to the opercle and the interopercle in all but *Nematogenys*. The opercles and interopercles to which the spines are attached are erectile, and by first erecting those on one side and then those of the other, the fishes are able to "elbow" their way forward in narrow openings, under rocks and up waterfalls. In some cases the spines are directed backward, but in *Vandellia* the opercular spines point obliquely upward and backward, the interopercular spines downward and backward.

All of the species secrete a copious mass of mucus, and the larger, ones are as

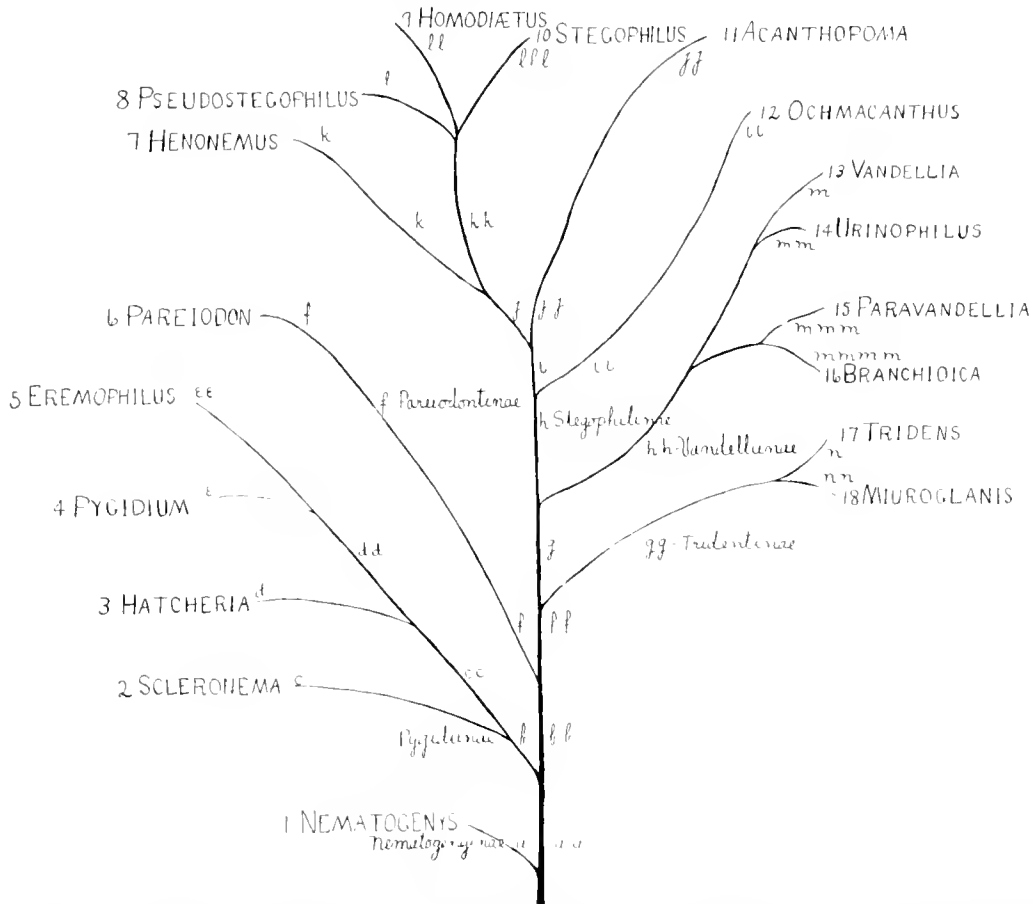


FIG. 1. Phylogenetic tree showing the relationship of the *Pygidiidae*. The letters correspond to the letters in the key to the subfamilies and genera. The *Nematogenyinae* are undoubtedly the most primitive of the family. The *Pygidiinae* have the family characteristics fully developed. Beyond these we have the more highly specialized subfamilies, culminating in the parasitic *Stegophilinae* and the urinophilous *Vandelliinae*.

slippery as the proverbial eel, which they resemble in other respects. The pectoral gland is very large in the smaller species.

KEY TO THE SUBFAMILIES AND GENERA OF THE PYGIDIIDÆ.

- a.* One pair of mental barbels, no opercular or interopercular spines; one barbel at angle of mouth; a small nasal barbel; pectoral spine pungent; dorsal over ventrals. (*Nematogenyina*.)
I. Nematogenys Girard.
- aa.* No mental barbels; opercle and interopercle with spines; two barbels at angle of mouth; pectoral spine not pungent.
- b.* A nasal barbel; mandible with considerable antero-posterior extent, teeth along less than half its total length; teeth strong; anal short; no mental barbels; opercle and interopercle with spines; two barbels at angle of mouth; free-living species, some of them of economic importance. (*Pygidiina*.)
- c.* Opercle with a long dermal flap; maxillary bone longer than the attached barbel; teeth narrow incisors; pectoral without a filament; anal short. **II. Scleronema** Eigenmann.
- cc.* Opercle without a dermal flap; maxillary very small.
- d.* Dorsal long; caudal peduncle subterete; anal usually entirely under the dorsal; outer pectoral ray without a filament. **III. Hatcheria** Eigenmann.
- dd.* Dorsal shorter; caudal peduncle compressed; anal partly or entirely behind the dorsal; outer ray of the pectoral prolonged or not.
- e.* Ventrals present. **IV. Pygidium** Meyen.
- ee.* No ventral fins; otherwise like *Pygidium*. **V. Eremophilus** Humboldt.
- bb.* No nasal barbels.
- f.* Mouth subterminal, the teeth strong, in a single series; gill-membranes united with isthmus; anal short. (*Parciodontina*.) **VI. Pareiodon** Kner.
- ff.* Mouth inferior.
- g.* Anal short, of 7-11 rays, its origin usually behind, rarely under that of the dorsal; lower barbel at angle of mouth minute; eyes superior. Species small, some of them commensals or parasites.
- h.* Mouth wide, teeth very numerous, in several very regular series; rami of the lower jaw transverse, meeting, with teeth along its entire length; premaxillary large. (*Stegophilina*.)
- i.* Accessory caudal rays few, not conspicuous; caudal not fan-shaped nor excessively contracted at base; upper lip with fine, hair-like, movable teeth.
- j.* Gill-membrane confluent with the isthmus; gill-openings reduced to a narrow slit in front of the pectoral.
- k.* Opercle with two spines. **VII. Henonemus** Eigenmann & Ward.
- kk.* Opercle with four to twelve spines.
- l.* Caudal deeply forked, the upper lobe prolonged; eight or nine spines on the interopercle; color in bands; origin of ventrals equidistant from caudal and angle of mouth.
VIII. Pseudostegophilus Eigenmann & Eigenmann.
- ll.* Caudal emarginate or obliquely rounded, origin of ventrals nearly equidistant from snout and caudal; color, if present, in spots. **IX. Homodiætus** Eigenmann & Ward.

lll. Caudal rounded; few accessory rays; origin of ventrals one-and-a-half to twice as far from snout as from caudal.

X. **Stegophilus** Reinhardt.

jj. Gill-membranes united, free from the isthmus. . . XI. **Acanthopoma** Lütken.

ii. Accessory caudal rays very numerous, the tail like that of a tadpole; base of caudal very narrow; no hair-like teeth on the upper lip.

XII. **Ochmacanthus** Eigenmann.

hh. Mouth narrower, the rami of the lower teeth feeble, not transverse, not meeting in the middle; teeth few, slender, pointed. (*Vandellina*.)

m. A few depressible teeth in a single series in the middle of the upper jaw; mandibles without teeth, or with a few excessively minute teeth on the ends of the rami; caudal rounded or emarginate

XIII. **Vandellia** Cuvier & Valenciennes.

XIV. **Urinophilus** Eigenmann.

mm. A band of depressible teeth in the middle of the upper jaw; a series of much smaller teeth laterad of the median band; no teeth on the mandible; caudal forked, the upper lobe longer. XV. **Paravandellia** Ribeiro.

mmm. Two series of depressible teeth in the middle of the upper jaw; a single series of much smaller ones laterad of the median series and a claw-like tooth on the end of the maxillary¹² of the median series; two short series of teeth on the ends of the mandible; caudal subtruncate.

XVI. **Branchioica** Eigenmann.

gg. Anal long, with fifteen to twenty-five rays, its origin in front of that of the dorsal; eyes large, lateral; caudal rounded or emarginate. (*Tridentina*.)

n. Opercular and subopercular patches of spines distinct; head greatly depressed, the eyes infringing on both the upper and lower surfaces of the head; mouth inferior; a series of fine labial teeth and strong teeth in the jaws; gill-membranes united, forming a broad free fold across the isthmus; opercle long, slender, ending in a few thorns; interopercle with similar but smaller thorns.

XVII. **Tridens** Eigenmann & Eigenmann.

nn. Opercular and subopercular patches of spines confluent; head less depressed; mouth subinferior; several series of strong teeth in each jaw; gill-membrane broadly united with the isthmus, without a free margin.

XVIII. **Miuroglanis** Eigenmann & Eigenmann.

Genus I. NEMATOGENYS¹³ Girard.

Nematogenys GIRARD, Proc. Acad. Nat. Sci. Phila., 1854, p. 198.

Type.—*Trichomycterus incermis* Guichenot.

Origin of dorsal over or slightly in front of origin of ventrals, near middle of the body; nasal barbels small; a single maxillary barbel at angle of mouth; a shorter mental barbel below it; mouth wide, terminal; teeth in a broad band in each jaw; gill-membranes narrowly joined to the isthmus; first pectoral ray spinous, with

¹² Possibly the premaxillary. See under the genus.

¹³ $\nu\eta\mu\alpha$, $\tau\acute{o}$ = thread, $\gamma\acute{\epsilon}\rho\upsilon\varsigma$, η = jaw. In allusion to the maxillary barbel.

serræ on its posterior margin; anal short; fontanel extending to the base of the occipital process, with a bridge over posterior margin of the eye; opercle and interopercle unarmed.

This genus resembles members of the *Pimelodinae* more than the other species of the family, and is probably nearer the primitive stock of the family than the following more highly specialized genera, if it is not a member of the *Siluridae*.

Habitat.—Chile.

1. *Nematogenys inermis* (Guichenot). (Plate XLII, figs. 1, 2.)

Native name "Bagre."

Trichomycterus inermis GUICHENOT, in Gay, Hist. Chil. Zoöl., II, 1848, p. 312; 1854, pl. IX, fig. 2 (Chile).

Nematogenys inermis GIRARD, Proc. Acad. Nat. Sci. Phila., 1854, p. 198; U. S. Nav. & Astron. Exped., 1855, p. 240, pl. XXXII (Rio Maypu near Santiago); GÜNTHER, Cat. Fish. Brit. Mus., V, 1864, p. 272; PHILIPPI, Mb. Ak. Wiss., Berlin, 1866, p. 716; EIGENMANN & EIGENMANN, Proc. Cal. Acad. Nat. Sci., (2), II, 1889, p. 50 (Curico; Santiago); Occasional Papers Cal. Acad. Sci., I, 1890, p. 323 (Curico; Santiago); Proc. U. S. Nat. Mus., XIV, 1890, p. 36; DELFIN, Catalogo de los Peces de Chile, 1901, p. 29 (Central Provinces of Chile); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1909, p. 246, pl. XXXI, fig. 2; 1910, p. 398, pl. XXXII, fig. 2.

Nematogenys nigricans PHILIPPI, Mb. Ak. Wiss., Berlin, 1866, p. 716.

Nematogenys pallidus PHILIPPI, *l. c.*, p. 716.

Habitat.—Fresh-waters of central Chile.

Head 3.8–4.33; depth 6–7; D. 10; A. 11; P. I, 8; Br. 11–12; eye small, superior; interocular little less than snout; caudal peduncle about as deep as body; origin of dorsal one-fifth nearer snout than to base of middle caudal rays in specimens 120 mm. long, one-fifth nearer caudal than snout in specimens 260 mm. long; origin of anal much behind the last dorsal ray; fins all rounded; caudal with numerous accessory rays. Light brown, mottled with darker; a series of about five light areas along the lateral line; fins speckled.

Genus II. *SCLERONEMA*¹⁴ Eigenmann. (Plate XXXVI.)

Scleronema EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 691.

Type.—*Scleronema operculatum* sp. nov.

Allied to *Pygidium*.

Ventrals nearer snout than to caudal; outer pectoral rays shortest, without a

¹⁴ σκληρός = hard, νήμα, τὸ = thread, in allusion to the hard base of the maxillary barbel.

filament; opercle with a long dermal flap; interopercular spines in a much more restricted area than in species of *Pygidium*; accessory rays of the caudal inconspicuous; maxillary barbel with a large osseous base (maxillary). Teeth very narrow incisors; mouth wide, terminal.

In other respects like *Pygidium*.

Habitat that of the single species.

1. *Scleronema operculatum* EIGENMANN. (Plate XLIV, fig. 1.)

Scleronema operculatum EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 691. 7077, C. M., type, one, 79 mm.; 7539 a-c, C. M. paratypes, 65-80 mm. Cacequy, Uruguay basin. Feb. 1, 1909. Haseman.

Head 5.2-5.66; D. 12.5; A. 7.5 counting the rudimentary rays; P. 7; eye in anterior half of the head; interocular five times in the length of the head; width of mouth nearly half the length of the head.

Nasal barbel short, reaching just beyond posterior nares; maxillary barbel reaching about half-way to the tips of the opercular spines, the bony base much longer than the soft filament; a broad, free membrane above from near the anterior nares to the tip of the osseous base of the barbel, a narrower membrane along the outer edge of the base of the barbel; six spines in the main row of the interopercle; opercular flap reaching to or beyond base of the last pectoral ray; pectoral about as long as the head; origin of ventrals about equidistant from the snout and from the base of the middle caudal rays; ventrals reaching beyond the anus, not quite to the anal, equal to the portion of the head behind the nasal barbels; origin of anal under the posterior part of the dorsal, the distance from the base of its last ray to the caudal four times in the length; caudal narrow and long, equal to the length of the head, its margin slightly oblique, rounded; origin of dorsal over posterior half of ventrals, the distance from the first ray to the caudal 1.3 in its distance from the snout.

Middle of sides with a series of large spots, similar spots along the back.

Genus III. HATCHERIA¹⁵ Eigenmann. (Plate XXXVI.)

Hatcheria EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1909, p. 248.

Type.—*Hatcheria patagoniensis* Eigenmann.

Origin of dorsal behind that of the ventral, which is near middle of the body; nasal barbels large; two barbels of nearly equal size at the angle of the mouth; no mental barbels; mouth terminal; teeth conic or narrow incisors, in a few series;

¹⁵ In memory of J. B. Hatcher, leader of the Princeton University Expeditions to Patagonia.

gill-membrane free or very narrowly joined to the isthmus; first pectoral ray not continued as a filament; opercles and interopercles with numerous spines; dorsal

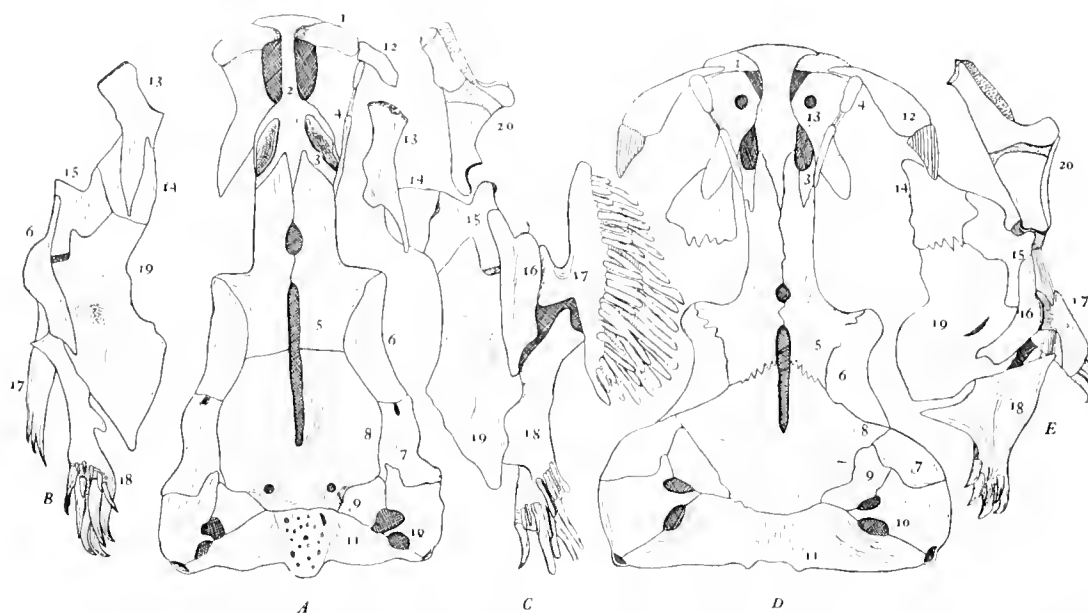


FIG. 2. A-C. *Hatcheria patagoniensis* Eigenmann. A. Skull from above. B. Opercular apparatus, etc., as seen from above when attached to the skull. C. The same spread out flat. D-E. *Scleroneuma operculatum* Eigenmann. D. Skull from above. E. Opercular apparatus spread out flat. 1, Premaxillary; 2, ethmoid; 3, lateral ethmoid; 4, nasal; 5, frontal; 6, sphenotic; 7, pterotic; 8, supra-occipital; 9, epiotic; 10, supraclavicle; 11, parapophysis of coalesced vertebrae; 12, maxillary; 13, palatine; 14, metapterygoid; 15, quadrate; 16, pre-opercle; 17, interopercle; 18, opercle; 19, hyomandibular; 20, mandible.

long, emarginate; caudal peduncle slender, the fin wider than the peduncle, with few accessory rays; origin and end of anal under the long dorsal, except in *H. arcolata*.

Habitat.—In the mountain-streams of northern Argentina, central Chile, and southward. Replacing the species of the genus *Pygidium* east of the Andes in the south, and largely also west of the Andes. Its definite boundaries not known.

KEY TO THE SPECIES OF HATCHERIA.

- a. Dorsal with fourteen to seventeen rays.
- b. Origin of dorsal equidistant from tip of caudal and some part of the snout; D. 15; last ray of anal under the last ray of the dorsal or very little farther forward.
- c. Distance between anal and caudal 4.5 in the length; origin of ventrals nearer the caudal than the snout; origin of anal nearer tip of caudal than head; origin of dorsal equidistant from tip of caudal and posterior nares 1. *patagoniensis* Eigenmann.
- cc. Distance between anal and caudal 3.75 in the length; origin of ventrals nearer snout than to caudal; origin of anal nearer the head than tip of caudal; origin of dorsal equidistant from tips of snout and caudal 2. *maculata* (Cuvier & Valenciennes).

- bb. Origin of dorsal equidistant from tip of caudal and occiput.
 d. Last anal ray under the dorsal; D. 17.....3. *titcombi* Eigenmann.
 dd. Last anal ray behind the last dorsal ray; D. 14....4. *areolata* (Cuvier & Valenciennes).
 aa. Dorsal with twenty-one rays; anal entirely under the dorsal.
 e. Ventrals nearer tip of caudal than snout.....5. *burmeisteri* (Berg).
 ee. Ventrals nearer snout than tip of caudal.....6. *macraei* (Girard).

1. *Hatcheria patagoniensis* EIGENMANN.

Hatcheria patagoniensis EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1909, p. 250 (Rio Blanco, at base of Andes, latitude 47° 30', longitude 72° W.; the southernmost record of the family); *l. c.*, 1910, p. 399.

Habitat.—Eastern slope of the Andes between latitudes 47° 30' and 31° 30'.

Mr. Haseman collected the following specimens:

7084, C. M., two, 66 and 82 mm. San Juan, Argentina. Feb. 25, 1909.

7085, C. M., six, 34–77 mm. San Juan, Argentina. Feb. 26, 1909.

11370 and 11371, I. U. M., four, paratypes, 94–120 mm. Rio Blanco; Hatcher.

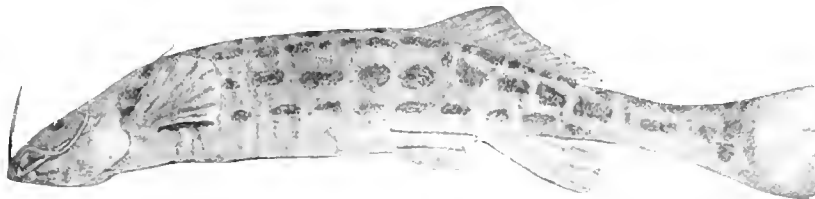


FIG. 3. *Hatcheria patagoniensis* Eigenmann. From a paratype in Indiana University.

Head 5; depth 8; D. (13) 15; A. 6. Elongate, slender; caudal peduncle slender, its depth nearly three times in the head, about four times in its length; upper maxillary barbel reaching pectoral, lower maxillary barbel reaching to margin of interopercle; a broad lobe of skin joining base of lower maxillary barbel to the lower lip; snout pointed, mouth narrow, its width 3.5 in head, equal to interorbital; nasal barbels reaching beyond eye; width of head but little less than its length; greatest width of body behind the pectorals, 1.6 in the length of the head. Gill-opening not extending forward to below eye; origin of dorsal equidistant from tip of caudal and posterior nares; base of dorsal equal to its distance from the caudal, its free surface emarginate, the anterior lobe rounded, the posterior pointed; beginning of last third of dorsal not much more than half as high as anterior lobe. Caudal moderate, emarginate, its lobes rounded, .8 of the length of the head. Anal broadly rounded, its last ray about under last ray of dorsal. Ventrals broad, their middle under origin of dorsal, 1.5 in head, equal to height of anal. Base of pectoral horizontal, closing edgewise to the body, its lower part folded when appressed, its first ray sickle-shaped, slightly prolonged. Dark yellowish, more or less regularly spotted with darker; dorsal, caudal, and pectorals irregularly blotched with black.

Some of the cotypes are more robust in body; in one the anal is blotched like the caudal; in some the spots form regular series along the sides, leaving lighter stripes between them.

2. *Hatcheria maculata* (Cuvier & Valenciennes). (Plate XLII, figs. 3-5.)

Trichomycterus maculatus CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1816, p. 493 (San Iago); GUICHENOT, in Gay, Hist. Chile, II, 1848, p. 311 (Chile); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 273; PHILIPPI, Mb. Ak. Wiss. Berlin, 1866, p. 716 (Chile); DELFIN, Catálogo, de los Peces de Chile, 1901, p. 30.

Trichomycterus maculatus GIRARD, Proc. Acad. Nat. Sci. Phila., 1854, p. 199; U. S. Naval & Astron. Exped. 1855, p. 243 (Rio Mapocho).

Pygidium maculatum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 51 (Rio Mapocho); Occasional Papers Cal. Acad. Sci., I, 1890, p. 329; Proc. U. S. Nat. Mus., XIV, 1890, p. 36.

Hatcheria maculata EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1909, p. 249, pl. XXXIII, figs. 1, 1a and 1b; 1910, p. 399.

Habitat.—Pacific slope of Chile.

Head 5.33; depth 7.5; D. 15; A. 9. Elongate, somewhat compressed; head as long as wide; caudal peduncle long and slender. Eye small, midway between tip of snout and end of opercle. Lips and lower surfaces of the head thickly covered with warts. Gill-openings not continued forward to below the eye, the membranes joined to the isthmus for a distance equal to one-third the width of the mouth. Pectorals rounded, the first ray not produced; origin of dorsal in front of the vent, but some distance behind the ventrals, equidistant from tip of snout and tip of caudal, its last ray over the last ray of the anal. Caudal long, truncate. Anal short and high, its height about equal to the length of the caudal, its distance from the base of the caudal 3.75 in the length. Origin of the ventrals equidistant from tip of snout and base of caudal, their tips reaching beyond the vent. Back and sides marbled with light and dark brown; fins pale, immaculate.

3. *Hatcheria titcombi* EIGENMANN. (Plate XLIV, fig. 2.)

Hatcheria titcombi EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan. 1918, p. 692.

Pygidium arcotatum EYERMANN & KENDALL (*non* Cuvier & Valenciennes), Proc. U. S. Nat. Mus., XXXI, 1906, p. 86. (Rio Comajo, tributary of Lake Traful, tributary to Rio Limay.)

Habitat.—Eastern slope of the Andes in Argentina, Limay basin.

14110, I. U. M., one, 164 mm. Arroyo Comajo, J. W. Titcomb.

This specimen is one of those mentioned by Evermann and Kendall in the paper quoted above. It differs from *P. areolatum* as described by Cuvier and Valenciennes, whose specimen came from Chile, west of the Andes. The origin of the dorsal is farther back, and its last ray is beyond the last ray of the anal.

Head 6.33; depth 6.5; D. 17.5 (3 and 14.5); A. 9.5, counting the minute imbedded rays in each case; P. 9; front margin of the eye in the middle of the head; interocular a little over three times in the length of the head, eye three in the interocular. Teeth very narrow chisels; nasal barbel reaching to above first interopercular spines, maxillary barbel to middle of opercular spines. Pectoral rounded, its first ray not prolonged, nearly two-thirds the length of the head; origin of the ventrals equidistant from snout and last fifth of the middle caudal rays; first anal ray under the sixth dorsal ray, the last anal ray under the fourth from the last ray of the dorsal; distance between anal and caudal 4.75 times in the length; origin of dorsal equidistant from tip of caudal and middle of pectorals, its distance from the caudal two times in its distance from the snout.

Sides without distinct markings; faint traces of longitudinal lines.

This specimen differs from a specimen of *H. areolata* in the Harvard Museum, in which the last dorsal ray is over the fourth ray of the anal. In a specimen of *areolata* in the British Museum drawn by J. Green, the last dorsal ray is over the penultimate anal ray.

4. *Hatcheria areolata* (Cuvier & Valenciennes).

Native name "Bagre."

Trichomycterus areolatus CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 492 (coast of Chile); GUICHENOT, in Gay, Hist. Chile, II, 1848, p. 309; GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 274 (Chile); PHILIPPI, Mb. Ak. Wiss. Berlin, 1866, p. 714; DELFIN, Catálogo de los Peces de Chile, 1901, p. 30.

Pygidium areolatum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 51 (Rio Mapocho, Chile); Occasional Papers Cal. Acad. Sci., I, 1890, p. 330; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; ? BERG, An. Mus. Nac. Buenos Aires, IV, 1895, p. 143 (Arroyo del Tala, Catamarca, Argentina).

Hatcheria areolata EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1909, p. 251, pl. XXXIV, fig. 2; 1910, p. 399.

Trichomycterus maculatus GURARD, part; U. S. Naval and Astron. Exped., 1855, p. 243 (Mapocho).

Habitat.—Pacific slope of Central Chile; ? Catamarca, Argentina.

It is doubtful whether the specimens mentioned by Berg, which had come from

east of the Andes, belong to *H. areolata*, the definitely known habitat of which is the western slope of Central Chile.

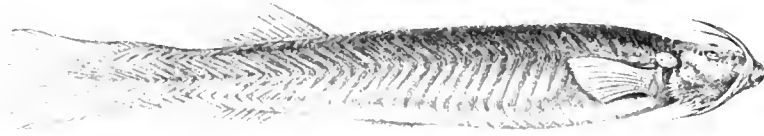


FIG. 4. *Hatcheria areolata* (C. & V.) after Eigenmann. From a specimen in the Mus. Comp. Zoöl., 103 mm. Mapocho, Chile.

Head 5.75; depth 8.5; D. 14; A. 8. Elongate, subterete. Lips and lower surfaces of the head thickly covered with small warts. Gill-openings continued forward to below the eye, the membranes free from the isthmus. Upper maxillary barbels reaching to the pectorals. Pectorals rounded, the first ray not prolonged; origin of dorsal slightly in front of the vent, equidistant from tip of caudal and occiput, its last ray over the fourth ray of the anal. Caudal very slightly emarginate. Distance of anal from the base of the caudal five times in the length. Origin of the ventrals equidistant from tip of snout and middle of caudal; tips of the ventrals not reaching the vent. Light brown, with purple longitudinal streaks.

5. *Hatcheria burmeisteri* (Berg.)

Pygidium burmeisteri BÉRG, An. Mus. Nac. de Buenos Aires, IV, 1895, p. 128, Lam. 2, fig. 1 (Rio Mendoza); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Trichomycterus burmeisteri BOULENGER, Ann. & Mag. Nat. Hist. (7), IX, 1902, p. 336 (Palmira, Rio Mendoza, 900 m.).

Habitat.—Province Mendoza, Argentina, elevation 900 meters.

Known from the type and the specimen recorded by Boulenger.

Reaches a length of at least 260 mm.



FIG. 5. *Hatcheria burmeisteri* Berg. After Berg.

Head 7.5 (9 in total); depth 9 (10); D. 21; A. 7; P.10; eye in the middle of the head; nasal barbel reaching to the eye, maxillary barbel scarcely to gill-opening; head much longer than broad, depressed; interopercular spines numerous; pectoral

ray scarcely produced, shorter than head; anal inserted under the eighth dorsal ray; caudal emarginate, the upper lobe slightly produced and pointed, the lower obtuse. Color uniform.

6. *Hatcheria macræi* (Girard.)

Thrichomycterus macræi GIRARD, U. S. Naval and Astron. Exped., 1855, p. 245 (Uspullata, 7,000 feet).

Pygidium macræi EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 51 (Uspullatuo*); Occasional Papers Cal. Acad. Sci., I, 1890, p. 328; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; DELFIN, Catálogo de los Peces de Chile, 1901, p. 29.

Hatcheria macræi EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1909, p. 248, plate XXXII, figs. 1, 1a and 1b; 1910, p. 399.

Habitat.—Eastern slope of the High Andes of central Chile.

7458a-j, C. M., 24-113 mm. San Juan, Argentina, Feb. 25, 1909, Haseman.

7549a-f, C. M., 37-70 mm. Rio Colorado, March 5 and 6, 1909, Haseman.

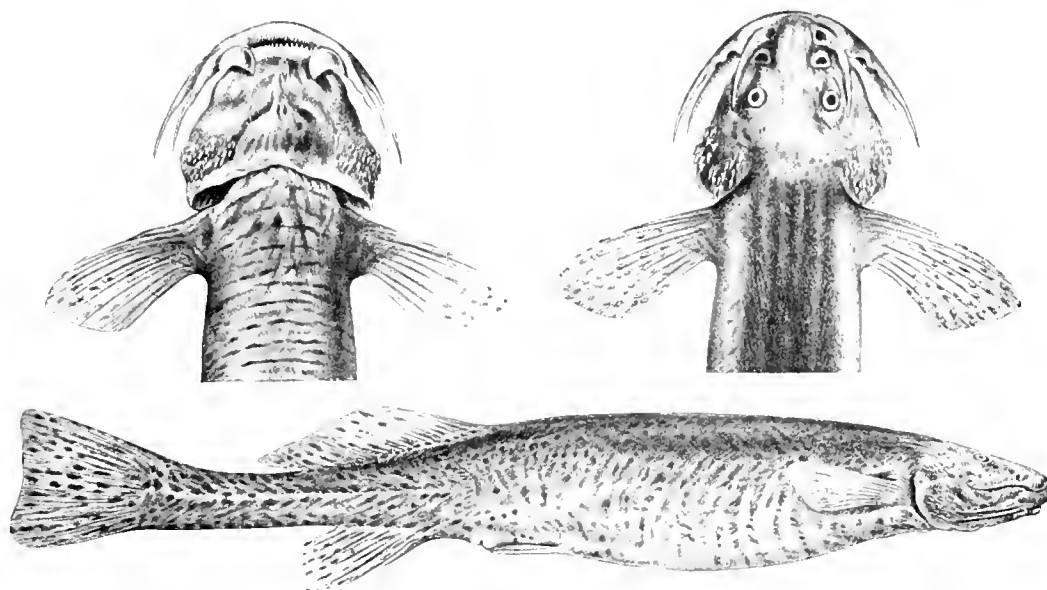


FIG. 6. *Hatcheria macræi* (Girard). After Eigenmann. From No. 8298, Mus. Comp. Zool., Uspullata, Chile.

Head 6.5; depth 7; D. 21 or 22, rarely 20 or 23; A. 10. Elongate, rather compressed, especially backward. Head nearly or quite as broad as long, snout rounded; eye small, midway between tip of snout and end of opercle; none of the barbels reaching the gill-opening. Gill-opening scarcely continued forward, joined to the isthmus for a distance equal to half the width of the mouth. Pectorals obliquely truncate, the first ray not produced in the type, or slightly produced in the speci-

* ? A misprint for *Uspullata*? “Uspullatuo” is not found in gazetteers or on maps. Editor.

mens collected by Haseman; origin of dorsal some distance behind ventrals, equidistant from occiput and tip of caudal in the type or from some portion of the snout and tip of caudal in the specimens collected by Haseman; fourth or fifth dorsal ray highest, then gradually decreasing in height to the last. Caudal emarginate, the upper lobe pointed, the lower rounded; anal inserted about under the ninth dorsal ray and terminating under about the seventeenth; ventrals inserted nearer tip of snout than to tips of middle caudal rays, reaching to the vent or slightly beyond.

Sides and back in the San Juan specimens profusely spotted, much less so in the specimens from the Rio Colorado.

Genus IV. PYGIDIUM¹⁶ MEYEN.

Trichomycterus VALENCIENNES, in Humboldt, Rec. d'Obs. Zoöl. et Anat., II, 1833, p. 348 (*nigricans*); not *Thrichomycterus* Cuvier and Valenciennes, in Humboldt, of which it is a misspelling. GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 272.

Thrychomycterus CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 485 (misspelled).

Thrichomycterus non Cuvier & Valenciennes, GIRARD, Proc. Acad. Nat. Sci. Phila., VII, 1854, p. 198; Girard, U. S. Nav. Astron. Exped., II, 1855, p. 242 (misquoted).

Pygidium MEYEN,¹⁷ Reise, I, 1835, p. 474 (*fuscum*).

Type.—*Pygidium fuscum* Meyen.

Skin naked; head depressed, nearly or quite as broad as long, its length five or six times in the length from snout to caudal; body terete, the caudal peduncle compressed, deep; a nasal barbel as long as the head or shorter, on the posterior edge of the anterior nares; two barbels at the angle of the mouth, the upper, connected with the rudimentary maxillary, may reach to the tip of the

¹⁶ περιτόν, τό = a thin rump = the tail much compressed.

¹⁷ In "Archiv für Naturgeschichte von Dr. Ar. Fr. Aug. Wiegmann, Zweiter Band, Berlin, 1835 (Part. II), p. 269," the original description with addenda appears as follows:

"Eine neue Gattung der Siluriden, *Pygidium*, hat Meyen (Reise, I, p. 475), nach einem toten Fische aufgestellt, den er in einem kleinen Bache Peru's antraf.

"Char. gen. Corpus elongatum, caudam versus compressum. Cirri maxillares 4, nasales nulli. Pinnae pectorales ut pinnae abdominales duae eum pinna anali circa anum positae. Pinna adiposa parva. (Die einzige Art *P. fuscum* ist 5–6" lang). Die Gattung bedarf einer genaueren Charakteristik; die gegebene ist dahin zu berichtigen, dass *cirri nasales* vorhanden sind, und die Rückenlosse Strahlen hat, also keine Fettlosse ist. Die Gattung steht demnach nicht *Malapterus*, sondern *Silurus* nahe, unterscheidet sich von diesem durch Zahnlosigkeit des Vomer, durch ein *operculum aculeato-serratum*, und durch die weit hinten stehende Rückenlosse. Das Exemplar ist im Berliner Museum."

pectoral, but is usually shorter; no mental barbels; eye small, in the middle of the head, or just in front of the middle, without a free orbital rim; interopercle with numerous spines in several series, those of the outer series largest (in the very young in a bunch as long as the opercular bunch, in the older in a much larger patch); opercle with a bunch of similar spines; gill-membranes narrowly united with the isthmus and usually with a narrow, free margin across it; mouth of moderate width, terminal, the jaws with two or more series of chisel-shaped or conic teeth; no teeth on lips or on the vomer; fins without spines, the pectoral short, the outer, simple ray usually prolonged into a filament extending distinctly beyond the rays; ventrals small, placed in the middle or considerably behind the middle of the body; anal short, usually in part below, more rarely behind, the dorsal; caudal short, broadly rounded, truncate or slightly emarginate, accessory rays variable, sometimes very conspicuous, sometimes much less so; origin of the dorsal between the vertical from the origin of the ventrals and anal, always nearer the base of the caudal than to the snout; the fin is low, rounded, short, with a variable number of rays up to twelve. Cuvier & Valenciennes state that the first ray of the dorsal of *P. nigricans* is prolonged in a filament. Is this a *lapsus digiti* for first ray of the pectoral? The dorsal and anal have from two to four minute accessory rays entirely hidden in the thick skin in front of the evident portion of these fins.

The color may be uniform, or there may be one or three longitudinal stripes or rows of spots, or large spots less regularly arranged, or numerous small spots which may be discrete, or which may coalesce into vermiculations. There are no distinct cross-bars. If the markings are longitudinally arranged, a series of spots may be replaced by a stripe or *vice versa* in different individuals of the same species.

Some of the species are of very small size, the maximum recorded size is 350 and 390 mm. in *P. rivulatum* and *P. taczanowskii* from Peru.

The eggs reach 2.5 mm. in diameter.

The species differ from each other largely in the shape of the teeth, the length of the barbels, the relative position of the dorsal, anal, and ventrals, and in the color.

Distribution.—The members of the genus *Pygidium* belong particularly to the mountains, where they live in all waters from small rills to large lakes like Titicaca. They are frequently found under rocks or buried in the muddy banks of streams. They extend from Panama southward to Chile and Patagonia, where they are replaced by the members of the allied genus *Hatcheria*. In favorable places they descend to the sea, as at Jequetepec and Callao, and they are among the last or are the very last to disappear in ascending the mountains, where they are associated

with a few other mountain forms like *Grundulus* at Bogotá, *Astroblepus* and *Bryconamericus* in the High Andes from Panama to Cuzco, and *Oresteus* in Lake Titicaca. The only fish found by Haseman in the headwaters of the Rio das Velhas was a member of this genus. Species of *Pygidium* were found in the most elevated places visited by Henn in Colombia and Ecuador. In Titicaca they are of considerable economic importance, and on the plains of Bogotá, the nearly related genus *Eremophilus* is of prime economic importance. They are found in Guiana and in the Amazon, but only as dwarfs. They also flourish in the mountain-streams of southeastern Brazil, but the species do not reach the size of those in Peru. Some of the species are found on both slopes of the Andes, but, unlike lowland species of other fishes, which if found on both sides of the Andes, usually have a very wide distribution, the species of the genus *Pygidium* all have rather limited ranges. Many of them are restricted to a single small river and no river has many species. In 1910 I said (Patagonia Report, p. 248), "There is no place on record harboring more than one species of this genus." This statement requires modification. While, so far as known, many basins contain but a single species, a number of other smaller rivers, the Iguapé for instance, contain several. Judging by its wide distribution, both horizontally and vertically, the genus is probably one of very long standing.

The species of the genus need a careful revision, but the descriptions usually omit mention of the character of the teeth, and no collection contains any great percentage of the total number of species described. Furthermore, judging from the fact that they are abundant in all the high mountain-rills and even in lowland rapids, and that from the stretch from Caracas along the eastern slope of the Andes to Peru we have only the types of the species *P. meridæ*, *kneri*, *metæ*, and *dorsostriatum*, the revision of the entire genus may be left in abeyance. The species are grouped according to the areas from which they have been reported.

CHILEAN SPECIES

The species from Chile where the members of the genus *Hatcheria* have in part replaced them, are *P. marmoratum* (Philippi), *P. palleum* (Philippi), and *P. tigrinum* (Philippi).¹⁵

1. *Pygidium marmoratum* (Philippi).

Trichomycterus marmoratus PHILIPPI, Mb. Ak. Wiss. Berlin, 1866, p. 714; EIGENMANN & EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1890, p. 326; DELFIN, Catálogo de los Peces de Chile, 1901, p. 31.

¹⁵ In addition to the three species described by Philippi, *Pygidium nigricans* (Cuvier & Valenciennes) is recorded from Chile by Gay. This is probably an error.

Pygidium marmoratum EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Chile.

Blackish gray, marbled with many black spots, as in *punctatum*; fins dark. Depth 10.82; D. 10; A. 6.

2. *Pygidium palleum* (Philippi.)

Trichomycterus palleus PHILIPPI, Mb. Ak. Wiss. Berlin, 1866, p. 715; EIGENMANN & EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1891, p. 325; DELFIN, Catálogo de los Peces de Chile, 1901, p. 30.

Pygidium palleum EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Chile.

Light reddish; fins colorless; head 6.5 in total; D. 9-10; A. 6.

3. *Pygidium tigrinum* (Philippi.)

Trichomycterus tigrinum PHILIPPI, Mb. Ak. Wiss. Berlin, 1866, p. 714; EIGENMANN & EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1890, p. 326; DELFIN, Catálogo de los Peces de Chile, 1901, p. 31.

Pygidium tigrinum EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Chile.

Light with reddish points; fins immaculate; head 6.5; depth 6.5 in total length; D. 9 or 10; A. 6.

Members of the genus *Pygidium* have been recorded from the mountains of Argentina, north of the latitude of Buenos Aires. South of this latitude species of *Hatcheria* take their place.

KEY TO THE SPECIES OF PYGIDIUM FROM ARGENTINA AND THE PARAGUAY BASIN

- a. Teeth pointed (not examined in *tenuis*).
 - b. Plain yellowish, eyes and barbels black; head triangular; opercle and pre-opercle well armed; body much compressed; D. 6; A. 5.....4. **tenuis** (Weyenbergh).
 - bb. Back spotted, sides with a band.
- c. Pectoral ray prolonged; head as wide as long, 4.66-5 in the length; eye very small, a little in advance of middle of head, its diameter three in the interorbital; maxillary barbel reaching pectoral; depth of caudal peduncle half its length; origin of dorsal behind the ventrals, its distance from the caudal two and one-half in its distance from the snout; origin of

- ventrals equidistant from snout and tip of caudal, or a little nearer the latter; caudal truncate, or slightly emarginate; olive above, more or less distinctly spotted with brown; a blackish band from opercle to the caudal; D. 8 or 9; A. 6 . . . 5. **corduvense** (Weyenbergh).
- cc.* Pectoral ray not prolonged; body and head tuberculate; head 6.5-7.5 in the length (with the caudal); eye a little in advance of the middle of the head; maxillary barbel broad and short; teeth minute, in many series; 6-8 spines in the main row of the interopercle; fins small; posterior part of dorsal over anal; caudal subtruncate or rounded; D. 3 + 8; A. 3 + 6.
6. **spgazzinii** Berg.
- bbb.* Back with spots; no lateral band; maxillary barbel reaching origin of the pectoral or farther; distance between origin of dorsal and caudal 2.5-3 in the distance between dorsal and snout; origin of ventrals equidistant from snout and tip of caudal.
- d.* Pectoral ray not prolonged; head 5.33-5.5; eye in middle of the head, 3 in interorbital; origin of anal under end of dorsal; caudal truncate; D. 10; A. 7. Spots of back large, round.
7. **borellii** (Boulenger).
- dd.* Pectoral ray much prolonged; head six times in the length; eye entirely in anterior half of the head; origin of anal nearly under origin of dorsal; caudal rounded; back, sides, dorsal and caudal densely spotted. 8. **eichorniarum** Ribeiro.
- aa.* Teeth in part, at least, incisors; head as long as broad; barbels short; first pectoral ray prolonged.
- c.* Head 8.5 in the length with caudal; eye in anterior half of head, 1.5 in the interorbital; dorsal obliquely truncate, its posterior third over the anal; caudal truncate; D. 2 + 9; A. 1 + 6; faint spots. 9. **riojanum** Berg.
- cc.* Head six times in the length without the caudal; eye in middle of the head; thirteen spines in the main row of the interopercle; caudal emarginate; D. 4 + 6.5; A. 2 + 5.5; nasal barbel extending to posterior margin of the eye 10. **heterodontum** Eigenmann.

4. **Pygidium tenue**¹⁹ (Weyenbergh). (See fig. 7, p. 293.)

Trichomycterus tenuis WEYENBERGH, Act. Acad. Nac. Cienc. Exact., Córdoba, III, 1877, p. 12, pl. III (Sierra de Córdoba, near Cruz del Eje); EIGENMANN & EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1890, p. 326.

Pygidium tenue EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Rio Primero, Córdoba.

Yellow, eyes and barbels black; head triangular; opercle and pre-opercle well armed. Body much compressed; D. 6; A. 5.

5. **Pygidium corduvense** (Weyenbergh).

Trichomycterus corduvensis Weyenbergh, Act. Acad. Nac. Cienc. Exact. Córdoba, III, 1877, p. 11, pl. III (Rio Primero); EIGENMANN & EIGENMANN, Occasional

¹⁹ Berg (An. Mus. Nac. Buenos Aires, IV 1895, p. 144) makes this a synonym of *Hatcheria arcuolata*. Boulenger (Boll. Mus. Zoöl. Anat. Comp. Univ. Torino, XII, 1897), contends that Weyenbergh is right in placing it near *P. dispar*.

Papers Cal. Acad. Sci., I, 1890, p. 326; BOULENGER, Boll. Mus. Zoöl. Anat. Comp. Univ. Torino, XII, 1897 (Caiza).

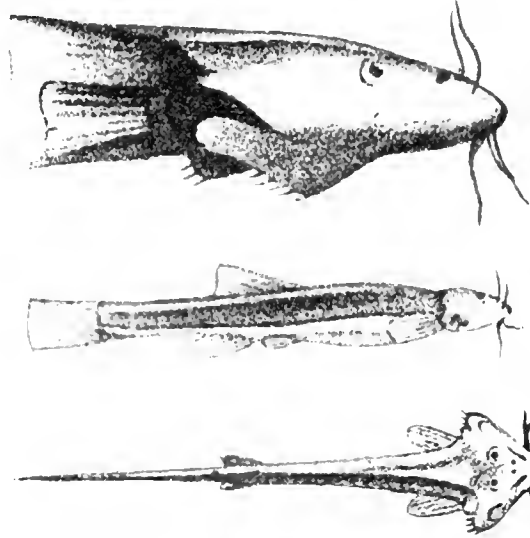


FIG. 7. *Pygidium tenuic* (Weyenbergh). After Weyenbergh.

Pygidium corduense EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

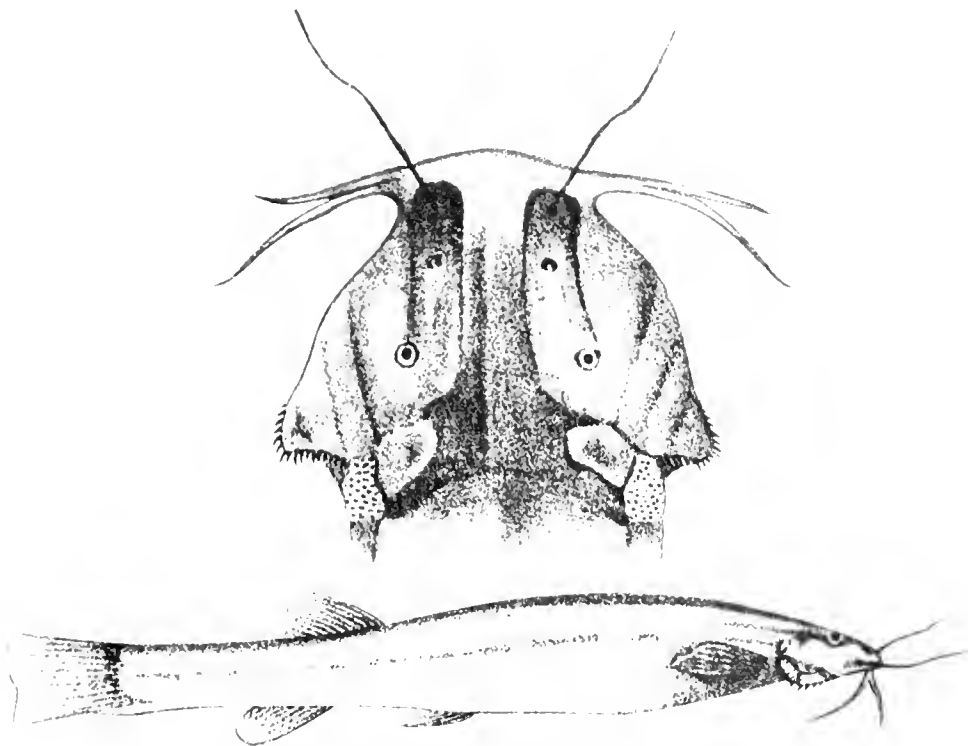


FIG. 8. *Pygidium corduense* (Weyenbergh). After Weyenbergh.

Habitat.—Sierra de Córdoba, near Cruz del Eje, Argentina; Caiza, Bolivian Chaco.

The following is from Boulenger's description of specimens up to 62 mm. long:

"Head 4.66–5; D. 8–9; A. 6; eye three times in interorbital, a little nearer snout than to opercle; maxillary barbel reaching pectoral; caudal peduncle twice as long as high; distance between origin of dorsal and caudal two and one-half times in the distance between dorsal and snout; outer pectoral ray prolonged; origin of ventrals equidistant from snout and tip of caudal, or a little nearer the latter; caudal truncate, or slightly emarginate. A dark lateral band."

6. *Pygidium spegazzinii* Berg.

Pygidium spegazzinii BERG, An. Mus. Nac. Buenos Aires, V, 1897, p. 267; Eigenmann, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Rio de Cachi, Province de Salta, northern Argentina, 2,500–2,800 m.

Known only from the types, 29 specimens, the largest of which is 95 mm., in the National Museum of Buenos Aires.

Head 6.5–7.5 in the length with the caudal; D. 11 (3 + 8); A. 9 (3 + 6); eye much nearer snout than to edge of opercle; nasal barbel extending beyond the eye, maxillary barbel short and broad; gill-membrane without free margin at the middle; teeth in many series; interopercular spines few, in three or four rows, the sixth to eighth in the lower row moderate in size; opercular spines also few and minute; body verrucose; pectoral obliquely rounded, its first ray not prolonged; anal inserted under posterior part of dorsal; caudal subtruncate or rounded.

7. *Pygidium borellii* (Boulenger).

Trichomycterus borellii BOULENGER, Boll. Mus. Zoöl. Anat. Comp. Univ. Torino, XII, 1897 (Mission d'Aguaienda; Tala; Lesser); Ann. & Mag. Nat. Hist. (7), IX, 1902, p. 336 (Palmira, Rio Mendoza).

Pygidium borellii EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Pygidium schmidti BERG, An. Mus. Nac. Buenos Aires, V, 1897, p. 266 (Rio de Belen, Prov. Catamarca, Argentina); EIGENMANN, *l. c.*, p. 399.

Habitat.—Mission d'Aguaienda, Bolivian Chaco; Tala and Lesser, Province Salta, northern Argentina; Rio de Belen, Province Catamarca, northern Argentina; Palmira.

Reaching a recorded length of 110 mm.

Head 5.35–5.5; D. 10; A. 7; eye very small, in middle of the head, three times in the interorbital; body compressed, caudal peduncle one and one-half times as

long as high; maxillary barbel reaching pectoral; origin of anal under end of dorsal; distance of origin of dorsal from caudal two and one-half to three in its distance from the snout; pectoral ray not prolonged; origin of ventrals equidistant from tips of snout and caudal; caudal truncate; sides and back with large dark spots.

8. *Pygidium eichorniarum* (Ribeiro). (Plate XLIV, fig. 3).

Trichomycterus eichorniarum Ribeiro, Comm. Linhas Telegraphicas Estrategicas Matto-Grosso ao Amazonas, Annexo, 5, 1912, p. 27 (Caceres).

Habitat.—Upper Paraguay.

Evidently allied to *P. riojanum*, *proöps*, and *meta*.

Known from the types, two specimens, the larger 44 mm., and 7556*a-c*, C. M., 24–30 mm. Caceres, May 27, 1909. Haseman.
7557*a & b*, C. M., 33–43 mm. Caceres, May 23, 1909. Haseman.
7558*a*, C. M., 42 mm. San Francisco, Rio Jaurú, Paraguay basin, June 10, 1909. Haseman.

7559*a*, C. M., 32 mm. Bastos, Rio Alegre, eight miles south of Villa de Matto-Grosso, June 26, 1909. Haseman.

7560*a-c*, C. M., 39–41 mm. San Antonio, Rio Guaporé, plantation of Maciel, July 31–Aug. 11, 1909. Haseman.

Head 5–5.75; D. 9–10; A. 8; P. 6; posterior margin of eye slightly in advance of the middle of the head; eye about 1.5–2 in the snout, 5.5–6.5 in the head, about equal to the interorbital; maxillary barbel reaching to axil or middle of pectoral; nasal barbel to the tip of the opercular spines or the axil of the pectoral; teeth conical, a very narrow band of but two or three irregular series; origin of ventrals equidistant from tip of snout and tip of caudal; origin of anal under, or but slightly behind, the first dorsal ray; distance from base of last anal ray to base of caudal about six times in the length; distance from origin of dorsal to base of caudal two and three-quarters in its distance from the snout; caudal rounded, accessory rays moderate; first pectoral ray much prolonged, with its filament nearly equal to the length of the head.

General color of *P. brasiliense*, back and sides profusely spotted; caudal rays with numerous spots, dorsal and anal less profusely spotted.

9. *Pygidium riojanum* Berg.

Pygidium riojanum BERG, Ann. Mus. Nac. Buenos Aires, V, 1897, p. 269; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Arroyo in the Cordillera de la Rioja, northern Argentina.

Known from the type, a specimen 85 mm. long, in the National Museum at Buenos Aires.

Head 8.5 in the length with the caudal; D. 9 (2 + 7); A. 7 (1 + 6); eye 1.5 in the snout, 1.5 in interorbital, 2.5 in posterior part of the head; nasal barbel scarcely extending beyond the eye; maxillary barbel scarcely to end of opercle; gill-membrane with scarcely a free margin; interopercular spines in two or three series, medium in size; teeth small, in irregular series, anterior ones larger, their tips broader; fins small; first pectoral ray prolonged; anal under last third of dorsal; caudal truncate.

10. *Pygidium heterodontum* EIGENMANN. (Plate XLIV, fig. 4.)

Pygidium heterodontum EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 692.

13832, I. U. M., 83 mm., ♀, Rio Mendoza, Palmira, Argentina, 900 m. Purchased from Rosenberg.

Palmira is probably the southernmost locality on the eastern slope of the Andes from which species of this genus have been taken.

Head six times in length, as long as broad; D. 10.5 (4 + 6.5); A. 7.5 (2 + 5.5); P. 9; eye in middle of the head, interocular 3.5 in the head; teeth in three series in each jaw, those of the outer row narrow incisors, of the second row much smaller incisors and of the third row conic. Head much depressed, interopercular spines numerous, thirteen in the last row.

Nasal barbel extending to the posterior margin of the eye, maxillary barbel to the base of the opercular spines; first pectoral ray scarcely produced, equal to the portion of the head behind the posterior nares; origin of ventrals midway between opercle and caudal, reaching to the vent; origin of anal under posterior part of the dorsal, the distance between its last ray and the base of the middle caudal ray 4.4 in the length; depth of the caudal peduncle 2.5 in its length; caudal narrow, emarginate, a little more than five in the length; origin of dorsal midway between the tip of the caudal and the occiput, over the tip of the ventrals, its distance from the caudal 1.75 in its distance from the snout.

A faint lateral band and obscure spots or marblings.

The members of the genus *Pygidium* reach their largest size and greatest economic importance in Peru. The Carnegie Museum has no specimens from this region, except *P. oroye* Eigenmann & Eigenmann. To the key below should be added *P. fuscum* Meyen, the type of the genus.

KEY TO THE SPECIES OF PYGIDIUM FROM PERU AND WESTERN BOLIVIA.

- a. Pectoral ray prolonged.
- b. Dorsal entirely in front of the anal.
- c. Caudal truncate or rounded.

- d.* Uniform brown, darkest on the back; head flat above; width of head less than its length; barbels scarcely extending beyond the eyes, which are in the middle of the head; a broad band of villiform teeth in each jaw; first pectoral ray but slightly prolonged; origin of dorsal equidistant from tip of caudal and nares, over posterior edge of base of ventrals; last ray of the dorsal over the origin of the anal; caudal rounded, distance between anal and caudal 4.5 in the length; ventrals nearer tip of snout than to tip of caudal; head 5; depth 5.66; D. 10; A. 9.....12. **eigenmanni** (Boulenger).
- dd.* Head and body with dark spots; a dark lateral stripe; head as broad as long; barbels equal to eight-tenths the length of the head; snout slightly shorter than the postorbital part of the head; outer pectoral ray as long as the head, longest branched ray three-quarters as long; origin of dorsal in advance of the vent, its distance from the base of the caudal one and one-half times in its distance from the snout; origin of anal slightly behind the last dorsal ray; caudal truncate; distance between anal and caudal 4.5 in the length; head 6.25; D. with six, A. with four branched rays.

13. **vittatum** (Regan).

cc. Caudal emarginate.

- c.* Back and sides profusely spotted; head longer than broad; barbels not quite reaching gill-openings; origin of ventrals equidistant between tip of snout and tip of caudal; head 5.2-5.66; D. 12; A. 9 or 10.

f. Sides, back, dorsal, and caudal with large spots; spots as large as, or larger than, the eye, smallest on the head; origin of dorsal equidistant from tip of caudal and anterior margin of eye; distance between anal and caudal five or six times in the length.....14. **dispar** Tschudi.

ff. Spots much smaller than the eye; origin of dorsal equidistant from tip of caudal and a point between occiput and anterior margin of the eye; distance between anal and caudal 6-6.5 in the length.....15. **punctulatum** (Cuvier & Valenciennes).

- cc.* Back and sides unspotted; maxillary barbel reaching past origin of pectoral; origin of dorsal varying with age; origin of ventrals a little nearer snout than to tip of caudal; distance between anal and caudal five times in the length; head 4.66-5.5; eye minute, in adult a little behind the middle of the head; teeth conic.²⁰

16. **taczanowskii** (Steindachner).

bb. Dorsal in part over the anal.

- g.* Accessory caudal rays conspicuous; caudal rounded; outer row of teeth narrow incisors; maxillary barbel reaching edge of pre-opercle; origin of dorsal equidistant from tip of caudal and a point between occiput and posterior nares; distance between caudal and anal 4.4-4.5 in the length; head 4.5-5.5; D. 13; A. 11.

17. **rivulatum** (Cuvier & Valenciennes).

gg. As under *g*, but "differing in its large, dark blotches.".....18. **poeyanum** (Cope).

- ggg.* Accessory caudal rays not evident; caudal emarginate; teeth conic; head 4.66; depth 7; D. 8; A. 6; eye in middle of the head; head longer than wide; nasal barbels reaching posterior margin of the eye; maxillary barbel to the gill-opening; distance between dorsal and caudal about 2 in its distance from the snout; distance between anal and caudal 5.5.

19. **barbouri** Eigenmann.

gggg. Accessory caudal rays not conspicuous, the caudal truncate; teeth conic; head 4.85; depth

²⁰ The male of *dispar* as figured by Tschudi agrees with this.

6; D. 9; A. 7; eye in middle of the head; head a little longer than wide; nasal barbels reaching lateral end of head, maxillary barbel a little beyond origin of pectoral.

20. *fassli* Steindachner.

aa. Pectoral ray not prolonged; end of dorsal about over the middle of the anal; caudal rounded; head as long as wide; sides and back with irregular spots.

h. Eye moderate; origin of the dorsal over or in front of the vent, equidistant from eye and tip of caudal or nearer the latter; head 5.75–6; D. 12; A. 10 21. *oroyæ* Eigenmann.

hh. Eyes very minute; origin of the dorsal in front of the vent, nearer the eye than the tip of the caudal; head 5; D. 8; A. 6 or 7 not counting the hidden rays; a dark lateral line.

22. *quechuorum* Steindachner.

11. *Pygidium fuscum* Meyen.

Pygidium fuscum MEYEN, Reise, I, 1835, p. 475; Wiegmann's Arch., 1835, II, p. 269; EIGENMANN & EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1890, p. 325; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Peru.

Very little is known about this species. It was imperfectly described by Meyen. Fortunately the type which was found dead in some stream in Peru, is in the Berlin Museum (*vide* Tschudi, Fauna Peruana, Ichthyologie, 1845, p. 21). Tschudi tells us that *fuscum* is specifically distinct from his own species *dispar*. This and the original description is all we know about the species.

12. *Pygidium eigenmanni* (Boulenger).

Pygidium knerii EIGENMANN & EIGENMANN (*non* Steindachner), Occasional Papers Cal. Acad. Sci., I, 1890, p. 335 (Cumbaca).

Trichomycterus eigenmanni BOULENGER, Boll. Mus. Zoöl. Anat. Comp. Univ. Torino, XIII, Dec. 2, 1898, substituted for *P. knerii* Eigenmann & Eigenmann, *non* Steindachner.

Pygidium eigenmanni EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Cumbaca. Location on map not known.

Boulenger based his *eigenmanni* on the description of *P. knerii* Eigenmann & Eigenmann, which, according to Boulenger, was based on a specimen distinct from *knerii*. The species is known from the description of a specimen 110 mm. long from Cumbaca, collected by the Thayer Expedition and now at Cambridge, Mass.

Head 5; depth 5.66; D. 10; A. 9. Elongate, compressed; head greatly depressed, flat above, the eyes entirely superior; width of the head less than its length. Barbels scarcely extending beyond the eyes, which are equidistant from tip of snout and end of opercle. A broad band of villiform teeth in each jaw. Pectoral rounded,

the first ray slightly prolonged. Origin of dorsal above posterior edge of base of ventrals, equidistant from tip of caudal and nares, the last ray over origin of anal. Caudal rounded, its distance from the anal 4.5 in the length. Ventrals nearer tip of snout than tip of caudal. Uniform brown, darkest on the back.

13. *Pygidium vittatum* (Regan).

Trichomycterus vittatus REGAN, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 623 (Collected by Oekenden).

Pygidium vittatum EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Marcapata Valley, eastern Peru.

Known from the types, 78 mm. long, in the British Museum.

Head 6.25; D. 6 (branched); A. 4 (branched); head as broad as long; diameter of eye 2.33 times in the interocular width, which is 3.5 in the length of the head. Snout slightly shorter than the postorbital part of head. Barbels equal to eight-tenths the length of head. Dorsal originating in advance of the anal opening, the distance from its point of origin to the caudal one and one-half times in the distance from the former to the tip of the snout. Anal originating slightly behind the vertical from the last dorsal ray, the distance from the base of its last ray to the caudal four and one-half times in the total length. Longest branched ray of pectoral three-fourths the length of the simple outer ray, which is as long as the head. Ventrals extending six-tenths of the distance from their base to the origin of the anal. Caudal truncate. Head and body with dark spots; a dark longitudinal stripe along the middle of the side.

14. *Pygidium dispar* Tschudi. (Plate XLV, fig. 5.)

Pygidium dispar TSCHUDI (*partim*), Faun. Peruana, Ichthyol., 1845, p. 22, pl. 3, upper figure. (Eastern slope of the Peruvian Andes at an altitude of 14,000 ft.); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 52 (Callao); Occasional Papers Cal. Acad. Sci., I, 1890, p. 335 (Callao); Proc. U. S. Nat. Mus., XIV, 1891, p. 36; Pellegrin, Bull. Soc. Zoöl., Paris, XXIX, 1904, p. 91; STARKS, Proc. U. S. Nat. Mus., XXX, 1906, p. 770 (Eteri, Peru); Poissons des Lacs des Haut Plateaux de l'Amer. Sud, 1907, p. 17 (Lake Titicaca); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—High Andes of eastern and western Peru, down to Callao and Eteri.

The *P. dispar* recorded by Ribeiro from the Rio Iporanga of southeastern Brazil is a different species. Tschudi says the species is abundant in the highland

between the two chains of the Cordilleras, but on the eastern slope only. It is quite possible that Tschudi had two species and that the unspotted male he figured is the *taczanowskii* of Steindachner. The specimens recorded by Pellegrin are probably *P. rivulatum*.

Head 5.2; D. 12; A. 9. Elongate, compressed, the depth everywhere less than the length of the head. Head longer than wide by more than a diameter of the eye. Eye moderate, four times in the interocular, equidistant from tip of snout and end of opercle. None of the barbels reaching quite to the gill-opening. Gill-openings continued forward to below the eye. Pectorals obliquely rounded, the first ray produced in a filament. Origin of dorsal equidistant from tip of caudal and anterior margin of the eye, the whole fin in front of the anal and behind the ventral fins. Caudal emarginate. Distance of anal from base of caudal six times in the length. Origin of ventrals midway between tip of snout and tip of caudal.

Reddish brown; sides, back, dorsal and caudal fins with large dark spots, those on the head smallest; lower surface plain.

15. **Pygidium punctulatum** (Cuvier & Valenciennes). (Plate XLV, fig. 4.)

Trichomycterus punctulatus CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 488 (Lima); Lütken, Velhas Flodens Fiske, 1875, p. 137 (Callao).

Pygidium dispar punctulatum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 52 (Rio Remae, near Lima); Occasional Papers Cal. Acad. Sci., I, 1890, p. 336 (Rio Remae, largest 180 mm.); Proc. U. S. Nat. Mus., XIV, 1890, p. 36.

Pygidium punctulatum STARKS, Proc. U. S. Nat. Mus., XXX, 1906, p. 771 (Callao); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Trichomycterus punctatus CUVIER & VALENCIENNES, *l. c.*, pl. 552.

Habitat.— Rio Remae, Peru.

4234, I. U. M., one, 145 mm., a female with empty ovary. Callao.

From the Harvard collections.

Head 5.33–5.66; D. 12; A. 10.

Teeth conic, in about five series in the middle of the jaws.

Origin of dorsal equidistant from tip of caudal and somewhere between occiput and anterior margin of eye; distance of anal from base of caudal 6–6.5 in the length.

16. **Pygidium taczanowskii** (Steindachner). (Plate XLVI, figs. 5–8.)

?*Pygidium dispar* TSCHUDI (in part), Fauna Peruana Ichthyol., p. 22, pl. 3 (lower figure).

Trichomycterus taczanowskii STEINDACHNER, Flussf. Süd-am., IV, 1882, p. 22, pl. IV, figs. 1–1b (Rio de Huambo; Rio de Tortora).

Pygidium taczanowskii EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 52; Occasional Papers Cal. Acad. Sci., I, 1890, p. 338; Proc. U. S. Nat. Mus., XIV, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—North and central Peru, between the Andes.

Head in specimens 110–113 mm. 5–5.5; in a specimen 390 mm. 4.75; D. 9–10; A. 7; P. 9; width of head 1.2 in its length, snout 2–2.33; interorbital 3–3.33, nasal barbels 1–1.25 in the head, in small specimens, 1.4 in larger specimens, maxillary barbels 1.21–1.25, lower barbels 1.6–2; width of mouth two times in the length of the head; anterior margin of eye slightly in front of the middle of the head in smaller individuals, in the middle in the larger; teeth brush-like; opercular and interopercular spines numerous, in several series, mostly concealed; origin of dorsal variable, moving back with age, in a specimen 110 mm. its origin much nearer gill-opening than to caudal; in specimens 390 mm. 1.22 nearer middle caudal rays than tip of opercle; origin of ventrals in specimens up to 210 mm. almost directly under the origin of the dorsal, in a specimen 390 mm. half the length of the head farther forward; the origin of the anal in front of the end of the dorsal in small specimens, under it in the specimen 390 mm. long; first pectoral ray prolonged, its length 1–1.37 in the length of the head. Without spots, bands, or stripes.

17. *Pygidium rivulatum* (Cuvier & Valenciennes). (Plate XLV, figs. 2, 3.)

Trichomycterus rivulatus CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 495 (Guasacona); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864; COPE, Proc. Amer. Philos. Soc., XVII, 1877, p. 46 (Lake Titicaca); PELLEGRIN, Bull. Soc. Zoöl. Paris, XXIX, 1904, p. 91; POISSONS des Lacs des Hauts Plateaux, de l'Am. Sud., 1907, p. 17 (Rio de Pazña, lac Poopo).

Pygidium rivulatum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 51 (Cuzco; Moho and Puno, Lake Titicaca); Occasional Papers Cal. Acad. Sci., I, 1890, p. 330, Proc. U. S. N. Mus., XIV, 1891, p. 36; STARKS, Proc. U. S. N. Mus., XXX, 1907, p. 771 (Lake Titicaca); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

?*Trichomycterus inca* CUVIER & VALENCIENNES, *l. c.*, 496 (Rio Guatanai at Cuzco).

Trichomycterus gracilis CUVIER & VALENCIENNES, *l. c.*, 497 (Rio Azangaro near Guasacona; Rio Guatanai near Cuzco; Rio Pontezualo near Coroico; Lake Compuella near Cuzco); COPE, Proc. Amer. Philos. Soc. XVII, 681, 1877 (Tinta).

Trichomycterus barbatula CUVIER & VALENCIENNES, *l. c.*, 498 (Guasacona; Rio Pontezualo near Coroico).

Trichomycterus pentlandi CASTELNAU, Anim. Nouv. Am. Sud., 49, pl. XXIV, fig. 1, 1855 (Lake communicating with the Ucayale).

Trichomycterus pictus CASTELNAU, Anim. Nouv. Am. Sud., 59, pl. XXIV, fig. 2, 1855 (Lake Titicaca).

Trichomycterus dispar GÜNTHER (*partim*), Cat. Fishes Brit. Mus., V, 273, 1864 (Lake Titicaca; Rio de Pontezualo; Andes de la Paz; Guasacona; Rio de Azangaro); GARMAN, Bull. Mus. Comp. Zoöl. III, 275, 1875 (Lake Titicaca). ?PELLEGRIN, Bull. Soc. Zoöl. Paris, XXIX, 1904, p. 91; Poissons des Laes des Hauts Plateaux de l'Am. des Sud., 1907, p. 7 (Lake Titicaca).

Trichomycterus pardus COPE, Proc. Acad. Nat. Sci., Phila., 1874, p. 132.

Habitat.—High Andes of Peru, about Cuzco, Titicaca, Jequetepeque, etc. 13833, I. U. M., one, 93 mm. Tirapata, eastern Peru. 13000 ft. From Rosenberg.

13750, I. U. M., one, 145 mm. Ollantaytambo. E. Heller.

Teeth in about five series in the middle of the jaws, those of the outer series narrow incisors, those of the innermost row conic.

Head 4.5-5.5; depth 3.75-6.5; D. 13; A. 11. Tail compressed, head depressed, about as wide as long; eye equidistant from tip of snout and end of opercle. Nasal barbels reaching to the posterior margin of the eye, longer in the young. Upper maxillary barbel about to edge of pre-opercle. Mouth wide, more than one-third the length of the head. Pectoral rounded, the first ray prolonged in a short filament, except in the very young. Origin of dorsal equidistant from tip of caudal and a point between occiput and posterior nares, its posterior portion always over the anterior half of the anal. Accessory rays of the caudal very numerous, their division from the true caudal rays marked. Caudal always rounded, its distance from the anal 4.5-4.4 in the length. Color of largest specimens dark reddish brown, sides with fine white or silvery spots and vermiculations. Specimens from 100-200 mm. greatly variable, grayish or dark brown, with darker markings; sometimes the ground color predominating, sometimes only forming reticulations between the dark markings; young with an interrupted dark band along the sides.

18. *Pygidium poeyanum* (Cope).

Trichomycterus rivulatus COPE (*non* Cuvier & Valenciennes), Proc. Acad. Nat. Sci. Phila., 1874, p. 132 (Arcquipa).

Trichomycterus poeyanus COPE, Proc. Am. Philos. Soc., 1877, p. 47.

Pygidium poeyanum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 50; Occasional Papers Cal. Acad. Sci., I, 1890, p. 326; Proc. U. S. Nat. Mus.,

XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399; FOWLER, Proc. Acad. Nat. Sci. Phila., 1915, p. 229 (note on type).

Habitat.—Arequipa.

This species named by Cope without any sort of description is said by Fowler to be "close to *rivulatum*, differing in its large dark blotches."

19. *Pygidium barbouri* Eigenmann.

Pygidium barbouri EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400; Ann. Carnegie Mus., VII, 1911, p. 214, pl. XXXII.

Habitat.—Beni River, eastern Bolivia.

12566 I. U. M., 37 mm. and 2465a-b, C. M., two, cotypes. Rio Beni, tropical eastern Bolivia. Obtained by Mr. Thomas Barbour at La Paz, Bolivia, from the Beni River.

This species has conical teeth.

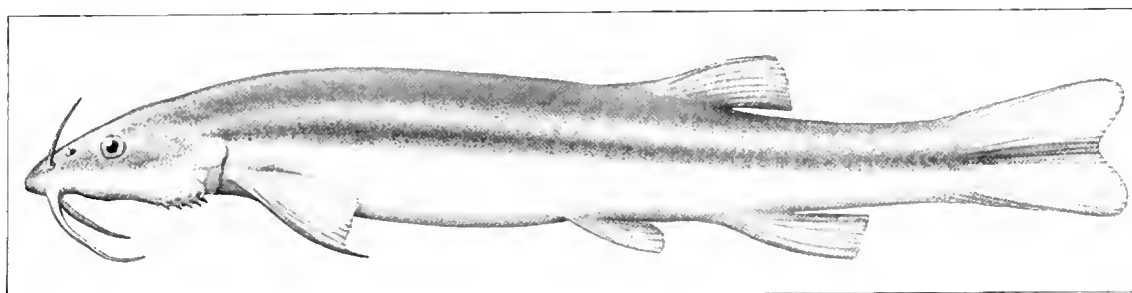


FIG. 9. *Pygidium barbouri* Eigenmann. After Eigenmann, Annals Carnegie Museum, VII, pl. XXXII.

Head 4.66; depth 7; D. 8; A. 6; eye 3 in snout, 7 in head, 2.5 in space between the eyes. Width of head equals its length behind the posterior nares, the body tapering to the caudal; nasal barbels reaching to posterior margin of the eye, the longer maxillary barbel scarcely to the gill-opening when laid straight back. Teeth minute, in bands. First pectoral ray prolonged, not as long as the head; dorsal subtruncate, none of its rays prolonged; distance of origin of dorsal from caudal 2.6 in the length; origin of anal from base of middle caudal rays 3.75 in the length; caudal emarginate; accessory rays not evident; ventrals not reaching the short, scarcely rounded anal. A dark median band from the gill-opening to the tip of the middle caudal rays, a light stripe above it; the back chocolate.

20. *Pygidium fassli* Steindachner.

Pygidium fassli STEINDACHNER, Anz. K. Akad. Wiss. Wien, 1915, No. XVII, p. 200 (Rio Songo, Province North Yungas, Bolivia).

Head 8.77; depth 6; D. 9; A. 7; P. 9; teeth pointed, in several irregular series; head a little longer than broad; eye in middle of head; nasal barbels reaching about to lateral end of head, maxillary barbels a little beyond origin of pectoral. First pectoral ray moderately elongate; caudal truncate; origin of anal behind the vertical from the middle of the dorsal, half a head nearer to base of middle caudal rays than to the lateral margin of the head; snout rounded. Body velvety with minute tubercles. Upper part of head, back, and sides light chocolate with darker spots in tolerably regular rows; a dark lateral band, the spots above it larger than the others, those of the uppermost rows sometimes confluent. Fins unspotted.

21. *Pygidium oroyæ* Eigenmann & Eigenmann.

Pygidium oroyæ EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 51; Occasional Papers Cal. Acad. Sci., I, 1890, p. 334 (Pochachara, Oroyo River); Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399; EVERMANN & RADCLIFFE, Bull. 95, U. S. Nat. Mus., 1917, p. 35, pl. IV, fig. 2 (Oroyo).

Habitat.—Rios Oroyo and Perené, central Peru.

5792, C. M., eighteen, 24.90 mm. Spring supplying water to Tarma, Peru. Lola Vance.

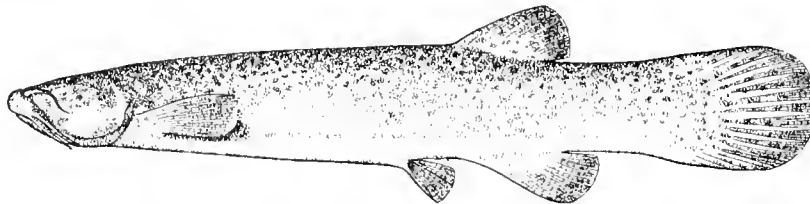


FIG. 10. *Pygidium oroyæ* Eigenmann & Eigenmann. After Evermann & Radcliffe.

Head 5.75–6; depth 5.75–8; D. 12; A. 10–11; P. 10. Head about as long as wide; none of the barbels reaching the gill-opening; teeth all pointed; gill-membrane narrowly joined to the isthmus, with a narrow, free margin. Pectoral shorter than head, fan-shaped, the first ray not prolonged. Dorsal inserted over or slightly behind the vent, its last ray over or behind the middle of the anal, its origin equidistant from anterior margin of eye or occiput and tip of caudal, its distance from the base of the caudal 1.5 in its distance from the snout. Caudal broadly rounded, its distance from the anal 4–4.75 in the length. Ventrals extending to or beyond the anus, their origin about midway between tip of snout and tip of caudal or nearer the former. Chocolate brown; sides, back and unpaired fins with irregular groups of dark points; traces of a dark lateral line in the young.

22. *Pygidium quechuorum* Steindachner.

Pygidium quechuorum STEINDACHNER, Anz. Ak. Wiss. Wien, 1900, p. 207 (Arequipa) Denkseh. Ak. Wiss. Wien, LXXII, 1902, p. 137 (49 of separate), pl. IV, fig. 3-3a (Rio Chile, Arequipa); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Rio Chile at Arequipa, Peru.



FIG. 11. *Pygidium quechuorum* Steindachner. After Steindachner.

Known from the types, five specimens, 51-64 mm. long, in the Vienna Museum.

Head about 5; depth 5.66-5.75 in total length; eyes very minute; interorbital 3 in the head, snout 3; width of head equals length of head or only very little less; first pectoral ray not prolonged, the fin 1.5 in the head; maxillary barbel to some part of the interorbital spines; origin of ventrals almost exactly in the middle; origin of dorsal about equidistant from base of caudal and pectoral; origin of anal behind the dorsal; caudal rounded or subtruncate; upper parts marbled; a narrow, diffuse lateral band, which is sometimes faintly interrupted.

KEY TO THE SPECIES OF PYGIDIUM FROM VENEZUELA, COLOMBIA, PANAMA, AND ECUADOR.

- a. Teeth incisors, apparently conic in the very young.
 - b. Last dorsal ray over the last anal ray; distance between last anal ray and base of middle caudal ray about 2.28 in its distance from the snout; distance between last anal ray and base of middle caudal rays five and one-half in the length; obscure spots about as large as the eye evenly distributed over back and sides, no lateral band 23. *laticeps* (Kner)
 - bb. Last dorsal ray over the anal.
 - c. Sides with a lateral band or nearly confluent series of spots.
 - d. Maxillary barbel extending beyond base of last pectoral ray; origin of ventrals equidistant between caudal and some part of the opercular spines; distance between anal and caudal four and one-half to four and three-fourths in the length; distance between origin of dorsal and base of caudal about two in its distance from the snout; a narrow lateral band, a variable number of small spots 21. *stellatum* Eigenmann.
 - dd. Maxillary barbel extending little beyond origin of the pectoral or shorter; a dark band or series of spots below and another above the median band.
 - e. Origin of ventrals equidistant from caudal and middle of pectoral; distance between anal and caudal five in the length; distance between origin of dorsal and caudal a little more than two in its distance from the snout 25. *chapmani* Eigenmann.
 - ee. Origin of ventrals nearer head than caudal; distance between anal and caudal five to five and one-half in the length; distance between origin of dorsal and caudal one and four-fifths to two in its distance from the snout 26. *tænium* (Kner).

- cc.* Sides with numerous spots, those along the middle line not forming a band; origin of ventrals equidistant from caudal and base or middle of the pectorals; distance between the anal and caudal four and three-tenths to five in the length; distance between origin of the dorsal and the caudal one and three-fourths to one and four-fifths in its distance from the snout. 27. **caliense** Eigenmann.
- ccc.* Sides plain; maxillary barbel extending beyond the axil; origin of ventrals equidistant from caudal and pre-opercle; distance between anal and caudal five and one-half in the length; distance between origin of dorsal and caudal two in its distance from the snout; origin of anal a little in advance of the middle of the dorsal. See also *kneri*.
28. **latidens** Eigenmann.
- aa.* Teeth sharp-pointed, conical or recurved conical.²¹
- f.* Origin of ventrals nearer to caudal than to tip of pectoral filament, the distance between the ventrals and caudal two in the distance from the snout; distance between origin of dorsal and caudal two and two-fifths in its distance from the snout. Sides densely covered with small spots with only verniculating light lines between them. 29. **metæ** Eigenmann.
- ff.* Origin of ventrals nearer to tip of pectoral filament than to caudal, usually much further forward.
- g.* Sides plain.
- h.* Origin of dorsal nearly over origin of the ventrals, nearer the eye than the tip of the caudal; distance between origin of dorsal and caudal 1.5 or less in its distance from the snout, head 4.5-5.33 in the length 30. **stramineum** Eigenmann.
- hh.* Origin of dorsal above or a little in advance of the vent, its distance from the caudal 1.8 in its distance from the snout; head six times in the length; caudal subtruncate; barbels as long as head. 31. **unicolor** Regan.
- hhh.* As under *h*, caudal emarginate, barbels reaching considerably beyond origin of pectoral 32. **kneri** (Steindachner).
- hhhh.* Origin of dorsal distinctly behind the origin of the ventrals, much nearer the tip of the caudal than the eye. **striatum**, No. 41, which see.
- gg.* Sides irregularly spotted, more rarely a lateral band, the spots along the middle of the sides rarely in a distinct series; caudal rounded.
- i.* Maxillary barbels very slender, reaching to the middle of the pectoral rays; eye entirely in the anterior half of the head; origin of dorsal equidistant from tip of caudal and opercle; sides and back with moderate-sized dark spots. 33. **meridæ** Regan.
- ii.* Maxillary barbels not reaching to the middle of the pectoral; eye in middle of the head.
- j.* Origin of dorsal, on an average, slightly nearer to the caudal than to the eye; dorsal inclusive of the rudimentary rays most frequently 12.5; head a little longer than wide; distance between dorsal and caudal 1.5-1.7 in its distance from the snout; sides and back with numerous large spots, rarely in rows, the spots largest in the larger specimens. 34. **bogotense** Eigenmann.
- jj.* Origin of dorsal nearly equidistant from tip of caudal and snout; D. 11.5 or 12.5; head as wide as long; distance between dorsal and caudal 1.4-1.52 in its distance from the snout; sides and back in the largest with numerous irregularly arranged spots about the size of the eye, the spots larger and less numerous in the young. Sometimes nearly plain, sometimes with a lateral stripe.
35. **nigromaculatum** (Boulenger).
- ggg.* Sides with distinct longitudinal bands or rows of spots; caudal emarginate, truncate, or truncate-rounded.

²¹ Not examined in *unicolor*, *kneri*, and *retropinna*.

- k.* Caudal emarginate; origin of dorsal equidistant from tip of caudal and opercle or pre-opercle, its distance from the caudal 1.5-1.8 in its distance from the snout; head five in the length; sides and back with numerous dark spots, those along the middle of the sides forming a distinct row, sometimes confluent along the anterior half of the body. 36. **banneaui** Eigenmann.
- kk.* Caudal truncate or rounded.
- l.* Dorsal, anal, and caudal truncate; origin of dorsal equidistant from tip of caudal and pre-opercle, its distance from the base of the middle caudal rays 1.6 in its distance from the snout; sides with a faint broad band, oversown like the back with spots about the size of the eye. 37. **spilosoma** Regan.
- ll.* Dorsal and anal rounded.
- m.* Lateral band above the middle; maxillary barbels extending to the axil.
- n.* Caudal truncate-rounded; origin of dorsal equidistant from tip of caudal and eye or nasal barbel, its distance from the caudal about 1.4 in its distance from the snout; the lateral band or row of spots above the middle, from the upper part of the gill-opening to above the middle of the caudal. 38. **dorsostriatum** Eigenmann.
- nn.* Barbels very short, about reaching the eye; origin of dorsal equidistant from tip of caudal and opercle, a faint lateral band, sides reticulated, first pectoral ray not prolonged. 39. **venulosum** Steindachner.
- mm.* Lateral band, if present, in the middle of the sides.
- o.* Origin of dorsal equidistant from tip of caudal and nasal barbel, its distance from the base of the middle caudal rays about 1.4 in its distance from the snout; a lateral band increasing in width to the caudal; middorsal area dark, a dark stripe between the lateral stripe and the dorsal stripe in front of the dorsal. 40. **latistriatum** Eigenmann.
- oo.* Origin of dorsal equidistant from tip of caudal and a point between the middle of the pectoral and the pre-opercle, its distance from the middle caudal rays 1.8-2 in its distance from the snout.
- p.* Maxillary barbel reaching a little beyond the axil or shorter; color very variable, plain, or with one to three lateral stripes; origin of the dorsal typically equidistant from tip of caudal and middle of pectoral rays. 41. **striatum** Meek & Hildebrand.
- pp.* Maxillary barbel reaching to near the end of the lower pectoral ray, longer than the head; origin of dorsal equidistant from tip of caudal and opercular spines. 42. **regani** Eigenmann.
- ooo.* Distance between origin of dorsal and caudal 2.2-2.4 in its distance from the snout; head as broad as long; eye in the middle of the head; distance between base of last anal ray and the caudal 5.4 in the length. An indistinct darker stripe along the middle of the side and traces of some darker spots. 43. **retropinne** (Regan).

23. **Pygidium laticeps** (Kner).

Trichomycterus laticeps KNER, Sb. Acad. Wiss. München, 1863, p. 228; KNER & STEINDACHNER, Abhandl. K. Bayer. Akad. Wiss., II. Cl., Vol. X, Part I, 1864,

p. 54 (western slope of Andes of Ecuador); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 274.

Pygidium laticeps EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci., II, 1889, p. 51; Occasional Papers Cal. Acad. Sci., I, 1890, p. 334; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Western slope of the Andes of Ecuador.

13811, I. U. M., one, 79 mm. Below Paramba, Prov. Imbabura, Ecuador. 2600 feet. Hemm.

13812, I. U. M., 7094*a-d*, C. M., seventy-one, largest 89 mm. Mindo. Hemm. Head 5-5.2; D. 10.5; A. 8.5; P. 7.



g. 12. *Pygidium laticeps* (Kner & Steindachner). After Kner & Steindachner.

The barbels in the specimens average a little longer than in the specimens of *P. tanium* from Llanos. Distance between last anal ray and base of middle caudal ray about 5.5 in the length; distance between origin of dorsal and base of middle caudal rays on an average 2.28 in its distance from the snout; *the last dorsal ray over the last anal ray*, the two fins coterminous.

Teeth: Incisors in two series in each jaw.

Dark brown, with obscure spots, about the size of the eye, evenly distributed over the sides and back. No trace of a lateral band in any of the specimens.

In the very small the last anal ray is a little back of the vertical from the last dorsal ray, and the color is uniform.

24. *Pygidium stellatum* Eigenmann. (Plate XLVII, fig. 1.)

7097, C. M., type, 78 mm. Quebrada Sarjento. Gonzales.

7098*a-c*, C. M.; 13814, I. U. M., paratypes, 65-85 mm. Quebrada Sarjento. Gonzales.

7096*a-c*, C. M.; 13815, I. U. M., five, 45-86 mm. Quebrada Guamal. Gonzales.

7099*a-b*, C. M.; 13816, I. U. M., five, 37-55 mm. Quebrada Guadual. Gonzales.

7100*a-i*, C. M.; 13817, I. U. M., seventeen, largest 50 mm. Rio Guaduas. Gonzales.

13807, I. U. M., three, 31-50 mm. Quebrada Cristalina, 28 kilom. above Puerto Berrio, 1000 ft. E. B. Williamson.

Head 5.5-6; D. 10.5; A. 7.5; P. 7; eye in middle of the head, or very slightly in

front of the middle; interocular three times in the head; teeth broad incisors, in two series.

Nasal barbels extending to the tip of the opercular spines or a little further, maxillary barbels usually beyond base of last pectoral rays; pectoral narrow, the filament longer than the head; origin of ventrals equidistant from base of middle caudal rays and some part of the opercular spines, the tips of the ventrals reaching vent; origin of anal under anterior half of the dorsal, the distance between the base of the last anal ray and the base of the middle caudal rays 4.5-5 in the length; caudal rounded, 5 to 6.5 in the length; origin of dorsal about equidistant from tip of caudal and opercle, its distance from the base of the middle caudal rays about two times in its distance from the snout.

A narrow, dark lateral stripe, a variable number of dark spots, smaller than the eye, above the band and below it on the tail.

The specimens from Cristalina have the lateral band very broad, the maxillary barbels reaching to the middle of the pectoral.

25. *Pygidium chapmani* Eigenmann. (Plate XLVII, figs. 2, 3.)

Pygidium chapmani EIGENMANN, Indiana University Studies, No. 16, dated Sept., issued Dec. 23, 1912, p. 18. (Boquia.)

4817, C. M., type, 106 mm.; paratypes, 4818*a-i*, C. M.; 12678, I. U. M., Boquia. Eigenmann.

7091*a-b*, C. M.; 13805, I. U. M., 4, 78-118 mm. Rio Dagua at Caldas. Eigenmann

Habitat.—Upper Cauca Valley.

Head 5-5.75; D. 10.5; A. 7-8.5; P. 7; interocular 3.5 in the head; eye in middle of the head; width of head equal to its length in the young, narrower in the adult. Teeth in 75 mm. specimens long and very narrow chisels, in smaller specimens less distinctly chisel-shaped, in 65 mm. specimens long and smaller, conical.

Nasal barbels extending to base or near tip of opercular spines; maxillary barbel just beyond origin of pectorals.

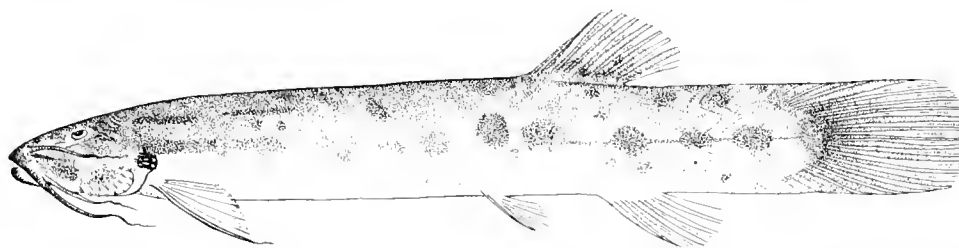


FIG. 13. *Pygidium chapmani* Eigenmann. Type, 106 mm., C. M. No. 4817. Boquia.

Pectoral narrow, the outer ray about equal to the head in length; origin of the ventrals about equidistant from base of caudal and middle of pectorals, the tips at or slightly beyond anus; origin of anal below middle or posterior part of the dorsal, the distance between the base of its last ray and the middle caudal rays five and one-third in the length; caudal distinctly rounded, about six and one-half in the length; origin of dorsal over tip or middle of the ventrals, its distance from the base of the middle caudal rays about two in its distance from the snout.

Smallest specimens with a black lateral band, a series of spots above and below it in the older, the band breaking up into a series of spots in specimens over sixty millimeters long. The oldest specimens dark with obscure darker spots and mottlings.

26. *Pygidium tænium* (Kner).

Trichomycterus tania KNER, Sb. Akad. Wiss. München, 1863, p. 228; KNER & STEINDACHNER, Abhandl. k. Bayer. Akad. Wiss., II. Cl., vol. X, part I, 1864, p. 52 (western slope of Andes of Ecuador); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 274.

Pygidium tania EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 51; Occasional Papers Cal. Acad. Sci., I, 1890, p. 334; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Western slope of the Andes of Ecuador and southern Colombia.

13813 I. U. M., 7095*a-d*, C. M., forty-two, 31-111 mm. Los Llanos, southern Colombia. March 8, 1913. Arthur Henn.



FIG. 14. *Pygidium tænium* (Kner). After Kner & Steindachner.

Head 5.2-5.6; D. 9.5 or 10.5; A. 8.5; P. 7; eye in the middle of the head, interorbital three in the length of the head.

Nasal barbel reaching to the opercular spines, the maxillary barbels to the pectoral; outer pectoral ray with its filament a little shorter than the head, the rays about equal to the head without the snout; ventrals reaching the vent, their origin equidistant between base of middle caudal rays and opercular spines; origin of anal under anterior half of the dorsal, the distance between the base of its last ray and the middle caudal rays about five in the length; caudal rounded, five and five-

tenths to six and five-tenths in the length; origin of dorsal over tips of ventrals, its distance from the base of the middle caudal rays one and eight-tenths to two in its distance from the snout.

Teeth in the largest specimen narrow chisels, three rows in the premaxillary and the middle of the mandible. In the young the teeth are more nearly conical.

Color variable; a dark band from the opercle to the middle caudal rays, sometimes in part, or as a whole, replaced by a series of large spots; an irregular series of irregular spots half way between the lateral band and the ventrals and anal, this series more rarely replaced by a band; a band or a series of spots between the lateral band and the mid-dorsal line; a mid-dorsal band; small spots sometimes interspersed among the larger ones.

27. *Pygidium caliense* Eigenmann.²²

Pygidium caliense EIGENMANN, Indiana University Studies, No. 16, p. 18, dated Sept., 1912, issued Dec., 1912.

4819, C. M., type, 53 mm. Cali. C. H. Eigenmann.

Head 4.88-5.75; D. 10.5 or 11.5; A. 9.5 or 10.5; P. 7; eye about in middle of the head interocular 3.5-4 in the length of the head.

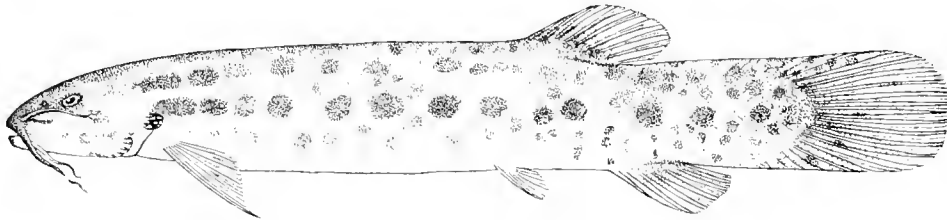


FIG. 15. *Pygidium caliense* Eigenmann. Type, 4819, Carn. Mus., 53 mm. Cali.

Nasal barbels extending to base or end of opercular spines, very little shorter in the type; maxillary barbel extending to the end of the opercular spines or beyond the origin of the pectorals; pectoral rays about equal to the length of the eye and the post-orbital part of the head, the filament extending for more than half the length of the fin beyond the tip of the divided rays on one side in the largest specimen, nearly as long as the head, shorter in other specimens; origin of the ventrals equidistant from base of middle caudal rays and base or middle of the pectoral rays, reaching just beyond the vent; origin of the anal about under the middle of the dorsal, the distance between the base of its last ray and the base of the middle caudal ray four and one-third to five in the length; caudal rounded, five and one-half to six and one-half in the length; accessory rays large, numerous; origin of dorsal

²² The head in the figure is a little too short.

over middle of the ventrals, its distance from the middle of the caudal one and three-fourths to one and eight-tenths in its distance from the snout.

Sides and back in the young with black spots, the middle ones of the sides larger and forming a more or less regular series in the young and half-grown; in the largest specimen the caudal peduncle and base of the caudal are profusely covered with spots smaller than the eye, the spots larger, less numerous and less conspicuous forwards.

Teeth round-tipped incisors in the largest, more pointed but distinct incisors in the middle-sized specimens; the teeth of the type narrow, pointed incisors.

28. *Pygidium latidens* EIGENMANN. (Plate XLVII, fig. 4.)

Pygidium latidens EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 693.

13801, I. U. M., one, 53 mm. Small creek near the mouth of Rio Calima, north of Buenaventura. May 7, 1913. Henn.

Head 5.5; D. 9.5; A. 7.5; P. 7; posterior edge of eye in advance of the middle of the head; interocular 3.5 in the head.

Nasal barbel extending beyond the tips of the opercular spines; maxillary barbel extending beyond the axil, longer than the head; pectorals broad, as long as head without snout; pectoral filament equal to the distance from the snout to the axil; ventrals not nearly reaching anus, their origin equidistant from the base of the middle caudal rays and the interopercle; origin of anal about under middle of the dorsal, distance between base of the last ray and the middle caudal rays five and a half in the length; caudal rounded, about six in the length; accessory rays well developed; origin of dorsal over anus, its distance from the middle caudal rays two in its distance from the snout; gill-membrane free to below the anterior spine of the interopercle, without a free membrane across isthmus; both jaws with two series of thin, chisel-shaped teeth.

Color plain, without spots or stripes.

29. *Pygidium metæ* Eigenmann. (Plate XLVII, fig. 5.)

Pygidium metæ EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 694.

13770, I. U. M., one, 78 mm. Barrigona. March, 1914. Manuel Gonzales.

Head 6.3 in the length; D. 10.5; A. 9.5, counting the rudimentary rays; P. 6; width of head nearly equal to its length; eye entirely in the anterior half of the head, snout 2.75 in the head, interocular 3.5. Teeth conic.

Nasal barbels reaching to tip of opercular spines, maxillary barbel slightly beyond origin of pectorals; pectorals small, equal to the postorbital portion of the head, the first ray with its filament equal to the head, origin of ventrals much nearer

base of middle caudal rays than to tip of pectorals, their tips reaching the anal; origin of anal under fourth dorsal ray (second fully developed ray), the distance between the base of its last ray and the base of the middle caudal rays six times in the length; caudal rounded; origin of dorsal over tip of ventrals, its distance from the base of the middle caudal rays two and two-fifths times in its distance from the snout.

Sides and back densely covered with spots about the size of the eye.

30. *Pygidium stramineum* Eigenmann. (Plate XLIX, fig. 1.)

Pygidium stramineum EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 694. 7101, C. M., type; 13818, I. U. M., paratype, 46 and 50 mm. Quebrada del Mango, Santander. Gonzales.

7089a, C. M., paratype, 35 mm. Quebrada del Maradat (?) Santander. Gonzales.

7090a-c, C. M., 13804, I. U. M., paratypes, seven, largest 45 mm. Quebrada da Densino, Santander. Gonzales.

7102a-h, C. M.; 13819, I. U. M., fifteen, largest 60 mm. Quebrada Deocamante, Santander. Gonzales.

7103a-b, C. M.; 13826, I. U. M., four, the largest 67 mm. Quebrada de Zuarta, Santander. Gonzales.

7104, C. M., one, 41 mm. Quebrada de La Honda, Santander. Gonzales.

Head 4.5-5.33; D. 10.5; A. 8.5-9.5; P. 9; posterior margin of eye in the middle of the head; interorbital three in the length of the head; teeth bristle-like, in about three series.

Nasal barbels reaching base of opercular spines or beyond origin of pectorals, maxillary barbels to tip of opercular spines or axil; pectoral filament about equal to the length of the head, the rays equal to the length of the head without the snout; origin of ventrals equidistant from the base of the middle caudal rays and a point between the axil and a little in front of the opercle (and the tips of the opercular spines in the type), tips of the ventrals slightly behind the vent; origin of the anal behind the vertical from the base of the last dorsal ray or under the posterior half of the dorsal, the distance between the base of the last anal ray and the middle caudal rays 4.5-5 in the length, accessory caudal rays very large and numerous; caudal rounded, six and a half times in the length; origin of dorsal over the origin of the ventrals, or but slightly behind this point, always nearer the eye than the tip of the caudal, sometimes equidistant from tip of snout and tip of caudal, its distance from the base of the middle caudal rays one and a half or less in its distance from the snout.

Uniform straw-colored in alcohol.

31. *Pygidium unicolor* Regan.

Pygidium unicolor REGAN, Ann. & Mag. Nat. Hist. (S), XII, Nov., 1913. (Condoto.)

Habitat.—San Juan basin.

The following is the original description of Regan:

“Depth of body 7 in length, length of head 6. Head as broad as long. Diameter of eye 12 in length of head or 3 in interocular width; eyes well in advance of middle of head, close behind nostrils. Barbels as long as head. Dorsal 8-9, with 5 or 6 branched rays, rounded; origin above or a little in advance of vent, $1\frac{1}{5}$ as far from end of snout as from base of caudal. Anal 7, with 4 branched rays; origin below last rays of dorsal. Pectoral filament $\frac{1}{5}$ to as long as head, branched rays $\frac{2}{5}$ length of head. Pelvies covering vent. Caudal subtruncate. Coloration uniform.

“Two specimens, 80 and 85 mm. in total length, from the Condoto (Spurrell).”

32. *Pygidium kneri* (Steindachner). (Plate XLVI, figs. 1, 2.)

Trichomycterus kneri STEINDACHNER, Ichthyol. Beitr., XII, 1882, p. 21, pl. V, figs. 1-1a.

Habitat.—Canelos, Rio Bobonaza; Rio Zamora, eastern slope of Ecuador; Rio Meta, eastern Colombia.

13907, I. U. M., one, 155 mm. Barrigona, Rio Meta. Gonzales.

Head 5.7; depth 6.3; D. 10; A. 10 including the rudimentary rays; eye 9 in the head, interocular 3, snout 2.3; eye in middle of the head.

Nasal barbel extending a little beyond gill-opening, as long as the head; maxillary barbel reaching to near tip of the shortest pectoral ray; first pectoral ray with its filament a little longer than the head, the rays about equal to the part of the head behind the nasal barbels; origin of ventrals equidistant from base of middle caudal rays and the eye; origin of anal under last dorsal ray; caudal truncate when half expanded, slightly rounded or emarginate when fully expanded or compressed, its middle rays equal to the length of the head; dorsal rays coterminous when depressed; distance of origin of dorsal from base of middle caudal rays 1.6 in its distance from the snout; depth of caudal peduncle about 1.5 in its length, which is five in the length.

Slightly darker above, without spots or streaks.

Steindachner's description and figure give the following variation from the above.

“Head 5.25-5.66; depth 6.75-7.5; D. 9; A. 7; eye 5-6 in the head; snout 2.5; interocular 2.66-3.75; width of the head 1.33-1.4 in its length.

"Nasal barbels reaching to gill-opening, maxillary barbel considerably beyond origin of pectoral; upper pectoral ray prolonged; origin of the dorsal behind that of the ventrals, its last ray over or a little in advance of the first anal ray; caudal slightly emarginate in the figure, said to be "schwach convex" in the text. Chocolate brown, thickly peppered with somewhat darker, very small, irregular spots or points."

33. *Pygidium meridæ* Regan. (Plate XLIX, fig. 2.)

Pygidium meridæ REGAN, Ann. & Mag. Nat. Hist. (7), XII, Dec., 1903, p. 624 (Merida and from Rio Albireggas above Merida, 3500 meters), EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, 399.

Habitat.—Cordillera of Merida, Venezuela.

13771, I. U. M., one, 99 mm. Merida. Purchased from Rosenberg.

Head 6 [-7]; D. 10.5 [6-7 branched rays]; A. 9.5 [4 or 5 branched rays]; P. 8; eye in front of the middle of the head; interocular contained three and one-third in the length of the head [3], snout two and one half times.

Nasal barbel reaching a little beyond the eye; maxillary barbel very slender, reaching about to middle of the pectorals, longer than the head [as long or nearly as long as the head]; outer pectoral ray equals length of maxillary barbel, the projecting filament being half as long as the rest of the fin [one and one-third times as long as head]; origin of ventrals equidistant from base of middle caudal rays and posterior portion of head, the ventrals reaching the vent; origin of anal below penultimate dorsal ray; distance between last anal ray and the middle caudal rays four and three-fourths in the length [four and two-thirds to five times]; caudal rounded [truncate], six and a half times in the length; origin of the dorsal on the vertical from a point just in front of the vent, over tip of ventrals; distance between origin of dorsal and base of middle caudal rays one and three-fourths times in its distance from the snout [one and two-thirds to one and four-fifths].

No lateral band; traces of dark spots.

The characters found by Regan are given in brackets.

34. *Pygidium bogotense* Eigenmann. (Plate XLIX, figs. 3, 4.)

Pygidium bogotense EIGENMANN, Indiana University Studies, No. 16, p. 18, dated Sept., issued Dec. 23, 1912. (Madrid; Chapinero.)

Habitat.—Plains of Bogotá and northward.

4820, C. M., type; 4821, C. M.; and 12679 I. U. M., paratypes, two hundred thirty-nine, largest 80 mm. Puente de Supa, beyond Chapinero, north of Bogotá. Eigenmann.

4834, C. M.; 12680, I. U. M., paratypes, six. Madrid, plains of Bogotá. Eigenmann.

University of Michigan, 94 mm. Mountains, 4,000 ft., Guira River, Santa Marta. July 18, 1913. A. S. Pearse.

University of Michigan, 66 and 68 mm. Small stream, San Lorenzo, Santa Marta, 4,500 ft. July 8, 1913. A. S. Pearse.

7087*a-c*, C. M., 13802, I. U. M., five, largest 52 mm. Rio Piedras, Santander. Gonzales.

7457, C. M.; 13845, I. U. M., five, largest 55 mm. Quebrada da Charda. Santander.

7088, C. M., 13803, I. U. M., twenty-six, largest 80 mm. (Label illegible—"Puchada? de la Porguira? de Norte Zipa Quira?") Gonzales.

13806, I. U. M., 85 mm. Mill-stream, Cincinati (twenty miles from Santa Marta), Colombia. Dec. 31, 1916, 4,500 feet. E. B. Williamson.

Head 5.25-6; D. 10.5 in two specimens, 11.5 in four, 12.5 in eight, 13.5 in two; A. 10.5; P. 8; center of the eye very little in front of the middle of the head; interocular about three in the length of the head; head but little longer than wide; teeth conical, in three or four irregular series.

Nasal barbel extending to tip or base of opercular spines; maxillary barbel extending to the base of the opercular spines or beyond the base of the pectoral; pectoral rays about as long as the head behind the nasal barbel, pectoral filament about as long as the head; origin of ventrals equidistant from base of middle caudal rays and tip or base of the opercular spines, tips of ventrals extending to or very slightly beyond the vent; origin of anal under one of the last three dorsal rays or just behind the vertical from the last one; distance between the base of the last anal ray and the middle of the caudal ray four and three-fifths to five in the length; caudal rounded, six to seven in the length; accessory caudal rays numerous and large; origin of dorsal over origin or posterior half of the ventrals, equidistant from tip of caudal and eye,²³ its distance from the base of the middle caudal rays one and five-tenths to one and seven-tenths in its distance from the snout.

²³ In this specimen the origin of the dorsal is over the origin of the ventrals. In the specimens from the plains about Bogotá examined in this regard, only one had the origin of the dorsal a little further forward, a number had it equidistant between the tip of the caudal and a point some distance behind the eye. In the specimens from the Santa Marta Mountains, the origin of the dorsal is a little further forward. These specimens approach *nigromaculatum*, to which they ought perhaps to be referred. It is certain that the largest specimens referred to *nigromaculatum* from Santa Marta belong to a species different from those found on the plains of Bogotá. It is possible that *P. bogotense* is also found in Santander and Santa Marta, but it is also possible that the half-grown of *P. bogotense* are indistinguishable from the half-grown of *P. nigromaculatum*, and that the specimens from Santander and Santa Marta are really the latter species.

Sides and back with numerous irregular spots, larger in the larger specimens, sometimes referable to distinct series. The spots are smaller in the specimens from Santander.

35. *Pygidium nigromaculatum* (Boulenger). (Plate XLIX, fig. 5.)

Trichomycterus nigromaculatus BOULENGER, Ann. & Mag. Nat. Hist. (5), XIX, 1887, p. 349 (Andes of Colombia).

Pygidium nigromaculatum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 52; Occasional Papers Cal. Acad. Sci., I, 1890, p. 336; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Andes of Colombia, especially Sierra de Santa Marta and Santander. No. ? ———, University of Michigan, two, 138 and 165 mm. Small stream, San Lorenzo, Santa Marta Mountains (4,500 ft.). Sept. 9, 1912. M. A. Carriker. No. ? ———, University of Michigan, two, 118 and 150 mm. Same place, Jan. 16, 1913. M. A. Carriker.

No. ? ———, University of Michigan, one, 73 mm. Same place, July 8, 1913. A. S. Pearse.

No. ? ———, University of Michigan, eight,²⁴ largest 55 mm. Same place, July 9, 1913. A. S. Pearse.

No. ? ———, one, 115 mm. Locality?

13837, I. U. M.; 7447*a-b*, C. M., four, largest 93 mm. Quebrada de la Raya, Santander. Gonzales.

7448*a-b*, C. M., two, the larger 45 mm. Quebrada Capitanejo, Santander. Gonzales.

7449*a-c*, C. M.; 13838, I. U. M., six, largest 68 mm. Quebrada de Cobarachior, Santander. Gonzales.

DESCRIPTION OF THE SPECIES FROM SAN LORENZO.

The characters given by Boulenger are in brackets.

Head 5.24–5.75 [6.5 in total]; D. 11.5 or 12.5; A. 9.5; P. 9; eye in middle of the head; interocular 3 in the length of the head; width of head equal to its length [longer than the distance between snout and a line connecting the tips of the two bunches of opercular spines]; teeth conical [pointed, recurved].

Nasal barbels extending to the tips of the opercular spines or to the base of the

²⁴ These specimens are so distorted that it is difficult to refer them to their proper place. The origin of the dorsal seems to be equidistant from the tip of the caudal and the front of the eye. There are traces of longitudinal bands.

last pectoral ray; maxillary barbels extending to the base of the last pectoral ray or a little beyond; pectoral broad, rounded, the filament equal or nearly equal to the length of the head; origin of the ventrals very little nearer base of middle caudal rays than eye, their tips reaching the vent or very little beyond it; origin of anal under the penultimate dorsal ray [anal entirely behind the dorsal], the distance between its last ray and the middle caudal ray four and one half to five in the length; caudal rounded, about six in the length; accessory caudal rays not conspicuous; origin of dorsal over the anterior two-thirds of the ventrals; origin of dorsal nearly equidistant from tip of snout and tip of caudal, its distance from the base of the middle caudal rays on an average 1.4 in its distance from the tip of the snout.

Sides and back in the largest with numerous irregularly arranged spots about the size of the eye, the spots larger and less numerous in the young, much as in *P. bogotense*.

In the specimens from La Raya, Santander, the dorsal and ventrals are a little farther back, the ventrals equidistant from base of middle caudal rays and tip of opercular spines, the distance between the dorsal and the middle caudal rays 1.52 in its distance from the snout. The anal is entirely behind the dorsal. The origin of the dorsal is equidistant from the eye and the tip of the caudal. Plain or but faintly spotted.

Specimens from Capitanejo resemble those from La Raya.

Some of the specimens from Cobarachior seem to be typical *bogotense*, while others approach the specimens from La Raya and *P. latistriatum* from Pinchote. *P. bogotense*, typical of the plains of Bogotá, grades into *P. nigromaculatum* of Santa Marta in Santander and Santa Marta.

36. **Pygidium banneaui** Eigenmann. (Plate XLVIII, fig. 1.)

Pygidium banneaui EIGENMANN, Indiana University Studies, No. 16, dated Sept., issued Dec. 23, 1912, p. 19.

Habitat.—Streams near Honda, Colombia.

4815, C. M., type; 4816a z, C. M., 12677, I. U. M., paratypes, eighty-nine specimens, the largest 44 mm. Bernal Creek, near Honda. Eigenmann.

7456a b, C. M.; 13844, I. U. M., four, 35–41 mm. Guaduas? Gonzales.

These specimens might be considered the young of some of the other species if it were not for the fact that one specimen, 34 mm. long, contains eggs over a millimeter in diameter, which must be nearly mature.

Head 5.33–5.5; depth 5.5–7; D. 10.5 or 11.5; A. 7.5 or 8.5; P. 8; eyes slightly in advance of the middle of the head; interocular three and five-tenths in the length of the head; teeth conical.

Nasal barbels reaching to the tips of the opercular spines, maxillary barbel to near the middle of the pectoral; upper pectoral ray prolonged in a filament, as long as the head or a little longer; ventrals reaching the vent, their origin about equidistant from snout and tips of middle caudal rays; origin of the anal under the middle of the dorsal, the distance between the last ray and the middle caudal rays 4.5-5 in the length; caudal distinctly emarginate, about five in the length; origin of dorsal a little nearer tip of caudal than eye, the distance between the origin of the dorsal and the caudal 1.4-1.66 in its distance from the snout.

Specimens 18 mm. long have a black line from the nasal barbel to near the tip of the middle caudal rays, accented in places; in specimens 20 mm. long the line is accented more strongly, appearing to be breaking up into spots; there are also spots on the back; in older specimens the line becomes diffuse; with growth a distinct series of spots develops along the middle of the back in front of the dorsal, and another series between these and the lateral series; in the largest the sides and back are profusely spotted, the spots varying in size and arrangement.

In the specimens from Guaduas the barbels are a little shorter and the dorsal a trifle farther forward. The color markings are less profuse than in the type.

37. *Pygidium spilosoma* Regan. (Plate XLVIII, fig. 2.)

Pygidium spilosoma REGAN, Ann. & Mag. Nat. Hist. (8), XII, Nov., 1913, p. 468. (Rio Sipi and Rio Tamana.)

This species from the Pacific drainage of central Colombia is known from three specimens 130-250 mm. long, described by Regan, and 7092, C. M., 97 mm. (Cordova on the Rio Dagua. Eigenmann.

In the following description, Regan's data are given in brackets.

Head 6 [to 6.75]; depth 7 [to 8]; D. 11.5 [9, with 6 branched rays]; A. 9.5 [7, with 4 branched rays]; P. 8; eye very little in front of the middle of the head; interocular 3.5 in the length of the head [2.5-3]; head longer than wide, tapering forward, the space between the nasal barbels 6.5 in the length of the head. Teeth minute, conical.

Nasal barbels extending to the base of the opercular spines, the maxillary barbel to their tip [to basal part of pectoral]; pectoral rather narrow, the upper part truncate, the filament equal to the head; origin of the ventrals equidistant from base of middle caudal rays and the tip of the opercular spines, a little too far forward in the figure, origin of the anal under the middle of the dorsal [a little behind end of dorsal], the distance between the base of its last ray and the base of the middle caudal rays 5 in the length; caudal truncate, six and one-fourth in the length; dorsal obliquely truncate, origin of dorsal over posterior half of the ventrals, its distance from the base of the middle caudal rays 1.6 in its distance from the snout.

An obscure, dusky band along the middle of the sides; sides and back with obscure spots about the size of the eye.

38. *Pygidium dorsostriatum* EIGENMANN. (Plate XLVIII, fig. 3.)

Pygidium dorsostriatum EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 695.

7093a-b, C. M.; 13810, I. U. M., four, 18-76 mm., the largest the type. Villavencio. Manuel Gonzales.

Distinguished by the eccentric, dark, lateral band.

Head 5; D. 12.5 (of which 4 minute); A. 9.5; P. 9; center of eye very little in advance of middle of the head,²⁵ interocular three in the head. Teeth conic.

Nasal barbels extending to, or but slightly beyond, origin of pectoral; maxillary barbel to the axil, equal to the length of the head; pectoral filament equal to the length of the head, the longest ray equal to the length of the head behind the nasal filament; origin of ventrals equidistant from base of middle caudal rays and base or tip of the interopercular spines, ventrals nearly reaching the anal; origin of the anal under the last quarter of the dorsal, the distance between the base of its last ray and the base of the middle caudal rays about 4.5 in the length; caudal rounded, six and five-tenths to seven times in the length; the first rudimentary dorsal ray over the base of the ventrals, its distance from the base of the middle caudal ray equal to its distance from the tip of the opercular spine, 1.47 in its distance from the snout.

A dark band or row of spots from just above the gill-opening to the base of the upper caudal lobe; a few spots below the band in the front half of the body in the larger specimen.

This description is based on the two larger specimens, 68 and 77 mm. long. The two smaller specimens, 18 and 21 mm. long, are uniform in color.

39. *Pygidium venulosum* Steindachner.

Pygidium venulosum STEINDACHNER, Anz. K. Akad. Wiss. Wien, 1915, No. XVII, p. 199 (Paramo de Cruz Verde, Eastern Cordilleras, Colombia, 3,000 M.)

Habitat.—Eastern Andes of Colombia.

I have not seen this species.

D. 10 or 11; A. 10; P. 8. Caudal peduncle greatly compressed. Caudal rounded; eye very small, a very little in front of middle of head. Barbels short, about reaching eye; origin of anal under middle of dorsal; origin of dorsal equidistant from tip of caudal and lateral margin of head; teeth pointed. First pectoral ray

²⁵ In the plate the eye is placed too far forward; the anterior margin should be where the posterior margin is.

not prolonged. Lateral band above middle of sides; back and sides with dark reticulations on a lighter background.

40. *Pygidium latistriatum* Eigenmann. (Plate XLVIII, fig. 4.)

Pygidium latistriatum EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 696. 7450, C. M., type, 46 mm. Quebrada de Pinchote, Santander. Gonzales.

Head 8 mm., length to base of caudal 39 mm.; width of head 6 mm., interocular 2.5 mm., eye a little in front of the middle; distance from snout to origin of dorsal 23 mm., to its last ray 27 mm.; distance between origin of dorsal and base of middle caudal rays 16 mm., distance from snout to origin of ventrals 22 mm., to origin of anal 28 mm., distance between base of last anal ray and base of middle caudal rays 9 mm., maxillary barbel 9 mm., nasal barbel 7 mm., length of outer pectoral ray with its filament 8 and 9 mm., the divided rays 5 mm., D. 8.5; A. 6.5, not counting the imbedded rays in either case; upper caudal rays 8 mm.; lower caudal rays about 6.5 mm. Accessory caudal rays numerous.

A lateral band from above the opercle to the middle of the caudal, increasing in width backward; mid-dorsal line dark; a dark stripe in front of the dorsal between the lateral stripe and the mid-dorsal stripe.

It is possible that some of the specimens under *P. nigromaculatum* belong here.

41. *Pygidium striatum* Meek & Hildebrand.

Pygidium striatum MEEK & HILDEBRAND, Field Mus. Publ., No. 166, Zoöl., Ser. X, Dec., 1913, p. 78 (Rio Cana); Publ. 191, Zoöl., Ser. X, Dec., 1916, p. 266 (Rio Cana), Tuyra Basin, Panama.

Habitat.—Colombia from Santander to the Rio Dagua in west central Colombia and the Rio Tuyra in Panama.

I have been able to examine the types and the following specimens:

Catalog Numbers.	Number of Specimens.	Length in Mm.	Locality.	Collector.
7113a-j, C.M., 13820 I.U.M.	41	79 largest	Quebrada Sarjento	Gonzales.
7114a-b, C.M., 13821 I.U.M.	5	33-60	Quebrada Alban	Gonzales.
7115a-b, C.M., 13822 I.U.M.	4	41-61	Quebrada de la Ropera, Santander	Gonzales.
7105 C.M.,	2	35 and 71	Quebrada de la Hato, Santander	Gonzales.
7106a-b, C.M., 13823 I.U.M.	5	58 largest	Guadual	Gonzales.
7108a-k, C.M., 13824 I.U.M.	20	50 largest	Villeta	Gonzales.
7109a-i, C.M., 13825 I.U.M.	16	60 largest	San Gil, Santander	Gonzales.
7111a-d, C.M., 13828 I.U.M.	9	43 largest	Rio Guaduas	Gonzales.
?7112, C.M.,	1	39	Quebrada Chamisal	Gonzales.
13829 I.U.M.	1	45	Caldas, Rio Dagua	Eigenmann.

Head 5-6; D. 10.5 or 11.5; A. 8.5 or 9.5; P.8; eye very little in advance of the

middle of the head, interocular 3.5 to 4 in the length of the head; the width of the head equal to its length behind the nasal barbels.

Nasal barbels about reaching the tip of the opercular spines, the maxillary barbels sometimes to the axil; first pectoral ray with its filament about equal to the length of the head, the rays equal to the length of the eye and postorbital portion of the head or a little longer; origin of the ventrals equidistant from the base of the middle caudal rays and some point in the basal half of the pectorals, their tips reaching the vent in the young, falling short in the adult; origin of anal under the middle of the dorsal, the distance between the base of the last ray and the base of the middle caudal ray five to five and one-half in the length; caudal rounded, six in the length; origin of the dorsal over some point in the last half of the ventrals, equidistant between tip of caudal and middle of pectorals or a little farther forward, its distance from the base of the middle caudal rays 1.8-2.2 in the length.

Sides and back spotted, the spots usually confluent into a narrow median lateral band and into a narrow band above and below the median band. The very young with a narrow black lateral band without other markings.

The above description applies particularly to the types and some of the specimens between Honda and Facatativa, Nos. 7113, 7114, 7106, and some specimens from Santander, No. 7105.

From these typical specimens the following variations were noted. In the specimens from Villeta, No. 7108, also on the line between Honda and Facatativa, the caudal is truncate with rounded outer edges, the origin of the dorsal is equidistant between the tip of the caudal and the opercle or a little farther forward. Some of these specimens are more distinctly spotted than the typical *striatum*, approaching *P. banneauxi*.

In the specimens from Guaduas, also along the line between Honda and Facatativa, and in those from San Gil, No. 7109, the position of the dorsal agrees with its position in those from Villeta, *i. e.*, it is in front of the typical position. In these, the most conspicuous marking is a black lateral band in which the spots are not recognizable. In some of those from San Gil, the band above the median band is also prominent, but it can sometimes be seen that both it and the median band are made up of series of spots. A small specimen from Chamisal, No. 13831, is nearly like them. The origin of the dorsal is median between the tip of the caudal and the base of the opercular spines, the barbel extends nearly to the middle of the pectoral; a narrow black lateral stripe, otherwise plain light.

The specimens from La Ropera are more profusely covered with small spots, their longitudinal arrangement inconspicuous.

In the specimen from Caldas, No. 13829, the origin of the dorsal is equidistant from the tip of the caudal and the opercular spines. The spots along the middle of the sides are conspicuous, but not confluent.

To this species probably also belong the following specimens.

7451a, C. M., 13839, I. U. M., 3, largest 60 mm. Quebrada de la Pelada, Santander.

7452a, C. M., 13840, I. U. M., 2, larger 41 mm. Quebrada de la Callegona, Santander.

7453a-b, C. M., 13841, I. U. M., 3, largest 61 mm. Rio Mogotes, Santander.

7454a-c, C. M., 13842, I. U. M., 6, largest 63 mm. Quebrada de Horizonte, Santander.

7455a-d, C. M., 13843, I. U. M., 8, largest 67 mm. Quebrada de Suescum, Santander.

These are like the typical specimens of *striatum* described above, but lack all color markings, being uniformly pale.

Very close to *striatum* if not identical with it, is *P. regani*.

42. *Pygidium regani* EIGENMANN. (Plate XLVIII, fig. 5.)

Pygidium regani EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 696.

? *Pygidium taenia* REGAN (*non* Kner & Steindachner), Ann. & Mag. Nat. Hist. (S), XII, 1913, p. 469 (Rio Sipi and Rio Tamana).

Habitat.—San Juan basin.

13772, I. U. M., one, 55 mm. Tado, Rio San Juan. Purchased from Rosenberg.

Head 6; D. 10.5; A. 8.5; P. 8; eye in middle of the head, interorbital four times in the length of the head.

Nasal barbel as long as the head, reaching beyond axil of pectoral; maxillary barbel reaching to near the end of the lower pectoral ray, considerably longer than the head; outer pectoral ray as long as the head; origin of ventrals equidistant from base of middle ray and tip of opercle, not quite reaching to the vent; origin of anal under posterior half of dorsal, the distance from the base of the last ray to the middle caudal ray contained five and one-half times in the length; caudal six times in the length; origin of dorsal equidistant from tip of caudal and opercular spines, over posterior third of the ventrals, its distance from the middle caudal ray one and four-fifths in its distance from the snout.

A dark streak from opercular spines to middle of caudal; faint spots above and below the lateral stripe.

TABLE OF MEASUREMENTS.

Length over all	55 mm.
Length to base of caudal	47 mm.
Length of head to tip of opercular spines	8 mm.
Distance of origin of dorsal from snout	30 mm.
Distance of origin of dorsal from middle caudal rays	17 mm.
Outer pectoral ray	8 mm.
Maxillary barbel	11 mm.
Nasal barbel	8 mm.
Length of eye	1 mm.
Length of snout	3.5 mm.
Interocular distance	2 mm.

This species is very similar to *striatum*, and may be a synonym of it.

43. *Pygidium retropinne* (Regan).

Trichomycterus retropinnis REGAN, Ann. & Mag. Nat. Hist. (7), XII, Dec., 1903, p. 624 (headwaters of Magdalena east of Papaganat, St. Augustine, Andes of Colombia, 5,000 ft.).

Habitat.—Headwaters of the Rio Magdalena.

“Length of head $5\frac{1}{2}$ times in the total length. Head as broad as long. Diameter of eye about 4 times in the interocular width, which is 3.33 times in the length of the head. Snout as long as the postorbital part of head. Barbels equal to about .8 the length of head. Dorsal with six branched rays, originating above or slightly behind the anal opening, the distance from its point of origin to the caudal 2.4 times in the distance from the former to the tip of the snout. Anal with 4 branched rays, originating below the anterior third of the dorsal, the distance from the base of its last ray to the caudal 5.4 times in the total length. Longest branched ray of the pectoral, .66 the length of the simple outer ray, which is equal to $\frac{5}{8}$ the length of head. Ventrals not quite reaching the anal opening. Caudal truncate-rounded. Brownish, with an indistinct darker stripe along the middle of the side and traces of some dark spots.”

“Total length 80 mm.”

“A third specimen, 30 mm. in total length, which I have purposely excluded from the above diagnosis, has a well-marked broad longitudinal stripe on each side. In it the longest branched ray of the pectoral is $\frac{5}{8}$ the length of the outer simple ray, and the distance from the origin of the dorsal to the caudal is 2.2 times in the distance from the former to the tip of the snout.”

KEY TO THE SPECIES OF PYGIDIUM FROM THE AMAZON TO THE ESSEQUIBO.

From the vast lowland area of the Amazon, Orinoco, and Guiana but few species are known.

a. Origin of the dorsal in front of the vertical from the origin of the anal; maxillary barbel reaching tip

- of opercle; snout about 2.5 in the head; nasal barbel reaching not quite to the tip of the maxillary barbel; head nearly as wide as long; eye just in front of middle of the head.
- b.* Head 6 in the length; the first pectoral ray with its filament equals the length of the head; sides and back with numerous spots, each larger than the eye, in about five series between the dorsal and anal; origin of dorsal equidistant from tip of caudal and eye. . . . 44. **guianense** Eigenmann.
- bb.* Head 5 in the length; first pectoral ray with its filament equals the length of the head without the opercle; uniform yellowish-brown above, lighter below, top of head marbled; origin of dorsal nearer tip of caudal than eye. 45. **conradi** Eigenmann.
- aa.* Origin of anal under origin of dorsal.
- c.* Head 6 in the length; maxillary barbel reaching tip of pectoral; upper parts obscurely spotted; origin of dorsal equidistant from tip of caudal and middle of pectoral; eye in anterior half of head. 46. **gracilior** Eigenmann.
- cc.* Head 7 in the length; maxillary barbel reaching middle of pectoral; eye entirely in anterior half of the head, nearly equal to the interocular and to the snout. . . 47 **amazonicum** (Steindachner).
- ccc.* Head 5.5 in the length; maxillary barbel reaching tip of last interopercular spine; eye entirely in anterior half of the head, considerably less than the interorbital or the snout; opercular and interopercular bunch of spines alike. 48. **hasemani** Eigenmann.

44. **Pygidium guianense** Eigenmann. (Plate L, fig. 1.)

Pygidium guianense EIGENMANN, Ann. Carnegie Mus., VI, 1909, p. 11; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400; Mem. Carnegie Mus., V, 1912, p. 212 (Aruataima Cataract above Holmia.)

Habitat.—Upper Potaro River, British Guiana.

1003, C. M., type, 77 mm. Aruataima Cataract. Eigenmann.

Head 6; depth equals head in length; D. 9; A. 7; eye 4 in snout, 9.5 in head; head nearly as broad as long; maxillary barbel reaching to tip of opercle; teeth in bands of about four irregular series; origin of anal under middle of dorsal; dorsal fulera extending forward to near the dorsal; caudal rounded; first pectoral ray prolonged in a filament nearly as long as the rest of the ray; round dark spots everywhere, except on belly and lower surface of head; caudal dusky, the margin light.

45. **Pygidium conradi** Eigenmann. (Plate L, fig. 2.)

Pygidium conradi EIGENMANN, Mem. Carnegie Mus., V, 1912, p. 212 (Amatuk and Waratuk Cataracts).

Habitat.—Lower Potaro River, British Guiana.

2212, C. M., 41 mm., type. Amatuk Cataract. Eigenmann.

11710, I. U. M., 34 mm., paratype. Waratuk Cataract. Eigenmann.

With the characters given in the key.

The teeth conic.

46. *Pygidium gracilior* Eigenmann. (Plate L, fig. 3.)

Pygidium gracilior EIGENMANN, Mem. Carnegie Mus., V, 1912, p. 213 (Erukin).

Habitat.—Lower Potaro River, British Guiana.

1730, C. M., 27 mm., type. Erukin. Eigenmann.

Head 6; depth 9; D. 8; A. 6; eye about 2 in the snout; interorbital a little greater than snout, snout 3 in the head.

Slender, head as broad as long; maxillary barbel reaching tip of pectoral; nasal barbel to origin of pectoral; outer pectoral ray prolonged, about equal to the head in length. Origin of the anal under origin of dorsal; distance from origin of dorsal to origin of caudal 3.5 in the length; length of caudal 5 in the length.

All upper parts obscurely spotted.

47. *Pygidium amazonicum* (Steindachner). (Plate XLVI, figs. 3, 4.)

Trichomycterus amazonicus STEINDACHNER, Flussf. Süd-am., IV, 1882, p. 29, pl. VI, figs. 4-4a (Cudajas).

Pygidium amazonicum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 53; Occasional Papers Cal. Acad. Sci., I, 1890, p. 338; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Amazon, at Cudajas.

This species is known from the type, a specimen 60 mm. long.

Head a little over 6, equal to the depth; D. 8; A. 7; P. 6; eye entirely in front of the middle of the head; interorbital a little greater than the eye; width of head nearly equal to its length.

Head greatly depressed, caudal peduncle strongly compressed; nasal barbels reaching nearly to gill-opening; maxillary barbel to the end of the first third of the upper pectoral ray, lower barbel to the base of the pectoral; dorsal and anal opposite each other; ventrals very short, 2 in the head; caudal rounded; upper pectoral ray nearly equal to the head.

Chocolate brown, with faint darker spots on the caudal peduncle; rays of dorsal and caudal dotted with violet.

48. *Pygidium hasemani* Eigenmann. (Plate L, fig. 4.)

Pygidium hasemani EIGENMANN, Ind. Univ. Studies, No. 20, March, 1914, p. 48. 5238 and 5239, C. M., type and paratypes, many, largest under 18 mm. Santarem.

Haseman.

Habitat.—Amazon at Santarem to Bolivia.

76023, C. M., about 16 mm. San Joaquin. Sept. 4, 1909. Haseman.

Head 5.5; D. 7 or 8; P. 6. Eye in anterior half of the head, about five times in the length of the head, less than the snout, about two times in interorbital. Teeth conical, in a single series; maxillary barbel extending to the tips of the interopercular spines; axillary glands large; opercular and interopercular bunches of spines similar, separate from each other; gill-membranes united, free from the isthmus; pectoral very narrow, about equal to the head in length, the first ray prolonged; origin of dorsal over origin of anal, its distance from the base of the caudal two in its distance from the eye or occiput, equidistant from tip of caudal and middle of pectoral; origin of ventrals nearer snout than tip of caudal; caudal rounded, merging into the large accessory rays.

Translucent, with many chromatophores; dusky spots on the back from a short distance in front of the dorsal to the caudal; a dark bar across base of caudal; dark spots, similar to those of the back, from between ventrals and anal to the caudal; a series of minute spots along the middle of the sides; a small spot on opercle, another on the interopercle, a dark line forward from the eye; a minute spot on base of ventrals.

SPECIES FROM SOUTHEASTERN BRAZIL.

The mountain brooks of southeastern Brazil from Rio Grande do Sul to the Rio San Francisco harbor a number of species. One of these, *P. iheringi*, has broad incisors, a number are known to have pointed teeth, while the rest, *nigricans*, *minutum*, *goeldii*, *itatiyã* and *punctatissimum*, I have not been able to examine. They have the following distribution:

<i>P. minutum</i>	Southern Rio Grande.
<i>P. nigricans</i>	Santa Catherina.
<i>P. davisi</i>	Rio Iguassú, southern São Paulo.
<i>P. proöps</i>	Ribeira, southern São Paulo and Rio Parahyba.
<i>P. iheringi</i>	Ribeira, Santos, and Sapina, São Paulo.
<i>P. paolence</i>	Northern São Paulo.
<i>P. goeldii</i>	Parahyba basin.
<i>P. vermiculatum</i>	Parahyba basin.
<i>P. immaculatum</i>	Parahyba basin; São Matheos; Goyaz.
<i>P. braziliense</i>	? Rio Grande do Sul, ? Rio Ribeira; Rio das Velhas; Rio Doce.
<i>P. itatiyã</i>	Parahyba basin.
<i>P. triguttatum</i>	Parahyba basin.
<i>P. reinhardti</i>	Burmier, into Rio das Velhas.
<i>P. alternatum</i>	Rio Doce.
<i>P. punctatissimum</i>	Araguay.
<i>P. santæ-ritæ</i>	Rio Preto.

KEY TO THE SPECIES OF PYGIDIUM FOUND IN SOUTHEASTERN BRAZIL.

- a.* First dorsal ray prolonged in a filament; barbels scarcely reaching the edge of eye; back uniform blackish, lower parts light; D. 11; A. 10; P. 9. 49. **nigricans** (Cuvier & Valenciennes).
- aa.* First dorsal ray not prolonged; teeth incisors; origin of dorsal equidistant from tip of caudal and a point between the eyes and nasal barbels.
- b.* First pectoral ray not prolonged, or with only a trace of a projection; first anal ray behind the dorsal; sides and back with numerous spots. 50. **iheringi** Eigenmann.
- bb.* First pectoral ray usually prolonged; first anal ray under the dorsal; markings conspicuous. 51. **zonatum** Eigenmann.
- aaa.* First dorsal ray not prolonged; teeth conical.²⁶
- c.* Origin of the dorsal nearer to the tip of the caudal than to the head, or sometimes equidistant between tip of caudal and occiput in *P. paolence*.
- d.* Origin of the anal under the second dorsal ray, last dorsal ray over middle of anal; origin of ventrals nearly equidistant from tip of caudal and snout; eye in anterior half of the head, near the posterior nares; head 5.5-6; D. 9; A. 7-9. 52. **proöps** (Ribeiro).
- dd.* Origin of the anal under the middle of the dorsal, last dorsal ray over third anal ray; origin of ventrals nearer to tip of caudal than to tip of the snout; eye just in front of the middle of the head; head six times in length.
- c.* D. 8.5; A. 6.5; many faint spots, a dark streak along the middle of the sides, another above it. 53. **paolence** Eigenmann.
- cc.* D. 9.5; A. 8.5; a broad lateral band with serrate edges; a series of spots below it and another above it. 54. **reinhardti** Eigenmann.
- ddd.* Dorsal opposite the space between ventrals and anal. (See No. 59 *goldii*.)
- ee.* Origin of the dorsal equidistant between the tip of the caudal and some point near the eye.²⁷
- f.* Pectoral ray without a filament; origin of ventral nearer snout than tip of caudal; origin of anal under posterior part of dorsal; color variable; D. 7; A. 5. 55. **davisi** Haseman.
- ff.* First pectoral ray usually prolonged as a filament.
- g.* Color plain; anal behind the dorsal; origin of ventral nearer snout than tip of caudal; caudal very slightly emarginate; eye in the middle of the head; D. 11.5-13; A. 9.5-10.5. 56. **immaculatum** Eigenmann & Eigenmann.
- gg.* Various marked.
- h.* Origin of the anal under posterior half of the dorsal.
- i.* *Origin of the dorsal over the origin of the ventrals*; origin of the ventrals nearer tip of caudal than eye; ventrals reaching anal; D. 8.5; A. 8.5; eye in middle of head; sides and back profusely covered with confluent spots, leaving the ground-color in irregular vermiculations. See also *punctatissimum*. 57. **vermiculatum** Eigenmann.
- ii.* Origin of the dorsal behind the origin of the ventrals.
- j.* Sides and back with large spots, sometimes alternating across the back; origin of ventrals equidistant from snout and middle of caudal; distance between origin of dorsal and caudal about 1.5 in distance of dorsal from the snout; caudal subtruncate; D. 10.5-11.5; A. 7.5 or 8.5. 58. **alternatum** Eigenmann.

²⁶ Not examined in *P. minutum*, *nigricans*, *goldii*, and *punctatissimum*.²⁷ Not examined in *P. goldii*.

- jj.* With ill-defined spots; origin of ventrals equidistant from snout and tip of caudal; caudal rounded; distance between origin of dorsal and caudal twice in its distance from the snout; D. 10; A. 7.
59. **goeldii** (Boulenger).
- jjj.* With small spots and vermiculations; origin of ventrals equidistant from snout and tip of caudal; distance between origin of dorsal and caudal 1.66–1.75 in distance of dorsal from the snout; D. 10.5 or 11.5; A. 7.5 or 8.5. 60. **brasiliense** (Reinhardt).
- jjjj.* A dark lateral band, spots above and below it; origin of ventrals a little nearer snout than to tip of caudal; distance between origin of dorsal and caudal 1.8 in distance of dorsal from the snout; caudal truncate.
61. **itatiayæ** (Ribeiro).
- hh.* Origin of the anal behind the vertical from the last dorsal ray, the dorsal opposite the space between the ventral and anal, its origin equidistant from snout and tip of caudal, or nearer one or the other; origin of ventrals nearer the snout than to the tip of the caudal; interopercle with about seven spines in a bunch similar to that of the opercle; a series of dots along the middle of the sides, another along the back and another between the two. 62. **triguttatum** Eigenmann.
- ccc.* Origin of dorsal equidistant from tips of snout and caudal; pectorals without filaments; dorsal entirely in front of the anal.
- k.* Sides and back with minute dark specks and vermiculations between them; origin of dorsal over origin of ventrals. 63. **punctatissimum** (Castelnau).
- kk.* Pale brown above with three longitudinal series of squarish brown blotches; origin of dorsal over middle of ventrals; head 4.5 in the length. 64. **minutum** (Boulenger).
- cccc.* Origin of dorsal nearer snout than to tip of caudal.
- l.* Nasal barbels not quite reaching eye, maxillary barbel little beyond posterior margin of the eye; dorsal entirely in front of anal; sides with large blotches. Head four times in the length; a long patch of interopercular spines; pectoral ray not prolonged.
65. **santæ-ritæ** Eigenmann.
- ll.* Nasal barbels reaching beyond origin of eye; pectoral ray prolonged.
- m.* Interopercle with a long patch of spines; pectoral ray prolonged. (See *P. alternatum*, No. 56.)
- mmm.* Interopercle with about seven thorns in a patch similar to that of the opercle; end of dorsal over anus; pectoral ray much prolonged. (See *P. triguttatum*, No. 60.)

49. **Pygidium nigricans** (Cuvier & Valenciennes.)

Trichomycterus nigricans CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 494; ? GAY, Hist. Chile, 1848, p. 311 (Chile); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 274 (copied); RIBEIRO, Fauna Braziliense, Peixes, IV (A), 1912, p. 220.

Pygidium nigricans EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 53; Occasional Papers Cal. Acad. Sci., I, 1890, p. 338; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Santa Catherina, Brazil.

Valenciennes's description of the only specimen known, 140 mm. long, is very brief, and I am afraid that it is in part misleading.

"D. 11; A. 10; P. 9; barbels short, scarcely reaching beyond the eyes; caudal peduncle short and deep; caudal small, truncate, 'le premiere rayon de la dorsal alongé en fil.'

"Back uniform blackish, lower parts light."

50. **Pygidium iheringi** Eigenmann. (Plate L, fig. 5.)

Pygidium iheringi EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 697.

Trichomycterus punctulatus (non Cuvier & Valenciennes) RIBEIRO, Arkiv. för Zoölogie, IV, No. 19, 1908 (Iporanga).

Trichomycterus dispar (non Tschudy) RIBEIRO, Kosmos, V, 1908, and Fauna Brasileira, IV (A), 1912, p. 222 (Rio Iporanga, São Paulo).

Habitat.—São Paulo in coastal streams and the Paraná basin.

7071, C. M., two, 151-160 mm. Sapina, São Paulo. July 3, 1908. Haseman.

10785, I. U. M., four, 140-161 mm. Santos. Von Ihering, the largest the type.

Allied to *P. punctatissimum* from the Araguay.

Head 4.5-5 in the length; D. 11.5 or 12.5; A. 7.5 or 8.5 counting the two rudimentary rays in each case; P. 8; width of head equal to its length behind the nasal barbel; eye in middle of the head, interorbital 3.5-4 in the length of the head. Teeth incisors with slightly expanded tips, in bands of four or five series.

Nasal barbels reaching about to middle of eye, axillary barbel to above middle of opercle; pectoral rounded, very little longer than snout and eye, the first ray not prolonged or with only a trace of a projection; distance between origin of ventrals and eye a little greater or less than that between origins of ventrals and middle caudal rays; the ventrals as long as the snout, not nearly reaching vent, nearly halfway to the anal; origin of anal on, or behind, the vertical from the base of the last dorsal ray; distance between bases of last anal ray and middle caudal rays five or a little over five in the length; caudal slightly rounded, seven to seven and a half in the length; dorsal low and long, the distance between its origin and the base of the middle caudal ray about one and a third in its distance from the snout, its first ray over posterior half of the ventrals.

Sides and back with numerous spots, smallest over pectorals, largest over dorsal, rarely coalescent.

51. **Pygidium zonatum** sp. nov. (Plate LI, fig. 1.)

7596, C. M., *a*, the type, 62 mm., *b* and *c*, paratypes, 50 and 55 mm. Agua Quente, Nov. 27, 1908. Haseman.

7595, C. M., paratype, 60 mm. Cubatão, seven miles west of Santos, São Paulo, Brazil. Aug. 1, 1908. Haseman.

In all but the teeth and color very similar to *P. davisi*.

Head 5; depth 6-6.5; D. 10; A. 7 or 8; P. 7 or 8; eye three times in the snout, seven to seven and one-half times in the head, two times in the interocular, exactly in the middle of the head or a little in front of it; posterior nares more than an orbital diameter from the eye; three rows of narrow incisors in each jaw. The teeth of the paratypes nearly conical.

Maxillary barbel reaching to near tip of last interopercular spine or to tip of opercular spines, the nasal barbel but little shorter; head pointed, but little longer than broad; gill-openings extending forward to below the anterior interopercular spines. First pectoral ray but slightly, if at all, prolonged, its length with the filament equal to the head without the opercular spines; origin of ventrals about equidistant from the snout and the middle of the caudal; origin of anal under penultimate, or fourth from last, dorsal ray; distance between bases of last anal ray and middle caudal rays four and one-half to five in the length; caudal truncate; origin of dorsal over last third of the ventrals, its distance from the base of the middle caudal rays 1.5-1.75 in its distance from the snout.

Color-markings coarse and conspicuous. In No. 7595 C. M., five obscure bars across the back in front of the dorsal, slightly emphasized at their lower ends on the middle of the sides; three similar bars behind the dorsal; a dark line from anterior to posterior nares. In the specimens from Agua Quente a dark lateral band broken toward the caudal in the smallest. Back and lower part of the sides with conspicuous spots.

52. *Pygidium proöps* (Ribeiro). (Plate LI, fig. 2.)

Tricomycerus proöps RIBEIRO, Kosmos, V, 1908, fig. 4; Fauna Brasiliense, Peixes, IV (A), 1912, p. 221, pl. XL, fig. 1.

Habitat.—Ribeira de Iguapé, southern São Paulo, Brazil, and Rio Parahyba. Known from the types, and from

7593, C. M., one, 60 mm. Agua Quente, Ribeira Basin. Nov. 27, 1908. Haseman.

7598, C. M., one 32 mm. São João da Barra, Rio Parahyba. June 22, 1908. Haseman.

Head 5.5-6; depth 7; D. 9; A. 7-9; P. 7; posterior margin of eye slightly in advance of the middle of the head, diameter of eye two times in the snout, six and one-half in the head, over one and one-half in the interorbital; posterior nares close to the eye, their posterior margin on a line with the anterior margin of the eye;

teeth conical, in very narrow bands; nasal barbels reaching to the base, maxillary barbels to the tips of the opercular spines; first pectoral ray not prolonged, pectoral equal to the length of the head without the snout; origin of ventrals equidistant

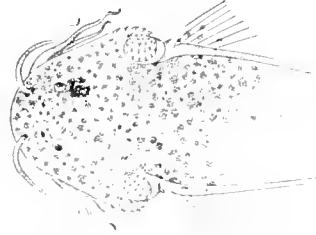


FIG. 16. *Pygidium proöps* (Ribeiro). No. 7593 C.M.

from tip of snout and tip of caudal; origin of anal under second or third dorsal ray; distance between last ray of anal and base of caudal five and one-third times in the length; caudal rounded; distance between origin of dorsal and caudal two and one-half times in its distance from the snout.

Back, sides, dorsal and caudal densely spotted.

The above description is based on the specimen from Agua Quente and Ribeiro's account; the smaller specimen from the Parahyba has:

Head 5; depth 8; D. 10; A. 9; P. 5; first pectoral ray considerably prolonged; origin of ventrals equidistant from tip of caudal and pre-opercle. Sides and back finely marbled, a faint dusky, lateral line, and another above it. Its prolonged first pectoral ray and narrow pectoral, with but five rays indicate a distinct variety, which may be called *parahybae*, var. nov.

53. *Pygidium paolence* Eigenmann. (Plate LI, fig. 3.)²⁸

Pygidium paolence EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 698.

Very close to *Trichomycterus proöps* Ribeiro.

7081, C. M., type, 68 mm. Alto da Serra, Rio Tieté, São Paulo. July 25, 1909. Haseman.

7597, C. M., paratype, 61 mm. Rio Parahyba bridge. Aug. 15, 1908. Haseman.

Head 5.33-6; D. 8.5; A. 6.5-8 not counting hidden rudiments, D. 10.5 and A. 8.5 with the rudiments; P. 6 or 7; head nearly as wide as long; eye in anterior half of the head, greater than its distance from the posterior nares; snout 2.33-2.5 in the length of the head, interocular 3-3.5; teeth conic; nasal barbel reaching base or tip of opercular spines, maxillary barbel reaching tip of opercular spines or a little farther; outer pectoral ray with its filament equal to head behind the posterior

²⁸ The head is too short in this drawing.

nares, the filament extending very little beyond the other rays; ventrals nearly reaching anal, their origin nearer caudal than to tip of pectorals; caudal rounded, six in the length; origin of anal under middle of dorsal, distance between the base of its last ray and the middle caudal ray 5.2 in the length; origin of dorsal equidistant from base of middle caudal rays and middle of pectorals, its last ray over the middle of the anal, the distance between the origin of the dorsal and the base of the middle caudal rays two in the distance between dorsal and snout in the type, 1.66 in the paratype.

With many faint spots about as large as the eye; in the type a dark streak along the middle of the sides, another along the side of the back, and a third along the edge of the belly.

This species is similar in appearance to *P. striatum*, from which it differs in the position of the ventrals, the pectoral filaments, etc.

7117a-j, C. M., ten, 25-30 mm. Mogy das Cruces, Rio Tieté, July 20, 1908.

These minute specimens came from near the type locality of *P. paolence* and are probably the young; the ventrals do not reach the vent; there is a series of minute spots along the sides, nearly confluent anteriorly; a series of larger spots above it on the sides of the back and a series along the middle of the back.

54. *Pygidium reinhardti* Eigenmann. (Plate LI, fig. 4.)

Pygidium reinhardti EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 699. 7078, C. M., one, 65 mm. Burmier on the Rio Itabira, a tributary of the Rio das Velhas. May 14, 1908. Haseman.

Mr. Haseman notes that this is the only species he secured at the particular locality where the only specimen of the present species was collected.

Head 6.5; D. 9.5; A. 8.5, counting the minute rudimentary rays in both dorsal and anal; P. 6; eye in anterior half of head; interocular three times in the head. Teeth conic.

Nasal barbel nearly as long as the maxillary barbel, which reaches the edge of the gill-membrane. First pectoral ray with its filament equal to the length of the head, much longer than the divided rays; ventrals reaching beyond the vent, their origin very little nearer tip of pectorals than base of middle caudal rays; origin of anal under middle of dorsal; distance between the base of the last anal ray and the middle caudal rays five and a half in the length; caudal narrow, a little longer than the head, the accessory rays inconspicuous; origin of dorsal over middle of ventrals, its distance from the middle caudal rays nearly two in its distance from the snout (19 and 36 mm. respectively).

A broad, dark stripe with notched edges from opercle to middle of caudal, bordered above and below by light bands; an irregular series of spots below the lower light band; a series of small spots more or less confluent forming a narrow, dark stripe above the upper light band; back and fins lightly spotted, a short dark bar in front of the opercle, a longer one above middle of pre-opercle.

55. *Pygidium davisii* Haseman. (Plate LI, fig. 5.)

Pygidium davisii HASEMAN, Ann. Carnegie Mus., VII, 1911, p. 380, pl. LXXVII, fig. 1, and pl. LXXVII.

Habitat.—Coastal streams of southern São Paulo.

2862, and 2861, C. M., type and paratypes. Rio Iguassú near Serrinha Paraná. Dec. 23, 1908. Haseman.

7116*a-d*, C. M., 52-60 mm. Morretes, Paraná, Brazil. Jan. 4, 1909. Haseman.

Head 5.5; D. 7; A. 5 without the imbedded rays; D. 10; A. 9 with the imbedded rays; P. 8; eye slightly in advance of the middle of the head; interocular four times in the length of the head; teeth conic.

Nasal barbel as long as the labial barbel, extending to the base of the opercular spines, maxillary barbel to their tips; pectorals shorter than the head, the first ray not prolonged; origin of ventrals equidistant from tip of snout and tip of caudal or nearer the former, not reaching the vent; origin of anal under the posterior part of the dorsal, the distance between its last ray and the base of the middle caudal rays about five in the length; caudal subtruncate, five and one-half in the length; origin of the dorsal over last half of the ventrals, equidistant between the tip of the caudal and the nasal barbels or eye; the distance between it and the caudal one and six-tenths in its distance from the snout.

Uniform light or dark, or mottled, sometimes with a dark lateral band with one or more series of blotches above it.

56. *Pygidium immaculatum* Eigenmann & Eigenmann. (Plate LII, fig. 1.)²⁹

Pygidium immaculatum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889 (Juiz de Fora; São Matheos; Goyaz); Occasional Papers Cal. Acad. Sci., I, 1890, p. 337; EIGENMANN, Report Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Trichomycterus immaculatus RIBEIRO, Fauna Brasiliense, IV (A), 1912, p. 222.

Habitat.—Rios Parahyba and Doce. Goyaz.

7076*a b*, C. M., two, 81-93 mm. Rio Doce. May 24 and 25, 1908. Haseman.

²⁹ The head is a little too short in the figure.

Head 4.75-5; D. 11.5-13; A. 9.5-10.5; P. 8 or 9; eye in the middle of the head or very nearly so, interocular 4-4.5 in the head. Teeth conic.

Nasal barbels extending to the middle of the interopercle, maxillary barbel about to opercular spines; pectorals but little longer than snout and eye, the first ray with its filament equal to head behind the nasal barbel; ventrals reaching vent, their origin very little nearer caudal than to eye; origin of anal just behind the vertical from the base of the last dorsal ray or under the penultimate ray, distance between the base of its last ray and the base of the middle caudal ray four and a half to five times in the length; caudal very slightly emarginate, about seven times in the length; origin of dorsal over posterior part of the ventral, its distance from the base of the middle caudal rays one and two-thirds times in its distance from the snout.

Sides and back uniform, without trace of spots or vermiculations; middle caudal rays dusky.

57. *Pygidium vermiculatum* Eigenmann. (Plate LII, fig. 2.)

Pygidium vermiculatum EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 699.

Pygidium brasiliense (non Lütken) RIBEIRO (*partim*), Fauna Brasiliense, IV (A), 1912, p. 225 (the specimens from Juiz de Fora).

Habitat.—Rio Parahyba.

7074, C. M., one, 131 mm. Juiz de Fora. June 9, 1908, presented by Dr. Ribeiro.

In general appearance like Lütken's figure of *brasiliense*, differing notably in the position of the ventrals.

Head 5.4 in the length; D. 8.5; A. 8.5 (counting in each case the two rudimentary rays); P. 7; width of the head nearly equal to its length; eye in middle of the head, interorbital three in the length of the head. Teeth conic, in bands.

Right nasal barbels reaching to above base of the opercular spines, maxillary barbels of right side nearly as long as head, reaching to the second fourth of the pectoral, both shorter on left side; pectoral rather narrow, the outer ray much prolonged, as long as the head behind the nasal barbel, the fin without the filament equal to the part of the head behind a point midway between eye and posterior nares; origin of ventrals under origin of dorsal, equidistant between base of middle caudal rays and last third of pectorals, ventrals reaching much beyond vent, almost to anal, as long as the snout; origin of anal under penultimate ray of the dorsal, distance between the base of its last ray and the base of the middle caudal ray a little more than five in the length; caudal rounded, six and one-third in the length; dorsal short, rounded, the distance between its origin and the base of the

middle caudal rays one and sixty-seven hundredths in the distance between its origin and the snout.

Sides and back profusely covered with confluent spots, which leave the light color as irregular vermiculations.

58. *Pygidium alternatum* Eigenmann. (Plate LII, fig. 3.)

Pygidium alternatum EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 700.

Pygidium brasiliensis EIGENMANN & EIGENMANN (*partim*), Proc. Cal. Acad. Sci. (2), II, 1889, p. 51; id. (*partim*), Occasional Papers Cal. Acad. Sci., I, 1890, p. 332; Ribeiro (*partim*), Fauna Brasiliensis, IV (A), 1912, p. 223.

Habitat.—Rio Doce.

It is possible that the young specimens of *P. brasiliensis* mentioned by Eigenmann & Eigenmann belong to this species.

7079, C. M., type and paratypes, sixty-seven, largest 81 mm. Rio Doce, May 25, 1908. Haseman.

7080, C. M., eleven, largest 49 mm. Rio Doce, May 25, 1908. Haseman.

7601a, C. M., 26 mm. Jacarehy, July 15, 1908. Haseman.

Head 5–5.5; D. 10.5–11.5; A. 7.5 or 8.5 counting the rudimentary rays; P. 7 or 8; eye in middle of the head or slightly farther forward; interocular 3–3.33 in the length of the head. Teeth conic, in bands.

Nasal barbel very little shorter than maxillary barbel, which reaches to the base of the pectoral and is as long as the head; pectoral rays equal to length of head behind the nasal barbels, the first ray with the filament longer than the head; ventrals reaching to, or just beyond, vent; origin of ventrals equidistant from base of middle caudal rays and a point between the posterior nares and the area just behind the eyes; origin of anal under posterior part of dorsal; distance between base of last anal ray and middle caudal rays four and a half to five and a third in the length; caudal subtruncate or rounded, very little longer than head; origin of dorsal over posterior half of ventrals; distance between origin of dorsal and base of middle caudal rays 1.54 in its distance from the snout.

Ten to fourteen large spots along the middle of the sides, an irregular series of much smaller ones below it. Large spots above the median series, frequently alternating with it, sometimes partly confluent into a longitudinal series, sometimes forming with a mid-dorsal series irregular bars across the back.

As the specimens, No. 7079, ranging up to 81 mm., are essentially alike in color and entirely different from the specimens of both smaller and larger size (74–120 mm.) from the same place referred to *P. brasiliense*, No. 7075, they have been

separated from the latter species. They may be identical with some of the younger specimens of *P. brasiliense* mentioned by Eigenmann & Eigenmann in the papers quoted above.

The specimens, No. 7080, are much shriveled but probably belong to this species.

59. *Pygidium goeldii* (Boulenger).

Trichomycterus goeldii BOULENGER, Ann. Mag. Nat. Hist. (6), XVIII, 1896, p. 154.

Habitat.—Colonia Alpina, Therezopolis, nearly 2,600 ft., near Rio de Janeiro.

I give the original description of Boulenger, *l. c.*:

“Head much depressed, as long as broad, six times in total length; eye small, midway between end of snout and opercular border, its diameter half interorbital width; upper maxillary barbel reaching the pectoral; gill-membranes narrowly joined to the isthmus, extending forward to below the eyes. Body as deep as broad; caudal peduncle strongly compressed, twice as long as deep. Dorsal with 10 rays, opposite to the space between ventrals and anal, twice as distant from the end of the snout as from the caudal; anal with 7 rays. Pectorals with the outer ray produced, filiform. Ventrals equally distant from the end of the snout and the posterior border of the caudal fin; latter rounded. Yellowish, with ill-defined brown spots above. Total length 99 millim.”

60. *Pygidium brasiliense* (Reinhardt).

Trichomycterus brasiliensis REINHARDT MS. in Lütken, Overs. Dansk. Vidensk.

Selsk., 1879, No. 3, p. 29 (Rio das Velhas); LÜTKEN, Velhas Flodens Fiske, p. 15, in Vidensk. Selsk. Skr. (5), Afd., XII, 1875, pp. 135 and I, pl. III, fig. 8 (Rio das Velhas); ? BOULENGER, Proc. Zoöl. Soc. London, 1891, p. 235 (Rio Grande do Sul); RIBEIRO, Kosmos, 1908 (Ribeiro); Archiv. Mus. Nac. Rio de Janeiro, XIII, 1906 (p. 7 of reprint); Fauna Brasiliense, Peixes, IV (A), 1912, p. 223, Arch. Mus. Nac. Rio de Janeiro, XVI.

Pygidium brasiliensis EIGENMANN & EIGENMANN (*partim*), Proc. Cal. Acad. Sci. (2), II, 1889, p. 51; Occasional Papers Cal. Acad. Sci., I, 1890, p. 332; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Trichomycterus brasiliensis tristis LÜTKEN, *l. c.*, p. 138, with figure, and p. I.

Habitat.—Rios das Velhas and Doce south to Ribeira do Iguapé and ? Rio Grande do Sul.

7594, C. M., four, 71–87 mm. Rio das Velhas. May 13, 1908. Haseman.

7550, C. M., one, 133 mm. Burmier. May 14, 1908. Haseman.

7075, C. M., fourteen, 74–120 mm. Rio Doce. May 25 and 27, 1908. Haseman.

Head 4.75-5 in the length; D. 10.5 or 11.5; A. 7.5 or 8.5 counting the rudimentary rays; P. 7; width of head very nearly equal to its length; eye in the middle of the head or partly in the anterior half; interocular 3-3.33 in the length of the head. Teeth conic.

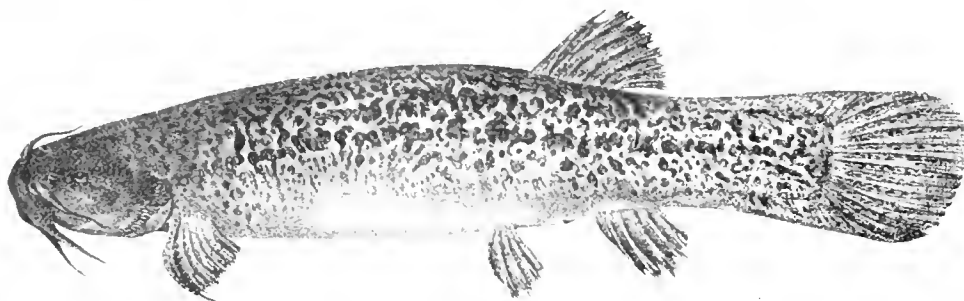


FIG. 17. *Pygidium brasiliense* (Reinhardt). After Lütken.

Nasal barbels extending to a point above the end of the interopercle, maxillary barbel to the gill-opening, or very little shorter or longer; pectoral a little longer than snout and eye, the first ray being very little prolonged in the smallest, equal to the length of the head less the opercle in the largest; origin of ventrals equidistant from base of middle caudal rays and base of pectoral in the specimen from Burnier, or to a point between the eyes and the opercle in the others, reaching very little beyond the vent, about two-thirds to anal, or to the anal in the specimen from Burnier; origin of anal below posterior half of dorsal, the distance between the base of its last ray and the base of the middle caudal rays four and two-thirds to five and a quarter in the length; caudal rounded, five and a half to six and a half in the length; origin of dorsal over posterior half or end of ventrals, the distance between its origin and the base of the middle caudal rays one and two-thirds to one and three-fourths times in the distance between its origin and the snout.

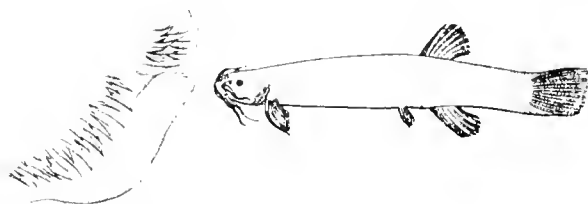


FIG. 18. *Pygidium brasiliense* (Reinhardt). Opercle and *P. brasiliense triste* (Lütken).

The color in the specimens from the Rio Doce is the same. Back and sides with numerous spots and vermiculations, the spots forming an irregular dark line along the middle of the sides in front. The spots and vermiculations are a little finer than in Lütken's figure of *brasiliensis*. In the specimens from Burnier and the Rio das Velhas there is a distinct median lateral band, the markings below it being coarse. In the largest the lateral band becomes obscure.

61. *Pygidium itatiayæ* (Ribeiro).

Trichomycterus brasiliensis itatiayæ RIBEIRO, Archives Mus. Nac. de Rio de Janeiro, XIII, 1906, p. 8, pl. I; Fauna Bras., IV (A), 1912, p. 223.

Habitat.—Itatiaya, Serra da Mantiqueira.

Caudal subtruncate; head longer than broad; last ray of the dorsal over the fourth of the anal; a dark lateral band.

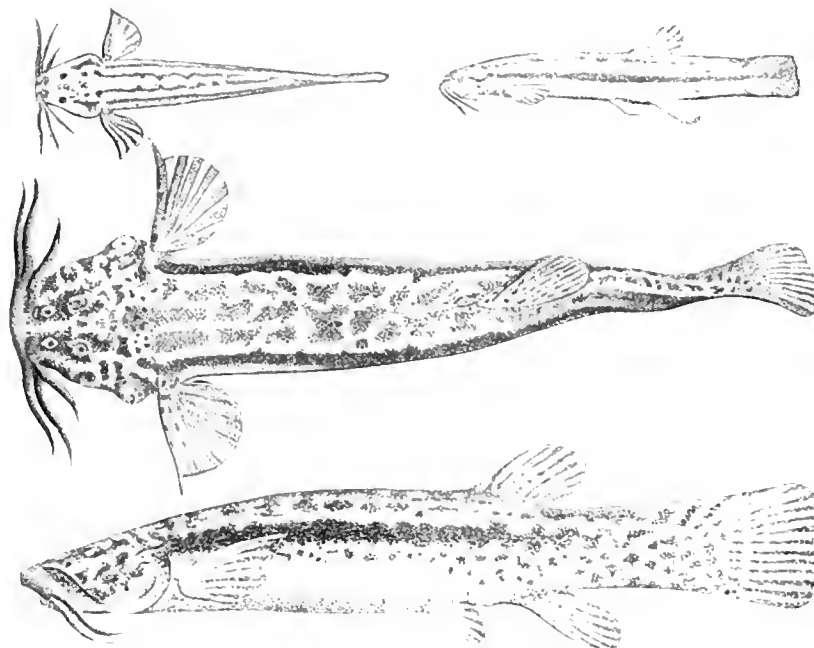


FIG. 19. *Pygidium itatiayæ* (Ribeiro), adult and young. After Ribeiro.

62. *Pygidium triguttatum* spec. nov. (Plate LII, fig. 4.)

7600, C. M., *a* the type 36 mm., *b* to *c*, paratypes 26–34 mm. Jacarehy. July 14 and 15, 1908. J. D. Haseman.

Readily distinguished by the few spines in the interopercle.

Head 5–5.5; D. 8 or 9; A. 6 or 7.5; P. 6; eye in anterior half of the head, 2 in the snout, 6 in the head, about 1.5 in the interorbital; teeth pointed, in very narrow bands; gill-openings reaching forward to below the eye; nasal barbels reaching to tip of opercular spines, or but little beyond the eye; maxillary barbels to the base of the opercular spine or to the axil; pectorals lanceolate, the first ray much prolonged, one and a third times as long as the head in the type, longer than the head in all but one of the paratypes; origin of ventrals equidistant from snout and middle of caudal; tips of ventrals reaching anus in two of the specimens, falling considerably short of the anus in the rest; origin of anal behind the dorsal; distance between last anal ray and caudal 5–5.5 in the length; caudal rounded, but few inconspicuous

accessory rays; distance from origin of dorsal to base of middle caudal rays 1.2–1.4 in the distance between snout and dorsal; distance from origin of dorsal to tip of caudal sometimes less, sometimes greater, than its distance from the snout.

A row of small spots along the middle of the sides, another along the middle of the back and a third between the two.

63. *Pygidium punctatissimum* (Castelnau). (Plate XLV, fig. 1.)

Trichomycterus punctatissimus CASTELNAU, Anim. Nouv. Am. Sud., 1855, p. 49, pl. 24, fig. 3, GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 272; RIBEIRO, Fauna Braziliense, Peixes, IV (A), 1912, p. 221.

Pygidium punctatissimum EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 52; Occasional Papers Cal. Acad. Sci., I, 1890, p. 334; Proc. U. S. Nat. Mus., XIV, 1891, p. 36; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—Rio Araguay.

Known from the types, with the characters given in the Key.

64. *Pygidium minutum* (Boulenger).

Trichomycterus minutus BOULENGER, Proc. Zoöl. Soc. Lond., 1891, p. 235, pl. XXVI, fig. 3.

Pygidium minutum EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 399.

Habitat.—San Lorenzo district, southern Rio Grande do Sul.



FIG. 20. *Pygidium minutum* (Boulenger). After Boulenger.

Head 4.5; D. 8; A. 6; eye a little in advance of the middle of the head, 1.5 in the interorbital; gill-opening not continued forward to below the eye; maxillary barbels three-fifths the length of the head, not reaching the gill-opening; nasal barbels extending to the eye; dorsal entirely in front of the anal; origin of dorsal midway between snout and tip of caudal; caudal rounded. Pale brown above, with three longitudinal series of large squarish brown blotches. Fins immaculate, the largest 40 mm.

65. *Pygidium santæ-rifæ* sp. nov. (Plate LII, fig. 5.)

7599, C. M., type, 24 mm. Santa Rita, Rio Preto. July 10, 1908. Haseman.

Head 4; D.11; A. about 9; P. 8; eye very nearly in the middle of the head; about two in the snout, five in the head, a little less than interorbital; teeth pointed, in a single series or in a very narrow band; gill-openings extending to below the middle of the eye; nasal barbel extending but little beyond posterior nares; maxillary barbels to middle of interopercle; outer pectoral ray not prolonged, a little less than head; origin of ventrals equidistant from snout and middle of caudal; anal entirely behind the dorsal, distance between its last ray and the caudal 4.5 in the length; caudal rounded, 5 in the length; distance between origin of dorsal and caudal equal to distance between dorsal and the middle of the eye.

Sides with large spots.

In the length of the barbels and the color this species agrees very closely with *P. minutum* from southern Rio Grande do Sul, with which it may be synonymous. It differs in its longer head, the forward extent of the gill-opening, the more anterior position of the dorsal. While the number of fin-rays as given differs, not much weight attaches to this. I have endeavored to count all of the rudiments.

Genus V. EREMOPHILUS³⁰ Humboldt. (Plate XXXVI; Plate XL, figs. A, B.)

Eremophilus sive *Thrichomycterus* Humboldt, Rec. d'Obs. Zoöl. et Anat., I, 1805, p. 17, pl. 6, reprinted in 1912, title-page 1911.

Trachypoma GIEBEL, Zeitschr. Gesellsch. Naturw., III, 1871, p. 97 (type *marmoratum* = *mutisii*).

Type.—*Eremophilus mutisii* Humboldt.

Like *Pygidium*, but without ventrals.

1. *Eremophilus mutisii* Humboldt. (Pl. XLI, figs. 1, 2; Pl. LIV, figs. 1, 2.)

Eremophilus mutisii HUMBOLDT, *l. c.*, I, 1805, p. 17, pl. 6; VALENCIENNES, *in* Humboldt, II, 1835, p. 340; CUVIER & VALENCIENNES, Hist. Nat. Poiss., XV, 1846, p. 500, pl. 553 (Bogotá); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 275; EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 53; Occasional Papers Cal. Acad. Sci., I, 1890, p. 339; Proc. U. S. Nat. Mus., XIV,

³⁰ ἐρημοφίλης, ὁ = loving solitude (of the mountain lakes and streams).

"Je l'ai nommé *éremophile*, à cause de la solitude dans laquelle il vit à de si grandes hauteurs, et dans des eaux qui ne sont presque habitées par aucun autre être vivant. Les naturalists qui craignent que de nouvelles espèces de ce même genre ne viennent à être découvertes dans des situations très-différentes, pourroient changer le nom d'*éremophile* en celui de *thrichomycterus*, tiré des barbillons attachés au nez de ce poisson."

1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400; Indiana University Studies, No. 23, Sept., 1914, p. 230.

Trachypoma marmoratum GIEBEL, *l. c.*

Habitat.—Plain of Bogotá and north of it for a short distance.

5046a-p, C. M.; 12840, I. U. M., many, largest 325 mm. Ponta de Suba, north of Chapinero. Eigenmann.

5049, C. M., two, largest 300 mm. Laguna near Bogotá (bought in the market). Eigenmann.

5048a-k, C. M.; 12841, I. U. M., twenty-two, largest 210. Herrera. Eigenmann.

5047a-h, C. M.; 12842, I. U. M., sixteen, largest 270 mm. Madrid. Eigenmann.

7445a, C. M.; 13834, I. U. M., two, 142 and 165 mm. Rio Chiquinquiere, Boyaca. Gonzales.

7446a, C. M., one, 220 mm. Rio Bogotá. Gonzales.

13836, I. U. M., three, 130-160 mm. Rio Funjuelo at Usme Sur near Bogotá.

Head 5.33-6; depth 5-6.33; D. 11.5; A. 9.5; P. 8; head pointed, a little longer than wide; center of the eye very little in advance of the center of the head; interocular three times, or a little more, in the head; teeth conical, in three to five rows; gill-openings not extending forward to below the eye; a very narrow free membrane across the isthmus.

Nasal barbel extending to the base of the opercular spines or shorter; maxillary barbel extending very little if any further than the nasal barbels; pectoral 1.5-2 in the head, its first ray sometimes very slightly produced, origin of anal about under the middle of the dorsal, the distance between the last ray and the middle caudal rays 4.5-5.5 in the length; depth of caudal peduncle 1.25-1.5 in its length, .66-.8 in the greater depth; caudal very broad and short, its length seven or more in the length; origin of dorsal nearly equidistant from tip of caudal and the head, its distance from the base of the middle caudal rays 1.8-2 in its distance from the snout.

Blackish, everywhere with well-defined but irregular spots or vermiculations. The black background most abundant above, the light vermiculations predominant below. In some specimens the dark predominates everywhere, the light being reduced to spots, or vermiculations, in others the light predominates; in the young there is a narrow dark median stripe, and the dark of the caudal peduncle consists of a few irregular spots, on the back in front of the dorsal the typical color of the adult obtains. Very variable.

The specimens from the Rio Funjuelo deserve special mention.

The largest measures a few millimeters over 160; it is not possible to give

the exact length, owing to the curves. This specimen is without pigment. The eye is apparent only on account of the lens and its overlying hyaline skin. The eye measures 2 mm. in diameter. This measurement is taken with the skin removed. The eye is not pigmented.

Another specimen measures 130 mm. It is also without pigment except in the eye. The eye seems to be fully pigmented and measures about 2 mm.

The third specimen measures 133 mm. The caudal and all but a small patch on the dorsal surface of the caudal peduncle are without pigment. The region from the caudal peduncle to the head is pigmented, but much more sparingly than in normal specimens, and there are irregular pigment-free spots. The sides of the head behind the eyes are free from pigment, the dorsal surface of the head and snout are again pigmented. The eye is normally pigmented and measures a little less than 2 mm.

These specimens seem to be identical with the normal "Capitan" in all respects except the color.

As stated elsewhere, the "Capitan" is a fish of considerable importance on the plains of Bogotá. The fish are caught with long-handled dip-nets several feet in diameter. The net is held in a slanting position by one man, one or several others drive the fishes into the net by beating the water. From time to time the net is raised and the fish removed. We supplemented this method by having the Indians drag a small seine, which yielded many smaller specimens. All we caught were about 80 mm. long or longer, *i. e.*, we caught no very young ones. The Indians also secured specimens by thrusting their hands and arms into the holes in the banks. It has heretofore been recorded exclusively from the Plains of Bogotá. Mr. Gonzales has sent two specimens from the Rio Chiquinquiere north of the plain.

Genus VI. PAREIODON³¹ Kner. (Plate XXXVII.)

Pareiodon KNER, Sb. Ak. Wiss. Wien, XVII, 1855, p. 160.

Centrophorus KNER, Denksehr. Akad. Wiss. Wien, 1859, XVII, p. 167.

Astemomycterus GUICHENOT, Rev. et Mag. Nat. Hist., XII, 1860, p. 525, fig. 2 (*pusillus*).

Pariodon GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 275.

Type.—*Pareiodon microps* Kner.

No mental barbels, no nasal barbel, two slender barbels at angle of mouth; outer pectoral ray not prolonged beyond the other rays; gill-membrane confluent with the isthmus, without a free fold in the middle, a narrow fold just below the

³¹ παρεία = cheek, ἰδοίς, ὀ = tooth.

gill-opening which is restricted to the space behind the interopercular spines, the membrane being confluent with the shoulder behind the opercular spines; mouth

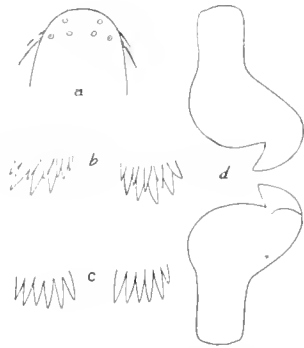


FIG. 21. *Pareiodon microps* Kner. *a*, outline of head from above; *b*, the interopercular spines; *c*, the opercular spines; *d*, a premaxillary and a mandibular tooth, very much enlarged.

subterminal, a single series of teeth in each jaw, about sixteen on the pre-opercle and about thirteen on the mandible. The teeth of the two jaws alike, similar to the teeth at the end of the premaxillary of *Branchioica* and some species of *Vandellia*. They consist of a narrow basal section, an enlarged middle section, from the inner (median) angle of which projects a short spur laterad, the spur being slightly twisted from the plane of the rest of the tooth; the teeth not movable; interopercle with a single series of six backward directed, slightly divergent spines; opercular spines slightly divergent, four spines in the main posterior row; five much smaller ones in the anterior row; caudal forked.

Pareiodon has the appearance of an overgrown *Vandellia*, from which it differs in dentition, in the size of the eye, and the general shape of the head.

1. *Pareiodon microps* Kner. (Plate LIV, fig. 3.)

Pareiodon microps KNER, *l. c.* (Borba on the Madeira about four days from its mouth); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 55; Occasional Papers Cal. Acad. Sci., I, 1890, p. 346; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; RIBEIRO, Fauna Bras., IV (1), 1912, p. 232; Comm. Linhas Telegraphicas Estrategicas de Matto-Grosso ao Amazonas. Anexo 5, Sept., 1912, p. 30 (Manaos); FOWLER, Proc. Acad. Nat. Sci. Phila., 1915, 229 (Amazon between mouth of Rio Negro and Peru).

Pareiodon microps GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 275; COPE, Proc. Acad. Nat. Sci. Phila., 1872, 290 (between Rio Negro and Peru.)

Trichomycterus pusillus CASTELNAU, Anim. Amér. du Sud, Poissons, 1855, p. 50, pl. 24, fig. 4 (Araguay; Amazon).

Astemomycterus pusillus GUICHENOT, *l. c.* (Araguay; Amazon).

Pareiodon pusillus RIBEIRO, *l. c.*, p. 234.

Habitat.—Amazon Basin.

The specimen in the collection of the Philadelphia Academy of Sciences, mentioned by Cope and Fowler, is about 145 mm. long. I am indebted to Dr. Fowler for the loan of this specimen.

Head 8; depth 6; D. 10, of which eight are full length; A. 7, of which five are full length; eye minute, about thirteen times in the head; center of head a full orbital diameter behind the posterior margin of the eye; interorbital 2.1 in the length of the head, snout 3 in the head, broad; width of head equal to its length; maxillary barbel not reaching to the interopercular spines; lower barbel reaching a little beyond the middle of the maxillary barbel; depth of caudal peduncle two and one-fourth in its length; pectoral about equal to the length of the head without the opercle; distance between origin of dorsal and base of caudal twice its distance from the snout; last dorsal ray slightly in front of the anal; dorsal and anal truncate or slightly emarginate; anus under middle of dorsal; ventrals not reaching anus, their origin equidistant from tip of caudal and interopercle; caudal deeply forked, the upper lobe two and one-half times as long as the middle rays; caudal fulera not conspicuous.

Genus VII. HENONEMUS³² Eigenmann & Ward. (Plate XXXVI).

Henonemus EIGENMANN & WARD, Ann. Carnegie Mus., IV, 1907, p. 118 (*intermedius*).

Cobitiglanis FOWLER, Proc. Acad. Nat. Sci. Phila., 1914, p. 268, fig. 16 (*taxistigma*).

Type.—*Stegophilus intermedius* Eigenmann & Eigenmann.

The genus *Henonemus* was created for *Stegophilus intermedius* on the observation that it has but one barbel at the angle of the mouth. The second (lower) barbel at the angle of the mouth is so minute that it ought not to be considered of generic value, especially since a minute barbel has been found on closer observation in a number of cases where but one barbel had been recorded. It is probably present in the type of *Henonemus*. The types of *Homodiatus* and *Henonemus* differ in the number of opercular spines, four or five in the former, but two in the latter. The names may, therefore, be at least temporarily retained.

Cobitiglanis was proposed as a subgenus of *Ochmacanthus*. However, the type of *Cobitiglanis* is not related to *Ochmacanthus*. *Cobitiglanis taxistigma* is scarcely distinct from *H. punctatus* and the name *Cobitiglanis* is a synonym of the subgenus *Henonemus*.

This genus, as far as known, consists of free-living species, and is closely related to the commensal *Stegophilus*. The mouth is wide, inferior, provided with numerous teeth in series on the jaws and lips; those of the middle of the upper lip are long and in part are homologous with those of *Vandellia*; the opercle bears two spines, the pre-opercle five or more. Where observed, the lower barbel is very minute, followed by an additional barbel or labial lobe; the lower jaw is well formed,

³² $\epsilon\nu$ = *one*, $\nu\eta\mu\alpha$ = *thread*. A misnomer, since there are two maxillary barbels.

the rami transverse, united. The genus differs from *Stegophilus* chiefly in the shape of the caudal, which is emarginate instead of rounded, and in the number of opercular spines.

KEY TO THE SPECIES OF HENONEMUS.

- a.* Origin of dorsal equidistant from tip of caudal and interopercle; origin of ventrals nearly equidistant from tip of lower caudal lobe and snout.
- b.* Sides plain, caudal spotted, last half of its lower lobe black; D. 10; A. 9. 1. **macrops** (Steindachner).
- bb.* Sides with a median series of spots, and smaller spots above them; tip of lower caudal lobe and an oblique band across the upper lobe black. 2. **punctatus** (Boulenger).
- bbb.* Sides with a regular series of spots, smaller spots above them; lower caudal lobe not black at tip, several obscure spots on dorsal, caudal and base of pectoral. 3. **taxistigmus** (Fowler).
- aa.* Origin of dorsal equidistant from tip of caudal and occiput; origin of ventrals equidistant from bases of caudal and pectoral; caudal with faint dusky spots; upper surface with dark spots; a series of larger spots along the middle of the sides. 4. **intermedius** (Eigenmann & Eigenmann).

1. **Henonemus macrops** (Steindachner).

Stegophilus macrops STEINDACHNER, Flussf. Süd-am., IV, 1882, p. 28, pl. VI, fig. 2-2a (Lake Manacapurú); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 55; Occasional Papers Cal. Acad. Sci., I, 1890, p. 344; Proc. U. S. Nat. Mus., XIV, 1891, p. 37.

Henonemus macrops EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401; RIBEIRO, Fauna Bras., IV (A), 1912, p. 231.

Habitat.—Lake Manacapurú.



FIG. 22. *Henonemus macrops* Steindachner. (After Steindachner.)

Known from the types only, which are in the Vienna Museum. Head 5; depth 5; D. 10; A. 9; P. 6; eye 3.4 in the head; width of head 1.25 in its length; barbel scarcely more than half as long as the eye; pectoral equals the head without the snout; distance between caudal and origin of dorsal 1.5 in its distance from the snout; origin of anal under the last dorsal ray; sides of head and body without spots; tip of lower caudal lobe dark, the other fins plain.

2. **Henonemus punctatus** (Boulenger). (Plate XI, fig. C.)

Stegophilus punctatus (BOULENGER), Proc. Zoöl. Soc. Lond., 1887, p. 279, pl. XXI, fig. 4 (Canelos); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II,

1889, p. 54; Occasional Papers Cal. Acad. Sci., 1, 1890, p. 343; Proc. U. S. Nat. Mus., XIV, 1891, p. 37.

Henonemus punctatus EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401.

Habitat.—Canelos, Ecuador; Santarem, Brazil.

Mr. Haseman collected the following specimens:

7083, C. M., fourteen, largest 88 mm. Santarem, Dec. 9, 1909.

7544, C. M., four, 72–90 mm. San Antonio, Rio Madeira, Nov. 3, 1909.



FIG. 23. *Henonemus punctatus* (Boulenger). After Boulenger.

Head 5.5–6; depth 6.5–7; D. 10 or 11; A. 8; P. 6; eye 4 in the head; width of the head 1.2 in its length; opercle with two spines, interopercle with four in the main row, of which the upper is much larger, two in the second row; three rows of movable teeth in the lip of the upper jaw, the rows close together, the teeth minute,



FIG. 24. *Henonemus punctatus* (Steindachner). A, opercle with its two spines; B, pre-opercle with its spines; C, half of the premaxillary with its teeth.

except for the middle ones of the inner series, which are much larger, similar to those in the premaxillary of *Vandellia*; four rows on the premaxillary, of which the three outer rows are similar to, but a little larger than, the labial teeth; the teeth of the inner series are pressed together, broad, bent toward the middle line near the tip and then are abruptly bent backward and inward, then outward; about fifty teeth in the inner row on each side, about seventy-five in the next row; five rows of teeth in the lower jaw, the outer series labial, those of the next three rows minute, recurved hooks, those of the innermost series like those of the inner series of the upper jaw; eye large, without a free orbital rim; posterior nares in a line with the anterior margin of the eye, much closer together than the anterior; no nasal barbel; maxillary barbel broad at base entirely concealing the very minute second barbel.

Axillary gland large, the pectorals considerably shorter than the head; distance of origin of dorsal from caudal 1.5–1.75 in its distance from the snout; origin of anal under or behind the last dorsal ray; back with numerous small spots; sides with a row of much larger spots; lower caudal lobe dark toward tip, base of the fin spotted like the sides, upper lobe free from chromatophores toward its tip, a few spots along lower margin of caudal peduncle; dorsal with spots on its basal half.

3. *Henonemus taxistigmus* (Fowler).

Ochmacanthus (Cobitoglanis) taxistigma FOWLER, Proc. Acad. Nat. Sci. Phila., 1914, p. 268 (*Rupununi River*).

Habitat.—Rupununi River, British Guiana.

Known from the type, 39344 A. N. S. P., 93 mm., which I have had the opportunity to examine through the courtesy of Dr. H. W. Fowler.

Head 5.5; depth 6.5; D. 10; A. 7.5; P. 7; eye 3–3.33 in the head, width of head 1.1, snout 3.25, width of mouth 1.5, interorbital 3.5, pectoral 1.4, lower caudal lobe 1.17, caudal peduncle 2.5; lower barbel one-fifth as long as the upper; upper jaw with four series of teeth, upper lip with three, at least seven series in the mandible; pre-opercle with five or more spines; opercle with two smaller spines; origin of dorsal equidistant from tip of caudal and interopercle.

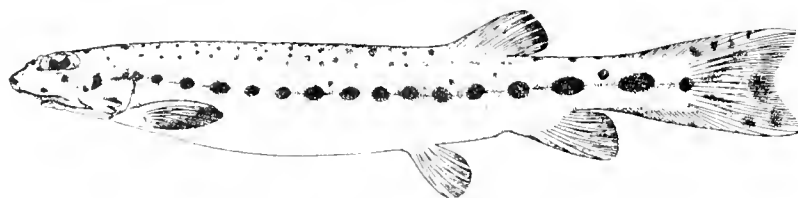


FIG. 25. *Henonemus taxistigmus* (Fowler). After Fowler.

Predorsal region with about four series of irregular, dusky spots, upper surface

of head with similar spots, one marking the interopercular, another the opercular spines; a few median, dusky spots behind the dorsal; sixteen sharply defined, dusky blotches along the lateral line increasing in size to the caudal peduncle. Fins all pale or whitish, several obscure spots of dusky on dorsal, caudal, and base of pectoral.

4. *Henonemus intermedius* (Eigenmann & Eigenmann).

Stegophilus intermedius EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 54; Occasional Papers Cal. Acad. Sci., I, 1890, p. 343; Proc. U. S. Nat. Mus., XIV, 1891, p. 37.

Henonemus intermedius EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401; Ribeiro, Fauna Bras., IV (A), 1912, p. 230.

Habitat.—Headwaters of the Rio Araguay.

This species, found in a region intermediate between the localities where *punctatus* and *maculatus* are found, combines in a remarkable way the characters of those species.

Type, No. 9842, M. C. Z., one specimen, 80 mm. Goyaz. Senhor Honorio.

Head 5.5; D. 9; A. 7; eye equals snout, 3.5 in the head; mouth large, upper lip with two series of teeth, premaxillary and mandible with four series of depressible teeth, those of the inner series enlarged at the tip; barbel shorter than eye; head a little longer than wide; opercle with two spines, interopercle with five or six claw-like spines

Elongate, compressed behind, depressed forward; head somewhat longer than wide, snout pointed; eye large, once in the snout, three and one-half times in the head. Mouth large. Lower lip not dilated. Origin of dorsal about equidistant from tip of caudal and occiput; caudal emarginate; anal placed entirely behind the dorsal; origin of ventrals equidistant from bases of caudal and pectoral. Light brown; entire upper surface with rather large dark brown spots; a series of larger dark spots along the middle line of the sides, the spots becoming larger towards the tail; caudal with a few, faint, dark spots.

Genus VIII. PSEUDOSTEGOPHILUS³³ Eigenmann & Eigenmann.

Pseudostegophilus EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 54.

Type.—*Stegophilus nemurus* Günther.

This genus has the characters of *Homodiatus* but has a deeply forked caudal.

³³ ψευδής = false; *Stegophilus*, the name of a related genus, see p. 353, from στέγος, τό = a roof, and φίλος, ό = a lover.

1. *Pseudostegophilus nemurus* (Günther). (Plate XLIV, fig. 5.)

Stegophilus nemurus GÜNTHER, Proc. Zoöl. Soc., London, 1869, p. 429. (Peruvian Amazon.)

Pseudostegophilus nemurus EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 54 (Marañon or Ucayale); Occasional Papers Cal. Acad., Sci. I, 1890, p. 341; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Upper Amazon, Rio Mamoré.

7547a f, C. M., 63–78 mm. Rio Mamoré. Sept. 19, 1909. J. D. Haseman.

Head 5; depth 6–6.5; D. 9; A. 7; P. 6; eye 4–4.5 in the head, less than snout or interorbital; maxillary barbel about as long as the eye, lower barbel very minute. Five rows of teeth on the upper lip, four in the upper jaw, six rows in the lower jaw and lip; gill-membrane not forming a fold across the isthmus; eight or nine spines on the interopercle and opercle; pectoral a little shorter than the head; origin of ventrals about equidistant from tip of snout and tip of middle caudal ray (its base in a specimen in the Mus. Comp. Zoöl.); origin of anal behind the dorsal, the distance of the base of its last ray from the base of the middle caudal ray four and one-half in the length; caudal deeply forked, the lobes pointed, the upper lobe longer than the lower; distance of origin of dorsal from base of middle caudal rays 1.5–1.6 in its distance from the snout; a dark shade across the head between the eyes, another between the opercles, four bands across the back and sides about equal to the interspaces, the margins of the bands darkest; lower caudal lobe and tip of the upper black.

Genus IX. HOMOBLETUS³¹ Eigenmann & Ward. (Plate XXXVII.)

Homodiatus EIGENMANN & WARD, Annals Carnegie Mus., IV, 1907, p. 117, pl. XXXIV, figs. 2 and 3 (*anisitsi*).

Type.—*Homodiatus anisitsi* Eigenmann & Ward.

Opercle with four or five spines directed upward and backward, interopercle with more, directed downward and backward; eye 3.5–5 in the head. Otherwise like *Henonemus*.

KEY TO THE SPECIES OF HOMOBLETUS.

- a. Caudal slightly emarginate, oblique; accessory rays numerous; origin of dorsal equidistant from tip of caudal and eye; origin of ventrals equidistant from snout and caudal; D. 8; A. 8; back and sides with chromatophores, but without distinct spots; middle caudal rays black.

1. *anisitsi* Eigenmann & Ward.

³¹ *ὁμοβλετρος* = living or eating with others. In allusion to the known parasitic habits of some of its relatives.

aa. Caudal forked or deeply emarginate, accessory rays few, inconspicuous; origin of dorsal a little nearer tip of snout than tip of upper caudal lobe, or the reverse; origin of ventrals equidistant from base of caudal and the eye, or a little nearer the former; D. 10; A. 7; back and sides with conspicuous spots unsymmetrically distributed, sometimes in part arranged as a median series; a spot at base of caudal, tips of caudal lobes black. 2. *maculatus* (Steindachner).

1. *Homodiætus anisitsi* Eigenmann & Ward. (Plate LVI, figs. 3 and 5.)³⁵

Homodiætus anisitsi EIGENMANN & WARD, Ann. Carnegie Mus., IV, 1907, p. 117, pl. XXXIV, figs. 2 and 3 (Villa Rica); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401.

Habitat.—Villa Rica, Paraguay.

Known only from the type in the collection of Indiana University.

10155, I. U. M., ♀, 43 mm., the type. Small creek at Villa Rica, Paraguay. Anisits.

Head 6.5; depth 5.75; D. 8; A. 8; eye equals snout, 3.5 in the head, about equal to interorbital; head nearly as wide as long; opercle with about four spines, interopercle with six; the barbel shorter than the eye, the inner barbels much smaller; upper jaw and lips each with about four distinct series of teeth; those on the lips freely movable; the teeth narrow, more or less spoon-ear-shaped, those of the inner series slightly larger; lower lip without teeth, three series of teeth on the jaw.

Axillary gland very large; origin of dorsal equidistant from tip of caudal and posterior margin of the eye; caudal slightly emarginate, the upper lobe longest; origin of anal under end of dorsal; ventrals reaching vent, which is equidistant from tip of mouth and tip of caudal, origin of ventrals equidistant from snout and caudal. Accessory rays numerous.

In alcohol uniformly pale. The fresh specimen preserved in formalin was straw-colored, the back with numerous large, conspicuous, stellate, black chromatophores, and many more smaller, much less conspicuous, brown ones; sides with a few small, stellate, black, chromatophores, gradually giving rise to a regular series along the middle of the tail; a dusky streak along the sides between the myotomes of the body and the thin covering of the abdominal cavity; a small, black spot at the base of the middle caudal ray; middle caudal rays dark, becoming intensely black toward tip; oblique bars extending from the end of the second ray below median dark one downward and forward to the tip of the lower caudal fulera and then as a black line forward along the tips of the fulera; another one like it in all respects from the tip of the second ray above the median dark one upward and forward to the tip of the caudal fulera and then forward along their tips as a black line; remaining fins more or less dotted.

³⁵ The caudal should be emarginate in the figure.

Alimentary canal straight, without convolutions or bends, the thin-walled stomach lying lengthwise and giving rise to a short, thin intestine, which merges into the much longer and larger, but thin-walled, large intestine which appears to be filled with minute grains of sand.

2. *Homodiætus maculatus* (Steindachner).

Stegophilus maculatus STEINDACHNER, Denk. Ak. Wiss., Wien, XLI, 1879, p. 25, IV, fig. 2 (La Plata); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 54; Occasional Papers Cal. Acad. Sci., I, 1890, p. 343; Proc. U. S. Nat. Mus., XIV, 1891, p. 37.

Henonemus maculatus EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401.

Habitat.—La Plata, in Province Buenos Aires; Uruguay Basin.

Known from the type, a specimen 105 mm. long, and
7545*a-d*, C. M., 67–69 mm. Uruguayana, Feb. 6, 1907. J. D. Haseman.
7546*a-c*, C. M., 64–70 mm. Cacequy. Feb. 2, 1907. J. D. Haseman.

Head 5.75–6.75; depth 6–9; D. 9; A. 7; P. 6; eye 3.66–4 in head, equal to snout or interorbital; maxillary barbel filamentous, equal to the eye, the inner barbel much smaller; seven series of teeth in the upper jaw and lip, five in the lower; about seven, graduate, opercular spines, about nine larger interopercular spines; gill-membrane forming a free fold across the isthmus; anal behind the dorsal. In the type, a series of spots along the back, another row of spots along the middle of the sides; two or three rows of smaller spots between the two; base of caudal with a dark cross-bar, several small spots along the upper edge of the caudal; tips of the caudal dark spotted.



FIG. 26. *Homodiætus maculatus* (Steindachner). After Steindachner.

In the specimens collected by Haseman the color-marking is less regular, the sides and back with unsymmetrically placed spots, largest on the caudal peduncle, smallest on top of the head, sometimes arranged in a series along the middle of the sides; the spot at the base of the caudal largely above the middle.

Genus X. STEGOPHILUS³⁶ Reinhardt. (Plate XXXVII.)

Stegophilus REINHARDT, Vidensk. Meddel. Naturh. Foren., Kjöbenhavn., 1858 (1859), p. 79, pl. II.

Type.—*Stegophilus insidiosus* Reinhardt.

No nasal or mental barbel, lower barbel at angle of mouth excessively minute, a minute dermal flap below the lower barbel; mouth very wide, inferior; eye large, superior; posterior nares between the front parts of the eyes; opercle and interopercle with several spines; gill-opening narrow, about a third as wide as the mouth, in front of the pectoral, the membrane not forming a free margin; first pectoral ray not produced in a filament; origin of ventral one and a half to two times as far from snout as from caudal; caudal rounded, not greatly contracted at base, the accessory rays not conspicuous; origin of dorsal behind the vertical from the origin of the ventrals; teeth very numerous, in regular series, those in the middle of the upper jaw larger than the others.

1. *Stegophilus insidiosus* Reinhardt.

Stegophilus insidiosus REINHARDT, *l. c.*, p. 79-97; GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 276; LÜTKEN, Velhas Flodens Fiske, p. 15; Vidensk. Selsk. Skr. (5), Afd. XII, 1875, p. 135, and I, text figures 1-3 (Rio das Velhas); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 55; Occasional Papers Cal. Acad. Sci., I, 1890, p. 344; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 400.

Habitat.—Parasitic in large fishes (*Pseudoplatystoma orbignianum* = *coruscans*) of the San Francisco basin and free on sand bars of the upper San Francisco basin. 7551, C. M., one, 32 mm. Opposite Januaría. Dec. 12, 1907. Haseman.

This example is the first one secured since Reinhardt obtained his specimens from the gill-chamber of a large catfish, *Pseudoplatystoma*. Haseman took his specimen on Dec. 12, 1907, from the sandy shore of an island in the Rio San Francisco, in front of the town of Januaría. If this specimen is really identical with those secured by Reinhardt from the same river basin, *Stegophilus* appears to have the general habit of members of the family of burrowing in sand as well as the peculiar habit of entering the gill-chambers of other fishes. This double, Jekyll and

³⁶ *στέγος, τό* = a roof; *φίλος, ο* = a lover, *i. e.*, loving a covered home, in allusion to its habit of living in the gill-cavities of other fishes.

Hyde, habit of *Stegophilus* lends probability to the reported habit of *Vandellia* of entering the urethrae of bathers. For an account of the habit of the species see page 267.

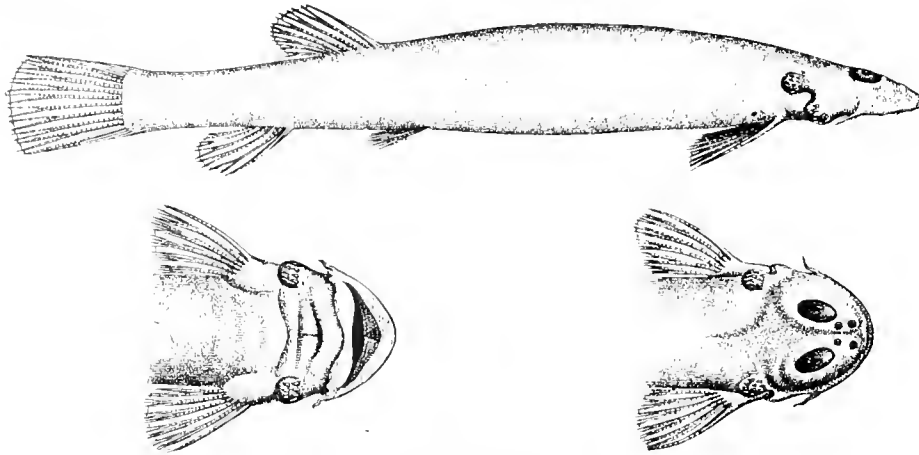


FIG. 27. *Stegophilus insidiosus* Reinhardt. (After Lütken.)

Head about six times in the length; D. 8; A. 7; P. 7; eye about equal to snout or interorbital, four times in the head; maxillary barbel equal to half the width of the mouth, extending to the interopercular spines, lower barbel about four-tenths as long; a thin, narrow membranous flap below the lower barbel; head flat below, its width equal to its length less the opercular spines.

This specimen has hardened in the alcohol and it is not possible to describe the details of the teeth.

Ten or eleven hooks in two series, on the interopercle, directed downward and backward, eleven or twelve thorns on the opercle in three or four irregular series, increasing in size from the minute anterior ones to the strong posterior one.

Pectoral about as long as the head without the snout; origin of ventrals equidistant from base of caudal and tip of pectoral; distance between origin of dorsal and base of middle caudal rays 2.33 in its distance from the snout, distance between last anal ray and base of caudal 6.5 in the length; caudal rounded, ventral accessory rays inconspicuous, a few prominent dorsal accessory rays.

No color-markings.

Genus XI. ACANTHOPOMA³⁷ Lütken. (Plate XXXVII.)

Acanthopoma LÜTKEN, Vidensk. Meddel. Naturh. Foren. Kjöbenhavn, for 1891, 1892, p. 53, fig. (*annectens*).

Like *Stegophilus*, the gill-membranes forming a free fold across the isthmus.

³⁷ ἄκανθος, ὁ = spine; πῶμα, τό = opercle.

1. *Acanthopoma annectens* Lütken.

Acanthopoma annectens LÜTKEN, *l. c.* (Huallága); EIGENMANN, Ann. Carnegie Mus., IV, 1907, p. 119; Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401.
Habitat.—Huallaga.

Known from the type 100 mm. long in the collection of Prof. R. Leuckart. Anterior part, especially the head, depressed; head parabolic; eyes not large; distance between anterior nares twice the distance between the posterior, neither with a barbel; a group of four to six large and some small spines on the opercle; another larger group, ten to twelve, on the interopercle; mouth inferior; upper jaw with six to seven very regular rows of very small teeth; in the lower jaw are "naeppe mere end en enkelt Rockke telstede." Free margin of the gill-membrane begins behind the interopercle and is continued across the isthmus without uniting with it.

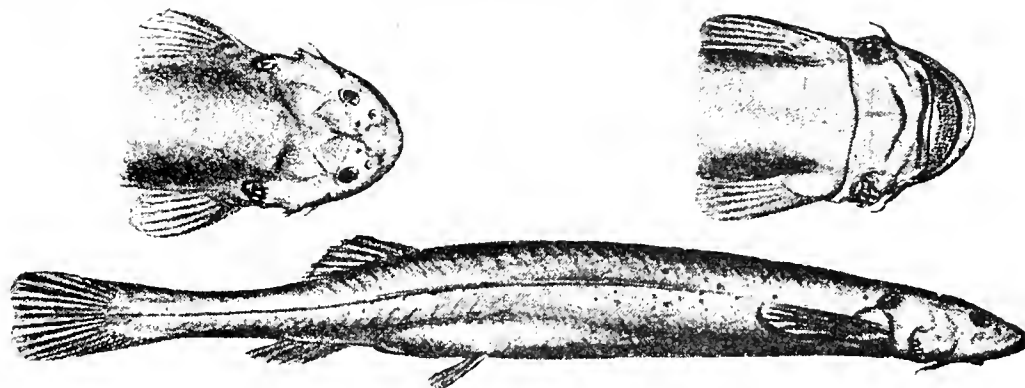


FIG. 28. *Acanthopoma annectens* Lütken. (After Lütken.)

Origin of ventrals equidistant from bases of caudal and pectoral, or tip of caudal and the mouth; origin of dorsal nearly twice as far from snout as from base of caudal; origin of anal under end of dorsal; caudal slightly emarginate; back with obscure spots.

Called *annectens* to indicate its supposed position between the Pygidiinæ and Stegophilinæ.

Lütken says it is nearest *Henonemus microps* = *macrops*?

Genus XII. OCHMACANTHUS³⁸ Eigenmann. (Plate XXXVII.)

Ochmacanthus EIGENMANN, Mem. Carn. Mus., V, June, 1912, p. 213.

Gyrinurus RIBEIRO, Comm. Linhas Telegraphicas Estrategicas de Matto-Grosso ao Amazonas, Annexo No. 5, Sept., 1912, p. 27, pl. with three figures.

Type.—*Ochmacanthus flabelliferus* Eigenmann.

³⁸ ὄχμα, τό = a hold; ἄκανθος, ὁ = a spine.

No nasal or mental barbels; lower barbel at angle of mouth minute or well developed; mouth very wide, inferior; eye large, superior; posterior nares between the anterior margins of the eyes; gill-opening very small; first pectoral ray not spinous, not produced in a filament; accessory caudal rays very numerous, the caudal greatly contracted at base; origin of anal behind that of the dorsal; teeth very numerous, in regular series, none on the lip of the upper jaw.

KEY TO THE SPECIES OF *Ochmacanthus*.

- a.* Maxillary barbel reaching pectoral; origin of dorsal equidistant between tip of caudal and snout or nearer caudal; accessory caudal rays highest near the middle; distance between last anal ray and caudal two in its distance from the snout. (*Gyrinurus*).....1. **batrachostoma** (Ribeiro).
- aa.* Maxillary barbel about as long as the eye, reaching tip of interopercular spines; origin of dorsal much nearer tip of caudal than snout; accessory caudal rays graduate to the caudal into which they gradually merge. (*Ochmacanthus*).
- b.* Distance between last anal ray and caudal 4-4.5 in the length; origin of dorsal in advance of origin of anal; ventrals not reaching anal; gill-opening extending from the opercle to behind the middle or lower part of the opercular spines.....2. **reinhardtii** (Steindachner).
- bb.* Distance between last anal ray and caudal three in its distance from the snout; origin of dorsal over origin of anal, ventrals reaching anal; gill-openings confined to the region between the interopercular and opercular spines.....3. **flabelliferus** Eigenmann.

1. *Ochmacanthus batrachostoma* (Ribeiro). (Plate LV, figs. 1-3.)

Gyrinurus batrachostoma RIBEIRO, *l. c.* (S. Luiz de Cáceres.)

Habitat.—Upper Paraguay.

Known from the type, a specimen 32 mm. long, and

7553, C. M., about 31 mm. Puerto Suarez, swampy shore of big bay between Brazil and Bolivia. May 7, 1909. Haseman.

7554, C. M., 30 mm. Rio Jaurú, twenty-eight miles above its mouth at Campos Alegre, thirty miles southwest of Cáceres. June 2, 1909. Haseman.

Head 5.5-6.5; depth 6.5-9; D. 10-12; A. 8-9; P. 4; eyes superio-lateral, three or four in the head, longer than the snout, about equal to the interorbital; maxillary barbel reaching axil of pectoral, the lower one to the opercular spines; head as broad as long; six to eight opercular spines arranged in a group; interopercle with about five to eight spines in one or two series; teeth conical, in three parallel series; body depressed in front, compressed behind; dorsal and anal rounded; dorsal behind the ventrals, its origin equidistant from tip of snout and tip of caudal in the figure of the type, its distance from the caudal 1.3-1.5 in its distance from the snout in the specimens enumerated above; anal partly under dorsal, distance of its last ray from the caudal about 3.5 in its distance from the caudal in the specimens at hand; caudal minute, rounded, hidden in the accessory rays which are greatly

developed into fins like those of a larval frog; everywhere except on the belly spotted. Twenty-one vertebrae behind the anal.

The type was caught among water-weeds (*Eichornia azurea*).

2. *Ochmacanthus reinhardti* (Steindachner). (Plate LV, fig. 4.)

Stegophilus reinhardti STEINDACHNER, Flussf. Südam., IV, 1882, p. 28, pl. VI, fig. 1 (Lake Manacapurú; Rio Iça; Montalegre; Te^{fr}é; Tabatinga); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 55; Occasional Papers Cal. Acad. Sci., I, 1890, p. 344; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401; RIBEIRO, Fauna Bras., IV (A), 1912, p. 401.

Habitat.—Amazons.

7552, C. M., 38 mm. Amazon, at upper end of island four miles above Santarem. Dec. 9, 1909. Haseman.

7555a-b, C. M., 35-46 mm. Igarape de Jaura, entering R. Tapajos two miles above Santarem. Dec. 11, 1909. Haseman.

Head 7; D. 11-13 (9 or 10 developed rays); A. 10-11 (8 or 9); P. 6, partly adnate; eye equals snout, less than interorbital, entirely in the anterior half of the head, 4-5 in the head; maxillary barbel reaching interopercular spines, the lower barbel a third or fourth as long; 8 or 9 interopercular spines, 9 to 12 opercular; width of head equal to its length. Three series of teeth in the upper jaw, those of the inner series close set, much more numerous than those of the outer series, the teeth of the outer two series at the middle of the mouth a little longer and more slender than the rest; lower jaw with two complete series of teeth, the inner series similar to inner series of the upper jaw, those of the outer series larger, fewer, and much more movable than those of the inner, about fifteen in the outer series, about forty in the inner; four increasingly shorter series from the inner series outward near the middle of the jaw.

A prominent pectoral pore, pectoral equal to the head or to the head without the snout. Origin of ventrals equidistant from bases of caudal and pectoral or a little farther forward, distance between last anal ray and caudal 4-4.5 in the length; distance between origin of dorsal and base of caudal 1.75-2 in its distance from the snout; caudal rounded, with many prominent accessory rays.

Back gray, sides and fins mottled.

3. *Ochmacanthus flabelliferus* Eigenmann. (Plate LV, fig. 5.)

Ochmacanthus flabelliferus EIGENMANN, Mem. Carnegie Mus., V, 1912, p. 213.

Habitat.—Essequibo basin.

1729, C. M.; 12111, I. U. M., type and paratypes, three, 33-35 mm. (Konawaruk.)

Head 5.33; depth 7; D. 8; A. 7; eye 1 in snout, 3.75 in head, 1 in space between the eyes. Width of head equal to its length; snout semicircular in outline, the head depressed; mouth very wide, its width equal to the length of the head less half the snout; upper jaw with three series of teeth; teeth of the two outer series conical, those of the inner series broad, removed from the others, forming a solid palisade; no labial teeth; lower jaw with an outer series of long, curved, claw-like teeth in the lip, and four series in the jaw, of which the first is short, near the middle, the second extends farther to the sides, the third is longest, extending from the middle to the side of the jaw, the fourth is shorter again and confined to the sides, not reaching the median line of the jaw. Interopercle with nine claw-like erectile spines; opercle somewhat prolonged, carrying a bunch of nine spines similar to those of the preopercle above and behind the gill-opening. Gill-opening small, entirely above the level of the middle of the pectoral; outer maxillary barbel about as long as the eye, the inner one minute. Pectorals partly adnate; ventrals small, free, reaching anal; dorsal about equal to the anal and but slightly farther forward.

"Light, with numerous chromatophores more or less aggregated in places; a black spot on base of caudal."

The only specimens known were killed with hiari poison in a small pool of back-water from the Essequibo.

Genus XII. *VANDELLIA*³⁹ Cuvier & Valenciennes. (Plate XXXVIII.)

Genus XIII. *URINOPHILUS* Eigenmann.

Vandellia CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 386, pl. 547.

Type of Vandellia.—*Vandellia cirrhosa* Cuvier & Valenciennes.

Long, slender fishes with small inferior mouth; a few teeth in a single series in the middle of the upper jaw; peculiar, claw-like teeth on the end of the maxillary in some species, probably all of them; teeth on the mandible in some species, none in other species; the mandibular rami not meeting, separated by a wide membrane; opercular spines directed obliquely upward and backward, interopercular spines directed downward and backward; gill-opening small; no nasal or mental barbels, the lower of the barbels at angle of mouth very minute; first pectoral ray not prolonged in a filament; ventrals very much nearer to caudal than to tip of snout; origin of the anal behind that of the dorsal.

³⁹ In honor of Domingo Vandelli, professor of natural history at Lisbon, who sent the types of the genus to Lacépède.

There are two generic types contained in the genus as here understood. One of the two genera has teeth on the mandibles and is represented by *V. sanguinea* at least; the other genus lacks teeth in the mandible, and *plazai* and *hasemani* at least belong to this genus. I do not know whether the type of *Vandellia* belongs to the one or the other of the genera. The new one may be named *Urinophilus*. The type is to be selected after the structure of the mandible in *Vandellia cirrhosa*, the type of *Vandellia*, has been examined.

The dentition of the *Vandelliina* is very peculiar. There are one or two series or a patch of pointed teeth in the center of the upper jaw. They are immediately below the center of the ethmoid at its anterior end, in other words, in the region occupied by the premaxillary in related forms. The bones are so thin and the fish so small, that it is difficult to determine all of the outlines of the bones, or to determine the identity of all of the bones. The bone on which these teeth are inserted is, in all probability, the premaxillary. The lateral points of the ethmoid are forked, and dovetail into the forked ends of maxillaries somewhat after the fashion of the two hands locked into each other between the thumbs and fingers. On the distal half of the maxillary of *Vandellia* there are from two to four comparatively large and very peculiar "claw-teeth," arranged like overlapping shingles, the outermost one being next the bone, the second from the end overlapping this and so on to the proximal one. The individual teeth consist of a flat, oval disk, from the upper proximal corner of which the tooth proper points toward the end of the bone. The bone touches the palatines proximally and the maxillary barbel is joined rather firmly to the end of it, all of which indicates that this bone is the maxillary. In *Branchioica* only one or two teeth of this sort are present, but between them and the ethmoid there is a series of slender, pointed teeth, similar to those on the premaxillary.

Catfishes with teeth on the maxillaries are very unusual. Outside of the *Vandelliina*, teeth are only found on the maxillary in *Diplomyste* of the *Diplomystidea* of Chile.

Covering the end of the maxillary and joined to the dorsal surface of the base of the barbel is a thin, comma-shaped bone, which may be the nasal.

Teeth, such as those described on the maxillary, have so far been noticed in *Vandellia hasemani*, *sanguinea*, and *plazai*. *V. cirrhosa* and *V. wieneri* have not been examined in this respect. Teeth like these are found in another member of the family, *Parciodon* (compare figures 21 and 34-35).

In *Paravandellia* and *Branchioica* the "claw-teeth" of the proximal part of the maxillary are replaced by slender, pointed teeth, and there are more than one

series of teeth on the premaxillary. In *Branchioida* a "claw-tooth" is present at the end of the maxillary.

The rami of the lower mandibles of the *Vandelliinae* seen from below are elongate triangles, converging forward, but not joined, in fact, not meeting in the center. Teeth may or may not be present in the lower jaw. When present, they are recurved, pointed, in two series at the end of the jaws, in apposition to the maxillary teeth.

The alimentary canal is a simple, straight tube, of nearly uniform diameter, evidently greatly distensible.

KEY TO THE SPECIES OF VANDELLIA.

- a.* Mandible without teeth, thorn-like teeth at end of maxillary of *V. plazai* and *hasemani*. (Neither mandible nor maxillary examined in *V. cirrhosa* and *wieneri*.)
- b.* Caudal truncate or slightly emarginate.
- c.* D. 8-9; A. 9-10; P. 6; depth 9; premaxillaries with five to eight teeth; maxillary barbel two in the head; caudal slightly emarginate, the lobes rounded, equal; pectorals longer than the head.....1. **cirrhosa** Cuvier & Valenciennes.
- cc.* D. 9; A. 8; P. 7; depth 12; premaxillaries with five to nine teeth; maxillary barbels less than half the length of the head; caudal emarginate, the lobes rounded; pectorals as long as the head.....2. **plazai** Castelnau.
- bb.* Caudal forked; D. 11; A. 10; P. 6; depth 7-8.
- d.* Premaxillaries with nine teeth; mouth wide, angle of gape nearly opposite the maxillary barbel; maxillary barbels about 3 in the head; distance between the origin of the dorsal and origin of the caudal 2.75 in the distance of the dorsal from the snout; pectorals shorter than the head.....3. **wieneri** Pellegrin.
- dd.* Premaxillaries with about six teeth; mouth small, the angle of the gape far in advance of the base of the barbel; maxillary barbel 2-2.5 in the head; distance between origin of dorsal and base of middle caudal rays two and a quarter to two and one-half in its distance from the snout; pectoral about equal to the length of the head.
4. **hasemani** Eigenmann.
- aa.* A patch of minute teeth on each mandible; one or two claw-like teeth on the end of the maxillary, just in front of the barbels; caudal truncate; D. 11; A. 8; P. 6; premaxillaries with five teeth; maxillary barbel two in the head; distance between origin of the dorsal and the origin of the caudal 2.8 in the distance of dorsal from the snout; pectorals little shorter than the head.....5. **sanguinea** Eigenmann.

1. **Vandellia cirrhosa** Cuvier & Valenciennes.

Vandellia cirrhosa CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 386, pl. 547; CASTELNAU, Anim. Amér. du Sud, 1855, p. 51, pl. 28, fig. 2 (Brazil); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 277; EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 55 (Hyavary); Occasional Papers Cal. Acad. Sci., I, 1890, p. 345; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; BOULENGER, Proc. Zoöl. Soc. Lond., 1897, pp. 901 and 920, Trans. Zoöl.

Soc. Lond., XIV, 1898, p. 426; JOBERT, Archiv. Parasit, I, 1898, p. 494; PELLEGRIN, Bull. Soc. Philom. Paris (10), I, 1909, p. ? (Apuré, Manáos); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401; RIBEIRO, Comm. de Linhas Telegraphicas Estrategicas de Matto-Grosso aõ Amazonas, Anexo 5, 1912, p. 30 (Manáos).

Habitat.—Amazon and Orinoco basins; Rio Jurua; Hyavary; Manáos; Apuré.

This fish, the bad repute of which is widespread (see page 265) in South America, is represented in Museums by only the few specimens in the following list, in part copied from Pellegrin:

Jardin des Plantes, Paris, three, locality? Vandelli.

Jardin des Plantes, Paris, one, Apuré. Geay.

Jardin des Plantes, Paris, two, Manáos. Anthony.

Mus. Comp. Zoöl., Cambridge, one, 40 mm., Hyavary. Bourget.

British Mus., London, ? many, Jurua. Bach.

Mus. Nac. Rio de Janeiro, one, 94 mm., Manáos. Ribeiro.

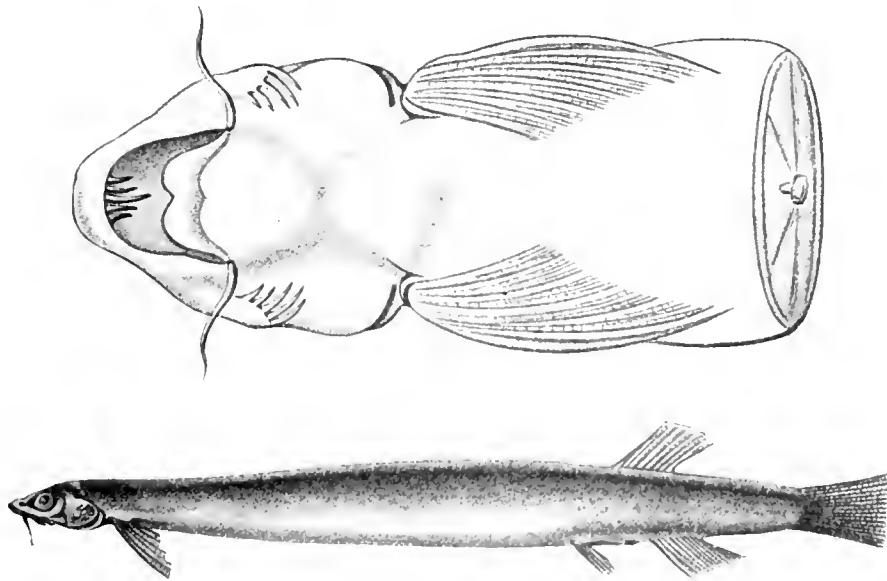


FIG. 29. *Vandellia cirrhosa* Cuvier & Valenciennes. (After Cuvier & Valenciennes.)

Head 8–10.5 (9–11.5 including the caudal); depth 9; D. 8–9; A. 9–10; P. 6. Head slightly longer than wide; eye less than 3 in the head, greater than the snout; six to ten spines on the opercle, five to ten on the interopercle; five to eight teeth on the premaxillary; origin of dorsal twice as far from tip of snout as from margin of caudal; dorsal partly over anal.

2. *Vandellia plazai* Castelnau. (Plate LIII, fig. 3.)

Vandellia plazai CASTELNAU, Anim. Amer. du Sud. Poissons, 1855, p. 51, pl. 28, fig. 1 (Ucayale); VAILLANT, Bull. Soc. Philom. (7), IV, 1880, p. 159 (Calderon); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 55 (Lake Hyuanuary); Occasional Papers Cal. Acad. Sci., I, 1890, p. 345; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; PELLEGRIN, Bull. Soc. Philom. Paris (10), I, 1909, p. ? (Calderon); EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401; RIBEIRO, Comm. de Linhas Telegraphicas Estrategicas de Matto-Grosso ao Amazonas, Anexo 5, 1912, p. 30 (Manáos).

Vandellia plaza GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 277.

Habitat.—Middle and Upper Amazon basin; Ucayale, Calderon; Lake Hyuanuary.

This species also is known from but few specimens, as follows:

Jardin des Plantes, Paris, ? Ucayale. Castelnau.

Jardin des Plantes, Paris, one, Calderon. Jobert.

Mus. Comp. Zoöl., Cambridge, Mass., one, 125 mm., Lake Hyuanuary. Bourget.

Mus. Nac. Rio de Janeiro, one, 67 mm., Manáos? Ribeiro.

7541, C. M., one, 66 mm. Dec. 9, 1909. Santarem. Haseman.

It is principally distinguished by its more elongate form.



FIG. 30. *Vandellia plazai* Castelnau. Carn. Mus., No. 7541.

Head 9-11 (10-12 in the total length); depth 12-15.3 in the total length; D. 9-10; A. 8-9; P. 7; twelve to sixteen opercular spines in 3 or 4 rows, seven or eight on the interopercle; head more rounded than in *cirrhusa*; barbel less than half the length of the head; pectoral as long as the head; 8 or 9 teeth in the upper jaw.

3. *Vandellia wieneri* Pellegrin.

Vandellia wieneri PELLEGRIN, C. R. Ac. Sc., November 29, Vol. 149, 1909, p. 1016;

Bull. Soc. Philom. Paris (1), X, 1909, p. 199, page of reprint 3, figure in the

text; Mission Géodesique de l'Equateur, XII, 1912, p. 2, p. 10, pl. I, fig. 2, near the mouth of the Rio Misahually.

Habitat.—Rio Napo, Ecuador.

This species is known from the type. It is distinguished by its short body, short barbel, and forked tail.

A.9934, Paris Museum, one, 92 mm. Rio Napo near the mouth of the Misahually, Ecuador. Charles Wiener.



FIG. 31. *Vandellia wieneri* Pellegrin. (After Pellegrin.)

Head over 7; depth 7; D. 11; A. 10; P. 6; 9 teeth; lower jaw incised in middle, without teeth; maxillary barbel about three in the head; eye two in the snout; fifteen opercular spines in four series, directed obliquely upward and backward; seven or eight interopercular spines in two rows; dorsal about two and three-fourths times nearer caudal than snout; ventrals a little in advance of the last third of the body; caudal peduncle 2.5 as long as high. Named for the collector, Mr. Charles Wiener.

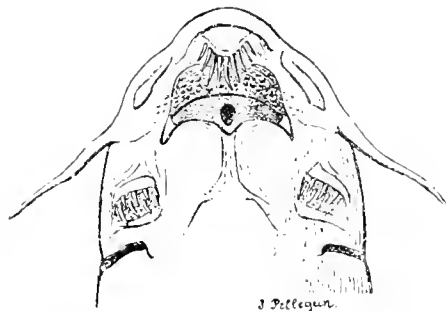


FIG. 32. *Vandellia wieneri* Pellegrin. (After Pellegrin.)

4. ***Vandellia hasemani*** Eigenmann. (Plate XVIII, fig. 3.)

7542, C. M., type, 72 mm.; 7543a-b, C. M., paratypes, 68 and 69 mm. Rio Marmoré. Haseman.

Evidently similar to *V. wieneri*. Head 8-8.5; depth 8; D. 11; A. 10; P. 6. Five or six teeth in the premaxillaries, two thorn-like teeth on the distal part of the anterior face of the premaxillary, two or three more slender teeth on the distal part of the lower face of the premaxillary; mandibular rami without teeth, widely separated from each other, the membrane between the two rami but little emarginate; angle of gape about halfway between the premaxillary and the barbel; maxil-

lary barbel 2-2.5 in the length of the head; lower barbel minute; about ten interopercular thorns, fifteen or more on the opercle; broad, free, fleshy lobes behind the opercular and pre-opercular spines; gill-openings about half as wide as the mouth;

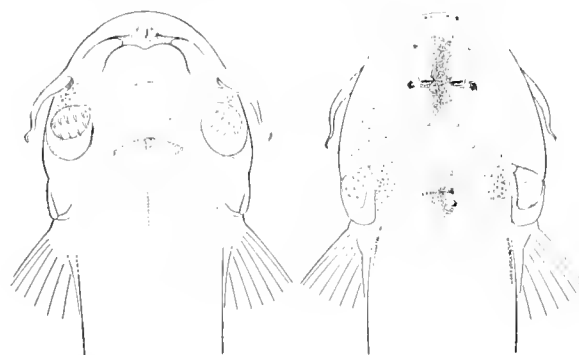


FIG. 33. *Vandellia hasemani* Eigenmann. Type, No. 7543a, Carn. Mus., 72 mm.

eye entirely in the anterior half of the head; the posterior nares nearly as large as the eyes and between the anterior halves of the latter, anterior nares with a short flap; pectorals about equal to the length of the head; origin of ventrals equidistant

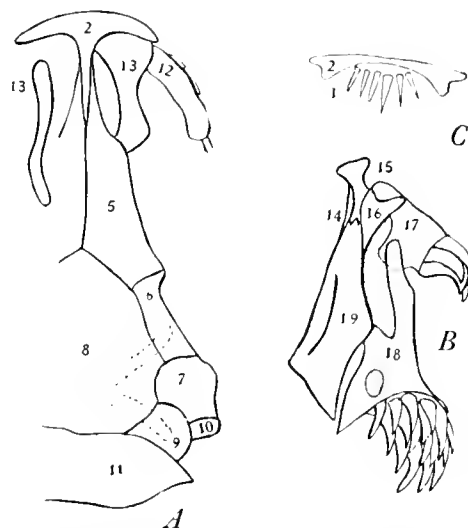


FIG. 34. *Vandellia hasemani* Eigenmann. A, skull from above; B, hyomandibular and opercular apparatus; C, end of ethmoid and premaxillary teeth from in front, 1, premaxillary; 2, ethmoid; 5, frontal; 6, sphenotic; 7, pterotic; 8, supraoccipital; 9, epiotic; 10, supraclavicle; 11, parapophysis of coelosep vertebrae; 12, maxillary; 13, palatine; 14, metapterygoid; 15, quadrate; 16, preopercle; 17, interopercle; 18, opercle; 19, hyomandibular.

from tip of caudal and eye or opercle, reaching a little beyond the anus; origin of anal under middle of dorsal; distance between anal and base of middle caudal rays 4.5-5.25 in the length; caudal forked for about two-ninths of its length; origin of

dorsal over the tips of the ventrals, distance of origin of dorsal from caudal 2.25–2.5 in its distance from the snout.

Back and basal part of caudal truncate.

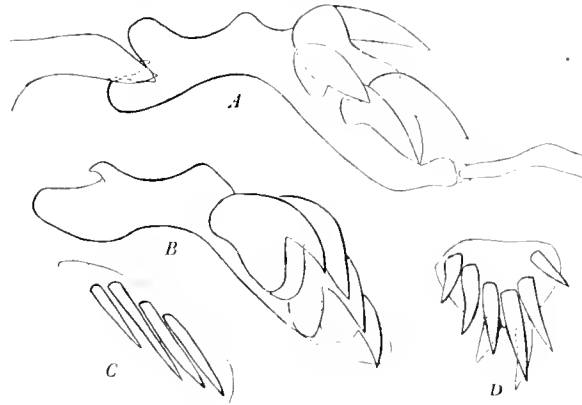


FIG. 35. *Vandellia hasemani* Eigenmann. A, Left premaxillary from below, with two functional and two relay teeth. B, left premaxillary of another individual with four teeth. C, the same, looking at the edge of the teeth. D, premaxillary from below.

5. *Vandellia sanguinea* Eigenmann. (Plate LIII, fig. 2.)

Vandellia sanguinea EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 701. 7082, C. M., type, 62 mm. San Antonio de Rio Madeira. Nov. 3, 1909. Haseman.

This species differs from the others of the genus *Vandellia* in having concealed teeth on the ends of the mandibles. It resembles them so much in other points that it naturally raises the question whether these structures have not been overlooked in *V. cirrhosa* and *wieneri*. They cannot be seen without considerable effort. The species greatly resembles *V. plazai*. Mr. Haseman noted that the specimen was white (translucent?), the alimentary canal straight and gorged with blood.

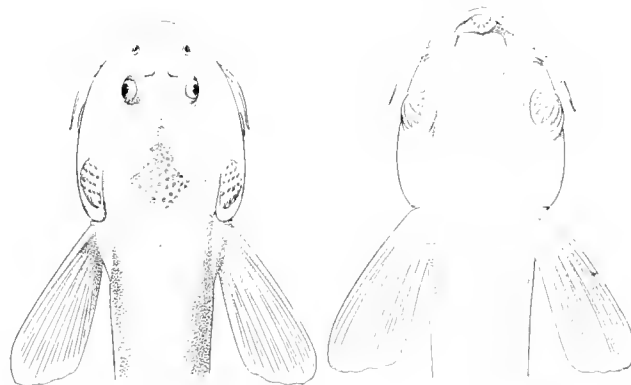


FIG. 36. *Vandellia sanguinea* Eigenmann. No. 7082, Carn. Mus. Type, 62 mm.

Head 11.66; depth 12; D. 4 + 8.5; A. 3 + 7; P. 7; nearly the entire eye in the anterior half of the head, a little more than four in the length of the head to the tip of the opercular spines. (The eye is too small in the drawings.)

Maxillary barbel extending to the tip of the interopercular spines, two in the head; the lower barbel minute, only about half a millimeter long as compared with the 2.5 mm. of the maxillary barbel; two flat, recurved teeth on the end of the

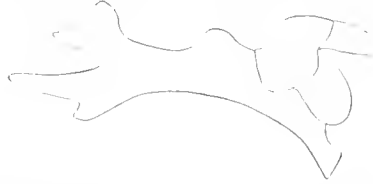


FIG. 37. *Vandellia sanguinea* Eigenmann. Left premaxillary, showing one of the concealed teeth.

premaxillary concealed just in front of the barbel; five premaxillary teeth graduated from the long middle one to the minute lateral ones; mandibles widely separated from each other with about five minute teeth; the teeth concealed by the lip; five spines in the main row of the interopercle, the middle ones very strong, directed backward, about five spines in supplementary rows; five spines in the main row of the opercle, about ten in supplementary rows; distance from origin of ventrals to base of middle caudal rays two times in its distance from the snout; origin of anal behind the origin of the dorsal, the last dorsal ray over the middle of the anal; distance between anal and base of middle caudal rays five and one-half times in the length; distance from origin of dorsal to base of middle caudal rays two and eight-tenths times in its distance from the snout; caudal truncate, with numerous accessory rays. Translucent, the eyes black.

Genus XV. PARAVANDELLIA⁴⁰ Ribeiro. (Plate XXXVIII.)

Paravandellia RIBEIRO, Comm. Linhas Telegraficas Estrategicas de Matto-Grosso ao Amazonas, Annexo No. 5, Sept., 1912, p. 29.

Type.—*Paravandellia oxyptera* Ribeiro.

No nasal or mental barbels, one (probably two) barbels at the angle of the mouth; first pectoral ray not continued as a filament; gill-opening small; mouth inferior, with a band of teeth in the middle of the upper jaw and a single series laterally; no teeth on the mandible; ventrals much nearer tip of caudal than snout; opercular and interopercular spines separate from each other. Caudal forked ("furcada"). Ribeiro says that this genus may be considered between *Stegophilus* and *Vandellia*, having the general appearance of the former.

⁴⁰ παρά = near, *Vandellia* = name of a related genus.

1. *Paravandellia oxyptera* Ribeiro.*Paravandellia oxyptera* RIBEIRO, l. c.*Habitat*.—Paraguay River near Cáceres.

Head triangular, eight times in the length including the caudal; D. 12; A. 10; P. 7; dorsal behind the ventrals, partly over anal, both behind the middle of the body; origin of dorsal nearer tip of caudal than base of pectorals; eyes without a free margin, large, two and one-half times in head, equal to snout; maxillary barbel reaching at most to tip of interopercular spines; pectorals large, falcate, one-fourth longer than head, the first ray longest, the next rapidly graduate, the outer rays longer again; caudal forked, the upper lobe a little the longer; anal similar to the dorsal, under the last rays of the latter.

White, the eyes black

The single specimen of this genus and species known, 22 mm. long, was taken in the same locality in which the *Ochmacanthus (Gyrinurus) batrachostoma* was caught, among the "pseudo-rhizomas de Agua-pé" *Eichornia azurea*, in the margin of the Paraguay River near San Luiz de Cáceres.

Genus XVI. BRANCHIOICA Eigenmann.⁴¹*Branchioica* EIGENMANN, Proc. Am. Phil. Soc., LVI, Jan., 1918, p. 702.*Type*.—*Branchioica bertonii* Eigenmann.

It is quite possible that this genus will, on direct comparison of specimens, prove a synonym of *Paravandellia*. It has the same general characters, but comes from the lower Paraguay, while *Paravandellia* comes from the upper. The present species was taken from a fish, while *Paravandellia* seems to be free swimming. It is quite possible that teeth will be found in *Paravandellia* at the end of the maxillary (pre-maxillary?) and on the mandibles when they are examined minutely. *Paravandellia* is said to have the caudal forked, while *Branchioica* has it subtruncate.

No nasal or mental barbels, two barbels at angle of the mouth, of which the lower is minute; first pectoral ray not spinous, not prolonged in a filament; gill-openings small, the membrane perfectly confluent with the isthmus; mouth inferior; two series of teeth in the front of the upper jaw, a single series of much smaller teeth laterad of these; maxillary with claw-like teeth at its end, just in front of the barbel and entirely concealed; two short series of teeth on the ends of the mandibles, opposite the lateral series of teeth of the upper jaw, the two rami of the mandibles not meeting; opercular and interopercular patches of spines separate from each other; caudal subtruncate.

⁴¹ βράγχια, τὰ = the gills of fishes; ὄικω = to inhabit.

The first specimen of this genus was received and described several years ago. Both the specimen and description were forgotten, the latter never published. The two specimens 13950 I. U. M. were received much later and independently described.

2. *Branchioica bertonii* Eigenmann. (Plate XLIII, figs. 3-5.)

Branchioica bertonii EIGENMANN, Proc. Am. Philos. Soc., LVI, Jan., 1918, p. 703.

13950. I. U. M., type, 24 mm., paratype about the same length over all, much curved. Taken from a large Characin, *Piaractus brachypomus* (Cuvier). Asunción, Paraguay. Collected by A. de W. Bertoni.

7545, C. M., paratype, 24 mm. Puerto Bertoni, Alto Paraná, from the branchia of *Piaractus brachypomus* (Cuvier). Bertoni.

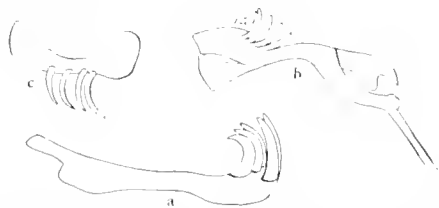


FIG. 38. *Branchioica bertonii* Eigenmann. *a*, mandible; *b*, left maxillary with its five teeth; *c*, portion of another maxillary, showing the proximal teeth only.

Head about 5.5; depth 5.5; D. 10; A. 7; P. 6; eyes superior, nearly the entire eye in the anterior half of the head, 3.5 in the head, about equal to the length of the snout, considerably larger than the interorbital; maxillary barbel extending to very near the interopercular spines, the lower barbel very minute; caudal peduncle slender, abdomen well rounded; premaxillary with two irregular series of slender, pointed teeth, those of the posterior series much the larger, about five in number, subequal, both series graduated from the larger ones nearer the center outward; laterad of the median series (on the premaxillary?) are four or five similar but smaller teeth, graduated from the larger proximal one; the rami of the lower jaw widely separated from each other, each with about five, recurved, pointed teeth in two series on its end, in apposition to the lateral series of the upper jaw; gill-opening minute, circular, gill-membranes perfectly confluent with the isthmus; opercle with a bunch of about twelve, subequal, upward directed spines; interopercle with about eleven curved, downward directed spines, arranged in two series; distance from origin of ventrals to caudal 1.6 in its distance from the snout, origin of anal behind the origin of the dorsal; distance between anal and caudal about 5 in the length; pectoral falcate, the outer ray not prolonged as a filament, about as long as the head; origin of dorsal between that of the ventrals and anal, twice as far

from snout as from caudal; caudal narrow, obliquely rounded or subtruncate, with few inconspicuous fulcra.

Translucent; eyes black; chromatopheres on the snout, along the back, along the base of the anal, on the base of the caudal, along the side of the abdominal cavity, and a few on the pectoral.

Genus XVII. TRIDENS Eigenmann & Eigenmann. (Plate XXXIX.)

Tridens EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), I, 1889, p. 53.

Type.—*Tridens melanops* Eigenmann & Eigenmann.

Anal long, with twenty or more rays, its origin in front of that of the dorsal; ventrals small, nearer to tip of snout than to base of caudal; head greatly depressed, the eye lateral, infringing on the upper and lower surfaces; a series of fine labial teeth, stronger teeth in the jaws; gill-membranes united, forming a broad, free fold across the isthmus; no nasal or mental barbel, two maxillary barbels; opercle and interopercle armed, the patches of spines separate.

The two species originally placed in this genus differ so greatly that they should probably be placed in separate genera. The specimens known are all very small, 27 mm. and less.

KEY TO THE SPECIES OF TRIDENS.

- a.* Depth 13; head 9; D. 10-12; A. 20-25; opercle with three spines; barbels minute, scarcely evident; distance between origin of dorsal and tip of caudal three in the length; distance between origin of anal and tip of caudal two and five-tenths in the length; caudal rounded, without accessory rays.
1. **melanops** Eigenmann & Eigenmann.
- aa.* Depth 6; head 6; D. 9; A. 22; opercle with 6 or more spines; maxillary barbel extending to the base of the pectoral; distance between origin of dorsal and tip of caudal two in the length; distance between origin of anal and tip of caudal less than two in the length; caudal emarginate; eye large, nearer end of opercle than tip of snout; first pectoral ray greatly produced.
2. **brevis** Eigenmann & Eigenmann.

1. **Tridens melanops** Eigenmann & Eigenmann. (Plate XLIII, figs. 1-2.)

Tridens melanops EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 53 (Iça); Occasional Papers Cal. Acad. Sci., I, 1890, p. 339; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401.

Habitat.—Iça, near boundary between Brazil and Peru.

Known from the types, the largest 27 mm., in the Museum of Comparative Zoölogy, one of which was received by Indiana University in 1891 and bears the number 4245.

Head 9; depth 13; D. 10-12; A. 20-25.

Body compressed, extremely slender. Head broad, the snout rounded; mouth broad, inferior. Opercle long and slender, terminating in three spines, trident-shaped. Pre-opercle with similar but smaller spines. Barbels minute, scarcely evident. Distance of origin of dorsal fin from extremity of caudal 3 in the length; origin of anal fin from extremity of caudal 2.5 in the length. Anal rays rapidly decreasing in height backward, the last ray about under the last ray of the dorsal. Caudal rounded, without accessory rays.

Yellowish; posterior half of the caudal fin dusky; a series of black spots along the base of the anal.

2. *Tridens brevis* Eigenmann & Eigenmann.

Tridens brevis EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 54 (Tabatinga); Occasional Papers Cal. Acad. Sci., I, 1890, p. 340; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401.

Habitat.—Tabatinga.

Known from the type, 21 mm. long, in the Museum of Comparative Zoölogy. A recent search for it has failed to locate it.

Head 6; depth 8; D. 9; A. 22.

Body short and deep. Head as broad as long; mouth broad, inferior. Opercle with a bunch of six or more spines; pre-opercle with a smaller bunch of spines. Barbels well developed, the outer one extending to the base of the pectoral, the inner to the gill-opening. Eye large, nearer end of opercle than tip of snout. Distance of origin of dorsal from tip of caudal little more than two in the length. Anal inserted very little in front of the dorsal and extending some distance beyond it, its rays decreasing in height toward the caudal. Origin of anal from extremity of caudal less than 2 in the length. First pectoral ray greatly produced. Caudal emarginate.

Yellowish; blackish dots along the bases of the fins; a series of blackish dots along the middle line of the sides; similar spots on the back. Head with brown dots.

Genus XVIII. *Miuroglanis*⁴² Eigenmann & Eigenmann. (Plate XXXIX.)

Miuroglanis EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 55.

Type.—*Miuroglanis platycephalus* Eigenmann & Eigenmann.

Anal long, with fifteen rays, its origin in front of that of the dorsal; no nasal or mental barbel; two barbels at angle of mouth; head greatly depressed, eye lateral,

⁴² *μείονρος* = curtailed; *γλάνης*, *ὄ* = a catfish.

behind the angle of the mouth; mouth subinferior; several series of strong teeth in each jaw; gill-membrane broadly united with the isthmus, without a free margin; opercular and subopercular patches of spines confluent.

1. *Miuroglanis platycephalus* Eigenmann & Eigenmann.

Miuroglanis platycephalus EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci. (2), II, 1889, p. 56 (Jutahy); Occasional Papers Cal. Acad. Sci., I, 1890, p. 347; Proc. U. S. Nat. Mus., XIV, 1891, p. 37; EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 401; RIBEIRO, Fauna Bras., IV (A), 1912, p. 227.

Habitat.—Jutahy.

Known from the type 17 mm. long, collected during the Thayer expedition by William James. A recent search for it in the collections of the Mus. Comp. Zoöl. has failed to locate it.

Head 5.5; D. 10; A. 15. Body short, compressed, and rather deep. Head greatly depressed, wider than long. Eye large, lateral, placed behind the angle of the mouth. Mouth subinferior, the upper jaw projecting slightly. Upper maxillary barbel scarcely extending to the gill-opening; no nasal barbels. The opercular and pre-opercular patches of spines united. Origin of the dorsal fin little behind that of the anal, its distance from the tip of the snout somewhat less than twice its distance from the tip of the caudal.

APPENDIX TO THE MONOGRAPH ON THE PYGIDIIDÆ.

PHREATOBIUS⁴³ Goeldi.

Phreatobius GOELDI, Comptes Rendus Congrès Intern. Zoöl., Berne, 1904, p. 549; FUHRMANN, Verhandl. Schweiz. Naturf. Gesellsch. Aarau, 1905, p. 50; Archives des Sciences Phys. Nat. Genève (4), 20, 1906, p. 578.

Type.—*Phreatobius cisternarum* Goeldi.

Origin of dorsal slightly in front of origin of the ventrals, much nearer snout than to caudal; no nasal barbel; maxillary barbel similar and about as long as the two mental barbels, placed nearer the anterior nares than to the angle of the mouth; the mental barbels of each side close together, but remote from their fellows of the other side, placed directly below the maxillary barbel; mouth terminal, wide, the lower jaw projecting; teeth in the upper jaw in about three series, in two series in the lower jaw in front, in one series on the side; the inner teeth the larger and in very regular series; gill-membrane extending but little above the base of the pec-

⁴³ φρέαρ, τὸ = cistern; βίος, ὁ = life.

toral, narrowly joined to the isthmus at a point about half-way between its posterior angle and the snout; first pectoral ray not spinous; anal very long, its origin under the end of the dorsal, its base more than one-third of the length; caudal small, accessory rays large and numerous, continuous with the anal fin and extending as a similar fin on the back for two-fifths of the distance to the snout; opercle and interopercle unarmed; eyes rudimentary, near the posterior nares.

This genus is distinguishable by the concomitant elongation of the caudal portion of the body, the anal fin and the accessory portion of the caudal, by the position of the dorsal in relation to the ventrals and by the development of the barbels and absence of opercular armature.

1. *Phreatobius cisternarum* Goeldi. (Plate LVI, figs. 1, 2 and 4.)

Phreatobius cisternarum GOELDI, Comptes Rendus Congrès intern. Zoöl., Berne, 1904, p. 549; FUHRMANN, Verhandl. Schweiz. Naturf. Gesellsch. Aarau, 1905, p. 50; Archives des Sciences Phys. Nat. Genève (4), 20, 1906; p. 578 (allied to *Clariidae*, not to *Leptosidae* and *Trychomyariæ*; *vide* Zoölogical Record).

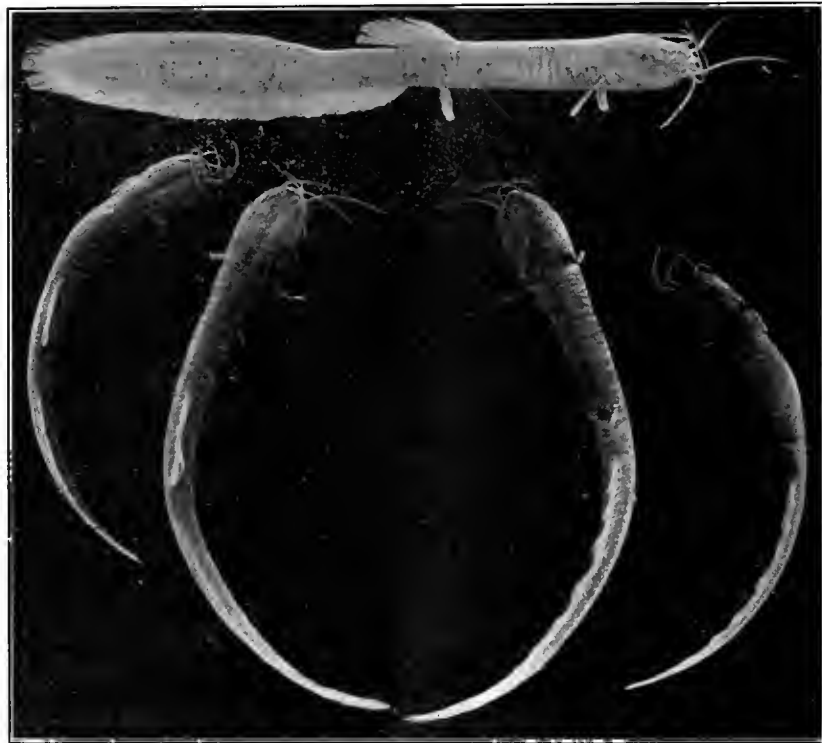


FIG. 39. *Phreatobius cisternarum* Goeldi. (By permission of Dr. O. Fuhrmann.)

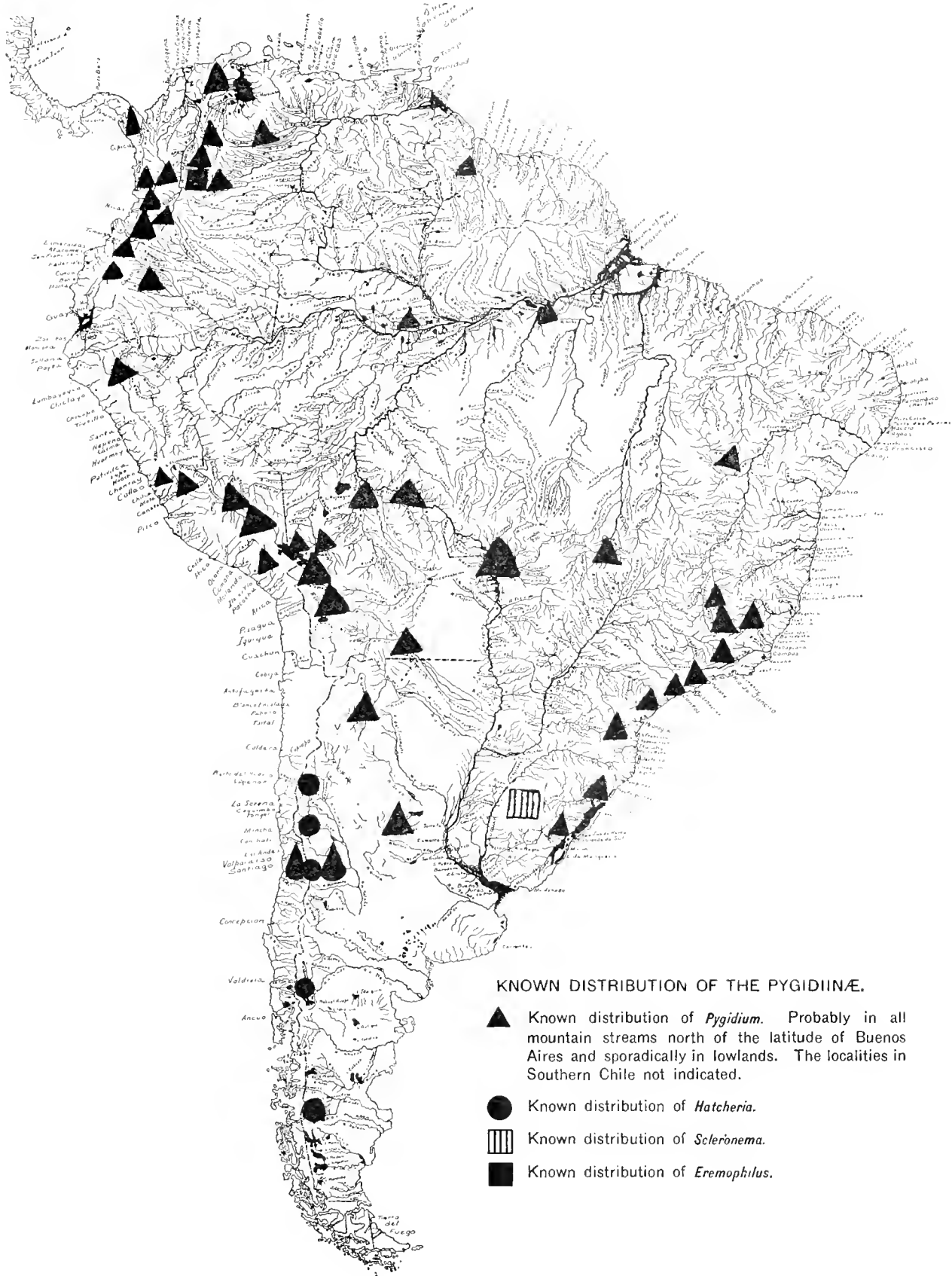
The generic as well as specific descriptions of this species are drawn from photographs lent me by Dr. O. Fuhrmann, and from a specimen 40 mm. long, also sent

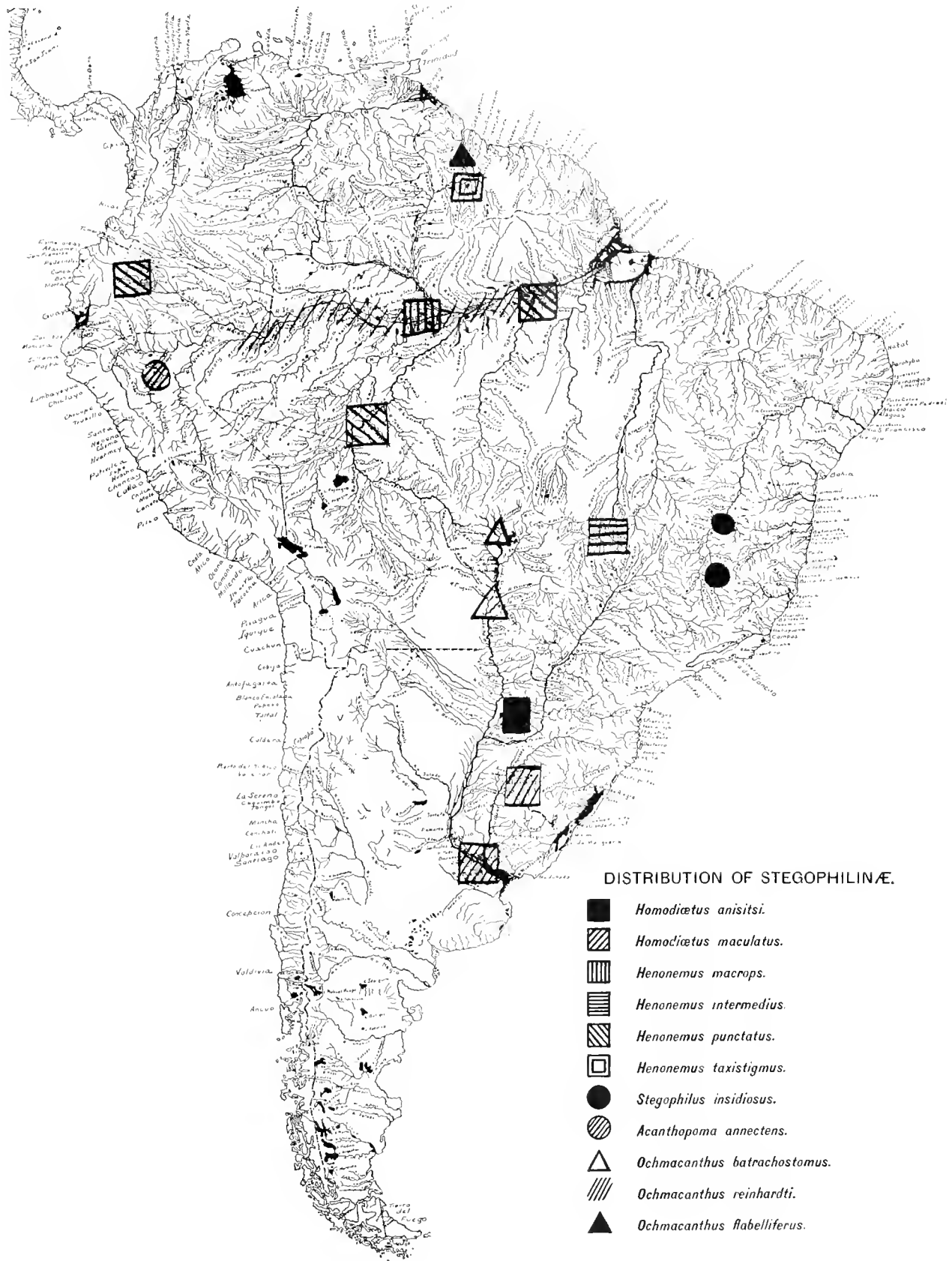
me by Dr. Fuhrmann, whose generosity, since he himself proposes to publish an account of the anatomy of the species, I greatly appreciate.

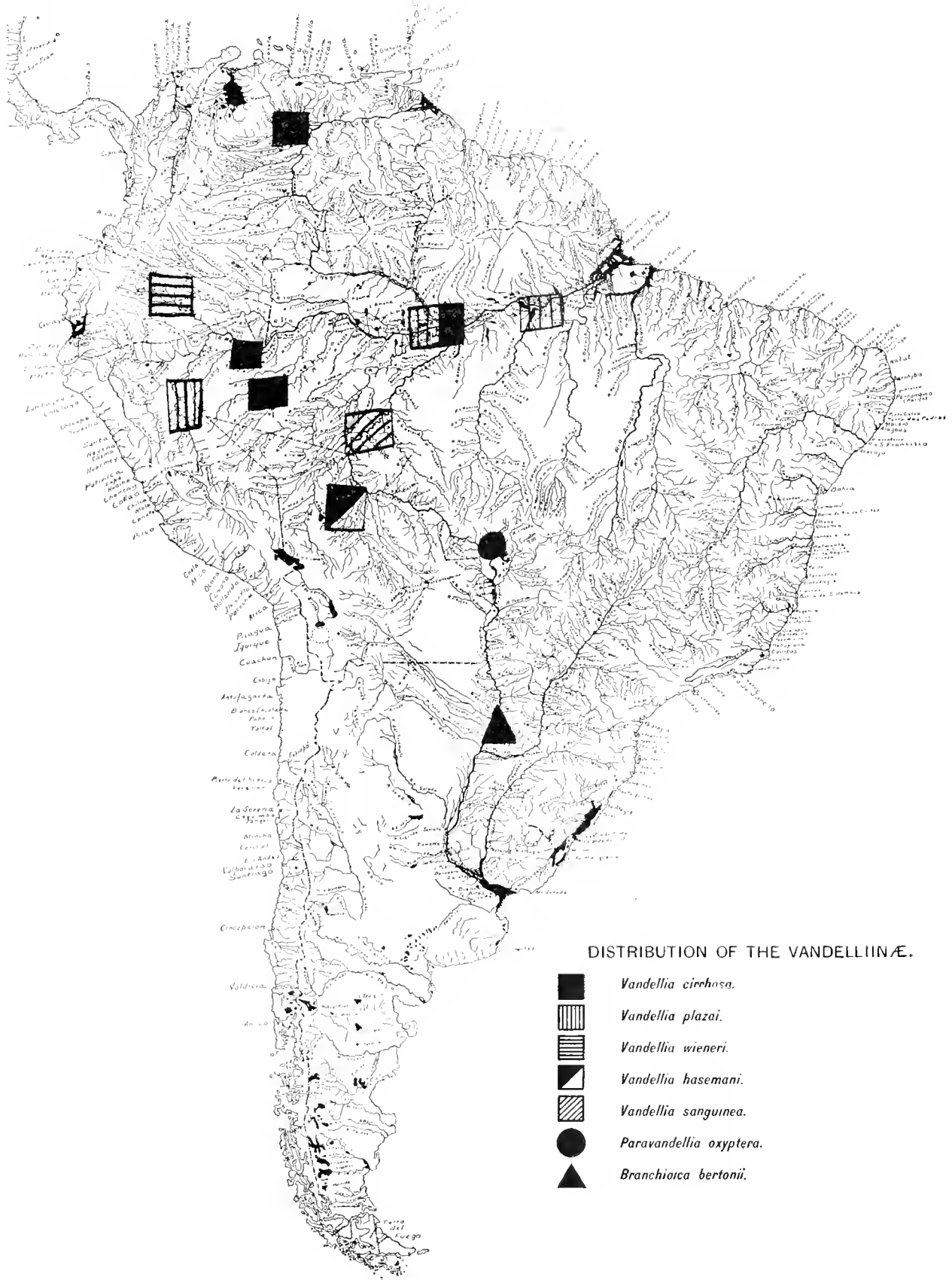
7603, C. M., 40.5 mm. Marajo. From Dr. O. Fuhrmann.

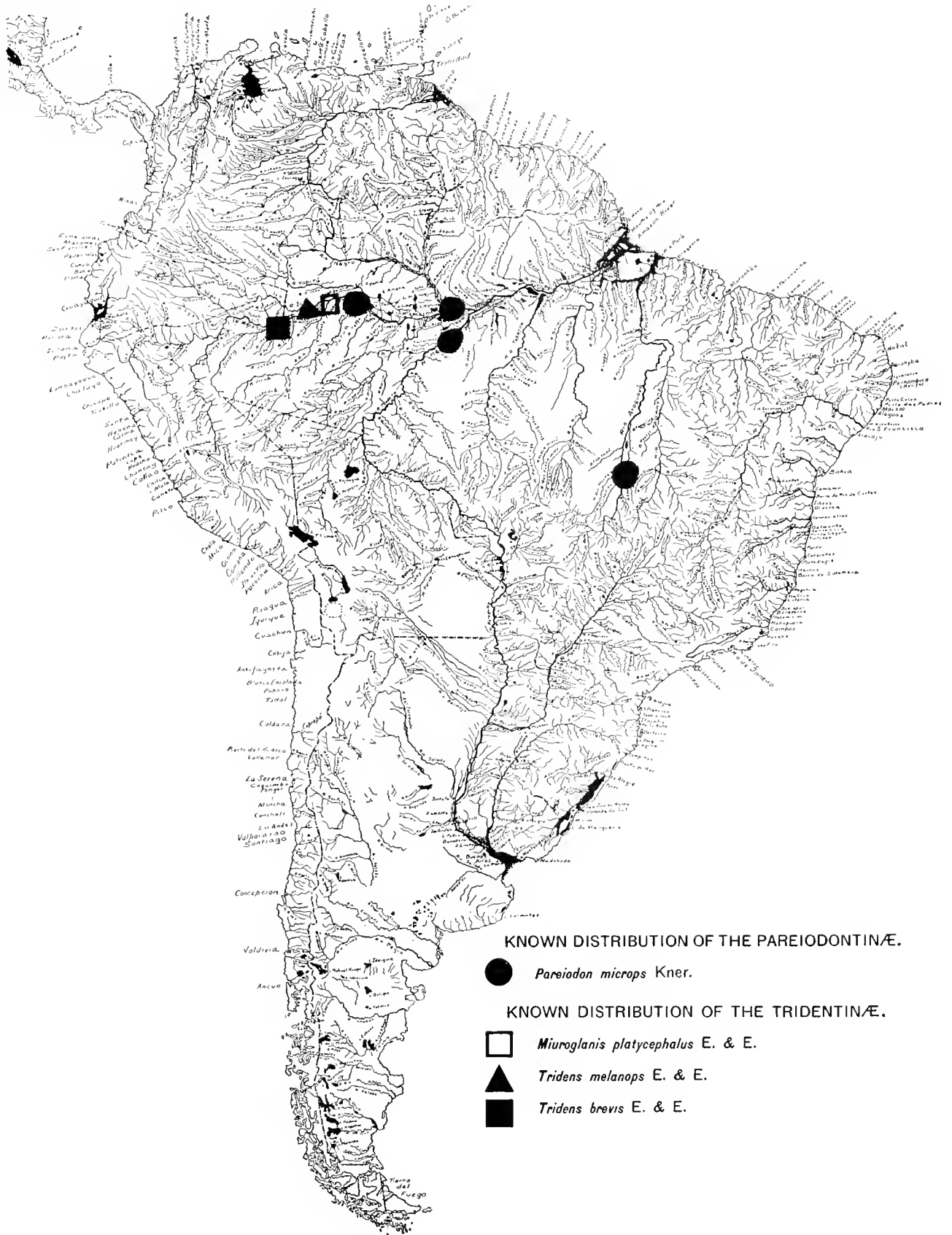
Head about 7; depth about 12; D. 7 (showing in photograph); A. about 25 (showing in photograph).

Heaviest at back part of head, tapering regularly to the base of the caudal, the depth of which is about one-third that of the head; mental barbels in pairs, not reaching pectoral, maxillary barbels sometimes to middle of pectoral; pectoral short and narrow, but little more than half as long as the head; distance from snout to origin of ventrals about one and a half in the distance between caudal and origin of ventrals; caudal small, rounded, one and one-half in the length of the head; origin of dorsal in advance of that of the ventrals, its last ray about over origin of anal; upper accessory caudal rays beginning about over the origin of the second third of the anal, the highest one but little lower than the dorsal rays; anal continuous with the lower accessory caudal rays; ventrals a little shorter than the pectorals. Color uniform.





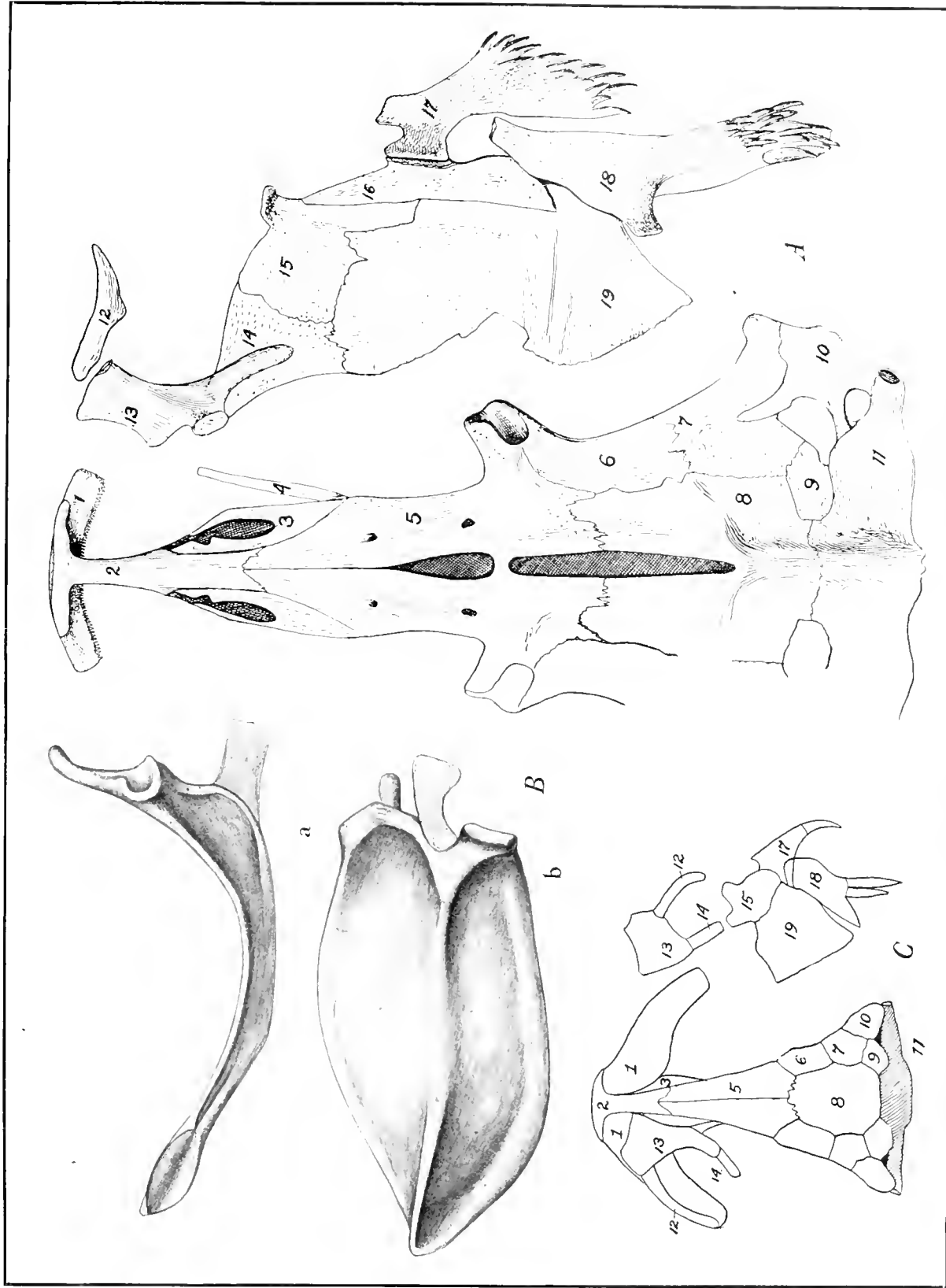




EXPLANATION OF PLATE XL.

A and *B*, *Eremophilus mutisii* HUMBOLDT; *C*, *Henonemus punctatus* (BOULENGER).

1, Premaxillary; 2, Ethmoid; 3, Lateral Ethmoid; 4, Nasal; 5, Frontal; 6, Sphenotic; 7, Pterotic; 8, Supraoccipital; 9, Epiotic; 10, Supraclavicle; 11, Parapophysis of coalesced vertebrae; 12, Maxillary; 13, Palatine; 14, Metapterygoid; 15, Quadrate; 16, Pre-opercle; 17, Interopercle; 18, Opercle; 19, Hyomandibular; *a*, clavicle from the side; *b*, posterior face of clavicle.



A and B. *Eremophilus mutisi* HUMBOLDT. C. *Hicromenus punctatus* (BOULENGER).
(For detailed explanation see opposite page.)

EXPLANATION OF PLATE XLI.

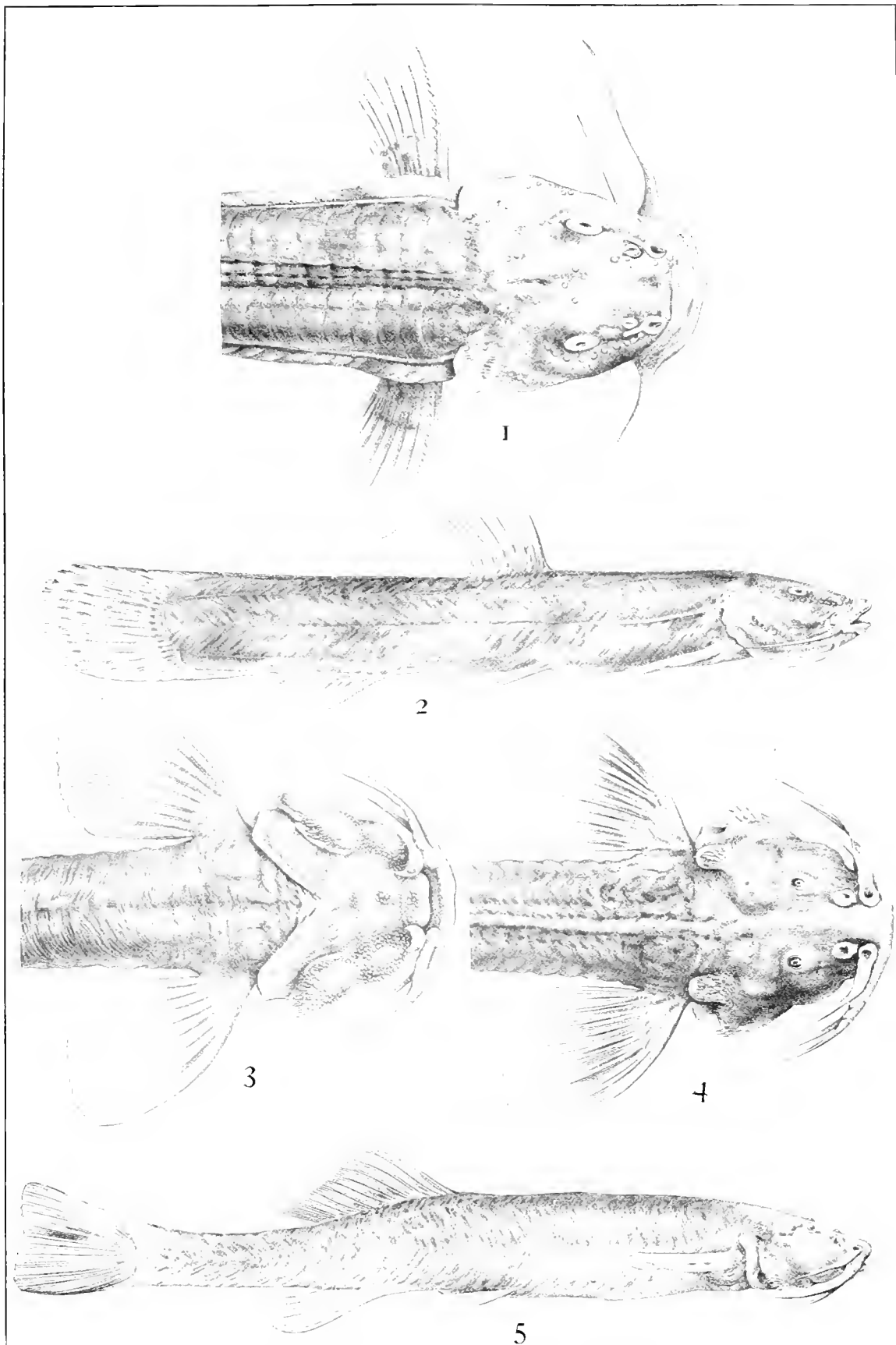
FIGS. 1-2. *Eremophilus mutisii* Humboldt. The air-bladders show faintly as two bags, one on either side of the origin of the vertebral column in fig. 2; and as a small vesicle just above the column in fig. 1. The outlines are marked with a few dots.

FIGS. 3-4. *Paracetopsis occidentalis* (Steindachner). The air-bladder shows as a large bag in fig. 3. A few points are placed in its wall to call attention to its outline.

The tails in figures 1 and 3 are from the same negatives as the rest of these figures, but have been printed heavier, as these portions are thin, and the negatives otherwise quite faint.

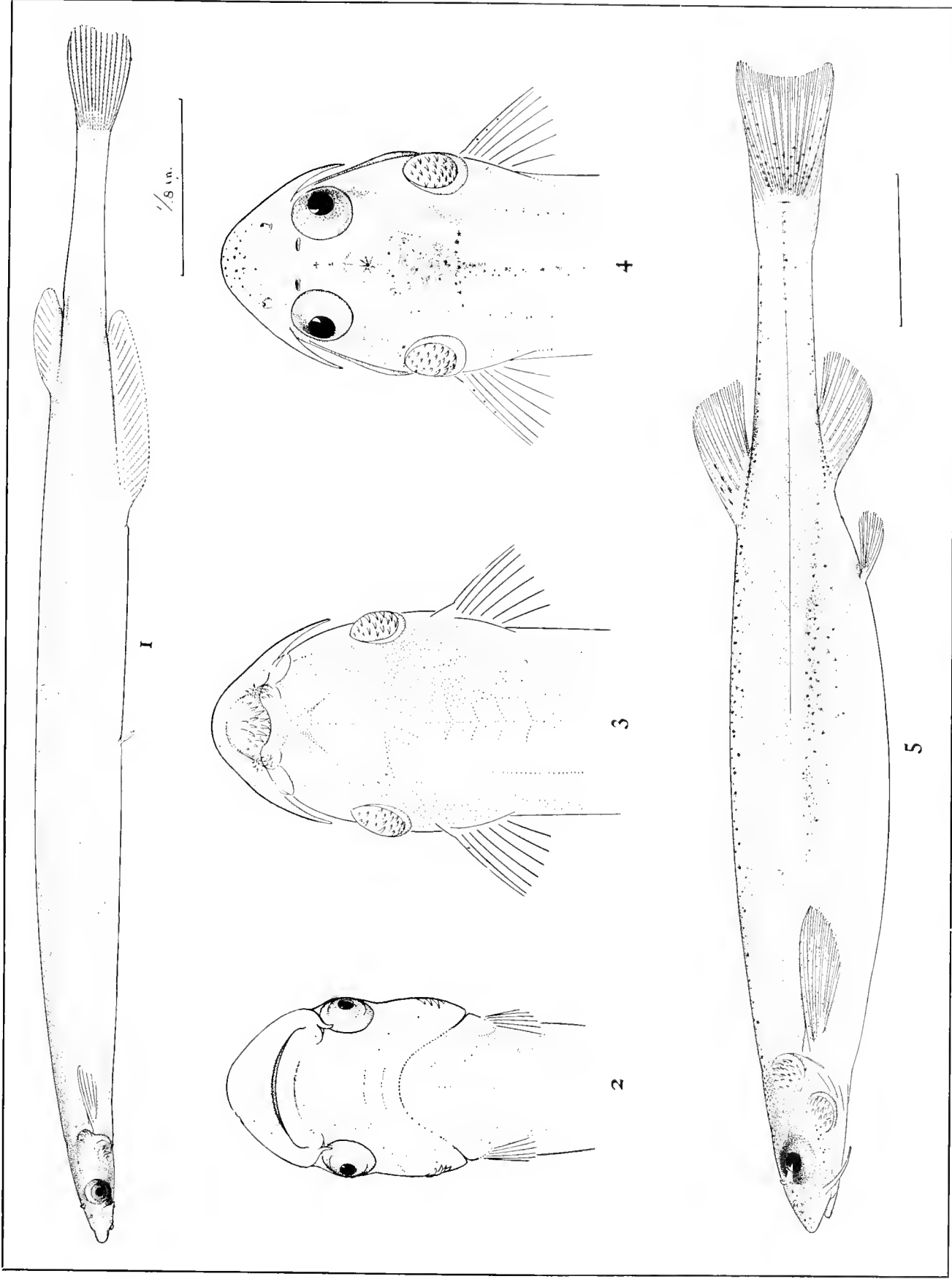


FIGS. 1-2. *Eremophilus mutisii* Humboldt. FIGS. 3-4. *Paracetopsis occidentalis* (Steindachner).



FIGS. 1-2. *Nematogenys inermis* (GUICHENOT). AFTER EIGENMANN. FROM NO. 9839, M. C. Z., CURICO, SANTIAGO, CHILE.

FIGS. 3-5. *Hatcheria maculata* (CUVIER & VALENCIENNES). AFTER EIGENMANN. FROM NO. 7736, M. C. Z., 92 MM. MAPOCHO, CHILE.



FIGS. 1-2. *Tridens melanops* EIGENMANN & EIGENMANN. COTYPE, 4245 I. U. M., 20 MM. IÇA. FIGS. 3-5. *Branchioica bertonii* EIGENMANN. TYPE, 13950 I. U. M., 24 MM. ASUNCIÓN.

EXPLANATION OF PLATE XLIV.

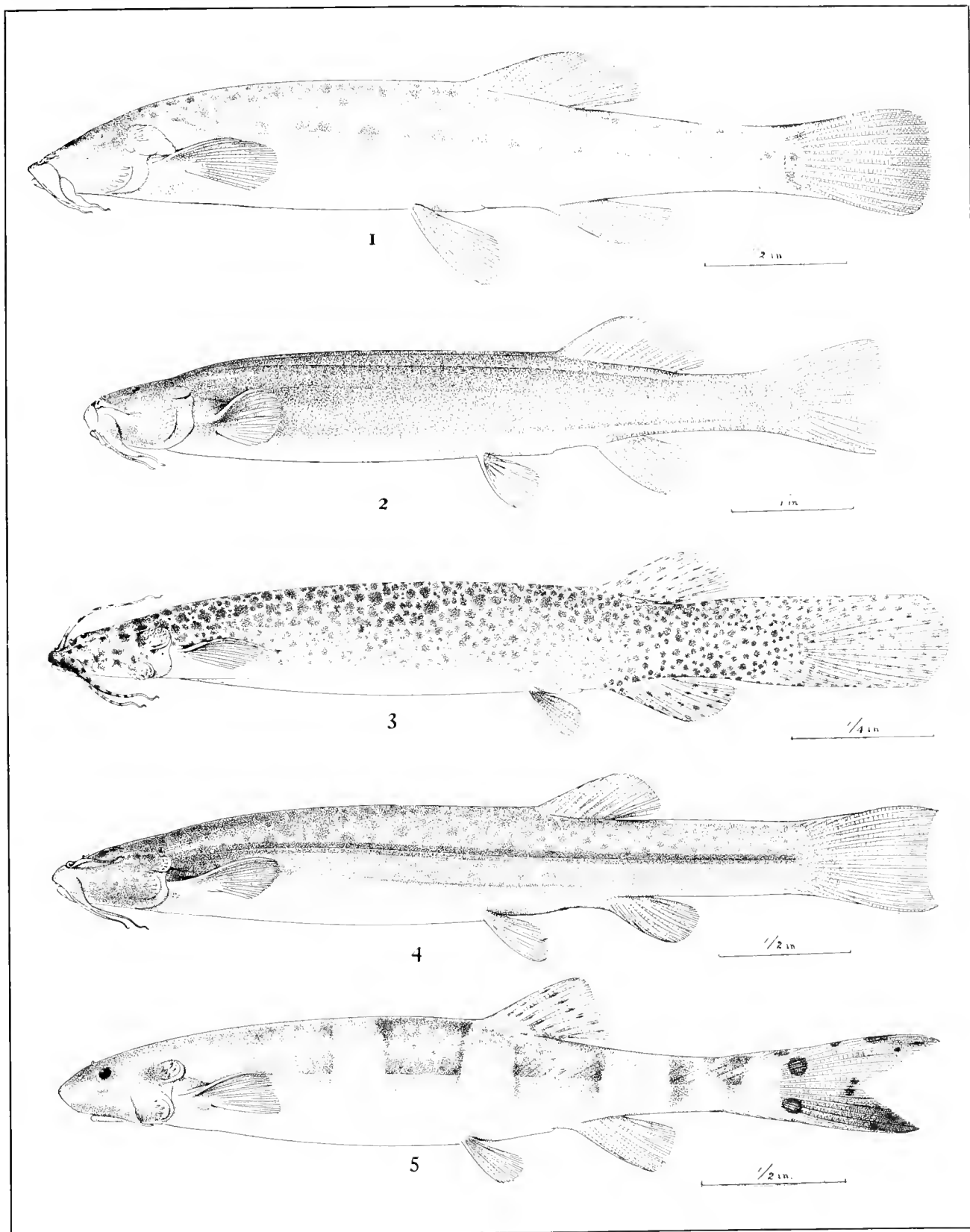
FIG. 1. *Sclerocma operculatum* Eigenmann. Type, No. 7077 C. M., 79 mm., Cacequy.

FIG. 2. *Hatcheria tilcombi* Eigenmann. Type, No. 11110 I. U. M., 164 mm., Arroyo Comajo.

FIG. 3. *Pygidium eichorniarum* Ribeiro. No. 7560a, C. M., 40 mm., San Antonio, Rio Guaporé.

FIG. 4. *Pygidium heterodontum* Eigenmann. Type, No. 13832 I. U. M., 83 mm., Rio Mendoza, Argentina.

FIG. 5. *Pseudostegophilus nemurus* (Günther). No. 7547 C. M., 78 mm., Rio Mamoré.



Scleronema, *Hatcheria*, *Pygidium*, AND *Pseudostegophilus*.
(For detailed explanation see opposite page.)

EXPLANATION OF PLATE XLV.

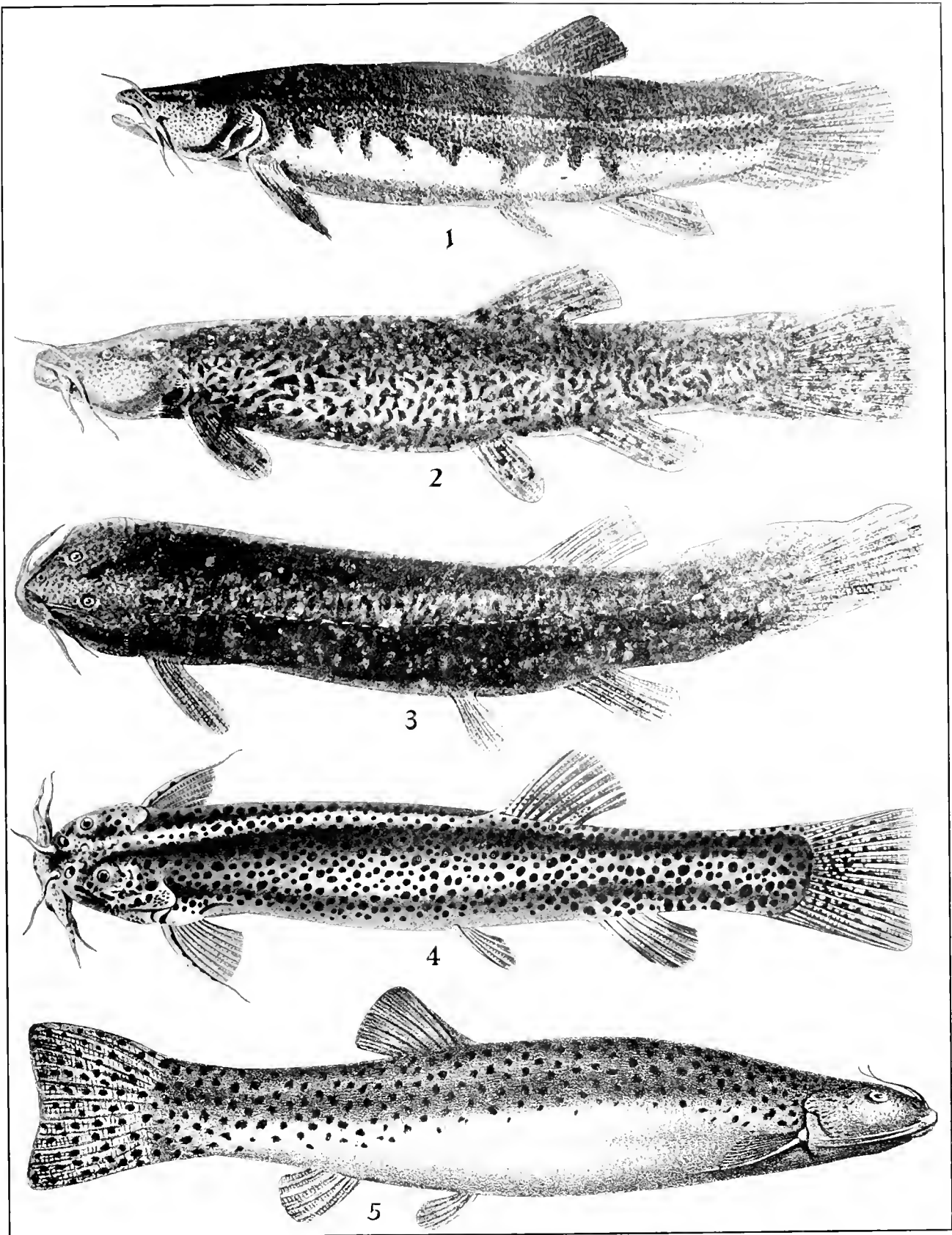
FIG. 1. *Pygidium punctatissimum* (Castelnau) after Castelnau.

FIG. 2. *Pygidium rivulatum* (Cuvier & Valenciennes). After Castelnau's figure of *Trichomyxerus penlandi*.

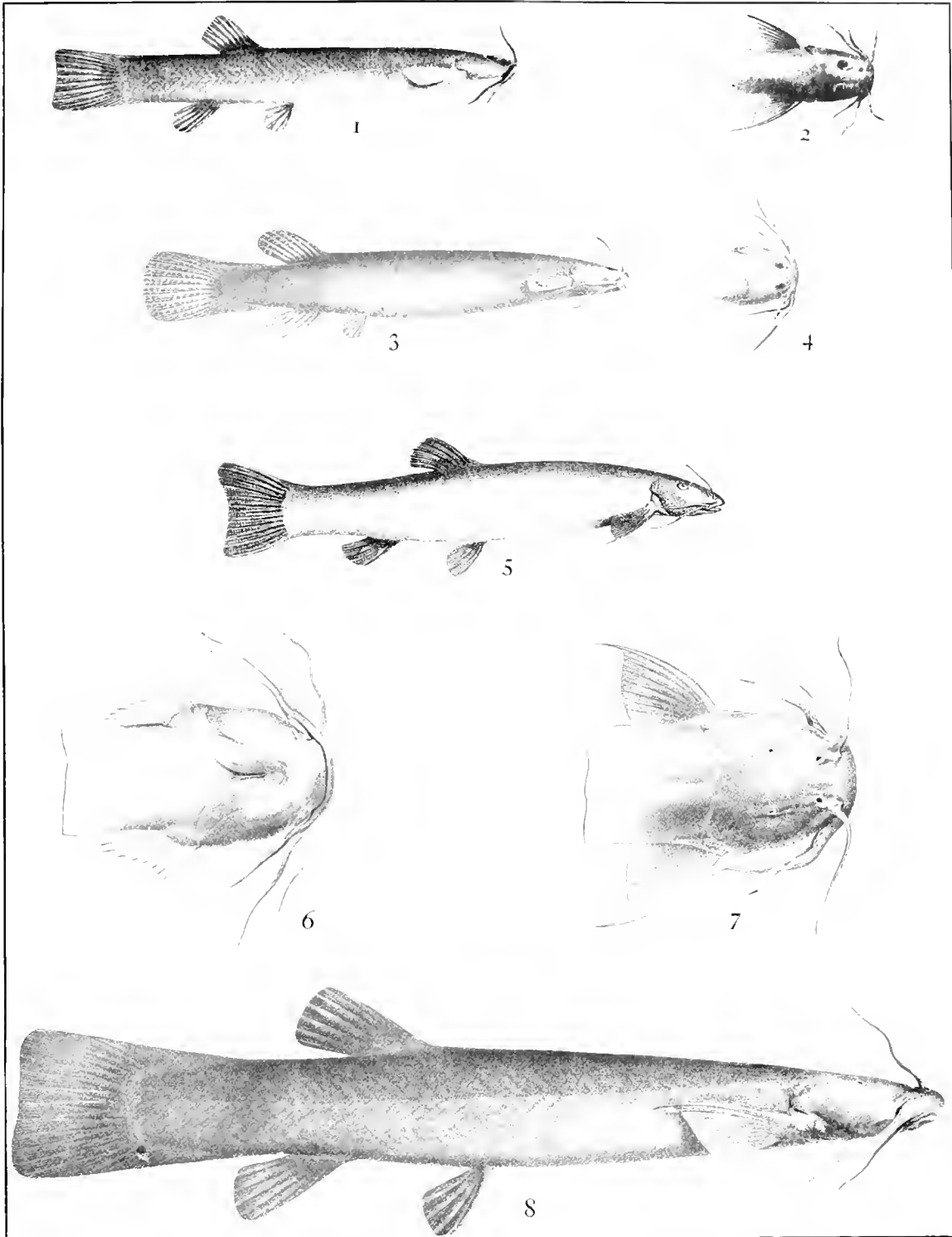
FIG. 3. *Pygidium rivulatum* (Cuvier & Valenciennes). After Castelnau's figure of *Trichomyxerus pictus*.

FIG. 4. *Pygidium punctulatum* (Cuvier & Valenciennes). After Cuvier & Valenciennes.

FIG. 5. *Pygidium dispar* Tschudi. After Tschudi.



Pygidium.
(For detailed explanation see opposite page.)



FIGS. 1, 2. *Pygidium kneri* (STEINDACHNER). AFTER STEINDACHNER.

FIGS. 3, 4. *Pygidium amazonicum* (STEINDACHNER). AFTER STEINDACHNER.

FIG. 5. *Pygidium tuczanowskii* (STEINDACHNER). AFTER THE MALE OF *Pygidium dispar* TSCHUDI, FAUN. PERUANA, ICHTHYOL., PL. III, LOWER FIGURE.

FIGS. 6-8. *Pygidium tuczanowskii* (STEINDACHNER). AFTER STEINDACHNER.

EXPLANATION OF PLATE XLVII.

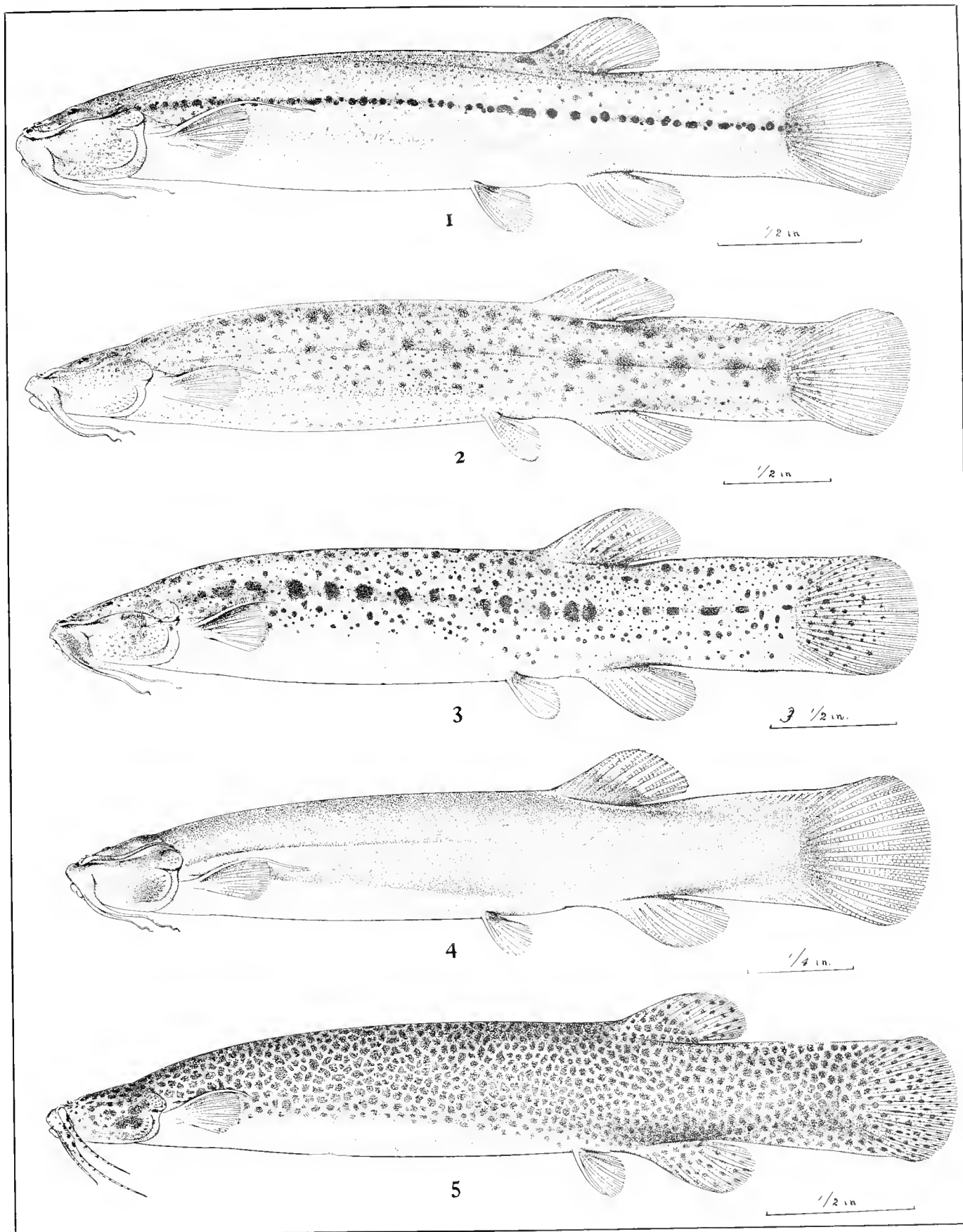
FIG. 1. *Pygidium stellatum* Eigenmann. Type, No. 7097 C. M., 78 mm., Quebrada Sargento.

FIG. 2. *Pygidium chapmani* Eigenmann. Type, No. 4817, C. M., 106 mm., Boquia.

FIG. 3. *Pygidium chapmani* Eigenmann. No. 7091 C. M., 86 mm., Rio Dagua at Caldas. Eigenmann.

FIG. 4. *Pygidium latidens* Eigenmann. Type, No. 13801, I. U. M., 53 mm., near mouth of Rio Calima, Colombia. (Head too short; it is 5.5 in the length.)

FIG. 5. *Pygidium meta* Eigenmann. Type, No. 13770, I. U. M., Barrigona.



Pygidium.
(For detailed explanation see opposite page.)

EXPLANATION OF PLATE XLVIII.

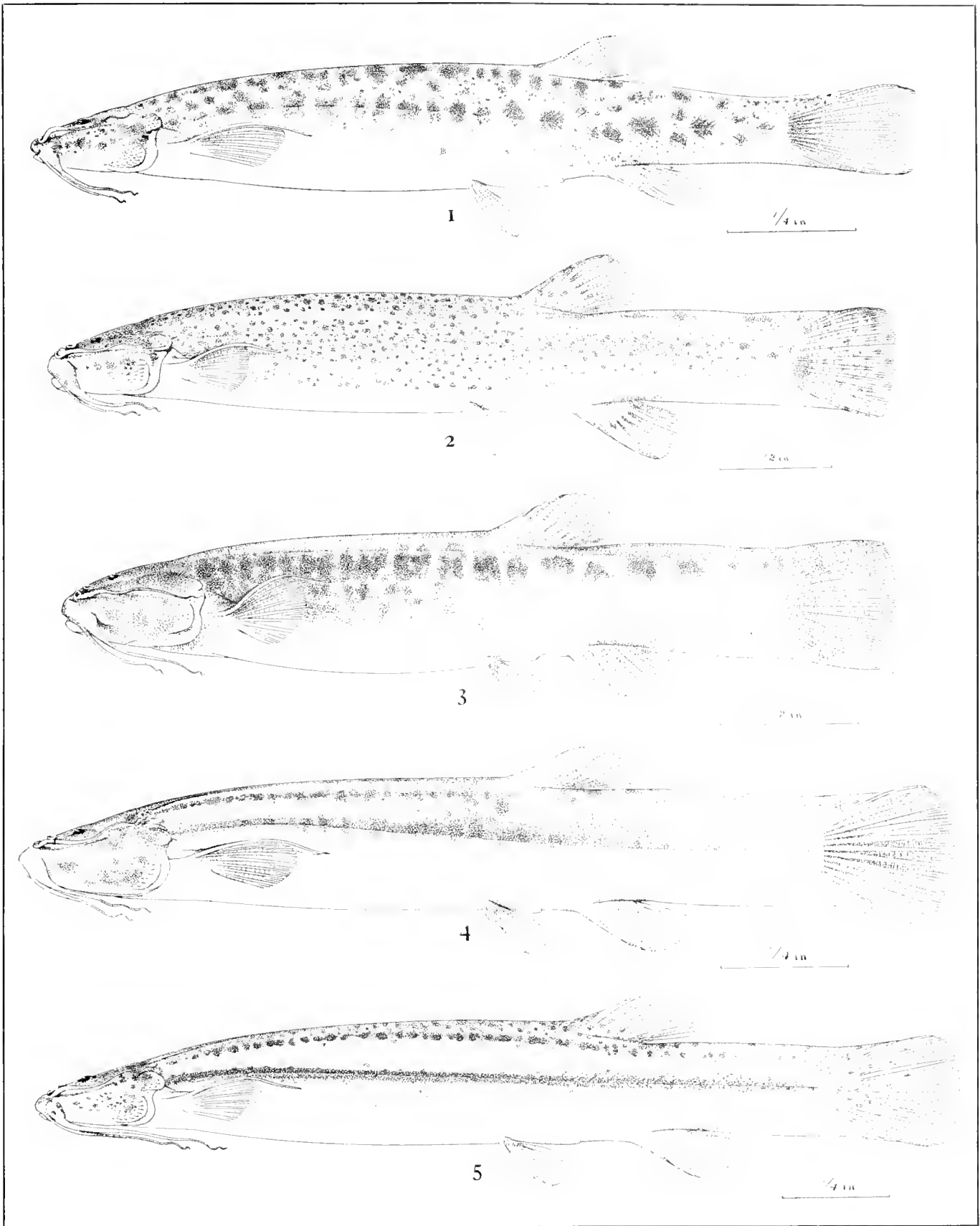
FIG. 1. *Pygidium bancaui* Eigenmann. Type, No. 4815, C. M., 43 mm., Bernal Creek.

FIG. 2. *Pygidium spilosoma* Regan. No. 7092, C. M., 97 mm., Cordova, Rio Dagua, Colombia.

FIG. 3. *Pygidium dorsostriatum* Eigenmann. Type, No. 7093a, C. M., 76 mm., Villavicencio.

FIG. 4. *Pygidium latistriatum* Eigenmann. Type, No. 7450, C. M., 46 mm., Quebrada de Pinchote, Santander.

FIG. 5. *Pygidium regani* Eigenmann. No. 13772, I. U. M., 55 mm., Tado.



Pygidium.
(For detailed explanation see opposite page.)

EXPLANATION OF PLATE XLIX.

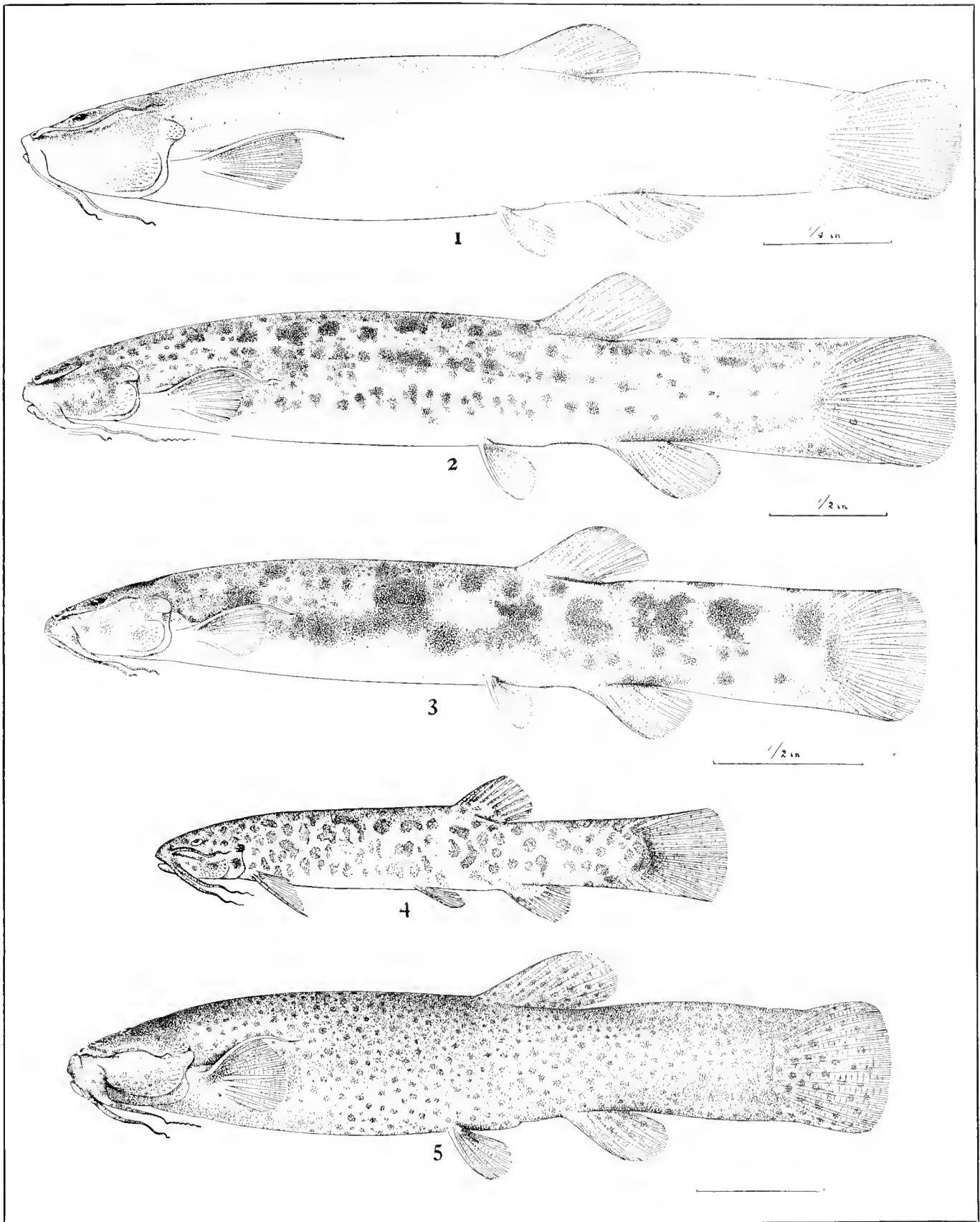
FIG. 1. *Pygidium stramineum* Eigenmann. Type, No. 7101, C. M., 46 mm., Quebrada del Mango. (The eye is farther forward than in the specimen.)

FIG. 2. *Pygidium merida* Regan. No. 13771, I. U. M., 99 mm., Merida, Venezuela.

FIG. 3. *Pygidium bogotense* Eigenmann. Type, No. 4820, C. M., 74 mm., Puente de Supa, near Chapinero, Plains of Bogotá.

FIG. 4. *Pygidium bogotense* Eigenmann. No. 4821*b*, C. M., 70 mm., Chapinero.

FIG. 5. *Pygidium nigromaculatum* (Boulenger). Univ. Michigan, 165 mm., San Lorenzo, Santa Marta Mountains, 4,500 ft.



Pygidium.
(For detailed explanation see opposite page.)

EXPLANATION OF PLATE L.

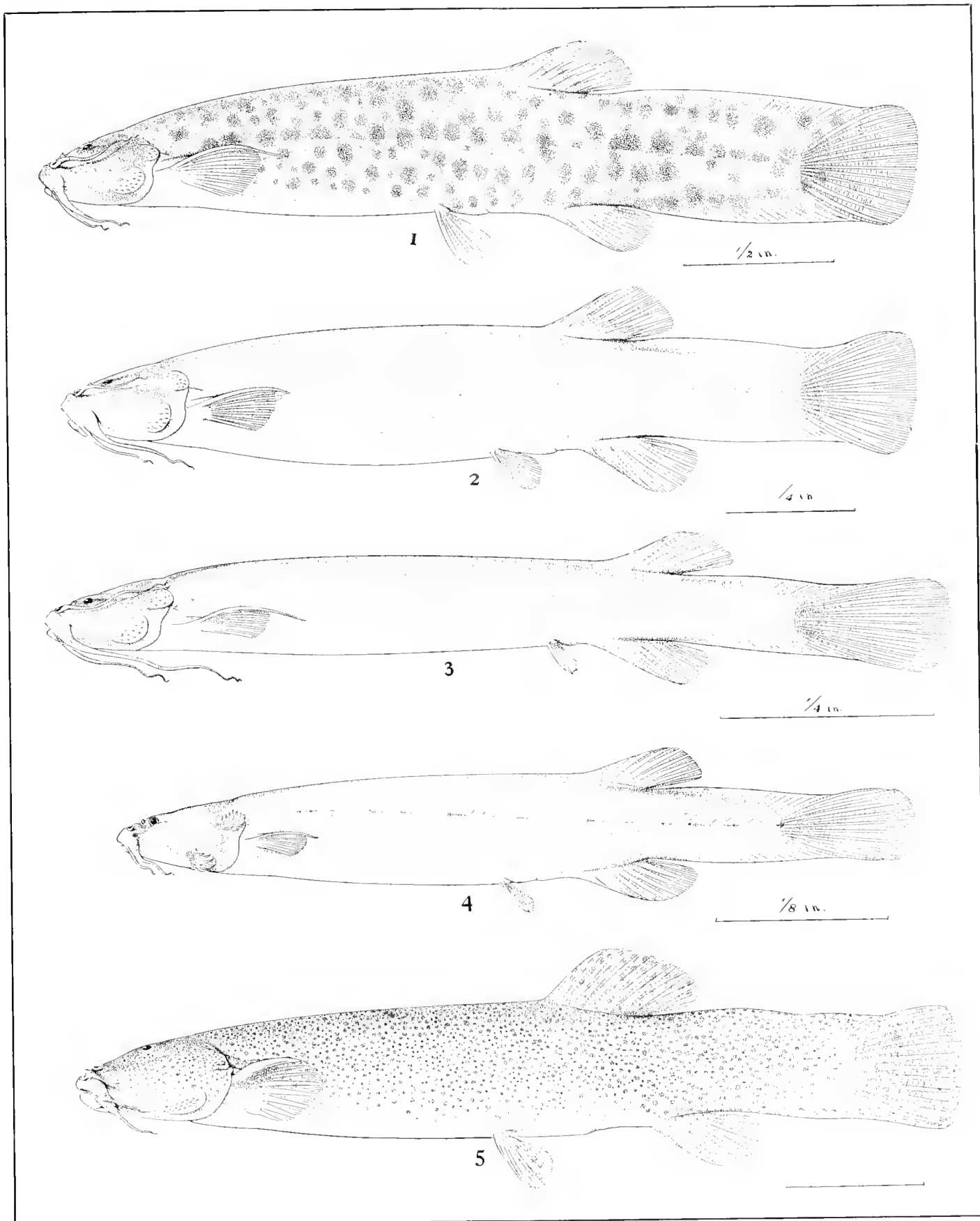
FIG. 1. *Pygidium guianense* Eigenmann. Type, No. 1003, C. M., 77 mm., Aruataima Cataract.

FIG. 2. *Pygidium conradi* Eigenmann. Type, No. 2212, C. M., 41 mm., Amatuk Cataract. (The head is a little too short.)

FIG. 3. *Pygidium gracilior* Eigenmann. Type, No. 1730, C. M., 27 mm., Erukin, British Guiana.

FIG. 4. *Pygidium hasemani* Eigenmann. Type, No. 5238, C. M., 15 mm., Santarem.

FIG. 5. *Pygidium iheringi* Eigenmann. Type, No. 10785, I. U. M., 161 mm., Santos.



Pygidium.
(For detailed explanation see opposite page.)

EXPLANATION OF PLATE LI.

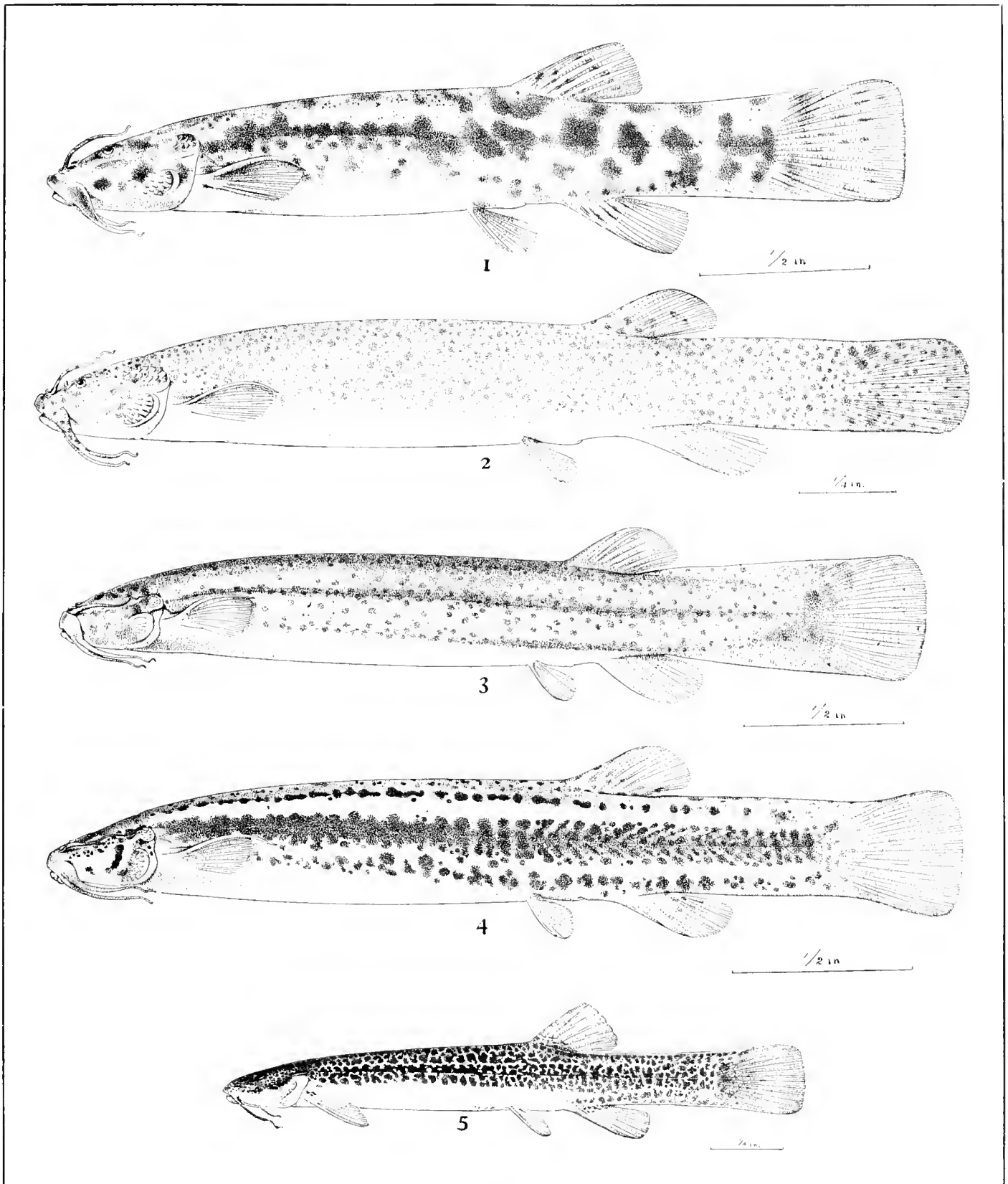
FIG. 1. *Pygidium zonatum* Eigenmann. Type, No. 7596, C. M., 62 mm., Agua Quente.

FIG. 2. *Pygidium proöps* (Ribeiro). No. 7593, C. M., 60 mm., Agua Quente.

FIG. 3. *Pygidium paolence* Eigenmann. Type, No. 7081, C. M., 68 mm., Alto da Serra, Rio Tieté, São Paulo, Brazil.

FIG. 4. *Pygidium reinhardtii* Eigenmann. Type, No. 7078, C. M., 65 mm., Burmier.

FIG. 5. *Pygidium darisi* Haseman. Type, No. 2862, C. M., 52 mm., Serrinha Paraná.



Pygidium.
(For detailed explanation see opposite page.)

EXPLANATION OF PLATE LII.

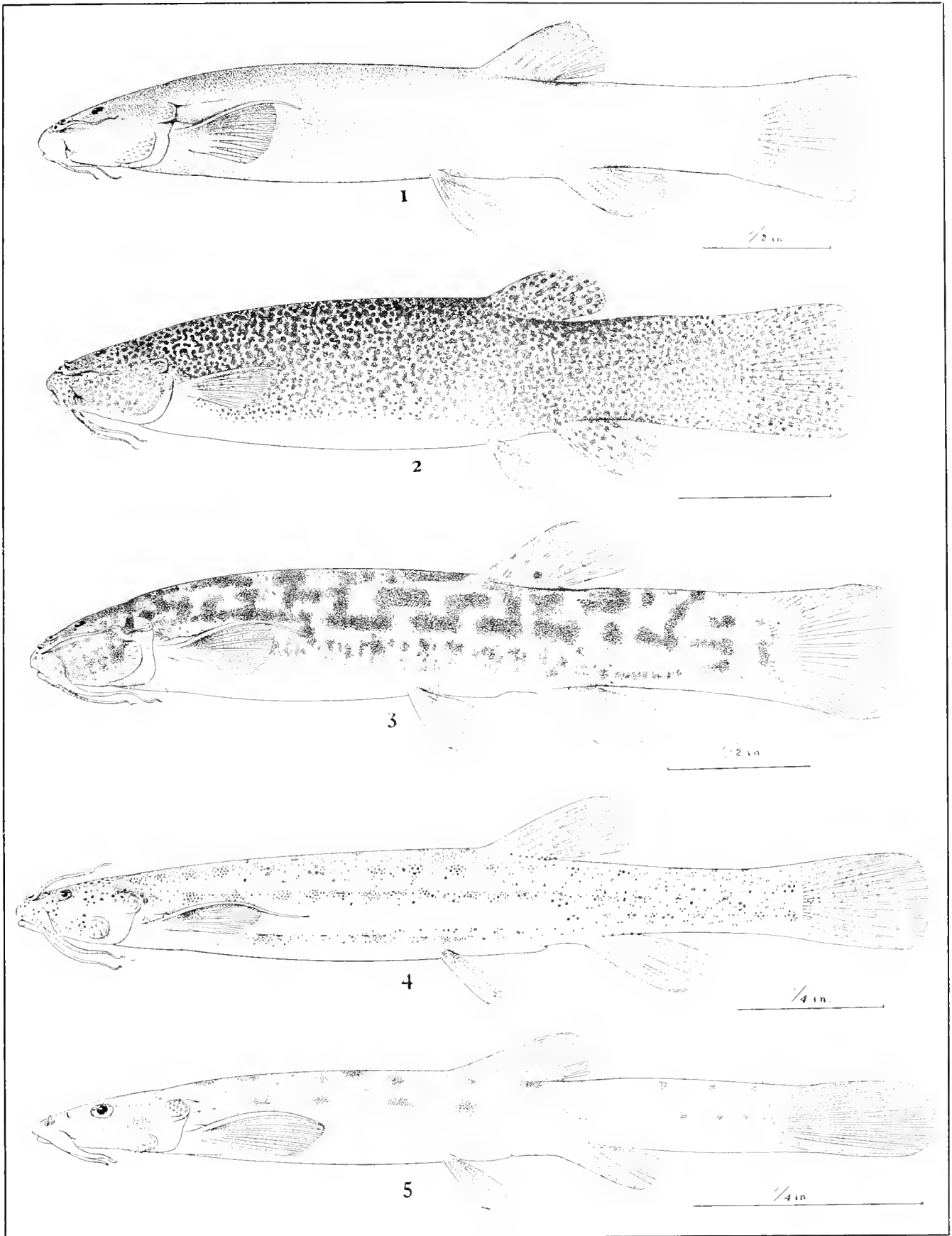
FIG. 1. *Pygidium immaculatum* Eigenmann & Eigenmann. No. 7076, C. M., 81 mm., Rio Doce.

FIG. 2. *Pygidium vermiculatum* Eigenmann. Type, No. 7074, C. M., 131 mm., Juiz de Fora.

FIG. 3. *Pygidium alternatum* Eigenmann. Type, No. 7079a, C. M., 79 mm., Rio Doce.

FIG. 4. *Pygidium triguttatum* Eigenmann. Type, No. 7600a, C. M., 36 mm., Jacarehy.

FIG. 5. *Pygidium santa-rita* Eigenmann. Type, No. 7599, C. M., 24 mm., Santa Rita.



Pygidium.

(For detailed explanation of Plate see opposite page.)

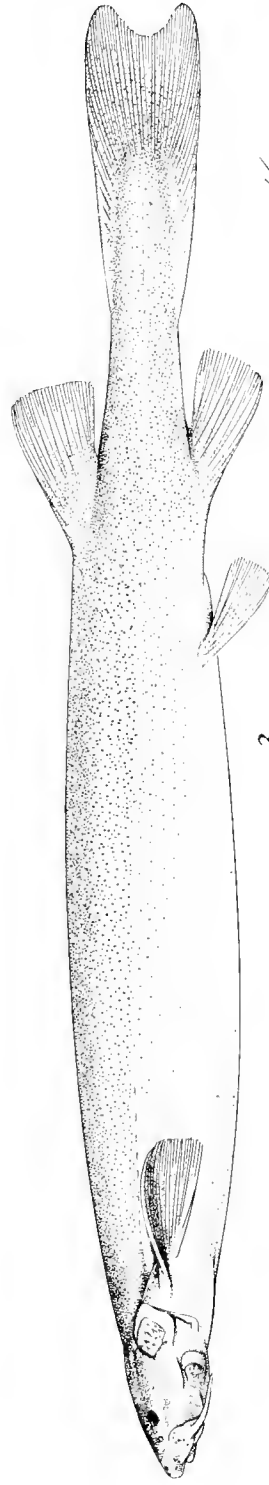
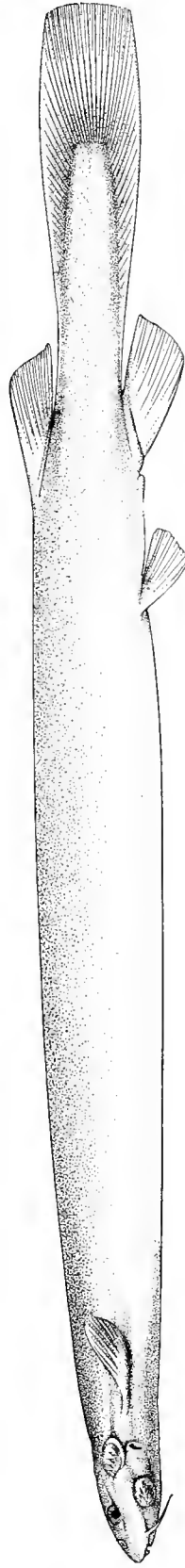
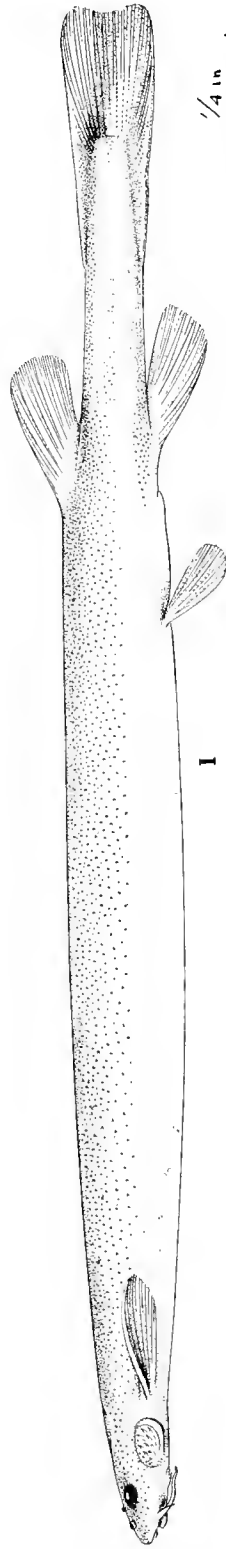


FIG. 1. *Vandellia plazai* CASTELNAU. No. 7541, C. M., 66 MM., SANTAREM.
FIG. 2. *Vandellia sanguinea* EIGENMANN. TYPE, No. 7082, C. M., 62 MM., SAN ANTONIO DE RIO MADEIRA.
FIG. 3. *Vandellia hasemani* EIGENMANN. TYPE, No. 7542, C. M., 72 MM., RIO MAMORÉ.

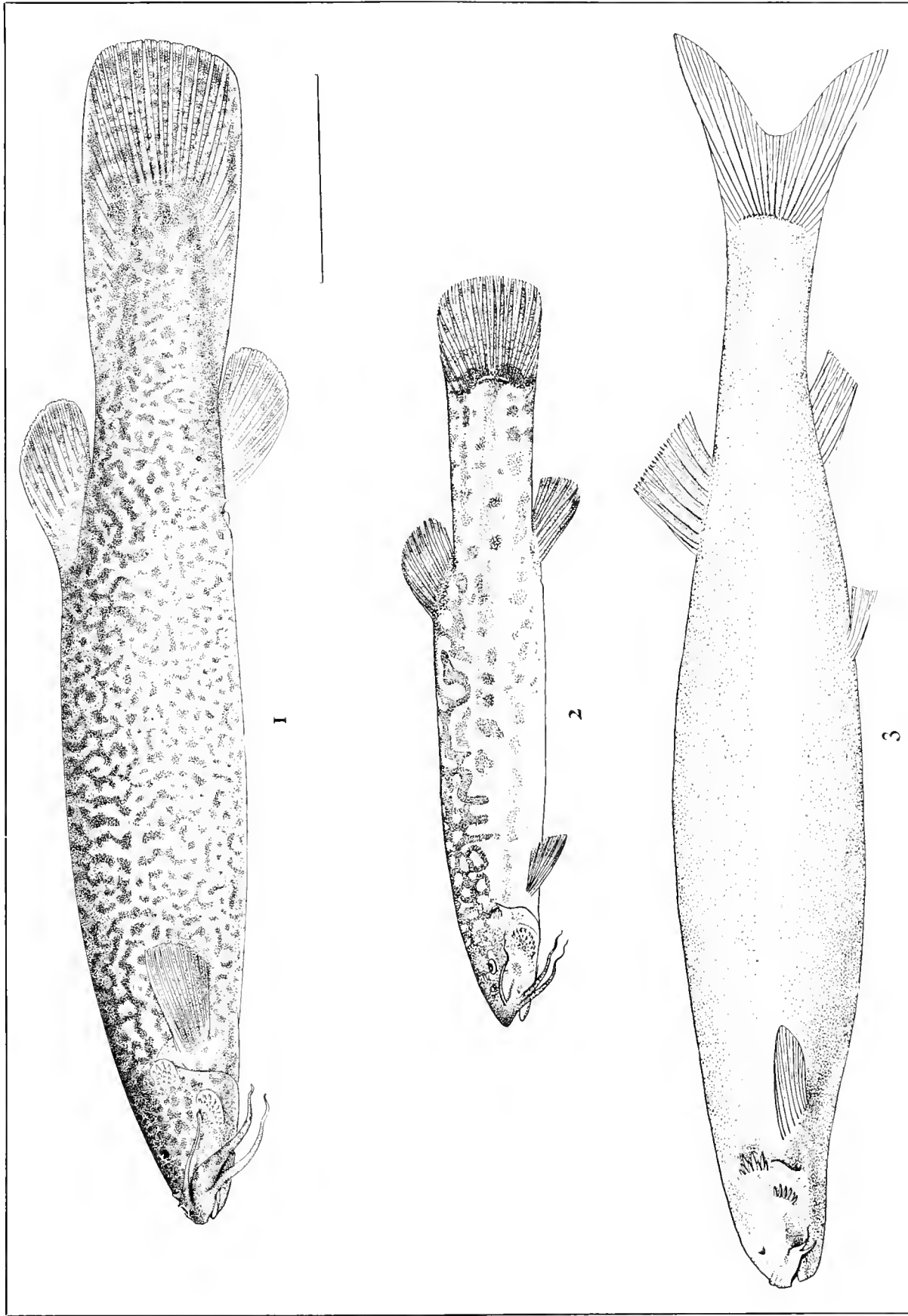
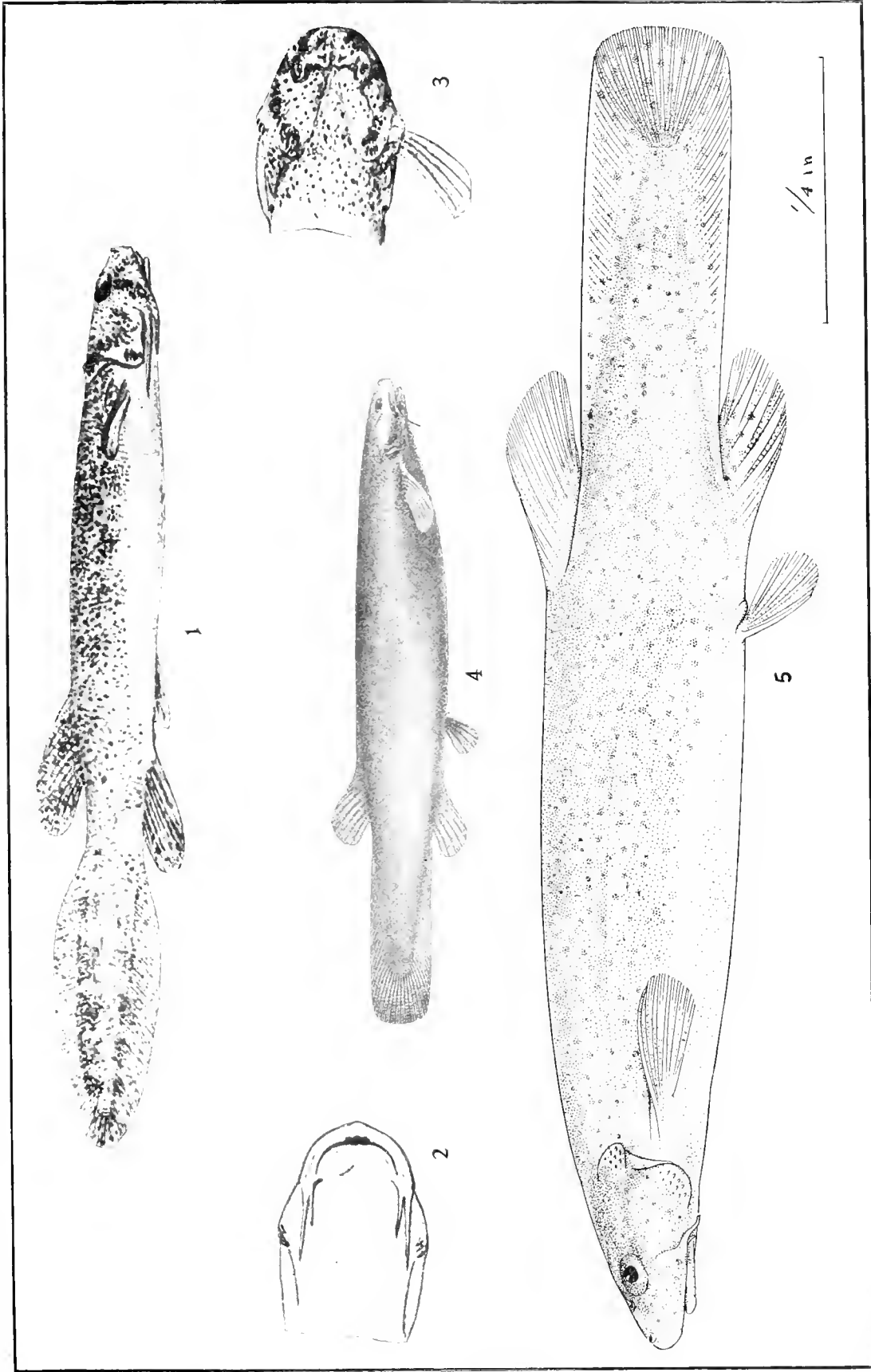
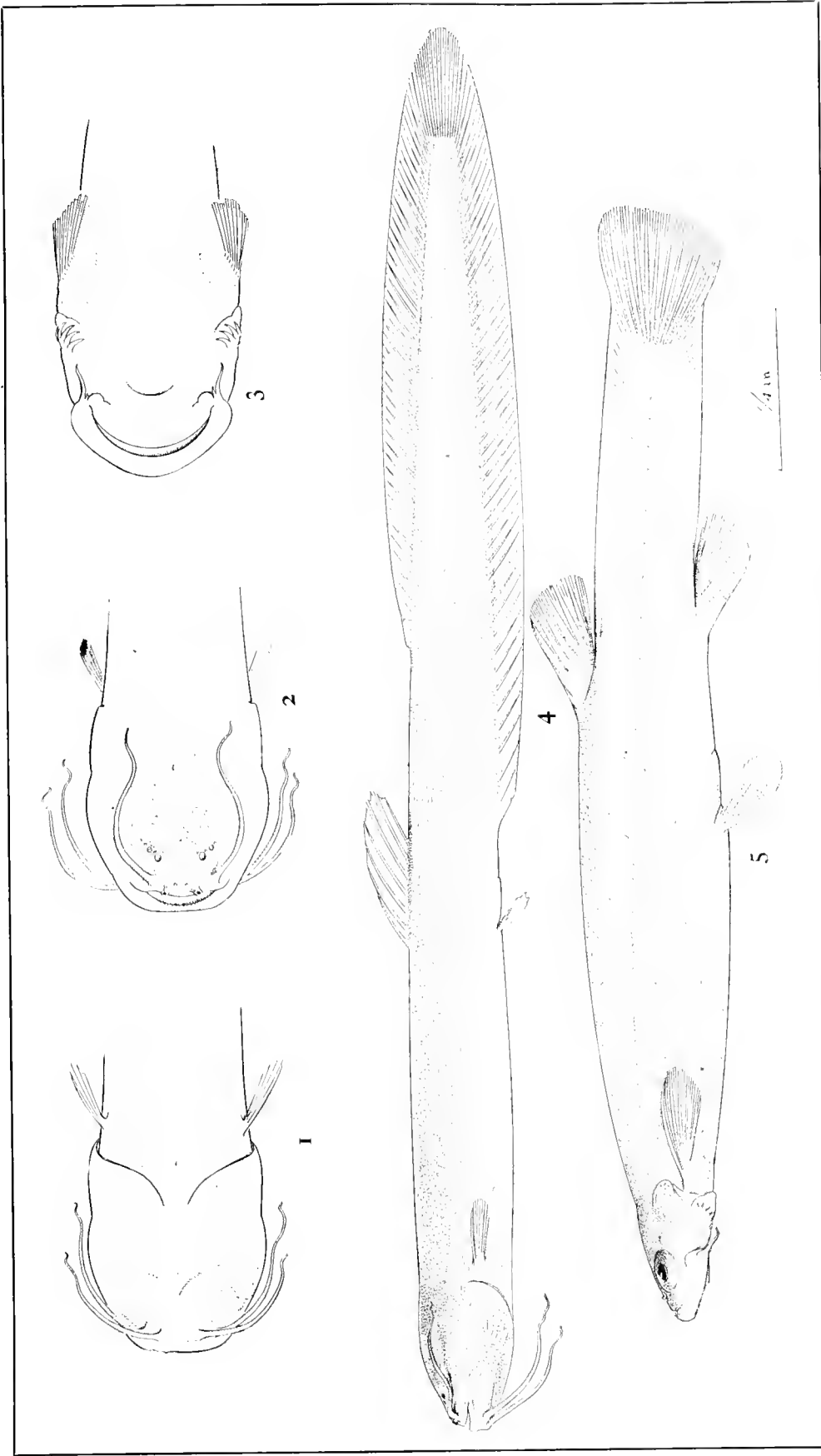


FIG. 1. *Eremophilus mutisii* HUMBOLDT. 146 MM. NEAR BOGOTÁ.
FIG. 2. *Eremophilus mutisii* HUMBOLDT. 85 MM. NEAR BOGOTÁ. SHOWING COLOR-PATTERN IN YOUNG.
FIG. 3. *Paréiadan microps* KNER. 145 MM., SPECIMEN IN ACAD. NAT. SCI. PHILADELPHIA.



FIGS. 1-3. *Ochmacanthus batrachostoma* (RIBEIRO). AFTER RIBEIRO.
FIG. 4. *Ochmacanthus reinhardti* (STEINDACHNER). AFTER STEINDACHNER.
FIG. 5. *Ochmacanthus flabelliferus* EIGENMANN. TYPE, No. 1729, C. M., 31 MM., KONAWARUK, BRITISH GUIANA.



FIGS. 1, 2, 4. *Phreatobius cisternarum* GOELDI. No. 7603, C. M., 40.5 MM. MARAJO.
FIGS. 3, 5. *Homodictus anisitsi* EIGENMANN & WARD. TYPE, No. 10155, I. U. M., 73 MM., VILLA RICA, PARAGUAY.

GUIDE TO CONTENTS.

	PAGE
Introduction.....	259
<i>Pariolius</i> (Footnote)	260
Habits.....	261
Distribution of the Pygidiidae..... (Plates XXXVI-XXXIX)	269
Chronology.....	270
Location of types.....	271
Sources of the material examined.....	274
Zoölogical position of the Pygidiidae.....	275
Synonymy.....	275
Limits of the family Pygidiidae..... (Plates XL-XLI)	276
Key to the subfamilies and genera..... (Text figure 1)	278
I. <i>Nematogenys</i>	279
<i>N. inermis</i> (Plate XLII, figs. 1 and 2)	280
II. <i>Scleronema</i> (Plate XXXVI, text figure 2)	280
<i>S. operculatum</i> (Plate XLIV, fig. 1)	281
III. <i>Hatcheria</i> (Plate XXXVI, text figure 2)	281
1. <i>H. patagoniensis</i> (Text figure 3)	283
2. <i>H. maculata</i> (Plate XLII, figs. 3-5)	284
3. <i>H. titcombi</i> (Plate XLIV, fig. 2)	284
4. <i>H. arcolata</i> (Text figure 4)	285
5. <i>H. burmeisteri</i> (Text figure 5)	286
6. <i>H. macraei</i> (Text figure 6)	287
IV. <i>Pygidium</i>	288
1. <i>P. marmoratum</i>	290
2. <i>P. palleum</i>	291
3. <i>P. tigrinum</i>	291
4. <i>P. tenue</i> (Text figure 7)	292
5. <i>P. corduveense</i> (Text figure 8)	293
6. <i>P. spagazzinii</i>	294
7. <i>P. borellii</i>	294
8. <i>P. eichorniarum</i> (Plate XLIV, fig. 3)	295
9. <i>P. riojanum</i> Berg.....	295

	PAGE
10. <i>P. heterodontum</i> (Plate XLIV, fig. 4)	296
11. <i>P. fuscum</i>	298
12. <i>P. cigenmanni</i>	298
13. <i>P. vittatum</i>	299
14. <i>P. dispar</i> (Plate XLV, fig. 5)	299
15. <i>P. punctulatum</i> (Plate XLV, fig. 4)	300
16. <i>P. taczanowskii</i> (Plate XLVI, figs. 5-8)	300
17. <i>P. rivulatum</i> (Plate XLV, figs. 2 and 3)	301
18. <i>P. poeyanum</i>	302
19. <i>P. barbouri</i> (Text figure 9)	303
20. <i>P. fassli</i>	303
21. <i>P. oroya</i> (Text figure 10)	304
22. <i>P. quechuorum</i> (Text figure 11)	305
23. <i>P. laticeps</i> (Text figure 12)	307
24. <i>P. stellatum</i> (Plate XLVII, fig. 1)	308
25. <i>P. chapmani</i> (Plate XLVII, figs. 2 and 3; Text figure 13)	309
26. <i>P. tæniūm</i> (Text figure 14)	310
27. <i>P. caliense</i> (Text figure 15)	311
28. <i>P. latidens</i> (Plate XLVII, fig. 4)	312
29. <i>P. metw</i> (Plate XLVII, fig. 5)	312
30. <i>P. stramineum</i> (Plate XLIX, fig. 1)	313
31. <i>P. unicolor</i>	314
32. <i>P. kneri</i> (Plate XLVI, figs. 1 and 2)	314
33. <i>P. merida</i> (Plate XLIX, fig. 2)	315
34. <i>P. bogotense</i> (Plate XLIX, figs. 3 and 4)	315
35. <i>P. nigromaculatum</i> (Plate XLIX, fig. 5)	317
35. <i>P. banneaui</i> (Plate XLVIII, fig. 1)	318
37. <i>P. pilosoma</i> (Plate XLVIII, fig. 2)	319
38. <i>P. dorsostriatum</i> (Plate XLVIII, fig. 3)	320
39. <i>P. venulosum</i>	320
40. <i>P. latistriatum</i> (Plate XLVIII, fig. 4)	321
41. <i>P. striatum</i>	321
42. <i>P. regani</i> (Plate XLVIII, fig. 5)	323
43. <i>P. retropinne</i>	324
44. <i>P. guianense</i> (Plate L, fig. 1)	325
45. <i>P. conradi</i> (Plate L, fig. 2)	325
46. <i>P. gracilior</i> (Plate L, fig. 3)	326

	PAGE
47. <i>P. amazonicum</i> (Plate XLVI, figs. 3 and 4)	326
48. <i>P. hasemani</i> (Plate L, fig. 4)	326
49. <i>P. nigricans</i>	329
50. <i>P. iheringi</i> (Plate L, fig. 5)	330
51. <i>P. zonatum</i> (Plate LI, fig. 1)	330
52. <i>P. proöps</i> (Plate LI, fig. 2; Text figure 16)	331
53. <i>P. paolence</i> (Plate LI, fig. 3)	332
54. <i>P. reinhardti</i> (Plate LI, fig. 4)	333
55. <i>P. davisi</i> (Plate LI, fig. 5)	334
56. <i>P. immaculatum</i> (Plate LII, fig. 1)	334
57. <i>P. vermiculatum</i> (Plate LII, fig. 2)	335
58. <i>P. alternatum</i> (Plate LII, fig. 3)	336
59. <i>P. goeldii</i>	337
60. <i>P. brasiliense</i> (Text figures 17 and 18)	337
61. <i>P. itatiaya</i> (Text figure 19)	339
62. <i>P. triguttatum</i> (Plate LII, fig. 4)	339
63. <i>P. punctatissimum</i> (Plate XLV, fig. 1)	340
64. <i>P. minutum</i> (Text figure 20)	340
65. <i>P. sante-rita</i> (Plate LII, fig. 5)	341
V. <i>Eremophilus</i> (Plate XXXVI; Plate XL, figs. A and B)	341
1. <i>E. mutisii</i> (Plate XLI, figs. 1 and 2; Plate LIV, figs. 1 and 2)	341
VI. <i>Pareiodon</i> (Plate XXXIX, text figure 21)	343
1. <i>P. microps</i> (Plate LIV, fig. 3)	344
VII. <i>Henonemus</i> (Plate XXXVII)	345
1. <i>H. macrops</i> (Text figure 22)	346
2. <i>H. punctatus</i> (Plate XL, fig. C; Text figures 23 and 24)	346
3. <i>H. taxistigmus</i> (Text figure 25)	348
4. <i>H. intermedius</i>	349
VIII. <i>Pseudostegophilus</i>	349
1. <i>P. nemurus</i> (Plate XLIV, fig. 5)	350
IX. <i>Homodiætus</i> (Plate XXXVII)	350
1. <i>H. anisitsi</i> (Plate LVI, figs. 3 and 5)	351
2. <i>H. maculatus</i> (Text figure 26)	352
X. <i>Stegophilus</i> (Plate XXXVII)	353
1. <i>S. insidiosus</i> (Text figure 27)	353
XI. <i>Acanthopoma</i> (Plate XXXVII)	354
1. <i>A. annectens</i> (Text figure 28)	355

	PAGE
XII. <i>Ochmacanthus</i> (Plate XXXVII)	355
1. <i>O. batrachostoma</i> (Plate LV, figs. 1-3)	356
2. <i>O. reinhardti</i> (Plate LV, fig. 4)	357
3. <i>O. flabelliferus</i> (Plate LV, fig. 5)	357
XIII. <i>Vandellia</i> (Plate XXXVIII)	358
XIV. <i>Urinophilus</i>	359
1. <i>V. cirrhosa</i> (Text figure 29)	360
2. <i>V. plazai</i> (Plate LIII, fig. 1; text figure 30)	362
3. <i>V. wicneri</i> (Text figures 31 and 32)	363
4. <i>V. hasemani</i> (Plate LIII, fig. 3; text figures 33, 34 and 35)	363
5. <i>V. sanguinea</i> (Plate LIII, fig. 2; text figure 36 and 37)	365
XV. <i>Paravandellia</i> (Plate XXXVIII)	366
1. <i>P. oxyptera</i>	367
XVI. <i>Branchioica</i> (Plate XXXVIII)	367
1. <i>B. bertonii</i> (Plate XLIII, figs. 3-5; text figure 38)	368
XVII. <i>Tridens</i> (Plate XXXIX)	369
1. <i>T. melanops</i> (Plate XLIII, figs. 1 and 2)	369
2. <i>T. brevis</i>	370
XVIII. <i>Miuroglanis</i> (Plate XXXIX)	370
1. <i>M. platycephalus</i>	371
Appendix	
<i>Phreatobius</i>	371
<i>P. cisternarum</i> (Plate LVI, figs. 1, 2 and 4; text figure 39)	372

21. Minute Book of the Virginia Court Held at Fort Dunmore (Pittsburgh) for the District of West Augusta, 1775-1776. CRUMRINE90	56. Meryocochærus, etc. DOUGLASS.	
22. Minute Book of the Virginia Court Held for Yohogania County, first at Augusta Town (now Washington, Pa.), and afterward on the Andrew Heath Farm near West Elizabeth, 1776-1780. CRUMRINE	2.25	57. New Merycoidodonts. DOUGLASS. (Nos. 56 and 57 sold together.)	1.00
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39. New Crocodile from the Jurassic of Wyoming. HOLLAND10	74. New Species of Procamelus from Upper Miocene of Montana. DOUGLASS30
40. Procambarus, a New Subgenus of the Genus Cambarus. ORTMANN15	75. Sections of the Conemaugh Series between Pittsburgh and Latrobe, Pa. RAYMOND35
41. Presentation of Reproduction of Diplodocus Carnegiei to the British Museum. HOLLAND15	76. List of the Unionidæ of Western Pa. ORTMANN50
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		92. Fossil Fishes from the Bituminous Shales at Riacho Doce, Alagoas, Brazil. JORDAN55
		93. Ordovician Trilobites, No. II. Asaphidæ from the Beekmantown. RAYMOND35
		94. Ordovician Trilobites, No. III. RAYMOND & NARRAWAY35

95. Ordovician Trilobites, No. IV. RAYMOND . . . . .	.40	133. Osteology of Lasiopyga and Callithrix, etc. SHUFELDT . . . . .	.25
96. Fishes from Irkutsk, Siberia. JORDAN and THOMPSON . . . . .	.30	134. New Rhyngocephalian from Solenhofen. GRIER . . . . .	.15
97. South American Tetrigida. BRUNER	1.00	135. Scales of South American Characinid Fishes. COCKERELL . . . . .	.25
98. Fauna of the Allegheny and Conemaugh Series in Western Pa. RAYMOND . . . . .	.30	136. Skeleton of Platigonus Leptorhinus. PETERSON . . . . .	.10
99. Ichthyological Survey About the San Juan Islands, Washington. STARKS . . . . .	.75	137. Lichens Collected in the Thunder Bay District, Ontario. R. HEBER HOWE, JR. . . . .	.10
100. New Species of Pygidium. EIGENMANN . . . . .	.10	138. Preliminary List of Fossil Plants in the Roof of the Pittsburgh Coal. GRIER . . . . .	.10
101. The Brachiopoda and Ostracoda of the Chazy. RAYMOND . . . . .	.50	139. Undescribed Remains of the Uinta Titanothere Dolichorhinus. PETERSON . . . . .	.15
102. A New Camel from the Miocene of Western Nebraska. PETERSON . . . . .	.15	140. Triassic Fishes Belonging to the Coptopteridæ and Semionotidæ. EASTMAN . . . . .	.15
103. Skeleton of Stenomylus hitchcocki, etc. PETERSON . . . . .	.15	141. Osteology of Promerycochoerus. PETERSON . . . . .	.40
104. Skeleton of Diceratherium cooki. PETERSON . . . . .	.15	142. Correction of a Generic Name. PETERSON . . . . .	.05
105. Carnegie Museum Expedition to Central South America, 1907-1910. HOLLAND . . . . .	.15	143. Skull of Bison Crassicornis. HOLLAND . . . . .	.10
106. Report Upon the Expedition of the Carnegie Museum to Central South America. HASEMAN & EIGENMANN . . . . .	.25	144. Serrasalminæ and Mylinæ. EIGENMANN . . . . .	.50
107. New Species of Fishes, etc., from Central South America. HASEMAN50	145. Heads and Tails: Notes on Sauropod Dinosaurs. HOLLAND15
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113. Species of Hasemanina, Hyphessobrycon, and Hemigrammus. ELLIS25	150. New Sphagebranchus from Bahamas. EIGENMANN07
114. New Characins in the Carnegie Museum. EIGENMANN . . . . .	.30	151. Marine Fishes from Colombia and Ecuador. WILSON . . . . .	.15
115. Jurassic Saurian Remains Ingested within Fish. EASTMAN . . . . .	.20	152. Apareiodon, a New Genus of Characid Fishes. EIGENMANN . . . . .	.18
116. Autograph Letter of U. S. Grant to Edwin M. Stanton. HOLLAND . . . . .	.15	153. New and Rare Fishes from S. American Rivers. EIGENMANN . . . . .	.25
117. Albert J. Barr. By W. J. HOLLAND . . . . .	.10	154. Three New Species of Characid Fishes. EIGENMANN & HENN . . . . .	.12
118. Seventeen New Neotropical Birds. TODD . . . . .	.25	155. The Species of Salminus. EIGENMANN . . . . .	.7
119. Dr. David Alter, the First Discoverer of Spectrum Analysis. HOLLAND . . . . .	.10	156. South American Pœciliid Fishes. HENN . . . . .	.40
120. Two Mummy Labels. ALLEN . . . . .	.10	157. A New Species of Apatosaurus. HOLLAND . . . . .	.7
121. The Families and Genera of Najades. ORTMANN	1.00	158. Birds of the Isle of Pines. TODD . . . . .	.70
122. Group of Stenomylins in the Carnegie Museum. PETERSON . . . . .	.25	159. Reptiles and Amphibians of the Isle of Pines. BARBOUR . . . . .	.20
123. Tertiary Fish-remains from Spanish Guinea. EASTMAN . . . . .	.25	160. Land and Fresh Water Shells of the Isle of Pines. HENDERSON . . . . .	.20
124. Plated Nematognaths. ELLIS . . . . .	.65	161. Pelecypoda of the Chazy. RAYMOND . . . . .	.45
125. New Species of Cambarus from the Isle of Pines. ORTMANN15	162. S. American Crickets, Gryllotalpoidea and Ache-toidea. BRUNER	1.30
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131. New Titanothere from the Uinta. PETERSON20	168. Land-Shell of Islands at Western End of Lake Erie, etc. CLAPP20
132. Small Titanothere from the Lower Uinta. PETERSON10	169. Orthoptera of the Isle of Pines. HOLLAND & KAHL15

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VOL. VII.

NO. 6.

W. J. HOLLAND, EDITOR.

THE AMERICAN DICERATHERES

By O. A. PETERSON

PITTSBURGH.

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VOL. VII.

THE AMERICAN DICERATHERES.

No. 6.

BY O. A. PETERSON.

(PLATES LVII-LXVI.)

INTRODUCTORY.

At the outset the writer wishes to acknowledge his indebtedness to Dr. W. J. Holland for much valuable assistance and advice in the preparation of the following paper, and for permission freely to use the material in the Carnegie Museum. To the authorities of the Peabody Museum of Natural History at Yale University thanks are due for their courtesy in allowing me to study and illustrate the types of Professor O. C. Marsh. I wish to express my gratitude to Professor F. B. Loomis, of Amherst, for granting me free access to his collection of types and drawings. I wish to gratefully acknowledge the kindness of the authorities of the American Museum of Natural History for granting me the privilege of examining the material from the John Day beds forming a part of the collection of the late Professor Cope, and allowing me to describe a new species of the genus *Diceratherium*. Thanks are also due to the Librarian of Congress for literature forwarded for consultation to the Carnegie Museum, to Mr. James W. Gidley, of the U. S. National Museum, and to Mr. Harold J. Cook for information. Mr. Syndey Prentice has carefully executed the drawings here reproduced.

EARLIER INVESTIGATIONS.

A number of papers dealing with the subject of this memoir have from time to time appeared, based upon material obtained by different parties, who in the past two decades have worked in western Nebraska and contiguous territory. Some of these papers possess genuine value. Other papers have also appeared, which indicate that the study given by their authors was hasty and of only a preliminary nature, often containing mistakes, which cause more or less difficulty to the student. One marked error has been the attribution of specific value to certain characters of the dentition and other parts, which after a more exhaustive study are clearly seen to be misleading. It is hoped that the following pages may prove to be a stimulus to further study and the exercise of greater care in this field of investigation.

In earlier contributions relating to the *Diccratheres* published by the author it has been stated that a more detailed study of the large collection obtained in the Agate Spring Fossil Quarries would be forthcoming, after the process of extracting the fossils from the matrix should be completed. Since that announcement much work has been done. The writer having at his command material consisting of the remains of some two hundred or more individuals, was induced to question the validity of some alleged specific characters. It is hoped that the following pages may supply safeguards against error in the future. With only a few specimens before him, a student may establish species to his own satisfaction upon characters selected by him at the time, but which after more abundant material is accessible to him may prove to be invalid.

In various publications¹, there have been reported to be in the Agate Spring Fossil Quarries and their immediate neighborhood no less than seven species of the genus *Diccratherium*, besides a new genus, *Metacænopus*. At first glance it might appear that the characters relied upon by the authors in establishing the different forms are valid, but after a more intensive study it is found that some species must be abandoned, and others must be regarded as doubtful. The result of our recent investigations proves that in this case we must either condense the number of proposed species, or establish an infinite number of additional new forms. The latter course would be eminently unscientific, though justifiable if we accept as valid the characters employed and relied upon in discriminating the various

¹ Loomis, F. B., Amer. Jour. Sci., Vol. XXVI, 1908, p. 51-64. Cook, Harold J., Amer. Naturalist, Vol. XLII, 1908, p. 543-545; Nebraska Geol. Surv., Vol. III, 1908, p. 245-247. Barbour, E. H., Science, N. S., Vol. XXIV, Dec. 14, 1906, p. 780-781. Peterson, O. A., Science, N. S., Vol. XXIV, Aug. 31, 1906, p. 282-283.

species which have been proposed. Whether the views expressed in the work upon the Diceratheres here offered shall prove to be conclusive, can only be ascertained in the light of the future. The improbability of having been able to reach an absolutely final conclusion is abundantly realized by the writer.

STRATIGRAPHY.

Since the earliest descriptions of the European forms of the Diceratheres by Pomel (1853), Duvernoy (1854), and the final determination of the genus by Marsh (1875), many papers treating of the Rhinocerotidæ have appeared in America as well as in the Old World. Through the studies of Professor Osborn and Mr. Hatcher, based upon some early American forms, we learn that the phylum *Diceratherina* had already acquired incipient nasal horns in the White River Oligocene of South Dakota. It is now known that the forms, not alone of *Diceratherium* from the succeeding John Day beds, but all other mammalian remains available for comparison from the same horizon of the John Day in which *Diceratherium* is found, represent an earlier faecies than those from the Nebraska-Dakota Miocene.

In order to give conveniently a clear view of the stratigraphic correlation the diagram on page 402 is inserted.

The Oligocene in South Dakota, as is well known, is much more extensively developed than in Nebraska. It comprises, besides the three usually recognized faunal zones, the Titanotherium beds (= Chadron beds), the Oreodon, and the Leptauchenia beds (= Brulé beds), two other easily recognized divisions, one the Metamynodon beds included in the Brulé beds, and the other, the Protoceras sandstones, both in the Leptauchenia clays which arose from deposits made by streams. The Miocene section of South Dakota falls into two (Lower and Upper Rosebud beds), instead of the four divisions, recognized in Nebraska. The four divisions of the Nebraska Miocene comprise the Gering, the Monroe Creek, the Lower and the Upper Harrison. The latter is regarded by the writer as the base of the Middle Miocene. The lower portion of the John Day beds may be regarded as of transitional character and should therefore be classed as either uppermost Oligocene or lowermost Miocene, the only difference being that they are not separated from the Middle John Day beds by any apparent stratigraphic break. The Mascall beds of the John Day are somewhat later than the Upper Harrison beds of Nebraska, as indicated by a comparison of the faunæ.

We know the earlier progenitors of *Diceratherium* less clearly, though it is held that *Cænopus occidentalis* (Leidy) from the middle Oligocene and *Cænopus*

	South Dakota.	Nebraska.	John Day.	European.	
PLIOCENE.		<i>Snake River Beds.</i> Sand and soft sandstones, thinly bedded.	Rattlesnake Formation.		
MIOCENE.	<i>Upper Rosebud.</i> Soft sandstone and sandy clays.	<i>Upper Harrison.</i> Massive soft sandstone.	Base of <i>Mascall.</i> Middle Miocene Tuffs, ashes, etc.	Upper and Middle Miocene.	
		<i>Lower Harrison.</i> Interstratified with harder sandstone ledges.	<i>Dicra-therium cooki;</i> <i>D. niobrarense.</i>	<i>Columbia.</i> Lava, basalt, and tuffs.	
	<i>Lower Rosebud.</i> Soft sandstone and sandy clays.	<i>Dicra-therium gregorii</i> sp. nov.	<i>Mauroe Creek Beds.</i> Hard sandstone.	<i>Upper John Day</i>	Lower Miocene (Aquitainian).
		<i>Gering.</i> Soft sandstones and sandy clays.	<i>Dicra-ther.</i> sp.	Middle and Lower John Day.	<i>D. annectens;</i> <i>D. armatum.</i>
OLIGOCENE.	<i>Upper Brulé.</i> Leptauchenia clay and Protoceras sandstones.	<i>Canopus tridactylus;</i> <i>C. dakotensis</i> sp. nov.	<i>Upper Brulé.</i> Leptauchenia clay.	Lower John Day transitional from Miocene to Oligocene.	<i>Rhinoceros,</i> spp. ind. (Stampian).
	<i>Lower Brulé.</i> Heavy bedded clays, Metamyndon sandstones.	<i>Canopus occidentalis;</i> <i>C. copei.</i>	<i>Lower Brulé.</i> Clays and thin sandstone ledges.		<i>Protoceratherium (Diceratherium) minutum.</i>
	<i>Chadron.</i> Clay and sandstones, Titanotherium Beds.		<i>Chadron.</i> Clays and sandstones. Titanotherium Beds.		Lower Oligocene (Sannoisian).

copei (Osborn) from the lower Oligocene (Metamydon beds) may be looked upon as at least in the line of this family.²

While the general trend of the characters of *Canopus tridactylus* and *Canopus dakotensis* sp. nov. is obviously in the direction of *Diceratherium*, it is in the John Day that we first recognize the genus as occurring in America. The South Dakotan and especially the Nebraskan series of *Diceratheres* are a later group belonging to the lower Miocene, closely following the species of the John Day, while the so-called *R. oregonensis* Marsh is an inadequate type, which furnishes information altogether too meager to be assigned to *Diceratherium* as is done by Pro-

² Osborn, H. F., Mem. Amer. Mus., Vol. 1, 1898, p. 164.

fessor Loomis. Among Professor Osborn's third phylum of the later Miocene Rhinoceroses³ we may find a representative of this phylum.

In Europe *Diceratherium pleuroceros* (Duvernoy) is the most completely preserved type from the Aquitanian. Its geological horizon apparently approximates in age the John Day beds of North America.

From the east of this European species (Fig. 1) it is seen that the cranium back of the orbit is very suggestive of *D. annectens*. The brain-case has similar small

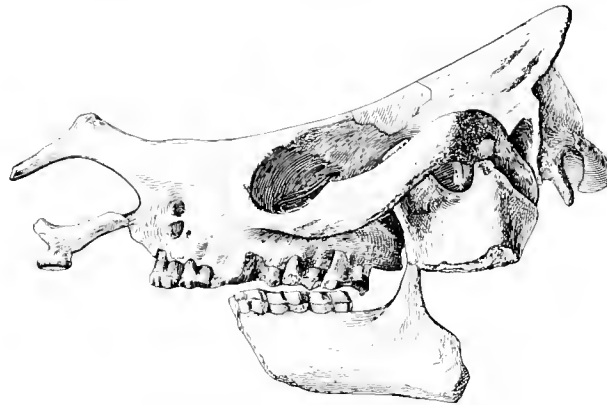


FIG. 1. *Diceratherium pleuroceros* (Duvernoy). From a plaster replica in the Carnegie Museum. $\times 16$.

proportions, the supra-orbital ridges converge gently to form a similarly short sagittal crest, though less prominent and more rounded in the European form. The inion is also somewhat higher in the latter. The muzzle is long, though higher, and perhaps having more the proportions of that part in *D. niobrarense* from the Nebraska Miocene. The basi-eranium in the east of *D. pleuroceros* is short and the mastoid process is in touch with the post-glenoid process. Thus the contour of the skull of the European species apparently has combined characters of *D. annectens* from the John Day and of *D. niobrarense* from the Nebraska Miocene. The dentition of the European form is too much worn to allow accurate comparison. By regarding such forms as *Protaceratherium*⁴ ("*Diceratherium*") *minutum* (Cuvier) of the Stampian as approximately parallel to *Canopus* of the upper and middle Oligocene of North America, it appears that the family may be traced back to nearly the same geologic time in Europe and North America,⁵

³ Bull. Amer. Mus., Vol. XX, 1904, p. 321; *Aphelops* (?*Peraceras*) *planiceps*, p. 322; *Aphelops* (?*Diceratherium*) *brachyodus* p. 324.

⁴ Abel, O., "Kritische Untersuchungen über die paläogenen Rhinocerotiden Europas," Abh. der K. K. Geologischen Reichsanstalt, Band XX, Heft 3, 1910, p. 10.

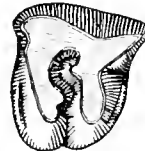
⁵ Osborn, Henry F., "Phylogeny of Rhinoceroses of Europe," Bull. Amer. Mus. Nat. Hist., Vol. XIII, 1900, p. 229-267; "Age of Mammals," p. 90.

while according to recent work by European authors *Prohyracodon orientale* Koeh is regarded as the earliest and most primitive representative of the Rhinocerotidae.⁶

Diceratherium armatum of the John Day formation has the dentition as well as certain other features of the skull in a much less advanced stage of development



2



3

FIG. 2. *Diceratherium minutum* (Cuvier). $M^2 \times \frac{1}{2}$. After Cuvier.

FIG. 3. *Diceratherium dowillei*. $M^2 \times \frac{1}{2}$. After Osborn.

than *D. annectens* of the same deposit (Compare Pl. LVII with text-figure 11, also with Pl. LXIII, fig. 6, and Pl. LXVI, fig. 1). In the latter form we naturally might expect to meet with a greater range of anatomical variations, especially in connection with the dentition. We may reasonably expect to find grinding teeth, having crests ranging from those which are quite plain to those which have the various incipient projections, as crista, crochet, anti-crochet, etc. It is far from my mind to depreciate some, or all, of these characters; on the contrary, indeed, it is reasonable to expect that the dentition should be one of the first parts of the organism to undergo modification with a change in the environment. It is nevertheless questionable whether the absence or presence of a crista, a crochet, and anti-crochet, more or less developed, or of a cingulum of greater or less prominence, should constitute a valid specific character in *Diceratherium*. I very much doubt whether these characters are of sufficient constancy to be relied upon to establish specific distinctions in a large collection of individuals from a given locality. Stress has in times past been laid upon the development of branches or spurs of different lobes of the cheek-teeth. It is plainly evident that *D. annectens*, as the result of its mode of life, was already in the time of the John Day more advanced, having filled out the grinding surface of its teeth more than its contemporary, *D. armatum*. In animals representing a later development in geological time, we should expect to find similar evidence of progression, and in a large assemblage of individuals that not all the specimens, say of *D. cooki* for example, are provided with crista and crochet united on the premolars and with crista small and crochet larger on the molars, but that these features, being in a plastic stage of development, *would be found in an endless number of combinations from those less developed to those having more complex forms, and all within one species.*

⁶ Abel, O., *Lc.*, p. 24, 44-45, 49.

Another feature, which often has been misinterpreted in connection with the study of the Diceratheres, is the difference in the contour of the skulls. It is a well-known fact that in individuals of almost any group of mammals the contour of the skull changes until well after complete maturity. Furthermore the sexual differences in the form of the skull in the *Dicrathérine* branch of the Rhinocerotidæ are surprising. In the early development of the phylum the difference between the sexes was well indicated by the form of the skull.⁷ This is undoubtedly due in great measure to the possession of the prominent nasal horns by the male. In a young male, for instance of *D. cooki*, there are found the incipient horn-cores, the nasals are quite long and pointed in front of the horns, while back of the horns there is relatively small lateral constriction of the nasals, the temporal ridges are generally weak and not united to form a sagittal crest, the zygomatic arches are slender, often without, or with very slight, rugosities on the posterior angles. This is also quite generally true of the skull of an adult female, with the exception that in the latter there is a gradation from skulls without any horn-cores in the young, to those having incipient horn-cores in some of the fully adult and old, and that there is considerable variation in the prominence of the temporal ridges and the manner of their convergence before they reach theinion. I have as yet never seen a well-developed and heavy horn-core, the ends of the nasals short and blunt, the skull much constricted laterally back of the horn-cores, saddle-shaped on top, with a sudden lateral expansion and heavy rugosities on the posterior angles of the zygomatic arches in *D. cooki*, except in association with well-worn or very old dentitions. It is very plain to me that more latitude should be assigned to the significance of the contour of the skull in the genus *Diceratherium* than has sometimes been done. In study and comparison especial pains should be taken (1) to ascertain whether the skull is that of a male or a female, or of the young, or not entirely adult animal; (2) skulls of fully adult or old males are more uniform in contour than any others, and therefore more reliable in establishing species; (3) the significance of the crushing received by the specimen in one direction or the other should be noted.

The following table of comparisons represents fairly well the large number of skulls of *Diceratherium cooki* in the collection of the Carnegie Museum. Remains of very young animals are not included in this table, but will be treated separately. The object of the descriptions given under H, Nos. 2816, 2463, and 2478 in the following table are to draw attention to the great ease by which misinterpretations may result with only a portion of the skull in hand and displaying characters, some of which may be only pathological.

⁷ Osborn, Henry F., "The Extinct Rhinoceroses," Mem. Am. Mus. Nat. Hist., Vol. I, Part III, 1898, p. 162.

CONTOUR OF SKULL COMPARED WITH THE DENTITION.

	Contour of Skull.	Dentition.
A. No. 1572. Type of <i>D. cooki</i> . Old male.	<p>Skull symmetrical in the region of the parietals, occiput, zygomatic arches, and palatal regions, but very slightly depressed by crushing in the frontal and nasal regions.</p> <p>Horn-cores prominent, nasals blunt and constricted back of horns, frontal region broad and flat, temporal ridges moderately prominent, but not united to form a sagittal crest, brain-case broad, arches suddenly expanded posteriorly, heavy and rugose on posterior angle. Skull comparatively broad and low.</p>	<p>Dentition considerably worn. Crista of premolars worn off, median valley on P² and P³ isolated by wear, crochet of P² and P³ united with ectoloph, cingulum on P² quite strong, crochet on P¹ not entirely united with ectoloph; crochet united with ectoloph, median valley open and post-fossette isolated on M¹; crista slight, crochet heavy, and post-fossette open posteriorly on M²; crista weak and crochet strong on M³.</p>
B. No. 1841. Paratype of <i>D. cooki</i> . Young male.	<p>Skull somewhat distorted by crushing and otherwise unreliable on account of immature age. Horn-cores incipient, nasals pointed, not projecting over the premaxillaries, due partly to crushing, a considerable constriction of nasals back of horn-cores; frontals comparatively narrow and slightly convex from side to side, due partly to crushing and partly to immaturity. Temporal ridges less prominent and not united to form a sagittal crest, but quite broadly united with the occiput, brain case broad, zygomatic arches expanded posteriorly and plainly indicating the usual rugosities formed in mature males. Skull comparatively narrow, partly due to immaturity and partly to crushing.</p>	<p>Permanent incisors just appearing in the alveoli of the premaxillaries. P¹ considerably worn, causing the post-fossette to have already become isolated. P² very slightly worn, crista and crochet very slightly developed and not united on tooth of the right side, while that on the left side has crista and crochet better developed and would on much wear form an isolated medifossette; anti-crochet slightly indicated. P³ has crista and crochet quite well developed and united. P⁴ is well worn, has a small tubercle in the median valley between proto- and metalophs, crochet well developed, nearly meeting the crista, which is only slightly indicated on the tooth of the right side. M¹ with well developed crista and crochet nearly meeting to isolate the medifossette. M² just erupted, and shows even less development of crista, but with strong crochet. M³ buried in the maxillary.</p>
C. No. 1923. Young male.	<p>Top of skull more symmetrical than in No. 1841, but considerable lateral crushing has taken place, especially noticeable in the region of the palatines. Base of skull open at suture and basioccipital lost.</p> <p>Horn-cores incipient, nasals projecting over the premaxillaries, more than in some specimens, slightly less pointed anteriorly and more constricted back of the horns than in No. 1841; frontals convex from side to side and proportionally narrow, due to crushing and immaturity; temporal ridges quite weak especially on right side, not united to form a sagittal crest; brain-case wide, zygomatic arches heavy, indicating that on further development of the skull the rugosities on posterior angle would be heavy as in old males generally. Skull comparatively narrow and high.</p>	<p>P¹ in same stage of wear as in No. 1841, P² quite simple, no crista, a weak crochet, which on further wear of the tooth would practically disappear; post-fossette very large. P³ not as yet worn, both crista and crochet weak, but showing a tendency to unite so as to isolate the medifossette on further wear of the tooth; post-fossette broadly open posteriorly. D.P¹ much worn, median valley nearly isolated by wear of proto- and metalophs; a tubercle of small size in the median valley; post-fossette isolated. M¹ with double, though small, crista; crochet heavy nearly reaching the protoloph; post-fossette broadly open posteriorly. M² just starting to receive wear, crista extremely weak, crochet stronger than usual. M³ buried in the maxillary.</p>

CONTOUR OF SKULL COMPARED WITH THE DENTITION.—*Continued.*

	Contour of Skull	Dentition.
D. No. 2467. Fully adult female.	<p>Skull somewhat crushed backward and to one side, though of quite symmetrical appearance.</p> <p>Only a suggestion of horn-cores, nasals not projecting over the premaxillaries, quite long and pointed in front of the horn-cores and very little constricted back of them; frontals quite broad, though slightly injured by lateral crushing; temporal ridges prominent, and remaining well apart throughout to the occipital crest; brain-case large, zygomatic arches light. Skull proportionally high and narrow.</p>	<p>Small functionless and persistent canines indicated on both sides. P¹ much worn. P² with no crista, but a weak crochet, the latter being double on tooth of left side; a small antecrochet present on this tooth of the right and left jaws and the post-fossette nearly enclosed. P³ without crista, crochet also poorly developed, crenulated, and post-fossettes isolated by wear. P⁴ with weak crista and crochet. All the premolars with strong cingulum internally. M¹ with no crista, but heavy crochet, a minute tubercle in the median valley; a large post-fossette and no cingulum on internal face of the tooth. M² with weak crista but strong crochet, a very minute tubercle in the median valley, post-fossette broadly open and cingulum only faintly indicated on the internal faces of the tooth. M³ has received little or no wear. Crista and crochet very poorly developed.</p>
E. No. 1855. Paratype of <i>D. cooki</i> . Female.	<p>Skull somewhat crushed to one side.</p> <p>Nasals broken well back, but the sides do not indicate as great a constriction as in skulls of males. Frontals broad; temporal ridges quite prominent and placed quite close together before reaching theinion, but not forming a sagittal crest. Brain-case broad, zygomatic arches light. Skull rather broad and low, to a great extent brought about by crushing.</p>	<p>P¹ much worn. P² with median pre-fossettes quite distinct; crochet with crenulated border, post-fossette large. P³ quite worn, but median pre-fossette indicated. Crochet nearly united with ectoloph. Post-fossettes quite large. P⁴ with median pre-fossette (especially on the tooth of right side) isolated, pre-fossette and median valley united. Post-fossette large. Premolars with heavy cingulum. M¹ much worn, no crista, crochet nearly united with ectoloph; post-fossette large, cingulum weak. M² with strong crista and crochet (the two nearly meeting on tooth of right side). Post-fossette large. M³ with crista and crochet much better developed on tooth of left side, cingulum weak on molars.</p>
F. No. 2809. Male.	<p>Skull slightly depressed by crushing.</p> <p>Nasal horn-cores very robust, nasals extend in front of premaxillaries, bluntly pointed anteriorly and gently constricted back of horn-cores; frontals broad; temporal ridges prominent and remaining far apart all the way back to the occiput. Brain-case large; zygomatic arches very robust on the posterior angle. Skull rather low and broad.</p>	<p>Dentition represented only by P³ and P⁴ and M¹ and M². P³ with no crista; crochet strong, crenulated internally and nearly united with ectoloph. Post-fossette large. P⁴ with no crista, crochet strong and crenulated, as on tooth in advance of it. Post-fossette large. M¹ with no crista, but strong crochet, which on a little further wear would unite with the ectoloph. Post-fossette nearly isolated by wear. M² with prominent crista and crochet. A tendency to develop a small tubercle in the median valley. Post-fossette large. The premolars have cingulum better developed than on the molars.</p>

CONTOUR OF SKULL COMPARED WITH THE DENTITION—*Continued.*

	Contour of Skull.	Dentition.
G. No. 2408. Paratype of <i>D. cooki</i> . Rather young female.	<p>Skull somewhat depressed by crushing, especially over the posterior part of the nasals and the frontals.</p> <p>Nasals not projected in front of the premaxillaries, pointed, no horn-cores indicated, but nasals thickened in this region; little or no constriction back of the thickened region; frontals broad and flat; temporal ridges fairly prominent and early united to form a sagittal crest before the union is reached (the latter is broken off); brain-case broad; zygomatic arches slender. Skull proportionally broad and low, due partly to crushing.</p>	<p>Dentition comparatively little worn. P¹ well worn. P² with medifossette isolated, especially on tooth of right side, tiny crenulation on the face of the crochet wall, post-fossette widely open behind. P³ with medifossette isolated, crenulation on crochet as on preceding tooth, post-fossette large. P⁴ with medifossette isolated, especially on tooth of left side, post-fossette large; prominent cingulum on internal faces of premolars. M¹ with moderate rounded crista and heavy crochet, but not united to form a closed medifossette, post-fossette broadly open posteriorly. M² with more prominent crista, which very nearly unites with the crochet, post-fossette large. M³ well erupted, but not yet in contact with the lower teeth, crista and crochet rather delicately developed. Cingulum little developed on the internal faces of the molars.</p>
H. No. 2463. Old female with pathological deformity.	<p>Skull crushed so as to produce an unusually, high occiput. Frontal and nasal regions quite symmetrical. Anterior portion of nasals and premaxillae broken off.</p> <p>Anterior portion of skull not unlike that of No. 1572 (type of <i>D. cooki</i>) in fact the general contour is similar. However, the sagittal region is narrower, there being a decided sagittal crest in the present specimen.</p> <p>Zygoma lighter, without the rugose area on the posterior angle. The comparatively light structure of the skull clearly indicates a female specimen.</p>	<p>P³ of left side represented only by an extremely thin band of dentine. P² and M¹ closely succeeding one another, nearly closing up the space for P⁴. This was accomplished during the life of the animal. M³ of both sides have curious metastyles located on the postero-internal angle, a deep fissure separating them from the main body of the teeth; median valley open, but crista and crochet well shown. Dentition much worn (See Fig. 4.)</p>
No. 2816, Male. No. 2478, Male?	<p>The greater portion of skull No. 2816 is preserved, while No. 2478 is only represented by a portion of the top and back.</p> <p>These two specimens are no less unique than No. 2463 just described.</p> <p>The chief feature is the inflated condition of the frontals, which is not unlike that in <i>Rhinoceros bicornis</i>, except that in the fossil specimens the swollen area is confined more to the posterior portion of the frontals. In No. 2478 the inflated area is more pronounced than in 2816 and also differs in the median line from the latter, having this inflated region continued backward as a prominent rounded ridge between the temporal ridges.</p> <p>Judging from the heavy and rugose zygomatic arches on No. 2816 the skull is undoubtedly that of a male.</p>	<p>The dentition of No. 2816 is essentially that of <i>D. cooki</i>, while in No. 2478 there are no teeth represented.</p>

In comparing (*D*) No. 2467 in the above table with the description by Dr. Loomis of his proposed species *Dicratharium schiffi* it will at once be observed that while the general contour of the skull agrees fairly well, the dentition totally disagrees in the presence of the minute canines⁸ and the difference of the config-

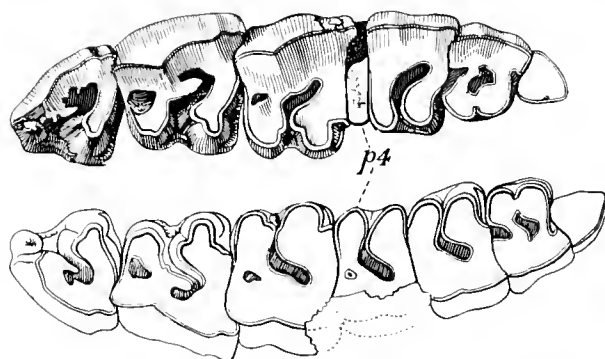


FIG. 4. Upper dentition of *Dicratharium cooki*, C. M., No. 2463, showing the reduced condition of P⁴ of right side and accessory tubercles on M³. $\times \frac{1}{2}$.

uration of the grinding surfaces of the teeth. We are not permitted, therefore, according to the usually accepted view to refer this specimen to the above proposed species. The same comparison with (*G*) No. 2408 shows that while the dentition agrees, the contour of the skull is less in accordance with the above-mentioned description, and corresponds better with the original type of *D. cooki*, sexual characters excepted. With another female skull (*E*) No. 1855, one of the original specimens used as a paratype in my earliest paper, *D. schiffi* seems to agree best, except that the temporal ridges come closer together before reaching theinion. It is thus seen that in comparing female skulls it is frequently found that dentition and contour of skull do not both agree; on the contrary the material affords numerous different combinations. There are of course female skulls which occasionally answer to the description by Loomis somewhat more closely than in the cases stated above. However, it is quite obvious that we would create a difficult task for the systematist and student, not to say a non-scientific record of the subject, were we to establish additional species founded upon our abundant material. The different patterns of the premolar and molar teeth which were formerly regarded as satisfactory for the establishment of species are obviously not to be relied upon, at least not in connection with the study of the material from the Agate Spring Fossil Quarries. The differences to which allusion is here

⁸ The canines are probably deciduous teeth, which sometimes abnormally persist and their presence may be regarded as only an individual peculiarity. Professor Owen speaks of a canine in the fetal skull of *Rhinoceros indicus* ("Odontography," p. 592).

made should rather be regarded as in the main due to the varying extent to which specialization has operated in the individual. The teeth, especially of the smaller American species of the *Diceratheres* of the Nebraskan Miocene, may be said to be in a stage of rather rapid and progressive change. It is hardly probable that we shall be able to perfect any satisfactory adaptive radiation of forms, such as has recently been suggested,⁹ from the study of this material. In paleontology we are debarred from the finer subdivisions used in recent zoölogy. We have to content ourselves with characters which stand out more prominently and which may be used not only to clearly determine species, but to give aid in the question of correlations of faunæ and demarcations in geology. From the study of the collection above tabulated, we are forced to regard the variations shown as being individual, sexual, juvenile, and pathological.

1. *Rhinoceros* (?*Diceratherium*) *pacificus* Leidy,¹⁰ *incertæ sedis*.

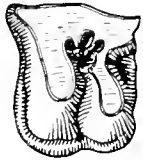


FIG. 5. *Diceratherium pacificum* Leidy, M². $\times \frac{1}{2}$.
After Leidy.

Type.—Upper molar, left side. United States National Museum.

Horizon.—? Miocene.

Locality.—"Alkali Flat" John Day region, Oregon.

Paratype.—A mutilated fragment of the upper jaw of the right side, with portions of the fangs of the true molars and an inferior molar tooth.

Horizon.—? Miocene.

Locality.—Bridge Creek, John Day region, Oregon.

As indicated in Leidy's original description this material from "Alkali Flat" in the John Day region, Oregon, was provisionally referred to *Cænopus* (*R.*) *occidentalis*. Receiving more material from the same general region Leidy again restudied the "Alkali Flat" specimens and finally placed them, together with the material from Bridge Creek, under his species *R. pacificus*.

This type like that of the John Day material referred to as *R. hesperius* we now find to be inadequate, or of very doubtful generic value. Leidy was apparently not clear as to the true association of these different fragments and teeth. On page 222 (*l.c.*) he states that the second molar described, "may be a true molar of the preceding species" [*R. hesperius*] described in his report.

I am unable to agree with Dr. Loomis in accepting this species as valid and am obliged, as the result of the study I have made, to regard this type as *incertæ*

⁹ Loomis, F. B., *l.c.*, p. 53.

¹⁰ Proc. Acad. Nat. Sci., Philadelphia, 1870, p. 112; 1871, p. 248; U.S.G.S. Terr., Vol. I, 1873, p. 221. Plates II, VII, Figs. 6-7, 24-25; Amer. Jour. Sci., Vol. XXVI, 1908, p. 55-56, Fig. 6.

sedis. It pertains to an animal no larger than, for instance, *D. annectens* (Marsh), but that is about all I feel justified in positively stating.

2. **Rhinoceros** (?**Diceratherium**) **hesperius** Leidy,¹¹ *incertæ sedis*.

Type.—A third upper molar. Location of the type uncertain.

Horizon.—Miocene?

Locality.—John Day region, Oregon.

The material from the John Day of Oregon, which Leidy finally referred with a question to the Californian species "*Rhinoceros hesperius*,"¹² is, as Leidy himself states, inadequate. The more important features of the remains of the skull appear to be the position and size of the infra-orbital foramen and the position of the base of the zygomatic process of the jugal. Of material referred to *R. hesperius* Leidy says (*l.c.*, U. S. G. S., Vol. 1, p. 220): "The anterior extremity of the space included by the zygoma extends to a line with the interval of the second and third molars; in *Rhinoceros* [*Cænopus*] *occidentalis* it extends only to a line with the back part of the last molar. The infra-orbital foramen is large and occupies a position above the second premolar; in *R. [C.] occidentalis* it is over the third premolar." This description agrees with *D. cooki* so far as the zygomatic arch is concerned, but the infra-orbital foramen of the latter species is usually opposite the interval between P² and P³ both in *D. annectens* and *D. cooki*. In *D. annectens* the space included by the zygoma referred to by Leidy is slightly more posterior. In comparing the measurements of well-known species of *Diceratherium* with the figures of specimens referred to *R. hesperius* and *R. pacificus* it is seen that M³ of *hesperius* might well go with the molar of *pacificus*. So far as the difference in size and even the configurations of the crowns in these teeth go, there is now no valid reason for separating the two on the evidence produced. The tubercle of the median valley of M³ of *R. hesperius* may well be questioned as a specific character, and is in all probability, as Leidy suggests, "merely an individual peculiarity." In my opinion these remains are generically and specifically unidentifiable, but hold the historic position of being the first material of the Rhinocerotidæ obtained in the John Day region of Oregon.



FIG. 6. *Diceratherium hesperium*, (Leidy) M³. $\times \frac{1}{2}$. After Leidy.

¹¹ Proc. Acad. Nat. Sci. Phila., 1865, p. 176-177; 1870, p. 112; 1871, p. 248. U. S. Geol. Surv. Terr., Vol. I, 1873, p. 220, Pl. II, Figs. 8-9. Amer. Jour. Sci., Vol. XXVI, 1908, p. 55, Fig. 5.

¹² Professor Osborn has placed this Californian specimen with *Cænopus platycephalus*, "The Extinct Rhinoceroses," Mem. Amer. Mus., Vol. I, 1898, p. 144.

3. **Rhinoceros** (?**Diceratherium**) **oregonensis** Marsh,¹³ *incertae sedis*.

Type.—Penultimate upper molar. Peabody Museum of Natural History No. 10,002.

Horizon.—"Pliocene deposits of Oregon") Mascall formation.

Locality.—John Day region, Oregon.

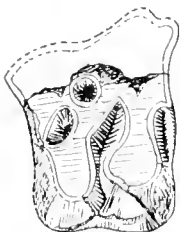


FIG. 7. (?*Diceratherium*) *Rhinoceros oregonensis* Marsh.

M². × ½.
After Loomis.

In reference to this fragment Marsh says: ". . . At the union of the transverse posterior ridge with the outer cusp, there is a deep cavity, nearly circular, and enclosed by a vertical cylinder of enamel. The anterior crest, also, is divided, a strong branch being sent inward and backward from the posterior side into the main transverse valley."

Whether or not this specimen pertains to a *Diceratherium* may never be settled. I have recently examined this tooth and may state that it may equally well belong to a middle Miocene *Rhinoceros* (*Teleoceras*). I cannot now see any reason for regarding this type as anything except of indeterminate value.

4. **Diceratherium** (?) **truquianum** (Cope), *incertae sedis*.

Type.—A symphysis of the lower jaws with all the incisors and the posterior portion of the ramus with M₂ and M₃. American Museum Natural History (Cope Collection) No. 7333.

Horizon.—Lower John Day, Miocene(?).

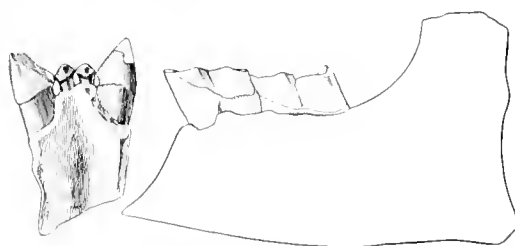


FIG. 8. *Diceratherium truquianum* (Cope). No. 7333, Coll. Am. Mus. Symphysis and portion of left ramus. × ¼.

In describing an incomplete mandible from the ("Truckee beds"¹⁴) (Lower John Day) Professor Cope says that the specimen "supports molar, canine [= lateral incisor], and incisor teeth. . . . The crowns of the canines [= lateral incisors] are considerably wider than those of the incisors [= median incisors], but do not project very far beyond them. They are sub-triangular in outline,

¹³ American Journal Science, Vol. V, 1873, p. 410. Ibid., Vol. XXVI, 1908, p. 60, Fig. 13.

¹⁴ American Naturalist, Vol. XIII, 1879, p. 333.

having a prominent shoulder at the base on their inner side. . . . Diastema long; ascending ramus vertical, flat in front. Depth of ramus at last molar .065; length of crown of canine [= lateral incisor] .027; width of do. at the base .024.”

This type specimen, now in the Cope collection of the American Museum of Natural History, has recently been studied by the writer. After a comparison with fragments of the lower jaw associated with a skull (No. 10,005) of *Diceratherium armatum* in the Yale Museum I think it possible that this specimen may pertain to that species. The thick and rather shallow ramus of Cope’s type is characteristic of *D. armatum*. The symphysis is similarly long and heavy, the mental foramen is below P₁, as in the latter species, and the comparative measurements of the two specimens agree fairly well. The question of the relationship of these two species cannot, however, be entirely satisfactorily settled until more complete material of the John Day forms is obtained.

ADDITIONAL MEASUREMENTS OF TYPE OF *D. TRUQUANUM* COPE.

Antero-posterior diameter of crown of median incisor	6 mm.
Transverse “ “ “ “ “ “	8 “
Height “ “ “ “ “ “	6½ “
“ “ “ “ lateral “	26½ “
Transverse “ “ “ “ “ “	23 “
Antero-posterior “ “ “ “ M ²	44 “
Transverse “ “ “ “ “ “	28 “
Anterior-posterior “ “ “ “ M ³	46 “
Transverse “ “ “ “ “ “	27 “

5. *Diceratherium petersoni* Loomis¹⁵ *incertæ sedis*.

Type.—First and second molars of left side. Amherst Museum, No. 1583.

Horizon.—Miocene.

Locality.—Agate Spring Fossil Quarries (quarry A) Sioux County, Nebraska.

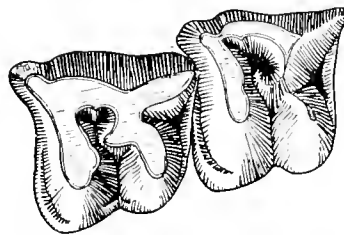


FIG. 9. *Diceratherium petersoni* Loomis. M² and M³ left side. No. 1583, Coll. Amherst Museum. × ½. After Loomis.

In the extensive collection from the Agate Spring Quarries and neighborhood now in the Carnegie Museum, there are not found any teeth or other remains

¹⁵ Amer. Jour. Sci., Vol. XXVI, July, 1908, p. 57, Fig. 7. Cook, Harold J., Neb. Geol. Surv., Vol. VII, Aug., 1912, p. 40.

comparable in size with this species. On the whole the configuration of the crowns of these teeth, as represented, does not greatly disagree with that of the type of *D. niobrarense*; one of the teeth being of a considerably younger individual than the latter. The size of the species of Loomis is, however, decidedly larger than *D. niobrarense*. If this does not prove to be a very large individual of the latter form, it may be a distinct species; possibly in a more direct line from the large form *D. gregorii* sp. nov., of the lower Rosebud beds of South Dakota (See page 421).

6. *Diceratherium armatum* Marsh.¹⁶ (Plate LVII and text-figure 10.)

Type.—Complete skull somewhat crushed dorso-ventrally. Bones of fore foot associated. Peabody Museum of Natural History No. 10,003.

Horizon.—Lower John Day Formation (?Lowermost Miocene).

Locality.—Near John Day River in eastern Oregon.

As is well known, the genus *Diceratherium* established by Professor O. C. Marsh in 1875 rests on this famous specimen in the Peabody Museum of Natural History. The type was only briefly described by Marsh. Since that time no

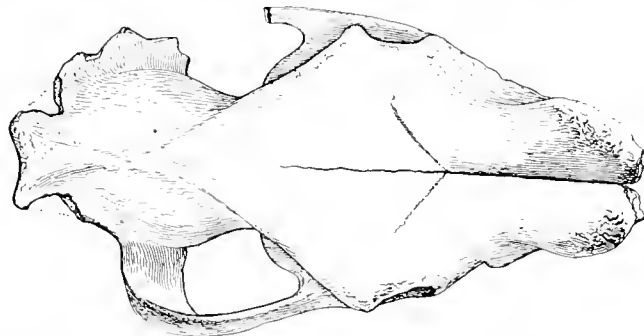


FIG. 10. *Diceratherium armatum* Marsh., No. 10003, Coll. Peabody Museum of Natural History. Top of cranium. $\times \frac{1}{2}$.

complete illustrations or detailed description of its osteological structure have appeared. For the purpose of more detailed records the writer was accorded the privilege of studying the type material in the Peabody Museum. The descriptions and illustrations of the type material follow the modified generic determination of *Diceratherium* and the specific characters of *D. armatum*.

GENERIC CHARACTERS ESTABLISHED BY PROFESSOR MARSH (MODIFIED).

Males with osseous protuberances on the anterior portion of the nasals. Females ranging from those with light or incipient nasal protuberances to those with nasals more or less smooth. Incisors $\frac{1}{2}$, Canines $\frac{3}{5}$ - $\frac{1}{5}$ [in rare cases a very minute canine persists]. Premolars $\frac{1}{4}$, Molars $\frac{3}{8}$. Fore and hind feet functionally tridactyl.

¹⁶ Amer. Jour. Sci., Vol. IX, 1876, p. 242; Ibid., Vol. XXVI, 1908, p. 54, Fig. 2.

Specific Characters.—*Diceratherium armatum* may be characterized as follows: *Frontals relatively broad over the orbits. Sagittal crest short. Inion light. Broad and heavy nasals. Anterior nares not extended as far back of the horn-cores as in D. cooki. Muzzle and premaxillaries long. Postglenoid and paroccipital processes well separated. Cheek-teeth comparatively simple in the configuration of their crowns. Animals of larger size than tapirs. [?Median lower incisors proportionally large.]**

General Description.—As stated above, the type specimen of this species is somewhat depressed by crushing. In the Peabody Museum collection is an additional specimen, a skull with fragments of the lower jaws, re-identified by Professor F. B. Loomis. This second specimen has the contour of the top much better preserved. From these two specimens it is at once observed that the frontals are quite broad over the eyes, which causes a rather short, sharp, emargination of the muzzle back of the horn-cores. The latter are, as in *D. niobrarense*, located near the lateral border of the nasals; they are well developed though somewhat less in proportion to those in *D. annectens* of the same horizon. The nasals as a whole are, however, heavier than in the later forms from Nebraska, *D. niobrarense* and *D. cooki*, while one might look for evidence to the contrary. Even when the crushed condition of the John Day type is duly considered, it seems clear that the nasals were not elevated over the premaxillaries as high as in the later Diceratheres from Nebraska. The temporal ridges are rather weak and the sagittal crest is not greatly developed and occupies a smaller antero-posterior area than in *D. niobrarense*. The inion is not nearly as heavy as in the latter form, resulting in a comparatively less saddle-shaped top. The nasals are unfortunately broken off in front of the horn-cores, but enough is present to indicate that they were of considerable length and possibly terminated in a rather sharp point. The premaxillaries are also broken off, but what remain of them indicates that they were of greater length than in the Nebraskan species. There is present a heavy lachrymal process in *D. armatum*. The palate is broad as are also the posterior nares. The anterior margin of the posterior nares extends even with the anterior face of M^2 . The post-glenoid and paroccipital processes are well separated, indicating the condition found in earlier Rhinoceroses. That the alveolar border of the maxillary terminates more abruptly back of M^3 and the paroccipital process is less robust than in some of the Nebraskan species are perhaps characters of less importance.

The dentition of the type is perhaps better known than any other part of the

* The only lower jaw of a large species with median incisors present is *D. truquianum* Cope. If the latter species should prove to be identical with *D. armatum* Marsh, then the above specific character is valid.

type specimen. This is due to the studies of Professor Marsh and later students. Therefore it is only necessary to here state that the ectoloph is perhaps thinner, the excavations or valleys of the crowns larger, and the cross-crests simpler, than in *D. annectens* or later forms from the Nebraska Miocene. P^1 is also observed to be proportionally large, and the cingulum seems to be well developed, especially on the internal faces of the teeth.

A case of reversion, or at least a non-uniformity of tooth-structure worthy of note, is seen in the second specimen of *D. armatum* in the Yale Museum collection (No. 10,055). The metacone on P^2 of the right side of this specimen displays a curious primitive roundness, though connected with the ectoloph by the usual thin cross-crest, while the corresponding tooth of the opposite side has this postero-internal tubercle of the usual type seen in the *Diceratheres*. There is otherwise little or no differences in the dentition from that in the type, except that No. 10,055 represents a younger animal. The crista, crochet, etc. are very little or not at all indicated, while the cingula are prominent, especially internally.

With the skull No. 10,055 of the Yale Museum collection, referred to *D. armatum*, there are associated fragments of lower jaws, which undoubtedly belong with the skull, inasmuch as the third molars, both upper and lower, are not yet entirely developed. These fragments of the lower jaw indicate that the horizontal ramus was very heavy, but rather shallow, the symphysis strong, the mental foramen of large size, and located directly below P_1 . The roots of the lateral incisors indicate that the crown was large and most likely of the usual type met with in the family. The symphysis is broken off too far back to show any indication of the median incisors. P_1 has a rather small antero-posterior diameter, but the crown is quite high; the tooth is broken externally and the grinding and internal faces are buried in the matrix. This is also true of P_2 . The external face of the latter tooth shows a very heavy cingulum, which extends around the entire posterior face, but has a less upward oblique trend than is seen in the later forms from Nebraska. The crowns of the cheek-teeth are little worn, indicating the juvenile stage of the specimen. M_2 has also a cingulum on the external face which is, however, less developed than on P_2 ; this is especially true of the posterior lobe of M_2 .

The fourth metacarpal associated with the type of *D. armatum* is rather long and broad, having a comparatively small antero-posterior diameter. The bone is somewhat crushed, but the proximal end is not distorted and indicates that the bone was not very thick fore-and-aft. The distal trochlea extends well up upon the anterior face of the metacarpal. Judging from the unciform, which is present, the carpus was fairly high.

MEASUREMENTS OF THE TYPE OF DICERATHERIUM ARMATUM.

Length of skull from condyles to end of nasals as preserved (Points of nasals broken off)	503 mm.
Length from occipital condyles to M ³	208 "
M ³ to end of maxillary (Point of maxillary broken off) approximately.	166 "
Greatest width across the zygomatic arches.	145 "
Greatest transverse diameter of occipital condyles.	112 "
Transverse diameter of occipital plate.	146 "
Inferior surface of condyles to end of inion.	159 "
Length of dentition (molar-premolar series).	248 "
Antero-posterior diameter of P ¹	29 "
Transverse " " P ¹ (greatest diameter).	24 "
Antero-posterior " " P ² " "	31 "
Transverse " " P ² " "	40 "
Antero-posterior " " P ³ " "	35 "
Transverse " " P ³ " "	45 "
Antero-posterior " " P ⁴ " "	38 "
Transverse " " P ⁴ " "	49 "
Antero-posterior " " M ¹ " "	44 "
Transverse " " M ¹ " "	53 "
Antero-posterior " " M ² " "	53 "
Transverse " " M ² " "	53 "
Antero-posterior " " M ³ " "	45 "
Transverse " " M ³ " "	50 "
Length of Me IV.	187 "
Greatest transverse diameter of head of Me IV.	51 "
Transverse diameter midway of shaft of Me IV.	40 "
Antero-posterior diameter of shaft of Me IV (approximately).	15 "
Height of unciform.	54 "

7. *Diceratherium annectens* (Marsh).¹⁷ (Plates LXIII, Fig. 6; LXVI, Fig. 1, and text-figs. 11 and 11a.) (See Pl. LVIII, Figs. 1, 2, 3.)

Synonym.—*Diceratherium nanum* (MARSH).¹⁸

Type.—A set of superior premolars of the left side; one superior incisor associated. Peabody Museum of Natural History No. 10,001.

Hypotypes.—Skull nearly complete. Cope Collection, American Museum Natural History, No. 7324, a male. Front of skull and lower jaws of Professor Marsh's type *D. nanum* in the Marsh Collection, Peabody Museum of Natural History, No. 10,004, a male.

Horizon.—Lower to Middle John Day Formation.

Locality.—Near John Day River in eastern Oregon.

¹⁷ Marsh, O. C., Amer. Jour. Sci., Vol. V, 1873, p. 4. Loomis, F. B., Amer. Jour. Sci., Vol. XXVI, 1908, p. 54, Fig. 3.

¹⁸ Marsh, O. C., Amer. Jour. Sci., Vol. IX, 1875, p. 243.

Specific Characters.—*Premaxillaries long and slender. Nasals and nasal horn-cores of males broad and heavy. Muzzle long. Anterior nares excavated back of the horn-cores in the same proportion as in D. armatum. A well-defined and quite heavy sagittal crest. Occiput overhanging, and the cranium well extended back of the posterior angle of the zygomatic arches. Liberal separation between the postglenoid and paroccipital processes. First premolar relatively large. Check-teeth with swollen cross-crests and crowns otherwise complicated; crista and crochet present, especially on the posterior premolars and the molar series. Median and lower incisors proportionally large. Animal about the size of, or larger than, a tapir.*

GENERAL DESCRIPTION OF THE TYPE MATERIAL.

From recent studies of the type material of Professor Marsh's collection in the Peabody Museum and the splendidly preserved skull in the Cope Collection of the American Museum there is now no valid reason for regarding the types of



FIG. 11. *Diceratherium annectens* (Marsh). No. 10001, Coll. Peabody Museum of Natural History. Premolar teeth of left side and superior incisor. $\times \frac{1}{2}$.

D. annectens and *D. nanum* as belonging to separate species. *D. annectens*, having been described before *D. nanum*, and also being now found to possess sufficient characters for identification and comparison, must be regarded as the type.

In his description of *D. annectens* Professor Marsh was apparently not entirely clear as to the composition of the specimen. Professor Loomis correctly associates the type, but mistook some of the premolars for molars.

There is no doubt in the mind of the present writer that this series of premolars belongs to one individual. In placing the teeth together one finds that they fit against one another perfectly and the grinding surfaces form a natural gradation generally obtained in specimens of *D. cooki* which have reached an equal stage of wear. Whether or not the associated incisor tooth belongs to the type is less satisfactorily determined, as it has received comparatively little wear and appears small in proportion. The small amount of wear of the upper incisors is, however, often found in skulls of *D. cooki*, when the check-teeth have been well ground down.

P¹ is very much worn, so that its configuration is practically obliterated. P² is also much worn, but plainly indicates that the cross-crests are more swollen than in the larger species, *D. armatum*, so that on extreme wear of the tooth the two crests become almost united internally and more nearly approximate the condition in the Nebraskan form *D. cooki*; there is a slight indication of a crochet in P². P³ has the internal portion of the cross-crests even more closely united, so that on extreme wear the tooth has a remarkably close similarity to that in *D. cooki*. There is, however, no crochet shown in this worn tooth; the crista might be said to be represented by a heavy fold on the inner face of the ectoloph. P⁴ in its general characters is practically a repetition of P³, except that the crista and crochet are more plainly shown. The crochet of P⁴ of this species represents, undoubtedly, the most external process of the comb-like plate on the posterior border of the medifossette in *D. cooki*; that is to say, the true crochet, which unites with the ectoloph on extreme wear of the tooth. In the forms of the John Day it appears that this crochet does not entirely unite with the ectoloph.

No. 10,004 of the Yale Museum Collection (Marsh's type of *D. nanum*) is laterally compressed by crushing. As a consequence the nasals appear less broad than otherwise would be the case, and they are also possibly somewhat lengthened by crushing. The horn-cores are well-developed and the points of the nasals are quite heavy, and extend well in front; their tips are broken off. The nasals as a whole are heavy and are elevated above the premaxillaries much as in later forms, thus presenting large anterior nares. The infra-orbital foramen is large, well up upon the maxillary and its posterior margin is opposite the middle of P³. The premaxillary is long; it is also slender, though somewhat heavier than in the later forms from Nebraska. There is a large upper incisor of the usual cutting pattern. The premolars are very much worn.

The lower jaws of the same specimen are also slightly crushed laterally. The most noteworthy feature of these jaws are the proportionally large median incisors and the long diastemata from the cheek-teeth to the incisors. The lateral incisor is robust, well sharpened by wear and procumbent in position. The cheek-teeth are much worn, indicating the senility of the individual. There is a fairly well developed cingulum on the lower premolars (Pl. LVIII, Figs. 1-3.)

As in the lower jaw of *D. armatum*, the ramus is quite heavy, but somewhat deeper in proportion. The internal face is also less convex supero-inferiorly. This latter character may in part be due to crushing.

As stated above, the skull (No. 7324 Cope Collection) in the American Museum is by far the best of the three specimens here described. (See Pls. LXIII Fig. 6;

LXVI, Fig. 1 and text fig. 11a.) From this material combined we are now in possession of practically all the anatomy of the skull of *D. annectens*. With the exception of the ends of the nasals, the anterior portion of the left horn, and the points of the premaxillaries this specimen is quite complete. The skull is somewhat depressed, so that the region about the horns and anterior portion of the maxillaries appears broader than in the New Haven specimen described above; however, the present specimen is in reality more robust. In proportion the horn-cores of *D. annectens* from the John Day are considerably heavier than in the later Nebraskan species and the tips of the nasals were evidently quite long. The constrict-

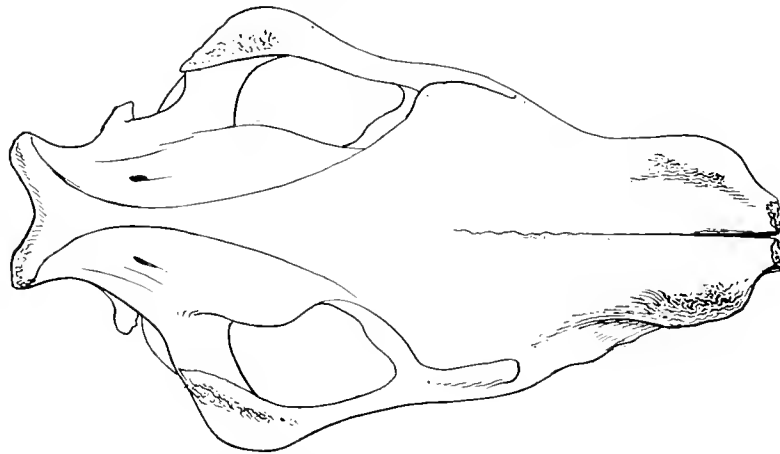


FIG. 11a. *Diceratherium annectens* (Marsh). No. 7324, Cope Collection, American Museum of Natural History. Hypotype. $\times 4$.

tion between the orbit and the nasal horn is, as in *D. armatum*, much shorter and sharper than in *D. niobrarense* or *D. cooki*, and the occiput extends further back of the posterior angle of the zygomatic arch and overhangs the occipital condyles to a greater degree. There is also a well-defined and quite heavy sagittal crest. The supratemporal ridges are distinct, but more gently oblique or more gradually converging towards the sagittal crest than in the Nebraskan species, which is due to the smaller brain-case in the form from the John Day. The occiput is somewhat more elevated above the occipital condyles and the transverse diameter of the occipital plate is actually less, though the skull is larger than that of the average skulls of *D. cooki* found in the Nebraskan quarries. As stated, the premaxillaries are broken off anteriorly, but it is very evident that the diastema from the cheek-teeth to the upper incisor in this specimen was as long as in the type at New Haven. The pre-orbital foramen is located above the anterior, or rather the middle, region of P^3 as in *D. cooki*, but it is further back of the nasal border,

due to the longer muzzle of the form from the John Day. The zygomatic arch of the latter is somewhat lighter, especially at the posterior angle, which forms a less direct right angle with the side of the skull and is not nearly so rugose. The region back of the pterygoid processes is decidedly longer in the John Day species than in the eastern species. Thus there is a wide separation between the postglenoid and paroccipital processes in the earlier species, while in the later form (*D. cooki*) these processes are closely united. Even the occipital condyles of the John Day specimen are less sessile. The anterior margin of the posterior nares is opposite the interval between M^1 and M^2 as in the smaller Nebraskan form, *D. cooki*, and the size of the nares is of the same proportion.

The premolars of the specimen in the American Museum are even more worn than in the type, which is brought out in the illustration, Pl. LXIII, Fig. 6. They are, however, not too far gone for identification and comparison, and they are seen to agree with the type in New Haven. M^1 has a decided antecrochet-like swelling of the anterior lobe, which is as great as, or perhaps greater than, in any of the Nebraskan specimens which I have seen. The crochet is of quite large size and totally separated from the ectoloph, so that at no stage of wear will this process apparently ever become united with the ectoloph as in *D. cooki*. M^2 has the crochet generally less developed than in *D. cooki*. M^3 has on the right side a curious basal cusp on the posterior margin of the exit of the median valley which is very similar to the same tooth in a specimen of *D. cooki* at the Carnegie Museum, though less deeply separated from the main body of the tooth. (See Fig. 4, p. 409.) On M^3 of the left side there is also a minute tubercle situated in a position similar to the one described above. With the exception of the relative size of the median incisor and the first premolars *D. annexens* from the John Day and *D. cooki* from the Nebraska Miocene differ less in the detailed structure of the dentition than was anticipated.

On page 422 are tabulated measurements of the specimens above described.

8. **Diceratherium gregorii**¹⁹ sp. nov. (Plate LIX and text-figure 12.)

Type.—Skull,? female. American Museum, No. 12,933.

Horizon.—Miocene, Lower Rosebud beds.

Locality.—Near Rosebud Indian Agency, South Dakota.

Specific Characters: Occiput low, but overhanging, as in the John Day form (*D. annexens*) Sagittal crest low, but well defined. Postorbital ridges converging very gradually, as in the John Day form, but the brain-case proportionally larger in size. Greater robustness of the inion, shorter basicranium and premaxillaries, when

¹⁹ In honor of Dr. W. K. Gregory, of the American Museum of Natural History, who found the type.

MEASUREMENTS OF *D. ANNECTENS*.

	Type, Y. M. No. 10001.	Neotype, Y. M. No. 10004.	Neotype, A. M. No. 7324.
Length of skull frominion to broken points of nasals.....			410 mm.
Occipital condyles to and including P ¹			368 mm.
Occipital condyles to M ³			185 mm.
Greatest transverse diameter of skull at posterior angle of zygomatic arches.....			235 mm.
Transverse diameter of occipital plate. (Measurement taken superiorly).....			83 mm.
Antero-posterior diameter of P ¹ , ² and ³			63 mm.
Length of upper dentition.....			185 mm.
Length of premolars.....	95 mm.		93 mm.
Length of molars.....			98 mm.
Antero-posterior diameter of P ¹	21 mm.	*19 mm.	19 mm.
Transverse " " P ¹	17 mm.	*18 mm.	17 mm.
Antero-posterior " " P ²	23 mm.	*23 mm.	24 mm.
Transverse " " P ²	27 mm.	*28 mm.	*28 mm.
Antero-posterior " " P ³	27 mm.		28 mm.
Transverse " " P ³	34 mm.		35 mm.
Antero-posterior " " P ⁴	29 mm.		30 mm.
Transverse " " P ⁴	38 mm.		39 mm.
Antero-posterior " " M ¹			35 mm.
Transverse " " M ¹			41 mm.
Antero-posterior " " M ²			40 mm.
Transverse " " M ²			41 mm.
Antero-posterior " " M ³			33 mm.
Transverse " " M ³			38 mm.
Length from P ₁ to and including the lateral incisor.....		110 mm.	
Length of P ₂ and P ₃		48 mm.	
Length of P ₂		23 mm.	
Length of P ₃		26 mm.	
Antero-posterior diameter of crown of median incisor.....		8 mm.	
Transverse diameter of same.....		6 mm.	

* Approximate measurements.

compared with the John Day species, *D. annectens*. Paroccipital and postglenoid processes in close proximity to one another as in *D. niobrarense*. Border of anterior nares extending further back than in the latter species. Animal considerably larger than the tapir.

GENERAL DESCRIPTION.

The type specimen was discovered by Dr. W. K. Gregory of the American Museum party of 1906. The skull is somewhat depressed by crushing, which fact has been taken into due consideration. That the cranium may probably be that of a female should also be noted. The animal was of advanced age, as the dentition is greatly worn down and of no practical service for specific determination.

There is no true contact between the broken end of the premaxillary and the maxillary bone in the type at present, but Dr. W. D. Matthew assured me that it was complete when discovered, and that the length of the premaxilla is not far from correct as restored. (See Pl. LIX). Whether or not there was a lateral incisor, as in *Cænopus tridactylus* from the Protoceras beds, cannot positively be

determined from the type. It is, however, most probable that this tooth is wanting, especially when we consider the proportionally small development of the premaxillary in the type, which is apparently much lighter and is no doubt shorter than, for instance, in *Cænopus tridactylus* of the upper Oligocene. The later geological formation in which this new species was found is also to be considered. The

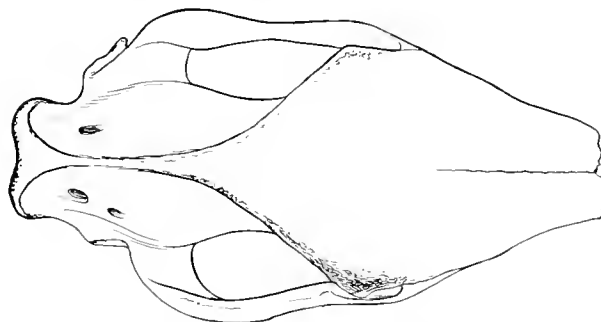


FIG. 12. *Diceratherium gregorii*. No. 12933, Coll. Amer. Museum. Top of cranium. $\times \frac{1}{4}$

nasals were apparently of considerable length in front of the very slight swelling on the anterior portion of the nasals. The crushing of the anterior region of the skull gives to the anterior nares an unusually low position, low even when proper allowance is made for the distortion which has occurred. This may, or may not, be a valid character. The postorbital ridges of the frontals converge very gradually, somewhat as in the John Day form (*D. annectens*), but the brain-case is somewhat larger in proportion. The sagittal crest is low, but well-defined, and the inion is intermediate between the John Day form and *D. niobrarense* of the Nebraska Miocene, that is to say, the rise from the sagittal crest proper to the top of the inion is very much more gradual than in *D. niobrarense*, even when the difference of sex and the crushing sustained by the specimen is taken into account, thus more like what is seen in *D. annectens*, but the slight emargination on the posterior face of the inion is more as it is in *D. niobrarense*. The inion itself is less rugose and the lambdoidal crests are thinner than in *D. annectens*, which may be a sexual character. The top of the skull when in perfect condition was on the whole less saddle-shaped; the zygomatic arches lighter, less prominent posteriorly, and united with the sides of the squamosals more obliquely than in *D. cooki*. The postglenoid and paroccipital processes are in touch with one another, but are not so completely fused as in the latter species. The external ear is large and in shape more nearly as in *D. niobrarense*.

The incisor present in the premaxilla is of unusually small size in comparison with the cheek-teeth and the size of the skull. P^1 has about the same relative

size as in *D. niobrarense*. As stated above, the cheek-teeth are much worn. The last molar does not indicate any crochet or crista as in the last named species; the cingulum is, however, equally prominent. M³ on the right side has a small cone in the median valley.

It is very likely that the above specific characters may be modified, or added to, when more material representing both sexes of this species is obtained.

MEASUREMENTS.

Greatest length of skull from inion to the end of the premaxillaries approximately	510	mm.
From occipital condyles to anterior end of maxillary, approximately	490	"
Occipital condyles to P ¹	362	"
Occipital condyles to M ³	230	"
From incisor to orbit	197	"
From orbit to occipital condyles	310	"
Incisor to and including M ³	266	"
Greatest transverse diameter of skull at posterior portion of zygomatic arches	258	"
Greatest transverse diameter of frontals	191	"
Greatest transverse diameter at constriction back of the enlarged portions of the nasals	97	"
Length of molar-premolar series	217	"
Length of premolar series	102	"
Length of molar series	119	"
Antero-posterior diameter of P ¹ (greatest diameter)	21	"
Transverse " " P ¹ " "	20	"
Antero-posterior " " P ² " "	26	"
Transverse " " P ² " "	32	"
Antero-posterior " " P ³ " "	31	"
Transverse " " P ³ " "	44	"
Antero-posterior " " P ⁴ " "	34	"
Transverse " " P ⁴ " "	48	"
Antero-posterior " " M ¹ " "	38	"
Transverse " " M ¹ " "	45	"
Antero-posterior " " M ² " "	45	"
Transverse " " M ² " "	47	"
Antero-posterior " " M ³ " "	38	"
Transverse " " M ³ " "	44	"
Antero-posterior " " crown of incisor	19	"
Transverse " " " " "	9	"

9. *Diceratherium niobrarense* Peterson.²⁰ (Plate LX, Fig. 2; Pl. LXI, Fig. 2; Pl. LXII, Fig. 2, and text-figure 13.)

Synonym.—*M. (Aceratherium) egrerius*.²¹

²⁰ Science (N.S.), Vol. XXIV, 1906, p. 28; Ann. Car. Mus., Vol. IV, 1906, p. 46, Pls. XIII-XIV; Loomis, F. B., Amer. Jour. Sci., Vol. XXVI, 1908, p. 56.

²¹ Loomis, F. B., *ibid.*, p. 61 [*Aceratherium egrerius*]; Cook, Harold J., Amer. Naturalist, Vol. XLII, 1908, p. 543, 2 figs [*Aceratherium egrerius*]; [*Metacynopus egrerius*]; Neb. Geol. Surv., Vol. III, 1908, p. 245, Pl. I.; Vol. VII, 1912, p. 41.

Type.—Skull of young male. C. M., No. 1,271.

Horizon.—Miocene.

Locality.—Agate Spring Fossil Quarries (Quarry A.) Sioux County, Nebraska.

Paratype.—Posterior portion of skull from same quarry as the type. Vertebrae and limb-bones referred to same species.

Specific Characters.—Premaxillary somewhat reduced in length. Grinding surface of cheek-teeth comparatively simple. Nasals long in front of the horn cores especially in females. Muzzle long. Border of anterior nares comparatively little extended backward. Skull quite saddle-shaped, especially in males, due to the development of the horn-cores and the highinion. Postorbital ridges less oblique than in the John Day forms due to the enlargement of the brain-case. A sagittal crest present; this is proportionally long, but not especially strong. Zygomatic arches somewhat more expanded posteriorly and the basi-eranium shorter than in earlier John Day forms. Paroccipital and postglenoid processes sometimes touching one another at their bases so as to enclose the external auditory meatus. Lower jaws heavy and the angle little or not at all crested. Animal smaller than *D. armatum* of the John Day formation.

GENERAL DESCRIPTION.

Since the earlier descriptions of this species the type has been restudied. Illustrations, which in some respects are more accurate than those which appeared earlier, are also herewith presented. I, furthermore, add data recently obtained, and have corrected certain errors, which occurred in earlier publications.

In Science (*l.c.*) it was stated that the nasals were found in the talus below the point where the skull was taken out. The nasals were separated from the skull at the fronto-nasal suture, but agree with the skull found *in situ*, with the corresponding parts missing. I at once associated the different parts as those of one individual, and have not since found any reason for changing my mind. Confirming my view, a good skull of this species in Dr. Loomis' collection at Amherst has the fronto-nasal suture quite open, as in the type. Dr. Loomis assures me that the nasals belong with the skull of his specimen, which is of approximately the same age as the type. (See Fig. 13.)

In the original description it was said that the brain-case is large, while Loomis states that the brain-case is comparatively small, a statement which only holds good so far as the present species and *D. cooki* are concerned. From the earlier John Day forms *D. niobrarense* may be distinguished by its having the brain-cavity of larger size. I stated that there is a well-formed sagittal crest, but I did not especially emphasize the fact that the crest is strong. From the Amherst

material it appears that there is some variation in this respect, judging from the statements of Dr. Loomis. The statement made by the latter author that the nasals project considerably beyond the horn-cores is characteristic of this species, while in *D. cooki* the points of the nasals are much abbreviated in fully adult or old males.

The muzzle of the skull in *D. niobrarense* is apparently not shorter than in the John Day forms, while the constrictions back of the horn-cores and in front of the orbits are longer and gentler, due to the relative narrowness of the nasals across the horn-cores and the narrower frontals. The location of the infra-orbital foramen is similar to that in *D. armatum*, located well back from the border of

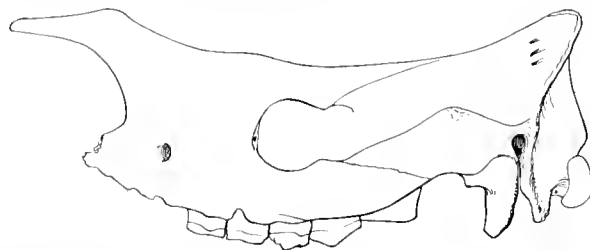


FIG. 13. *Diceratherium niobrarense* Peterson, No. 1022, Coll. Amherst Museum. $\times \frac{1}{2}$. After an outline drawing by Dr. F. B. Loomis.

the anterior nares due to the slight backward excavation of the latter. The occiput is, however, not overhanging, as in the John Day forms, while the external ear is sometimes enclosed below.

As has been shown by Loomis and Peterson the molar-premolar dentition of *D. niobrarense* is more primitive than in *D. cooki*, and more nearly like that of *D. armatum*. In the latter species, which is clearly an older and rather primitive type, we find that P^1 is somewhat larger, the ectoloph of the grinders is thinner, the different valleys wider, and the cingulum perhaps somewhat more prominent. To judge from the scanty remains of *D. armatum* which we possess, it certainly is indicated that the crista is practically wanting, while the crochet is in a very much more rudimentary stage of development on the teeth of the latter species than in *D. niobrarense*.

In comparing the descriptions and figures of *Aceratherium egyptius*, later called *Metacænopus* (*l.c.*) by Mr. Harold J. Cook, it is very evident that the remains of an adult female of *Diceratherium niobrarense* has been used as the type. Cook admits that there is a "thickening of the nasals at the point where a horn usually occurs in the Rhinocerotidæ, which may indicate a rudimentary horn." Indeed one should expect to find this thickened condition, and we usually do find it in

the young males and in female skulls of *D. cooki* of more adult stages. It appears that in males of *D. niobrarense* the nasal horn-cores are located more laterally and point more outward,²² while in *D. cooki* they are nearer the median line and point more directly upward. (See Pl. LXII.)

With the exception of the longer nasals in front of the thickening portion or the incipient horn-cores (undoubtedly a sexual character), Mr. Cook's description agrees quite well with the type of *D. niobrarense*.

The premaxillaries are complete in this splendidly preserved specimen in Mr. Cook's collection, and show some reduction in length from those in the older John Day forms.

There is a considerable portion of the left mandible in Mr. Cook's specimen, which was found in an articulated position on the skull. Cook states that this mandible is "heavier and lacks the outward turn or flange commonly found in the Diceratheres." A splendid pair of lower jaws in the Loomis collection at Amherst (see Fig. 14) referred to *D. niobrarense* also agrees with the characteri-

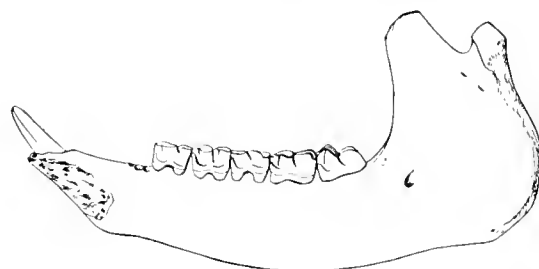


FIG. 14. *Diceratherium niobrarense* Peterson, No. 1022, Coll. Amherst Museum. Internal view of ramus. $\times \frac{1}{2}$. After an outline drawing by Dr. F. B. Loomis.

zation in Cook's paper, and plainly indicates that the masseteric muscle was much less developed in this species. Unfortunately the outline drawing kindly furnished by Professor Loomis from the Amherst specimen does not indicate the external view of the mandible.

The atlas and axis of Mr. Cook's specimen were found attached to the occipital condyle and are so illustrated in his paper. No description in detail of these vertebræ is, however, furnished.

A series of cervicals (atlas, 3d, 4th, and 6th), an anterior dorsal (?5) and three lumbar vertebræ were found isolated in the same quarry (quarry A) in which the type of *D. niobrarense* and the Amherst material was found. These bones, No. 1910, are here provisionally referred to *D. niobrarense*, inasmuch as the size

²² Figures on Plate I of Cook's illustrations show admirably well these lateral eminences although of an incipient stage most likely due to sex. Cook states that there is no double-horn tendency in his type.

corresponds very well to the type. All these vertebrae, except the atlas, are more or less mutilated, but enough is preserved to show that they are very similar to those bones in *D. cooki*, size excepted. In its proportions the atlas referred to is not unlike that of the smaller form (*D. cooki*), save that the transverse process is less extended forward and is somewhat heavier, especially along the terminal border. A second marked difference of this bone in the two species is the presence

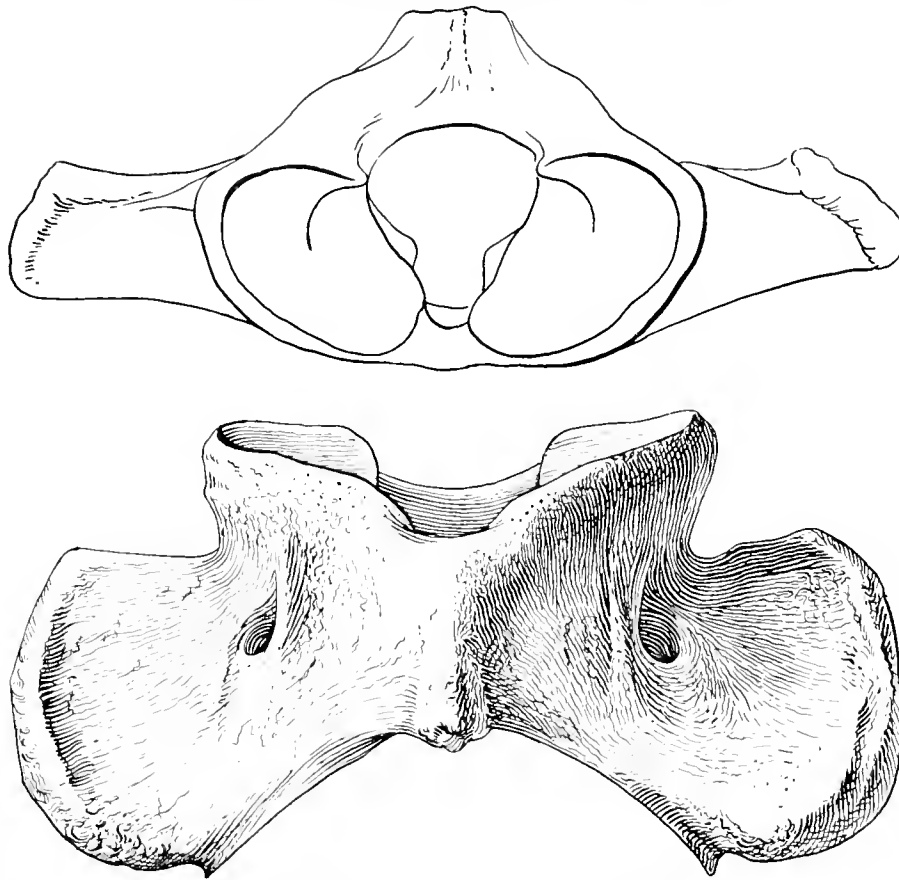


FIG. 15. *Dicratherium niobrarense* Peterson, No. 1910, Coll. Carnegie Museum. Anterior and ventral views of atlas. $\times \frac{1}{2}$.

in *D. niobrarense* of a round venal foramen, (remnant of the inferior exit of the vertebrarterial canal) on the ventral face at the base of the transverse process, and a strong antero-posteriorly directed ridge immediately internal to the foramen. While there is in *D. cooki* a groove and occasionally a minute foramen, located in the same position as the foramen described on the atlas of *D. niobrarense*, there is found no evidence of the ridge in *D. cooki*. If the heavy terminal border of the transverse process and the venal canal are constant in *D. niobrarense*, this may be regarded as an additional specific character. (See Fig. 15.) The third cervical

has the ventral keel of the same proportions as in the smaller species, and the same faintly indicated neural spine, and the strong transverse process similarly expanded laterally. Cervical four has the neural spine as prominent, but the back part of its transverse process is perhaps somewhat heavier than in *D. cooki*. Cervical six again has the same downwardly directed inferior lamella of the transverse process, which is, however, proportionally less developed fore-and-aft than in *D. cooki*. The dorsal vertebra referred to presents the same characters as the corresponding bone in the latter species, including the mammillary process on the upper anterior surface of the transverse process. With the exception of a somewhat more decided ventral keel and possibly a lighter spine, the lumbar series associated are of approximately the same relative size and detailed structure as in the smaller form, *D. cooki*.

The remains of the limb-bones (No. 1910) which were found in this same quarry, and are provisionally associated with the type of *D. niobrarense*, show that the scapula is proportionally shorter than in the smaller species, and possibly also somewhat broader; the coraco-scapular notch shorter and shallower; the bicipital groove of the humerus smaller; and the shaft of the ulna straighter. The proportionate length of the femur cannot positively be ascertained from the material at hand, but the tibia is decidedly shorter. The remains of the foot-bones associated bear no marked differences from those of *D. cooki*, except their larger size.

The type (No. 1040) of "*Metacænopus*" (*Acceratherium*) *stigeri* in the Amherst College Museum is described by Dr. Loomis, and the right upper molar-premolar series is illustrated. Dr. Loomis says: "The small skull is elongated, light in build and rather narrow. The orbit is large and the zygomatic arch light. The premolar teeth are crowded, there being neither an anterior nor posterior cingulum, though one is developed along the inner face around the protocone, running out on the hypocone. Crista and crochet are wanting on these teeth of a rather old individual, except that on the fourth premolar there is a faint trace of a crista, and on the third premolar a small anterochet is developed. On the molars the cingulum is reduced as in the premolars, and both crochet and crista are wanting. The protocone, however, is swollen, making a considerable fold as in European Diceratheres. *A. stigeri* is closely related to *A. egrerius* but is smaller, and has the cingulum on the premolars and the crochet on the molars less developed."

In the description of this complete skull the greatest stress is laid on the configuration of the grinding surface of the teeth, principally for the purpose of comparison. The illustration indicates an animal of old age, as Loomis states. The crista, if there was one, has consequently disappeared by wear. The crochet

most likely has likewise disappeared, or rather united with the ectoloph, while the cingulum may be lighter or even wanting. The cingulum has united (by the wear of the tooth) with the internal border of the grinding face, especially on the posterior portion. It is very evident, from the enclosed post-fossette that the dentition illustrated by Loomis is very much more worn than that of the type of *D. niobrarense*. Finally through the courtesy of Professor Loomis, I had the opportunity of restudying his type and find that the Amherst specimen as well as the description agree quite well with the average old female skulls of *D. cooki* in the Carnegie Museum.

MEASUREMENTS OF THE TYPE OF *D. NIOBRARENSE*.

Greatest length of skull, approximately.....	450 mm.
Length of skull from occipital condyle to and including P ²	370 "
Length of skull from occipital condyle to M ³	190 "
Greatest transverse diameter of skull.....	235 "
Greatest transverse diameter of brain-case.....	130 "
Greatest transverse diameter of frontals.....	150 "
Greatest transverse diameter of occipital condyles.....	103 "
Greatest transverse diameter of palate.....	68 "
Vertical diameter of the orbit.....	60 "
Length of 2d, 3d and 4th premolars and the molar series.....	185 "
Antero-posterior diameter of P ²	26 "
Transverse diameter of P ²	29 "
Antero-posterior diameter of P ⁴	32 "
Transverse diameter of P ⁴	36 "
Antero-posterior diameter of M ¹	39 "
Transverse diameter of M ¹	37 "
Antero-posterior diameter of M ³	35 "
Transverse diameter of M ³	39 "
Scapula, approximate height.....	280 "
Humerus, length.....	340 "
Tibia, length (No. 1910).....	335 "
Tibia, length (No. 1910a).....	310 "
Tarsus, height tuber of calcaneum not included, approximately.....	85 "
Tarsus, length of tuberosity of calcaneum.....	58 "
Metatarsal II, length.....	130 "
Metatarsal III, length.....	145 "

The occurrence of the material of the above described species in the Agate Spring Fossil Quarries is of considerable interest. *Dicratherium niobrarense* has only been found in Quarry A. The remains of this species may be said to be practically absent in the representative fauna of the quarries in the Carnegie or the University Hills (See Mem. Car. Mus. Vol. IV, Fig. 1, p. 205), while similar

remains representing *D. cooki* of these latter quarries are quite as abundantly mingled with the remains of *D. niobrarense* in Quarry A. The latter quarry is only a very short distance (300 yards) to the north of the main quarries and may possibly represent a somewhat earlier time; or, more probably, the sediments accumulated at this spot represent a different stream, which had its origin in, and flowed through a locality more favorable to this species.

10. *Diceratherium cooki* Peterson.²³ (Plates LX, LXI, LXII, fig. 1, LXVI, figs. 2, 4).

Synonyms.—*Diceratherium arrikarense* Barbour; *D. schiffi* Loomis; *Accrathium stigeri* Loomis; *Diceratherium aberrans* Loomis; *D. loomisi* H. J. Cook.²⁴

Type.—Skull of old male. C.M. No. 1572.

Paratypes.—Eight skulls, a number of lower jaws, and other skeletal material C. M. Nos. 1573, 1575, 1581, 1841, 1848, 1853, 1855, 1888, 2408, 2443, 2799.

Specific Characters.—Skull, especially of males, short and broad in its proportions. Median lower incisor small. Crowns of the upper cheek-teeth complicated. Crochet often uniting with ectoloph in much worn teeth. Muzzle short. Horn-cores of males prominent, but nasals not broad across the horns, and ends of nasals abbreviated. Females varying from those with no horns to those with incipient horns. Postorbital ridges seldom entirely meeting to form a sharp sagittal crest. Brain-case large. Occiput quite broad, of moderate height, and not overhanging. Premaxillaries short. Margin of anterior nares much excavated, extending well back of the horn-cores and the infra-orbital foramen situated close to the border. Posterior point of zygomatic arch greatly expanded laterally and covered with heavy rugosities in fully adult or old males. Basicranium short. Post-glenoid and paroccipital processes united to enclose the external auditory meatus. Animal considerably smaller than *D. niobrarense*.

GENERAL DESCRIPTION.

Skull.

As stated in the original description, this species rests on a number of skulls, lower jaws, and other skeletal material from which a male skull No. 1572 was originally selected as the type. In the first description it was stated that "the occiput is rather low, . . . the temporal ridges quite prominent, not uniting

²³ Science (N.S.), Vol. XXIV, Aug. 31, 1906, p. 282-283; Annals Car. Mus., Vol. IV, 1906, p. 47. Pl. XV, text-figs. 12-13; Vol. VII, 1910, p. 274-279, Pl. LXV; Loomis, F. B., Amer. Jour. Science, Vol. XXVI, July, 1908, p. 58.

²⁴ *D. arrikarense* Barbour, Science (N.S.), Vol. XXIV, Dec. 14, 1906, pp. 780-781, figs. 1, 2; *Accrathium stigeri* Loomis, Amer. Journal Sci., XXVI, July, 1908, p. 60; *Diceratherium schiffi* Loomis, *l.c.*, p. 57; *D. aberrans* Loomis, *l.c.*, p. 59; *D. loomisi* Cook, Harold J., Neb. Geol. Surv., VII, p. 48-32, figs. 2-3.

to form a sagittal crest, but continuing separate to theinion where they join the lambdoidal crest." Loomis on the other hand states that the skull is relatively short and high, with high occipital crest and a moderate sagittal crest, formed by the confluence of the two ridges from over the orbits. This mistake is undoubtedly due in part to the illustration (Ann. Carn. Mus., Vol. IV, 1906, p. 48, Fig. 12) which does not accurately represent the top of the skull. This is remedied in the illustration given with this paper, Pl. LXII, Fig. 1.

Loomis further states that "on the premolars, the cingulum is greatly reduced, while the strong crochet is united with the feeble crista, thus isolating the median fossette. In like manner on the molars the cingulum is reduced to traces on the front, inner side, and rear of the teeth." While this description was undoubtedly based on the material in the Amherst Museum and answers some individuals of this species in the Carnegie Museum, the type specimen does not agree with his description. In the first place the internal faces of the premolars, except P² are incomplete. The said premolar has a prominent cingulum on the anterior and internal faces of the protocone, which is confluent by wear with the grinding face of the metacone. On the antero-internal angle of P³ a prominent cingulum is indicated, the inner face of the tooth is otherwise, as stated, broken off as is also P⁴ on the anterior inner angle (See Pl. LX, Fig. 1.) M¹ and M² are also damaged in this same region, but enough is preserved to indicate that the cingulum is as prominent as is the case in other skulls, which are more complete in this respect. P² and P³ have the crochet united with the ectoloph through wear; no crista is shown, while the post-fossette is entirely isolated on P³. P⁴ has only a trace left of the crochet, but no crista; post-fossette nearly enclosed. M¹ has crochet united with the ectoloph by wear, and post-fossette enclosed. M² has a strong crochet and the crown is injured in the region of the crista. M³ has a strong crochet and a fairly prominent crista. The entire dentition is much worn, plainly indicating an old individual. The distinguishing characters of *Acerratherium stigeri* and *Diccratherium schiffi* given by Dr. Loomis now appear to rest entirely on sexual characters and individual variation, the type of his proposed species being female skulls of *D. cooki*, while his species *D. aberrans* is established on D. P.² of the left side as has already been pointed out.²⁵

From Professor Barbour's description and figures of his proposed species *D. arrikarens* in Science, N.S., Vol. XXIV, 1906, p. 780, it is clear that he has described a male skull of *D. cooki* minus the dentition, while Mr. Cook's proposed

²⁵ Peterson, O. A., "Recently Proposed Species of the Genus *Diccratherium*," Science (N.S.), Vol. XXXVI, 1912, p. 801.

species, *D. loomisi*, is also established on a maxilla of *D. cooki* with deciduous teeth. (Neb. Geol. Surv., VII, 1912, p. 29.)

In comparing the crania of the abundant material of *D. cooki* with the earlier John Day forms, or even with *D. niobrarense* found in the same beds in which *D. cooki* is found in Nebraska, it is at once clear that *D. cooki* is a comparatively more specialized and modified type of the *Diceratherina*. We find in the male skull (1) a pair of prominent horn-cores set closely together on the nasals; the nasals themselves not nearly as heavy as in the earlier John Day forms; and the ends of the nasals much abbreviated as in more specialized or modified forms of the *Titanotheridae*; (2) muzzle, premaxillaries, and the front of the lower jaws shortened and the lateral margin of the anterior nares extended further back of the horn-cores; (3) brain-case enlarged; occiput broadening and not overhanging; basieranium short, analogous to *Teleoceras* from the middle Miocene and the recent Rhinoceroses (*R. bicornis*); (4) zygomatic arches much expanded with heavy rugosities on the posterior angle, and the angle of the lower jaws heavy and very much

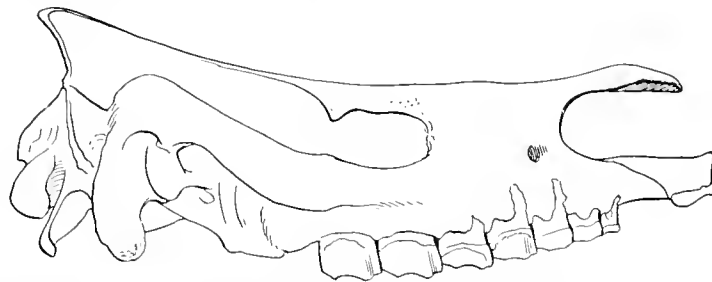


FIG. 16. *Diceratherium cooki* Peterson. No. 1853, Coll. Carnegie Museum. Skull of an old female. $\times \frac{1}{2}$.

everted to support heavy masseteric muscles; (5) the grinding surface of the cheek-teeth further complicated with a tendency on the part of the crotchet to become united with the ectoloph, especially in teeth having received some wear.

As has already been stated in the introductory paragraphs of this paper, a greater range of variability must be allowed in dealing with female crania of this species. They range from those without horns in very young and immature females to those with incipient horns in fully adult and old individuals. The top of the skull is consequently comparatively little concave antero-posteriorly and the supratemporal ridges vary so much in their course to theinion that this region of the cranium may be said to range from a broad surface to a completely formed sagittal crest (this variation of the supratemporal and sagittal ridges holds good even in males, though to a somewhat less extent). Another feature of the female skull, no less noticeable, is seen in the longer pointed nasals, the

lighter zygomatic arches without the heavy rugosities on the posterior angle, and the less everted angle of the lower jaws. In connection with these characters the skeletal frame is lighter and the pelvic cavity proportionally somewhat larger, judging from the material at hand.

Mandible.

(Pl. LXVI, Figs. 2 and 4.)

As stated elsewhere²⁶ the lower jaws are heavy, especially those of the males. The depth of the ramus, however, is not great, and the diastema between the lateral incisor and P₂ is rather short. The symphysis, though short, is very heavy, and the median suture is entirely obliterated in old individuals. The angle is very greatly everted; in males the border of this everted area is very rugose, while in females and young the angle is less everted and is also less rugose, but still furnishes an unusual heavy surface for the masseteric muscles. The glenoid condyle is quite broad transversely and the coronoid process is strongly directed forward.

Dentition.—In proportion the median incisor is extremely small; it has a rounded enamel-covered crown, and is implanted in the symphysis by a thick short root; in many specimens this rudimentary tooth has dropped out. The lateral, or cutting incisor, is, as usual, comparatively large, but varying in different individuals. The canine is generally absent, even in the young. Occasionally this tooth is present in young individuals, and sometimes there is found on the alveolar border of the diastema a shallow groove, or scar, in which a minute canine is found in a very procumbent position. P₁ is absent. In young individuals a small milk-tooth is often found immediately in front of P₂ which persists in the alveolar border until all the cheek-teeth are erupted. On Pl. LXVI, Figs. 2 and 4 the characters of the cheek-teeth are well shown, and require no detailed description.

Only a very few hyoid bones are found mixed with the general mass of material in the quarries, there evidently having been during deposition too much disturbance for the preservation of these delicate parts.

In this connection it is interesting to turn to the work of Professor Henry F. Osborn, "The Extinct Rhinoceroses" Mem. Amer. Museum Natural History, Vol. I, 1898, pp. 136-140. In this publication, Osborn characterizes *Cænopus* (*Aceratherium*) *mitis* from the lower Oligocene as follows (p. 139): "C₁²⁷, P₃, M₃, Diastema short. Canine²⁷ alveoli semi-procumbent. Premolar-molar series

²⁶ Peterson, O. A., Ann. Car. Mus., Vol. VII, 1910, p. 275.

²⁷ [= Lateral incisor.]

142 mm. Mandibular symphysis very short. Locality Colorado. Amer. Mus., Cope Collection, No. 6325."

This type specimen is accompanied by an upper maxillary with teeth and other skeletal material, but, as there seems to be some doubt as to their association, they will not here be considered.

A second specimen in the American Museum Collection from the upper Oligocene (Protoceas Beds) illustrated on page 139 of Osborn's work is especially interesting. This lower jaw (No. 1110) is doubtfully referred to *Cænopus (Acera-therium) mitis* Cope, and exhibits just such characters as one might expect to find in an ancestral form of *D. cooki*: the short symphysis; the short diastema between incisor and cheek-teeth; the curving of the lower border of the ramus; and the angle everted as in *D. cooki*. The ramus itself is, however, deeper, the vertical ramus having a greater antero-posterior diameter, and the coronoid process a more nearly vertical position than in *D. cooki*, as indicated by the illustration. The measurements (p. 140) do not appear to agree completely with the illustrations.

This lower jaw undoubtedly represents a distinct species, judging from the great vertical depth of the sediments lying between the Titanotherium beds in which *Cænopus mitis* (Cope) was found, and the Protoceas sand-stones, together with the general change in the fauna of these two geological horizons. This lower jaw from the Protoceas beds may here be provisionally regarded as the type of *Cænopus dakotensis* sp. nov. and also provisionally placed in the line more or less directly leading to *D. cooki* found in the lower Harrison beds of Nebraska as indicated in the table found in the introduction to this paper.

Vertebral Column.

The vertebral formula is provisionally given as follows: *Cervicals*, 7; *Dorsals*, 19 (?); *Lumbers*, 5; *Sacrals*, 4-5; *Caudals*, 26.

Cervical Vertebrae (Figs. 17-21). In a fully adult animal the width of the atlas is almost double that of the length. The anterior projection of the transverse process extends well forward. The neural canal is of moderately large size, while the arterial canal on the ventral face of the transverse process is generally lacking. The median area of the neural arch varies in different individuals in robustness and rugosity. The transverse process and the median tubercle of the lower posterior face of the body also vary in robustness and size.

The odontoid process and body of the axis are heavy; the neural spine is generally heavy and overhanging, while the transverse process projects rather strongly backward. The latter process is subject to much variation in size, as is

also the ventral keel. The arterial canal is indicated by a deep groove on the anterior border of the pedicel, which is often found completely bridged over by a

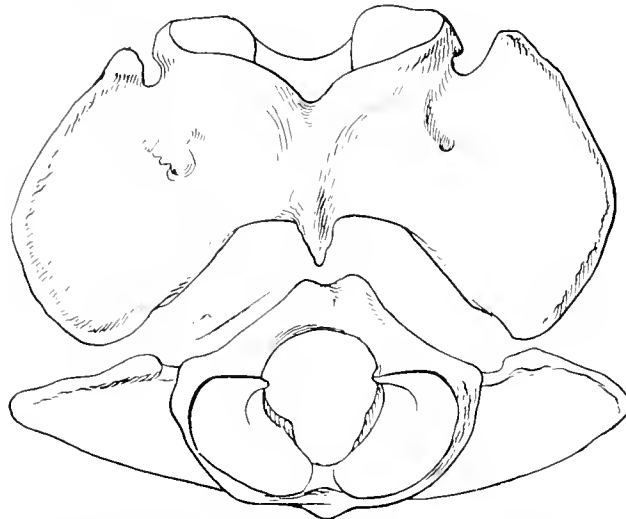


FIG. 17. *Diceratherium cooki* Peterson. No. 1853, Coll. Carnegie Museum. Ventral and anterior views of atlas. $\times \frac{1}{2}$.

thin splint of bone. Additional features of this bone are well shown in the illustrations. (See Fig. 18.)

The third, fourth, and fifth cervicals are, as usual, very uniform in their details

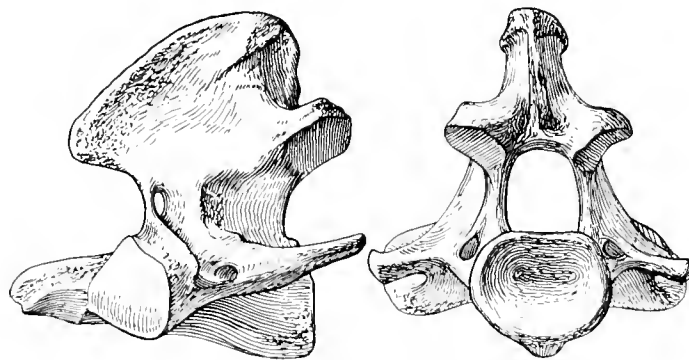


FIG. 18. *Diceratherium cooki* Peterson. No. 1853, Coll. Carnegie Museum. Lateral and posterior views of axis. $\times \frac{1}{2}$.

of structure. There is, however, no neural spine on the third; the fourth has a spine more or less clearly indicated; the fifth a spine of considerable size varying in length in different individuals.

The sixth cervical is characterized by the broad, thin, hatchet-shaped, inferior lamella of the transverse process, which sometimes terminates in a rounded process

behind. The superior, or transverse process proper, is located well up on the centrum; it is trihedral in cross-section, rather short, and projects strongly backwards. The neural spine of this vertebra is quite high, attenuated, of great antero-posterior diameter, and terminates rather abruptly.

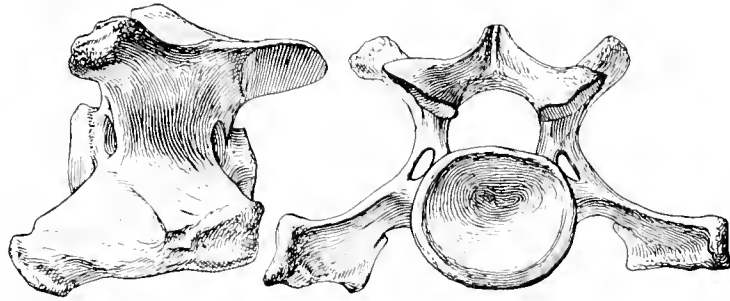


FIG. 19. *Diceratherium cooki* Peterson. No. 2499, Coll. Carnegie Museum. Lateral and posterior views of fourth cervical. $\times \frac{1}{2}$.

The neural spine of the seventh cervical is quite high and generally terminates in a sharp point. The transverse process is abruptly reduced and there is no vertebrarterial canal.

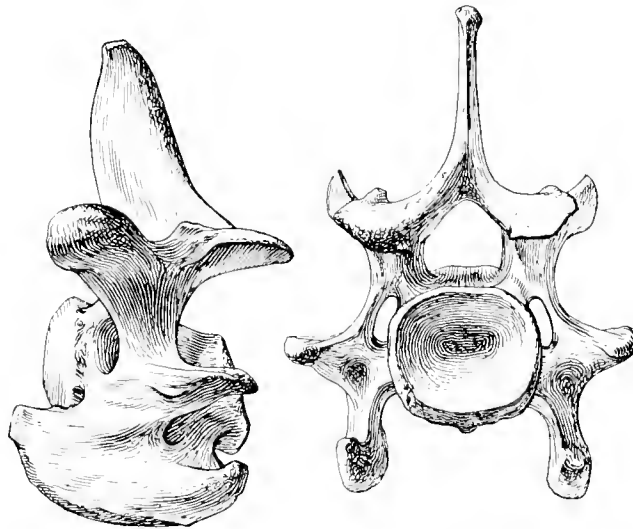


FIG. 20. *Diceratherium cooki* Peterson. No. 2499, Coll. Carnegie Museum. Lateral and posterior views of sixth cervical. $\times \frac{1}{2}$.

Dorsal Vertebrae (Figs. 22-24). We are not yet in a position to positively state the number of vertebrae in the dorsal series. In the skeletons articulated and those assembled for articulation and sent to other institutions by the Carnegie Museum there have been inserted nineteen. This number is thought to be ap-

proximately correct, as it corresponds with those in *Cænopus tridactylus* Osborn which was found, articulated, in the upper Oligocene of South Dakota.²⁸

The first dorsal vertebra is characterized by the proportionally large and high

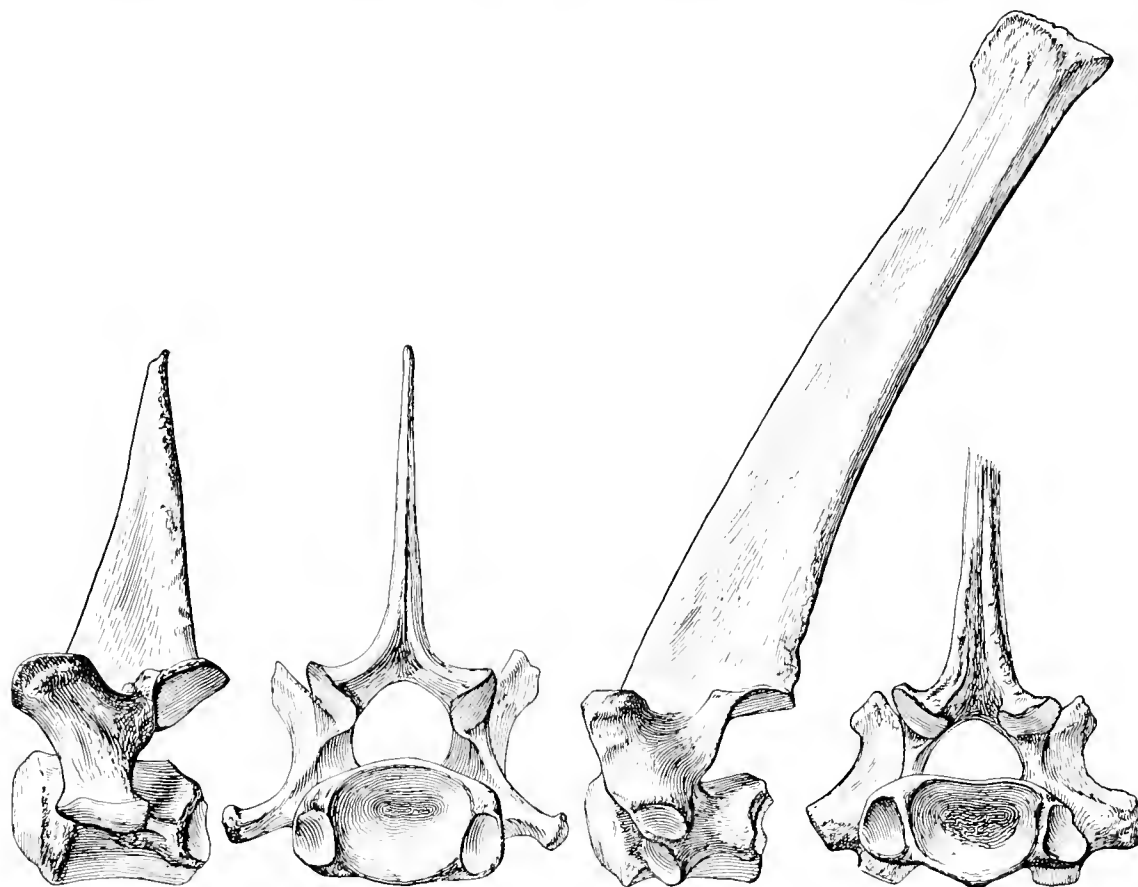


FIG. 21.

FIG. 22.

FIG. 21. *Diceratherium cooki* Peterson. No. 2499, Coll. Carnegie Museum. Lateral and posterior views of seventh cervical. $\times \frac{1}{2}$.

FIG. 22. *Diceratherium cooki* Peterson. No. 2499?, Coll. Carnegie Museum. Lateral and posterior views of first dorsal. $\times \frac{1}{2}$.

neural spine and the depressed centrum; the prezygapophyses are also much expanded laterally to receive the postzygapophyses of the last cervical. The articulations for the ribs are located very low on the side of the centrum and the pedicel is broad and heavy.

With the exception of the skull, there is probably no other part of the skeleton in this species which is subject to greater variation than the neural spines of the dorsal vertebræ. In specimens undoubtedly referable to adult and old males

²⁸ Osborn, H. F., Bull. Amer. Mus. Nat. Hist., Vol. V, 1893, p. 85.

the first dorsal spine is high, broad, and rugose, as shown in Fig. 22, while in many specimens, fully adult and old, this spine is 50 mm. shorter, and sometimes even more. In the anterior dorsals the curvature of the neural spine also varies from a comparatively straight spine to one with a gentle sigmoid curve. The latter are generally those with the longer and heavier spines. The neural spine of the second dorsal is suddenly reduced in size, but back of the second the reduction is more gradual. The anterior dorsals have short, broad, and depressed centra, while further back they are higher, narrower, and terminate ventrally in better defined keels. The intervertebral notch is deep and in the posterior upper side of the centrum it continues downward in a broad and well-defined groove, principally due to the greatly elevated border of the capitular facet on the centrum.

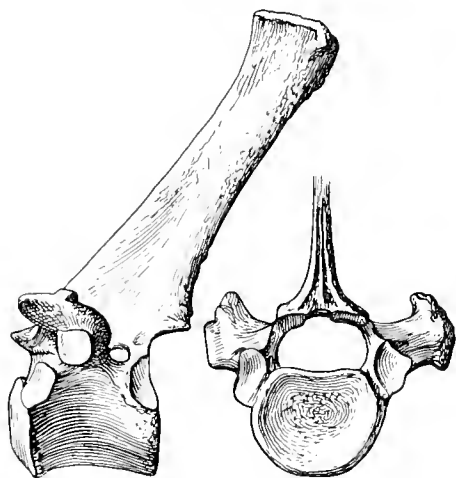


FIG. 23.

FIG. 23. *Diceratherium cooki* Peterson. No. 2499, Coll. Carnegie Museum. Lateral and posterior views of tenth dorsal. $\times \frac{1}{2}$.

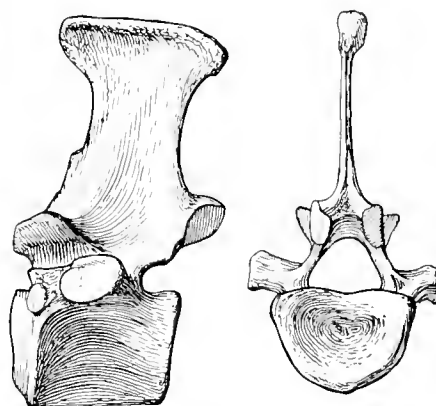


FIG. 24.

FIG. 24. *Diceratherium cooki* Peterson. No. 2470a, Coll. Carnegie Museum. Lateral and posterior views of eighteenth dorsal. $\times \frac{1}{2}$.

In the neighborhood of the eighth, ninth, and tenth dorsals there is usually a foramen formed at this notch, which is characteristic of all posterior dorsals except the last. (See Figs. 23-24.) The fourteenth and fifteenth dorsals have the neural spines broader and more lumbar-like; the mammillary processes, so characteristic of the transverse processes of the dorsals are also longer and project forward in these vertebræ to a greater extent. The inferior aspect of the centra vary from a gently rounded to a more decided ventral keel, possibly due to sex.

Lumbar Vertebrae. Figs. 25-27. There are five lumbar vertebræ. This causes this part of the spinal column to be rather short. In general outline the

centrum of the first lumbar is not unlike that of the posterior dorsals, while further back the lumbar vertebræ are more depressed and gradually broadened. The last is broader than long. The last lumbar vertebra is otherwise conspicuous on

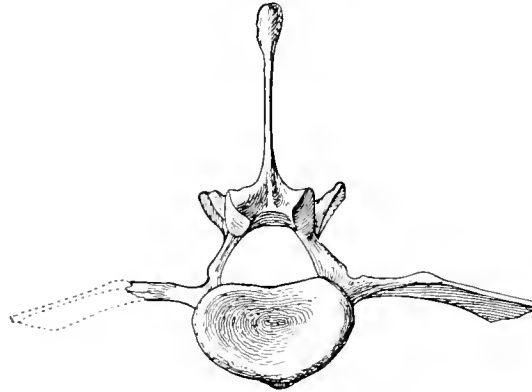


FIG. 25. *Dicratherium cooki* Peterson. No. 2470a, Coll. Carnegie Museum. Posterior view of second lumbar. $\times \frac{1}{2}$.

account of its suddenly reduced neural spine. This reduction is principally in the fore-and-aft direction so that there are broad vacuities between the spines in front and behind.

The more noticeable variations in the lumbar series result from the presence or the absence of an articulating buttress between the fourth and fifth lumbar.

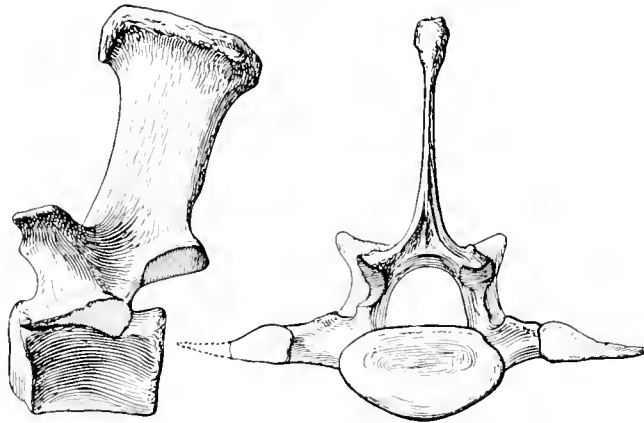


FIG. 26. *Dicratherium cooki* Peterson. No. 2470a, Coll. Carnegie Museum. Lateral and posterior views of lumbar four. $\times \frac{1}{2}$.

This articulation is located on the transverse process (posterior face) of the fourth, and meets a corresponding surface on the anterior face of the process on the fifth lumbar. (See figs. 26 and 27.) The first lumbar is sometimes found to possess an unusually long transverse process, which tapers rapidly and is rib-like.

Sacrum. Fig. 28. There are four and often five coössified centra of the sacrum. The two first vertebrae support the ilium, while those in the rear have sharp lateral edges and gradually taper toward the caudals. The neural spine of

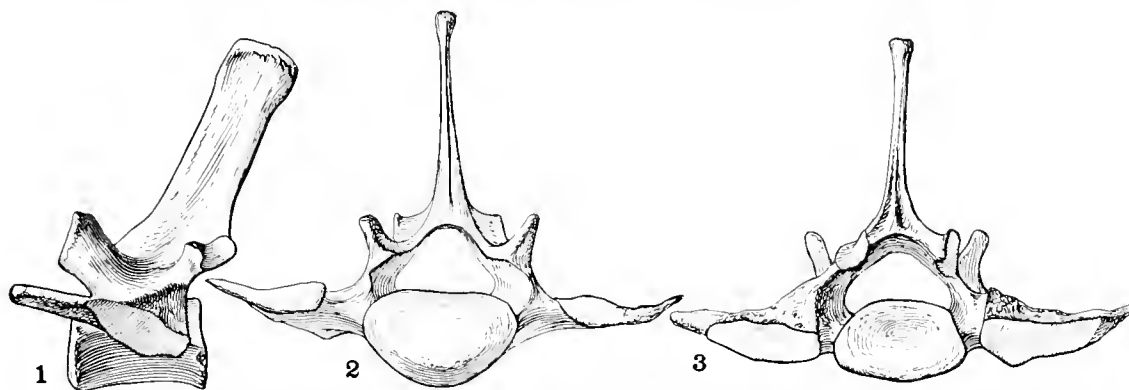


FIG. 27. *Diceratherium cooki* Peterson. No. 2470a, Coll. Carnegie Museum. 1, lateral view of fifth lumbar; 2, anterior view of same; 3, posterior view of same. $\times \frac{1}{2}$.

the first sacral is generally quite slender, but further back the spines are more robust. The sacral foramina are of large size and the coössification between the

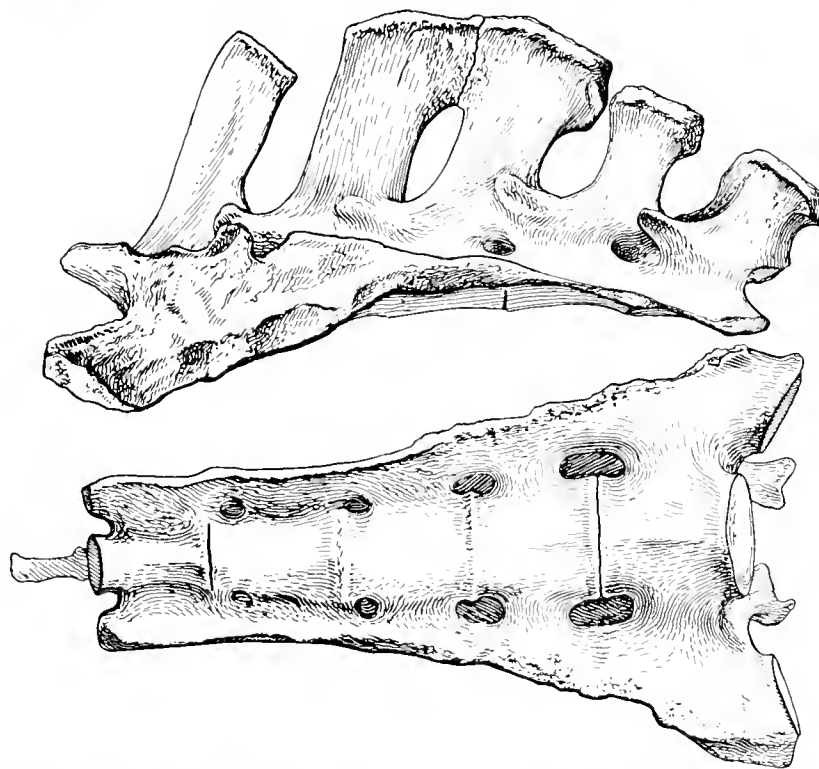


FIG. 28. *Diceratherium cooki* Peterson. No. 2797, Coll. Carnegie Museum. Lateral and ventral views of sacrum. $\times \frac{1}{2}$.

centra is complete, especially in fully adult or old individuals, there being little or no trace of a suture.

Caudal Vertebrae. Twenty-six vertebrae have been attributed to the tail. This is thought to be approximately correct, inasmuch as seventeen were found in consecutive order from the first to and including the seventeenth. The seventh caudal is the last with a complete neural arch, and the eighth is the last with traces of a transverse process. The tail as a whole is moderately long and tapers to a fine point as indicated by many very small vertebrae found in the collection.

Ribs.—The ribs, even the posterior, are rather long. In the anterior region they are flat, though not broad, while further back their cross-sections have a tendency to be more trihedral. There are well-defined tubercular facets throughout the entire series. Altogether the thorax forms a rather solid cylinder.

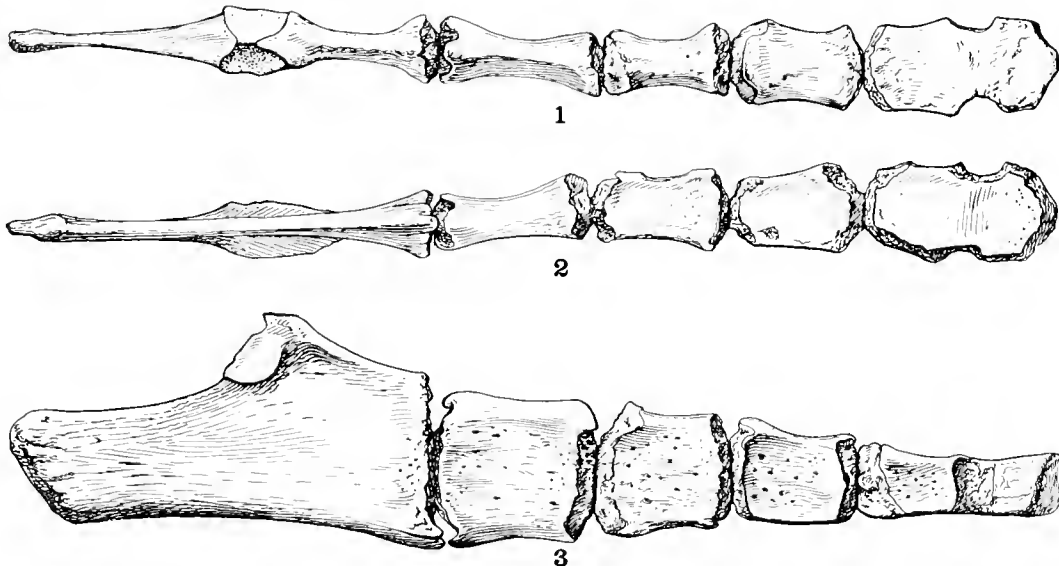


FIG. 29. *Diceratherium cooki* Peterson. No. 2817, Coll. Carnegie Museum. 1, Dorsal view of sternum; 2, ventral view of same; 3, lateral view of same. $\times \frac{1}{2}$.

Sternum. Fig. 29. The sternum was described in part as follows:²⁹ 'The manubrium is an elongated, laterally compressed, and vertically deep plate of bone. Anterior to the contact for the first pair of ribs there is a long heavy process, extending forward, and constituting the greater half of the entire length of the presternum. Posteriorly the bone is slightly expanded transversely and has a rough surface for the attachment of the mesosternum. The first two segments of the latter are somewhat deeper than wide. The posterior end of the fourth sternebra is nearly square in outline, while the fifth and sixth are broader than deep.'

²⁹ Peterson, O. A., Ann. Car. Mus., Vol. VII, 1911, p. 277.

Fore Limb.

Scapula. The scapula is long, narrow, and recurved. It is perhaps somewhat narrower than in earlier types (*C. tridactylus*, Osb.) and nearer the proportions found in more recent forms (*R. pachygnathus* or *R. bicornis* Wagn.) In general the outlines are very similar to those of these species. The coracoid is prominent, the supra-scapular notch quite deep. The spine, which nearly equally divides the supra- and infra-spinous fossæ, terminates in a very heavy and retroverted process. There is a third fossa at the coracoid border immediately above the suprascapular notch, which is separated from the supraspinous fossa by a

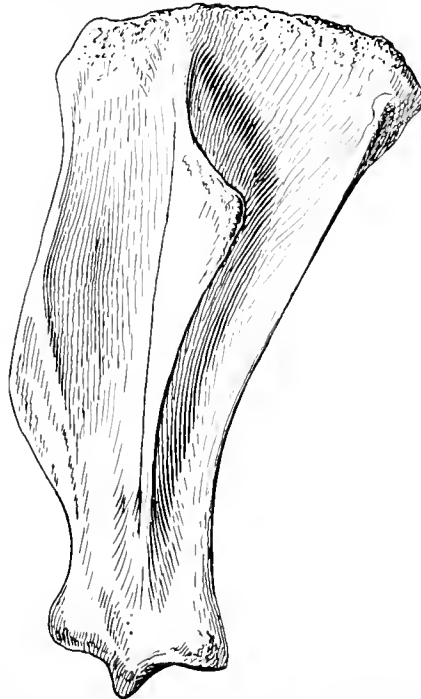


FIG. 30. *Dicratherium cooki* Peterson. No. 2473, Coll. Carnegie Museum. External views of scapula. $\times \frac{1}{3}$.

somewhat prominent vertical ridge. The fossa itself, however, is rather shallow and of relatively small size. (See Fig. 30). There is very little variation in the details of the scapula in fully adult animals, robustness and size excepted.

Humerus. The humerus is short and heavy. The tuberosities of the proximal end, though not as heavy in proportion as in some of the recent Rhinoceroses (*R. bicornis*), are nevertheless, very prominent and the bicipital groove has a tendency to become double, *i.e.*, separated by a broad, but very low ridge, approaching the condition in the recent Rhinoceros where the bicipital tubercle is more prominent. Distally the bone has furthermore a great transverse diameter due to

the large entepicondyle and prominent supinator ridge. The anconeal fossa is very deep and of considerable height (See Fig. 31.)

The proportionate length of the radius and ulna is approximately like that of *Rhinoceros bicornis*. In the fossil form the shafts of both radius and ulna are, how-

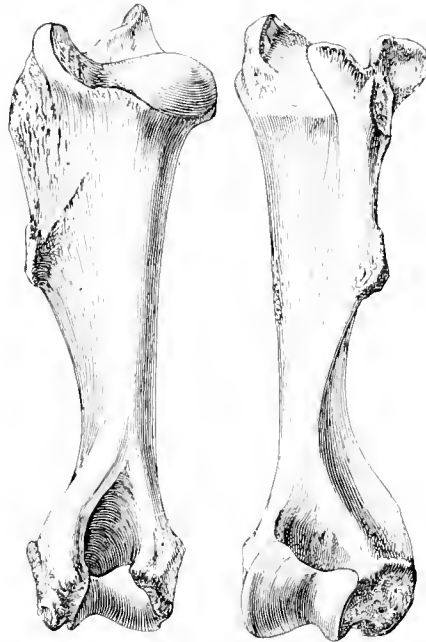


FIG. 31. *Diceratherium cooki* Peterson. No. 2473, Coll. Carnegie Museum. Posterior and anterior views of humerus. $\times \frac{1}{3}$.

ever, flatter than in the African species. In fully adult and old individuals this is chiefly due to the rugose and prominent ridges, which actually come in contact with each other throughout the whole length of the bones, while in the recent form the median region of the shafts is rounded and the two bones are separated by a considerable space. The shaft of the radius is quite straight, while the ulna as a whole is much bent backward, especially the upper half, a characteristic seen in the recent form. The carpal articulations differ from those in the African form to a marked degree. Thus the lunar articulates exclusively with the radius in *Diceratherium*, while in *R. bicornis* it encroaches to a considerable extent on the distal face of the ulna. On the other hand it is observed in a number of cases in *Diceratherium* that the cuneiform extends over upon the radius, forming a minute facet on the extreme ulnar border as well as on the palmar face. There is a considerable variation, especially in length and robustness, of the fore-arm of *D. cooki*, which is undoubtedly due to sexual and individual variation as well as age.

Manus. Pls. LXIII; LXIV. The height and breadth of the carpus are

practically equal, the height being sometimes very slightly greater than the breadth, while in the recent rhinoceros the breadth is a little greater than the height. The proximal facets of the scaphoid and cuneiform are not unlike those in recent forms, while the lunar lacks the facet for the ulna, so plainly shown in the African species. The large facets and the heavy palmar hook of the lunar uniting the lateral bones on the proximal row of the carpals in *R. bicornis* are conspicuously absent in *Diceratherium*. The second row of the carpals in the latter are higher than

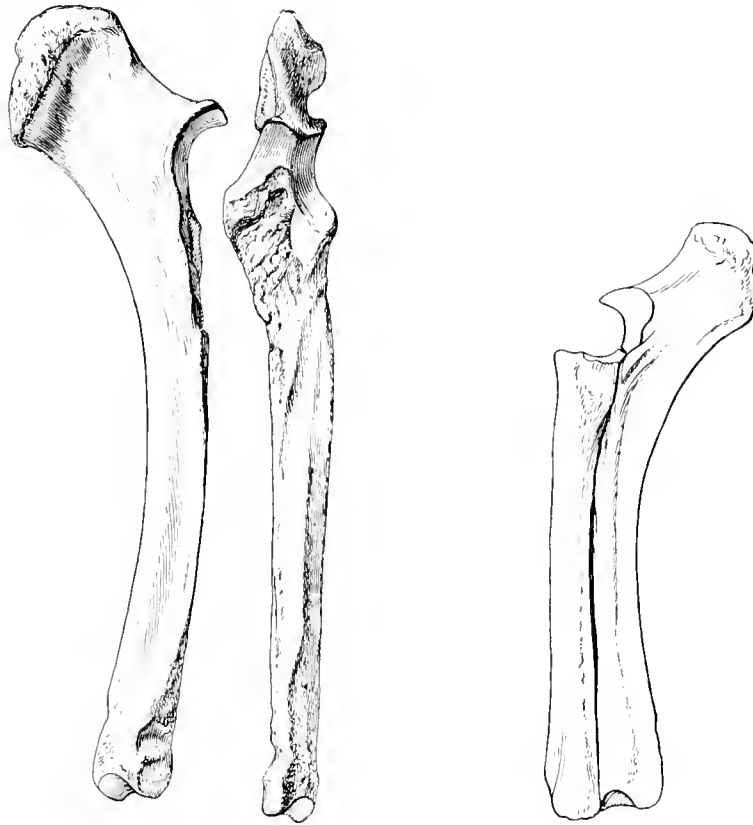


FIG. 32.

FIG. 32. *Diceratherium cooki* Peterson. No. 2473, Coll. Carnegie Museum. Radial and dorsal views of ulna. $\times \frac{1}{4}$.

FIG. 33.

FIG. 33. *Diceratherium cooki* Peterson. No. 2499, Coll. Carnegie Museum. Oblique ulnar view of radius and ulna. $\times \frac{1}{4}$.

those in *R. bicornis*; otherwise there are only minor details of difference between the two forms. With regard to size, the trapezium and metacarpal V have approximately the same proportions as in the living species. The three functional metacarpals in *D. cooki* are decidedly longer, slenderer, and the shafts of II and IV are more curved. This curvature of the shafts of Me II and IV is to conform to

the sides of Me III to which bone they lie rather close with comparatively little divergence distally. All the phalanges are broad, short, and depressed. (See Pl. LXIII).

In *Cænopus tridactylus* the metacarpals also are close to one another, but the lateral metacarpals are heavier in proportion than in *D. cooki*. This is also true of the bones in the hind foot. Another noticeable feature of the hind foot in *C. tridactylus* is seen in the proportionally larger size of the entocuneiform, which is not remarkable, when we consider the differences in size of the lateral metapodials in the two genera here compared.

Hind Limb.

The pelvis is short and broad. The area for the gluteal muscle is broadly expanded, but the supra-iliac border is emarginated as in *Cænopus* of the Oli-

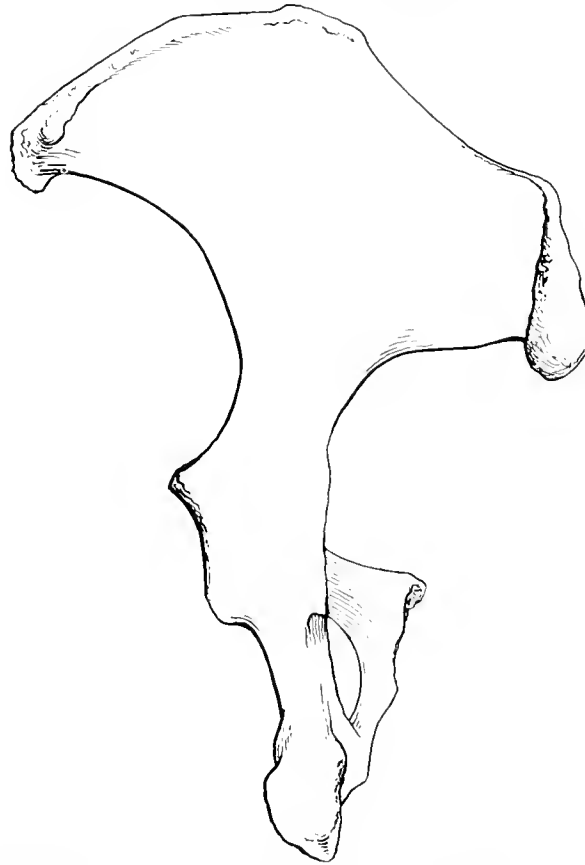


FIG. 34. *Diceratherium cooki* Peterson. No. 2797, Coll. Carnegie Museum. Left half of pelvis, dorsal view. $\times \frac{1}{2}$.

goene. The ischium and pubis are relatively short when compared with *Cænopus tridactylus*, indicating quite an advance in the direction of the recent Rhinoceroses.

The acetabulum is well rounded and deep; the pit for the round ligament is quite deep and the cotyloid notch broad. The obturator foramen is very large and ovate in outline. The sciatic notch of the ischium is well-defined by the sudden termination of the spine and the heavy and suddenly upward, or outward, turned tuber ischii. The prominence of the latter tuberosity is subject to some variation

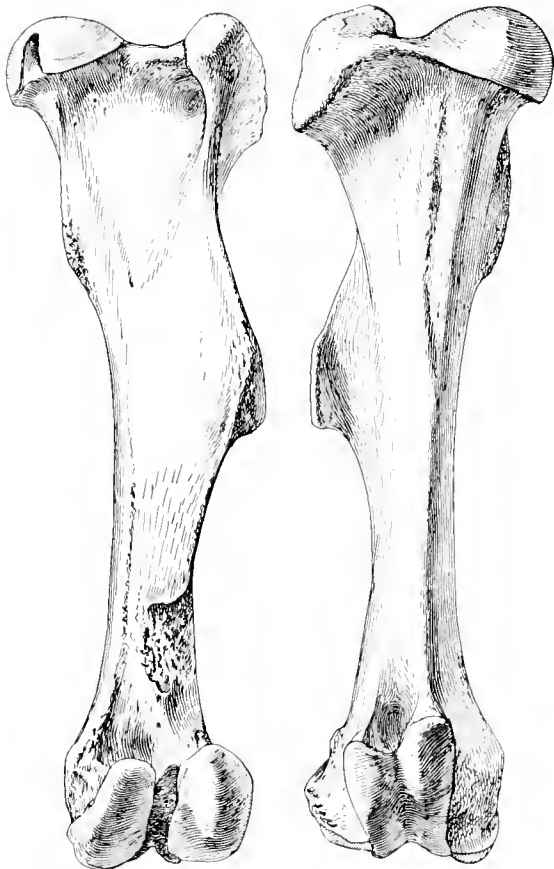


FIG. 35.

FIG. 35. *Diceratherium cooki* Peterson. No. 2460, Coll. Carnegie Museum. Posterior and anterior views of femur. $\times \frac{1}{3}$.

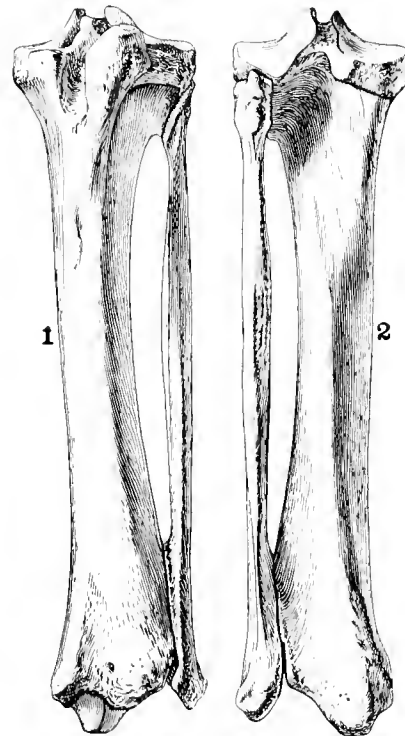


FIG. 36.

FIG. 36. *Diceratherium cooki* Peterson. No. 1840, Coll. Carnegie Museum. 1, anterior view of tibia and fibula; 2, posterior view of same. $\times \frac{1}{3}$.

in different individuals. In fact there is in this species a considerable degree of variation in the robustness of the pelvis in the large collection before us. This, in my judgment, is due to age and sex.

The femur is quite long. The shaft, when seen from the front, is quite straight, but on a rear view appears curved, due to the prominence of the different trochanters (See Fig. 35.) The third trochanter, though large, is not the long, forward, and

outward extending process seen in *R. bicornis*. Nor is the proximal end so much expanded laterally as in the African species.

The tibial border of the rotular trochlea is greatly developed; it has very nearly reached the extreme modernized stage of development seen in the recent Rhinoceros and the horse. The antero-posterior diameter of the distal end is therefore greater than the transverse in approximately the same proportion as in *R. bicornis*.

The patella is triangular in general outline, due to the large development of the internal process in order to cover the greatly developed internal border of the rotular trochlea described above. The trochlear grooves of the patella are quite uneven in size and the bone as a whole unlike that of the horse.

In fully adult and old individuals both ends of the tibia and fibula have a strong tendency to become coössified. This is a direct indication of the progressive development which has reached its culmination in the completely united tibia and fibula of *R. bicornis*. Like the femur, the tibia and fibula are rather long and slender, when compared with these bones in the recent species, and it also appears that



FIG. 37. *Diceratherium cooki* Peterson. No. 1840, Coll. Carnegie Museum. Posterior and anterior views of patella. $\times \frac{1}{3}$.

these bones in *Cænopus tridactylus* (Osborn) are proportionally shorter and possibly also somewhat heavier than in *D. cooki*.

Pes. Pls. LXIII, LXIV. As is already known, the pes is strictly tridactyl. It is on the whole narrow and quite high, especially when compared with *R. bicornis*. It is also somewhat higher and slenderer than the pes in *Cænopus tridactylus*.

The tuber of the calcaneum has about the same general proportions as the European species *D. (?) croizeti* Pomel*, *i.e.*, it is quite heavy and of medium length, while the sustentacular facets are similar in detail. The broad and rather low astragalus also agrees in detail with that of this European form. The cuboid is quite high and has an extremely heavy process posteriorly. The metatarsals are quite elongated, the lateral metatarsals with curved shafts somewhat similar to those in the manus. The ungual phalanges are shorter than in the manus.

The remains of *Diceratherium cooki* constitute by far the greatest percentage of all the material found in the Agate Spring Fossil Quarries. Another significant

* Pomel referred the species to *Aceratherium*. Professor Max Schlosser identifies it as *Diceratherium* in the case of material sent to us from the Royal Museum in Munich.

MEASUREMENTS OF THE TYPE OF *D. COOKI*.

Greatest length of skull	350 mm.
Length from occipital condyle to and including P ²	307 "
Length from occipital condyle to M ³	150 "
Greatest transverse diameter of skull	215 "
Greatest transverse diameter of brain-case	107 "
Greatest transverse diameter of frontals	140 "
Transverse diameter of nasals back of horn-cores	65 "
Transverse diameter of nasals at the horn-cores	70 "
Transverse diameter of palate at M ³	55 "
Vertical diameter of the orbit	30 "
Antero-posterior diameter of premolars two, three, and four	68 "
Antero-posterior diameter of the molar series	90 "
Antero-posterior diameter of P ²	22 "
Transverse diameter of P ²	23 "
Antero-posterior diameter of P ¹	28 "
Transverse diameter of P ¹	29 "
Antero-posterior diameter of M ¹	34 "
Transverse diameter of M ¹	32 "
Antero-posterior diameter of M ³	26 "
Transverse diameter of M ³	32 "

MEASUREMENTS OF LIMB BONES OF SKELETON.

Scapula, height	273 mm.
Scapula, width at superior border	138 "
Humerus, length	250 "
Ulna, length	315 "
Radius, length	250 "
Carpus, height	59 "
Carpus, transverse diameter	60 "
Mc II, greatest length	70 "
Mc III, greatest length	138 "
Mc IV, greatest length	115 "
Phalanges, median digit	70 "
Pelvis, total length	335 "
Pelvis, diameter across ilia	355 "
Pelvis, Diameter across acetabulum	220 "
Femur, length	323 "
Tibia, length	275 "
Tarsus, height of tuber of calcaneum not included	70 "
Tarsus, length of tuber of calcaneum	48 "
Tarsus, greatest transverse diameter	53 "
Mt. II, length	110 "
Mt. III, length	125 "
Mt. IV, length	110 "
Phalanges, third digit	30 "

fact is the great number of bones representing young animals and females in proportion to those of males. This would appear to indicate (1) that the animals were polygamous to a great degree and that the males were either struggling for the possession of the herds after the manner of recent ungulates (*Equus*), and were few, or, that they were strong enough to extricate themselves when overtaken by the calamities which destroyed the herds.

The articulated skeleton of *Diceratherium cooki* has been fully discussed in the Annals of the Carnegie Museum, Volume VII, pp. 274-279.

MODES OF DEVELOPMENT OF CERTAIN DENTAL AND BONY STRUCTURES OF THE CRANIUM IN DICERATHERIUM.

(Plates LXV and LXVI.)

Important facts, in connection with the evolution of the dental formula and other features of the cranium of the Rhinocerotidae, are obtained from the large collection under study in the Carnegie Museum. Some studies bearing on the evolution of the incisors and canines of *Diceratherium* were already presented before the Paleontological Society at Pittsburgh in 1910. The following pages are given to a further discussion of the appearance and shedding of the different deciduous teeth, the appearance of the permanent series, and other changes of contour of the head from the young to the fully adult form of *Diceratherium cooki*.

1. A skull of a young *Diceratherium*, No. 1848 (See Pl. LXV, Figs. 1, 2, 4) which belongs to the original series from which the type of *D. cooki* was selected, is especially complete and furnishes an excellent opportunity for study. In viewing this skull from above, the most noticeable characters are the following: brain-case proportionally broad; occiput short; frontals broad; horn-cores little developed, and nasals gradually pointed, more like that of adult females. Back of the horn-cores on the lateral margin of the nasals there is also less constriction in skulls of young individuals and adult females than is the case in males. The supra-orbital ridges are so varied that one cannot attach great importance to them, though it would appear that in female skulls they are generally less prominently developed and in their backward progression to the occiput they possibly have a tendency to be further separated from the median line. On either a direct side view or a palatal view of the young skull the most noticeable feature is the great backward extent of the alveolar border of the maxillary. The alveole for M³ is seen to be nearly opposite the pterygoid, while in fully adult forms this tooth is well in advance of this region. In very young individuals, the base and the supra-occipital of the skull are often slipped off at the sutures, not an unusual feature of the mammalia. In the skull here described, the base is lost, but the supra-occipital is in position.

Buried deep in the small round alveolus, the point of the upper permanent incisor is found. Judging from the size of the alveole, the deciduous tooth was rather small and had a root of more rounded outline than the permanent one, and the crown was perhaps also of an entirely different shape. There is no canine present and, if there were a deciduous canine in this individual, it dropped out early and the alveole was closed, there being in this region a small groove which extends for a short distance back of the maxillary-premaxillary suture. If there was a deciduous first premolar in the *Diceratheres*, it was possibly shed very early in life.³⁰ P¹ is somewhat worn, but not enough to lose the characters of the grinding face. (See Pl. LXV, Fig. 2.) The ectoloph is, as usual, well developed, the protoloph is less prominent than the metaloph, which gives to the tooth the characteristic triangular outline. The post-fossette is sometimes constricted in such a manner as to form an isolated fossette on the metaloph on further wear, while the main post-fossette continues to the posterior edge of the tooth. This fossette is not always present. D.P² is considerably worn, but the detailed structure is yet easily made out. The tooth is longer than the permanent tooth, the ectoloph is heavy, the protoloph is well developed internally as is also the metaloph. The crista is enormously developed, extending on an even internal line with the proto- and metalophs. In a young or unworn tooth this ridge is often constricted so as to form an internal tubercle, which on further wear unites with the true crista. In the young of the John Day forms both the crista and this internal tubercle are less developed and apparently entirely separated, judging from the material in the American Museum. This is admirably illustrated on Pl. LXV Fig. 3. The crochet of D.P² in *D. cooki* is quite distinct though much less developed than the crista, and the cingulum is well developed on the internal face of the tooth. In excavating the maxillary above D.P² it is seen that P² is quite well advanced. See Pl. LXV, Fig. 1. D.P³ is well worn. The median valley is open, but the crochet is evidently united with the ectoloph, while the post-fossette is isolated by wear of the tooth. There is a small tubercle on the internal cingulum in the median valley. D.P⁴ has the well developed crochet still separated from the ectoloph, but the crista is rather poorly developed or wanting. The median valley is open and, as in the preceding tooth, there is a small tubercle on the cingulum at the exit of the valley. The post-fossette is broad and open. M¹ is fully erupted and has already received some wear. The ectoloph is yet quite thin, but in excavating

³⁰ If P¹ in *Diceratherium* did not succeed a milk-tooth in extremely early stages of the animal, this tooth may be regarded as a persistent milk-tooth which would agree with the studies of Huxley ("Anatomy of Vertebrate Animals," p. 362); Lydekker ("Notes on the Dentition of Rhinoceroses," Jour. Asiatic Society of Bengal, Vol. 49, 1880, pp. 135-6).

the median and profossettes, the walls of the internal face of the ectoloph and the external face of the crochet are rapidly slanting toward one another, so that on extreme wear the tooth would have the usual appearance seen in old individuals of this species. The post-fossette is deep and broad. The cingulum is less developed internally than on the milk premolars. M^2 is just appearing in its alveolus and M^3 is entirely buried in the maxillary.

2. In a somewhat younger individual (No. 2476) it is observed that the roots of $D.P^2$ are longer and heavier and in excavating the maxillary, P^2 is found in an extremely early stage of formation (often no evidence of it is found). M^1 in this individual is just cutting through the alveolar border, while that in the specimen described above has received slight wear. There can be only a comparatively small difference in age of these two individuals, and it thus appears that the permanent teeth developed extremely rapidly after they began to show the form of tooth in the maxillary bone. This rapid formation and development of the permanent dentition in *Diceratherium* should not be regarded as out of the ordinary when comparison is made with the shedding of the deciduous and the appearance of the permanent teeth in man and other mammals.

3. In the collection of the Carnegie Museum are two left rami (Nos. 1820 and 1821) representing very young animals, most probably foetal. The total length of the rami of each of these young specimens is approximately 180 mm., while the depth in the middle antero-posterior region is 28 mm. The most characteristic features are as follows:

The lunate-shaped outline of the ramus due to the greatly downward curved under border of the jaw in the fore-and-aft direction, the close proximity of the cheek-teeth to the canine and the incisors, due to the absence of a diastema on the alveolar border of the jaw, the very slight constriction in front of the cheek-teeth and back of the incisors which is so very pronounced in adult and even in quite young specimens, the small transverse diameter of the symphysis, and the deep groove on the external face of the jaw extending from the symphysis about 20 mm. back in a parallel line with the long axis of the ramus. The glenoid condyle is not present in either one of the rami; the coronoid process on the other hand is present in No. 1820. The latter is rather low, and terminates in an attenuated process.

The second deciduous incisor is in place, while the alveolus for the first is empty. The lateral incisor is not present and a small opening external to $D.I_2$ of this individual may or may not have contained this tooth. The small alveolus for the canine is immediately in front of that for $D.P_1$; the latter is a round opening

of considerable size. The two succeeding round openings are for the roots of D.P₂. Back of this point the two succeeding cheek-teeth are partly erupted. (See Pl. LXVI, Figs. 3, 8 and 9.) The general pattern of these teeth is quite similar to that of the permanent set, indeed it is not easy to distinguish one set from the other. Portions of a fifth cheek-tooth (M₁) lie buried deep in the jaw behind the two just described.

4. Two pairs of lower jaws (Nos. 2476, 2477) have been selected from the collection to represent the next stage of evolution in the development of the ramus, No. 2476 being represented on Pl. LXVI, Fig. 7. The total length of jaws Nos. 2476, 2477 is 250 and 270 mm. and their depth is 36 and 40 mm. respectively. At this stage the jaw is easily recognizable, as all the characteristic generic features are present. The jaw is less lunate-shaped, the characteristic diastema in front of the cheek-teeth is quite well developed, including the constriction of the alveolar border, which in the younger stage is represented only by the deep groove on the external face of the ramus referred to above. In this stage of development the chin is broader, due to the lodgment of the already well-advanced lateral incisor. The temporal fossa is well developed, as are the condyle and the coronoid process.

The median incisors are just through the alveolar border and present the same small and conical-shaped crowns met with in older forms. These teeth are succeeded by a short diastema before the alveoli of D.I₂ is reached. The latter is situated somewhat posterior to I₁ and I₃ in the alveolar border and is thus placed in an irregular position. In the specimens of the Carnegie Museum under observation there is sometimes found a delicate septum separating the second and third incisors. This bony bridge is often broken. D.I₃ is frequently found in position as is the case in the specimen here described, see Pl. LXVI, Fig. 7. This tooth has a long root, quite robust, on which sits a small enamel-covered crown very little larger in circumference than the root itself. The two lateral incisors are succeeded by a diastema; the alveolar border here forms a heavy rounded edge with a noticeable swelling on the external face. This swelling of the incisive alveolar border is due entirely to the rapid development of the cutting incisor of the second set of teeth which is yet buried underneath the deciduous dentition. The deciduous canine is found in many individuals. This is a small tooth with a conical enamel-covered crown and a rather short root. The canine is quite generally found in a procumbent position, isolated by diastemata in front and behind, and drops out very early. The diastema back of the canine constitute a long and sharp border which has first a slight inward curvature and then suddenly takes an outward direction to meet the cheek dentition. The first deciduous cheek-tooth is rather

small, simple-crowned, receives comparatively little wear, and is closely crowded to the anterior face of the succeeding tooth. D.P₂ is proportionally longer and narrower than P₂. The configuration of the crown is otherwise quite similar in the two. D.P₃ has by far the greatest wear and is, if one may judge by the degree of wear, the first cheek-tooth to appear in the young. D.P₄ is less worn and cuts the alveolar border simultaneously with or perhaps a little sooner than D.P₂. Back of D.P₄ are seen the points of the crown of M₁ and back of the last-mentioned tooth the alveolar border is deeply marked to indicate the position of M₂ which is still entirely buried in the jaw.

5. The next stage of development in the succession of teeth from the deciduous to the permanent series is interesting. Three individuals have been selected which fairly well cover the main points in individual variation and irregularities of development. Of these three individuals No. 1923*a* might be considered as the most normal and will be first discussed. The small median incisor occupies the usual position, while the permanent lateral incisor has broken through the alveolar border (Pl. LXVI, Fig. 5), uniting the alveoli for D.I₂ and D.I₃ into a large transversely oblongate fissure for receiving the cutting and procumbent incisor.³¹ In this individual the alveolus for the canine of the right ramus is present, though very small, while in the left there is no trace of an alveolus for the canine. D.P₁ is in place while D.P₂ has been shed and the crown of P₂ appears through the alveolar border. D.P₃ is still in place but P₃ is well advanced and the deciduous tooth was almost ready to drop off before the death of this individual. D.P₄ is apparently quite solid in the jaw and still served well for masticating purposes. M₁ has already received considerable wear, while M₂ is almost entirely erupted. M₃ is quite undeveloped and is buried deep in the jaw.

6. The next specimen to be considered is No. 1841, a pair of lower jaws. This specimen presents some irregularities worthy of note. From the illustration (Pl. LXVI, Fig. 6) it is seen that the permanent lateral incisors of this specimen are retarded, *i.e.*, they have not yet appeared above the surface of the alveolar border; the alveoli for the canines are quite large. D.P₁ is still in place, but contrary to the specimen just described both D.P₂ and D.P₃ have disappeared and P₂ and P₃ have already received some wear, D.P₄ is solidly inserted in the jaw, M₁ has been in use for some time and is considerably worn as in No. 1923*a*, while M₂ has received slight wear on the anterior portion. M₃ on the other hand is apparently no further developed than in the specimen previously described.

³¹ In the judgment of the writer this incisor is probably I₂ while I₃ and the canine of the *Diceratheres* are atrophied.

7. In No. 1854 it is seen that the lateral incisor is no further advanced than in No. 1841 just described. The alveole or deep groove³² for the deciduous canine is still quite prominent while D.P₁ is shed and all traces of its alveole entirely obliterated. P₂ and P₃ have received slightly more wear than those teeth in the previous specimen described, but D.P₄ is still well rooted in the alveolar border. M₁ is quite well worn and the anterior part of M₂ is also more worn than that in No. 1841. The deep fissure back of M₂ indicates the position of M₃. The latter is very little further developed than in the two preceding specimens and is yet buried in the angle of the jaw. The three lower jaws just described are of approximately the same age as the skull No. 1848, referred to in the opening paragraph of this discussion.

In connection with the probable manner in which the upper and lower incisors of *Diceratherium*³³ developed in size, and modified into the shape in which we find them, it is interesting to return to the foetal specimens Nos. 1820 and 1821 just described (page 452). We have already found that the deciduous dentition of these specimens forms practically a close series, without the constricted and thin areas of the alveolar border between the cheek-teeth and the incisors of older animals, the alveolus for the canine is deep though small; in excavating the chin, the continuation of the dental canal is found, but the germ for the permanent incisor had not yet started, hence the small transverse diameter of the chin.

In the next stage represented by Nos. 2476 and 2477, the specimens are of quite young animals. We observe here a sudden change. It is likely that the characters so prominently developed in this young animal had already been well advanced during the latter part of the intra-uterine stage. At all events the jaw was still in a very plastic condition in order to have transformed so quickly between the two stages represented in the illustrations (see Pl. LXVI, Figs. 7 and 9). In the specimens of this second stage we find a broad and heavy chin in order to support the heavy and long-rooted permanent incisor. The alveolus for the canine, which we originally found quite deep and placed close to the cheek-teeth, is now shifted well forward and is transformed into a shallow groove, which in

³² In more matured individuals, the fissure in the alveolar border which lodged the canine cannot be regarded as a true alveolus.

³³ Not only *Diceratherium* but the Rhinocerotata in general (such forms as the Aemynodonts excepted) undoubtedly developed the cutting incisors along the same general line.

The result of the present study is contrary to the statement by Professor Marsh (Amer. Jour. Sci., Vol. XIV, 1877, p. 251). It may be said here that the presence of the canines in the Aemynodonts does not prove "that the large lower teeth, usually regarded as incisors in *Aceratherium* and many other members of the Rhinoceros family, are really canines."

the majority of cases is empty, the small canine lodged therein having dropped out, while back of the canine we find a long diastema which is very much constricted forming externally a deep and rather broad groove for the lodgment of the inferior labial muscles.

Let us suppose that the foetal specimens referred to have the jaws more or less like those of the early Tertiary forms. We must in any event expect that the early progenitors of the family had, first a complete dental series, *i.e.*, $\frac{3}{3} \cdot \frac{1}{1} \cdot \frac{4}{4} \cdot \frac{3}{3}$ (abundantly proven by the genus *Trigonias* of the lower Oligocene); and secondly quite likely the absence of a diastema back of the incisors.³⁴ It follows that advancing influences effected gradual changes of the bony structure simultaneously with that of the teeth. If we have, for instance, a set of lower incisors of subequal size and a normal canine in its natural position (we actually do find evidence of a canine in young *Diceratheres*), we should expect the upper incisors to meet the lower. When the atrophied and hypertrophied changes took place, which transformed the original sub-equal teeth to those which obtained in later forms, *it was not the lower canine, but I₂, which received the constant impact from the upper median tooth.* The diastemata between the incisors, canine, and cheek-teeth was most likely an early development of the group. The modification of the cutting incisor was contemporaneous with the reduction of I₁ the atrophy of I₃, the broadening of the chin, and the constriction of the ramus in the region of the canine which, in turn probably, caused the reduction and final disappearance of the latter tooth. After the present study of the *Diceratherine*, I cannot accept the designation given to this tooth, as "canine," by some authors, Professors Marsh, Cope, and Gaudry having been the first to promulgate this view.

Since the preceding paragraphs were submitted for publication, Professor W. B. Scott of Princeton University has published his splendid work on the "History of Land Mammals in the Western Hemisphere." On consulting the history of the Rhinocerotidae in Scott's volume, pp. 326-340, it is very evident that he does not regard the large cutting incisor of the lower jaw in the early Rhinoceroses as a canine. In fact since the genus *Trigonias* from the Lower Oligocene of America was established by Mr. Lucas³⁵ and more completely described by Mr. Hatcher³⁶ the morphology of the incisors and canines of the Rhinocerotidae rests on a firmer foundation.

³⁴ Even in *Colonoeceras agrestis* Marsh, a genus which might be regarded as possibly near the ancestral line of the *Diceratheres*, there is a well-established diastema back of the superior canines.

³⁵ Proc. National Museum, Vol. XXIII, 1900, pp. 221-223.

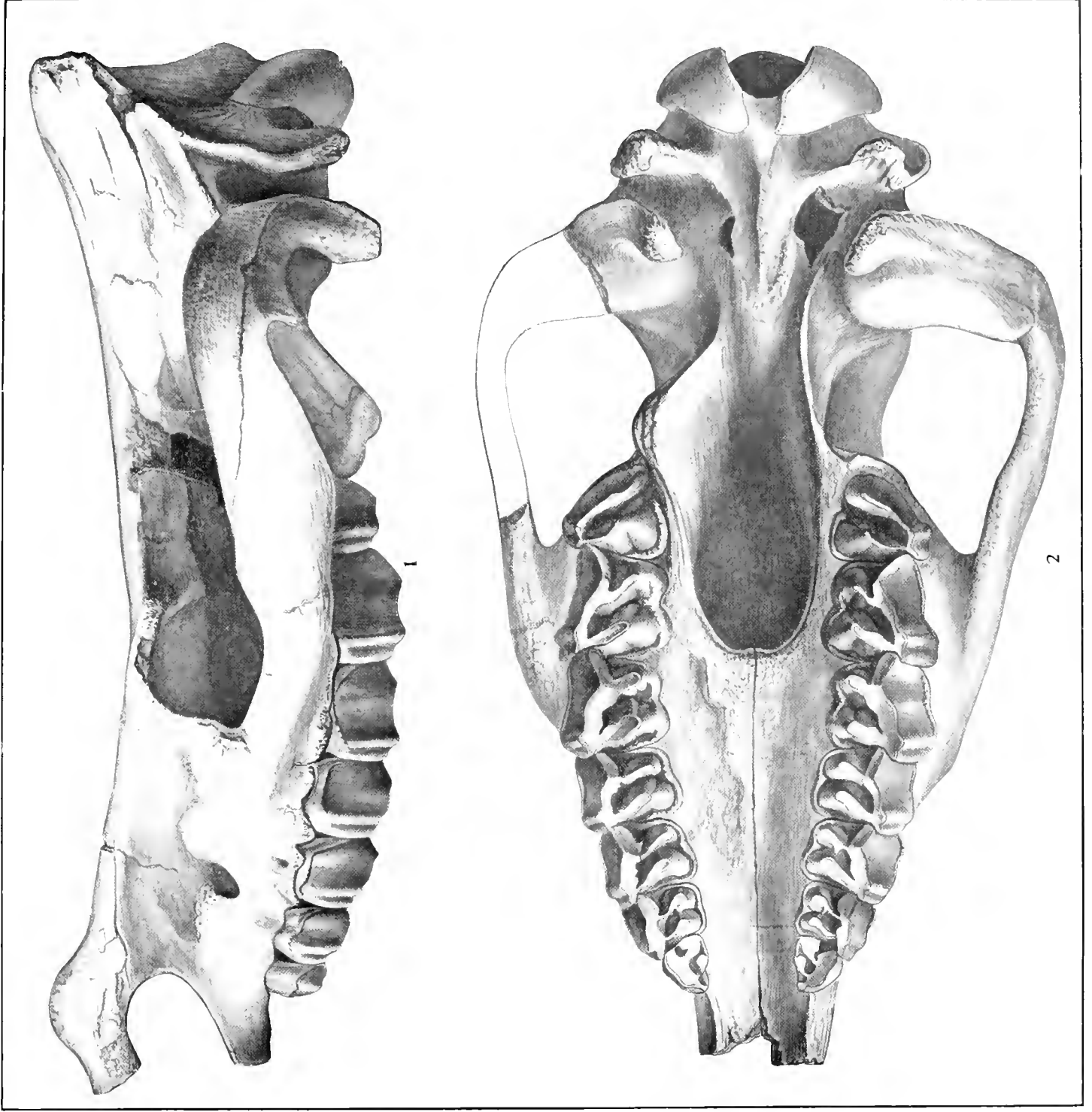
³⁶ Ann. Carnegie Museum, Vol. I, 1901, pp. 135-144.

EXPLANATION OF PLATE LVII.

FIG. 1. *Diceratherium armatum*, type. Side view of skull. Peabody Museum, No. 10003.

FIG. 2. *Diceratherium armatum*, type. Palatal view of same specimen as Fig. 1.

All figures about $\frac{3}{8}$ natural size.



Diceratherium armatum MARSH.

EXPLANATION OF PLATE LVIII.

FIG. 1. *Diceratherium nanum*, (Marsh) type. Peabody Museum of Natural History, No. 10004. Front of skull from the side.

FIG. 2. *Diceratherium nanum*, type. Front of jaws from the side.

FIG. 3. *Diceratherium nanum*, type. Alveolar border and dentition.

FIG. 4. *Diceratherium cooki*. Carnegie Museum, No. 1555.

All figures $\frac{1}{2}$ natural size.

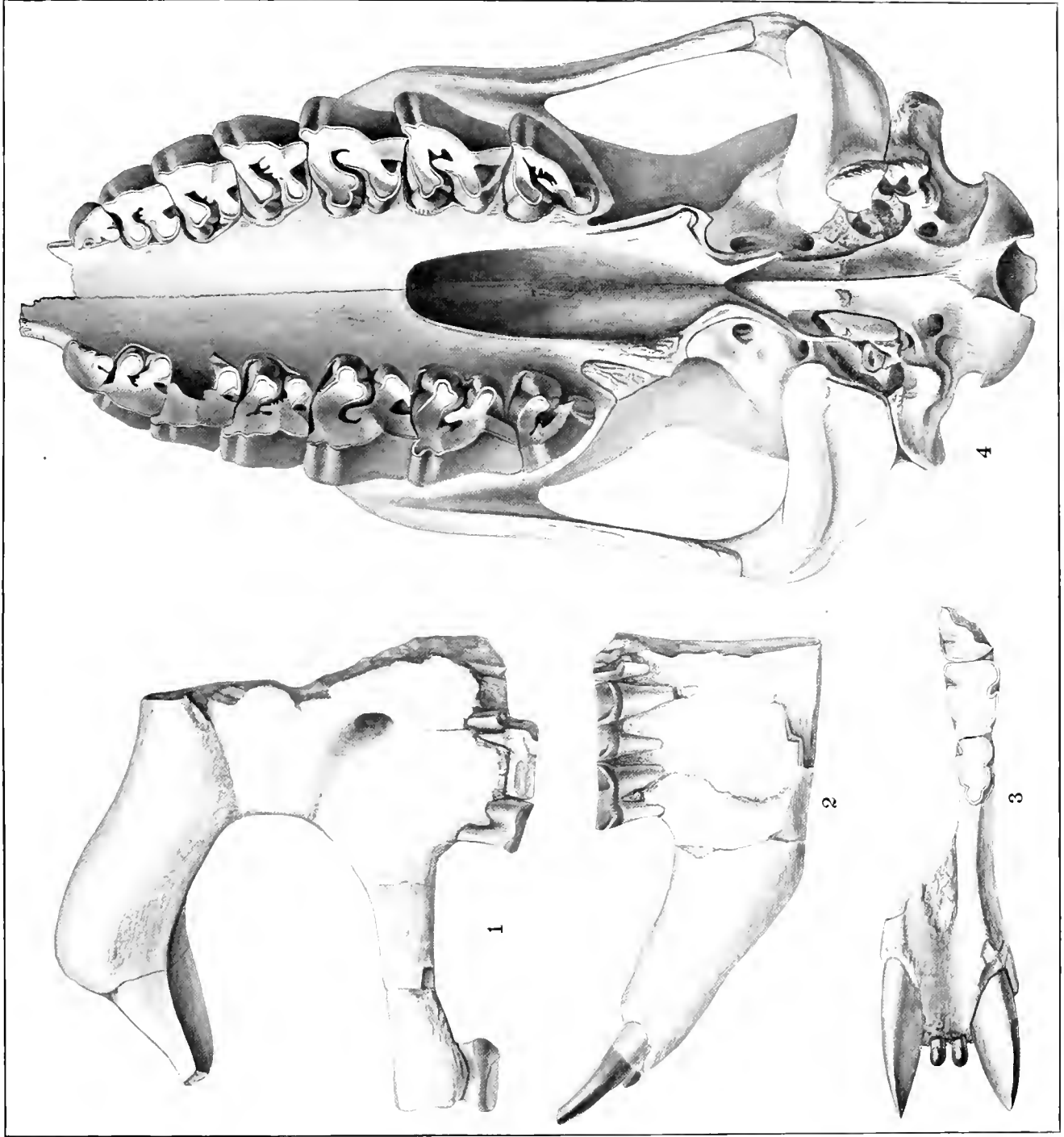


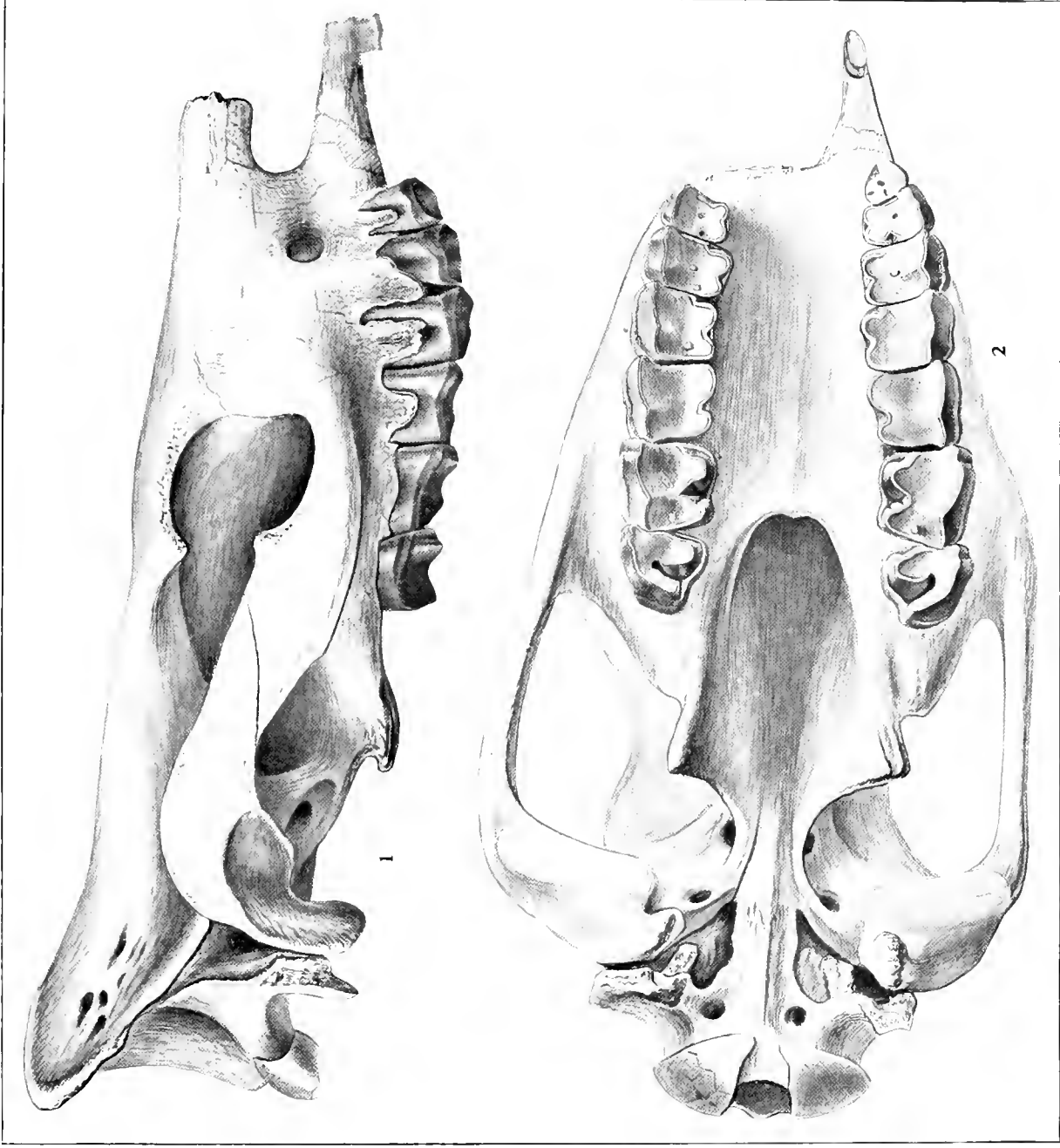
FIG. 1-3, TYPE OF *D. nanum* MARSH; FIG. 4, *D. cooki* PETERSON.

EXPLANATION OF PLATE LIX.

FIG. 1. *Diceratherium gregorii*, type. Side view of skull. American Museum of Natural History, No. 12933.

FIG. 2. *Diceratherium gregorii*, type. Palatal view of the same skull.

All figures $\frac{1}{3}$ natural size.



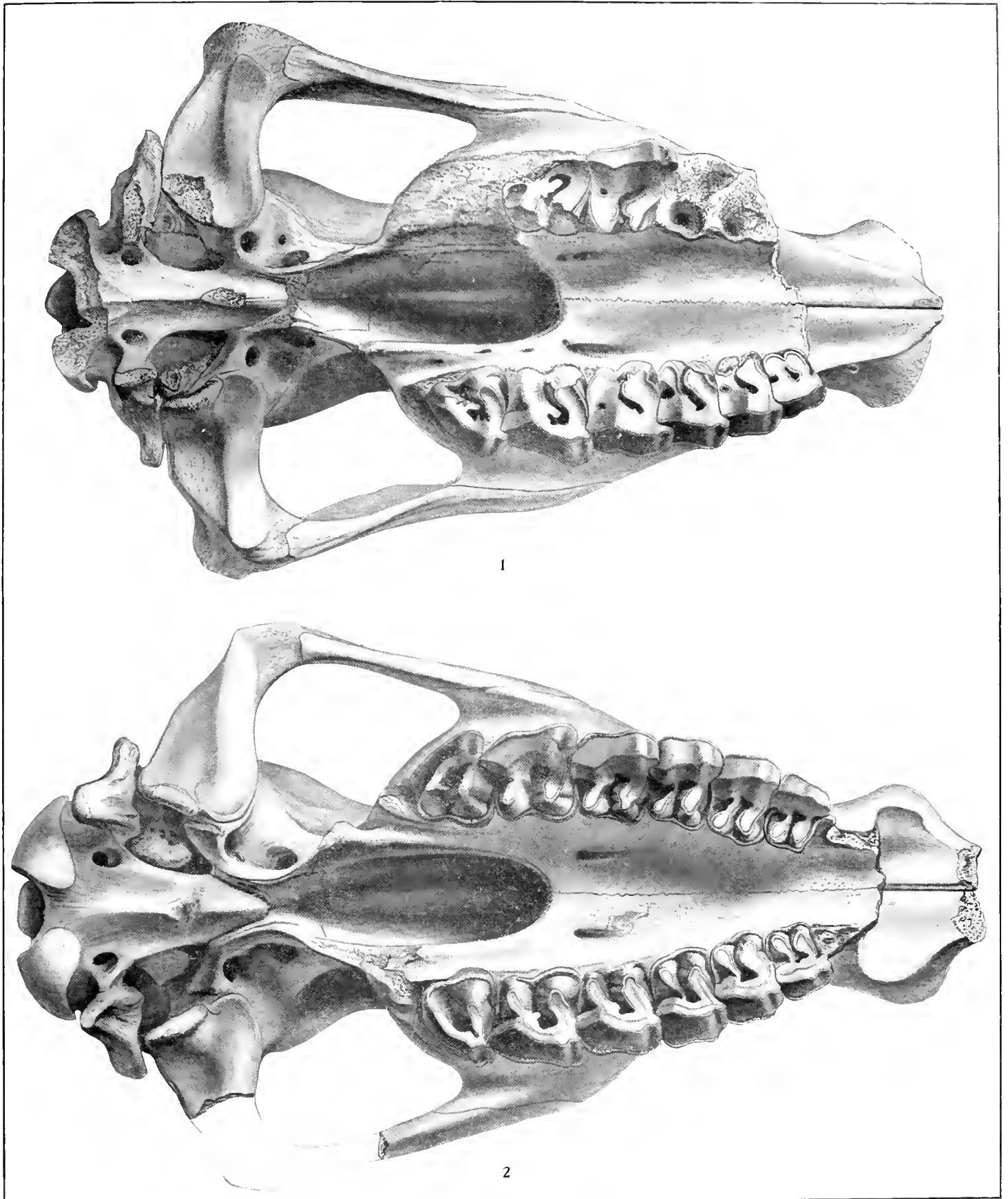
D. gregorii PETERSON.

EXPLANATION OF PLATE LX.

FIG. 1. *Diceratherium cooki* type. Carnegie Museum, No. 1572.

FIG. 2. *Diceratherium niobrarense* type. Carnegie Museum, No. 1271.

Fig. 1, $\frac{1}{2}$ natural size; Fig. 2, $\frac{1}{3}$ natural size.



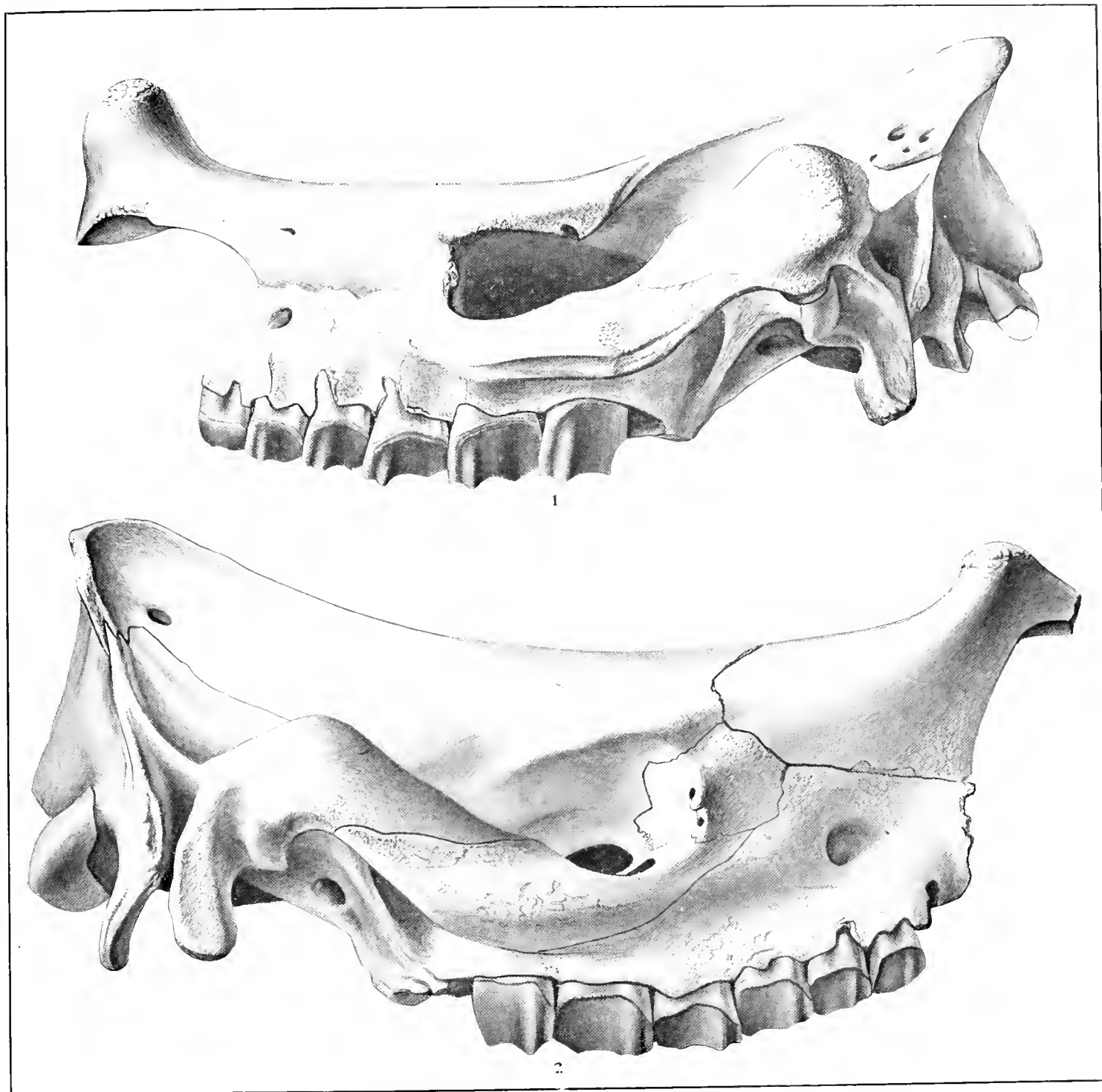
D. cooki PETERSON AND *D. niobrarensis* PETERSON.

EXPLANATION OF PLATE LXI.

FIG. 1. *Diceratherium cooki*, type. Carnegie Museum, No. 1572.

FIG. 2. *Diccratherium niobrarense*, type. Carnegie Museum, No. 1271.

Fig. 1, $\frac{1}{2}$ natural size; Fig. 2, $\frac{1}{6}$ natural size.



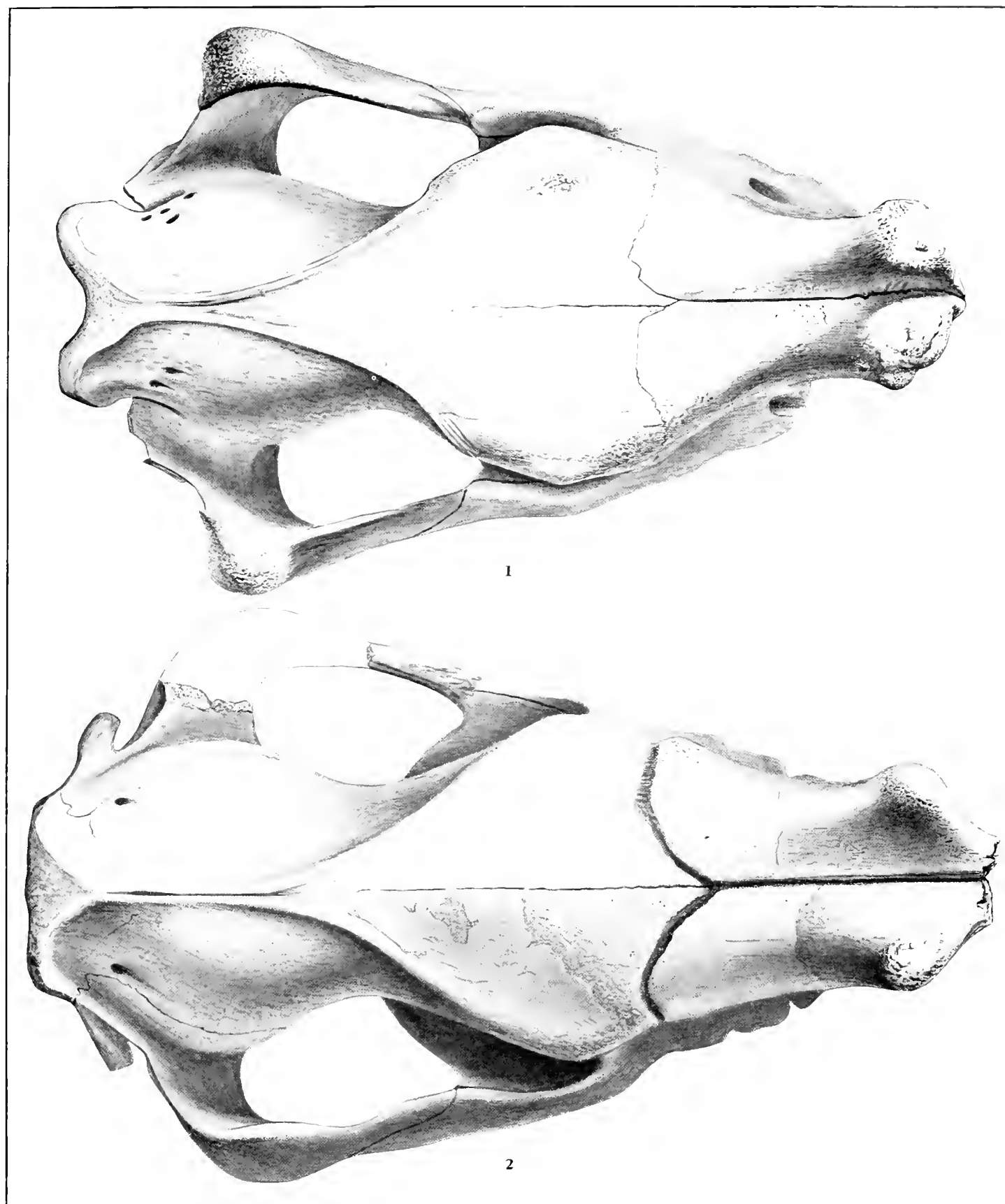
D. cooki PETERSON AND *D. niobrareuse* PETERSON.

EXPLANATION OF PLATE LXII.

FIG. 1. *Diccratherium cooki*, type. Carnegie Museum, No. 1572.

FIG. 2. *Diccratherium niobrarense*, type. Carnegie Museum, No. 1271.

Fig. 1, $\frac{1}{2}$ natural size; Fig. 2, $\frac{4}{9}$ natural size.

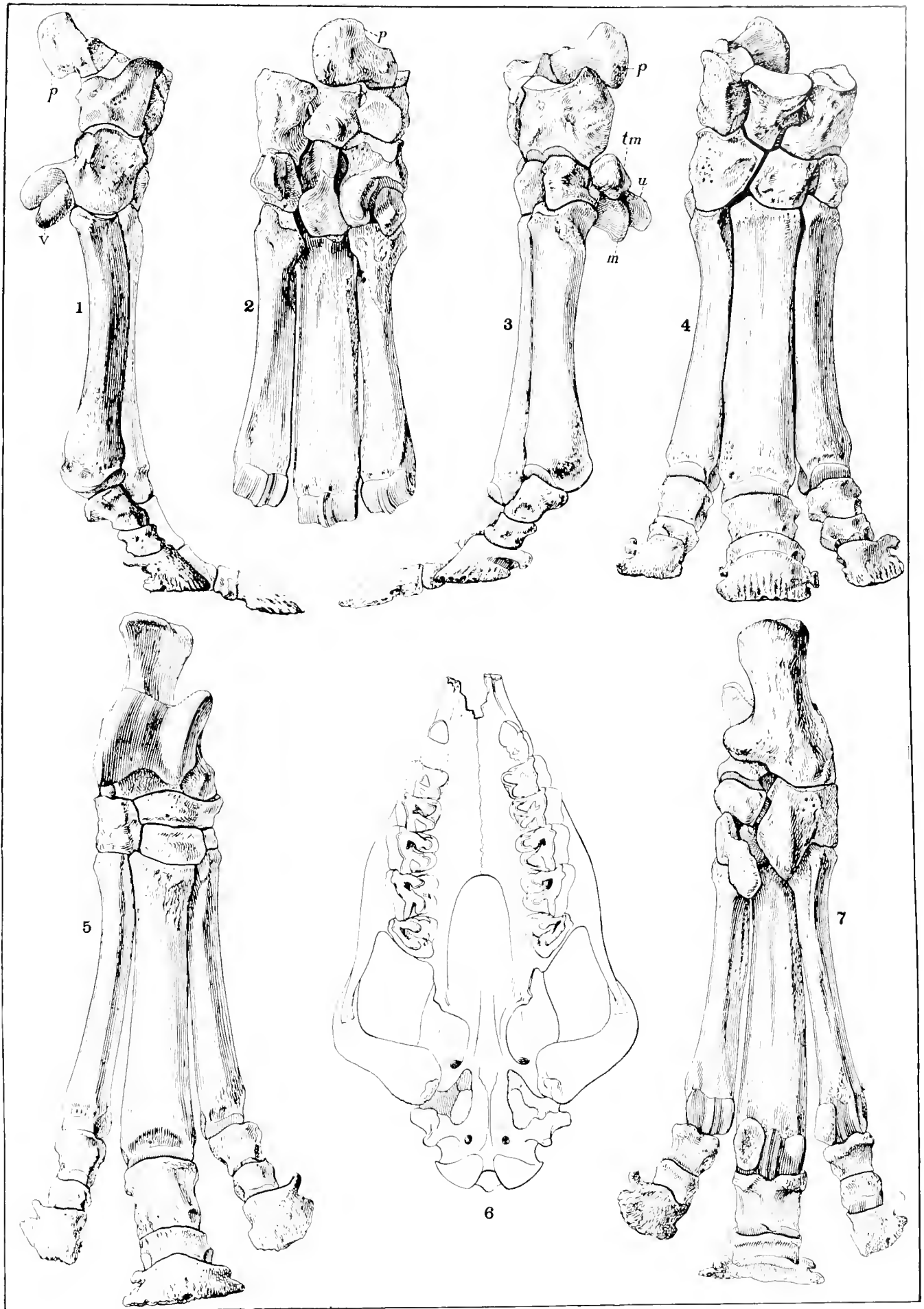


D. cooki PETERSON AND *D. niobrarense* PETERSON.

EXPLANATION OF PLATE LXIII.

- FIG. 1. *Dicratherium cooki*, ulnar view of manus, Carnegie Museum, No. 2473.
FIG. 2. *Dicratherium cooki*, palmar view of manus, Carnegie Museum, No. 2473.
FIG. 3. *Dicratherium cooki*, radial view of manus, Carnegie Museum, No. 2473.
FIG. 4. *Dicratherium cooki*, dorsal view of manus, Carnegie Museum, No. 2473.
FIG. 5. *Dicratherium cooki*, dorsal view of pes, Carnegie Museum, No. 1888.
FIG. 6. *Dicratherium annectens* hypotype, American Museum Natural History,
No. 7324, Cope Coll.
FIG. 7. *Dicratherium cooki*, plantar view of pes, Carnegie Museum, No. 1888.

All figures $\frac{1}{2}$ natural size except Fig. 6, which is $\frac{1}{4}$ natural size.



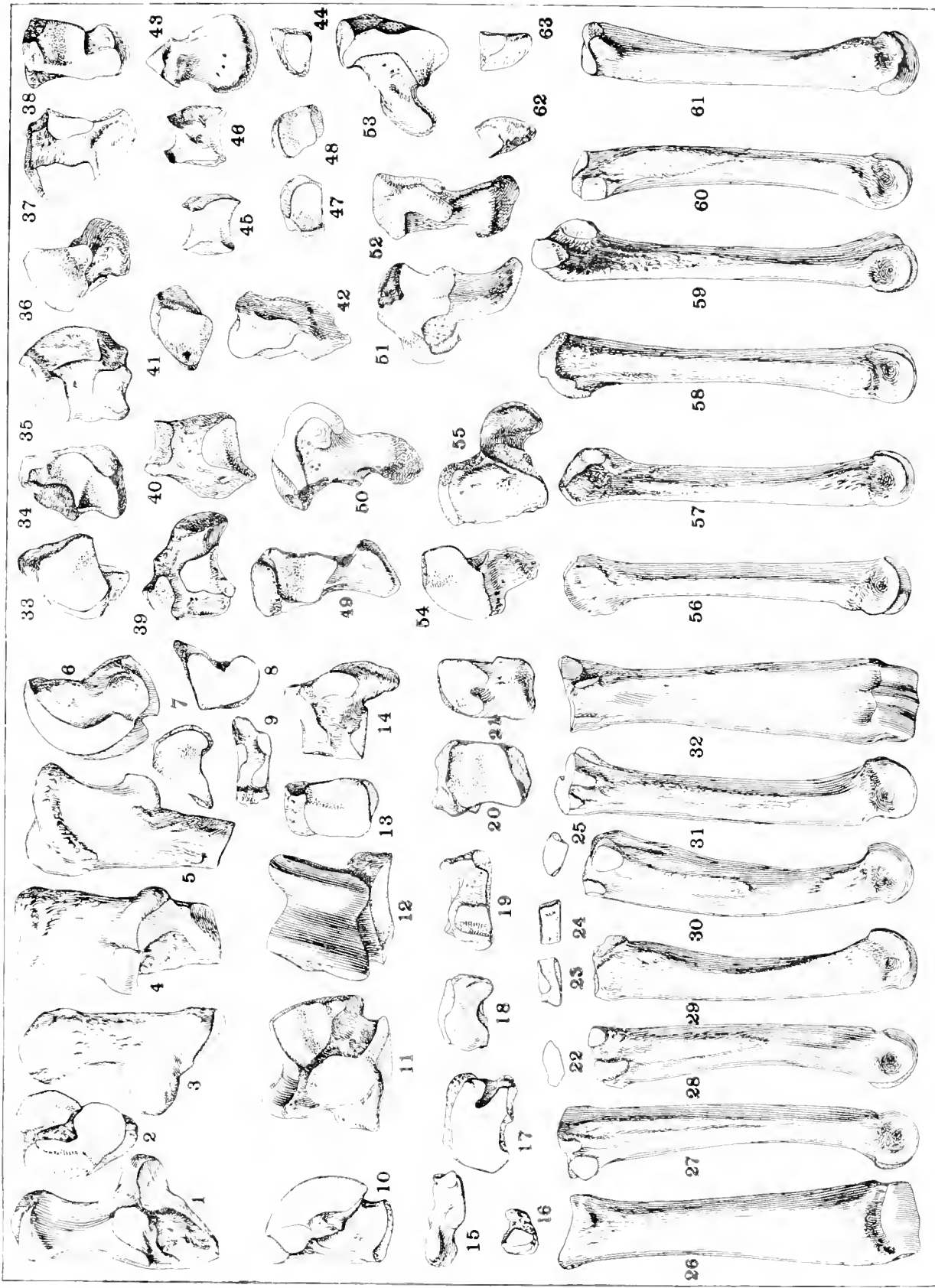
D. cooki PETERSON AND *D. annectens* (MARSH).

EXPLANATION OF PLATE LXIV.

Diceratherium cooki.

- Carnegie Museum, No. 1888.
- FIG. 1. Calcaneum, dorsal view.
 FIG. 2. Calcaneum, distal view.
 FIG. 3. Calcaneum, plantar view.
 FIG. 4. Calcaneum, tibial view.
 FIG. 5. Calcaneum, fibular view.
 FIG. 6. Astragalus, tibial view.
 FIG. 7. Ectocuneiform, proximal view.
 FIG. 8. Ectocuneiform, distal view.
 FIG. 9. Ectocuneiform, tibial view.
 FIG. 10. Astragalus, fibular view.
 FIG. 11. Astragalus, plantar view.
 FIG. 12. Astragalus, dorsal view.
 FIG. 13. Cuboid, proximal view.
 FIG. 14. Cuboid, tibial view.
 FIG. 15. Entocuneiform, fibular view.
 FIG. 16. Entocuneiform, distal view.
 FIG. 17. Navicular, distal view.
 FIG. 18. Navicular, posterior view.
 FIG. 19. Navicular, fibular view.
 FIG. 20. Navicular, proximal view.
 FIG. 21. Cuboid, distal view.
 FIG. 22. Mesocuneiform, distal view.
 FIG. 23. Mesocuneiform, fibular view.
 FIG. 24. Mesocuneiform, tibial view.
 FIG. 25. Mesocuneiform, proximal view.
 FIG. 26. Metatarsal III, dorsal view.
 FIG. 27. Metatarsal III, fibular view.
 FIG. 28. Metatarsal II, fibular view.
 FIG. 29. Metatarsal II, tibial view.
 FIG. 30. Metatarsal IV, tibial view.
 FIG. 31. Metatarsal III, tibial view.
 FIG. 32. Metatarsal III, plantar view.
- Carnegie Museum, No. 2453.
- FIG. 33. Scaphoid, proximal view.
- FIG. 34. Scaphoid, distal view.
 FIG. 35. Scaphoid, ulnar view.
- Carnegie Museum, No. 2453.
- FIG. 36. Lunar, proximal view.
 FIG. 37. Lunar, radial view.
 FIG. 38. Lunar, distal view.
 FIG. 39. Lunar, ulnar view.
 FIG. 40. Cuneiform, radial view.
 FIG. 41. Cuneiform, distal view.
 FIG. 42. Cuneiform, ulnar view.
- Carnegie Museum, No. 1853.
- FIG. 43. Pisiform, radial view.
 FIG. 44. Trapezium, ulnar view.
 FIG. 45. Trapezoid, radial view.
- Carnegie Museum, No. 2453.
- FIG. 46. Trapezoid, ulnar view.
 FIG. 47. Trapezoid, distal view.
 FIG. 48. Trapezoid, proximal view.
 FIG. 49. Magnum, distal view.
 FIG. 50. Magnum, ulnar view.
 FIG. 51. Magnum, radial view.
 FIG. 52. Magnum, proximal view.
 FIG. 53. Unciform, radial view.
 FIG. 54. Unciform, proximal view.
 FIG. 55. Unciform, ulnar view.
 FIG. 56. Metacarpal II, radial view.
 FIG. 57. Metacarpal II, ulnar view.
 FIG. 58. Metacarpal III, radial view.
 FIG. 59. Metacarpal III, ulnar view.
 FIG. 60. Metacarpal IV, radial view.
 FIG. 61. Metacarpal IV, ulnar view.
 FIG. 62. Metacarpal V, radial view.
 FIG. 63. Metacarpal V, palmar view.

All figures are $\frac{1}{2}$ natural size.



D. cooki PETERSON.

EXPLANATION OF PLATE LXV.

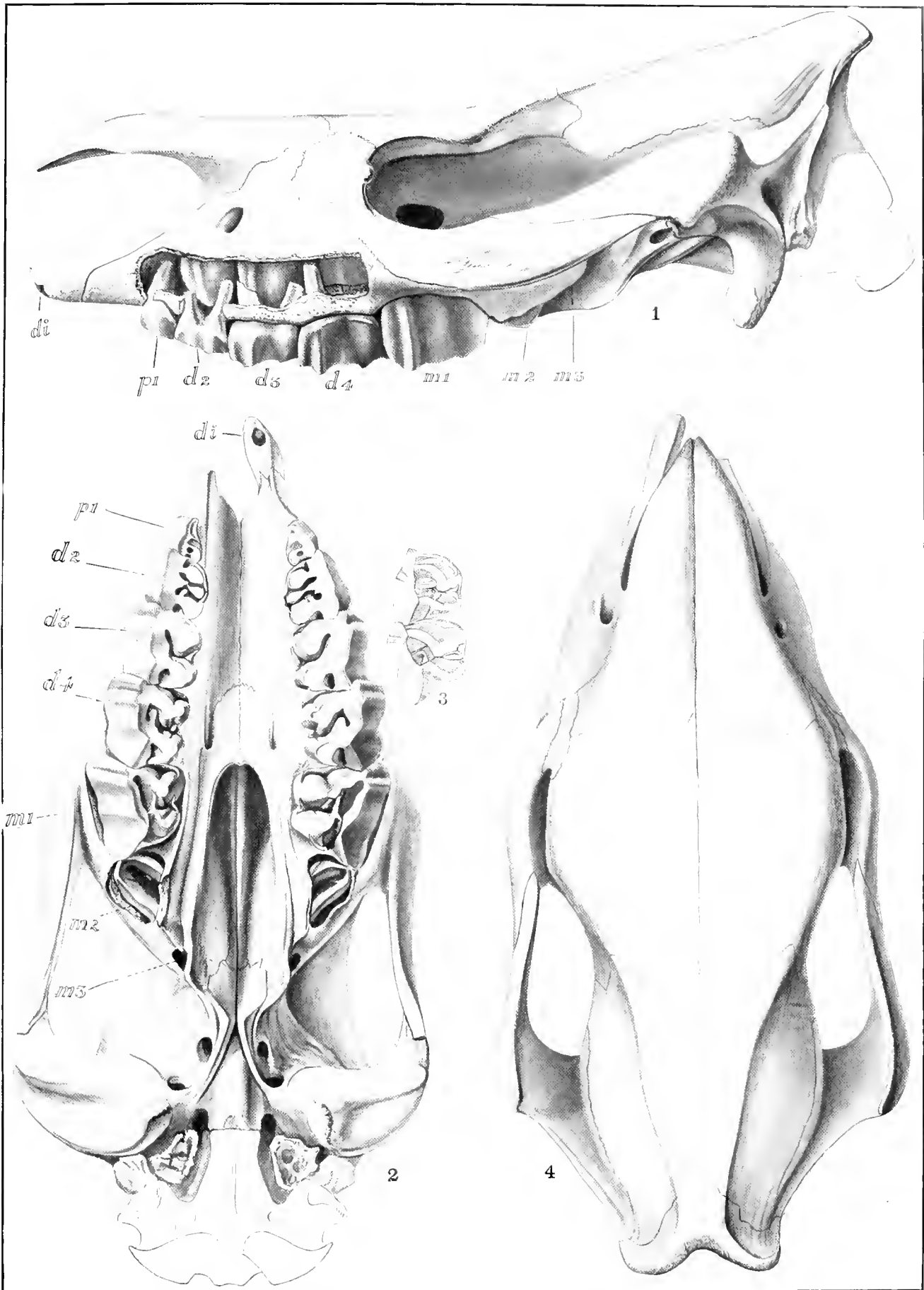
FIG. 1. *Dicratherium cooki*, young male, side view of skull. Carnegie Museum, No. 1848.

FIG. 2. *Dicratherium cooki*, Palatal view same as Fig. 1.

FIG. 3. *Dicratherium? annectens*, deciduous upper teeth, American Museum collection.

FIG. 4. *Dicratherium cooki*, top view of skull, same as Figs. 1 and 2.

All figures $\frac{1}{2}$ natural size.



D. cooki PETERSON AND *D. annectens* (MARSH).

EXPLANATION OF PLATE LXVI.

FIG. 1. *Diceratherium annectens*, hypotype, Side view of skull, American Museum, No. 7324, Cope Coll.

FIG. 2. *Diceratherium cooki*, upper contour of lower jaws and crown view of dentition. Carnegie Museum, No. 2499.

FIG. 3. *Diceratherium cooki*, outer view of mandible in very young stage of development. Carnegie Museum, No. 1820.

FIG. 4. *Diceratherium cooki*, outer view of mandible of fully adult male. Carnegie Museum, No. 2499.

FIG. 5. *Diceratherium cooki*, alveolar border of lower jaw and crown view of dentition. Carnegie Museum, No. 1923a.

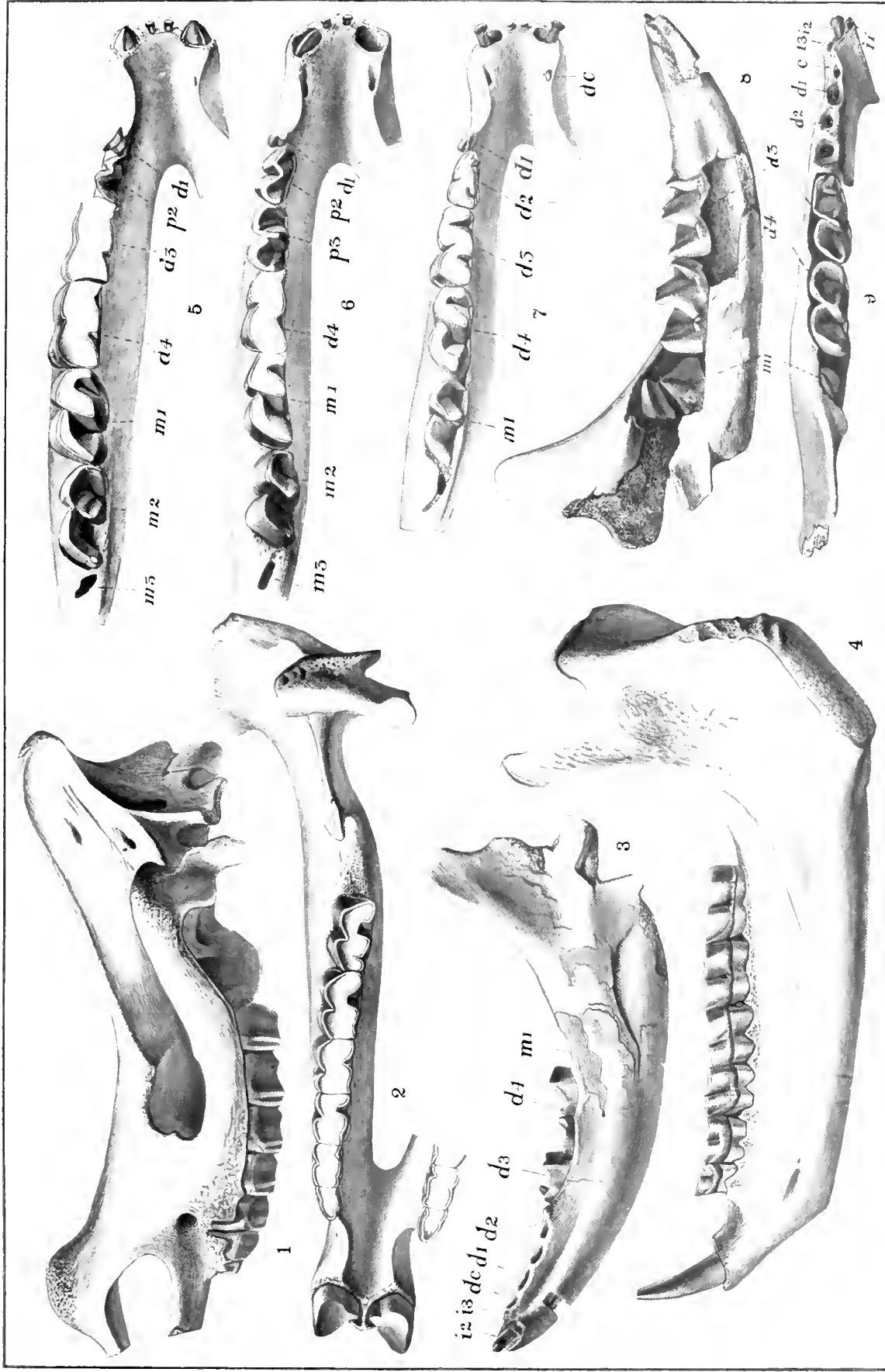
FIG. 6. *Diceratherium cooki*, alveolar border of lower jaw and crown view of dentition. Carnegie Museum, No. 1841.

FIG. 7. *Diceratherium cooki*, alveolar border and crown view of dentition. Carnegie Museum, No. 2476.

FIG. 8. *Diceratherium cooki*, inner view of mandible, very young stage of development, Carnegie Museum, No. 1820.

FIG. 9. *Diceratherium cooki*, upper contour of lower jaw and crown view of dentition, same as Nos. 3 and 8.

Fig. 1 is $\frac{1}{4}$ natural size; Figs. 2 and 4 are $\frac{1}{3}$ natural size; Figs. 3, 5, 6, 7, 8, and 9 are $\frac{1}{2}$ natural size.



D. cooki PETERSON AND *D. annectens* (MARSH).

INDEX.

- aberrans, *Diceratherium*, 432
Acanthopoma, 261, 269
 annectens, 354, 355
acuminatus, *Oxybelis*, 211
aesculapii, *Erythrolamprus*, 207
affinis, Baëna, 109
agassizi, *Aphyocharax*, 12, 23, 36
 Cheirodon, 3
Agkistrodon piscivorus, 227
Aglypha, 170
ahætulla, *Leptophis*, 184
albirostris, *Helminthophis*, 166
albiventris, *Liophis*, 187
alburnus, *Aphyocharax*, 3, 12, 13, 23, 24,
 25, 27, 29
 Paragoniates, 3, 12, 40, 41
almadensis, *Liophis*, 187
alteruatum, *Pygidium*, 327, 328, 336
amazonicum, *Pygidium*, 327, 328, 336
amazoni, *Priobrama*, 39
Amblycephalidæ, 221
ammon, *Testudo*, 151, 154
amphithorax, *Testudo*, 155
Amyda, 101
 crassa, 155
 egregia, 155, 156
 scutumantiquum, 155, 157
anceps, *Glyptosaurus*, 160
Anguidæ, 159
angulata, *Helicops*, 179
Anisits, J. D., 2, 74
anisitsi, *Aphyocharax*, 12, 13, 23, 29, 30,
 33
 Homodiætus, 351
annæ, *Cheirodon*, 7, 12, 64, 67, 68, 69, 76
annectens, *Acanthopoma* 355
 Diceratherium 403, 411, 416, 417,
 420, 422
annulata, *Leptodeira*, 210
Anosteira, 101
 ornata, 102, 121, 122
antiqua, Baëna, 109
Aphyocharax, 9, 15
 agassizi, 12, 23, 36
 alburnus, 3, 12, 13, 23, 24, 25, 27, 29
 anisitsi, 12, 13, 23, 29, 30, 33
 avary, 12, 23, 24, 30, 31
 dentatus, 3, 12, 13, 23, 24, 25, 26, 28
 erythrus, 12, 23, 24, 28
 filigerus, 37
 maxillaris, 12, 23, 25, 37
 melanotus, 23
 nattereri, 12, 23, 24
 paraguayensis, 12, 24, 25, 33
 puleher, 3
 pusillus, 12, 13, 22, 23, 24, 28, 29
 rathbuni, 12, 24, 31, 32
 stramineus, 32
 Key to the species of, 24
Aphyocheirodon, 5, 8, 16
 hemigrammus, 12, 58, 59
Aphyodite, 5, 16, 48
 grammica, 12, 47
Aporophis flavifrenatus, 170
 lineatus, 170
 melanocephalus, 171
areolata, *Hatcheria*, 285
arenosa, Baëna, 107, 108, 109, 121
Argopleura, 11
armatum, *Diceratherium*, 404, 413–416,
 419, 426
armillatus, *Pariolus*, 260
Atractus badius, 172
 roulei, 173
 tæniatus, 173
australis, *Pimelodella*, 230, 231, 233
avanhandavæ, *Pimelodella*, 232, 240, 253
avary, *Aphyocharax*, 12, 23, 24, 30, 31

- azurea*, *Eichornea*, 357, 367
badius, *Atractus*, 172
Baëna affinis, 109
 antiqua, 109
 arenosa, 107, 108, 109, 121
 clara, 110, 116, 121
 emiliae, 109, 111, 114, 119
 gigantea, 116, 117, 118, 119
 hatcheri, 117, 118, 119
 inflata, 107, 108, 112, 113, 115, 117,
 118
 platyplastra, 120
 riparia, 118
 sima, 112, 115, 117, 121
Baënidæ, 101, 107
 "Bagre," 280
 molle, 267
banneoui, *Pygidium*, 307, 318
Barbour, Thomas, 274
barbouri, *Pygidium*, 274, 297, 303
batrachostoma, *Ochmacanthus*, 356, 367
Bertoni, Sr. A. de, 274
bertonii, *Branchioica*, 268, 269, 367, 368
bicornis, *Rhinoceros*, 444
bifossatus, *Drymobius*, 176
bitorquata, *Clelia*, 201
Boa cooki, 167
 hortulana, 167
bocourti, *Leptophis*, 184
boddaerti, *Drymobius*, 177
bogotense, *Pygidium*, 306, 315, 316, 318
bogotensis, *Pœcilia*, 17
Boidæ, 167
boliviana, *Pimelodella*, 230, 231, 233, 245
bondensis, *Helminthophis*, 165
borellii, *Pygidium*, 294
Bramocharax, 10
Branchioica, 262, 359
 bertonii, 268, 269, 274, 367, 368
brasiliense, *Pygidium*, 295, 327, 329, 337
brasiliensis, *Pimelodella*, 230, 232, 242
 Pygidium, 336, 338
brevidens, *Glyptosaurus*, 160
brevis, *Tridens*, 370
brontops, *Testudo*, 154
Bryan, W. L., President Indiana Uni-
 versity, 1
buckleyi, *Pimelodella*, 230, 231, 232, 240,
 241, 245
burmeisteri, *Hatcheria*, 283, 286
cæcutiens, *Cetopsis*, 263
Cænopus dakotensis, 402
 mitis, 435
 tridactylus, 402, 446, 448
caliense, *Pygidium*, 306, 311
calliurus, *Cheirodon*, 76, 77
callopyge, *Echmatemys*, 123, 124, 125,
 126, 127, 132, 134
Cambeja, 267
 "Candirú," 262-263
 Cetopsis, 263
 "Capitan," 343
carinatus, *Herpetodryas*, 183
carinicauda, *Helicops*, 179
Carriker, Jr., M. A., 274
catesbyi, *Cochliophagus*, 221
Cenchoa, *Himantodes*, 208
cenehria, *Epierates*, 168
Cetopsinæ, 276
Cetopsis cæcutiens, 262, 263
 candirú, 263
chagresi, *Pimelodella*, 230, 231, 252, 253
chapmani, *Pygidium*, 305, 309
Cheirodon, 16
 agassizi, 3
 annæ, 6, 12, 64, 67, 68, 69, 76
 calliurus, 76, 77
 eques, 3, 52
 gorgonæ, 70
 ibicuhyensis, 12, 65, 74
 insignis, 12, 65, 70
 interruptus, 3, 6, 12, 57, 65, 71, 72,
 74, 76, 77
 madeira, 12, 65, 76
 microdon, 12, 64, 66, 80, 81
 micropterus, 77
 monodon, 12, 65, 71, 72, 73, 74
 nattereri, 35
 notomelas, 7, 12, 65, 74, 75
 parahybæ, 12, 65, 70

- Cheirodon* pequirã, 83
 piaba, 7, 9, 11, 12, 65, 71, 72, 76, 77, 79, 80
 pisciculus, 2, 6, 12, 13, 64, 65, 67, 68
 pulcher, 3, 35
 ribeiroi, 63
 steindachneri, 35
 stenodon, 66, 80, 82
 Key to the species of, 65
- Cheirodontinæ* (The), a Subfamily of Minute Characid Fishes of South America, By Carl H. Eigenmann, 1-99
 Anal fin of, 6
 Distribution of, 11, 12
 Dorsal fin of, 6
 Generalized type of, 3, 4, 5
 Highest altitude of, 14
 In various museums, 2
 Key to the genera of, 14
 Mouth of, 6
 Museums containing species of, 2
 Phylogenic arrangement of the genera of, 13
 Relationship of the, 10
 Secondary sexual differences, 11
 Teeth of, 6, 9
 See also Errata and Corrigenda, p. xxiii
- Chelonian fauna of the Uinta, last appearance of the, 101
- cibollensis*, *Echmatemys*, 139
cirrhusa, *Vandellia*, 263, 358, 360
cisternarum, *Phreatobius*, 371, 372
clara, *Baëna*, 110, 116, 121
Clelia bitorquata, 201
 clælia, 201
 doliata, 202
 euprepa, 203
 petolaria, 205
 rhombifer, 205
 trigemina, 206
- Cobitiglanis taxistigma*, 345
 "Cobra de Agua," 182
Cochliophagus catesbyi, 221
 Coggeshall, Arthur S., 103
 Colubridæ, 170
- Colubrinæ, 170
colubrinus, *Xenodon*, 199
columbianus, *Elaps*, 216
Compsura, 10, 13, 16
 heterura, 6, 12, 60, 61
conradi, *Pygidium*, 325
Constrictor constrictor, 168
cooki, *Boa*, 167
 Diceratherium, 403-409, 411, 420, 421, 425, 428, 431, 433, 448
- Corais*, *Elaphe*, 174
corallinus, *Elaps*, 217
corduvense, *Pygidium*, 292, 293
coronata, *Pseudoboa*, 206
Coronella micropholis, 176
corsoni, *Hadrianus*, 143, 144, 145, 146, 148
crassa, *Amyda*, 155
cristata, *Pimelodella*, 230, 231, 236, 237
cristatus, *Pimelodus*, 229
croizeti, *Diceratherium*, 448
Crotalina, 222
Crotalus terrificus, 226
cyanostigma, *Pimelodella*, 230, 231, 232, 242
cyclolepis, *Parecbasis*, 12, 44, 45, 46
- dakotensis*, *Cænopus*, 402
davisi, *Pygidium*, 327, 331, 334
dentatus, *Aphyocharax*, 3, 12, 13, 23, 24, 25, 26, 28
depressa, *Echmatemys*, 139, 140, 141
 Dermatemydidæ, 121
Diceratheres, The American. By O. A. Peterson, 399-476
 Early investigations, 400-401
 Stratigraphy, 401
- Diceratherium aberrans*, 432
annectens, 403, 411, 416, 417, 420, 421, 422
armatum, 404, 413, 416, 419, 426
arrikarense, 432
cooki, 403-409, 411, 420, 421, 425, 428, 431, 433, 448
croizeti, 448
douvillei, 404
gregorii, 421

- Diceratherium hesperius*, 411
 loomisi, 433
 minutum, 404
 niobrarense, 403, 414, 420, 422, 424, 425
 pacificus, 410
 petersoni, 413
 schiffi, 432
 truquianum, 412
dichroa, *Elaphe*, 174
Dimades plicatilis, 175
Dipsadomorphinae, 201
dispar, *Pygidium*, 297, 299
doliata, *Clelia*, 202
dorsostriatum, *Pygidium*, 290, 307, 320
Douglass, *Earl*, 101, 103
doulassi, *Echmatemys*, 128, 130, 131, 132
douvillei, *Diceratherium*, 404
drepanon, *Odontostilbe*, 3, 12, 90, 92
Drymobius bifossatus, 176
 boddaerti, 177
 boddaerti var. *rappii*, 177
 rhombifer, 178

Echmatemys callopyge, 123, 124, 125, 126, 127, 132, 134
 eibollensis, 139
 depressa, 139, 140, 141
 doulassi, 128, 130, 131, 132
 eutmeta, 139
 hollandi, 132, 135
 lativertebralis, 133
 megaulax, 132, 139, 141
 obscura, 135, 136, 137, 138, 139
 pusilla, 140, 141, 142
 septaria, 124, 125, 126, 127
 stevensoniana, 132
 uintensis, 127, 131
ecuadorensis, *Megalampodus*, 2, 12, 99
egregia, *Amyda*, 155, 156
egrerius, *Aceratherium*, 426
Eichornea azurea, 357, 367
eichorniarum, *Pygidium*, 295
Eigenmann, *Carl H.*, *The Cheirodontinae*, a Subfamily of Minute Characid Fishes of South America, 1-99
 Eigenmann, *Carl H.*, *Pimelodella* and *Typhlobagrus*, 229-258
 Pygidiidae (The), a Family of South American Catfishes, 259-398
 eigenmanni, *Pimelodella*, 230, 231, 234, 241, 248
 Pygidium, 297, 298
 eigenmanniorum, *Pimelodella*, 241
 elaoides, *Liophis*, 187
 Elaphe corais, 174
 dichroa, 174
 Elapinae, 216
 Elaps colombianus, 216
 corallinus, 217
 frontalis, 218
 hollandi, 218
 nupartitus, 219
 narducei, 220
 princeps, 220
 elongata, *Pimelodella*, 230, 231, 252, 254
 emiliae, *Baëna*, 109, 111, 114, 119
 Epierates cenchria, 168
 var. *fusca*, 169
 eques, *Cheirodon*, 3, 52
 Megalampodus, 12, 50, 52
 Eremophilus, 260
 mutisii, 270, 341
 a food fish, 260
 Erythrolamprus æsculapii, 207
 erythrurus, *Aphyocharax*, 12, 23, 24, 28
 Eumectes murinus, 169
 notaeus, 169
 euprepa, *Clelia*, 203
 eutania, *Pimelodella*, 230, 231, 252, 254
 eutmeta, *Echmatemys*, 139
 exornata, *Testudo*, 154

 fasciata, *Natrix*, 227
 fasciatus, *Phrynonax*, 194
 fassli, *Pygidium*, 298, 303
 filigera, *Prionobrama*, 38, 39, 40
 filigerus, *Aphyocharax*, 37, 3, 12, 13
 Fisher, *Carl G.*, 1
 flabelliferus, *Ochmacanthus*, 356, 357
 flavifrenatus, *Aporophis*, 170
 frontalis, *Elaps*, 217

- fugitiva*, *Odontostilbe*, 90, 92, 93
fulgidus, *Oxybelis*, 212
fuseum, *Pygidium*, 288, 296, 298
fuscus, *Herpetodryas*, 183
- Gephyrocharax*, 37
gigantea, *Baëna*, 116, 117, 118, 119
 Gilmore, Charles W., *The Fossil Turtles of the Uinta Formation*, 101-161
Glyptosaurus, 102, 159
 - anceps*, 160
 - brevidens*, 160
 - montanus*, 160
 - nodosus*, 160
 - ocellatus*, 160
 - princeps*, 160
 - rugosus*, 160
 - sphenodon*, 160
 - Geological arrangement from deposits of North America, 160
- goeldii*, *Pygidium*, 327, 328, 337, 339
 Gonzales, Manuel, 274
gorgonæ, *Cheirodon*, 70
gracilior, *Pygidium*, 325, 326
gracilis, *Pimelodella*, 230, 231, 232, 237, 238, 239, 251
grammica, *Aphyodite*, 12, 47
gregorii, *Diceratherium*, 421
 Griffin, Lawrence Edmonds, *A Catalog of the Ophidia from South America at present (June, 1916) in the Carnegie Museum with Descriptions of Some New Species*, 163-227
griffini, *Pimelodella*, 235, 250
grisea, *Pimelodella*, 230, 231, 251, 252
Grundulus, 3, 6, 8, 10, 14, 20
 - bogotensis*, 12, 17, 18
- guaporensis*, *Microschemobrycon*, 12, 56
 "Guapuche," 17
guianense, *Pygidium*, 325
 - Rhinostoma*, 214
- Gyrinurus*, 367
- Hadrianus*, 102
 - corsoni*, 143, 144, 145, 146, 148
 - majuseculus*, 146, 148, 150
- Hadrianus octonarius*, 145
 - robustus*, 146, 147, 148
 - tumidus*, 147, 148, 150
 - utahensis*, 148, 149
- hartti*, *Pimelodella*, 230, 231, 235, 248
 Haseman, John D.: *Travels in South America*, 163, 164, 275
basemani, *Pimelodella*, 230, 231, 232, 241
 - Pygidium*, 325, 326
 - Vandellia*, 359, 360
- hastata*, *Odontostilbe*, 10, 12, 90, 91
 Hatcher, J. B., 274
hatcheri, *Baëna*, 117, 118, 119
Hatcheria, 260
 - areolata*, 285
 - burmeisteri*, 283, 286
 - maerai*, 283, 287
 - maculata*, 282, 284
 - patagoniensis*, 281, 282
 - titecombi*, 283, 284
 - Key to the species of, 282
- Hay, Dr. O. P., 103, 104
Helicops angulata, 179
 - carinicauda* (Wied) var. *infrataeniata* Jan.
 - leopardina*, 180
 - modesta*, 181
 - polylepis*, 181
- Helminthophis albirostris*, 166
 - bondensis*, 165
- Hemigrammus*, 5
 - hemigrammus*, *Aphyocheirodon*, 12, 58, 59
- Henn, Arthur W., 99, 274
Henochilus, 2
Hemionemus, 261, 269, 277
 - intermedius*, 349
 - macrops*, 346
 - mierops*, 353
 - punctatus*, 345, 346
 - punctatus*, 345, 346
 - taxistigma*, 346, 348
- Heptapterus*, 260, 276
Herpetodryas carinatus, 183
 - var. *flavolineatus*, 183
 - fuscus* 183

- Herpetodryas fuscus* var. *saturninus*, 183
hesperius, *Dicratherium*, 411
 Rhinoceros, 410
heterodon, *Holesthes*, 3, 12, 84, 87, 88
heterodontum, *Pygidium*, 296
Heterognathi, 14
heterostomus, *Probolodus*, 12
heterura, *Compsura*, 6, 12, 60, 61
Himantodes cenchoa, 208
histricus, *Lystrophis*, 192
Holesthes, 17, 83
 heterodon, 3, 12, 84, 87, 88
 pequira, 3, 12, 84, 86
 Key to the species of, 84
Holland, W. J., 1, 101, 103
hollandi, *Echmatemys*, 132, 135
 Elaps, 218
Holoprion maxillaris, 23
 nattereri, 23
 paraguayensis, 23
Homodietus, 261, 269, 274, 345
 anisitsi, 351
 maculatus, 351, 352
hortulana, *Boa*, 167
Hyphessobrycon, 5, 62

ibicuhyensis, *Cheirodon*, 12, 65, 74
Ihering, H. von, 2, 274
iheringi, *Pygidium*, 327, 328, 330
immaculatum, *Pygidium*, 327, 328, 334
Indiana University Expedition to South America, 2
inermis, *Nematogenys*, 280
 Trichomycterus, 279
inflata, *Baëna*, 107, 108, 112, 113, 115, 117, 118
insidiosus, *Stegophilus*, 267, 353, 354
insignis, *Cheirodon*, 12, 65, 69, 70
intermedius, *Henonemus*, 349
interruptus, *Cheirodon*, 3, 6, 12, 57, 65, 71, 72, 74, 76, 77
itapicuruensis, *Pimelodella*, 230, 231, 234, 247
itatayae, *Pygidium*, 327, 329

jatuaranae, *Leptobrycon*, 7, 12, 40
Kennedy, Clarence, drawings by, 1
Kerby, J. O. Serpents collected by, 165
kneri, *Pygidium*, 290, 306, 314
kronci, *Typhlobagrus*, 230, 255

Lachesis lanceolatus, 222
 lansbergi, 223, 224
 mutus, 224
 neuwiedi, 224
 peruvianus, 226
lanceolatus, *Lachesis*, 222
Landon-Fisher Expedition to South America, 2
lansbergi, *Lachesis*, 223, 224
lateristriga, *Pimelodella*, 230, 231, 245, 249, 250
laticeps, *Pimelodella*, 230, 231, 233, 243
 Pygidium, 305, 307
latidens, *Pygidium*, 306, 312
latistriatum, *Pygidium*, 307, 318, 321
lativertebralis, *Echmatemys*, 133
leopardina, *Helicops*, 180
Leptagoniates, 6, 10, 15
 steindachneri, 3, 12, 42
Leptobrycon, 15, 48
 jatuaranae, 7, 12, 40
Leptodeira annulata, 210
Leptophis abietulla, 184
 bocourti, 184
 nigromarginatus, 185
 occidentalis, 185
 rostralis, 186
Leptorhamdia, 260
lineatus, *Aporophis*, 170
Link, G. A., Collections of snakes made by, 163
Liophis albiventris, 187
 almadensis, 187
 elaeoides, 187
 melanostigma, 189
 melanotus, 189
 pœcilogyrus, 190
 reginae, 191
 viridis, 192
Localities in South America at which John D. Haseman collected reptiles, 164

- loomisi, Diceratherium, 433
 Loricariidæ, 263
 Lystrophis histrius, 192
 semieinctus, 193
- maeraei, Hatcheria, 282, 287
 maerops, Henonemus, 346
 Macropsobrycon, 16, 47
 uruguayana, 7, 12, 48, 49
 macturki, Pimelodella, 230, 231, 234, 248
 maculata, Hatcheria, 282, 284
 maculatus, Homodiætus, 351, 352
 madeiræ, Cheirodon, 12, 65, 76
 Odontostilbe, 3, 12, 90, 91, 97
 Prionobrama, 37
 majusculus, Hadrianus, 146, 148, 150
 marmoratum, Pygidium, 290
 Matthew, W. D., 103
 maxillaris, Aphyocharax, 12, 23, 25, 37
 Holoprion, 23
 meeki, Pimelodella, 230, 231, 235, 249
 Megalamphodus, 16, 47, 48
 ecuadorensis, 2, 12, 99
 eques, 12, 50, 52
 heteresthes, 12, 50, 53, 54
 megalopterus, 4, 7, 12, 49, 50, 51, 54
 melanotus, 12, 50, 53
 micropterus, 7, 10, 12, 50, 54, 55
 megalops, Pimelodella, 230, 231, 232, 242
 megalopterus, Megalamphodus, 4, 7, 12,
 49, 50, 51, 54
 megaulax, Echmatemys, 132, 139, 141
 melandeta, Odontostilbe, 9, 12, 90, 91, 98
 melanocephala, Tantilla, 209
 melanocephalus, Aporphis, 171
 melanops, Tridens, 369
 melanostigma, Liophis, 189
 melanotus Aphyocharax, 12, 23, 25, 37
 Liophis, 189
 Megalamphodus, 12, 50, 53
 meridæ, Pygidium, 290, 306, 315
 merremi, Rhadinea, 195, 196
 Xenodon, 199
 "Metacænopus" (Aceratherium) stigeri,
 429
 metæ, Pimelodella, 230, 231, 233, 242
 meta, Pygidium, 290, 295, 306, 312
 microcephala, Odontostilbe, 12, 85, 94
 microdon, Cheirodon, 12, 64, 66, 80, 81
 micropholis, Coronella, 176
 microps, Henonemus, 355
 Pareiodon, 343, 344
 micropterus, Cheirodon, 77
 Megalamphodus, 7, 10, 12, 50, 54, 55
 Microsehemobrycon, 5, 7, 16
 guaporensis, 12, 56
 microstomus, Oligobrycon, 6, 12, 56, 57
 minutum, Diceratherium, 404
 Pygidium, 327, 329, 340
 mipartitus, Elaps, 219
 Miuroglanis, 262
 platycephalus, 370, 371
 Mixobrycon, 5, 10, 16
 ribeiroi, 12, 62, 63
 modesta, Helicops, 181
 Pimelodella, 230, 231, 251, 252
 monodon, Cheirodon, 12, 65, 71, 72, 73, 74
 montanus, Glyptosaurus, 160
 mucosa, Pimelodella, 230, 231, 235, 250
 murinus, Eunectes, 169
 mutisii, Eremophilus, 270, 341
 mutus, Lachesis, 224
 Myoglanis, 260 (*err*) (*Cf.* Errata and Cor-
 rigenda)
- narducei, Elaps, 220
 Natrix fasciata fasciata, 227
 nattereri, Aphyocharax, 12, 23, 24
 Cheirodon, 35
 Holoprion, 23
 Philodryas, 212
 Thamnodynastes, 215
 Nematogenyina, 259, 275
 Nematogenys, 259, 279
 inermis, 280
 nemurus, Pseudostegophilus, 349, 350
 neuwiedi, Lachesis, 224
 Xenodon, 200
 nigricans, Pygidium, 289, 327, 328, 329
 nigromaculatum, Pygidium, 306, 316, 317,
 318
 nigromarginatus, Leptophis, 185

- niobrarense*, *Diceratherium*, 403, 414, 420, 422, 424, 425
nodosus, *Glyptosaurus*, 160
notaeus, *Eumectes*, 169
notomelas, *Cheirodon*, 7, 12, 65, 75, 74
Pimolodella, 230, 231, 233, 244
obscura, *Echmatemys*, 135, 136, 137, 138, 139
occidentalis, *Leptophis*, 185
Rhinoceros, (*Cænopus*) 411
occipitalis, *Rhadinea*, 195
ocellatus, *Glyptosaurus*, 160
Ochmacanthus, 261, 345
batrachostoma, 356
flabelliferus, 356, 357
(*Gyrinurus*) *batrachostoma*, 367
reinhardti, 356, 357
Key to the species of, 356
octonarius, *Hadrianus*, 145
Odontostilbe, 17
drepanon, 3, 12, 90, 92
fugitiva, 90, 92, 93
hastata, 10, 12, 90, 91
melandeta, 9, 12, 90, 91, 98
microcephala, 12, 85, 94
paraguayensis, 12, 90, 96, 97
pulehra, 2, 12, 95
Key to the species of, 90
offersi, *Philodryas*, 213
Oligobrycon, 7, 16
microstomus, 6, 12, 56, 57
operculatum, *Scleronema*, 280
Ophidia: A Catalog of the Ophidia from South America at Present (June, 1916) Contained in the Carnegie Museum with Descriptions of some New Species. By Lawrence Edmonds Griffin, 163-227
Opisthoglypha, 201
orbignianum, *Pseudoplatystoma*, 353
oregonensis, *Rhinoceros*, 412
orientale, *Prohyracodon*, 404
orina, *Rhadinea*, 195
ornata, *Anosteira*, 121, 122
oroyæ, *Pygidium*, 274, 296, 298, 301
Ostariophysa, 14, 275
Oxybelis acuminatus, 211
fulgidus, 212
oxyptera, *Paravandellia*, 366, 367
pacificus, *Rhinoceros*, 410
Diceratherium, 410
Palæotheea polycypha, 139
terrestris, 139
palleum, *Pygidium*, 291
paolence, *Pygidium*, 327, 328
papilliferus, *Spintherobulus*, 12, 19, 20
Paragoniates, 10, 15
alburnus, 3, 12, 40, 41
paraguayensis, *Aphyocharax*, 12, 24, 25, 33
Holoprion, 23
Odontostilbe, 12, 90, 96, 97
Prionobrana, 3, 12, 13, 38, 40
parahybæ, *Cheirodon*, 12, 65, 70
Paravandellia, 262, 269, 359
oxyptera, 366, 367
Parcebasis, 3, 15, 48
cyclolepis, 12, 44, 45, 46
Pareiodon microps, 343, 344
Pareiodontinae, 261, 275
Pariolus armillatus, 260, 276
patagoniensis, *Hatcheria*, 281, 282, 283
Pearse, A. S., 274
pectinifera, *Pimelodella*, 230, 231, 232, 241
pequira, *Cheirodon*, 83
Holesthes, 3, 12, 84, 86
peruviana, *Tachymenis*, 214
peruvianus, *Lachesis*, 226
Peterson, O. A., 101, 103; *The American Diceratheres*, 399
petersoni, *Diceratherium*, 413
petolaria, *Clelia*, 205
Phanagoniates, 6, 10, 15
wilsoni, 12, 43
Philodryas nattereri, 212
offersi, 213
schotti, 213
Phreatobius, 260, 371, 372
Phrynonax fasciatus, 194
piaba, *Cheirodon*, 7, 9, 11, 12, 65, 71, 72, 76, 77, 79, 80

- Pimelodella australis*, 230, 231, 233
avanhandavae, 232, 240, 253
boliviana, 230, 231, 232, 242
brasiliensis, 230, 232, 242
buckleyi, 230, 231, 232, 240, 241, 245
chagresi, 230, 231, 252, 253
cristata, 230, 231, 236, 237
cyanostigma, 230, 231, 232, 242
eigenmanni, 230, 231, 234, 241, 248
eigenmanniformis, 241
elongata, 230, 231, 252, 254
eutania, 230, 231, 252, 254
gracilis, 230, 231, 232, 237, 238, 239, 251
griffini, 235, 250
grisea, 230, 231, 251, 252
hartti, 230, 231, 235, 248
hasemani, 230, 231, 232, 241
itapicuruensis, 230, 231, 234, 247
lateristriga, 230, 231, 245, 249, 250
laticeps, 230, 231, 234, 248
laticeps australis var. nov., 243
macturki, 230, 231, 234, 248
meekei, 230, 231, 235, 249
megalops, 230, 231, 232, 242
metæ, 230, 231, 233, 244
modesta, 230, 231, 251, 252
mucosa, 230, 231, 235, 250
notomelas, 230, 231, 233, 244
pectinifera, 230, 231, 232, 241
puruensis, 230, 231, 232, 240
roceæ, 230, 231, 232, 240
steindachneri, 230, 232, 237
transitoria, 230, 231, 235, 249
vittata, 230, 231, 235, 249
vittata, 230, 231, 234, 247
serrata, 235
yuncensis, 251, 253
 Distribution of, 230
 Key to the Cis-Andean species of, 231
 Key to the Trans-Andean species of, 251
- Pimelodella* and *Typhlobagrus*. By Carl H. Eigenmann, 229-258
- Pimelodinæ*, 280
- Pimelodus cristatus*, 229
- Pisces*, 275
- pisciculus*, *Cheirodon*, 2, 6, 12, 13, 64, 65, 67, 68
- piscivorus*, *Agkistrodon*, 227
- platycephalus*, *Miuroglanis*, 370, 371
- platyplastra*, *Baëna*, 120
- plazai*, *Vandellia*, 359, 360, 362
- Plectospondyli*, 14, 275
- plicatilis*, *Dimades*, 175
- Pœcilia bogotensis*, 17
- pœcilogyrus*, *Liophis*, 190
- poeyanum*, *Pygidium*, 297, 302
- polycepha*, *Palcothecca*, 139
- polylepis*, *Helicops*, 181
- princeps*, *Elaps*, 220
Glyptosaurus, 160
- Prionobrama*, 6, 11, 15
amazoni, 39
filigera, 38, 39, 40
filigerus, 3, 12, 13
madeiræ, 37
paraguayensis, 3, 12, 13, 38, 40
- Probolodus*, 7, 15
heterostomus
- Prohyracodon orientale*, 404
- proöps*, *Pygidium*, 295, 327, 331
- Protaceratherium* ("Diceratherium")
minutum, 403
- Proteroglypha*, 216
- Psalidodon*, 2
- Pseudoboa coronata*, 206
- Pseudoplatystoma orbignianum coruscans*, 353
- Pseudoplatystomus*, 267
- Pseudostegophilus*, 261, 277
nemurus, 349, 350
- pulcher*, *Aphyocharax*, 3
Cheirodon, 3, 35
- pulchra*, *Odontostilbe*, 2, 12, 95
- pullatus*, *Spilotes*, 197
- punctatissimum*, *Pygidium*, 327, 329, 340
- punctatus*, *Henonemus*, 345, 346
- punctulatum*, *Pygidium*, 297, 300
- puruensis*, *Pimelodella*, 230, 231, 232, 240
- pusilla*, *Echmatemys*, 140, 141, 142
- pusillus*, *Aphyocharax*, 12, 13, 22, 24, 28, 29

- pusillus, *Trichomycterus*, 263
- Pygidiidae, 275
- Appendix to, 371
 - Chronology of, 270
 - Distribution of, 269
 - A Family of South American Catfishes. By C. H. Eigenmann, 259-398
 - First species discovered, 270
 - Generic Names and present equivalents, 270
 - Guide to contents of monograph, 395
 - Habits of, 261
 - How distinguished, 259
 - Limits of the family, 276
 - Key to the subfamilies and genera, 278
 - Location of the types and specimens in the museums of the world 271
 - Phylogenetic Tree showing relationship, 277
 - Sources of material examined, 274, 275
 - Synonymy, 275
 - Zoölogical position, 275
- Pygidiinae, 260, 275
- Pygidium: Key to the species from Argentina and Paraguay Basin, 291; from the Amazon to the Essequibo, 324; from Peru and Western Bolivia, 296; from Southeastern Brazil, 328; from Venezuela, Colombia, Panama, Ecuador, 305; from Chile, 290; from Southeastern Brazil, 327
- Pygidium alternatum*, 327, 328, 336
- amazonicum*, 325, 326
 - bancaui*, 307, 318
 - barbouri*, 274, 297, 303
 - bogotense*, 306, 315, 316, 318
 - borellii*, 294
 - brasiliense*, 295, 327, 329, 336, 337
 - caliense*, 306, 311
 - chapmani*, 305, 309
 - conradi*, 325
 - corduvense*, 292
 - davisi*, 327, 331, 334
- Pygidium dispar*, 297, 299
- dorsostriatum*, 290, 307, 320
 - eichorniarum*, 295
 - eigenmanni*, 297, 298
 - fassli*, 298, 303
 - fuscum*, 288, 296, 298
 - goeldii*, 327, 328, 337, 339
 - gracilior*, 325, 326
 - guianense*, 325
 - hasemani*, 325, 326
 - heterodontum*, 296
 - iheringi*, 327, 328, 330
 - immaculatum*, 327, 328, 334
 - itatiayae*, 327, 329
 - kneri*, 290, 306, 314
 - laticeps*, 305, 307
 - latidens*, 306, 312
 - latistriatum*, 307, 318, 321
 - marmoratum*, 290
 - meridae*, 290, 306, 315
 - metae*, 290, 295, 306, 312
 - minutum*, 327, 329, 340
 - nigricans*, 289, 327, 328, 329
 - nigromaculatum*, 306, 316, 317, 318
 - royae*, 284, 296, 298, 304
 - palleum*, 291
 - paolence*, 327, 328
 - poeyanum*, 297, 302
 - proöps*, 295, 327, 331
 - parahybæ*, 332
 - punctatissimum*, 327, 329, 340
 - punctulatum*, 297, 300
 - quechuorum*, 298, 305
 - regani*, 307, 323
 - reinhardti*, 327, 328, 333
 - retropinne*, 306, 307, 324
 - riojanum*, 295
 - rivulatum*, 289, 297, 300, 301
 - santæ-ritæ*, 327, 329, 341
 - spagazzinii*, 294
 - spilosoma*, 307, 319
 - stellatum*, 305, 308
 - stramineum*, 306, 313
 - striatum*, 306, 307, 321, 324
 - taczanowskii*, 289, 297, 300
 - tænium*, 305, 310

- Pygidium tenue*, 291, 292
 tigrinum, 291
 triguttatum, 327, 329, 339
 unicolor, 306, 314
 venulosum, 307, 320
 vermiculatum, 327, 328, 335
 vittatum, 297, 299
 zonatum, 328, 330

quechuorum, *Pygidium*, 298, 305

rathbuni, *Aphyocharax*, 12, 24, 31, 32
regani, *Pygidium*, 307, 323
reginæ, *Liophis*, 191
reinhardti, *Ochmacanthus*, 356, 357
 reinhardti, *Pygidium*, 327, 328, 333
Reptilia in the Carnegie Museum, 163-165
 Localities in South America where
 collected by J. D. Haseman, 164
reticulata, *Typhlops*, 166
retropinna, *Pygidium*, 306, 307, 324
Rhadinea merremi, 195, 196
 occipitalis, 195
 orina, 195
Rhinoceros bicornis, 444
 hesperius, 410
 oregonensis, 412
 pacificus, 410
Rhinostoma guianense, 214
rhombifer, *Clelia*, 205
 Drymobius, 178
Ribeiro, Dr. Alipio de Miranda, 64
ribeiroi, *Cheirodon*, 63
 Mixobrycon, 12, 62, 63
riojanum, *Pygidium*, 295
riparia, *Baëna*, 118
rivulatum, *Pygidium*, 289, 297, 300, 301
robustus, *Hadrianus*, 146, 147, 148
roccæ, *Pimelodella*, 230, 231, 232, 240
Rosenberg, W. F. H., 274
rostralis, *Leptophis*, 186
roulei, *Atractus*, 173
rugosus, *Glyptosaurus*, 160
Ruthven, Alexander G., 274

sanguinea, *Vandellia*, 359, 360, 365
santæ-ritæ, *Pygidium*, 327, 329, 341

saturninus, *Herpetodryas fuscus* var., 183
Sauria, 159
schiffi, *Diceratherium*, 432
schotti, *Philodryas*, 213
Scleronema, 260
 operculatum, 280
seutumantiquum, *Amyda*, 155, 157
semicineta, *Tantilla*, 209
semicinetus, *Lystrophis*, 192
scptaria, *Echmatemys*, 124, 125, 126, 127
Serpentes, 165
serrata, *Pimelodella*, 235
severus, *Xenodon*, 200
Silurida, 259, 260
 Branchicola, 275, 276
 Opisthoptera, 275, 276
sima, *Baëna*, 112, 115, 117, 121
Smith, Mr. & Mrs. H. H., Collections of
 snakes made by, 164
Sorubim, 267
spgazzinii, *Pygidium*, 294
sphenodon, *Glyptosaurus*, 160
spilogaster, *Tropidodipsas*, 197
spilosoma, *Pygidium*, 307, 319
Spilotes pullatus, 197
Spintherobulus, 6, 7, 14, 19
 papilliferus, 12, 19, 20
Squamata, 159, 165
Stegophilina, 261, 275, 276
Stegophilus, 261
 insidiosus, 267, 353, 354
 intermedius, 345
Steinbach, José, Collections of snakes
 made by, 165
steindachneri, *Cheirodon*, 35
 Leptagoniates, 3, 12, 42
 Pimelodella, 230, 232, 237
stellatum, *Pygidium*, 305, 308
stenodon, *Cheirodon*, 66, 80, 82
stevensoniana, *Echmatemys*, 132
stigeri, *Metacanopus (Aceratherium)*, 429
Stout, Prof. Selatie E., 263
stramineum, *Pygidium*, 304, 313
stramineus, *Aphyocharax*, 32
striatum, *Pygidium*, 306, 307, 321, 324
Stylemys, 151
 "Sucuruja," 175

- "Sucury," 175
- Tachymenis peruviana, 214
 taczanowskii, Pygidium, 289, 297, 300
 taniatus, Atractus, 173
 tanium, Pygidium, 305, 310
 Tantilla melanocephala, 209
 semicineta, 209
 taxistigma, Cobitiglanis, 345
 taxistigmus, Henonemus, 346, 348
 Teleostomi, 14, 275
 tenue, Pygidium, 291, 292
 terrestris, Palæotheca, 139
 terrificus, Crotalus, 226
 Testudinidae, 143
 Testudo ammon, 151, 154
 amphithorax, 155
 brontops, 154
 exornata, 154
 uintensis, 150, 152, 153
 Thamnodynastes nattereri, 215
 Thayer Expedition to South America, 2
 tigrinum, Pygidium, 291
 titeombi, Hatcheria, 283, 284
 transitoria, Pimelodella, 230, 231, 235, 249
 Trichomycteridae, 276
 Trichomycterus, 267
 inermis, 279
 pusillus, 263
 tridactylus, Ctenopus, 446, 448, 402
 Tridens, 262
 brevis, 370
 melanops, 369
 Key to the species, 369
 Tridentinae, 261, 275
 trigemina, Clelia, 206
 Trigonias, 456
 triguttatum, Pygidium, 327, 329, 339
 Trionychidae, 102, 155
 Tropidodipsas spilogaster, 197
 truquianum, Diceratherium, 412
 tumidus, Hadrianus, 147, 148, 150
 Turtles (Fossil) of the Uinta formation,
 By Charles W. Gilmore, 101-161; Ac-
 credited to the Uinta formation, 104;
 in the Carnegie Museum, 105.
- Typhlobagrus kronei, 230, 255
 Typhlopidae, 165
 Typhlops reticulata, 166
 unicolor, Pygidium, 306, 314
 uintensis, Echmatemys, 127, 131
 Testudo, 150, 152, 153
 Urinophilous habit of members of the
 Pygidiidae, 262
 Urinophilus, 358
 uruguayanae, Macropsobrycon, 7, 12, 48,
 49
 utahensis, Hadrianus, 148, 149
- Vanee, Miss Lola, Fishes collected by, 274
 reptiles collected by, 165
 Vandellia cirrhosa, 262, 263, 358, 360
 hasemani, 359, 360
 plazai, 359, 360, 362
 sanguinea, 359, 360, 365
 wieneri, 360, 362, 363
 Key to the species of, 360
 Vandellinae, 261, 275
 venulosum, Pygidium, 307, 320
 vermiculatum, Pygidium, 327, 328, 335
 Viperidae, 222
 viridis, Liophis, 192
 vittata, Pimelodella, 230, 231, 234, 247
 vittatum, Pygidium, 287, 299
- Weber, Rudolph, 103
 wesseli, Pimelodella, 237
 Williamson, E. B., 262, 275
 wieneri, Vandellia, 360, 362, 362
 Wilson, Charles, 2
 wilsoni, Phanagoniates, 12, 43
- Xenodon colubrinus, 199
 merremi, 199
 neuwiedi, 200
 severus, 200
- yuccensis, Pimelodella, 251, 253
 zonatum, Pygidium, 328, 330

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