



















ANNALS  
OF THE  
CARNEGIE MUSEUM

VOLUME XXIX

1942-1943



PUBLISHED BY THE AUTHORITY OF THE  
BOARD OF TRUSTEES OF THE CARNEGIE INSTITUTE  
PITTSBURGH, PA.  
OCTOBER, 1943

ARRANGED FOR PUBLICATION BY

ARTHUR W. HENN



507.73  
P4P684E

## TABLE OF CONTENTS

Title Page.....	i
Title of Contents.....	iii
List of Genera and Species new to Science.....	v

ARTICLE

I. List of the Tinamous in the collection of the Carnegie Museum. By W. E. Clyde Todd (Feb. 27, 1942)....	1-29
II. Observations on the life history of a new Chalcidoid Wasp, an internal parasite of Ant-lion larvae. By George E. Wallace, pl. I (March 13, 1942).....	31-40
III. Upper Cretaceous fauna of the Asphalt Ridge, Utah. By I. P. Tolmachoff, pls. I-II (May 5, 1942).....	41-60
IV. A review of the genus <i>Phoca</i> . By J. Kenneth Doust, pls. I-XIV (May 12, 1942).....	61-125
V. The Cephalopod fauna of the Conemaugh series in western Pennsylvania. By A. K. Miller and A. G. Unklesbay, pls. I-VIII (June 12, 1942).....	127-174
VI. Descriptions of two new Salamanders from peninsular Florida. By M. Graham Netting and Coleman J. Goin, pl. I (June 16, 1942).....	175-196
VII. Critical remarks on the races of the Sharp-tailed Sparrow. By W. E. Clyde Todd (June 16, 1942).....	197-199
VIII. The Canadian forms of the Sharp-tailed Sparrow, <i>Amospiza caudacuta</i> . By James L. Peters (Sept. 3, 1942)..	201-210
IX. Description of a new race of <i>Siren intermedia</i> Le Conte. By Coleman J. Goin (Sept. 3, 1942).....	211-217
X. The Chazy Conularida and their congeners. By G. Winston Sinclair, pls. I-III (Oct. 1, 1942).....	219-240
XI. Scolecodonts from the Erindale, Upper Ordovician, at Streetsville, Ontario. By E. R. Eller, pls. I-IV (Nov. 6, 1942).....	241-270

XII. List of the Hummingbirds in the collection of the Carnegie Museum. By W. E. Clyde Todd (Dec. 31, 1942) .	271-370
XIII. A collection of Lepidoptera (Rhopalocera) from the Cayman Islands. By G. D. Hale Carpenter and C. B. Lewis (Jan. 15, 1943).....	371-396
XIV. New and rare Ithomiinae (Lepidoptera) in the Carnegie Museum. By Richard M. Fox, pl. I (March 5, 1943) .	397-408
XV. Birds collected during two cruises of the "Vagabondia" to the west coast of South America. By Ruth Trimble (June 3, 1943) . . . . .	409-441
XVI. New Neididae (Hemiptera) from South America, with notes on some little-known species. By Halbert M. Harris (June 30, 1943) . . . . .	443-450
Index . . . . .	451-468

## LIST OF GENERA AND SPECIES NEW TO SCIENCE

<i>Stomatoceras rubra eriensis</i> , var. nov. Insecta.....	31
<i>Cardium kayi</i> , sp. nov. Lamellibranchiata.....	54
<i>Crenella burkei</i> , sp. nov. ".....	57
<i>Phoca vitulina mellonae</i> , subsp. nov. Mammalia.....	111
<i>Poterioceras subellipticum</i> , sp. nov. Cephalopoda.....	135
<i>Pennoceras</i> , gen. nov. ".....	146
<i>Pennoceras seamani</i> , sp. nov. ".....	147
<i>Pseudotriton montanus floridanus</i> , subsp. nov. Amphibia.....	175
<i>Pseudobranchus striatus axanthus</i> , subsp. nov. ".....	183
<i>Siren intermedia nettingi</i> , subsp. nov. ".....	211
<i>Conularina</i> , gen. nov. Conularida.....	220
<i>Conularina undosa</i> , sp. nov. ".....	222
<i>Conularina irrasa</i> , sp. nov. ".....	223
<i>Conularina raymondi</i> , sp. nov. ".....	223
<i>Conularina narrawayi</i> , sp. nov. ".....	224
<i>Climacoconus</i> , gen. nov. ".....	225
<i>Climacoconus rallus</i> , sp. nov. ".....	228
<i>Climacoconus humilis</i> , sp. nov. ".....	228
<i>Climacoconus clarki</i> , sp. nov. ".....	229
<i>Climacoconus bromidus</i> , sp. nov. ".....	230
<i>Climacoconus pumilus</i> , sp. nov. ".....	231
<i>Lumbriconereites marlenediesae</i> , sp. nov. Annelida.....	243
<i>Lumbriconereites proclivis</i> , sp. nov. ".....	244
<i>Lumbriconereites deflexus</i> , sp. nov. ".....	244
<i>Lumbriconereites copiosus</i> , sp. nov. ".....	245
<i>Nereidavus ineptus</i> , sp. nov. ".....	246
<i>Nereidavus hamus</i> , sp. nov. ".....	246
<i>Nereidavus procurvus</i> , sp. nov. ".....	247
<i>Idraites exquisitus</i> , sp. nov. ".....	248
<i>Idraites fritzae</i> , sp. nov. ".....	248
<i>Idraites patulus</i> , sp. nov. ".....	249
<i>Paleœnonites</i> , gen. nov. ".....	250
<i>Paleœnonites accuratus</i> , sp. nov. ".....	250

<i>Paleœnonites latissimus</i> , sp. nov.	"	251
<i>Paleœnonites edentulus</i> , sp. nov.	"	251
<i>Paleœnonites accuratus</i> , sp. nov.	"	252
<i>Eunicites denticulatus</i> , sp. nov.	"	252
<i>Eunicites purus</i> , sp. nov.	"	253
<i>Ænonites conterminus</i> , sp. nov.	"	254
<i>Ænonites crepitus</i> , sp. nov.	"	254
<i>Ænonites sinuatus</i> , sp. nov.	"	255
<i>Ænonites caducus</i> , sp. nov.	"	256
<i>Leodicites acclivis</i> , sp. nov.	"	256
<i>Leodicites streetsvillensis</i> , sp. nov.	"	257
<i>Leodicites creditensis</i> , sp. nov.	"	257
<i>Leodicites summus</i> , sp. nov.	"	258
<i>Leodicites barbatus</i> , sp. nov.	"	259
<i>Leodicites densus</i> , sp. nov.	"	259
<i>Staurocephalites cuspis</i> , sp. nov.	"	260
<i>Arabellites perpensus</i> , sp. nov.	"	260
<i>Diopatraites fustis</i> , sp. nov.	"	261
<i>Colibri cyanotus crissalis</i> , subsp. nov.	Aves	292
<i>Chlorostilbon stenurus ignotus</i> , subsp. nov.	"	305
<i>Lepidopyga luminosa phœochroa</i> , subsp. nov.	"	308
<i>Amazilia chionopectus orienticola</i> , subsp. nov.	"	318
<i>Amazilia fimbriata elegantissima</i> , subsp. nov.	"	323
<i>Amazilia amabilis costaricensis</i> , subsp. nov.	"	330
<i>Chalybura buffoni interior</i> , subsp. nov.	"	332
<i>Ocreatus underwoodi polystictus</i> , subsp. nov.	"	347
<i>Brephidium exilis thompsoni</i> , subsp. nov.	Lepidoptera	392
<i>Hypothyris meterus deëmae</i> , subsp. nov.	"	398
<i>Hyaliris deuscula</i> , sp. nov.	"	399
<i>Hyaliris munda</i> , sp. nov.	"	401
<i>Napeogenes astarte</i> , sp. nov.	"	402
<i>Oleria crispinella hemina</i> , subsp. nov.	"	404
<i>Xenoloma</i> , gen. nov.	Hemiptera	443
<i>Xenoloma princeps</i> , sp. nov.	"	444
<i>Phaconotus</i> , gen. nov.	"	445
<i>Phaconotus ensis</i> , sp. nov.	"	446
<i>Protacanthus nexus</i> , sp. nov.	"	446
<i>Parajalysus pallidus</i> , sp. nov.	"	449
<i>Parajalysus nannus</i> , sp. nov.	"	449









*Annals of the Carnegie Museum*

29

ART. I. LIST OF THE TINAMOUS IN THE COLLECTION OF THE CARNEGIE MUSEUM

BY W. E. CLYDE TODD

INTRODUCTION

The Tinamous (Family Tinamidae) in the Carnegie Museum total 412 specimens, belonging to 61 species and subspecies. Although only about half of the known forms are represented, so many interesting findings have come to light in the course of their determination that I have thought it well to put the results on record for the benefit of other workers. The Tinamous are an especially difficult group, and their study has been unduly handicapped not only by the paucity of material, but also by its (generally) poor quality. Few collections can boast satisfactory series of more than a few species, and it is usually necessary to assemble material from several sources for purposes of study and comparison. While the Tinamou material in the Carnegie Museum is above the average in quality, the series of most forms are small. In identifying some of them I have had to draw on the collections of other museums, in particular the American Museum of Natural History and the Academy of Natural Sciences of Philadelphia. To the authorities of these institutions my acknowledgments are due. I am particularly indebted also to Mr. N. B. Kinnear, who in June, 1938, enabled me to examine the Tinamous in the collection of the British Museum (Natural History). Also, Dr. C. E. Hellmayr and Mr. Ludlow Griscom have been good enough to make comparisons of specimens sent them for that purpose.

It should be explained that the present list includes all the specimens of Tinamous entered in the Museum catalogue, whether now in the collection or alienated therefrom by exchange. Remarks on forms not represented in our collection are also inserted at their proper places. The sequence of the list closely follows that of Mr. J. L. Peters' "Check-List of Birds of the World," not because I consider this the final word but merely a standard work of reference and a convenient point of departure.

Since the publication of Mr. Peters' list, several papers dealing with the systematics of certain species have appeared. Some new forms have been

MAR 3 1942

described, and changes in the status of other forms have been proposed. Some authors manifest an increasing tendency to combine related forms under one specific head and to alter their nomenclature accordingly, as the "formenkreis" theory demands. With these views I cannot always agree. While subspecies are of course "representative forms," the converse is not necessarily true. Thus to enlarge and change the original concept of the subspecies is to go far beyond and outside the plan and purpose of the trinomial system of nomenclature, for the adoption of which a bygone generation of zoologists had to contend so long and so vigorously. We realize—all too keenly—the shortcomings of the system to express all the facts as we find them in Nature, but if the present tendency to load too much on the names continues, the system will fall of its own weight. I can only deplore the proposals to reduce a number of well-characterized forms of this particular group to subspecific rank, and in the present paper I have indicated what I consider to be their true status, insofar as my material would justify an opinion.

Two papers dealing with the taxonomy of the Tinamous in general have appeared in the last decade and merit special notice. Dr. Hans von Boetticher has a very important paper in German, published in 1934 (see bibliography). In this paper the author discusses the relationships of the group, the color patterns of the several genera, and the characters exhibited by the bill, nostrils, tarsi and toes, and tail. He takes into consideration also the ecological distribution of the genera before presenting his scheme of classification and a genealogical tree. He divides the family into three subfamilies: Tinaminae, to include *Crypturellus*, *Tinamus*, and *Nothocercus*; Rhynchotinæ, with *Rhynchotus*, *Nothura*, *Nothoprocta*, and *Taoniscus*; and Eudromiinae, with *Tinamotis* and *Eudromia*. This arrangement has been carefully worked out, and it has much to commend it. The author makes no attempt to arrange the species within the genera.

Sr. Alipio de Miranda-Ribeiro's paper in Portuguese appeared in 1938. Although obviously prepared without reference to Dr. von Boetticher's 1934 paper, it covers the same ground (in some respects more fully), but he bases the systematic discussion solely on the forms found in Brazil. These are treated in some detail and are accompanied by lists of specimens and references to the literature. Significantly, he groups the Brazilian genera into subfamilies just as Dr. von Boetticher does, although not exactly on the same basis. In addition, he splits *Crypturellus* and sets up a new genus, *Orthocrypturus*, for *C. variegatus* and its allies. For *C. cinereus* he accepts *Crypturornis*. (To these groups I would give

subgeneric status.) This paper embodies certain good suggestions for the proper arrangement of species and races, although the nomenclature is faulty in some respects, and at least two of the new names proposed were anticipated.

In this paper all measurements are in millimeters, and the names of colors are in the main taken from Ridgway's "Color Standards and Color Nomenclature."

#### LIST OF SPECIES

##### ***Tinamus tao tao*** Temminck.

One specimen: Apacy, Rio Tapajóz, Brazil.

The upperparts are purer gray than in the other races of this species, and the black bars are distinct. Our single specimen comes from the west bank of the Rio Tapajóz. However, the range of this race is actually more extensive than Peters (1931b, 12) allows, since two specimens from Santarem, on the east bank of the same river, are recorded by Oliveira Pinto (1938, 2), and one from Cussary, farther down on the Amazon, is listed by Sneath (1914, 46). Temminck's type-specimen came from the "province of Pará."

##### ***Tinamus tao septentrionalis*** Brabourne and Chubb.

Four specimens: La Cumbre de Valencia, Lagunita de Aroa, and Puerto La Cruz, Venezuela.

This appears to be a valid race, easily distinguished from typical *tao* by its more uniform upperparts, which are vermiculated rather than barred and have a slight olive wash in evidence. A young bird (September 24) resembles the adults except for the very small whitish spots on the wings.

##### ***Tinamus tao kleei*** (von Tschudi).

Four specimens: Cerro del Amboró and Cerro Hosáne, Bolivia.

These are fully as heavily barred above as our single specimen of typical *tao*, but they have a decided olive wash. They have not been directly compared with topotypical Peruvian specimens of *kleei*, but are referred thereto on the authority of Hellmayr, who (so H. B. Conover writes me) is now inclined to consider Bolivian birds the same. The latter were described under the name *Tinamus weddelli* by Bonaparte (1856, 881, 954), which name will thus become a synonym of *kleei*, as suspected by Peters.

**Tinamus major robustus** Sclater and Salvin.

Ten specimens: Manatee Lagoon, Quamin Creek, Toledo District, and Cockscomb Mountains, British Honduras.

"Iris hazel: bill leaden brown [brownish plumbeous?]; feet plumbeous" (Peck).

There is considerable individual variation affecting the precise shade of the upperparts, as well as the amount of black barring thereon. A British Honduras bird mentioned by Salvin and Godman (1904, 449) is paler than Guatemala skins, but this is doubtless without significance. A half-grown young bird, readily distinguished by the small buffy spots on the upperparts, is dated July 12. These indications of immaturity persist on the tertiaries of another fully grown bird taken as late as December 7.

On the status and relationships of the Central American races compare Chapman, 1917, 187, and Griscom, 1929, 150. These authors insist that the forms with rufous heads (*major*, etc.) and those with gray heads (*robustus*, *fuscipennis*) are conspecific. Nevertheless, it is interesting to note that both types (according to Griscom) occur in the Canal Zone and still maintain their respective characters. In western Ecuador, according to Chapman (1926, 146), both types are also found indiscriminately.

**Tinamus major fuscipennis** Salvadori.

Five specimens: Cuabre, Rio Sicsola, Carrillo, and El Hogar, Costa Rica.

No. 23,886 (Cuabre) is practically indistinguishable from British Honduras *robustus*, to which form both Carriker and I at one time referred it. This specimen has the same olivaceous color above as *robustus*, and grayish shading below, with little buff. But since the other two specimens from this region are clearly *fuscipennis*, it seems better to consider this odd example an extreme individual variant such as sometimes occurs within the range of a given form. The only other alternative would be to give both *robustus* and *fuscipennis* specific rank—a manifest absurdity. The remaining four specimens, although varying considerably among themselves, exhibit the differences pointed out by Griscom (*l.c.*) fairly well as a series. One has the back very nearly uniform. The markings on the secondaries vary from fine vermiculations to prominent bars, but the series is much too small to say whether or not this is a character due to age.

*Tinamus salvini* of Underwood (type-locality Carrillo), as maintained by Salvin and Godman, is unquestionably *fuscipennis* in immature dress.

**Tinamus major castaneiceps** Salvadori.

Five specimens: Pozo Azul de Pirris and El Pozo de Terraba, Costa Rica.

Clearly this form is only a race of the South American *T. major*, with which it is connected through *latifrons* and probably through *ruficeps* also. Our Pozo Azul adult is decidedly brownish above; the others are more olivaceous. A young bird, dated May 16, resembles the adults but has buffy spotting above, as is usual in this group.

**Tinamus major saturatus** Griscom.

Two specimens: Murindo and Malagita, Colombia.

On geographical grounds these should belong to *saturatus*, but they fail to show the comparative characters claimed for that race, except for an obvious occipital crest. Their coloration is slightly lighter than that of Costa Rican specimens of *castaneiceps*, especially on the underparts, which are more uniform, with the barring less in evidence; the crown, however, is not appreciably different. Mr. Griscom has been kind enough to compare these two specimens with the type-series and writes as follows: "Your two specimens agree in coloration with the paler extremes of our excellent series of *saturatus*; in other words, they are not really typical of this subspecies. You will note, however, that the development of the occipital crest in your two specimens is very much less than in *saturatus*, nor am I able to see that this difference is due to any defects in your two specimens."

Pending the receipt of more material I shall provisionally refer these examples to *saturatus*. It is entirely possible that they may prove to belong to a race intermediate between *saturatus* and *latifrons*.

**Tinamus major zuliensis** Osgood and Conover.

Seven specimens: Valparaiso, La Tigrera, Las Vegas, and Pueblo Viejo, Colombia; Rio Mocho, Venezuela.

I had at one time (following Chapman) identified these as *ruficeps* (type from eastern Ecuador), but I now agree with Osgood and Conover that they should be referred to their race *zuliensis*, a form which ranges from the Caura Valley in Venezuela to the Magdalena Valley in Colombia (in the Tropical Zone). Compared with typical *major*, it is a pale race; this pallor appears on both the upper- and underparts; the occipital crest is not strongly marked. The Arid Tropical habitat of this race is reflected

in these characters. *T. m. zuliensis* is very different from *castaneiceps*, the range of which it touches on the west.

***Tinamus major major*** (Gmelin).

Eight specimens: Rio Yuruan, Venezuela; Tamanoir and Pied Saut, French Guiana; Upper Araucaua and Obidos, Brazil.

Salvadori (1895, 504) calls this form *subcristatus* Cabanis, mainly on the ground that so-called *major* had not been found in recent times at Cayenne, and because of the misidentification of the name. But von Berlepsch (1908, 298) insists on the pertinence of the earlier name, after throwing out Marcgrave's reference.

This form has the following comparative characters: buffy suffusion below; a decided occipital crest; dark-colored head, with the sides and front more or less dusky or ashy, contrasting with the crown; and little or no rufescent barring or squamation on the lower neck in front. The color of the upperparts varies greatly, also the extent and heaviness of the barring. A slightly immature bird from Obidos is heavily barred above and deeply washed with brown, whereas an adult female from the same place is decidedly more olivaceous above and lightly barred.

***Tinamus major serratus*** (Spix).

Two specimens: Tonantins and Manacapurú, Brazil.

Hellmayr (1906, 699 *et seq.*) argues at length to prove the specific distinctness of *serratus* and *major*. He argues that since birds with long occipital crests and ashy foreheads occur together with others having no crests and plain rufous foreheads, there must be two species (this in the Rio Negro region). Evidently he has changed his mind since, if one may judge from Conover's later remarks (1937, 192). Conover has handled both specimens here listed. They are very different from each other but agree in having a bright rufous and uniform pileum, the sides of the head distinctly rufous, and much buffy and rufous suffusion and squamation on the neck in front; the occipital crest is short.

The specimen from Tonantins is almost immaculate above as compared with the Manacapurú bird, which is strongly barred.

***Tinamus major olivascens*** Conover.

Nine specimens: Rio Surutu (near Buena Vista) and Buena Vista, Bolivia; Villa Braga (Rio Tapajóz), Hyutanahan (Rio Purús), and Nova Olinda (Rio Purús), Brazil.

This name has been set up by Conover to cover all the birds of this species from south of the Amazon, from Pará to Bolivia. The above specimens agree in generally dark coloration—dark olive gray breast and sides, less buffy, more whitish abdomen, and deep rusty (and uniform) pileum with virtually no occipital crest. The amount of barring above and the exact shade of color are variable characters, as in other forms of this species; accordingly the name *olivascens* is not entirely appropriate. The sides of the head are strongly rufescent, as in *serratus*, but this shading does not extend to the neck in front, as in that form.

### ***Tinamus guttatus* von Pelzeln.**

Sixteen specimens: Benevides, Colonia do Mojuy, Villa Braga, Bella Vista, Hyutanahan, Nova Olinda, Arimã, São Paulo de Olivença, and Tonantins, Brazil.

If the female is constantly larger than the male, as is usual with Tinamous, then several of our skins must be wrongly sexed.

At first glance these seem to fall into two series, according to locality. The lower Amazon birds appear whiter below, while those from the upper Amazon and Rio Purús are more buffy, less vinaceous. Also, the buffy spotting on the neck in the latter is richer, more ochraceous. These differences are better marked in the males, but since certain specimens from both regions are virtually indistinguishable, I do not think the discrimination of an eastern race is feasible. The upperparts also vary in ground-color from rich umber brown to decidedly olivaceous, and in the extent and width of the black barring, but I am not convinced that these variations are geographical. They parallel those shown in *T. major*.

Borba, Rio Madeira, has been fixed as the type-locality by Hellmayr (1907, 409), hence if any subdivision of the species were made, the eastern birds would constitute the new race.

### ***Nothocercus nigrocapillus nigrocapillus* (Gray).**

One specimen: Incachaca, Bolivia.

This example differs from Salvadori's description and plate (1895, 511, pl. 8) in being more brownish, less rufescent throughout, and in having the sides of the head dusky slate-color like the crown. These discrepancies must be of an individual character, however, since the type, although ascribed by Gray to Chile, could have come only from Bolivia. Carriker (1933, 2) has described a race from Peru.

**Nothocercus julius julius** (Bonaparte).

One specimen: "Bogotá," Colombia. A young bird.

**Nothocercus bonapartei frantzii** (Lawrence).

Two specimens: Volcano Turrialba and Ujarás de Terraba, Costa Rica.

The Turrialba specimen is much more rufescent throughout than the other, but a series would be necessary to establish geographical variation. Incidentally, this particular specimen was originally labeled "Guacimo" and later "Cartago." However, in Carriker's list (1910, 377) it is said to come from the "Volcan Turrialba, 4,000 feet," which locality is probably correct, since the species belongs to the Subtropical Zone. It is best regarded as a race of the South American *N. bonapartei*, in spite of its separated range.

**Nothocercus bonapartei bonapartei** (Gray).

Two specimens: La Cumbre de Valencia and Paramo de Rosas, Venezuela.

The first is a young bird (September 12); it closely resembles the adult in coloration, but the dusky of the crown is flecked with grayish, and the throat is grayish, although sparsely feathered. In the adult the outer primaries are rufescent, grayish-tinged, and have narrow dusky bars, precisely as in the "Bogotá" specimens mentioned by Salvadori (1895, 512). The wing is about nine inches long—longer than in the type. A "Bogotá" skin in the American Museum Collection has the wing 210 mm. long.

**Crypturellus cinereus cinereus** (Gmelin).

Four specimens: Cayenne and Pied Saut, French Guiana; Upper Araucaua, Brazil.

Having already discussed the taxonomy of *Crypturellus cinereus* at some length (1938, 123-126), I shall need to give here only an abstract of my conclusions.

Our specimens correspond closely to the description of *Tetrao cinereus* Gmelin (*ex* Buffon), which came from Cayenne, French Guiana. The name was later extended to apply to birds from other parts of the range, which was traced southward into Brazil and westward to the Andes. Several writers had noted certain variations in color characters, but it



remained for Brabourne and Chubb (1914, 320) to discriminate a dark-colored form of Tinamou from British Guiana under the name *Crypturus macconnelli*. Their description was elaborated by Chubb two years later (1916, 8, pl. 1, fig. 1), in connection with the form supposed by him to be the true *C. cinereus*, which was figured also on the same plate. But I am convinced that in describing *macconnelli* Chubb merely renamed *cinereus*, mistaking for the latter the lighter-colored rufescent form which ranges from the interior of British Guiana to the Amazon Valley. Our topotypical specimens from French Guiana obviously belong to this dark-colored form, which must be called *cinereus*, of which *macconnelli* is thus a pure synonym. Miranda-Ribeiro (1938, 758) has reached precisely the same conclusion.

Since my paper appeared, I myself have examined the series in the collection of the British Museum and found my conclusions verified. The differences between the dark and light birds are entirely bridged over in the series of British Guiana specimens. Some marked "*macconnelli*" (by Chubb himself) are decidedly rusty brownish above. Two supposed Cayenne birds (very old skins) are more rusty than ours, but they were probably dark-colored birds originally. The plate of *macconnelli* is somewhat misleading, since the type-specimen is actually not so dark-colored as thereon depicted. The light-colored bird of the plate will stand as

#### ***Crypturellus cinereus rufescens* Todd.**

Seven specimens: Villa Braga, Miritituba, Hyutanahan, and Arimã, Brazil.

Miranda-Ribeiro (1938, 760) correctly discriminated this race but wrongly called it *assimilis* Schlegel—a name which has no standing whatever, since it is based on a misidentification of *Nothura assimilis* Gray.

In addition to these specimens I have handled the series in the British Museum, as already said, and certain specimens from the collection of the American Museum of Natural History. "Chubb's plate is somewhat overdrawn; the differences between the two forms, while perfectly obvious on comparison, are not so conspicuous as there indicated" (Todd, 1938, 125). Two adults from the Rio Purús vary in the direction of the Bolivian race (*cinerascens*), while three Peruvian examples (in the British Museum) vary among themselves, but are probably referable to *cinerascens* or *fumosus*. The several forms of this group are certainly very close to each other and are subject to considerable variation.

**Crypturellus cinereus** subsp.

One specimen from Benevides (near Pará), Brazil, as already remarked, may represent an undescribed race, but more specimens are needed to determine its status. Incidentally, I have examined the type-specimen of *Crypturus megapodius* Bonaparte (1856, 954), now in the British Museum, and I have found it to be a young bird of some form of *C. cinereus*, but which one is quite indeterminable.

**Crypturellus berlepschi** Rothschild.

One specimen: Potedo, Colombia.

Examination of additional material of this form in the British Museum confirms my belief that it is a perfectly distinct species, peculiar to the Colombian-Pacific Fauna. "Its darker coloration, pure black pileum, lack of white shaft-stripes on the throat, and differently colored bill seem to be good specific characters when compared with *cinereus*" (Todd, 1938, 126).

**Crypturellus castaneus** (Sclater).

As shown by material in the British Museum, this species resembles *C. obsoletus*, but the upper- and underparts are chestnut; the head is darker gray.

**Crypturellus cerviniventris** (Sclater and Salvin).

After examining the type-specimen in the British Museum, I am decidedly of the opinion that this form is not conspecific with either *C. castaneus* or *C. obsoletus*. I think it should stand as a full species.

**Crypturellus obsoletus punensis** (Chubb).

Nine specimens: Cerro Hosáne, Locotal, San José, and Incachaca, Bolivia.

## MEASUREMENTS

No.	Sex	Wing	Bill	Tarsus
79409.....	(♀ im.)	154	23	42
85274.....	♀	158	24	44
85284.....	♂	152	23	45
85584.....	♂	144	23	43
85641.....	♀	157	25	46
85676.....	♀	151	24	43
119582.....	♀	154	24	45
120420.....	♂	149	23	45

As represented by specimens in the British Museum, *C. obsoletus obsoletus* has the head gray all around, and the back and scapulars olive brown, and the underparts dull rufous, posteriorly barred with buff and dusky. *C. obsoletus punensis* does not differ greatly, but the posterior underparts are somewhat deeper buffy. Three Bolivian birds examined appeared to be the same as those from Peru. The type of *punensis* is close to the type of *castaneus*, but is paler, with less chestnut above and below, while the slaty gray of the head extends over the back as a wash. The throat appears grayer, but in the type of *castaneus* this color may have faded somewhat. In size the two forms agree.

Our specimens have been compared with four in the Rothschild Collection from southern Brazil (Paraná, Minas Geraes, São Paulo) which supposedly represent true *obsoletus*. The Brazilian birds are appreciably different, in that they are paler, more ochraceous, less cinnamomeous, below, with the abdomen and crissum more buffy. The upperparts, too, are lighter brown (less rufescent), especially the wings and tail, and lack the grayish wash evident in the Bolivian skins. Our series of the latter have not been directly compared with topotypical material from Peru; they have been identified as *punensis* on the basis of their agreement in size and coloration with the description, and of the comparisons made at the British Museum. Chubb's name was based on birds from Puno, Peru, in the same general faunal region from which our birds came. Very recently, Bond and de Schauensee (1941, 1), after examining topotypes of *punensis*, have described the Bolivian bird as a distinct race, *crucis*, on the basis of its larger size, darker gray throat, and duller underparts. My measurements do not agree with theirs, but this may well be due to the personal equation. The proposed new race may indeed be a valid one, but I am reluctant to accept it on the present evidence.

#### ***Crypturellus griseiventris* (Salvadori).**

Nine specimens: Santarem and Colonia do Mojuy, Brazil.

The series is fairly uniform; the extent and intensity of the vinous chestnut of the breast is the most variable feature. No. 72,421 (April 30), a young bird, shows some fine white spots above and obsolete bars below.

Admittedly this form is related to *C. obsoletus*, but in my judgment not so closely as to be reduced to a subspecies thereof, as given by Peters. The ranges of these two forms are not known to approximate each other, since *griseiventris* is confined to the lower Amazon Valley east of the Rio

Tapajóz. Representatives of this form in the British Museum have been compared with *cerviniventris*, *punensis*, and *castaneus*; in my opinion they are not conspecific with any of these forms.

#### ***Crypturellus soui meserythrus* (Sclater).**

Three specimens: Manatee Lagoon, British Honduras.

In addition to these, I have handled (in the Museum of Comparative Zoölogy) two other specimens from the same locality.

"Iris dull yellow or yellowish brown; bill leaden brown, paler below; feet dull greenish yellow or yellowish brown" (Peck).

Sclater's name was originally applied to birds from Playa Vicente, Oaxaca, Mexico, from which region I have seen no specimens. The male of this form is noticeably duller and browner than the female.

#### ***Crypturellus soui modestus* (Cabanis).**

Five specimens: Guapiles, Cuabre, Carrillo, Buenos Aires, and Tucuriqui, Costa Rica.

Costa Rican specimens, sex for sex, are darker, less rufescent below than either *meserythrus* or *mustelinus*. Males are browner, less rufescent than females, but the average sexual difference, so it appears, is less than in the allied races. Peters (1931a, 296) calls attention to the fact that the color phases in this species are not definitely correlated with age or sex.

#### ***Crypturellus soui caucae* (Chapman).**

Twelve specimens: Jaraquiel, La Palmita, and El Tambor, Colombia.

These agree in all essential respects with a pair of birds in the American Museum collection from Las Lomitas and Rio Frio, Colombia. Four specimens from Jaraquiel closely resemble the Santa Marta race (*mustelinus*) in the color of the underparts, but they are much darker above, less rufescent, and have a grayish cast. The specimens from La Palmita and El Tambor show the characters of *caucae* as remarked by Griscom in his review (1932, 308). Coming as they do from the Magdalena Valley, they may be taken as representing that form correctly. The pileum is darker in these birds than in those from Jaraquiel, which latter are probably to be considered intergrades between *caucae* and *mustelinus*.

***Crypturellus soui harterti*** (Brabourne and Chubb).

Six specimens: Soatata, Potedo, Heights of Caldas, and Yumbo, Colombia.

Griscom (1932, 307) has shown that this is the race of *soui* which ranges from western Ecuador and western Colombia into eastern Panama. The present series conform with this allocation. The single male specimen is much darker than the same sex of either *caucæ* or *mustelinus*, as Griscom says, and the females are also dark-colored by comparison and have a decided dusky or grayish wash on the neck.

***Crypturellus soui caquetæ*** (Chapman).

Two specimens in the collection of the American Museum have been examined in this connection (Florencia and La Murelia, Caqueta, Colombia). The female is similar to the same sex of *mustelinus*, but it is very dark above (dark chestnut brown), with the pileum dusky slate-color. This race is evidently perfectly distinct.

***Crypturellus soui nigriceps*** (Chapman).

One specimen: São Paulo de Olivença, Brazil.

Reference of this specimen to *nigriceps* involves an extension of the heretofore known range of the race to western Brazil, south of the Amazon. On the north bank it is replaced by typical *soui*.

***Crypturellus soui mustelinus*** (Bangs).

Fourteen specimens: Don Amo, Don Diego, Cincinnati, Minca, and Palmar, Colombia; El Hacha, El Trompillo, Sierra de Carabobo, and Guamito, Venezuela.

A well-marked race, whose differential characters I have already discussed at some length (1922, 165). The above listed specimens from Venezuela are clearly referable to this race, the range of which extends eastward to that country, to and beyond the Andes of Merida to the region south of the coast range. Moreover, much to my surprise, I find that our two females from Palmar, east of the Eastern Andes in Colombia, are *mustelinus* and not *caquetæ*. Hence *caquetæ* does not occupy all of Colombia east of the Andes, as supposed by Chapman. It is odd, however, to find *mustelinus* on both sides of the Venezuelan Andes.

No. 36,271, El Hacha, Venezuela, December 1, is a downy chick. Its

head pattern is characteristic: the front (broad) and sides of the crown are buff, enclosing a median rufous crown patch, produced down the neck, and itself enclosing a longitudinal area of buff; the back is rich rufous, freckled anteriorly with buffy feather-tips; the throat is white; and the rest of the underparts are buffy and the crissum rufescent.

***Crypturellus soui soui*** (Hermann).

Nineteen specimens: El Peru Mine, Venezuela; Cayenne, Mana, and Pied Saut, French Guiana; Obidos, Tonantins, Manacapurú, and Rio Manacapurú, Brazil.

I judge that the brighter-colored birds are females and the duller-colored ones males, but the sex marks on the labels do not all correspond. This race is richly colored by comparison, as indicated by Griscom (1932, 308). The females are chestnut or bay above, the pileum is ashy or sooty blackish, the throat is decidedly buffy, and the breast and sides are rich rusty buffy (between Mars yellow and tawny of Ridgway's "Color Standards"), without any trace of dusky or ashy color. No. 34,139, an immature bird from El Peru Mine in Venezuela, is referred here on geographical grounds. Manacapurú and Obidos specimens are a little brighter above than those from French Guiana, but they are not sufficiently different in my opinion to deserve a name. Miranda-Ribeiro (1938, 769) refers a single specimen from Manacapurú to his new race *lyardi*. All his other specimens of that form come from south of the Amazon. Also, a single bird from Tonantins, on the north bank of the upper Amazon, obviously belongs here, although another race (*nigriceps*) lives across the river. The range of typical *soui*, therefore, extends from Guiana and Brazil, north of the Amazon, westward to the frontiers of Colombia and Ecuador.

***Crypturellus soui andrei*** (Brabourne and Chubb).

Nine specimens: Santa Lucia, San Rafael, and Mirasol, Venezuela.

These birds, coming from the region north of the coast range in Venezuela (in the states of Miranda and Sucre), are not *mustelinus*, than which they are darker-colored above and below, with a decided dusky band across the neck, and a restricted white throat patch. On the other hand, they are certainly not referable to *soui*. Upon comparison they prove to be substantially identical with a pair of birds from Trinidad in the collection of the American Museum of Natural History. Incidentally,

these specimens do not agree precisely with the original description of *andrei*, but they must nevertheless belong to that very distinct race, which is thus shown to reach the north coast of Venezuela.

***Crypturellus soui hoffmannsi*** (Brabourne and Chubb).

Ten specimens: Benevides, Santarem, Villa Braga, and Miritituba, Brazil.

The name *Crypturellus soui decolor* Griscom and Greenway (1937, 417) was based on the above series and one other specimen (the type) from the same region.

A few months later birds from this region were described by Miranda-Ribeiro (1938, 767) under the name *Crypturornis soui lyardi* (*lyardi?*). It is a pale, washed-out race, as the name implies. The pileum is brown, rather than ashy, with the sides of the head similar but paler. In the most richly colored female (No. 75,816) the back is argus brown, and the underparts are deep ochraceous buff. A small young bird (No. 72,079, April 16) is spotted with black above and below, and has some buff on the wings; the pileum still retains some of the rufous feathers of the natal stage.

These have been compared with five specimens (wretched skins!) from the Rio Madeira which Hellmayr calls *hoffmannsi*, and in my judgment they are the same form. Variation in exact coloration is in evidence, but since all the Rio Madeira birds can be closely matched by others of the lower Amazon series, I can see no point in keeping them apart. Consequently *decolor* falls as a synonym of *hoffmannsi*, the recognized range of which must be accordingly extended.

***Crypturellus soui inconspicuus*** Carriker.

Nine specimens: Buena Vista (Rio Surutu and Rio Yapacani) and Cerro Hosáne, Bolivia; Hyutanahan (Rio Purús), Brazil.

According to Carriker (1935, 315) these represent his new race *inconspicuus*, described from the Rio Beni in Bolivia, but since the Rio Purús specimen seems to be the same, comparison with *hoffmannsi* of the Rio Madeira is indicated. I have recently made this comparison, and I have found that the two series are racially distinct. *C. s. inconspicuus* is darker, more rufescent, less buffy below, while its upperparts are also darker-colored on an average. I continue to refer the specimen from the Rio Purús here, although I am at a loss to explain the range thereby involved. The form is quite distinct racially from *nigriceps*.

**Crypturellus undulatus adpersus** (Temminck).

Seven specimens: Santarem, Villa Braga, Goyana Island (Rio Tapajóz), Miritituba, and Apacy, Brazil.

Pará (the state) is the type-locality, but Hellmayr (1929, 477) says that Rio Tapajóz birds are typical. The back, neck, and even the pileum are more or less rufescent, with the rump, upper tail-coverts, and wing-coverts grayish olive, in decided contrast. All are vermiculated on these latter areas, and some have decided bars—this character tending thus toward *confusus*. The breast and underparts generally are plain grayish buffy, becoming decidedly buffy on the tibiae, lower abdomen, and crissum.

**Crypturellus undulatus yapura** (Spix).

Six specimens: Arimã, Manacapurú, and Caviana, Brazil.

These specimens agree with each other, and differ from a series from the Rio Tapajóz (*adpersus*) in being darker, more decidedly grayish, less buffy, below, and also in being darker brown above, with the pileum dusky plumbeous, in decided contrast; the vermiculations on the back are finer.

This form was described from the Rio Yapura, one of the northern affluents of the Amazon coming in not so far above Manacapurú but that specimens from that point would be referred to it on geographical grounds. Its range appears to include also the region south of the Amazon, since the specimen from Arimã on the Rio Purús is perfectly typical. Farther up that river, at Hyutanahan, however, it is replaced by *confusus*, but according to Hellmayr (1929, 477) the Rio Juruá race is *yapura*.

In its characters this race is farthest of all from *undulatus*, with which it is connected through *adpersus* and *confusus*; otherwise it could stand as a species.

*C. balstoni* (Bartlett) is a synonym, according to Hellmayr. Examination of the type in the British Museum shows that the colored plate in the "Catalogue" is not a good representation. There is too much cross-barring on the underparts; whereas the breast and abdomen are nearly plain medially.

**Crypturellus undulatus confusus** (Brabourne and Chubb).

Twelve specimens: Hyutanahan, Brazil.

This form is a connectant between *undulatus* and *adpersus*; its characters, as shown by the present series, vary now toward the one, and now



toward the other. Heretofore it has been known only from the type, which was taken at Humaythá, on the left bank of the Rio Madeira. (Peters' ascription of it to the Rio Purús is based on specimens from the above series examined by him.) Some examples are decidedly grayish-tinged below (like *yapura*), others are more buffy (like *adspersus*). The barring above varies considerably; some specimens are almost as heavily barred as *undulatus*, while others are more nearly like *adspersus* in this respect. The pileum tends to be brownish plumbeous; the upperparts and neck behind are strongly rufescent. Young birds (Nos. 87,043-4) are more or less barred and spotted below with blackish.

The range of this race embraces the region between the rivers Madeira and Purús, south of (about) 5° S. The Amazonian race, *yapura*, apparently occupies both banks of the Amazon between the mouths of these two tributaries, and ranges up the Rio Purús as far as Arimã.

#### ***Crypturellus undulatus undulatus* (Temminck).**

Sixteen specimens: Buena Vista (including Rio Surutu), Bolivia.

These fit the description and plate of *Crypturus scolopax* in the British Museum "Catalogue," as of course they should do, since they come from the type-locality. But according to Hellmayr (1929, 477) this name is a synonym of the earlier *undulatus*, based on the bird of Paraguay. It is recognized, however, by Miranda-Ribeiro (1938, 748).

The series shows much individual variation, affecting the color-tone of the underparts, the extent and intensity of the barring on the upperparts, neck, breast, and flanks, and the coloration of the pileum, which in some specimens is distinctly barred, in others plain slaty gray. A young bird (94,670) shows a little dark spotting on the breast.

Bolivian specimens in the British Museum are much more heavily barred above than those from Chapada, Matto Grosso, Brazil, but examples in the American Museum of Natural History from these respective regions are practically indistinguishable.

No. 80,932, February 28, is a chick, colored as follows: above mummy brown, with slight buffy feather-tipping; broad front and sides of head deep buffy, with a dark stripe through the eye; this stripe behind the ear centered with a median stripe of raw umber; crown raw umber, this color reaching the nape, bordered on either side by a narrow black edge, and divided by a median buffy stripe; throat white; rest of underparts dull buffy.

**Crypturellus boucardi boucardi** (Sclater) (?)

Two specimens: San Pedro Sula, Honduras; Cockscomb Mountains, British Honduras.

The British Honduras specimen should belong to the recently described race *blancaneauxi* Griscom (1935, 543) but it does not fit the description, since it is much darker and grayer below than the Honduras skin. I have compared it directly with a specimen from Secanquim, Guatemala (Am. Mus. No. 393,410), than which it is slightly darker above, with pronounced black bars on the wings, tail, and lower back. I have examined also the type and one other specimen of *blancaneauxi* in the British Museum. Both seem to be females. They are more rufescent above and buffier below than Guatemala skins. In the type the pileum is mostly brown; in the other it is slaty. Judging from these two skins alone, I would call *blancaneauxi* a valid race, but I should like to see more material before finally accepting it.

**Crypturellus variegatus variegatus** (Gmelin).

Twenty-two specimens: El Llagual, Venezuela; Pied Saut, French Guiana; Cayari Island, Upper Araucaua, Obidos, Tonantins, and Manacapuru, Brazil.

This species and its component races I have already discussed at some length in a former paper (1937, 175-178). To my remarks there I have only to add that a series from British Guiana in the collection of the British Museum shows much variation in the coloration of the underparts, the barring on the flanks and back, etc. I have examined also the type of *Tinamus bimaculatus* Gray. It is a young bird in spotted dress, without indication of locality, and absolutely indeterminable as to subspecies, so that the name may be disregarded.

**Crypturellus variegatus transamazonicus** Todd.

Seventeen<sup>1</sup> specimens: Santarem, Colonia do Mojuy, Villa Braga, Hyutanahan, Arimã, and São Paulo de Olivença, Brazil.

To the remarks in my paper above cited I have only to add that this is obviously the same form that was described a few months later by Miranda-Ribeiro under the name *Orthocrypturus variegatus superciliosus*

<sup>1</sup> In my former paper I listed nineteen specimens of this form, but I inadvertently included two specimens of *C. barletti* in the total.

(1938, 741). This author designates no type-specimen, and the example from Manacapurú which he lists is undoubtedly referable to true *variegatus*, as is our own from the same locality. The range of this pale-colored race would seem to reach the Rio Gy-Parana in western Matto Grosso.

#### ***Crypturellus variegatus salvini* (Salvadori).**

The type-series in the British Museum conforms to the description with respect to the barring on the upperparts. They are in fact by comparison very blackish above and richly colored below (the type especially); however, the barring on the flanks is not very distinct. As I have already said, *salvini* is merely a darker race of *variegatus*, and it is not a very strongly marked one at that.

#### ***Crypturellus brevirostris* (von Pelzel).**

Four specimens: Tamanoir, French Guiana; Hyutanahan, Brazil.

Since my previous account of this species appeared (*l.c.*), a second specimen from Tamanoir, French Guiana, which had been inadvertently disposed of by exchange, has been located and returned for study. H. B. Conover, whose specimen it is now, writes that Peters' ascription of "Cayenne" in the range of this species was probably based on this specimen, although it did not come from that exact locality. It agrees perfectly with the other bird from the same place in having white posterior underparts; this fact increases the probability that two races are represented in the series, as I have already suggested. It is a male, and measures: wing, 129; tail, 39; bill, 19; tarsus, 41. The flanks and tibiae show some barring, although not so much as in the Rio Purús skin.

Oliverio Pinto (1938, 500) records a specimen of this rare species from the Rio Vaupes, on the Colombian frontier of Brazil—a record which considerably extends the known range.

#### ***Crypturellus bartletti* (Sclater and Salvin).**

Eleven specimens: Hyutanahan, Nova Olinda, and Arimã, Brazil.

Compare my previous remarks on this species (1937, 178). To the list of specimens there given two more must be added. Compare also the remarks by Miranda-Ribeiro (1938, 750).

***Crypturellus cinnamomeus mexicanus* (Salvadori).**

Two specimens: Rio Sabinas, near Gomez Farias, Tamaulipas; and Valles, San Luis Potosi.

These examples are not alike, but I judge the differences to be sexual and not geographical. While at the British Museum I made a study of the races of this species, and reached precisely the same conclusions as Griscom announced (1935, 541-3).

***Crypturellus cinnamomeus vicinior* Conover.**

One specimen: Monte Redondo, Honduras.

***Crypturellus cinnamomeus præpes* (Bangs and Peters).**

One specimen: Bebedero, Costa Rica.

***Crypturellus idoneus* (Todd).**

Two specimens: Bonda, Colombia.

For a full description and critical remarks on this form compare my former account (1922, 166). Although it was originally described as a full species, Peters (1931b, 21) reduces it to a race of *cinnamomeus*. Conover (1933, 113) dissents, but Zimmer (1938, 50) insists that this view is correct. My material representing *cinnamomeus* is scanty I admit, but I should certainly keep *idoneus* as a species distinct both from the former on the one hand and from *erythropus* on the other. In my opinion *idoneus* does not fit in well with either of these and ought to stand alone. It occupies a semi-insular range in the Santa Marta region of Colombia.

***Crypturellus noctivagus* (Wied).**

This form is unrepresented in our collection, but I have examined three authentic specimens from the states of São Paulo and Bahia, Brazil, lent by the American Museum of Natural History. The male differs from the same sex of *C. erythropus* in its darker general coloration and the more decided barring of the lower back, upper tail-coverts, wings, flanks, and posterior underparts. Adult males of *erythropus* are almost devoid of barring, nearly "solid" brown in fact. The female is still more different from the other species, since it has the superciliaries and cheeks white, the throat rufescent, barred with dusky, the breast dull rufescent ochraceous (with no grayish), and the rest of the underparts rich buff, the sides barred

with black. The wings and tail are conspicuously barred with buff and the back is black, barred with rufous; the feet (in the skin) are yellowish, instead of dark-colored, as in the male. I consider these differences of specific value.

***Crypturellus erythropus erythropus*** (von Pelzeln).

Fourteen specimens: San Esteban, Venezuela; Obidos, Brazil.

Zimmer (1938, 50) reduces this form to a subspecies of *C. noctivagus* without apparent hesitation, but I think that he goes too far. According to Hellmayr (quoted by him), *C. dissimilis* is the same as *C. erythropus*. Our San Esteban specimen was examined by Hellmayr some years ago and was pronounced *dissimilis*. On geographical grounds it should be referable to *C. spencei* Chubb, but I am unable to distinguish it from the series from Obidos, on the Amazon River. Zimmer recognizes *spencei*, but not on the basis of topotypical material, since all his specimens but one came from points much farther east in Venezuela. Indeed, he says that females of the two forms (*erythropus* and *spencei*) are not certainly distinguishable. In describing *spencei*, Chubb compares it with *cinnamomeus* of Middle America, instead of with the South American *erythropus*. I have examined the type and one other specimen of *spencei* in the British Museum. They are in my judgment the same as *erythropus*, despite the rather prominent buffy bars on the back and wings. Specimens of the latter in the British Museum vary considerably among themselves. Some are almost uniform buffy below, while others have a more or less grayish wash on the breast. Again, some are almost uniform olive brown above; others (females or young birds?) are decidedly barred with buff and black, especially on the lower back and wings, like *variegatus*. The head is rufescent all around, and the forehead usually slaty.

Our specimens are all sexed as males. Rufescent throats are the rule, but in several individuals this part is white, either partially or wholly. The depth of the rufescent shade below, the amount of grayish wash on the breast, the dark barring of the flanks, the shade of brown on the back, and the black barring on the lower back and upper tail-coverts all vary considerably.

***Crypturellus erythropus garleppi*** (von Berlepsch).

Two specimens: Buena Vista (Rio Surutu), Bolivia.

These fit the original description fairly well, and coming as they do from the type-locality (virtually), they could scarcely be anything else. The

form proves to be so close to *C. erythropus* as to be only subspecifically separable, in my opinion. It differs from *erythropus* in the general color of the underparts, which averages darker, deeper rufous, and in the more olive brown (rather than cinnamon brown) shade of the upperparts, with the black vermiculation much more distinct.

The type-specimen of *C. garleppi affinis* Chubb, examined by me in the British Museum, has been marked by Hellmayr as the female of *garleppi*. Chubb was evidently misled by von Berlepsch's statement that *garleppi* was close to *atrocapillus*. The latter I have seen (in the British Museum), and I consider it a well-marked and perfectly distinct species.

#### ***Crypturellus strigulosus strigulosus* (Temminck).**

Ten specimens: Santarem, Villa Braga, and Hyutanahan, Brazil.

I cannot accept Zimmer's arrangement making *strigulosus* and *erythropus* conspecific (1938, 50). The differences are far too great, and moreover, as I have just shown, *erythropus* is represented in Bolivia by an allied race, with *strigulosus* coming in between. One female of the latter (No. 75,306) is decidedly buffy below, while another (No. 78,199) is the whitest of the series. A young bird (No. 78,200, September 16) is also whitish below. Two males from the Rio Purús are practically indistinguishable from the Rio Tapajóz specimens. This fact suggests that the unique type of *hellmayri* from the Rio Madeira may be only an individual variant. In our series the shade of brown in the upperparts varies considerably.

#### ***Crypturellus parvirostris* (Wagler).**

Thirteen specimens: Buena Vista (also Rio Surutu and Rio Yapacani), Santa Cruz de la Sierra, Guanacos, and Rio Quiser, Bolivia; Santarem, Brazil.

Most recent writers on this species admit no racial variation, but certain characters shown by our series are at least suggestive of such. Two birds (a pair) from Santarem are darker, more grayish below, sex for sex, than the "general run" of Bolivian specimens. They may possibly represent the lately described *C. p. fuscus* of Miranda-Ribeiro (1938, 775), based on two females from the island of Marajó. Compared with two specimens from Bahia (fixed as the type-locality by Hellmayr [1929, 478]) in the collection of the American Museum of Natural History, Bolivian

skins are paler above; they have slaty (instead of brownish) pileum and sides of the head, and grayer, less brownish sides and breast. If separable, they may be entitled to the name *cervinus* of Bonaparte from Chiquitos, Bolivia—unless, indeed, as is possible, this name applies to *C. tataupa*. (The description is brief and unsatisfactory.) However, Hellmayr (1907, 410) says that in young birds of *parvirostris* the pileum is mainly pale brown, as it is indeed in our specimen from Santa Cruz de la Sierra, so that the Bahia skins above mentioned may be immature.

Three skins from Chapada, Matto Grosso, and one from Bolivia, in the British Museum, are pale as compared with other skins from Brazil.

No. 79,109 (January 12) is emerging from the natal down, but it still shows traces of the characteristic head pattern of this early stage. No. 43,763 is immature, with the breast obsoletely squamate, and with black subterminal spots, partially concealed, on the feathers of the back and wing-coverts. Females are uniformly darker and more richly colored than males.

Miranda-Ribeiro (*l.c.*) has described also a third race of this species (*superciliaris*) from the "Planalto Parecis" of Brazil, from which he had a single specimen. In view of the observable differences depending on age, sex, and individual, I feel that no geographical races of this species should be recognized unless on the basis of a very much larger series of specimens than are at present available.

#### ***Crypturellus tataupa tataupa* (Temminck).**

Eight specimens: Puerto Suarez, Palmarito, Rio Grande, and Samaipata, Bolivia.

These require comparison with specimens from Brazil and Paraguay, although Hellmayr (1929, 478) discounts the chance of any racial variations in this region.

#### ***Rhynchotus rufescens rufescens* (Temminck).**

Nine specimens: Buena Vista, Bolivia.

The buffy barring on the underparts is subject to considerable variation in these specimens. They have not been compared as yet with birds from São Paulo, Brazil, which Mrs. Naumburg accepts as the type-locality (1930, 60).

**Rhynchotus maculicollis** Gray.

Three specimens: Samaipata, Cerro San Benito, and Incachaca, Bolivia.

I see no reason for reducing this form to subspecific rank, even if the neck markings in one specimen are somewhat less prominent. Its range closely approximates that of *R. rufescens*, and drops down to 1200 meters at Samaipata.

**Nothoprocta ornata ornata** (Gray).

Eight specimens: La Paz, Colomi, Guaqui, and Incachaca, Bolivia.

In this species the breast is decidedly gray, but this feature is not well shown in the plate (17) in the "Catalogue of the Birds in the British Museum." The spotting and barring above vary; they are less prominent in the Incachaca specimen, which may possibly belong to a different race.

**Nothoprocta cinerascens** (Burmeister).

Five specimens: Miraflores and Machomuerto, Argentina.

**Nothoprocta curvirostris** Sclater and Salvin.

Two specimens: Mount Pichincha, Ecuador.

A chick, collected January 28, is assumed to belong to this species. Above it is mottled and striped with black, brown, and white; the superciliaries, malar region, and throat are white; the underparts are dull gray, mottled with brown.

**Nothoprocta pentlandi pentlandi** (Gray).

Thirteen specimens: Cochabamba, Tiraque, Comarapa, and Pocona, Bolivia.

At first glance these fall into two series, according to size and coloration. In the larger birds (wing 130-155 mm.) the forehead, the sides of the head (except a postocular streak), and the throat and breast are decidedly grayish (the latter with some white spots); the prevailing tone of the upperparts is grayish brown; the white streaking is present but not prominent, especially on the upper back; the sides and flanks are shaded and more or less barred with buffy. In the smaller birds (wing 127-139 mm.) the forehead, the sides of the head, and the throat and breast are buffy with



brownish streaking (the breast more grayish buffy, with white spots); the prevailing tone of the upperparts is dull Brussels brown to rich tawny olive (especially in evidence on the tertiaries); the black bars and white streaks are conspicuous, even on the upper back; the sides and flanks are spotted and barred with dusky brown. In one specimen (No. 81,333) the breast is similarly spotted with brownish black. The two lots look like two species, but this could hardly be true, because there is one specimen (No. 120,132) which is clearly intermediate, since it has rich tawny olive tertiaries and brown-spotted sides combined with grayish forehead, sides of the head, and breast. Moreover, the smaller birds (with one exception) were shot at the same time as the larger ones, as I judge from the continuity of the collector's numbers. These smaller birds fit the description of *Nothoprocta moebiusi* von Berlepsch, but I agree with Salvadori that this must be the young of *pentlandi*.

Three birds shot in September and February are obviously more rufescent buffy below than those taken in June. This character I believe is one that has been used for discriminating a Peruvian race of this form, which race needs re-investigation.

Females appear to have the throat spotted with grayish, but some doubt attaches to the sexing of the specimens.

#### ***Nothoprocta perdicaria perdicaria* (Kittlitz).**

One specimen: Valparaiso, Chile.

#### ***Nothura maculosa agassizi* Bangs.**

Five specimens: La Paz (market), Guaqui, and Desaguadero, Bolivia.

Mr. Griscom, to whom four of the above specimens were sent for comparison with the type, writes as follows: "Our specimens of this race of *maculosa* consist of the type and one other specimen. Your specimen marked, '♂,' from Desaguadero, matches our two specimens of *agassizi* exactly. Your other three specimens, however, take on the hue of difficulty. They come from a different locality, which may or may not be faunally isolated or distinct from the other." He goes on to suggest that, being females, they may be different on that account, or else that they are nearer *boliviana*. Comparison with this latter form suggests that they do actually tend somewhat towards it. Peters reduces both *agassizi* and *boliviana* to races of *N. maculosa*, as also does Laubmann (1934, 280). Pending further study I accept this arrangement provisionally, although

somewhat doubtful of its propriety. Compare also, in this connection, Wetmore's remarks on the affinities of these forms (1926, 37). At any rate, *agassizi* and *boliviana* appear to be very distinct from each other, in spite of variation in both forms. I am not prepared to discuss their relationships to the recently described *Nothura maculosa oruro* Bond and de Schauensee (1941).

#### **Nothura maculosa boliviana** Salvadori.

Five specimens: Cochabamba, Chocaya, Tiraque, and Totorá, Bolivia.

These specimens were sent to Hellmayr at the British Museum for comparison with the type of *boliviana*. He reported that they were the same.<sup>2</sup> The specimen from Tiraque is a very good match for the type, particularly in the deep coloration below. The Cochabamba birds as well as the original series of *boliviana* are indeed easily distinguished from *agassizi*, of Lake Titicaca, which is blacker above and much more coarsely marked with black on the chest and sides. He goes on to say that Bridges' type-series probably came from the Valley of Cochabamba. The form ranges from Bolivia through the Chaco to Paraguay and Argentina (compare Wetmore, *l.c.*).

#### **Nothura boraquira** (Spix).

Eleven specimens: Santa Cruz de la Sierra and Buena Vista, Bolivia.

These agree with the figure of *N. marmorata* Gray (in Salvadori, 1895, pl. 18). According to Hellmayr (1906, 705), however, this name is a synonym of *Tinamus boraquira* Spix—an opinion which he reiterates (1929, 478) after seeing specimens from the same locality from which our own come. Miranda-Ribeiro (1938, 704) renames this form *spixi*, on the ground that "*boraquira*" is "bad Portuguese"—which reason under present rules is of course no reason at all. Wetmore (1926, 37, note) would refer this species to *Nothoprocta* on account of the posterior aspect of the tarsal envelope as shown on Spix's plate. This plate is incorrect in this particular respect, however, although it is otherwise a fair representation.

Two sizes of birds are represented in our series, but not according to sex (as marked). The smaller ones may be younger birds, as I judge from our specimen No. 79,124, which is rather prominently spotted below.

<sup>2</sup> In sending these I inadvertently overlooked the fact that Dr. Hellmayr had already compared Bolivian specimens from Mr. H. B. Conover.

## LITERATURE CITED

- BERLEPSCH, HANS GRAF VON.  
1908. On the Birds of Cayenne. Part II.—*Novitates Zoologicae*, November, 1908, 261-324.
- BOETTICHER, HANS VON.  
1934. Beitrag zu einen phylogenetisch begründeten, natürlich System der Steisshühner (*Tinami*) auf Grund einiger taxonomisch verwertbarer Charaktere.—*Jenaische Zeitschrift für Naturwissenschaft*, 69, 1934, 169-192.
- BONAPARTE, CHARLES LUCIEN.  
1856. Tableaux paralleliques de l'ordre des Gallinacés.—*Comptes Rendus Academie Sciences Paris*, 42, 1856, 874-884. Note sur les Tableaux des Gallinacés.—*Ibid.*, 953-957.
- BOND, JAMES, and DE SCHAUENSEE, RODOLPHE MEYER.  
1941. Descriptions of New Birds from Bolivia.—*Notulae Naturae* No. 93, October 14, 1941. pp. 7.
- BRABOURNE, LORD, and CHUBB, CHARLES.  
1914. A Key to the Species of the Genus *Crypturus*, with Descriptions of some new Forms.—*Annals and Magazine of Natural History*, (8), 14, October, 1914, 319-322.
- CARRIKER, MELBOURNE A., JR.  
1910. An Annotated List of the Birds of Costa Rica including Cocos Island.—*Annals Carnegie Museum*, 6, September 7, 1910, 314-915, 1 map.  
1933. Descriptions of new Birds from Peru, with notes on other little-known species.—*Proceedings Academy Natural Sciences of Philadelphia*, 85, March 24, 1933, 1-38.  
1935. Descriptions of new Birds from Bolivia, with Notes on other little-known species.—*Proceedings Academy Natural Sciences of Philadelphia*, 87, October 10, 1935, 313-341.
- CHAPMAN, FRANK M.  
1917. The Distribution of Bird-Life in Colombia: A Contribution to a Biological Survey of South America.—*Bulletin American Museum of Natural History*, 36, 1917, pp. x + 729, 41 pls.  
1926. The Distribution of Bird-Life in Ecuador.—*Bulletin American Museum of Natural History*, 55, 1926, pp. xiv + 784, 30 pls.
- CHUBB, CHARLES.  
1916. The Birds of British Guiana. Vol. 1, 1916, pp. liii + 528, 10 pls., map.
- CONOVER, H. B.  
1933. The Races of the Tinamou *Crypturellus cinnamomeus*.—*Proceedings Biological Society of Washington*, 46, June 30, 1933, 116-117.  
1937. A new race of *Tinamus major* from Brazil.—*Proceedings Biological Society of Washington*, 50, October 28, 1937, 191-192.

## GRISCOM, LUDLOW.

1929. A Collection of Birds from Cana, Darien.—*Bulletin Museum Comparative Zoölogy*, 69, April, 1929, 149-190.
1932. The Ornithology of the Caribbean Coast of Extreme Eastern Panama.—*Bulletin Museum Comparative Zoölogy*, 72, January, 1932, 303-372.
1935. Critical Notes on Central American Birds in the British Museum.—*Ibis*, July, 1935, 541-554.

## GRISCOM, LUDLOW, and GREENWAY, JAMES C.

1937. Critical Notes on New Neotropical Birds.—*Bulletin Museum Comparative Zoölogy*, 81, May, 1937, 417-437.

## HELLMAYR, CARL E.

1906. Revision der Spix'schen Typen brasilianischer Vögel.—*Abhandlungen K. Bayerischen Akademie Wissenschaften*, II Kl., 22, 1906, 563-726, 2 pls.
1907. On a Collection of Birds made by Mr. W. Hoffmanns on the Rio Madeira, Brazil.—*Novitates Zoologicae*, 14, November, 1907, 343-412, pl. 3.
1929. A Contribution to the Ornithology of Northeastern Brazil.—*Field Museum Zoological Series*, 12, March 4, 1929, 235-501, map.

## LAUBMANN, A.

1934. Weitere Beiträge zur Avifauna Argentiniens.—*Verhandlungen Ornithologischen Gesellschaft in Bayern*, 20, 1934, 249-336, map.

## MIRANDA-RIBEIRO, ALIPIO DE

1938. Notas Ornithologicas (xii). Tinamidae.—*Revista do Museu Paulista*, 23, March 18, 1938, 667-788, pls. 1-18.

## NAUMBURG, ELSIE M. B.

1930. The Birds of Matto Grosso, Brazil.—*Bulletin American Museum of Natural History*, 60, 1930, pp. vii + 432, 17 pls., map.

## OLIVEIRA PINTO, OLIVERIO M. DE

1938. Catalogo das Aves do Brasil e lista dos exemplares que as representam no Museu Paulista.—*Revista do Museu Paulista*, 22, "1937," 1938, pp. xviii + 566.

## PETERS, J. L.

- 1931a. Additional Notes on the Birds of the Almirante Bay Region of Panama.—*Bulletin Museum of Comparative Zoölogy*, 71, February, 1931, 293-345.
- 1931b. Check-List of Birds of the World. Cambridge, June, 1931, pp. xviii + 345.

## SALVADORI, TOMMASO.

1895. Catalogue of the Birds in the British Museum. Vol. 27, 1895, includes the Chenomorphæ, Crypturi, and Ratitæ, pp. xv + 636, 19 pls.

SALVIN, OSBERT, and GODMAN, F. DUCANE.

1904. *Biologia Centrali-Americana*. Vol. 3, 1897-1904, pp. iv + 510.  
(Tinamidæ, pp. 448-459, April, 1904.)

SNETHLAGE, EMILIA.

1914. *Catálogo das Aves Amazonicas contendo todas as especies descriptas e mencionadas até 1913.*—*Boletim do Museu Goeldi*, 8, "1911-12," 1914, 1-530, 6 pls., map.

TODD, W. E. CLYDE, and CARRIKER, MELBOURNE A.

1922. *The Birds of the Santa Marta Region of Colombia: A Study in Altitudinal Distribution.*—*Annals Carnegie Museum*, 14, 1907, 3-611, 9 pls.

TODD, W. E. CLYDE.

1937. *Critical Remarks on Crypturellus variegatus and its Allies.*—*Proceedings Biological Society of Washington*, 50, October 28, 1937, 175-178.  
1938. *Notes on Crypturellus cinereus (Gmelin).*—*Proceedings Biological Society of Washington*, 51, May 19, 1938, 123-126.

WETMORE, ALEXANDER.

1926. *Observations on the Birds of Argentina, Paraguay, Uruguay, and Chile.*—*Bulletin U. S. National Museum*, No. 133, 1926, pp. iv + 448, 20 pls.

ZIMMER, JOHN T.

1928. *A new form of Crypturellus noctivagus.*—*Proceedings Biological Society of Washington*, 51, March 18, 1938, 47-51.









ART. II. OBSERVATIONS ON THE LIFE HISTORY OF A NEW <sup>E</sup>  
CHALCIDOID WASP, AN INTERNAL PARASITE  
OF ANT-LION LARVAE

BY GEORGE E. WALLACE

(One plate)

During the summer of 1940, two ant-lion cocoons, *Myrmeleon im-maculatus* De Geer, collected at Presque Isle, Erie, Pennsylvania, were found to be parasitized by a chalcidoid wasp belonging to the genus *Stomatoceras* (family *Chalcididae*). One adult wasp emerged from each cocoon. Both individuals were females. Further collections of host material, both larvae and cocoons, were made during July 1941. From this host material forty-five parasites, comprising both males and females, were reared. Several more of the parasites were taken in the field, and the process of oviposition was observed both in the field and in captivity. Dissection revealed pupal cases of the wasp within the remains of the ant-lion larvae.

It was at first thought that this *Stomatoceras* material from Presque Isle might prove to be a new species. However, in the writer's opinion, the material should be considered, for the present at least, as a variety of *Stomatoceras rubra* Ashmead,<sup>1</sup> and as such it is here described.

The author is indebted to Mr. C. F. W. Muesebeck and Mr. A. B. Gahan, at the United States National Museum, and Mr. E. T. Cresson, Jr., of the Academy of Natural Sciences of Philadelphia, for permission to study material in the collections of these two institutions.

***Stomatoceras rubra* Ashmead *erimensis***, new variety

*Female*: length 4.7 mm. Head barely as wide as the thorax, antero-posteriorly thin and somewhat depressed between the lateral ocelli. The distance between each lateral ocellus and the eye margin equal to the diameter of the ocellus; the posterior edge of the median ocellus not quite reaching the vertex. Eyes prominent, with a very few short widely scattered hairs. Face long, triangular in appearance. Clypeus short, lower margin gently concave. Labrum visible. Left mandible bidentate; (the right mandible concealed in the holotype, but in other specimens tridentate). Maxillary palpi 4-jointed; labial palpi 3-jointed. Cheeks

<sup>1</sup> Ashmead, W. H., *Trans. Amer. Ent. Soc.*, vol. 21, p. 332, 1894.

rimmed posteriorly by a sharp thin carina. Head, excepting antennal furrow, hairy and closely pitted with coarse punctures, each puncture enclosing a hair. Antennal furrow delicately cross-striated. Antennae 11-jointed, situated close together just above the clypeus; a carina present between their scrobes. Scape equal to about one-half the length of the flagellum, and extending to the upper (posterior) margin of the median ocellus. First funicle joint the longest. Following joints of flagellum gradually diminishing in length with the exception of the apical joint which is nearly equal to the first funicle joint. The ring joint a little longer than broad—almost quadrate. Pedicel equal to the third funicle joint. Pubescence of antennae appearing slightly longer and denser from tip of pedicel to and including the first funicle joint.

Thorax slightly longer than wide. Prothorax transverse quadrate,

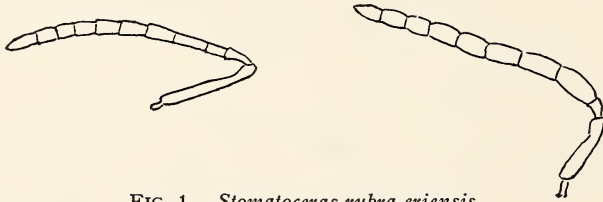


FIG. 1. *Stomatoceras rubra eriensis*

Left figure, outline of antenna of female, x 15; right figure, outline of antenna of male, x 16.

though somewhat declivous anteriorly; the sides but not the notum bordered anteriorly by a carina. Parapsidal furrows complete. Axillae not meeting at base of scutellum. Scutellum bounded laterally by a carina which posteriorly forms the two small lobes or teeth typical of the genus. Below the carina bounding the scutellum is an area bordered below by a second carina; this area is traversed by rugae connecting the two carinae. Prothorax, mesonotum, and upper portion of the scutellum thickly pitted with coarse punctures. Metepisternum punctate and hairy. Propodeum short, declivous, aerolated by numerous rugae; hairy at the lateral angles. Propodeal spiracles thin, slit-like, directed toward scutellum. All coxae with short silvery hairs. Lower margin of hind femora not markedly convex; denticular ridge straight (slightly notched in some specimens). Hind tibiae two-spurred, the outer spur minute—much the shorter of the two. Forewings overlapping abdomen, fuscous with an embrowned area below the point where the submarginal vein joins the marginal. A hyaline area extends from the embrowned

portion to a short distance beyond the postmarginal. Both embrowned and hyaline areas extend a little less than halfway to the posterior edge of the wing. *Pubescence of wings brown; no silvery white pubescence in the hyaline area.*

Abdomen globose. First segment the longest, dorsally extending slightly more than half the length of the abdomen. The second, third, fourth, and fifth segments very short, very finely roughened; the second, fourth, and fifth subequal, each dorsally equal to about one-sixth of the first segment; the third segment small, forming a barely visible transverse strip. Posterior margins of the third, fourth, and fifth tergites concave. *The sixth tergite forms a vertical plate which is furnished with conspicuous punctures. Ovipositor not visible; the sheaths visible, but not projecting beyond the sixth tergite.*



FIG. 2. *Stomatoceras rubra eriensis*

Left figure, outline of head of female, front view, x 13; right figure, outline of head of male, x 13.

General body color dark red except for the following structures which are black: antennae, excepting ring and first funicle joint; anterior margin of mesonotum, posterior third of mesonotum, extreme antero-lateral angles of parapsides together with the adjoining portion of prothorax and tegulae, axillae at anterior angles; metathorax except median spot of red; propodeum, mesosternum, metasternum, front and middle tibiae except apices; inner faces and proximal tips of front femora; mid-trochanters and mid-femora, mid- and hind tarsi except apices; hind tibiae except apices; denticulate portion of hind femora, and median portion of first abdominal tergite.

Ring joint and first funicle joint fusco-rufous; in life this portion of antennae appears pale silvery. The middle femora somewhat suffused with fusco-rufous on outer sides. The apices of front and middle tibiae, all of fore tarsi, apices of mid- and hind tarsal joints fusco-rufous. A faint touch of blackish on occiput, vertex, parapsidal furrows, dorsal surface of scutellum, and lower margin of sixth tergite.

*Male*: length 3.7 mm. Head not as long as in female. Eyes hairy. Ring joint and first funicle joint of antennae apparently fused together, forming a 10-jointed antenna. Antennal scape equal to about one-third the flagellum, barely reaching the median ocellus. Pedicel smaller than than any of the funicle joints.

Thorax similar to that of female. Lower margin of hind femora convex; denticulate ridge with an incision so that proximal six to nine denticles appear to be on a prominence. Forewing similar to that of female.

Abdomen small, globose, length 1.4 mm. First abdominal tergite the longest, equal to half the abdomen; the second, third, fourth, fifth, and sixth tergites nearly equal in length, the third being smaller than the others. Hind margins of the second and third tergites appear concave when seen from above. All tergites very finely roughened; the fourth, fifth, and sixth with some coarse punctures.

Color black; inner portions of tarsal joints, particularly at apices, tinged with fusco-rufous.

*Size and color*: the females of the paratype series show considerable variation in both size and color. The largest specimen is 4.9 mm. in length, the smallest 3.6 mm. The average size of all the female type specimens (including the holotype) is 4.5 mm.; however the majority of the specimens exceed this figure. The lightest colored specimen of the female paratypes has only the tibiae, anterior and posterior margins of the mesonotum, anterior edges of parapsides, mesosternum, metasternum, and basal portion of the antennal scapes, black. The darkest female specimen has the head and thorax almost entirely black, and the abdomen heavily suffused with black.

The males of the type series range in size from 3.6 mm. to 4.4 mm. The average size of the males is 4.1 mm., but the majority of the specimens exceed this figure.

#### VARIETAL DIFFERENCES SUMMARIZED

The chief differences between *S. rubra* Ashmead<sup>2</sup> and the variety *eriensis*, as shown by female specimens, are summarized as follows:

1. The general color of *eriensis* is much darker red than *rubra*. As mentioned previously, the head and thorax are almost uniformly black in the darker specimens of the *eriensis* paratype material. In both light

<sup>2</sup> Of the four types (all females) designated by Ashmead, only the two deposited at the U. S. National Museum have been examined by the writer.

and dark specimens the tibiae are black. The body color of *rubra* tends more to orange rufous with no such black coloration as mentioned above.

2. In the *rubra* types, the wing cilia in the hyaline area immediately behind the marginal vein are silvery white and appear slightly flattened. The wing cilia of *eriensis* are entirely dark with none appearing flattened.

3. The hind femur of *eriensis* does not have the lower margin as decidedly convex nor the denticulate ridge as deeply notched as in *rubra*.

4. The abdomen of *eriensis* is globose; the abdomen of *rubra* is pointed ovate. Also all of the tergites of *eriensis* are sculptured, the first to fifth tergites with reticulations and the sixth with coarse punctures. The first tergite of *rubra* is smooth, the second to fifth not as distinctly reticulate as in *eriensis*, and the sixth tergite is not punctate.

5. In average size, the females of *eriensis* are slightly (0.5 mm.) larger than *rubra*; however, because of the few *rubra* specimens available, size differences should not be stressed at present.

#### MATERIAL EXAMINED

*Holotype*: female, Presque Isle, Erie, Pa., July 10, 1941. Taken while ovipositing on an ant-lion larva.

*Allotype*: male, which emerged from cocoon of ant-lion parasitized by holotype.

*Paratypes*: twenty-nine females and eighteen males all from Presque Isle, Erie, Pa. Two females taken in the field; July 11, 1933, and July 18, 1941. The other females were all reared from host material; one specimen reared July 1940, the remainder during July and August, 1941. All males, except one, reared during July, August, and September; the specimen excepted was taken on July 18, 1941.

Holotype and allotype in the collection of the Carnegie Museum; paratypes in the Carnegie Museum, and the United States National Museum, Washington, D. C.

In addition to the Presque Isle specimens and the two types of *Stomatoceras rubra* studied, other material, here considered as a variety of *Stomatoceras rubra*, has also been examined. This additional material includes the following specimens: (1) at the U. S. National Museum—a female specimen from Brownsville, Texas; four female specimens from Beach, North Dakota; a female specimen from Raleigh, North Carolina; and a female reared from *Myrmeleon immaculatus* at Medora, Kansas, by R. C. Smith; (2) at the Academy of Natural Sciences of Philadelphia—

a female specimen from Montana determined as *Stomatoceras rubra* Ashmead (the identification label being in Ashmead's handwriting); two females and a male from North Woodbury, New Jersey; and a female specimen bearing only the label "Dac." All of these specimens are apparently intermediate between the *rubra* types and *eriensis*, but are closer to the latter. The females possess the lighter color of *rubra*, and the wing ciliation of *eriensis*. The abdomen is globose and sculptured as in *eriensis*. The male specimen at the Academy of Natural Sciences agrees with the males of *eriensis* except that the prominence on the denticulate ridge is not as pronounced as in *eriensis*. Possibly these specimens may represent a separate variety of *rubra*. In order to ascertain this point, however, it seems best to wait until further reared series are available, and also to learn more of the distribution of both *rubra* proper and of *eriensis*.

#### LIFE HISTORY

Parasitism of *Myrmeleon immaculatus* in North America has been previously recorded by Smith,<sup>3</sup> and by Balduf.<sup>4</sup> Both of these references pertain to the rearing from ant-lion cocoons by Smith<sup>5</sup> of chalcidoid specimens, which were identified as *Stomatoceras* sp. Other parasites of *Myrmelionidae* have been mentioned by Wheeler.<sup>6</sup>

Oviposition of *Stomatoceras rubra* var. *eriensis* takes place on the active ant-lion larva in the latter's pit. Successful oviposition by *eriensis* in the field was observed on one occasion, and an unsuccessful attempt was observed at another time. In this last instance, the parasite was inadvertently disturbed after it had inserted the ovipositor, but before egg-laying had been completed. In addition to these two cases, oviposition by *eriensis* in vials was noted once. In a number of other cases, ant-lion larvae in vials were stung, but no egg was deposited.

In searching for the host, the females of *S. r. eriensis* walk slowly about over the sand—the antennae being bent downward and rapidly tapped or vibrated against the ground. They evince great interest in small depres-

<sup>3</sup> Smith R. C., *Journ. Kan. Ent. Soc.*, vol. 7, no. 4, p. 137, 1934.

<sup>4</sup> Balduf, W. V., *The Bionomics of Entomophagous Insects*, pt. II, John S. Swift Co., Inc., St. Louis, Mo. (1939), p. 326.

<sup>5</sup> One of which is the specimen previously mentioned as having been studied by the author at the U. S. National Museum.

<sup>6</sup> Wheeler, W. M., *Demons of the Dust*. W. W. Norton & Company, Inc., New York (1930), p. 139.

sions, furrows, footprints, etc. When a suitable ant-lion pit is found, the wasp takes up a position facing upward on the side of the pit. In this position the parasite may remain motionless for a considerable period of time providing the ant-lion has shown signs of activity. If the ant-lion senses the presence of the wasp, it begins the characteristic procedure of flipping sand from the lower portion of the pit, causing the sand around the sides of the pit to slide downward. With the commencing of this "flipping" and the downward slide of the sand, the parasite slightly elevates its wings and spreads its hind legs. In this position it slides backward into the jaws of the ant-lion larva and is pulled under the sand. Insertion of the ovipositor and the consequent release of the wasp from the ant-lion's mandibles evidently take place immediately. In the cases observed, the ant-lion, after pulling the wasp under the sand, could be detected moving hastily about. In one instance the attacked ant-lion came to the surface of the sand in its endeavors to escape. Oviposition behavior was easily observed with a hand lens in those cases where an egg was actually in the process of being deposited. The ovipositor is inserted in the prothorax of the host, the wasp standing either to one side of the mandibles or on the head of the ant-lion. The antennae and fore legs are folded downward, the parasite being supported by the ovipositor, hind, and mid-legs. When the egg has been deposited, the antennae begin to vibrate, and the ovipositor is withdrawn. The exact time required for oviposition was not ascertained; however the length of time from the moment the parasite is seized to the time the ovipositor is withdrawn is judged to be about two minutes.

Successful oviposition on ant-lion larvae in captivity was accomplished only by a single specimen—the holotype (the same specimen that was observed completing oviposition in the field). Captive recently emerged female parasites would use the ovipositor only as a means of defense, and then not always successfully. In all cases, however, the "flipping" activity of the ant-lion caused an immediate cessation of walking on the part of the wasp, and the assumption of the characteristic attitude of lifted wings, and extended hind legs.

The parasitized ant-lion larvae appeared to be partially paralyzed, able only to feebly move their heads and mandibles. They eventually formed cocoons but did not pupate, the parasites emerging from the enclosed larvae. Parasites were never observed to emerge from larvae not enclosed in cocoons. The ant-lion larvae which were stung in self defense by young females of *eriansis* eventually died without forming co-

coons. Larvae in which *eriensis* had oviposited, as well as those larvae which merely had been stung, did not construct pits and were indifferent to food, *i.e.* live insects placed with the larvae in vials.

As stated before, two instances of successful oviposition were observed. In the case where oviposition took place in the field, the egg was deposited on July 10, 1941, and the adult male offspring (the allotype) emerged September 6. The exact day on which the host larva spun its cocoon is not known, but it was sometime between August 4 and 23. In the case of oviposition in captivity, the egg was deposited July 10, the host larva had spun a cocoon by the morning of July 11, and a female parasite emerged August 22.

The proportion of parasitism of host material collected during 1941 was approximately 41 percent. Of 177 host cocoons, 45 gave rise to adult parasites, 28 were found by dissection to be parasitized, and 104 were not parasitized. No cases of secondary parasitism were observed.





## EXPLANATION OF PLATE

*Stomaloceras rubra* variety *eriensis*

Figures 1-3, photographed by transmitted light.

FIG. 1. Hind leg of female ( $\times 13$ ).

FIG. 2. Hind leg of male ( $\times 13$ ).

FIG. 3. Forewing of male ( $\times 13$ ).

FIG. 4. Side view of male ( $\times 8$ ).

FIG. 5. Cocoon of ant-lion host, *Myrmeleon immaculatus* De Geer, showing emergence aperture of adult parasite ( $\times 3$ ).



1



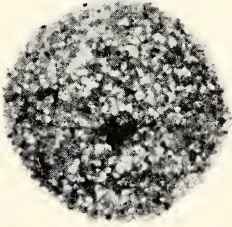
2



3



4



5



7.73  
Pittsburgh.

ART. III. UPPER CRETACEOUS FAUNA OF THE  
ASPHALT RIDGE, UTAH

By I. P. TOLMACHOFF

(PLATES I-II)

INTRODUCTION



In the summer of 1932, the writer together with J. J. Burke and J. LeRoy Kay twice visited Asphalt Ridge, located a few miles southwest of Vernal, Utah. We did not intend to make any detailed geological investigation of the ridge but wished only to collect more fossils in the locality at the northwestern end of the ridge where a small fauna was discovered by J. LeRoy Kay in 1929. In spite of the very short time at our disposal, we succeeded in collecting a small but typical assemblage of the fauna which permits making a fairly exact correlation of the corresponding strata. A few additions to this fauna were made, in 1933, by the writer and E. R. Eller, and in later years by J. LeRoy Kay. The whole fauna is described in the present paper.

According to H. S. Gale,<sup>1</sup> Asphalt Ridge is composed chiefly of the strata of the Wasatch Formation underlaid from the northeast by the Mesaverde Formation of the Cretaceous. The Tertiary and Cretaceous are separated from each other by an unconformity. The Wasatch Formation was identified as such chiefly on the ground of the lithological character of its rocks. E. M. Spieker's<sup>2</sup> interpretation of the stratigraphy of the Asphalt Ridge is different from that of Gale. He recognized unconformity between the Cretaceous and Tertiary, but the latter he considers represented by the Uinta Formation alone, the Wasatch and Green River Formations being absent from this locality. Since he thinks that a considerable thickness of Upper Cretaceous is also missing here, the unconformity assumed by him appears to be of considerable magnitude, although nowhere well expressed with the exception perhaps only of his "location 8" where it is possible to suggest "angular discordance between the formations."<sup>3</sup> His correlation of the Tertiary of the Asphalt Ridge is based on tracing the

<sup>1</sup> Gale, H. S., Coal Fields of Northwestern Colorado and Northeastern Utah: U. S. Geol. Surv. Bull. 415, pl. XXI (map), Washington, 1910.

<sup>2</sup> Spieker, E. M., Bituminous Sandstone near Vernal, Utah: U. S. Geol. Surv. Bull. 822-C, Washington, 1930.

<sup>3</sup> *Ibidem*, p. 82.

Uinta Formation from central and western parts of the Uinta Basin and also on the lithological character of the formation. Eight sections described by Spieker along the ridge are placed within the Uinta Formation with a few exceptions. In Section 1, the basal horizon is "doubtless Cretaceous. The overlying bituminous beds may also be Cretaceous."<sup>4</sup> Basal horizon in Section 8 is referred to the Upper Mesaverde. The whole thickness of bituminous sandstones in Section 2, about 190 feet, may also be Cretaceous. This contradicts the statement that "most and perhaps all of the bituminous sandstone of the Vernal locality is in the Uinta Formation."<sup>5</sup> A certain vagueness of correlation was explained, however, by the lack of paleontological evidence and the necessity of depending upon the general geological structure of the area, lithological character, local unconformities, etc.

Paleontologists of the Carnegie Museum found in sandstones of the Asphalt Ridge, below the lowermost conglomerate, parts of a skull of *Mesagriochoerus primus* Peterson<sup>6</sup> which placed the whole suite of conglomerates and sandstones above the bituminous sandstones in the Duchesne River Formation.<sup>7</sup> There was no attempt made at that time to trace the lower limit of that formation or subdivide formations lying under the conglomerate-sandstone series. As the Cretaceous age of lower horizons in the Asphalt Ridge was established, only after 1932, on the basis of paleontological evidence, all these formations were referred to the Tertiary.

The writer is much obliged to Dr. R. S. Bassler, through whose courtesy he was able to secure important comparative materials from the United States National Museum.

#### DESCRIPTION OF LOCALITY

Sandstones, in which the Cretaceous fauna was collected in the Asphalt Ridge, outcrop at the northwestern end of the ridge under a layer of bituminous sandstone. They are yellowish gray in color, a little shistose in upper horizons, rather loose or massive in places, and in the whole are about a hundred feet thick. Within this sandstone formation were found

<sup>4</sup> Spieker, E. M., U. S. Geol. Surv. Bull. 822-C, p. 83.

<sup>5</sup> *Ibidem*, p. 81.

<sup>6</sup> Peterson, O. A., List of Species and Description of new Material from the Duchesne River Oligocene, Uinta Basin, Utah: Ann. Carnegie Museum, XXIII, p. 382.

<sup>7</sup> Kay, J. LeRoy, The Tertiary Formations of the Uinta Basin, Utah: Ann. Carnegie Museum, XXIII, p. 358.

four layers of hard, calcareous sandstone, each about two feet thick, located as follows: one near the top of the sandstone formation, two about thirty or thirty-five feet below the top two feet distant from each other, and the fourth one about sixty feet below. Because of their hardness and brownish color on the surface (grayish inside) these sandstones are very conspicuous in the locality. Massive in general, they break locally into curved crusts because of their concretionary structure. Strongly effervescent with hydrochloric acid the fragments are soon broken into fine quartz.

Cretaceous sandstone underlying the bituminous sandstone corresponds apparently to the lowest horizon in Spieker's sections 1, 3, and 8. The southern dip, 13, 20, and 18 degrees, corresponds to one found by the writer—15° south. The thickness of the same sandstone in the profile 1-50-100 feet also corresponds more or less to that given above.

#### CORRELATION

The separation of the Tertiary and Cretaceous has not yet been established in the Asphalt Ridge. As the well identified Tertiary lies above the bituminous sandstone and the Cretaceous sandstone underlies the latter, it is the stratigraphical position of the bituminous sandstone which has to be determined. The bituminous sandstone is a well expressed horizon. In Spieker's sections it is subdivided into a number of beds distinguishable from each other chiefly by the amount of bitumen, and the color and coarseness of the sand grains. In some cases bituminous sandstone is split by the insertion of shales, but such a splitting is apparently only local and the whole horizon remains a unit attaining locally a thickness of several hundred feet, but much thinner in other places. Near the northern end of the ridge a double layer of the bituminous sandstone outcrops about fifty feet below the main layer. However, nowhere on the northeastern face of the ridge could this lower horizon be discovered, although conditions of observation in many places were favorable for such a discovery. Spieker does not mention the lower horizon either, although local people often refer to the upper and lower asphalt. It is quite possible, however, that the lower bituminous sandstone near the northern end of the ridge is the same upper bituminous sandstone but thrown down for about fifty feet along the fault shown here by Spieker on his map. If such an interpretation is wrong and lower bituminous sandstone exists as an independent unit, the Cretaceous sandstone will be located between two bituminous sandstones and this will be a good argument for attribut-

ing Cretaceous age to them. As was mentioned above, Spieker's correlation is rather indefinite. In his sections, however, with the exception of Section 5 in which a horizon with "typical Uinta lithology" underlies a thick bituminous zone, the bituminous part of the sections is always well separated from the overlying Tertiary. This was also the general impression of the writer. In the southeastern continuation of the Asphalt Ridge on Green River, the Tertiary, here the Green River Formation, overlies with well expressed discordance on the suite of different, partly bituminous sandstones corresponding to those of the Asphalt Ridge. All these observations bring the writer to the conclusion in favor of the Cretaceous age of the bituminous sandstones of the Asphalt Ridge, at least in their larger part.

With a few exceptions, the fossils collected in the Cretaceous sandstone were found in the form of casts and often could be identified only tentatively, even as far as their generic association is concerned. Perhaps a number of the forms described in the present paper should be considered as described from material not sufficiently well preserved for complete identification.

The following species were identified from the Cretaceous of the Asphalt Ridge:

<i>Enchodus</i> sp.	<i>Leptosolen conradi</i> Meek
<i>Apatæodus</i> sp.	<i>Anatina lineata</i> Stanton
<i>Scapanorhynchus</i> sp.	<i>Cymella bella</i> Conrad
<i>Placenticeræ meeki</i> J. Boehm.	<i>Lucina</i> sp.
<i>Turritella</i> sp.	<i>Cardium kayi</i> sp. nov.
<i>Gyrodes</i> sp.	<i>Tellina</i> sp.
<i>Margarita</i> sp.	<i>Cymbopora</i> sp.
<i>Fissurella</i> sp.	<i>Yoldia evansi</i> M. & H.
	<i>Crenella burkei</i> sp. nov.

This small collection of rather badly preserved specimens shows well the marine origin of the fauna and its correlation with the Mesaverde Formation of the Upper Cretaceous. From five species known before, only *Leptosolen conradi* Meek is a typical form for the Dakota Sandstone at the base of the Upper Cretaceous. Of other species, *Placenticeræ meeki* J. Boehm. was found in the uppermost part of the Mancos Shale and in the basal section of the Mesaverde Formation. *Anatina lineata* Stanton was found in deposits corresponding in their age to the Mancos Shale and also in deposits of the Mesaverde Formation. *Cymella bella* Conr. and *Yoldia evansi* M. & K. both were described from the Fox Hills



Sandstone stratigraphically covering the Mesaverde Formation and from the Pierre Shale (Fort Pierre Group) corresponding to the Mesaverde Formation.

DESCRIPTIONS OF THE FAUNA

PISCES

A few fish remains found in the Cretaceous of the Asphalt Ridge are so incomplete and isolated that their identification, even only a generic one, cannot be accepted as other than tentative.

TELEOSTEI

Family ENCHODONTIDAE

ENCHODUS Agassiz

**Enchodus** sp.

(Plate I, figs. 2-3)

A fragment of a tooth about 17.5 mm. long without the base and apex. The restoration of lacking parts should bring the whole length to about 25 mm. or a little more. The general shape is that of a long, narrow, slightly bent cone with an unsymmetrical/elliptical cross-section at the upper end with sharpened but not barbed edges. The cross-section at the base is of a rounded, triangular shape. One surface (concave) is covered with delicate ribs, replaced on the convex side with fine striations.

In general appearance this tooth reminds one of *Enchodus* (*Phascanodus*) *dirus* J. Leidy from the Upper Cretaceous of Dakota<sup>8</sup> and for this reason it is brought, tentatively, into this association.

Carnegie Museum, Catalogue of Vertebrate Fossils, no. 9423.

Family SCOPELIDAE

APATEODUS Smith Woodward

**Apateodus** sp.

(Plate I, fig. 4)

A small isolated tooth, cylindrical in the lower portion, conical in the middle, and laterally compressed at the upper end thus becoming here

<sup>8</sup> Leidy, Joseph, Contributions to the Extinct Vertebrate Fauna of the Western Territories: Rept. U. S. Geol. Survey of the Territories, vol. I, p. 289, pl. XVII, figs. 23-24.

lanceolate with more or less sharp edges. The surface is completely smooth. Enamel yellowish white except for the sharp edges where it is nearly black. The length is 3.2 mm., and the thickness of the lower part in two diameters, 0.7 and 0.8 mm.

In its general shape this tooth reminds one very closely of teeth of different species of the genus *Apateodus* Sm. Woodward as for example, *Apateodus striatus* Sm. Woodward<sup>9</sup> or *Apateodus lanceolatus* Sm. Woodward,<sup>10</sup> both from the Upper Cretaceous of England. Teeth of English forms are, however, considerably larger than the tooth from the Asphalt Ridge. However, both figures used for comparison represent premaxillary teeth which are much larger than the rest.

Carnegie Museum, Catalogue of Vertebrate Fossils, no. 9424.

### Indeterminable scale

(Plate I, fig. 1)

To the Teleostei belongs also a cycloid scale of sub-elliptical outlines, a little distorted, 12.6 mm. long and 11.2 mm. wide. One end has a small triangular incision. Surface shiny, covered with fine concentric wrinkles, distinguishable only under favorable illumination.

Carnegie Museum, Catalogue of Vertebrate Fossils, no. 9422.

## SELACHII

### Family LAMNIDAE

#### SCAPANORHYNCHUS Smith Woodward.

#### *Scapanorhynchus* sp.

(Plate I, fig. 5)

The only specimen of a small, incomplete shark tooth characterized by a long slender principal cusp of flattened, conical shape with smooth, sharp lateral edges. A shallow and narrow groove runs along one edge. The basal part of the tooth is broken off. The length of the fragment is 2.8 mm.; the greatest width 1.1 mm.

Tentatively this form is brought into association with the genus *Scapanorhynchus* Sm. Woodw., which has similar long narrow teeth.

Carnegie Museum, Catalogue of Vertebrate Fossils, no. 9425.

<sup>9</sup> Woodward, Arthur Smith, Catalogue of the Fossil Fishes in the British Museum, pt. IV, p. 260, pl. XIII, fig. 6, London, 1901.

<sup>10</sup> *Ibidem*, p. 264.

## MOLLUSCA

## CEPHALOPODA-AMMONOIDEA

## Family COSMOCERATIDAE (PLACENTICERATINAE)

## PLACENTICERAS Meek

**Placenticerus meeki** J. Boehm.

(Plate II, figs. 1-2)

1927. *Placenticerus meeki* Reeside, The Cephalopods of the Eagle Sandstone and related Formations in the Western Interior of the United States: U. S. Geol. Surv. Prof. Paper 151, p. 29, pl. 22, figs. 5-7, pls. 23-24, pl. 25, figs. 1-2 (synonymy).

A fragment of an inner cast of an ammonite which in spite of its poor and fragmentary preservation can be identified even specifically with a degree of certitude. It belonged to a much compressed discoidal form of about 130 mm. in diameter. Whorls have a high, triangular cross-section and very narrow, slightly concave venter bordered by low ridges. Umbilicus deep, narrow, with abruptly rounded umbilical shoulder and hardly noticeable tubercles. The surface of the whorl was smooth and no remnants of sculpture are preserved on the cast. Some markings on the cast may be perhaps considered to be remains of the suture or at least connected with the suture. The preservation is, however, so poor that nothing more or less definite can be said about the character of the suture. J. B. Reeside described this species from the Telegraph Creek Formation and the Eagle Sandstone of Montana; from the upper part of Cody Shale and Steele Shale of Wyoming; from the lower part of Pierre Shale of the Black Hills and of eastern Colorado<sup>11</sup>; uppermost part of Mancos Shale and basal part of Mesaverde Formation from New Mexico. The stratigraphic position of this species in the central continental Cretaceous is thus well fixed. At the Wasatch Plateau it would correspond to the Emery Sandstone member.<sup>12</sup>

Carnegie Museum, Catalogue of Invertebrate Fossils, no. 7572.

<sup>11</sup> Dane, C. H., Pierce, W. G., and Reeside, J. B., Jr., The Stratigraphy of the Upper Cretaceous Rocks north of the Arkansas River in Eastern Colorado: U. S. Geol. Surv. Prof. Paper 186-K, p. 230.

<sup>12</sup> Spieker, E. M. & Reeside, J. B., Jr., Cretaceous and Tertiary Formations of the Wasatch Plateau, Utah: Bull. Geol. Soc. Am., vol. 36, p. 439.

## GASTROPODA

## CTENOBRANCHINA

## Family TURRITELLIDAE

## TURRITELLA Lam.

**Turritella** sp.

(Plate II, figs. 3 and 7)

This species is represented by an incomplete natural mold composed of seven whorls and a fragment of an inner cast of three whorls which may belong to the same form.

Shell small, composed probably, when complete, of about ten whorls tapering under an apical angle of about twenty degrees. Volutions are almost round, separated by deep sutures. The surface of the shell was ornamented with a few spiral ridges, faint traces of which may be perceived on the mold here and there. Length of the mold 11.7 mm., width 5.3 mm.; length and width of the fragment of the inner cast are correspondingly 6.5 and 4.5 mm.

This species is rather similar to *Turritella pumila* (?) Gabb. from the Upper Green Marls of New Jersey,<sup>13</sup> but may not be more closely compared with the latter because of the poor preservation.

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7573, 7574.

## Family NATICIDAE

## GYRODES Conrad

**Gyrodes** sp.

(Plate II, figs. 4 and 6)

Shell low with about three volutions increasing rapidly in size. The inner ones scarcely rise above the outer ones. Volutions rather ventricose, ovate in a transverse section. Umbilicus apparently large and open. Suture deep. Faint traces of transverse ridges or lines of growth can be discerned on the casts. The greater diameter of the larger specimen 6.5 mm., the height of the same 3.5 mm.

The species under consideration is closely similar to *Gyrodes abyssina*

<sup>13</sup> Whitfield, R. P., *Gastropoda and Cephalopoda of the Raritan Clays and Greensand Marls of New Jersey*: U. S. Geol. Surv. Mon. XVIII, p. 187, pl. XXIII, figs. 5-6.

Morton from the Lower Green Marls of New Jersey.<sup>14</sup> However, this form is much larger than the Utah specimens and possibly has a smooth shell.

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7575, 7576.

ASPIDOBANCHINA

Family TROCHIDAE

MARGARITA Leach.

**Margarita** sp.

(Plate II, fig 5)

Shell small with moderately elevated spire having an apical angle of about 65°. Volutions, three to four in number, are round, ventricose, separated by deep sutures. Surface marked by fine, even, spiral ridges over the entire shell, hardly perceivable on the present cast. The height about 4.0 mm., the greatest diameter 5.0 mm.

This species is represented only by a cast which is in such a fragmentary condition that its identification would be considered impossible if it were not very similar to *Margarita abyssina* Gabb. from the Lower Green Marls of New Jersey.<sup>15</sup> So far as both forms may be compared they are similar in their general shape and sculpture, but *Margarita abyssina* Gabb. is about twice as large as the Utah form.

Carnegie Museum, Catalogue of Invertebrate Fossils, no. 7577.

Family FISSURELIDAE

FISSURELLA Lam.

**Fissurella** sp.

(Plate I, fig. 13)

An inner cast of a small patelliform shell of suborbicular outlines with length about 8.1 mm., and width 7.3 mm. The height was hardly more than 3 mm. The summit was located apparently rather close to the middle of the regularly convex shell. On the cast may be distinguished a perforation in the form of a slit reminding one of the genus *Emarginula* Lam. but not cutting through the border of the shell. The thin shell had the epidermal cover preserved only around the border in the form of a broken narrow fringe. It is smooth, glassy, and without any sculpture.

<sup>14</sup> *Ibidem*, p. 123, pl. XV, figs. 9-12.

<sup>15</sup> Whitfield, R. P., U. S. Geol. Surv. Mon., XVIII, p. 133, pl. XVII, figs. 1-5.

What is apparently the impression of a muscular scar may be seen on the side of the cast opposite the slit side.

The shape of the aperture and the lack of any sculpture make its assignment to the genus *Fissurella* Lam. very problematic. Perhaps this form may have a more independent systematic position. The material on hand is, however, too poor to permit a more exact description of this form.

Carnegie Museum, Catalogue of Invertebrate Fossils, no. 7578.

## LAMELLIBRANCHIATA

### DESMODONTA

#### Family SOLENOPSIDAE

#### LEPTOSOLEN Conrad

#### **Leptosolen conradi** Meek

(Plate II, fig. 9)

1876. *Leptosolen conradi* Meek, F. B., A Report on the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country: U. S. Geol. Survey of the Territories, IX, p. 253, pl. 2, figs. 12a-b.

Shell oblong, about three times as long as high, with the hinge and parallel margins subparallel to each other and almost straight. Anterior end rounded, tapering a little from the pallial line. Posterior end roundly truncated. Both ends gaping, the posterior one more so. Beaks inconspicuous, located behind the first third of the length of the valve. Thickness about half the height. Shell apparently thin and not preserved. The surface was covered with fine lines of growth more or less conspicuous on some inner casts. Found also on inner casts is a deep furrow extending from the beak downwards and a little backwards which becomes also somewhat wider towards its end. It dies out on the lower quarter of the height of the valve.

#### Dimensions in mm.

Length	Height
35.2	10.3
32.4	11.0
31.5	10.5
18.6	6.1

As far as general form and sculpture are concerned, the Utah form corresponds well with the Kansas form. However, the former attains larger dimensions than those given for the latter. Another difference is

in the character of the transverse inner ridge to which corresponds the furrow on the casts. In the Utah form it has a different direction, pointing a little backwards and is apparently longer and thinner. These differences, however, might be considered as hardly sufficient to distinguish both forms, even as plain varieties. *Leptosolen conradi* Meek was found in the Dakota Group of Kansas.

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7579-7582.

Family ANATINIDAE

ANATINA Lam.

**Anatina lineata** Stanton

(Plate II, fig. 10)

1893. *Anatina lineata* Stanton, T. W., The Colorado Formation and its Invertebrate Fauna: U. S. Geol. Surv. Bull. 106, p. 117, pl. XXVI, figs. 3-4.

Shell of medium size, elongate-ovate in outline, inequilateral, represented by one left valve and two fragments. Anterior end produced, broadly and regularly rounded. Posterior end shorter and more narrowly rounded than the anterior one. Hinge border slightly concave behind the small beak and straight or even a little convex in front of it. Shell rather thin with the greatest thickness in the anterior part owing to the slight flattening of the valve in its middle. The surface is covered with abundant, regularly distributed rather fine, concentric folds which are better expressed on the anterior part, and fade towards the posterior end where they finally become obsolete. Length of the valve 33.4 mm., height 20.8, thickness of both valves will be about 7-8 mm.

The Utah form corresponds very closely to that of Colorado, particularly with reference to a small variety figured by Stanton in fig. 4. The Colorado form was found in the Pugnellus sandstone at the top of the Fort Benton Shales. The species was also mentioned by Stanton from Utah where, at Coalville, it was found in sandstones of the "First Ridge" which may be correlated with the Pugnellus sandstone of Colorado, and from the "Third Ridge" sandstone which belongs, however, to much higher horizons corresponding to the Montana Formation or Group, perhaps to the basal section of the latter.<sup>16</sup>

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7583-7584.

<sup>16</sup> Reeside, J. B., Upper Cretaceous and Tertiary Formations of the Western Part of the San Juan Basin of Colorado and New Mexico: U. S. Geol. Surv. Prof. Paper 134, p. 16.

## CYMELLA Meek

*Cymella bella* Conrad

(Plate II, fig. 8)

1875. *Cymella bella* Conrad, Descriptions of New Genera and Species of fossil Shells of North Carolina, in the State Cabinet at Raleigh: Rep. Geol. Surv., N. Carolina, vol. I, appendix, p. 10, pl. 2, fig. 9.
1876. *Leiopista (Cymella) undata* Meek, A Report on the invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country: U. S. Geol. Survey of Territories, vol. IX, p. 236, pl. 39, figs. 1a-b.
1877. *Leiopista (Cymella) undata* White, Report upon the invertebrate Fossils collected in portions of Nevada, Utah, Colorado, New Mexico, and Arizona, by parties of the Expeditions of 1871, 1872, 1873, and 1874: U. S. Geogr. Survey west of 100th Meridian, IV, p. 187, pl. XVIII, fig. 15a.
1880. *Leiopista (Cymella) Meeki* Whitfield, Paleontology of the Black Hills of Dakota: U. S. Geogr. & Geol. Survey of the Rocky Mountain Region, p. 418, pl. XI, figs. 27-28.
1885. *Cymella Meeki* Whitfield, Brachiopoda and Lamellibranchiata of the Raritan Clays and Greensand Marls of New Jersey: U. S. Geol. Surv. Mon. IX, p. 142, pl. XX, figs. 6-7.

Shell small, oblongly circular, almost equilateral; rather thick with sub-central prominent beaks located a little nearer to the anterior end. They are not separated from the general convexity of valves. Behind beaks on better preserved specimens it is possible to see a rudimentary escutcheon-like area. The shell is covered with numerous rather strong, concentric undulations which are crossed by strong radial ribs very conspicuous on the middle part of the valves, but fading on both ends of the latter. Length of the largest specimen 13.0, height 10.0, thickness 7.0-7.5 mm.

The general shape of the shell and its sculpture are typical enough to permit bringing this form into association with Conrad's species, although the latter is twice as large as the Utah form.

*Cymella undata* M. & H. could hardly be distinguished from Conrad's species. Meek remarked that both species are alike in almost all respects with the only exception that *Cymella bella* Conrad "has rather more prominent and ventricose beaks and less closely arranged radiating markings." Whitfield describing *Leiopista (Cymella) Meeki* Wh. finds that from *Cymella undata* M. & H. his species only "Differs in the greater size and more robust habit, also in the comparatively stronger undulations and in having the radiating costae continuing to the anterior end, if not to the posterior also. The outline of the shell also differs somewhat."<sup>17</sup>

<sup>17</sup> Whitfield, R. P., Paleontology of the Black Hills, p. 419.



Describing *Cymella Meeki* Wh. from New Jersey, Whitfield compared it with *Cymella bella* Conrad, but kept both species apart, chiefly because of the difference in the distribution of the radial ribs. In Conrad's species they are lacking or fading on both ends of the valves, while in *Liopista (Cymella) undata* M. & H. they are supposed to become fainter and thinner towards both ends of the valves, being stronger in the middle part of the latter.<sup>18</sup> In a few specimens of *Liopista (Cymella) undata* M. & H. available to the writer, radial ribs are obsolete on both ends of the valves thus making the sculpture corresponding to that of *Cymella bella* Conrad. Whitfield's name might not be used as it was preoccupied by White for a different form.<sup>19</sup> *Leiopista (Cymella) undata* M. & H., described by White, has the same size as the Utah form, but its surfacial markings are apparently thinner than in the latter. Following Grabau and Shimer,<sup>20</sup> the finer radii distinguish *Liopista (Cymella) undata* M. & H. from Conrad's species. However this character is very variable and rather badly defined and may hardly be accepted for separation of both species. Henderson substituted *Liopista (Cymella) mountainensis* Henderson for *Liopista (Cymella) undata* M. & H., because the specific name *undata* had been preoccupied a long time before.<sup>21</sup> However, including this species in the synonymy of *Cymella bella* Conrad makes Henderson's alteration unnecessary.

*Cymella bella* Conrad was described from the Ripley Formation of North Carolina. As *Leiopista (Cymella) undata* M. & H., it was described from the top of the Fox Hills Sandstone (Group) at the mouth of Judith River on the Upper Missouri, Idaho, and from the nearer non-subdivided "Strata of the Cretaceous Period" in New Mexico. In the Black Hills, Whitfield described *Leiopista (Cymella) meeki* from the Cretaceous strata which he considered at that time as belonging, probably, to the Fox Hills Sandstone (Group) but later <sup>22</sup> to the Pierre Shale (Fort Pierre Group).

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7585-7587.

<sup>18</sup> Whitfield, R. P., U. S. Geol. Surv. Mon. IX, p. 143.

<sup>19</sup> White, C. A., U. S. Geol. Survey west of 100th Meridian, IV, p. 186, pl. XVIII, figs. 14a-d. Stanton, T. W., U. S. Geol. Surv. Bull. 106, p. 118, pl. XXVI, figs. 5-7.

<sup>20</sup> Grabau, A. W. and Shimer, H. W., North American Index Fossils, I, p. 532.

<sup>21</sup> Henderson, Junius, The Nomenclature and systematic positions of some North American fossil and recent Mollusks: *Nautilus*, XXXII, 1918, p. 60.

<sup>22</sup> Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan Clays and Greensand Marls of New Jersey: U. S. Geol. Surv. Mon. XVIII, p. 28. The species is mentioned here under the name of *Cymella meekanum*.

## HETERODONTA

## Family LUCINIDAE

## LUCINA Brug

**Lucina** sp.

(Plate I, fig. 6)

Shell suborbicular, lenticular, moderately convex, almost equilateral, with length a little greater than height. Basal margin broadly rounded, posterior and anterior ends more narrowly so. Beaks small, slightly elevated a little nearer to the posterior than to the anterior end. No traces of the sculpture are preserved on the casts. Length 3.7 mm., height 3.1 mm.

This form is represented only by a number of inner casts and hardly can be identified, even only generically, with certitude. If, in spite of this it has been brought into the association of the genus *Lucina*, this has happened only because of its similarity with *Lucina subundata* H. & M. from the Cretaceous of the Upper Missouri area.<sup>23</sup> Although very small, the latter species is, however, still much larger than the form from the Asphalt Ridge.

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7588-7590.

## Family CARDIIDAE

## CARDIUM Linn.

**Cardium kayi** sp. nov.

(Plate I, fig. 7)

Shell small, of angularly elliptical outlines, ventricose and sharply angular along the posterior umbonal ridge. Beaks massive but rather acute, considerably projecting above the short hinge line. Anterior end rather short and regularly rounded. Posterior end long and truncate. Basal line arcuate obliquely, ascending towards the anterior border. The sculpture consists of coarse round radial ribs, thirty in number on the larger specimen. Height of the figured valve 9.8 mm., length 7.4 mm., appreciated thickness 3.0-3.5 mm.

The species is represented only by several inner casts of separated valves. In general shape it is pretty closely related to *Fragum tenuistriatus* Whitfield from the Lower Marls of New Jersey,<sup>24</sup> but is distinguished from

<sup>23</sup> Meek, F. B., U. S. Geol. Survey of the Territories, vol. IX, 1876, p. 133, pl. XVII, figs. 2a-e.

<sup>24</sup> Whitfield, R. P., U. S. Geol. Surv. Mon. IX, p. 139, pl. XX, figs. 15-16.

the latter by its much smaller size and relatively coarser sculpture. It reminds one also of *Cardium subcurtum* Meek from coal-bearing Cretaceous of Coalville, Utah.<sup>25</sup> Outlines of both forms are, however, different. Meek's species is less ventricose and lacks the angularity of slopes. Besides ribs it has also the marks of growth.

The name is given in honor of J. LeRoy Kay with whom the writer visited and examined the locality.

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7591-7594.

Family TELLINIDAE

TELLINA Linn.

**Tellina** sp.

(Plate I, fig. 12)

Shell small, rather flat, transversely elongate, elliptical, almost equilateral with protruding umbonal part, but with the beaks not differentiated from the surface of valves. Umbonal angle about 130°. No trace of sculpture is preserved on the inner casts which are the only remains present. The character of the hinge and other details of inner structure are not known. The length of a left valve 15.7 mm., height 8.3, depth about 1.5 mm.

Without knowledge of the internal structure, the generic determination of this form is quite tentative and is based chiefly on the close general similarity of this form with *Tellina modesta* Meek from the Cretaceous of Utah.<sup>26</sup>

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7595-7597.

Family MACTRIDAE

CYMBOPHORA Gabb.

**Cymbophora** sp.

(Plate I, fig. 11)

Although this form is represented by more than a dozen specimens, even its generic identification is only tentative. All specimens are inner casts of isolated valves without any indication of the hinge structure. Very poor traces of concentric lines of growth may be distinguished in

<sup>25</sup> Meek, F. B., U. S. Geol. Expl. 40th Parallel, IV, part I, p. 152, pl. XV, fig. 3a.

<sup>26</sup> Meek, F. B., *ibidem*, p. 157, pl. XV, figs. 4-5; Stanton, T. W., U. S. Geol. Surv. Bull. 106, p. 111, pl. XXV, fig. 3.

some cases. The form is brought into the association with the genus *Cymbophora* only on account of the very close similarity of its general form with such forms as *Maetra* (?) *emmonsi* Meek,<sup>27</sup> or *Maetra* (*Cymbophora*) ? *utahensis* Meek,<sup>28</sup> both forms from the Upper Cretaceous of Utah. From both species, and especially from the latter, the one under consideration is distinguished by its smaller size. Variations in the general shape remind one of those mentioned for *Maetra* (?) *emmonsi* Meek.

Length	Dimensions in mm.	
	Height	Thickness (appreciated)
11.2	10.2	2.5
6.3	6.6	2.0

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7598-7600.

## TAXODONTA

### YOLDIA Moeller

#### *Yoldia evansi* M. & H.

(Plate I, fig. 8)

1876. *Yoldia evansi* Meek and Hayden, A report on the invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country: U. S. Geol. Survey of Territories, vol. IX, p. 111, pl. 28, figs. 10a-c.

1880. *Yoldia evansi* Whitfield, Paleontology of the Black Hills of Dakota: U. S. Geogr. & Geol. Survey of the Rocky Mountain Region, p. 409, pl. XI, figs. 1-2.

Shell transversely elongate-sub-elliptical, a little gibbous in the central and umbonal regions. Beaks small, not protruding, located a little in front of the middle of the valves. Both ends narrowly rounded, the posterior one more so. The most prominent part of the rounding is nearer to the hinge border. Hinge border is almost straight, sloping only a little on both sides from the beaks. Numerous teeth can be seen in a number of specimens. Basal border is only slightly convex in the middle and rounds up gradually on both ends. The species is represented only by inner casts on a few of which it is possible to see indications of very fine lines of growth.

Length	Dimensions in mm.	
	Height	Thickness
15.2	7.0	3.0
12.3	6.3	2.5
15.6	8.5	3.4

<sup>27</sup> Meek, F. B., U. S. Geol. Expl. 40th Parallel, IV, part I, p. 153, pl. XV, fig. 8.

<sup>28</sup> *Ibidem*, p. 155, pl. XV, figs. 9, 9a-b.

From the typical forms this one from the Asphalt Ridge may be distinguished perhaps only by its smaller size. A few details of inner structure mentioned by Meek cannot be found in the specimens under consideration.

*Yoldia evansi* M. & H. was found at the Moreau River in the Fox Hills Sandstone (Group); on the Yellowstone River in the beds containing a mingling of forms found usually in the upper part of the Pierre Shale (Fort Pierre Group) and the Fox Hills Sandstone (Group); on the Milk River apparently in the upper part of the Pierre Shale (Fort Pierre Group); and in the Black Hills in the Pierre Shale (Fort Pierre Group). In the Pierre Shale and Fox Hills Sandstone it is mentioned also from Eastern Colorado.<sup>29</sup>

Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7602-7605.

### ANISOMYARIA

Family MYTILIDAE

CRENELLA Brown

***Crenella burkei* sp. nov.**

(Plate I, figs. 9-10)

Shell roundly rhomboidal with the height a little greater than the width, almost equilateral with beaks moved forwards of the median line only a little. Beaks strong, protruding, curved above the hinge line not separated from the in general strongly convex valves. Hinge border short, sloping both ways from the beaks. Pallial border regularly rounded. The surface of the shell looks smooth but with a magnifier it is possible to discern very fine sculpture consisting of numerous very crowded thin radiating ribs crossed by very thin lines of growth. Length of the figured left valve is 6.2 mm., width 5.0 mm., depth about 1.5 mm. A few other specimens of poorer preservation, which may belong to this species, are a little larger.

Very poor material makes it impossible to determine the exact generic characters and the generic association is therefore only tentative. The name is given in honor of J. J. Burke with whom the writer visited the locality.

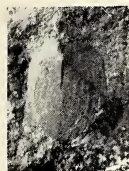
Carnegie Museum, Catalogue of Invertebrate Fossils, nos. 7606-7609.

<sup>29</sup> Dane, C. H., Pierce, W. G., and Reeside, J. B., Jr., The Stratigraphy of the Upper Cretaceous Rocks north of the Arkansas River in Eastern Colorado: U. S. Geol. Surv. Prof. Paper 186-K, p. 230 and 232.

## EXPLANATION OF PLATE I

All enlargements are given approximately. Where no enlargement is stated, the figure is of natural size.

- FIG. 1. Scale of Teleostei. C.M.V.F., no. 9422.  
FIGS. 2-3. *Enchodus* sp. Fig. 3, (sculpture) x 5. C.M.V.F., no. 9423.  
FIG. 4. *Apateodus* sp. x 7. C.M.V.F., no. 9424.  
FIG. 5. *Scapanorhynchus* sp. x 8.5. C.M.V.F., no. 9425.  
FIG. 6. *Lucina* sp. x 5.3. C.M.I.F., no. 7588.  
FIG. 7. *Cardium kayi* sp. nov. x 1.5. C.M.I.F., no. 7591.  
FIG. 8. *Yoldia evansi* M. & H.  $\times$  2. C.M.I.F., no. 7602.  
FIGS. 9-10. *Crenella burkei* sp. nov. fig. 9 x 2, fig. 10 x 7. C.M.I.F., no. 7606.  
FIG. 11. *Cymbophore* sp. x 1.8. C.M.I.F., no. 7598.  
FIG. 12. *Tellina* sp. x 1.8. C.M.I.F., no. 7595.  
FIG. 13. *Fissurella* sp. x 2.5. C.M.I.F., no. 7578.



1



2



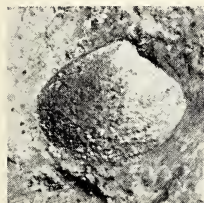
3



4



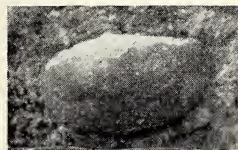
5



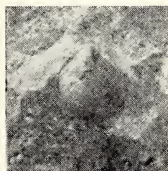
6



7



8



9



13



11



12



10



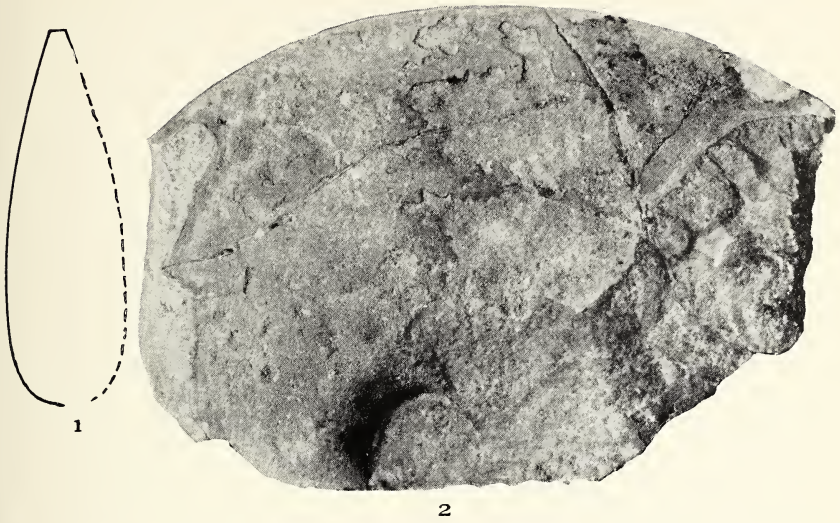




## EXPLANATION OF PLATE II

All enlargements are given approximately. Where no enlargement is stated, the figure is of natural size.

- FIGS. 1-2. *Placenticerus meeki* J. Boehm. Fig. 1, cross-section of the specimen shown in fig. 2. C.M.I.F., no. 7572.
- FIG. 3. *Turritella* sp. Wax cast from a natural mold, x 2. C.M.I.F., no. 7573.
- FIG. 4. *Gyrodos* sp. x 2. C.M.I.F., no. 7575.
- FIG. 5. *Margarita* sp. x 2. C.M.I.F., no. 7577.
- FIG. 6. *Gyrodos* sp. x 3. C.M.I.F., no. 7576.
- FIG. 7. *Turritella* sp. x 3.5. C.M.I.F., no. 7574.
- FIG. 8. *Cymella bella* Conrad. x 1.5. C.M.I.F., no. 7585.
- FIG. 9. *Leptosolen conradi* Meek. C.M.I.F., no. 7579.
- FIG. 10. *Anatina lineata* Stanton. C.M.I.F., no. 7583.



3



4



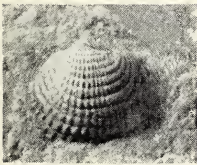
5



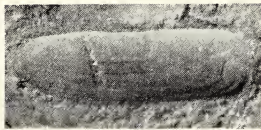
6



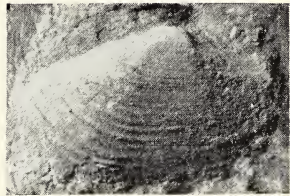
7



8

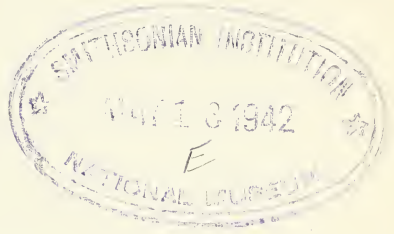


9



10







Type of *Phoca vitulina mellonae* described on page 111

ART. IV. A REVIEW OF THE GENUS *PHOCA*

BY J. KENNETH DOUTT

(PLATES I-XIV)

TABLE OF CONTENTS

Introduction.....	62
Acknowledgments.....	62
Geography and geology of Seal Lake region.....	64
Life zones.....	65
History of the Phoca of Seal Lake.....	65
Previous exploration of the region.....	67
Biology of the seals.....	68
Derivation of the seals in Seal Lake.....	71
Relationships of the race of <i>Phoca vitulina</i> in Seal Lake.....	73
Time of isolation.....	74
Taxonomy.....	79
Key to the species of the genus <i>Phoca</i> .....	80
Descriptions of species.....	82
<i>Phoca vitulina</i> .....	82
<i>Phoca hispida</i> .....	85
<i>Phoca groenlandica</i> .....	87
<i>Phoca fasciata</i> .....	91
Comparisons.....	95
Variation in the genus.....	99
Supernumerary bones in the base of the cranium.....	99
Age determination.....	101
Type description.....	111
Relationship of the races of <i>Phoca vitulina</i> .....	114
Summary.....	118
Specimens examined.....	119
Literature cited.....	123

## INTRODUCTION

The seals living in the landlocked lakes of the world present a problem in speciation which is intimately associated with the geological history of the region, and furthermore, they offer excellent examples of the effect of isolation on the development of new species. This paper announces the discovery of a new race of *Phoca vitulina* from Seal Lake, Ungava, and presents evidence indicating the length of time which has elapsed since the race was separated from the original stock. It also offers descriptions and keys for the identification of the northern species of the genus *Phoca*; discusses methods of age determination; and presents a list of the recognized races of *Phoca vitulina*.

## ACKNOWLEDGMENTS

During the course of this study many persons have assisted in various ways with the progress of the work, and it is a pleasure to express here my gratitude to them. Without the generous contributions of Mr. and Mrs. W. L. Mellon, the expedition could never have left Pittsburgh. For financial assistance I am indebted also to Dr. George H. Clapp, Mr. R. K. Mellon, Mr. John B. Semple, Mr. George D. Lockhart, Mrs. Lawrence C. Woods, Mr. and Mrs. Lawrence C. Woods, Jr., Lieut. Col. Paul C. Hunt, Mr. W. E. Clyde Todd, and Miss Margaret Shaw Campbell. I am indebted to Mr. Lawrence C. Woods, Jr., for much enthusiastic support in soliciting funds, and also for his pleasant companionship during the latter part of the expedition, when he joined the party in the field. To Dr. Andrey Avinoff, Director of the Carnegie Museum, I am obligated, not only for much encouragement, but also for assistance in raising funds, for the privilege of studying at other institutions, and for many other courtesies.

Mr. W. E. Clyde Todd initiated the plans for the expedition, personally supervised the purchase of all provisions, and gave constant advice and assistance throughout the preparation for the trip.

Without the coöperation of the Hudson's Bay Company the expedition would have been practically impossible. We are especially indebted to the District Manager, Mr. M. Cowan, and the Post Managers, Mr. Norman Ross and Mr. Robert Cruickshank.

To my companion throughout the trip, Dr. Arthur C. Twomey, at that time Field Collector for the Section of Ornithology, I am grateful for many months of comradery.



For the privilege of examining specimens under their charge, and for many helpful suggestions, I am indebted to many persons at other institutions, especially to the following: Dr. Glover M. Allen and Mr. Harold J. Coolidge, Jr., Museum of Comparative Zoölogy, Cambridge, Massachusetts; Dr. R. M. Anderson, National Museum of Canada, Ottawa; Mr. Gerrit S. Miller, Jr., and Dr. Remington Kellogg, U. S. National Museum; Dr. H. E. Anthony, Mr. George G. Goodwin, and Mr. T. Donald Carter, American Museum of Natural History; Mr. Charles M. B. Cadwalader and Mr. Wharton Huber, The Academy of Natural Sciences of Philadelphia; Mr. C. D. Bunker and Mr. Claude W. Hibbard, University of Kansas; Dr. Robert T. Orr, California Academy of Sciences; and Dr. Seth B. Benson, Museum of Vertebrate Zoology, Berkeley, California.

For information concerning the geology of the region around Seal Lake and the probable time of isolation of the seals, I am likewise indebted to: Dr. Ernst Antevs, Globe, Arizona; Professor Kirk Bryan and Professor R. A. Daly, Geological Museum, Harvard University; Professor Douglas Johnson, Columbia University; Mr. W. A. Johnston, Campbellford, Ontario; Professor Richard J. Lougee, Colby College; Mr. D. A. Nichols, Victoria Memorial Museum, Ottawa; Dr. Horace G. Richards, New Jersey State Museum; and Dr. George M. Stanley, Department of Geology, University of Michigan. Where I have made use of specific information received from these men, special mention is made of the fact in the body of the paper.

For information and advice concerning the anatomy of the seals I wish to express my indebtedness to Dr. William K. Gregory and Mr. H. C. Raven, American Museum of Natural History; Dr. Remington Kellogg, U. S. National Museum; Professor A. Brazier Howell, Johns Hopkins Medical School; and Dr. G. C. L. Bertram, Scott Polar Research Institute, Cambridge, England.

I want to express my gratitude to Dr. Glover M. Allen, Dr. Herbert W. Graham, and to my wife, Dr. Margaret T. Douth, for reading the manuscript and for making many helpful suggestions for its improvement.

Miss Olive L. Bown (now Mrs. Coleman J. Goin) assisted me throughout the study, and I am grateful to her for the unfailing energy and enthusiasm with which she worked, as well as for the many helpful suggestions which she made.

Miss Caroline A. Heppenstall has been an invaluable assistant in the preparation of the manuscript, and has assumed the responsibility for all

its literary details. Mr. Sidney Prentice made the drawings; and Mr. Robert M. Burford copied the maps reproduced here.

#### GEOGRAPHY AND GEOLOGY OF SEAL LAKE REGION

Lower Seal Lake lies approximately ninety to one hundred miles inland from the east coast of Hudson Bay, between fifty-six and fifty-seven degrees north latitude. According to Low (1898, p. 13 L), it has an elevation of approximately 800 feet above sea level. It is about fifty miles long and varies in width from about a half mile to five miles. Rounded rocky hills rise from 100 to 300 feet above the level of the lake (figs. 1-3, pls. II, III, XIV).

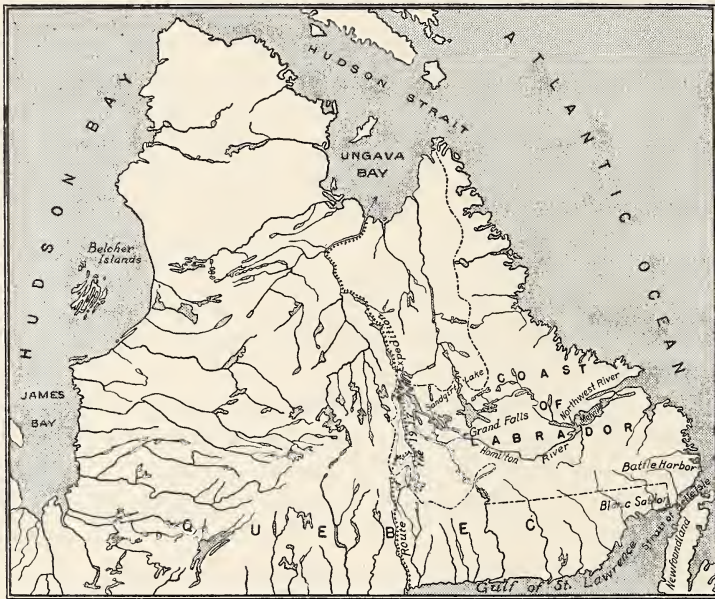


FIG. 1. Map of the Ungava Peninsula, sometimes called the Labrador Peninsula, which is bounded on the west by Hudson Bay, on the north by Hudson Strait, on the east by the Atlantic Ocean, and on the south by the St. Lawrence River and Gulf.

The Indian route from Hudson Bay to Seal Lake passes through a large lake, shown as Clearwater Lake on most maps, but known to the Indians as "We-ya-sha-ga-me." From Hudson Bay to Clearwater Lake old sea beaches can be seen along the sides of the hills, and numerous rounded

boulders, perched high on the hilltops, give abundant evidence that the region has been submerged beneath the sea. For fifteen miles, between Clearwater Lake and Seal Lake, the canoe route follows a series of lakes which are connected by small streams; but the actual separation between Seal Lake and the headwaters of Clearwater Lake is a narrow ridge about 500 yards across. In these fifteen miles, a remarkable change takes place. The old sea beaches and the rounded boulders disappear. In their place huge angular blocks of granite and diabase rest on the hillside, where they were dropped by the glacier, and long eskers follow down the valleys.

From this evidence it seems certain that the sea, at one time, extended as far inland as Clearwater Lake, but that it did not reach Seal Lake.

#### LIFE ZONES

Seal Lake lies at the northern edge of the Hudsonian Zone. In the protected valleys, black spruce and tamarack are common trees, but these are decidedly stunted. The tops of the hills are covered mainly with moss and lichens, typical of the Arctic Zone (Plate III).

The common mammals are the black bear, the marten, the weasel, the otter, the white and the red fox, the lynx, the red squirrel, and the barren ground caribou. Common winter birds are the rock and the willow ptarmigan, the Canada jay, the red poll, the hawk-owl, and the white-winged crossbill (Plate IV).

#### HISTORY OF THE PHOCA OF SEAL LAKE

More than forty years ago, Mr. W. E. Clyde Todd began a study of the birds of the Ungava Peninsula. During the course of his work in the region, he heard a rumor of the occurrence of landlocked seals in Lake Minto. When he financed the 1935 Expedition to Hudson Bay (Doutt, 1935, pp. 195-200), he suggested that I try to reach Lake Minto and collect specimens of the seals found there. A study of the Twin Islands in James Bay was the primary objective of that trip, however, so it was August before we reached Great Whale River, the starting point for the trip to Lake Minto. Here I met an Eskimo named Kooke, who had lived on the shores of Lake Minto. He agreed to take me to the lake but, when I told him why I wanted to go, he said there were no seals in that lake. He said he had spent his childhood and youth in the vicinity of Lake Minto; that he knew there were no seals in that lake; and that what he told me was the truth. He said seals were found near the mouth of

the Leaf River and that they ascended the river some distance, but that none ever got into Lake Minto. As I talked with him further about the matter he told me that thirteen years previously he had killed four seals in Lower Seal Lake, and, while he had never been to Upper Seal Lake, the Indians said many seals were to be found there also. I was convinced that what he told me was the truth, so, for the time at least, I gave up the idea of going to Lake Minto. The occurrence of seals in Lake Minto is still an open question. Kooke's definite statement that there are no seals in Lake Minto is backed up by a similar statement from two of the Indian guides, James and Joseph Sandy, who accompanied us on the trip to Seal Lake in 1938. These men live in the vicinity of Clearwater Lake and frequently travel to Lake Minto while hunting caribou. They should know whether or not seals live in Lake Minto, and I know of no reason why they should not have told me the truth about their presence or absence there. They were very definite about this statement that no seals were to be found in Lake Minto. Opposed to the statements of this Eskimo and the Indians are references by Low and Flaherty. Low makes no definite statement about seals in Lake Minto, but he refers to it as "Kasiagaluk Lake" (1902, p. 34). "Kasagaea" is the Eskimo name for *Phoca vitulina*. It seems strange that the Eskimos would call this "Seal Lake" if there were no seals in it. Flaherty (1918, pp. 119-120) makes a more definite statement about the matter. In speaking of Lake Minto he says, "The lake is famous among the Eskimos as the habitat of the fresh-water seal, hunted primarily not as food, but for the pelt, which, much darker, softer, and more lustrous than that of the salt-water variety, is used for their finer garments." Neither Low nor Flaherty mentions seeing seals in Lake Minto, however. I am unable to reconcile these conflicting statements.

The presence of seals in Lower Seal Lake was already known. In 1896, A. P. Low made a traverse of the Labrador Peninsula from Richmond Gulf to Ungava Bay. In the report which he published concerning that traverse (Low, 1898, p. 13 L), he records the fact that three seals were seen in the lake and that the Indians annually kill more than thirty. To the best of my knowledge this is the first published record of seals in Seal Lake, although the Indian name for Lower Seal Lake is "Mushawa Atchiguanipe" which means "Barren Seal Lake," in contrast to the name for Upper Seal Lake, which they call "Menasqua Atchiguanipe," meaning "Seal Lake in the Woods." These native names suggest that for generations the Indians have known that seals lived in these lakes. In the forty-

odd years that the white man has known about these seals no specimens have ever been collected, and the identity of the species has been open to question (figs. 2, 3, pls. II, XIV).

We returned from Great Whale River to Moosonee by canoe, and during part of the trip the Revillon Frères and Hudson's Bay Company interpreters, Ernest Cadot and Roderick McDonald, accompanied us. Ernest gave me a sealskin bag which he said he had obtained from an Indian at Richmond Gulf. He thought the skin was from a seal which had been killed in Seal Lake. The specimen was that of a harp seal, the occurrence of which would be most unusual in a fresh-water lake.

After we returned to Pittsburgh plans were made for an expedition to Seal Lake, the purpose of which was to collect specimens of this fresh-water seal. This second expedition left Pittsburgh on January 2, 1938 (Doutt, 1939, pp. 227-236). After numerous difficulties, we reached Seal Lake on March 12, and ten days later obtained our first specimen of seal. It was a female, carrying a well-developed embryo. On the following day another specimen, a male, was obtained. They were a race of the harbor seal, however, not the harp seal.

#### PREVIOUS EXPLORATION OF THE REGION

Since 1824, five different parties of white men have passed through Lower Seal Lake. The first white man to make the journey, Dr. Mendry, apparently left no account of it except a rough sketch map. What little we know about his journey is recorded by Low (1896, p. 15 L): "In 1824, a party was fitted out at Moose Factory to proceed overland to Ungava Bay and there establish a post; but it was not until three years later that this was accomplished by Dr. Mendry, who coasted along the east shore to Richmond Gulf, and then passed inland to Clearwater and Seal Lakes, thus reaching the headwaters of the Larch Branch of the Koksoak River, which was descended to near its mouth, and Fort Chimo there established. This trip is the basis of Ballantyne's 'Ungava' a popular story for boys. A map made of the route by Dr. Mendry, is at present at Moose Factory, and a tracing of it is in the Geological Survey office; the part between Clearwater Lake and the forks of the Larch River has been used, in the compilation of the map accompanying this report." In another report (1898, p. 6 L), he comments on Mendry's trip as follows: "The route followed between Hudson Bay and Ungava Bay was first passed over in 1824 by Dr. Mendry, when sent by the Hudson's Bay Company from Moose

Factory to establish a trading post at the mouth of the Koksoak River. The only known record of his trip is a rough map of his journey, from which a copy was taken at Moose Factory in 1887; since then the original map has been lost."

I am likewise indebted to Low for a record of the second white man who passed through Seal Lake. Although an account of his trip was published, I have been unable to locate a copy of it. Low (1898, p. 6 L) recounts his trip in one sentence, "In 1885, the Rev. J. Peck, of the Church Mission Society, crossed by the same route and subsequently wrote a short account of his trip which was printed in a publication of the Society." Low (1898) gives an excellent account of his own exploration in the region from Richmond Gulf to Ungava Bay.

The next party to pass through Seal Lake was led by Stephen P. Tasker and his wife. Their chief guide was George Elson, now famous for the part he played in the ill-fated expedition of Dillon Wallace and Leonidas Hubbard (Wallace, 1905), and the trip of Mrs. Hubbard (1908). Tasker's trip was made in 1906 and an account of it was published by Mrs. Florence A. Tasker in "Field and Stream" for February, and March, 1908. Mrs. Tasker lists some of the most essential items in their equipment and gives a very interesting account of their expedition. No especial mention, however, is made of Seal Lake.

Daniel Petacameshcum, our chief Indian guide, told us of a party of eight prospectors who passed through Seal Lake a year or two previous to our visit there, and at one place pointed out to me the stakes where their tents had been pitched. He did not know who they were, and I have been unable to find any account of their trip.

#### BIOLOGY OF THE SEALS

Seal Lake is more than fifty miles long, and has several long narrow arms. The Indians informed me that Upper and Lower Seal Lakes are connected, although they are shown on most maps as separate lakes, each with its own outlet. James Sandy, an Indian who hunts in this region, drew for me a map of Upper and Lower Seal Lakes and explained how the seals were able to get from one part of the lake to the other (figure 2). I talked with him and several other Indians, especially Daniel Petacameshcum, Jacob Rupert, Luke Cash, and Thomas George, who hunt in the vicinity of Seal Lake, and also with Jimmie Egokea (Kumiak), an Eskimo who accompanied us on our trip to Seal Lake. They told me many things

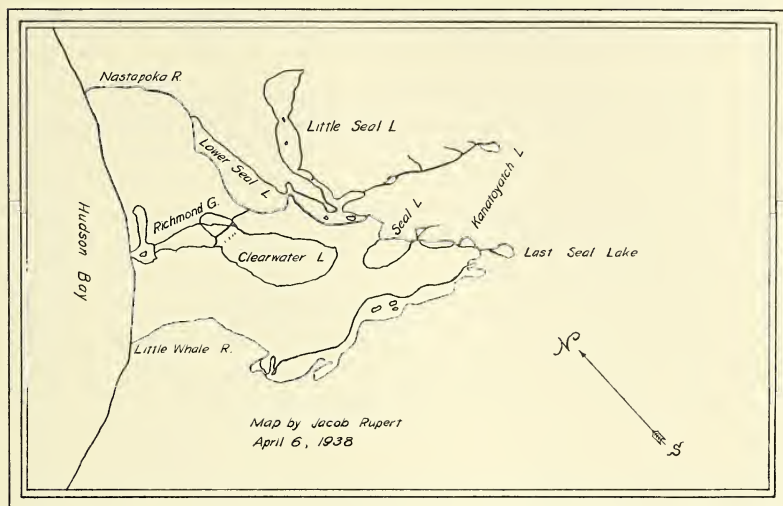


FIG. 2. Sketch map made by Jacob Rupert, showing the connection between Upper and Lower Seal Lakes. Upper Seal Lake is the lowermost elongate body of water, not indicated by name in this sketch, which apparently empties into Hudson Bay through Little Whale River.

about the fresh-water seal. I believe they were telling me the truth as far as they knew it, and I present here the disconnected bits of information obtained from them, for whatever they may be worth. Before we left Richmond Gulf, the Eskimos said we would not find breathing holes of the seal in this fresh-water lake. When we arrived at Seal Lake the Eskimo, with the help of his dog, hunted diligently, but he did not find anything which he thought was the same as the breathing hole which the jar seal (*Phoca hispida*) makes. He did find a small hole in a crevice of the ice which he thought the seals had been using for a breathing hole. He watched at it for several hours on two or three different days, but saw no seals at it.

Jacob Rupert, one of the Indians who was with us on the hunt, was the son of an old Indian known as the "Seal Hunter." From him Jacob had learned how to make a seal net of a special design for setting in narrow places between the lakes. Jacob set several of these nets for us, but we caught no seals in them. Daniel, another Indian we had with us, said that from one to five seals spend the winter at these places of open water. Usually there are one or two old ones and one or two young ones. Probably all are of one family.

“Seals come out on the ice only on warm sunny days—on cold windy days they stay in the water.”<sup>1</sup>

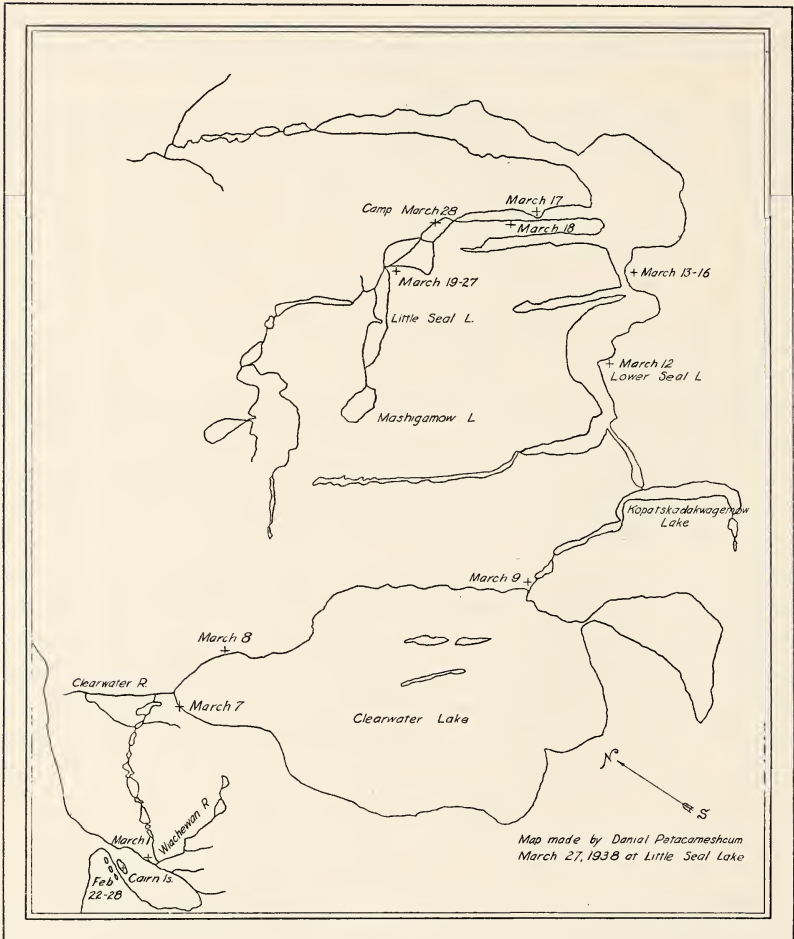


FIG. 3. Sketch map made by Daniel Petacamescum, showing Clearwater Lake, Lower Seal Lake, and Little Seal Lake. The dates and locations of our camps are indicated.

<sup>1</sup> I use quotation marks here to indicate that the enclosed sentences are statements of the Indians or the Eskimo, although they are not direct quotations but are the translation and interpretation of what they told me. In many instances these are the summaries of long discussions.



"The embryo of the fresh-water seal is yellowish in color, with definite evidence of spotting, and with rather smooth hair, as compared with the embryo of *Phoca hispida* which is white, with no evidence of spotting, and is covered with long, woolly hair."

"*Phoca hispida* probably weighs nearly fifteen pounds when born, and is about 750 mm. long. The young is born in February, or March, in a cavity hollowed out between the ice and the snow which covers it. In Seal Lake the young seals are born about the end of April, or early May, when the birds are here. When born they weigh about thirty pounds. The young are born on land after the snow and ice have melted."

Jacob said that the male lives about the same hole with the female and that he stays with her and helps when she is having her young. In the summer he said that he saw them together occasionally, but in the winter they were always in pairs.

Open water is the place to get seals when the lakes are frozen. Such places are found in the rivers where steep hills narrow the channel and make swift water. The holes change rapidly with changes in the weather—warm weather opens new holes and makes old ones larger—cold weather closes up the smaller ones entirely and narrows the larger ones to small dimensions.

The stomach of the adult female we obtained was nearly filled with well-digested pieces of fish.

#### DERIVATION OF THE SEALS IN SEAL LAKE

Since Seal Lake is about ninety miles from Hudson Bay, the nearest arm of the sea, and lies at an elevation of about 800 to 860 feet, the question which naturally arises is, how did the seals get into Seal Lake? It would be interesting also to know how long they have been there and whence they came. Since this form represents a new race—distinguishable from its closest relatives not only by color, but also by skull characters—we have here a means of determining approximately how long it has taken for a new race to develop. In this case the animal has been marooned in a habitat different from that in which the species normally lives. Although *Phoca vitulina* customarily ascends the fresh-water rivers in the spring, its usual habitat is the sea. The seals in Seal Lake are confined to a fresh-water lake throughout the year and have no access to the sea. Moreover, the food found in this lake must be markedly different from that found in the sea, or in rivers which have easy access to the sea.

There are several suppositions as to how the seals got into Seal Lake.

The Indians have a legend that a seal was sleeping on the ice and its breathing hole froze shut, so it was compelled to travel over the ice and snow to find another breathing hole. This legend disregards so many of the facts, however, that it seems possible to dispose of it with little consideration.

The seals might have gained access to Seal Lake by way of the Koksoak, Larch, and Stillwater rivers. The journey over the height-of-land, from the headwaters of the Stillwater River to the headwaters of Seal Lake, is only a matter of about fifty yards, but to the best of my knowledge seals are not known above the Koksoak and Kenogamistuk rivers. If they entered Seal Lake by this route, shortly after the retreat of the glacier when the land was at a lower elevation, the result would be about the same as if they had entered by way of Hudson Bay drainage at that time. Daniel, our Indian guide, told me that many years previous to our visit someone had seen a seal in Clearwater Lake, but both he and Jacob said they had never heard of one being killed there. At one place, Seal Lake is separated from a tributary to Clearwater Lake by a narrow ridge, scarcely more than 500 yards wide, and certainly less than a hundred feet in elevation. In view of the proximity of these two large lakes, it seems strange that the seals have not migrated across this slight barrier and become established in Clearwater Lake too. According to reports of the Indians, Clearwater Lake is much better stocked with fish than is Seal Lake.

Low (1898, p. 13 L) sets forth his assumptions concerning the presence of seals in Seal Lake as follows: "The name [Seal Lake] is derived from the seals living in its waters, which are either the common harbour seal (*Phoca vitulina*) or a closely allied species. The harbour seal is known to travel overland for considerable distances, but its presence in this lake nearly a hundred miles from salt-water at an elevation of nearly 800 feet above the sea, can hardly be due to its migration up such a rough stream as the Nastapoka. Another way in which it might have reached the lake was during the subsidence of the land at the close of the glacial period, when the lake was nearer sea-level than at present by more than 600 feet, and when the deep bay extended inland up the present valley of the Nastapoka to or near the outlet of the lake, with such conditions it would be easy for seals to reach the lake, and having found it full of fish they probably lost the inclination to return to the sea. Three seals were seen in the lake, and the Indians kill annually more than thirty, showing that the animal breeds freely in the fresh water."

My own observations along the route into Seal Lake led me to the same conclusion. Although specimens of *Phoca vitulina* are killed occasionally

along the coast of Hudson Bay, there is no reason to assume that these animals might migrate in and out of Seal Lake. The Nastapoka River, which is the outlet of Seal Lake, enters Hudson Bay with a fall of 170 feet. Even making ample allowance for the remarkable migratory powers of *Phoca vitulina* across the land, it still seems unbelievable that a seal would pass around a barrier such as this in order to proceed up such a turbulent stream as the Nastapoka. Furthermore, if we did assume that the seals could migrate from Hudson Bay up the Nastapoka River to Seal Lake, we would have to explain why they did not go up many other rivers of Ungava, and inhabit innumerable lakes in the interior. There are many other rivers which would be easier to ascend than the Nastapoka, and many other lakes which are better stocked with fish than Seal Lake. It seems to me, therefore, that Low's explanation is the only satisfactory one.

Muskrat Falls on the Hamilton River, Labrador, is an excellent example of the case in point. On our return from the Grand Falls in August, 1939, we saw approximately fifty seals on a sand bar and in the water just below Muskrat Falls. Our guides said that the seals come up the river as far as Muskrat Falls every year, but that they never get beyond that point. We saw no evidence of them above the Falls. Muskrat Falls is not a formidable barrier. Low (1896, p. 130 L) described it as follows: "For three miles above Muskrat Island, the river narrows to less than a third of a mile, with a narrow island obstructing the channel in the upper mile. Above this narrow, the channel widens out into a nearly circular basin about two miles across, into the west side of which the river pours with a chute of twenty feet called Muskrat Fall. Above this chute is a heavy rapid 400 yards long, with a chute of twenty-five feet at its head, the total fall being seventy feet. At the chutes, where it rushes over ledges of gneiss, the river is only about 100 yards wide. Immediately on the north side of the falls, there is a rounded, rocky hill rising 250 feet above the level of the valley." Low does not describe the terrain on the south side of the river, but here there is a bench not far above the level of the river, which would be a very insignificant barrier in comparison with that of the Nastapoka River, the outlet of Seal Lake.

#### RELATIONSHIPS OF THE RACE OF PHOCA VITULINA IN SEAL LAKE

Although specimens from Seal Lake do not have the premaxillaries extended back along the nasals—a character which separates about eighty-five per cent of the specimens of *Phoca vitulina richardii* from *Phoca*

*vitulina concolor*, still in some minor characters they resemble *Phoca vitulina richardii* more than they do *Phoca vitulina concolor*. Although this resemblance is slight, it led me to consider the possibility that the stock now living in Seal Lake may have been derived from the Pacific Ocean rather than from the Atlantic.

It is possible that, during the Pleistocene, Hudson Bay was connected with the Pacific Ocean *via* the Arctic Ocean and Bering Strait, while a barrier of ice or land separated it from the Atlantic, and that the seals which now inhabit Seal Lake came originally from the Pacific into Hudson Bay, rather than from the Atlantic. In a letter to me, dated December 6, 1939, Dr. George M. Stanley of the University of Michigan says, "The existence of an ice barrier across Hudson Straits while a free connection existed between Hudson Bay and the Pacific seems entirely possible for some stage of ice retreat." In a letter dated at Ottawa, December 15, 1939, Dr. D. A. Nichols says, "Nearly all of Boothia and Melville Peninsulas were covered by the sea, and a belt of the mainland extending roughly from Queen Maude Gulf to Hudson Bay, taking in the area about Garry Lake, Baker Lake, and the wide belt of Coastal Plain west of Hudson Bay." Although this presents no positive evidence, it does indicate that the route of migration was open, and that access from the Pacific Ocean into Hudson Bay was much easier then than now.

While seals are able to swim against strong currents, and are not dependent on them for distribution, still, it is interesting to note that the currents of Arctic America flow from west to east, rather than from east to west (Nichols, 1940, pp. 18-22). This general trend would seem to aid the migration of forms from the Pacific to Hudson Bay, and would tend to hinder the migration of forms from the Atlantic into Hudson Bay. Unfortunately I have no specimens from Hudson Bay which shed any important light on the subject. Thus the evidence is not sufficient to justify any conclusions, but it does leave open an interesting problem. To what extent may the fauna and flora of Hudson Bay have been derived from the Pacific Ocean?

#### TIME OF ISOLATION

If the time which has elapsed since the seals became isolated in Seal Lake could be determined, it would help to answer the question—how long does it take to make a species? Obviously there are many factors which influence this transformation, one of the most important of which is whether or not the environment has changed. However, if this question

is ever to be answered I think it will be answered best by an accumulation of many specific instances. In this case the post-glacial history of the region is especially significant. Of course there are differences of opinion among geologists as to the length of time required for many of the post-glacial events to take place, since these events have progressed at different rates and have reached different magnitudes in different regions where they have been studied. No work of this nature has been done in the interior of the Ungava Peninsula. Because of all the unknown factors, I have tried to obtain opinions from several authorities on the subject so that I might present maximum and minimum figures. I was surprised to find the agreement so close and the estimated length of time so short.

Answering my question concerning the possible length of time that the seals had been isolated in Seal Lake, Dr. Nichols, in a letter dated December 15, 1939, replied as follows: "Antevs, Memoir 168 'Late Glacial Correlation and Ice-recession in Manitoba' (Geological Survey of Canada) states that the Post-Glacial epoch commenced about 9,000 years ago and, at that time, in eastern North America the ice-sheet was confined to the Labrador Peninsula.

"The younger late-glacial epoch may have lasted 2,000 years after the uncovering of the Cochrane area, Ontario. So the Seal Lake area would apparently be free of ice from about 9,000 to 10,000<sup>2</sup> years ago, and accessible to oceanic waters." In answer to the same question, Dr. George M. Stanley (letter dated December 6, 1939) says, "My guess is that some 5,000 to 12,000 years have probably elapsed since the formation of the highest marine beaches about Richmond Gulf, which was about the time when Seal Lake was most accessible from the sea, . . ."

Dr. Ernst Antevs, in a letter dated at Globe, Arizona, December 17, 1939, says, "My guess is that Lower Seal Lake was separated<sup>3</sup> from the Hudson Bay some time between 8,000 and 6,000 years ago."

Thus it seems that Seal Lake was an embayment of Hudson Bay between 9,000 and 10,000 years ago. Since then, the land has risen about 800 feet. As the land rose, the connection between Seal Lake and Hudson Bay was gradually severed.

It is impossible to say how much the land would have had to rise in order to cut off the seals in Seal Lake from access to Hudson Bay, for it

<sup>2</sup> Dr. Ernst Antevs, in a letter to Doult dated December 16, 1941, suggests that these figures should be 7,000 to 8,000.

<sup>3</sup> That is, "formed by being raised above Hudson Bay." Letter from Dr. Antevs, December 16, 1941.

is a well-known fact that seals can live in fresh water and that they may travel long distances up rivers, even passing strong rapids. It is evident, however, that a rise of something less than 800 feet has been required. It is possible that a rise somewhere between 400 and 600 feet would be sufficient; on the other hand, it may not have required more than 200 feet. These are purely guesses on my part, for nothing is known of the topography along much of the Nastapoka River, and thus it is impossible to say whether it is the present falls at the mouth of the river or some other falls farther inland which has cut off access to the sea. Within these limits, however, it is possible to make maximum and minimum estimates, which, geologically speaking, are not so very far apart.

Professor R. A. Daly, in a letter dated November 5, 1941, has pointed out that Gutenberg (1941) has estimated that the rate of uplift is nearly two meters per century, but that formerly the rate was two or three times faster. Using a rate of four meters, or about twelve feet per century, and assuming that a maximum uplift of 600 feet was required, it would have taken about 5,000 years after the ice left to complete the isolation of Seal Lake. Thus, if Seal Lake had been free from glacial ice about 9,000 to 10,000 years ago, and it required 5,000 years after this to complete the isolation, the seals have been confined in Seal Lake approximately 4,000 to 5,000 years. If, on the other hand, a rise of only 200 feet was required, this could have been accomplished in about 2,000 years, making 7,000 to 8,000 years since isolation took place. Of course it is well known that the rate of rise was not constant. For some time after the ice melted, uplift was very rapid, but more recently it has been gradually reduced. It seems undesirable, however, to go into such refinements at this time, because they imply a degree of accuracy which is impossible to attain until more is known about the region between Seal Lake and Hudson Bay.

Daly (1934, p. 71) gives a curve showing Nansen's opinion as to the rate of uplift at the center of the Scandinavian Ice Cap at the time when the last ice was removed from that center. In a letter, dated December 2, 1941, he makes reference to this and says, "The rate then was about ten times the present rate. Two thousand years after, the rate had fallen to three times the present rate. Let us take 800 feet as the elevation of Seal Lake; this is roughly 250 meters. Assuming that the mean rate of uplift up to the time of isolation of Seal Lake was five meters per century, the preceding uplift would have taken about 5,000 years. If the mean rate were seven meters per century, the time taken would be roughly 3,500

years.<sup>4</sup> A good estimate of the total time since uplift began at this point during the ice-free time is 8,000 years. Subtracting 5,000 and 3,500 from 8,000, we have, respectively, 3,000 and 4,500 years as the life of Seal Lake, a freshwater body. Probably the value 3,500 years is the best bet. You see that this estimate agrees with your own rather nicely.”

Dr. W. A. Johnston, in a letter of November 28, 1941, writes, “If the land would have had to rise 400 to 600 feet before the seals in Seal Lake were cut off from access to the sea, as you suggest, three to four thousand years is a reasonable estimate of the time that has elapsed since the seals were isolated in Seal Lake.”

Dr. Stanley, who has visited Hudson Bay, and has personally examined and measured the region around Richmond Gulf, expresses his opinions as follows (letter dated December 9, 1941), “The very most northerly parts of the Great Lakes region seem to be rising at a rate of approximately one meter per century which is about the same near the center of the glaciated tract in the Baltic. At this rate, as a guide and not to be specifically assumed, the coast near the Nastapoka River would have taken almost 4,600 years to rise 150 feet, over 5,100 years to rise 170 feet.

“The rate of rise at the place in question may very likely be two or three times as great as that employed in this calculation, at any rate, greater, almost undoubtedly. If we were to suppose an extreme case—that 150 feet of uplift had occurred here within the last thousand years—the probability of the last century’s share in this having escaped a universal recognition by local people seems remote.

“I think you would do well to avoid specific dating of a matter so questionable. The land-locking of those seals is interesting enough regardless of the exact time of isolation.”

There is no evidence to show how long after Seal Lake was isolated that the seals became sufficiently different to be recognizable. It may be that differentiation took place very rapidly at first, and that the progress has already slowed down or ceased, and that little change is now in progress. On the other hand, it is just as logical, and I believe more reasonable, to assume that the process of differentiation is still in progress, and given another five thousand years, the race will be even more distinct. The fact that the seals in Lake Baikal differ more from *Phoca hispida* than the *Phoca vitulina* of Seal Lake does from *Phoca vitulina vitulina* of Europe

<sup>4</sup> This is the time required to raise Seal Lake to an elevation of about 800 feet, probably a rise of something less than this was required to isolate the seals.

probably indicates a longer time of isolation, and would suggest that after isolation, differentiation continues indefinitely.

These seals have a comparatively long life span, and breed rather slowly. Although I have made considerable effort to locate a specimen of seal of known age I have so far been unsuccessful. Thus I am unable to state how long a seal may live. I believe, however, that ten to fifteen years may be a reasonable figure to place on the life span of the individuals of this species. S. S. Flower (1931, p. 181) in speaking of *Phoca vitulina* says that although this species is frequently kept in captivity, it usually lives only a very few years. He continues his statement, however, as follows: ". . . eight individuals that lived for over six years averaged 10 years 9 months, with a maximum of over 14 years." Of course it is possible that in a wild state they may live considerably longer. Usually only one young is born at a time, and breeding probably takes place once each year, after sexual maturity is reached. The number of generations per hundred years would thus be markedly less than in a small species, such as in the genus *Peromyscus*, or *Mus*, where the birth rate is high and the life span short. It would seem that a large species with a long life span and few generations per hundred years, would require a longer period of time to show changes of a subspecific nature than would a species with a short life span and many generations per hundred years.

On the other hand, the stock has been subjected to isolation in a fresh-water lake. Life here must be markedly different from the normal existence with free access to the ocean. The food, too, must be quite different. This changed environment would require many adjustments, which would tend to encourage the development of new characters in the species more rapidly than if the environment had remained the same.

To summarize, then, it would seem that we have a large species, with few generations per century; but it has been thrust into a new environment which would cause it to change more rapidly than would otherwise be the case. Thus, these two factors tend to cancel one another. The estimates for the time of isolation range from 8,000 years to 3,000 years, with 5,500 years as a mean. Thus it seems probable that about 5,500 years, plus or minus 2,500 years, has been the time required to produce a new subspecies under the conditions set forth above.<sup>5</sup>

<sup>5</sup> Using the estimates of 7,000 to 8,000 years since the glacial ice left this region, as suggested in Dr. Antevs' letter of December 16, 1941, these figures become 6,000 to 2,000, with an average of 4,000 years.



## TAXONOMY

The number of names which have been proposed for the members of the family Phocidae is most perplexing, but in addition to the great number of synonyms, technical names have been switched from one species to another, so that at times it is impossible to know which animal is under discussion. In reviewing the technical history of the Phocidae, Allen (1880, p. 459), remarks upon the number of synonyms as follows: "One hundred and three distinct specific and varietal names have thus been bestowed upon sixteen species, leaving eighty-seven of the names as synonyms,—an average of about six to a species." The English common names, also, have been misapplied; but, strangely enough, it seems that the Eskimo names, wherever they have been used, have been rather consistently applied to the proper species. Wherever the Eskimo name is given in a discussion, therefore, it is usually helpful in allocating the material to the proper species. Fortunately, too, the Eskimo names, unlike Indian names, are very similar from Greenland to Alaska. In some parts of Alaska, however, the language is quite different, and different names are in use. Throughout the eastern arctic the Eskimo name "Kasagua" refers to *Phoca vitulina*, "Netcheck" to *Phoca hispida*, "Kiolik" or "Kioole" to *Phoca groenlandica*, and "Ootroo" or "Oogjook" to *Erignathus barbatus*. Of course there is considerable variation in the spelling of these names. This is due partly to the difference in the local Eskimo dialects, and partly to the way different authors hear and record the same sounds. In general, however, there is sufficient similarity between the various spellings to make the different names recognizable.

The family Phocidae, at the present time, contains eleven genera. Of these, only four, *Phoca*, *Erignathus*, *Halichoerus*, and *Cystophora*, are known to occur in the North Atlantic, North Pacific or Arctic oceans. In the northern hemisphere, the genus *Phoca* can be divided into four distinct groups, as follows:

1. *Phoca vitulina* and related races
2. *Phoca hispida* and related races
3. *Phoca groenlandica*
4. *Phoca fasciata*

Various authors have treated these groups in different ways. Some have considered them to be distinct genera, others have treated them as subgenera, and still others have considered them as species. Such treatment, of course, is largely a matter of personal opinion, and depends upon

the author's approach to the subject. From the present study, however, I can see no reason for elevating these groups above specific rank. Together they form a closely related group, which is very distinct from *Halichoerus* and *Cystophora*. *Erignathus*, however, is more closely related to the genus *Phoca* than it is to either of these two genera. Its teeth and skull characters are not markedly different from other members of the genus *Phoca*, yet, in general, it is more aberrant than any of the other four species which I have included in the genus. For the present, therefore, I prefer to let it stand as a separate genus. Each of these four species can be recognized readily by distinctive skull characters.

#### KEY TO THE SPECIES OF THE GENUS PHOCA

- A. Posterior margin of palate notched or incised, resembling a pointed Gothic arch.
- a. Greatest length of skull, more than 178 mm.; length of upper second premolar, 6.8 mm. or more; mandibular teeth crowded out of line, and overlapping; least interorbital width 7 mm. or more. . . . . *P. vitulina*
  - b. Greatest length of skull, 178 mm. or less; upper second premolar, less than 6.8; mandibular teeth not crowded out of line; least interorbital width less than 7 mm. . . . . *P. hispida*
- B. Posterior margin of palate not notched or incised, resembling a rounded Roman arch (Plates IX, X).
- a. Palatal length,<sup>6</sup> more than 86 mm.; posterior palatine foramina in, or anterior to, maxillo-palatine suture; range, North Atlantic and Arctic oceans<sup>7</sup>. . . . . *P. groenlandica*
  - b. Palatal length, 86 mm. or less; posterior palatine foramina in, or posterior to, the maxillo-palatine suture; range, North Pacific ocean. . . . . *P. fasciata*

<sup>6</sup> Measured from most anterior part of rostrum to midline at posterior edge of palate.

<sup>7</sup> Although Allen (1880, pp. 640-641) states that *Phoca groenlandica* is circumpolar in its distribution and mentions records from the Pacific, he states that its distribution there is not well known. Furthermore, he had no specimens from there, and his authority for including the Pacific in its distribution was derived from the writings of early explorers, such as Pallas, Steller and Temminck. It is quite possible these authors were referring to some other species. I have seen no specimens from the Pacific. Dr. R. M. Anderson, in a letter dated November 21, 1941, has sent me the following comments concerning its occurrence in waters adjacent to the Pacific: "The only Canadian record that I have from western Arctic waters is a good photograph of a specimen which was caught in a fishnet at Aklavik in 1926. Mr. A. E. Porsild, who spent some time at Aklavik in the west branch of the Mackenzie delta, N.W.T., while engaged in reindeer introduction, sent me a film which was taken at the time by the Rev. Father Trocellier, O.M.I., and I had a print made from it. Mr. Porsild saw part of the skin. The prints plainly show the characteristic pattern of *Phoca groenlandica*, a broad diagonal

This key will serve to distinguish all normal specimens, but in any large series certain specimens may be found which are so aberrant that they will not fit into any classification. For example, the rounded arch of the posterior margin of the palate is characteristic of all *Phoca groenlandica* which I have examined, except one specimen, Carnegie Museum no. 18714. In this specimen the palate is notched, very much as in *Phoca hispida* or *Phoca vitulina*. In other respects, however, it is typical of *Phoca groenlandica*. Another specimen, The Academy of Natural Sciences of Philadelphia no. 2139, is a typical *Phoca hispida* in most of its characters; yet, regardless of the fact that it is quite young, its least interorbital width is 8 mm., which is 14.3 per cent greater than the largest specimen I have seen in a series of more than seventy. Its teeth, too, are unusually heavy for a *Phoca hispida*. Another specimen, Carnegie Museum no. 17852, has the teeth, palate, and interorbital width of *Phoca hispida*, but in length of skull (193 mm.), width across mastoids (117.5 mm.), and general massiveness, it resembles *Phoca groenlandica*. Is it possible that these species interbreed on rare occasions?

Except for anomalous specimens such as those mentioned above, the black area on the side, extending from middle of shoulders on sides and upward again to base of tail. I never met the species during seven years spent along the western Arctic coast in Alaska, Canada, and Northwest Territories, and the Eskimos did not know the animal, so it is evidently only of accidental or casual occurrence." The above mentioned photograph is reproduced in this paper as figure 5 of Plate XIII.

While this paper was in galley proof I received another letter from Dr. Anderson, dated Feb. 20, 1942, which follows:

"I am enclosing a copy of another record of Greenland Seal for the Western Arctic district, sent in through the Royal Canadian Mounted Police. The Inspector at Fort Smith thought it might be of interest to the National Museum. I think it is a good record as many of the men in R. C. M. P., and Hudson's Bay Co., in western Arctic have also served in the eastern Arctic and know the seals pretty well.

"Re: Seal, Cambridge Bay District.

1. Native Ehakataitok brought the hide of a Greenland seal into the Settlement on the 10th instant. I have questioned a few of the natives in this district and they all admit that this is the first time that they have seen this species of seal. This animal was killed off the north end of Melbourne Island [a little east of base of Kent Peninsula].

'Sgd.' D. C. MARTIN  
A/Cpl.'

"Forwarded through the office of Commissioner, R. C. M. P., Ottawa, 1942, and copy transmitted to National Museum of Canada, Feb. 18, 1942."

four species of *Phoca* can be distinguished by skull characters without great difficulty.

#### DESCRIPTIONS OF SPECIES

##### ***Phoca vitulina***

(Plates V, VII, IX; text figure 5)

*External Characters:* In color and markings this species is exceedingly variable, ranging from almost black with a few white spots, to almost white with a few black spots. This wide range of variation has been described so well by Allen (1880, pp. 562-565) that I take the liberty of quoting it here.

"Color variable. Above, usually yellowish-gray, varied with irregular spots of dark brown or black; beneath, yellowish-white, usually with smaller spots of dark-brown. Sometimes uniform brownish-yellow above, and somewhat paler below, entirely without spots; or uniform dark-gray above, and pale yellowish-white below, everywhere unspotted. Not infrequently everywhere dark-brown or blackish, varied with irregular streaks and small spots of yellowish-brown; the head wholly blackish from the nose to beyond the eyes; the lips and around the eyes rusty-yellow. Length of male, 5 to 6 feet; of female, somewhat less. Young at birth uniform soiled-white or yellowish-white, changing to darker with the first moult.

"The variations in color are almost endless, ranging from uniform yellowish-brown to almost uniform dark-brown, and even nearly black, with, between these extremes, almost every possible variation, from dark spotting on a light ground to light spotting on a dark ground. The markings vary in size from very small spots to large, irregular patches and streaks. The more common color is brownish-yellow, varied with spots and patches of darker, but not unfrequently the general color is blackish, more or less varied with spots, patches and streaks of lighter. The lower surface is generally thickly marked with small oval or roundish spots, smaller and less confluent than those of the upper surface. Specimens from Denmark and the Atlantic coast of North America are indistinguishable from those of Lower California, Washington Territory, and Alaska. Specimens from the Pacific coast present the same wide range of color-variations, and precisely the same phases as those from the shores of the Atlantic. . . .

"Unlike the *Phoca foetida*, *P. groenlandica*, and most other Phocids

of the northern waters, the first coat is shed before or soon after birth, but as to the exact time at which it is cast authorities disagree. Mr. Bartlett, in describing a young Seal of this species (wrongly identified at the time as *Phoca foetida*), born in the Garden of the London Zoölogical Society, June 8, 1868, says: 'It was born near the edge of the water, and in a few minutes after its birth, by rolling and turning about, was completely divested of the outer covering of *fur* and *hair*, which formed a complete mat, upon which the young animal lay for the hour or two after its birth.'

"It is sometimes stated that the foetal coat is retained for four or five days after birth, but other writers affirm that it is shed at the time of birth."

Allen's descriptions apparently were taken from preserved specimens, and he has been misled by the oxidation which takes place in these skins when they are allowed to dry with grease on them. Under these conditions the normally white or silvery white colors change to yellowish or brownish, so that in many places where he has described the color as yellowish or brownish, the natural color was probably whitish or silvery white.

On the Belcher Islands I examined a young seal of this species which was apparently only a few hours old. Part of the navel cord was still attached, but it was not yet dry. There was no evidence of the white foetal coat.

TABLE I  
Skull Measurements of *Phoca vitulina*  
(Text figures 9-11)

	Maximum	Minimum	Average
Total length.....	221.5 mm. <sup>8</sup>	157.3	184.1
Width across mastoids.....	128.0	100.0	111.6
Interorbital width.....	16.0	9.5	11.6
Length of nasals.....	67.3	33.4	45.7
Width of nasals at tip.....	21.0	9.4	14.2

The nasals are broad and taper gradually from the tip to the maxillo-frontal suture, but from here back they narrow rapidly. For the anterior half of their length they lie between the maxillaries and pre-maxillaries. The posterior half of their length lies between the frontals. Posteriorly the palate ends acutely like a pointed Gothic arch. The posterior palatine

<sup>8</sup> The measurements used throughout this paper are expressed in millimeters unless otherwise indicated.

foramina, with but a few exceptions, lie anterior to the maxillo-palatine suture. The maxillary teeth are large, being both wide and long. The third upper molariform tooth is usually the largest. It has a large central cusp, and frequently two accessory posterior cusps, although in some instances only one posterior accessory cusp is present. Usually there is one small anterior cusp as well. The anterior end of each ramus of the mandible is heavy and blunt and curves gradually to meet the lower border of the ramus. The coronoid process is short and broad, and usually does not extend backwards beyond the glenoid process. The mandibular teeth, like the maxillary teeth, are large and heavy. The third molariform tooth is the largest. It has one large central cusp, two small posterior cusps and one small anterior cusp. One or two small tubercles are frequently found near the base of this small anterior cusp. These teeth are frequently set diagonally in the jaw, so that the posterior portion of the one tooth overlaps the anterior portion of the one behind it. This is particularly true of young specimens in which the jaw has not attained its full growth. As age advances the jaw grows; thus the teeth receive more space, and gradually come into line with the jaw.

*Range:* Along the Atlantic coast of North America the species is most abundant from Maine to Labrador. It has been reported from as far south as North Carolina (Allen, 1880, p. 585), and as far north as Ellesmere Island (Anderson, 1934, p. 75), but is rare, or uncommon, at the extremes of its range. On the Pacific coast of North America it is common from California to Alaska, ranging from Lower California (Allen, 1902, p. 495) to Pt. Barrow, Alaska (Allen, 1902, p. 484). Along the Pacific coast of Asia it has been reported from Bering Strait (Allen, 1902, p. 485) south to the mouth of the Yangtze River (G. M. Allen, 1938, p. 493). A specimen has recently been described from Chefoo on the Shantung coast of China by Leroy (1940).

On the European side of the Atlantic it has been reported as occurring occasionally in the Mediterranean. From France northward to Scandinavia it is the commonest species of the family. It ranges from here northward and eastward along the Arctic coast, but apparently does not reach Spitsbergen and Jan Mayen Islands (Allen, 1880, pp. 586-587). According to Smirnov (1908, pp. 69-70), it reaches Upernivik in northern Greenland and eastward, Novaya Zemlya, but is not known east of there. It frequently travels inland up fresh-water rivers and lakes and has been reported from Lake Ontario and Lake Champlain, and from the Columbia River near the Dalles, above the Cascades and approximately 200 miles

from the sea (Allen, 1880, pp. 587-588). In Hudson Bay it is not common along the east coast, but is occasionally seen as far south as Great Whale River and the Belcher Islands. Here it is known to the Eskimos as "Kasagaea."

### ***Phoca hispida***

(Plates V, VII, IX; text figure 4)

*External characters:* The color markings of *Phoca hispida* are so similar to those of *Phoca vitulina* that I could not be certain of distinguishing every specimen by color alone. However, there is a difference in the texture of the hair, which, combined with general differences in color, makes it possible to distinguish practically every specimen. The wide range of variation makes description very difficult, however. In general, the skins are white, silvery white, or yellowish white on the belly. In preserved specimens, where the grease has not been removed completely, the belly is usually yellowish or brownish. The hair around the lips and sometimes the sides of the head, the axilla of the front flippers, the underside of the tail and the inside of the hind flippers is usually a salmon or light brownish color ("Tawny" or "Russet" of Ridgway, 1912). This is particularly noticeable in fresh specimens, but becomes more or less obliterated if the specimens have become yellow from age and grease. The back is spotted, streaked or marbled with black. White spots with dark centers are characteristic, but not always present. The dark markings may be confined to the mid-dorsal region, or may extend down on the sides to the belly. These dark markings are usually black or some shade of dark brown, and usually begin on the top of the head between the eyes and extend backwards to, and include the tail. The face, from the nose to the eyes, is usually light. The hair is coarse and stiff and usually points directly backward.

The coat of the newly born young is quite different, being soft and woolly and of a white or yellowish white color. According to Allen (1880, p. 600), "At the age of about four weeks this gradually gives place to the coarser, more rigid pelage of the adult, and the color changes to dusky, marked sparsely with small blackish spots. Yearlings are often yellowish-white; dusky along the middle of the back, with here and there small spots of blackish.

"There is a wide range of individual variation in color, in the newly-born young as well as in the adults. . ."

In addition to this wide range of color, Kumlien (1879, p. 60) mentions hairless and albino specimens. Degerbøl and Freuchen (1935, p. 196) mention variation in total length of from one to two meters. This difference is attributed to the amount of food available.

TABLE II  
Skull Measurements of *Phoca hispida*

	Maximum	Minimum	Average
Total length.....	177.0	155.5	165.8
Width across mastoids.....	105.8	90.4	100.05
Interorbital width.....	6.2	4.0	5.04
Length of nasals.....	42.5	30.0	37.33
Width of nasals at tip.....	12.1	9.5	11.26

The nasals are long and narrow and taper gradually from the tip to the maxillo-frontal suture; at this point they narrow rapidly. The portion of the nasals lying posterior to the maxillo-frontal suture is usually considerably less than one-half the length of the nasals. The posterior margin of the palate ends acutely in a pointed Gothic arch. The posterior palatine foramina lie in or posterior to the maxillo-palatine suture. The molariform teeth are small, the third one being the largest. It has a large central cusp and may have two small posterior cusps, though usually only one is present. It also has one small anterior cusp. There is seldom any evidence of the small tubercles which are frequently seen in *Phoca vitulina*. Although possessing nearly the same number of cusps as *Phoca vitulina*, the teeth of *Phoca hispida* are readily distinguished by their much smaller size. The anterior end of each ramus of the mandible is narrow and pointed and slopes backward in a nearly straight line, to the lower margin of the ramus. The coronoid is long, slender and pointed, and extends much further backward than it does in *Phoca vitulina*. As in the maxillary teeth, the third mandibular tooth is the largest. It has one large central cusp, two smaller posterior cusps, and one small anterior cusp. These teeth are seldom crowded out of line as they are in *Phoca vitulina*, but occasionally the second molar tooth may be set diagonally in the jaw.

*Range:* The species is reported to be circumpolar in its distribution. It has been found as far north as 82°40' and ranges southward on the Atlantic coast of North America to Labrador (Allen, 1880, p. 615). On the Pacific coast of North America it has been reported as far south as St. Michaels, Alaska (Allen, 1902, p. 477), but Osgood (1904) did not mention it in his "Reconnaissance of the Base of the Alaska Peninsula." On the



Atlantic coast of Europe, it has been reported as far south as the British Channel (Allen, 1880, p. 615) and along the Pacific coast of Asia, it has been reported from the Okhotsk Sea (Allen, 1902, p. 480). Smirnov (1908, p. 57) states that its southern limit here is the Amur River. He says that it is found in the Bering Sea, White Sea, and Baltic Sea. Degerbøl and Freuchen (1935, p. 46) record specimens from King William Land. It shares part of its range with *Phoca vitulina*, but is a more northern species, being found commonly much farther north, and never ranging as far south as that species.

In Hudson Bay it is the most common seal along the east coast, and at the Belcher Islands. The Eskimos here call it "Netcheck." I have specimens from as far south as the Twin Islands, and on September 24, 1935, I saw a seal which I took to be this species at the mouth of the Moose River.

### ***Phoca groenlandica***

(Plates VI, VIII, X; text figure 6)

*External characters:* The small number of skins which have been available to me have not been sufficient to permit a description of this species, therefore I have borrowed the following description from Robert Brown (1868, pp. 416-420).

"It seems to be almost unknown to most writers on this group that the male and female of the Saddlebacks are of different colours; this, however, has long been known to the Seal-hunters. *Male*.—The length of the male Saddleback rarely reaches 6 feet, and the most common length is 5 feet; while the female in general rarely attains that length. The colour of the male is of a tawny grey, of a lighter or darker shade in different individuals, on a slightly straw-coloured or tawny-yellowish ground, having sometimes a tendency to a reddish-brown tint, which latter colour is often seen in both males and females, but especially in the latter, in oval spots on the dorsal aspect. The pectoral and abdominal regions have a dingy or tarnished silvery hue, and are not white as generally described. But the chief characteristic, at least that which has attracted the most notice, so much as to have been the reason for giving it several names, from the peculiar appearance it was thought to present (*e.g.*, 'harp' Seal, 'saddleback,' etc.), is the dark marking or band on its dorsal and lateral aspects. This 'saddle-shaped' band commences at the root of the neck posteriorly, and curves downwards and backwards at each side superior

to the anterior flippers,\* reaches downwards to the abdominal region, whence it curves backwards anteriorly to the posterior flippers, where it gradually disappears, reaching further in some individuals than in others. In some this band is broader than in others and more clearly impressed, while in many the markings only present an approximation, in the form of an aggregation of spots more or less isolated. The grey colour verges into a dark hue, almost a black tint, on the muzzle and flippers; but I have never seen it white on the forehead as mentioned by Fabricius. The muzzle is more prominent than in any other northern Seal.

“*Female*.—The female is very different in appearance from the male: she is not nearly so large, rarely reaching 5 feet in length; and when fully mature her colour is a dull white or yellowish straw-colour, of a tawny hue on the back, but similar to the male on the pectoral and abdominal regions, only perhaps somewhat lighter. In some females I have seen the colour totally different; it presented a bluish or dark grey appearance on the back, with peculiar oval markings of a dark colour apparently impressed on a yellowish or reddish-brown ground. These spots are more or less numerous in different individuals. Some Seal-hunters are inclined to think this is a different species of Seal from the Saddleback, because the appearance of the skin is often so very different and so extremely beautiful when taken out of the water; yet as the females are always among the immense flocks of the Saddleback, and as hardly two of the latter females are alike, but varying in all stages to the mature female, and on account of there being no males to mate with them, I am inclined to believe with Dr. Wallace that these are only *younger female Saddlebacks*. The muzzle and flippers of the female present the same dark-chestnut appearance as in the male. . .

“(a) The colour after birth is a pure woolly white, which gradually assumes a beautiful yellowish tint when contrasted with the stainless purity of the Arctic snow; they are then called by the sealers ‘white-coats’ or ‘whitey-coats’ †; and they retain this colour until they are able to take

\*I use this very convenient sealers’ vernacular term to express the ‘paws,’ ‘hands,’ etc. of systematic authors.

†These are rarely seen in Danish Greenland, and then are called ‘Isblink’ by the Danes from their colour; at least, so Fabricius says. He, moreover, informs us that the third year they are called *Aglektok* (as mentioned above), the fourth *Millaktok*, and after a winter *Kinaglit*, when they are beginning to assume the harp-shaped markings of the male (Nat. Selsk. Skrift., i, p. 92). I never heard these names in North Greenland.

the water (when about fourteen or twenty days old). . . The white-coat changes very quickly. In 1862 the late Capt. George Deuchars, to whom science is indebted for so many specimens, brought me two alive from near Jan Mayen; they were white when brought on board, but they changed this coat to a dark one completely on the passage, of a week or ten days.

“I consider that about three years are sufficient to complete these changes. This is also the opinion held in Newfoundland, though the Greenland people consider that five years are necessary. I wish, however, to say that these changes do not proceed so regularly as is usually described, some of them not lasting a year, others longer, while, again, several of the changes are gone through in one year; in fact the coats are always gradually changing, though some of the more prominent ones may be retained a longer, and others a shorter time. It would require a very careful and extended study of this animal to decide on this point, which, owing to their migrations, it is impossible to give. After all, these changes and their rapidity vary according to the season and the individual, and really will not admit of other than a general description.”

TABLE III  
Skull Measurements of *Phoca groenlandica*

	Maximum	Minimum	Average
Total length . . . . .	221.0	190.0	204.7
Width across mastoids . . . . .	123.6	107.5	114.6
Interorbital width . . . . .	20.0	8.3	11.7
Length of nasals . . . . .	52.6	35.8	42.1
Width of nasals at tip . . . . .	19.2	14.9	16.6

The nasals are long and narrow and in some respects resemble those of *Phoca hispida* more than those of *Phoca vitulina*. Except in very young specimens, the nasal sutures are frequently so ossified that the margins are not distinctly visible. The nasals taper rather gradually from the anterior to the posterior end. Thus the abrupt change observed in *Phoca vitulina* and *Phoca hispida* at the junction of the maxillo-frontal sutures is not so evident. The posterior margin of the palate is round like a Roman arch, and is seldom notched or incised like that of *Phoca vitulina* and of *Phoca hispida*. The posterior palatine foramina usually lie in or anterior to the maxillo-palatine suture. The teeth are comparatively small. The third

molariform tooth is usually the largest. It has one large central cusp and one small posterior cusp, and occasionally there is evidence of a still smaller second posterior cusp. Occasionally, also, there is a very small anterior cusp. The anterior end of each ramus of the mandible is narrow and pointed and slopes backward in a nearly straight line to the lower margin of the ramus. In this respect it is very similar to *Phoca hispida*, but the angle made by this sloping portion with the base of the ramus is much more acute than in *Phoca hispida* (Pls. VII, 1; VIII, 1). The coronoid is long, slender and pointed. It is prolonged backward much as in *Phoca hispida*. The mandibular teeth are small, the third being the largest of the set. It has one large central cusp, two small posterior cusps and one small anterior cusp. In number of cusps they resemble *Phoca hispida*, but in *groenlandica* the central cusp is proportionately larger. The teeth are not crowded in the jaw, but are spaced even farther apart than in *Phoca hispida*.

*Range:* The home of this species is the North Atlantic. It is found in great numbers off the coast of Newfoundland and Labrador, especially in the early spring. It has been reported as far south on the American coast as New Jersey (Allen, 1880, p. 640), although its occurrence there is rare. It has been reported as far north as Annanactook at about lat. 67°N., long. 68°50'W., Kumlien (1879, p. 61). Sverdrup (1904, vol. II, p. 40) reports them from Jones Sound, about lat. 76°N., long. 85°W. Along the Atlantic coast of Europe they have been reported from as far south as "Morecombe Bay, England."<sup>9</sup> Northward they are common about "Ice-land," "Jan Mayen," "Spitzbergen," and also occur about "Nova Zembla," "Franz Josef Land" and the "Kora Sea" (Allen, 1880, p. 641). Plehanoff (1933) found them on Marjovez Island in the White Sea. They enter Hudson Bay and are found at least as far south as Great Whale River and the Belcher Islands. The Eskimos here know them by the name of "Kioole."

Allen (1880, p. 640) says the species is circumpolar, but later (p. 641) he says that the distribution of the species in the North Pacific is not well known. The only authorities he gives for its occurrence there are Pallas and Temminck. He says he saw no specimens from there. I have seen no specimens from the Pacific either, and am inclined to believe that the species does not occur there.

<sup>9</sup> I have used quotes here to show that I am copying these place names directly from Allen (1880). Different names and spellings are now employed for some of these places.

**Phoca fasciata**

(Plates VI, VIII, X; text figure 7)

*External Characters:* The males of this species can be recognized at once by the unique color pattern. It may be considered as a black seal with a white band around the neck, around each foreleg, and around the body just anterior to the junction of the hind flippers. Since I have seen only two skins of this species I am unable to describe the range of variation or the color of the female or young, so I have borrowed the following description from Allen (1880, pp. 676-678), who, for the most part, was quoting von Schrenck.

"*Adult male.* General color, dark brown. A narrow yellowish-white band surrounds the neck extending forward to the middle of the head above; another broader yellowish-white band encircles the hinder portion of the body, from which a branch runs forward on each side to the shoulder, the two branches becoming confluent on the median line of the body below, but widely separated above. In other words, the (1) front part of the head, the (2) hind limbs, and the posterior fourth of the body, the (3) top of the neck and the whole anterior half of the back, as well as (4) the forelimbs and a considerable area at their point of insertion, are dark brown; these four regions being separated by bands of yellowish-white, of variable breadth over different regions of the body. The brown of the anterior part of the dorsal region also extends laterally in the form of a narrow band around the lower part of the neck, where it expands to form a small shield-like spot on the breast. There are also very small spots of brown on the posterior part of the abdominal region.

"*Adult female.*—Uniform pale grayish-yellow or grayish-brown, with the exception of an obscure narrow transverse whitish band across the lower portion of the back. The extremities and the back are darker, with a faint indication of the dark 'saddle'-mark seen in the male.

"*Young.*—The young of both sexes are said to resemble the adult female.

"Von Schrenck's detailed description, on which the foregoing is mainly based, is substantially as follows: The dark-brown of the head, in the male, is followed by a broad dusky yellowish-gray neck-band, which on the middle line, both above and below, passes forward, but on the sides has the convexity pointing backward. Behind this light neck-band is a broad, long saddle-shaped patch upon the back, which, on the middle line, runs forward in a point, but which extends itself laterally in two narrow bands

meeting and expanding on the breast into a pointed spot; posteriorly the dark dorsal patch is also prolonged backward and laterally, but without meeting below. Along the sides of this dorsal area runs a broad, curved, light, soiled yellowish-gray band, with the convexity upward; these lateral light bands become deflected downward, both anteriorly and posteriorly, and form, by their union, a light band along the belly. Within these light bands anteriorly, on each side, is a large oval dark-brown spot, in which are inserted the anterior extremities. The light ventral area encloses posteriorly two small oval dark-brown spots, and in front of these a third narrower and larger. Behind the dark area on the back is a very broad dorsal cross-band of light yellowish-gray, joining the light bands on the side of the body. Behind this light cross-band the whole posterior part of the body, as well as on the tail and hind limbs, is blackish-brown. As a rule the above-described dark and light color areas are very sharply defined. Sometimes, however, there extends from the dark areas a smaller spot more or less isolated. According to the same writer the color varies considerably in different individuals, one of those he describes having the dark color of a dark grayish-black, and the light markings whitish or straw-yellow. He also states that in the figures given by Siemaschko the light neck-band is deflected backward from the back of the neck to the fore-limbs, leaving the whole breast of the same dark-brown color as the head. Besides this the dark-brown color of the back extends, both posteriorly and anteriorly, to the lower sides of the body, occupying the whole of the ventral surface, with the exception of two light bands which run crosswise around the base of the anterior extremities, and a separate light band that crosses the hinder part of the body. In consequence of the wide departure of the pattern of coloration in Siemaschko's figure from his own examples, von Schrenck is left in doubt as to whether the figure is really a true copy from nature.

"The single specimen I have examined. (Nat. Mus. No. 9311, Cape Romanzoff, W. H. Dall), a flat skin, lacking the flippers and the facial portion, agrees with von Schrenck's figure in respect to the form and size of the neck-band, but there is a far greater preponderance of light color, which occupies rather more than half the entire surface. Only the posterior sixth of the body is black, and the dark area of the back is very much more restricted, and differs somewhat in outline. In this specimen the breadth of the dark dorsal portion occupies scarcely more than one-third of the whole width of the skin, the light portion on either side nearly equalling it in breadth. It widens over the neck and sends down a lateral

branch on each side, the two meeting on the breast. It is contracted over the shoulders, behind which it again expands, and at its posterior border sends down a very narrow branch from the right side to the middle of the belly; its fellow on the opposite side is nearly obsolete, forming merely a broken chain of small dusky spots. There is hence in this example a wide departure from the specimens described by von Schrenck, while the want of symmetry in the two posterior branches of the dorsal spot, and the relatively nearly equal amount of light and dark color, lead one to apprehend a much wider range of individual variation in coloration than von Schrenck apparently suspected, and that after all Siemaschko's figure merely represents a variation in the opposite direction from that here indicated, or an unusual extension of the dark color at the expense of the lighter markings.

"*Size*.—Von Schrenck states that this animal is reported to sometimes attain the length of  $6\frac{1}{2}$  feet. He gives the length of a full-grown male as 5 feet,  $6\frac{1}{4}$  inches (1683mm.), and that of a full-grown female as 5 feet, 3 inches (1600mm.), based on Wosnessenski's specimens obtained in Kamtschatka, which his hunters informed him were not of the largest size. In other words, it appears to be a Seal of the medium size, or about as large as *Phoca groenlandica*."

TABLE IV

Skull Measurements of *Phoca fasciata*

	Maximum	Minimum	Average
Total length.....	201.3	193.0	197.0
Width across mastoids.....	133.4	122.0	127.7
Interorbital width.....	14.6	9.8	12.2
Length of nasals.....	43.3	42.2	42.75
Width of nasals at tip.....	10.0	9.8	9.9

Only two adult specimens were available for the above measurements. The nasals are long and narrow and taper gradually from the anterior to the posterior end. Like *Phoca groenlandica* there is little change in contour at the maxillo-frontal suture. The palate is broad and the posterior margin is rounded like a Roman arch. In this respect it resembles *Phoca groenlandica* and differs from the notched palate of *vitulina* and *hispida*. In one of the three specimens which I have the palate is lobed like a printer's brackets (Pl. X, fig. 2). The palatine foramina lie in or posterior to the maxillo-palatine suture. The auditory bullae are larger than in any of the other three species. The three specimens which I have measure 48 x 33, 42 x 32, and 38 x 28. The maxillary teeth are very small and

usually without accessory cusps. The central point is curved backwards. The teeth are spaced even farther apart than they are in *Phoca groenlandica*. The anterior end of the mandible is very slender and slopes backward to meet the base of the ramus at a much less acute angle than in *Phoca groenlandica* or *Phoca hispida*. The coronoid is long and slender and projects backward very much like that in *Phoca groenlandica*. The mandibular teeth are very small, the third being the largest. It has one large central cusp and one very small posterior cusp. Occasionally there is a small tubercle representing the anterior cusp. Like the maxillary teeth these teeth are well-spaced, so there is no tendency toward crowding in the jaw.

*Range:* This is a rare species and its distribution is not well known. Apparently, however, it is confined to the Pacific Ocean. Allen (1880, pp. 681-682) gives its range as follows:

"According to Pallas, the present species occurs around the Kurile Islands and in the Ochots Sea. Von Schrenck states that Hr. Wosnesenski obtained specimens that were killed on the eastern coast of Kamtschatka, and that he himself saw skins of examples killed on the southern coast of the Ochots Sea, where, however, the species seems to be of rare occurrence. He further states that it occurs also in the Gulf of Tartary, between the island of Saghalien and the mainland, but apparently not to the southward of that island, the southern point of which (in latitude 46°N.) he believes to be the southern limit of its distribution. Mr. Dall secured specimens taken at Cape Romanzoff. Captain Scammon states, 'It is found upon the coast of Alaska, bordering on Behring Sea, and the natives of Ounalaska recognize it as an occasional visitor to the Aleutian Islands. . . The Russian traders, who formerly visited Cape Romanzoff, from St. Michael's, Norton Sound, frequently brought back the skins of the male *Histriophoca*, which were used for covering trunks and for other ornamental purposes.' This writer also states that he 'observed a herd of Seals upon the beaches at Point Reyes, California,' in April, 1852, which, 'without close examination, answered to the description given by Gill' of the present species. Probably, however, a 'close examination' would have shown them to be different, as no examples are yet known from the Californian coast, and the locality is far beyond the probable limits of its habitat. Its known range may, therefore, be given as Behring's Sea southward—on the American coast to the Aleutian Islands, and on the Asiatic coast to the island of Saghalien."

According to Smirnov (1908, p. 53), it is found in the Bering Sea and



Okhotsk Sea. He quotes Nordquist as authority for its northern limit at Cape Serdge Kamen, East Cape, and Point Barrow. The southern limit on the Asiatic side, according to von Schrenck, is the southern end of Sakhalin Island, and on the American side, Cape Vancouver.

#### COMPARISONS

*Phoca hispida* is at once distinguished from the other three groups of the genus, by its smaller size and the very narrow interorbital. The following table gives comparative measurements of the four species of *Phoca*.

TABLE V  
Comparative measurements of *Phoca* skulls

	No. of specimens used	Greatest length of skull			Least interorbital width		
		Max.	Min.	Av.	Max.	Min.	Av.
<i>Phoca vitulina</i> . . . . .	30	221.1	162.8	182.8	16.0	9.5	11.8
<i>Phoca hispida</i> . . . . .	30	177.8	154.9	166.5	6.6	4.5	5.4
<i>Phoca groenlandica</i> . . . . .	38	221.0	190.0	204.7	20.0	8.3	11.7
<i>Phoca fasciata</i> . . . . .	2	201.3	193.0	197.0	14.6	9.8	12.2

*Phoca hispida* resembles *P. groenlandica* more closely in many of its characters than it does either of the other two groups. This is especially true of the long, narrow nasals; the small, narrow molariform teeth; the long narrow palate; the narrow, compressed central incisors; the narrow rostrum; the general contour of the skull as seen in dorsal view, and the long narrow coronoid process of the mandible. *P. hispida* is distinguished from *P. groenlandica* by its smaller size; narrower interorbital; shorter and more pointed rostrum, and smaller central incisors. In *Phoca hispida* the palate ends posteriorly in an acute notch like a Gothic arch, while in *Phoca groenlandica* the palate ends in a broad Roman arch. In *Phoca hispida* the posterior palatine foramina usually enter the palate in, or posterior to, the maxillo-palatine suture. In *Phoca groenlandica* these foramina enter in, or anterior to it. On the upper molariform teeth *P. hispida* usually has a small accessory cusp anterior to the large central cusp. *Phoca groenlandica* lacks this anterior accessory cusp. In the mandibular teeth, both species have the accessory anterior cusp, but it is much better developed in *Phoca hispida*; in fact, in some specimens it is nearly as large as the central cusp, while in *P. groenlandica* it is much smaller than the central cusp. In *Phoca groenlandica* the supra angle is well developed and extends backward in the same plane as the angle,

while in *Phoca hispida* its development is much slighter, and it extends laterally almost at right angles to the plane of the angle.

*Phoca fasciata*, in some respects, resembles *P. hispida* and *P. groenlandica* more than it does *P. vitulina*. This is especially true of the small molariform teeth and the narrow nasals. It resembles *groenlandica*, rather than *hispida*, in the squarish cut of the anterior end of the rostrum, and in the broad Roman arch formed by the posterior end of the palate. In interorbital breadth it is more like *vitulina*. It is at once distinguished from the three other groups of the genus by its very broad and arched palate. The palate is higher in the center than it is at the incisors or the posterior nares, so that it gives the impression of being convex. Its length, from the anterior end of the rostrum to the posterior end of the palate along the mid-line, is not more than 1.48 times the width. In *Phoca groenlandica* it is seldom less than 1.60 and averages 1.9.<sup>10</sup> Expressed as a ratio of length over width, *Phoca fasciata* gives a percentage of 65.2 to 87.1, while the maximum for *Phoca groenlandica* is 62.2 and the minimum is 45.0, the average being 52.4. These averages for *Phoca groenlandica* are derived from a series of 51 specimens from Greenland and the Atlantic coast of North America. Unfortunately I have only three specimens of *Phoca fasciata*, and the one specimen which is responsible for the low percentage is a very young individual. In width of palate, *Phoca vitulina* approaches *P. fasciata* more closely than any other species; but it is distinguished at once by the notched palate, much larger mandibular teeth, larger nasals, and more rounded rostrum. The mandibular teeth of *Phoca fasciata* lack the anterior accessory tubercle, or have it developed to a lesser degree than *P. groenlandica*, so that it is quite distinct from the well-developed tubercle found in *P. hispida* and *P. vitulina*. The coronoid process is short, more like that in *P. vitulina* than in *P. groenlandica* or *P. hispida*.

Just as *Phoca fasciata* can be distinguished at once by a glance at the palate, so *P. vitulina* can be distinguished by a glance at the teeth. The molariform teeth are broader and longer than those in any other group of the genus. In both *P. groenlandica* and *P. fasciata* the accessory cusps are reduced, thus accentuating the central cusp. *P. hispida*, therefore, resembles *P. vitulina* in this character more closely than either of the other two. *P. hispida* usually (but not always) has one small, but well-developed, cusp anterior to the large central cusp, and one posterior accessory cusp,

<sup>10</sup> This measurement of width was made across the outer, or buccal, side of the maxillaries, opposite the last molars.

while *P. vitulina* has one cusp anterior to the large central cusp, and two posterior accessory cusps. In a series of seventy *P. hispida*, only one specimen has two, well-developed posterior accessory cusps. The teeth in *P. vitulina* are both longer and heavier than in *P. hispida*, or any other northern form of this genus. In the mandible the teeth are so large that, especially in young specimens, there is not room for them to stand in line parallel with the jaw, and as a result they are crowded out of line, and stand at an angle to the jaw (figure 11). The nasals of *P. vitulina* are broader than in any of the other three species of the genus. The anterior end of the rostrum is tapered, similar to that found in *P. hispida*, and quite distinct from the squarish outline of *P. groenlandica* and *P. fasciata*. Likewise, the posterior margin of the palate is pointed like a Gothic arch, and thus similar to *P. hispida*, but quite distinct from the broad Roman arch found in *P. fasciata* and *P. groenlandica*. The posterior palatine foramina usually enter the palate anterior to the maxillo-palatine suture, and in this respect, resemble *P. groenlandica*, but differ from *P. hispida* and *P. fasciata*, in which the foramina enter posterior to this suture.

The color and markings of the skin have already been treated, so I have summed them up here very briefly. The males of *Phoca groenlandica* and *Phoca fasciata* are known at once by their characteristic markings. *Phoca vitulina* and *Phoca hispida*, however, are more similar and sometimes cannot be separated without attention to details. In addition to the color and markings given above, the differences in the hair and claws are a very satisfactory way of distinguishing *Phoca hispida* and *Phoca vitulina*. The hair in *Phoca hispida* appears to be longer and straighter than in *Phoca vitulina*, in which the tip of each hair curls forward so that it gives the animal, as a whole, an appearance of being softer and more woolly. On the underside of the flipper, and in the axilla, there is usually a brownish or salmon tint ("Tawny" or "Russet" of Ridgway, 1912) to the hair of *Phoca hispida*. Although this is characteristic, it is not always present. It is seldom present in *Phoca vitulina*.

In *Phoca hispida* the claws are distinctly triangular in cross section. This triangular shape is such that the upper side of the claw has the appearance of a distinct ridge. On the upper side, too, the bands, or annual growth rings, can be seen and felt. The under side is concave, with sharp edges on each side. The claws of *Phoca vitulina* are smaller (figures 4 and 5), although the animal itself is considerably larger. No annual growth rings can be detected, and the cross section is not nearly so triangular, but

is much more rounded. The edges on the under side are not nearly as sharp as those of *P. hispida*.

The claws of *Phoca groenlandica* and *Phoca fasciata* are more like those of *Phoca hispida* than of *Phoca vitulina*. In both *groenlandica* and *fasciata* the annual growth rings are evident, and the claws are triangular in ap-

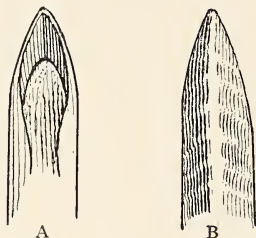


FIG. 4.

*Phoca hispida*

Ventral (A) and dorsal (B) views of the second claw of the right front flipper, nat. size.

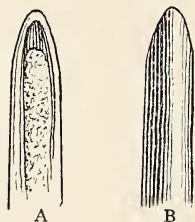


FIG. 5.

*Phoca vitulina*

FIG. 4. *Phoca hispida*, male, from near Wiegand Island, Belcher Islands, Hudson Bay; May 7, 1938; Carnegie Museum, no. 15,250.

FIG. 5. *Phoca vitulina*, male, from Hudson Bay, Canada; Spring, 1940; Carnegie Museum, no. 18,746.

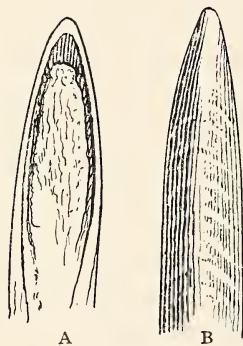


FIG. 6.

*Phoca groenlandica*

Ventral (A) and dorsal (B) views of the second claw of the right front flipper, nat. size.

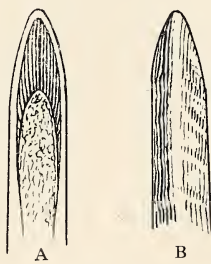


FIG. 7.

*Phoca fasciata*

FIG. 6. *Phoca groenlandica*, male, from La Tabatière, North Shore, Gulf of St. Lawrence, Quebec, Canada; January 7, 1940; Carnegie Museum, no. 18,696.

FIG. 7. *Phoca fasciata*, male, from north of Sevoonga, St. Lawrence Id., Bering Sea; June 25, 1931; Museum of Vertebrate Zoology, no. 51,385.

pearance, although the ridge along the upper surface is not so distinct. In specimens of about equal size, the claws of *Phoca fasciata* are notably larger than those of *groenlandica* (figures 6 and 7).

It seems possible that the differences in the claws of *Phoca hispida* and *Phoca vitulina* may be correlated with a difference in habits. *Phoca hispida* keeps a series of breathing holes open through the ice all winter. For this purpose its claws are used extensively to scratch away the ice. It also gives birth to its young in a cavity which it scratches out between the ice and the snow. *Phoca vitulina* does not keep a series of breathing holes, and its young are born on the land after the ice and snow have gone. The sharp edges on the under side of the claws of *Phoca hispida* are well adapted to scratching away the snow and ice. The more rounded weaker claws of *Phoca vitulina* would not be nearly as satisfactory for this purpose.

#### VARIATION IN THE GENUS

The genus *Phoca* is remarkable for the amount of variation which may be found among the individuals of any species. Practically all former students of the group have commented on this fact. In some instances, variation in the genus is sufficient to overlap the specific characters. Thus, a skull of one species, in some rare cases, may be so abnormal as to be mistaken for that of another species. The greatest single cause of variation within the species can probably be ascribed to age. Individual variation, regardless of age, is extensive also. Sexual variation in the skull, at least in *P. hispida* and *P. vitulina*, is not pronounced, and without good series of properly sexed skulls it is difficult to demonstrate. I know of no reliable characters which can be used to determine it. Because of this great amount of variation in the genus, the study and description of only three specimens has been very difficult.

A series of about seventy skulls of *P. hispida* was available, however, from the Belcher Islands. These were studied to determine the nature and amount of variation to be expected in the genus *Phoca*. After that, most of the specimens of *Phoca vitulina* which are now preserved in the museums of the United States were examined, either by visiting the museums which had extensive collections or by borrowing the material. These specimens were measured and examined carefully for variation.

#### SUPERNUMERARY BONES IN THE BASE OF THE CRANIUM

During this study three supernumerary bones were observed in the base of the cranium. These bones seem to occur regularly in both *Phoca*

*hispida* and *Phoca vitulina*, but they coalesce with other elements at such an early age that they may be observed only in animals less than six months old. One of these bones, the tabulare, has been reported by various authors. Broom (1916, p. 459) was one of the first to call attention to this bone in the Phocidae. Weber (1927, Band 1, p. 67) gives several other references to it. These men have all homologized this bone with the tabulare of the reptile skull. None of them, however, has called attention to the two additional small bones marked as (1) and (3) on figure 8. A. B. Howell (1928, p. 17) speaks of them as follows: "In the fetal *Phoca* skull there is a pair of symmetrical bones, one on either side, bounded by the mastoid, parietal, supraoccipital and exoccipital, and measuring 21

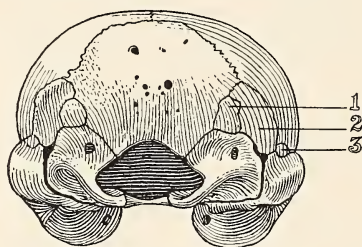


FIG. 8. Supernumerary bones in the base of the cranium. *Phoca hispida*, specimen from near Great Whale River, Hudson Bay, Canada; February 28, 1938; Carnegie Museum, no. 15,224.

by 10 mm. These are found in those few very young *Phoca vitulina* skulls that are available, but their outlines become obliterated in older animals—even in immatures of medium size. In an adult skull of *Phoca groenlandica*, however, and a subadult of *Cystophora*, these accessory bones can be perfectly traced. They can not be considered as Wormian bones, for they are too symmetrical and too regularly situated. It seems justifiable to consider them as a phylogenetic remnant, comparable to the 'reptilian' supernumerary bones of some insectivores. (See Wortman, 1921.) I can not, however, find that their undoubted homologue exists in the skull of any reptile which I have encountered in the literature of the subject, unless they are comparable to supratemporals of such a genus as *Procolophon*; and I am far from convinced that this is likely." W. K. Gregory also is not at all certain that these bones can be homologized with those of the reptilian skull. In a letter, dated May 15, 1940, he said, "I regret to state that it would require direct paleontological evidence to convince me that it is safe to homologize these extra bones with the primitive reptilian elements. . . I think it is far safer to assume that the

lateral spreading of the brain in pinnipeds, together with delay in bone formation and sutural closure in aquatic mammals, has conditioned the separation of these ossicles from the margins of the occipito-mastoid region of the chondrocranium." As a name for the bones at the base of the cranium he would suggest extra-occipitalia, one, two, and three, beginning medially. Schultz (1923) discusses bregmatic bones in the fontanelle of various mammals. According to his studies, bregmatic bones occur with considerable regularity in some species. Dr. Remington Kellogg, in a letter dated April 26, 1940, said: "It is true that I got somewhat interested in these same bones a few years back and spent several months trying to figure out what their reptilian homologues might be. Then I began to find that they were present in most carnivores and a number of other groups. . . . At any event none of my palaeontological or anatomical friends, who have given considerable study to such problems, are willing to concede that these elements are homologues of any reptilian elements. After some study I decided they were probably correct and dropped the whole matter."

These bones are seldom seen in adult animals and are seldom mentioned in anatomical texts, yet they are of considerable interest, and I think should be noted wherever they are found. It seems that it is better, for the present at least, to consider these extra bones in the occipital region of the seal as being of the nature of fontanelle bones rather than to try to homologize them with elements in the reptilian skull.

#### AGE DETERMINATION

The study of *Phoca vitulina* bore out the discovery made in the preliminary study of *Phoca hispida*, that the age variations were sufficient to obscure subspecific characters. Since only three skulls from Seal Lake were available, it seemed necessary to compare these with other skulls of the same age. Fortunately these Seal Lake specimens were an adult male, an adult female, and a well-developed embryo.

How to determine the age of a seal then became an important consideration. Suture closure, wear of teeth, and the size and general ossification of the skull are obvious methods of estimating age. Wear on teeth is subject to much variation, due to the feeding habits of the individual. I have found some skulls, which, from all other evidences, were not the *oldest* ones of the lot, yet the crowns of the teeth were worn completely away so that nothing was left but the separate roots of the teeth. In other cases, animals which were, from all other evidence, old indi-

viduals, showed only moderate wear on their teeth. Thus, while wear on the teeth was not ignored, it was considered only an accessory means of estimating the age of the skull.

Size also varies considerably with the individual. Some of the very oldest skulls were smaller than others which were younger. Size alone, therefore, cannot be taken as a criterion of age, although usually very old skulls are also very large ones. Bony material seems to accumulate gradually as the animal becomes older; *i.e.*, the bone seems to become more dense, and the skull of an old animal weighs more than a skull of the same size from a younger animal. The specific gravity of a skull might be a means of judging age, if suitable apparatus were designed for the work, but general ossification is difficult to evaluate, so it was not given a place in the table for estimating age.

The temporal ridges mark the place of attachment on the skull for the temporal muscles. As the animal grows older the upper margins of these ridges gradually converge until, when the animal is very old, they meet on top of the skull, where they form a "sagittal crest." Since this convergence progresses with age, it was felt that a measurement of the distance between the temporal ridges could be used as an indication of the age of the individual. In general this is true, although it was not considered to be as reliable an indicator as sutural closure (see Table VI).

The relative length of P<sup>2</sup> to the total length of the molariform tooth row was also considered as an indicator of age. The teeth do not grow after they are once well formed above the gums; but the skull continues to lengthen until the individual reaches maturity. At first there is not sufficient room for the teeth, and they are crowded out of line, but as the skull lengthens the cheek-teeth receive more space and gradually come into line. The individual teeth, then, never become any larger, but more space becomes available for them as the animal ages. Thus the ratio of P<sup>2</sup> to the total length of the maxillary tooth row may be considered as an indication of age, in specimens which have not yet reached maturity. The second upper premolar tooth was used because it is the largest cheek-tooth and, in young specimens, its long axis is usually more diagonal to the general axis of the tooth row than any other. It is easier to measure, therefore, and it is the tooth which receives the most adjustment as more space becomes available. The ratio of the length of the mandible to the length of P<sup>2</sup> was also considered. Either of these ratios may be used as an accessory means of determining age in specimens which have not reached maturity (see Table VI).



TABLE VI  
PHOCA VITULINA RICHARDII (figs. 9-11)

U.S.N.M. Cat. Number	Sex	Length	Width Across Molars	Width Above Molars	Premax. to Molar	Width Across Incisors	Length of Nasals	Width of Nasals	Distance Between Temporal Ridges at Coronal Suture	Length P <sub>2</sub>	Length of Lower Jaw	Height of Lower Jaw	Symphysis to Last Molar	Depth Lower Jaw Behind Last Molar	Ratio P <sub>2</sub> to Length of Tooth Row	Suture Age
146434	♂	191.4	112.5	93.3	68.8	18.7	49.0	14.6	6.3	8.4	126.9	51.2	53.0	16.2	12.2	31
146432	♀	216.0	128.0	97.2	71.0	21.4	52.7	15.7	2.6	8.8	146.0	70.6	63.4	25.0	12.4	28
128066	.....	194.7	120.0	95.8	64.6	19.9	42.5	15.0	9.2	8.7	126.2	57.7	54.3	17.8	11.9	27
146430	♂	216.7	119.6	92.4	75.0	23.3	54.8	15.9	1.0	8.5	147.0	68.6	62.4?	22.6	11.3	26
146431	♀	193.6	113.8	90.0	65.3	18.4	44.8	13.1	24.3	8.9	128.7	51.4	55.0	19.8	13.6	25
146437	♂	187.7	114.0	94.0	61.8	18.4	42.2	11.9	24.6	8.2	123.2	47.6	53.7	17.2	13.3	24
146429	♂	194.6	118.6	91.0	64.6	18.0	46.7	13.8	17.6	7.8	129.8	55.6	56.2	18.8	12.1	23?
219877	♂	205.6	126.8	94.8	68.7	23.0	49.3	16.8	15.7	9.0	131.4	62.3	58.8	20.0	13.1	21
21474	.....	162.7	102.6	84.4	52.8	16.0	37.3	10.0	32.0	6.8	104.3	43.8	49.5	13.4	12.8	20
131459	.....	166.5	104.3	86.6	52.8	14.6	38.0	9.4	41.8	7.0	105.0	40.0	48.7	13.0	13.3	19
131458	.....	166.8	105.4	87.1	53.7	16.8	38.0	11.0	32.3	7.3	109.2	43.7	49.4	14.6	13.6	18
225795	.....	162.0	98.3	82.1	50.7	15.0	37.2	10.0	37.8	6.8	100.4	39.0	46.0	13.5	13.5	17
154016	.....	157.3	102.8	86.9	52.8	16.6	40.3	12.3	35.1	7.4	98.7	41.4	47.8	16.4	14.0	16
219867	.....	176.4	106.8	90.7	58.0	18.0	41.0	13.0	34.0	8.3	110.0	46.2	50.5	16.8	14.3	14
245914	♂	190.0	114.0	90.4	59.4	17.5	45.4	12.0	37.6	9.0	121.8	48.2	53.6	16.0	15.2	13
253237	.....	131.0	88.2	77.8	46.5	14.0	32.5	9.3	41.2	.....	83.8	29.6	42.8	12.8	.....	9
154015	.....	159.5	104.1	88.7	54.8	16.9	40.3	10.6	35.0	8.2	103.2	38.4	49.7	15.0	14.9	8
Maximum	.....	216.7	128.0	97.2	75.0	23.3	54.8	16.8	41.8	9.0	147.0	70.6	63.4	25.0	15.2	31
Minimum	.....	131.0	88.2	77.8	46.5	14.0	32.5	9.3	1.0	6.8	83.8	29.6	42.8	12.8	11.3	8
Mean	.....	180.7	110.57	89.6	60.07	18.02	43.05	12.61	25.18	8.06	117.38	49.13	52.63	16.99	13.21	19.9

Suture closure seemed to be more reliable than any other method, so I made a special study of this subject. After trying various methods, a system was developed for classifying skulls by the number of sutures which were closed. It was soon found that suture closure is a gradual process, and that frequently a suture may be only partly closed. Thus each suture was listed as: closed, more than half-closed, less than half-closed, or open. Each of these stages was assigned a value; 1 for open, 2 for less than half-closed, 3 for more than half-closed, and 4 for completely closed. Ectocranial suture closure alone was considered. By adding the numbers assigned to all of the sutures a sum was obtained which was taken as the sutural age of that particular specimen. The older the animal, the more the sutures will be closed, and the higher will be the number for its sutural age. This will be made clearer by an examination of Table VII.

All sutures were considered, but it was soon found that only certain

TABLE VII

PHOCA VITULINA RICHARDII (figs. 9-11)

U.S.N.M. Cat. Number	Sex	Occipito-parietal	Squamoso-parietal	Inter-parietal	Inter-frontal	Coronal	Basioccipito-basisphenoid	Maxillary	Basisphenoid-presphenoid	Suture Age
146434 . . . . .	♀	C	C	C	C	C	C	D	C	31
146432 . . . . .	♂	C	C	C	C	C	C	D	X	28
128066 . . . . .		C	C	C	C	D	C	D	X	27
146430 . . . . .	♂	C	C	C	C	C	C	X	X	26
146431 . . . . .	♂	C	C	D	D	D	C	D	X	25
146437 . . . . .	♂	C	D	D	D	D	C	D	X	24
146429 . . . . .	♂	C	C	C	C	D	X?	I	X	23?
219877 . . . . .	♂	C	C	C	D	I	I	X	X	21
21474 . . . . .		C	D	D	D	D	X	I	X	20
131459 . . . . .		C	D	D	D	D	X	X	X	19
131458 . . . . .		D	D	D	D	D	X	X	X	18
225795 . . . . .		D	D	D	D	I	X	X	X	17
154016 . . . . .		C	I	I	I	I	X	I	X	16
219867 . . . . .		D	D	I	I	X	X	X	X	14
245914 . . . . .	♂	I	I	I	I	I	X	X	X	13
253237 . . . . .		I	X	X	X	X	X	X	X	9
154015 . . . . .		X	X	X	X	X	X	X	X	8

C = 4            I = 2

D = 3            X = 1

ones were applicable to the present problem. For example, the component parts of the occipital bone, the supra-, ex-, and basi-occipitals, unite so soon after birth that they were of no particular value in this study. For studying ages in embryonic specimens, or specimens less than six months old, these sutures would be very valuable. Other sutures, such as those between the maxillaries and frontals, those between the nasals and maxillaries, and those of the malar, seem to remain open throughout life; at least they are still open in the oldest specimens I have seen. This is true of *Phoca vitulina* and *Phoca hispida*, but is not true of *Phoca groenlandica*. It is likely that some growth may take place throughout the life of the animal in this region of the skull. The loose connection here also accounts for the fact that weathered or maltreated skulls of *Phoca vitulina* and *Phoca hispida* often break in two along these sutures. These sutures, like those which close very early in life, were of no value in this study, so were omitted from the charts. The sutures which were finally considered to be of most value for this problem are listed here in the order in which they close. The lambdoidal (=occipito-parietal) is the first to close, the next is the squamosal (=squamoso-parietal), then the sagittal (=interparietal), interfrontal (or metopic), coronal, basioccipital-basisphenoid, intermaxillary (along the mid-line of the palate), and finally the basisphenoid-presphenoid. It is sometimes difficult to tell whether a suture is open or partly closed, or whether it is more or less than half-closed; and this is where individual judgment and unintentional bias must be watched carefully. Occasionally a specimen was found in which the coronal suture had closed before the sagittal, or some other inversion of the normal order occurred. Sometimes sutures in very young skulls appeared to be closed much before their normal time; and again, maceration, drying of the bone, or the blow which killed the animal, opened sutures which had been partly ossified. Some sutures seem to take a long time to close, while others, once closure has started, proceed rapidly to completion. The basioccipito-basisphenoid is a short suture, and a good example of the latter type. Very few specimens show this suture in the process of closing; most of them being either open or closed. The coronal, on the other hand, is a good example of the type in which closure proceeds very slowly. The unconscious tendency to list all sutures up to a given point as "closed," and all others beyond that, as "open" is another source of error which must be rigidly guarded against. In general, however, the specimens adhered closely to the established order, and the results of this method proved to be quite satisfactory.

Suture closure in the Weddell Seal, *Leptonychotes weddelli*, as given by Lindsey (1937, pp. 131-133) is somewhat different. Like *Phoca*, the components of the occipital are the first to close, and these are followed by the occipito-parietal (=lambdoidal) and the squamosal. From here on, however, suture closure follows a different order. He puts them in the following order: parieto-frontal, parieto-squamosal, basioccipito-basisphenoid, intermaxillary, interpalatine, and maxillo-palatine. The best series of the *Phoca vitulina* group which I have had for study was that of *Phoca vitulina richardii*, from the Pacific coast, so it was on this subspecies that the order of suture closure was worked out. No difference in order of suture closure for other specimens of the *Phoca vitulina* group was noted, but a slight difference was found in the *Phoca hispida* series. From this it would seem that the order for suture closure is fairly constant within any given species, but that it varies from one species to another. Considerable effort was directed toward finding a means of determining the actual age of the specimens which the suture closure index suggested, but I have been unable to locate any specimens of known age among the collections of the museums or zoological gardens of this country. Without such a specimen it has been impossible to do anything on this problem.

Suture closure studies have been employed in this way by numerous workers. The most refined and painstaking work has been done by T. Wingate Todd and his associates, and their publications give references to many of the former studies on this subject. One of his associates, F. P. Schweikher (1930, p. 455), sums up the subject as follows: "Thus, in spite of individual fluctuations, it appears that there is a definite march of progress in suture union and that this onward march can be clearly identified even upon a small series." In a letter from Dr. G. L. C. Bertram, of the Scott Polar Research Institute, Cambridge, England, dated December 1939, he mentions briefly the various methods of determining age in seals, and discusses his method of age determination by an examination of old corpora lutea in the ovaries. He informs me that his paper, one in a series of reports on the British Graham Land Expedition of 1934-37, to be published shortly by the British Museum (Natural History), will give a full description of his method, and a complete bibliography of all previous work on the subject.

The Belcher Island Eskimos say they can tell the age of a seal (*Phoca hispida*), up to about seven years; beyond this, the age may be estimated, but is not so definite. They have, as a matter of fact, different names for seals of different ages. *Phoca hispida* is born with a white woolly covering

which is shed shortly after birth. In this stage they are known to the fur trade as "white coats." This covering is replaced in a short time with one of sleek, silvery hair which lasts throughout the first year. When this coat is shed it is replaced with coarse, less silky hair. The first two stages are easily distinguished, but at the end of its first year, when the animal moults for the second time, it becomes difficult to tell the age by the hair alone. In the male the penis bone remains very small for at least two or three years, so for the first few years its age can be easily ascertained. On the claws of the front flipper in *Phoca hispida*, distinct annulations, or growth rings, can be observed. These, the Eskimos say, represent annual stages of growth, and the age of the individual, up to seven years, can be determined by counting these bands. Beyond seven years, however, wear at the tip of the claws removes some of the rings, so that there is no way of telling how many may have been worn away. It would seem, therefore, that under normal conditions one might tell the age of a seal, up to four or five years, by this series of rings. Similar rings may be observed on the claws of *Erignathus barbatus*, and Plehanoff (1933) has discussed the value of these rings as an age character in *Phoca groenlandica*. No rings of this nature are to be found on the claws of *Phoca vitulina*, however.

While discussing this problem with Dr. E. G. Meisel, Professor of Dental Pathology and Dental Radiography at the University of Pittsburgh, he remarked that in man age can be estimated with reasonable accuracy by radiographs of the teeth. He very kindly agreed to make and interpret the necessary radiographs of the teeth of the series of seals. Approximately 365 pictures were made of 122 different specimens, and he and his assistant, Dr. J. C. Eselman, studied them carefully. The age of each specimen was recorded, and the specimens were listed in order according to age. Although their study was totally independent of mine, the order in which Dr. Meisel and Dr. Eselman listed the specimens was very similar to the order in which I had listed them according to suture closure.

This close agreement in final results, from two completely different and independent methods of study, seems to indicate that by both methods it is possible to arrive at a reasonably accurate estimate of the age of these seals.

To the best of my knowledge this is the first time radiographs have been used as a means of determining age in mammals, other than man; and judging from my present experience with the method, it seems to be a

convenient and very satisfactory means of determining age. Both it and suture closure, have, as yet, unexplored possibilities. Dr. Meisel is to be given full credit for suggesting the idea and carrying out the studies on this phase of the problem. He has given me the following account of his method:

"Dentists generally are familiar with structural differences in teeth and in adjacent alveolar bone in individuals of different age groups. The more widely separated the ages of the individuals compared, the greater are the structural differences seen.

"Structural changes in teeth and in their supporting bone in individuals of different age groups are basically due to an altered apportionment of the organic and inorganic elements, the advance in age being accompanied by an increase in the amount of inorganic material present and a resulting decrease in the organic material. These changes may be noted clinically by such common observations as darkening in the color of teeth and increased brittleness of teeth and bone. Dentists operating on teeth note changes in density in the dentine as well as an increase in its thickness, which occurs at the expense of the pulp chamber which is correspondingly diminished in size.

"These structural changes are easily and quite accurately portrayed in radiographs of the teeth and jaws. Radiographs are two-dimensional shadow pictures in black and white, the black areas indicating structures easily penetrated by the x-rays and the white markings portraying the calcified structures which offer resistance to the passage of the rays.

"Characteristic changes due to age observed in dental radiographs are diminution in the size of the pulp chamber and canals with correspondingly heavier dentine walls; generally smaller cancellations in the bone, with denser trabeculae indicative of greater amounts of calcium salts; loss of supporting bone due to resorption of the alveolar crest margins is seen, and in quite young specimens incomplete development is readily noted. Additional signs of age are noted in the amount of abrasion and attrition suffered by the teeth, and in the number and size of restorations present.

"The accompanying illustrations, (Pl. XIII, figs. 1, 2) show graphically the comparative ease with which structural changes in human teeth and jaws may be observed in widely separated age periods. Figures 3 and 4 show the strikingly similar structural conditions in the teeth and jaws of the seal.

"By this method wide differences in age may be detected easily, and

specimens may be sorted according to their markings into comparatively similar age groups. The ages of the various groups of human specimens may be estimated with some accuracy, but as yet no dependable standard has been found by which the ages of the groups of seals can be determined."

After variations due to age had been determined, the next problem was

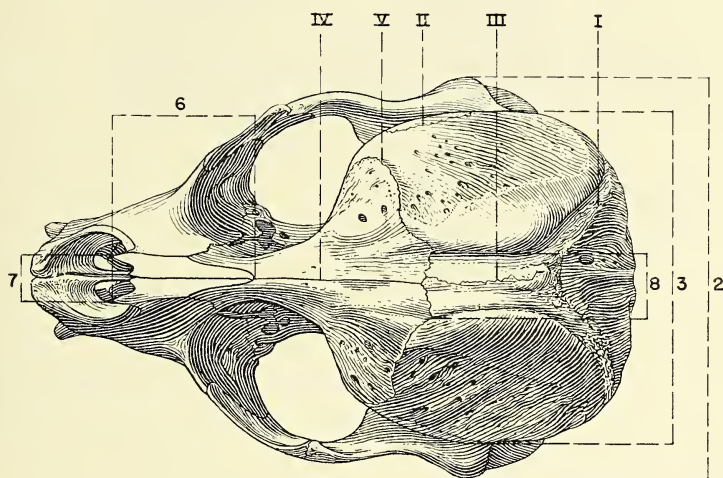


FIG. 9. Dorsal view of seal skull to show points of measurement and sutures considered in this study. *Phoca vitulina concolor* from Northwest River, Hamilton Inlet, Labrador; August 29, 1939; Carnegie Museum, no. 17,849. The measurements of the skulls were made with twelve inch calipers.

Measurements are indicated by Arabic numerals, as follows:

- |                          |   |
|--------------------------|---|
| 1. Total length          | 8. Distance between temporal ridges at coronal suture |
| 2. Width across mastoids | 9. Length of P <sup>2</sup>                           |
| 3. Width above mastoids  | 10. Length of lower jaw                               |
| 4. Premaxillary to molar | 11. Height of lower jaw                               |
| 5. Width across incisors | 12. Symphysis to last molar                           |
| 6. Length of nasals      | 13. Depth of lower jaw behind last molar              |
| 7. Width of nasals       |   |

The sutures used in this study are indicated by Roman numerals, as follows:

- |                       |                                |
|-----------------------|--------------------------------|
| I. Occipito-parietal  | V. Coronal                     |
| II. Squamoso-parietal | VI. Basioccipito-basisphenoid  |
| III. Interparietal    | VII. Maxillary                 |
| IV. Interfrontal      | VIII. Basisphenoid-presphenoid |

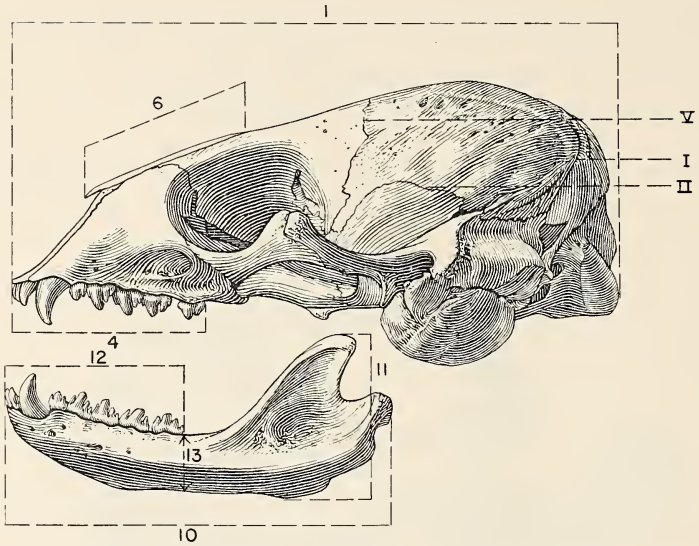


FIG. 10. Lateral view of skull shown in figure 9, where an explanation of the numerals is given.

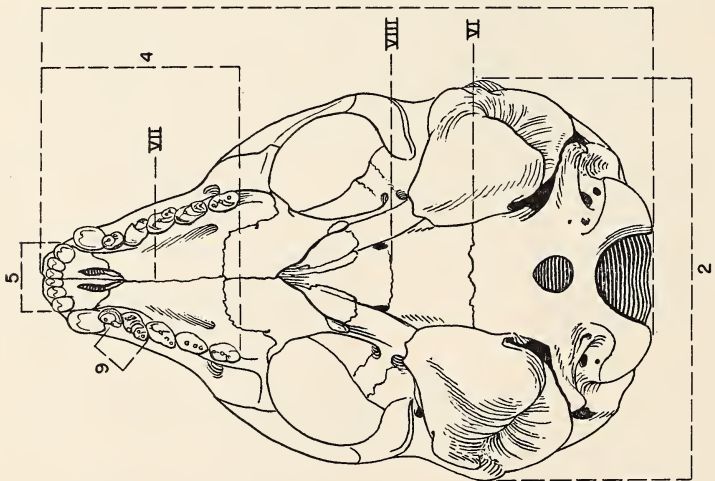


FIG. 11. Palatal view of skull shown in figure 9, where an explanation of the numerals is given.



a determination of the amount of individual variation which might be found in the species. This could be done, to a certain degree, by a series of carefully selected measurements of the skulls and mandibles; but some of the variations defied measurement. Such characters as, roundness of the cranium, or squarishness of the rostrum, were difficult to express in figures, although they were apparent enough to the eye. Practically all of the specimens available for study in this country were measured, and examined for the kind and amount of individual variation. The sexes were separated, then the specimens were arranged in age groups, and the measurements were recorded in a chart similar to that reproduced in Table VI. Maximum, minimum, mean and mode were determined for each column of measurements under each group (see figs. 9-11).

At first thought it might seem unnecessary to compare Seal Lake specimens with specimens from the Pacific coast, but study showed that, in some respects at least, the Seal Lake specimens bore more resemblance to those from the Pacific coast than to those from the Atlantic coast. The possibility of this relationship was discussed in a previous paragraph.

From this study I gained a fair idea of the variation which was to be expected in a population of *Phoca vitulina concolor* and *Phoca vitulina richardii*. The two adult specimens and three additional skins from Seal Lake were compared with specimens of similar ages of both *Phoca v. richardii* and *Phoca v. concolor*. This comparison showed the specimens from Seal Lake to represent a hitherto undescribed race which may be known as follows:

***Phoca vitulina mellonae* subsp. nov.<sup>11</sup>**

(Plates I, XI, and XII)

*Type*: Adult male; skin and skeleton, no. 15215; Carnegie Museum. From Lower Seal Lake, Quebec, about 90 miles east of Richmond Gulf, Hudson Bay, 56°30' north latitude, 74°30' west longitude. Collected March 23, 1938, by J. Kenneth Douth, original number 5112.

*Diagnosis*: Size about as in *Phoca vitulina concolor* and *Phoca vitulina richardii*. Color of back very dark, darker than in any other race except *Phoca vitulina geronimensis*; mandible slender, with long pointed coronoid process curving backward to plane of condyloid process; angle well de-

<sup>11</sup> It is a pleasure to name this new race in honor of Mrs. Mary Taylor Mellon, who, with her husband, Mr. William Larimer Mellon, came to the aid of the expedition at a time when it seemed doomed to failure for lack of funds.

veloped; brain case broad and flat; nasals long and narrow; rostrum slender; incisors small and closely set; zygomatic arches slender and rounded.

*Measurements* (in millimeters): Type and female paratype, Carnegie Museum, numbers 15215 and 15213. Total length, 1430, 1460; tail, 80, 80; hindfoot, 260, 210; ear, 14, 15. Skull: condylo-basal length, 195;<sup>12</sup> basal length, 182; zygomatic breadth, 112.8; greatest breadth across parietals, 95.9; greatest breadth across mastoids, 118.2; length of upper cheek tooth row, 42.8; gnathion to last molar, 64.5, 63.5; width across incisors, 20.1, 18.9; length of nasals, 51.5, 50.2; width of nasals, 15.8, 14.3; length of lower jaw from condyle to anterior tip of ramus, 126.7, 122.5; height of lower jaw from base of ramus to tip of coronoid, 57.3, 54; length of lower tooth row from symphysis of jaw to last molar, 55.0, 53.2; depth of lower jaw behind last molar, 18.2, 16.7 (figs. 9-11).

*Range*: Restricted to Upper and Lower Seal Lakes, which lie about ninety miles east of Richmond Gulf, Hudson Bay, Canada.

*Color*: General impression: back black, broken by a few light spots, an indistinct, black, dorsal stripe; belly, dirty whitish, with numerous light brown spots; chin, throat and flippers darker. Details: Back, dark markings black, light markings silvery white to Pale Olive-Buff (capitalized color terms after Ridgway, 1912); sides, dark markings between Buffy Brown and Hair Brown, light markings (slightly yellowed by oxidation) between Deep Olive-Buff and Light Grayish Olive; belly, dark markings, Hair Brown, light markings, Deep Olive-Buff; head black with a sparse sprinkling of white hairs; fore flippers, upper surface, Chaetura Drab; under surface in axilla, Drab, in center of flipper, between Honey Yellow and Deep Olive-Buff; hind flippers, dorsal surface, Hair Brown to Chaetura Drab, under surface, Hair Brown to Drab.

The individual hairs are flat, and the tips curl forward. In the black hairs, the tips are colorless and translucent. This combination of flat body and translucent tip gives the hairs a high reflective power, so that, in the proper light, the skin appears very glossy and silvery.

*Remarks*: *Phoca vitulina mellonae* belongs to the *vitulina* group, and is closest to *Phoca vitulina concolor* and *Phoca vitulina richardii*.

The most distinctive feature of the skull is the slender, pointed coronoid process, which reaches backward to the plane of the condyloid process (pls. XI, XII). This is characteristic of *Phoca groenlandica* and *Phoca hispida*, but not of the *Phoca vitulina* group. In length of coronoid, and

<sup>12</sup> Skull of paratype broken.

narrowness of rostrum, *Phoca vitulina richardii* resembles *Phoca vitulina mellonae* more closely than does *Phoca vitulina concolor*, but *Phoca vitulina richardii* can usually be distinguished from *Phoca vitulina concolor* by the extension of the premaxillaries backward along the nasals, as pointed out by Allen (1902, p. 471). In this character, *Phoca vitulina mellonae* is like *Phoca vitulina concolor*.

Of the thirty-one skins of *Phoca vitulina concolor* in the American Museum of Natural History and the U. S. National Museum, all but one are so much lighter in color than the specimens from Seal Lake that no careful comparison seems necessary. The one specimen is American Museum no. 70214, from the New York Aquarium. Unfortunately, no other locality is given, but it is labeled *Phoca vitulina concolor*, female, November 27, 1924. Measurements are: total length, 1160 mm.; tail, 160; hind foot, 240. The skull is that of a very young specimen; all the teeth are out and most of the sutures are open. It is very similar to other young specimens of *Phoca vitulina concolor*, except for a well-defined ridge following down along the coronal suture from the temporal lines. The mandible is slender, and has a well-developed angle which is more conspicuous than in most specimens. Although this skin is so much darker that it stands out in striking contrast to most specimens of *Phoca vitulina concolor*, still, it is noticeably lighter than the two specimens of *Phoca vitulina mellonae*.

The United States National Museum collection contains twenty-nine skins of the *Phoca vitulina* group from the western coast of North America, and one skin from Kamchatka. All except six of these specimens are so much lighter in color that they require no comparison with the specimens from Seal Lake. The five specimens from San Geronimo Island, and the one specimen from San Martin Island, Lower California, are all so similar, and differ from the others so markedly, that they should be put in a class by themselves at once; and they are strikingly like the specimens from Seal Lake! They are more heavily spotted, and darker on the belly than specimens of *mellonae*, however, and the skull is markedly different. On the strength of the premaxillaries bending back along the nasals, these specimens would be put with *richardii*. The skulls of the old males are very large and robust, heavily ossified, and with a distinct tendency to form a sagittal crest. United States National Museum, no. 81518, a female, from San Geronimo Island, is more like the type from Seal Lake in size and age than any other specimen I have seen, but it is much more rugose; the braincase is not so broad and flat; the rostrum is wider and

heavier; the premaxillaries are not straight, as in Seal Lake specimens, but bulge outward at the center of the narial opening; the nasals are broader and shorter; and the premaxillaries bend backward along the nasals (as is typical in *richardii*). The second upper premolar is longer and narrower; the bullae are smaller; the mastoids protrude farther beyond the braincase; the interparietal is wider; and the distance between the rostrum and the braincase (*i.e.* the interorbital constriction) is very short. The mandible is quite distinct. At first glance it appears to be very short and heavy, but actually it is the same length as that of the Seal Lake specimens. The coronoid process is very long, and projects backward almost to the plane of the condyloid process. It is not curved or pointed, however, and actually has little resemblance to that of the Seal Lake specimens. Both the angle and the subcondyloid process are very strongly developed. The ramus and the coronoid are broad, and the coronoid rises at a sharp angle from the ramus. The forepart of the ramus rises in a steep straight line, not in a curve as in *Phoca vitulina mellonae*. Thus, while the skins of *Phoca vitulina geronimensis* resemble those from Seal Lake more closely than any others, the skulls indicate a race which is very distinct.

*Phoca vitulina mellonae* is the first race of *Phoca vitulina* to be described from an inland lake. The races described from the landlocked lakes of Europe and Asia all belong to the *Phoca hispida* group.

#### RELATIONSHIP OF THE RACES OF PHOCA VITULINA

The material now available is not sufficient to demonstrate conclusively the relationship of members of the *Phoca vitulina* group on opposite sides of the Atlantic and Pacific oceans. Thus from the material I have examined, I am unable to state how specimens from the American side of the Atlantic can be distinguished from specimens taken on the European side. It is possible, however, that with a good series of specimens from European waters the distinction between *Phoca vitulina vitulina* and *Phoca vitulina concolor* can be made clear. For the present, therefore, I have considered them as distinct subspecies.

Specimens of the *Phoca vitulina* group from the Pacific can usually be distinguished from those occurring in the Atlantic by the projection of the premaxillaries backward along the nasals. This character was described as follows, by Allen (1902, p. 471), "In the Pacific coast skulls the premaxillae ascend not only to the nasals but extend posteriorly so as to touch the sides of the nasals for about 8 to 10 mm.; in the Atlantic coast

specimens the premaxillae barely touch the nasals (in some cases do not quite reach them)—a distinction, according to Dr. True, first made known by Dr. Merriam.\* This distinction appears to be constant in all the skulls I have examined from the Alaskan and Kamschatkan coasts, as compared with those of the Atlantic coast.” In a series of 58 specimens from the Pacific coast which I examined, 87.94 per cent showed this character, while 12.06 per cent lacked it. In 14 specimens from the Atlantic coast of North America which I examined, 11 specimens, or 78.57 per cent, had premaxillae which did not reach the nasals, while two specimens, or 14.28 per cent, resembled the Pacific coast race. One specimen, 7.14 per cent, was a borderline case. A larger series of specimens would undoubtedly alter these percentages, but I believe it would demonstrate that the majority of specimens could be separated on this character alone.

From the material which has been available to me, I am not able to present any characters by which specimens from the American and Asiatic sides of the Pacific may be separated. Smirnov (1908, p. 63) puts *richardii*, *pribilofensis*, *geronimensis*, *stejnegeri*, and *macrodens* all in synonymy under *Phoca vitulina largha*. He thinks that Allen was mistaken when he considered *Phoca largha* identical with *Phoca ochotensis* Pallas. He says that Pallas undoubtedly wrote about “nerpa” (one of the *Phoca hispida* group). He also points out that Pallas mentioned the holes in the snow used by the “nerpa.” Thus, according to Smirnov, there is only one representative of the *Phoca vitulina* group in the Pacific, and that is *Phoca vitulina largha* Pallas.

Although the description by Pallas (1811, p. 113) does not give much information by which the species can be recognized, he does say that the young of *Phoca largha* are born on the shore and that they immediately follow their mother. The young of *Phoca vitulina* are born on the shore in the early summer after the ice has gone, but the young of *Phoca hispida* are born in the early spring, in cavities in the ice. In speaking of *Phoca ochotensis*, Pallas (*ibid.*, p. 117) says that the young are born toward the end of February or at the beginning of March, in hiding places on the shore amid the ice, or in hiding places dug in the snow, where the pups lie hidden for many days. These two statements seem to me to show con-

\*“Cf. True, in Jordan’s ‘Report on the Fur Seals and Fur-Seal Islands of the North Pacific Ocean,’ Part III, 1899, p. 351. At a meeting of the Biological Society of Washington, held Jan. 30, 1897, Dr. Merriam is recorded (Proc. Biol. Soc. Wash. XI, 1897, p. viii) as having presented a communication on ‘The Pribilof Island Hair Seal,’ but the paper does not appear to have been published.”

clusively that Pallas was describing an animal of the *Phoca vitulina* group when he described *Phoca largha*, and that he was describing an animal of the *Phoca hispida* group when he described *Phoca ochotensis*.

I have examined the American Museum specimen, no. 18169, which Allen (1902, p. 480) used for his redescription of *Phoca ochotensis*, and the two other specimens which he mentioned by number. All of the characters which he uses can be matched in specimens of *Phoca vitulina* from the west coast of North America, and I am unable to find any other characters which can be considered of subspecific value. However, since the material is so inadequate (I have only one complete skull), the conservative attitude, it seems, would be to recognize the race on the American side of the Pacific as *Phoca vitulina richardii*, and the one on the Asiatic side as *Phoca vitulina largha*, until material sufficient to settle the matter can be obtained.

I do not believe there is room for all the species which Allen (1902) described from the North Pacific. The great amount of variation in the genus often leads to the description of local races, when the number of specimens available is not sufficient to justify such conclusions. Also, in the genus *Phoca*, there seems to be a tendency toward the establishment of local clans; that is, a number of specimens taken at the same place and the same time show a great similarity, but other specimens taken, years later, at that same place may be quite different. It seems that the dominant characteristics of a particular strain may be established for a time at a given locality, but after a while these characteristics are swamped by others—perhaps by the introduction of new blood from other localities. For example, four specimens in the American Museum collection from Boothbay Harbor, Maine, all taken at the same time, are very similar, and are so distinct from specimens taken at other localities along the New England coast that they might be described as a new race, but I would consider such a course very inadvisable. Five specimens taken at San Geronimo Island at the same time are all very similar, and may be recognized, on skin characters alone, as a distinct race, although I am unable to find, in the material I have, any good characters in the skulls. I am inclined to adopt the conservative view of recognizing the race from San Geronimo Island as *Phoca vitulina geronimensis* until sufficient material is available to settle the question. Dr. Osgood (1904, p. 48) also questioned the advisability of recognizing so many races in the North Pacific. He says, "Dr. Allen's recent separation of the northern hair seals under the name *pribilofensis* may fairly be called provisional,

since the available material was admittedly a rather meager basis for such separation. (Cf. Bull. Am. Mus. Nat. Hist., XVI, p. 495, Dec. 12, 1902). While admitting the probability that the seals of Bering Sea may differ subspecifically from those of Puget Sound, I am unable to appreciate any characters whatever after an examination of all the material now available. Even if the alleged characters should prove real and constant, there still might be some question as to the advisability of recognizing three forms on the Pacific coast, for it would be a case of two extremes (*geronimensis* and *pribilofensis*) and an intermediate (*richardii* [sic]). The differences between the extremes being only of size, and these not very marked, there would scarcely seem to be room for more than two definable forms."

The races of *Phoca vitulina* may be summarized as follows:

### TABLE VIII

#### RACES OF PHOCA VITULINA

***Phoca vitulina vitulina* Linnaeus**

1758. *Phoca vitulina* Linnaeus, Syst. Nat., ed. 10, vol. 1, p. 38.

Range: European side of the Atlantic Ocean.

***Phoca vitulina concolor* De Kay**

1842. *Phoca concolor* De Kay, Zool. of New York, pt. 1, Mamm., p. 53.

Range: American side of the Atlantic Ocean.

***Phoca vitulina mellonae* subsp. nov.**

Range: Seal Lake, Ungava Peninsula, Quebec.

***Phoca vitulina richardii* (Gray)**

1864. *Halicyon richardii* Gray, Proc. Zool. Soc. London, p. 28.

1902. *Phoca richardii pribilofensis* Allen, Bull. Amer. Mus. Nat. Hist., vol. 16, p. 495, December 12, 1902.

Range: American side of the North Pacific Ocean.

***Phoca vitulina geronimensis* Allen**

1902. *Phoca richardii geronimensis* Allen, Bull. Amer. Mus. Nat. Hist., vol. 16, p. 495, December 12, 1902.

Range: American side of Pacific Ocean in vicinity of Lower California.

*Phoca vitulina largha* Pallas

1811. *Phoca largha* Pallas, Zoographia Rosso-Asiatica, vol. 1, p. 113.

1902. *Phoca ochotensis* Allen, Bull. Amer. Mus. Nat. Hist., vol. 16, p. 480 (not *Phoca ochotensis* Pallas).

1902. *Phoca ochotensis macrodens* Allen, Bull. Amer. Mus. Nat. Hist., vol. 16, p. 483.

1902. *Phoca stejnegeri* Allen, Bull. Amer. Mus. Nat. Hist., vol. 16, p. 485.

*Range*: Asiatic side of North Pacific Ocean.

## SUMMARY

The region around Seal Lake is described. The possibility that the seals in Seal Lake may have been derived from a stock entering Hudson Bay from the Pacific rather than from the Atlantic is discussed. It is suggested that the seals now living in Seal Lake may have gained access there shortly after the recession of the glacier, when the region was considerably lower than at present. The seals have been isolated there for approximately 4,000 years, and it is assumed that this is the length of time which has been required to make a new subspecies under conditions of a changed environment.

The genus *Phoca* is divided into four distinct groups, *Phoca vitulina* and related races, *Phoca hispida* and related races, *Phoca groenlandica* and *Phoca fasciata*. A key is presented for the identification of the species. Each species is described, and compared with the forms which it resembles most. Variation in the genus is discussed. Methods of determining the comparative ages of seals are discussed. Suture closure is studied in detail, and a method of age determination by radiographs of the teeth is described. It is concluded that both of these are good methods for determining comparative ages of seals. A new subspecies, *Phoca vitulina mellonae*, is described. Several races of *Phoca* are placed in synonymy, and a summary of the recognized races is submitted.



## SPECIMENS EXAMINED

The following list of the 196 specimens examined includes only specimens of *Phoca vitulina*. Specimens of other species, the examination of which was incidental to the major part of this paper, have been omitted from this list. An explanation of the abbreviations used is included at the end of the list.

***Phoca vitulina vitulina***

BRITISH ISLES—M.C.Z. 26,861

NORTHERN EUROPE—U.S.N.M. 11,742

North Sea—C.M. 1741; 1774; M.C.Z. 7739

GERMANY

KONIGSBERG, Holstein—U.S.N.M. 238,153; 238,154

SWEDEN

BOHUSLAN, Boca—M.C.Z. 17,948

No definite locality—A.N.S.P. 2127

***Phoca vitulina concolor***

CANADA

ANTICOSTI ISLAND—M.C.Z. 19,591

BAFFIN ISLAND, Cape Dorset, Hudson Strait—N.M.C. 10,358

Cumberland Gulf, Sardukjeah Nettilling Fiord—N.M.C. 6138

NORTHWEST TERRITORIES, Mouth of Chesterfield Inlet—U.S.N.M. 180,285

Hudson Bay, Southampton Island—C.M. 6671

QUEBEC, Godbout—U.S.N.M. 75,642; 188,223; 188,224

La Tabatière—C.M. 17,679

North Shore of Gulf of St. Lawrence—C.M. 18,716

Saguenay Co., North Shore Gulf of St. Lawrence, Moisie Bay—  
N.M.C. 9,311

ST. LAWRENCE RIVER (Zoo specimen)—U.S.N.M. 124,654

STRAITS OF BELLE ISLE, Battle Harbor—C.M. 17,484

GREENLAND—A.M.N.H. 100; 101; U.S.N.M. 3506

Holsteinborg—A.M.N.H. 10,137

LABRADOR

HAMILTON INLET—C.M. 17,849

HOPEDALE—M.C.Z. 7657

OKAK—M.C.Z. 7428

25 MI. UP PARADISE RIVER—U.S.N.M. 210,004

## NOVA SCOTIA

LUNENBURG, Chester—U.S.N.M. 258,494; 258,495

SABLE ID.—U.S.N.M. 3634; 4713; 4716

## UNITED STATES

MAINE, Cumberland Co., Portland Head—U.S.N.M. 253,795

Hancock Co., Brooklyn [Brooklin]—U.S.N.M. 84,575

Hancock Co., Buckport [Bucksport]—M.C.Z. 4222

Lincoln Co., Bayville—U.S.N.M. 144,975

Lincoln Co., Boothbay Harbor—A.M.N.H. 100,187; 100,192; N.M.C. 12,501; U.S.N.M. 123,381

No definite locality—U.S.N.M. 49,911; 82,820; 82,821; 155,609

Zoo specimens—A.N.S.P. 12,594; U.S.N.M. 63,018

MASSACHUSETTS, Barnstable Co., Chatham—M.C.Z. 249; Provincetown—A.M.N.H. 102; U.S.N.M. 15,276

Barnstable Co., Woods Hole—U.S.N.M. 28,223; 38,230

Essex Co., Beverly Farms—M.C.Z. 5144

Essex Co., Ipswich Bay—M.C.Z. 11,460

Massachusetts (?)—M.C.Z. 1142

NEW YORK, Westchester Co., Sing Sing (Ossining)—U.S.N.M. 129,150

Long Island Sound—A.M.N.H. 80,201

New York (?)—A.M.N.H. 80,195

## SPECIMENS KEPT IN CAPTIVITY

A.M.N.H. 6270; 6271; 6366; 13,968; 13,969; 15,964; 16,876; 22,727; 35,261; 35,278; 35,310; A.N.S.P. 4969; 17,106; U.S.N.M. 85,572; 142,510; 174,627

## NO DATA

A.M.N.H. 1564; 24,160; 36,779; 69,491; 70,214; 77,934; 100,065; 100,196; M.C.Z. 10,584; 10,795; U.S.N.M. 21,166; 188,826

***Phoca vitulina mellonae***

## CANADA

QUEBEC, Ungava Peninsula, Richmond Gulf, 125 mi. NE Cairn Id.—C.M. 15,211; 15,212; 15,213; 15,214; 15,215; 15,216

***Phoca vitulina richardii***

## ALASKA

ADAKTI ID.—U.S.N.M. 14,399

BERING SEA, Sevoonga, Neskok—M.V.Z. 51,158

CAPE ELIZABETH—U.S.N.M. 127,598; 127,599

DOUGLAS PT.—U.S.N.M. 147,681; 147,700

HINCHINBROOK—U.S.N.M. 146,429; 146,433; 146,434; 146,437

- IZEMBEK BAY—U.S.N.M. 245,914; 245,915  
 KAGAMIK ID.—U.S.N.M. 261,817  
 BETWEEN KATMAI AND KANATAK—U.S.N.M. 131,457; 131,458; 131,459;  
 131,460; 131,461  
 KENAI PENINSULA—U.S.N.M. 136,751  
 KING ID.—U.S.N.M. 219,865  
 MONTAGUE ID.—U.S.N.M. 146,430; 146,431; 146,432; 146,435; 146,436  
 NAGI ID.—U.S.N.M. 261,781  
 OTTER ID.—U.S.N.M. 217,914  
 PT. BARROW—U.S.N.M. 16,761; 225,795  
 BETWEEN PORTAGE BAY AND BECHAROF LAKE—U.S.N.M. 128,065; 128,066  
 PRIBILOF IDS.—U.S.N.M. 217,918  
 ST. GEORGE ID.—U.S.N.M. 101,330; 219,867; 219,868; 219,869; 219,871;  
 219,874; 219,879; 219,883; 219,884; 219,886  
 ST. MICHAELS—U.S.N.M. 21,474; 21,475; 21,477  
 ST. PAUL ID.—C.A.S. 3074; U.S.N.M. 14,337; 154,015; 154,016; 219,873;  
 219,877  
 ST. LAWRENCE ID., NW Cape Sevookok—M.V.Z. 51,387  
 North of Sevoonga—M.V.Z. 51,385  
 YAKUTAT, Disenchantment Bay—M.V.Z. 4734  
 YAKUTAT, U.S.N.M. 98,139  
 No definite locality—A.M.N.H. 19,843; 21,850; U.S.N.M. 15,676

## UNITED STATES

- CALIFORNIA, Ano Nuevo Id.—C.A.S. 5  
 Humboldt Co., 150 yds. North Goat Rock—M.V.Z. 84,124  
 Monterey Co., Monterey—C.A.S. 342; 344; 409; 411; 414; 531; 532  
 OREGON, Clatsop Co., Mouth of Columbia River—U.S.N.M. 140,853  
 Clatsop Co., near Astoria—U.S.N.M. 142,159  
 WASHINGTON, Grays Harbor Co., Copalis Beach—M.V.Z. 86,877  
 Skagit Co., Bay View—U.S.N.M. 253,041; 253,042; 253,043; 253,046;  
 253,234; 253,237; near Bay View—U.S.N.M. 253,045; 253,233;  
 253,235; 253,238  
 Skagit Co., Laconner—C.M. 18,738  
 Thurston Co., Nisqually—U.S.N.M. 250,713  
 WASHINGTON TERRITORY—U.S.N.M. 6486  
 WASHINGTON OR CALIFORNIA—M.V.Z. 85,159; 85,160

## NO DATA

- U.S.N.M. 250,712

***Phoca vitulina geronimensis***

## MEXICO

- LOWER CALIFORNIA, San Geronimo Id.—U.S.N.M. 81,515; 81,516; 81,517;  
81,518; 81,519; 81,521; 81,522  
San Martin Id.—U.S.N.M. 140,401; 140,402

***Phoca vitulina largha***

## U. S. S. R.

- N. E. SIBERIA—A.M.N.H. 15,817  
N. E. SIBERIA, Anadyr River—A.M.N.H. 18,275  
N. E. SIBERIA, Matuga—A.M.N.H. 18,169; 18,170; 18,171; 18,172  
KAMCHATKA, Avatcha Bay—U.S.N.M. 83,448

## ABBREVIATIONS

- A.M.N.H. The American Museum of Natural History, New York, N. Y.  
A.N.S.P. The Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.  
C.A.S. California Academy of Science, San Francisco, Calif.  
C.M. Carnegie Museum, Pittsburgh, Pa.  
M.C.Z. Museum of Comparative Zoölogy, Cambridge, Mass.  
M.V.Z. Museum of Vertebrate Zoology, Berkeley, Calif.  
N.M.C. National Museum of Canada, Ottawa, Ontario, Canada  
U.S.N.M. United States National Museum, Washington, D. C.

## LITERATURE CITED

ALLEN, GLOVER M.

1938. The Mammals of China and Mongolia. Nat. Hist. Central Asia, vol. 11, Part 1, pp. i-xxv, 1-620, 22 maps, pls. 1-9, fig. 1. Publ. by Amer. Mus. Nat. Hist.

ALLEN, J. A.

1880. History of North American Pinnipeds. U. S. Geol. & Geogr. Surv. Terr., Misc. Publ. no. 12, pp. i-xvi, 1-785, figs. 1-60.
1902. The Hair Seals (Family *Phocidae*) of the North Pacific Ocean and Bering Sea. Bull. Amer. Mus. Nat. Hist., vol. 16, Art. 34, pp. 459-499, figs. 1-10.

ANDERSON, R. M.

1934. Mammals of the Eastern Arctic and Hudson Bay. Canada's Eastern Arctic, Publ. by Dept. Interior, Canada, pp. 67-108, 8 figs., 2 maps.

BROOM, R.

1916. On the Structure of the Skull in *Chrysochloris*. Proc. Zool. Soc. London, no. 23, pp. 449-459, pls. 1-2, figs. 1-3.

BROWN, R.

1868. Notes on the History and Geographical Relations of the Pinnipedia Frequenting the Spitzbergen and Greenland Seas. Proc. Zool. Soc. London, no. 28, pp. 405-440, June 25.

DALY, R. A.

1934. The Changing World of the Ice Age. New Haven, Yale University Press: pp. i-xix, 1-271, figs. 1-149.

DEGERBOL, M. AND P. FREUCHEN

1935. Mammals: Part 1. Systematic Notes. Part 2. Field Notes and Biological Observations. Report of the Fifth Thule Expedition, 1921-23, vol. 2, nos. 4-5, pp. 1-278, 1 map, 12 figs.

DOUTT, J. KENNETH

1939. The Expedition to Hudson Bay. Carnegie Magazine, vol. 12, no. 8, pp. 227-236, illus. January.

DOUTT, MARGARET T.

1935. Twin Islands: An Arctic Outpost. Carnegie Magazine, vol. 9, no. 8, pp. 195-200, map, illus. December.

FLAHERTY, ROBERT J.

1918. Two Traverses Across Ungava Peninsula, Labrador. Geogr. Rev., vol. 6, no. 2, pp. 116-132, pl. 7, figs. 1-12. August.

FLOWER, STANLEY S.

1931. Contribution to our Knowledge of the Duration of Life in Vertebrate Animals. Proc. Zool. Soc. London, pp. 145-234.

GUTENBERG, BENO.

1941. Changes in Sea Level, Postglacial Uplift, and Mobility of the Earth's Interior. Bull. Geol. Soc. America, vol. 52, pp. 721-772, figs. 1-4.

## HOWELL, A. BRAZIER

1929. Contribution to the Comparative Anatomy of the Eared and Earless Seals (Genera *Zalophus* and *Phoca*). Proc. U. S. Nat. Mus., no. 2736, vol. 73, art. 15, pp. 1-142, pl. 1, figs. 1-30.

## HUBBARD, MRS. LEONIDAS, JR.

1908. A Woman's Way Through Unknown Labrador. Toronto: William Briggs, pp. i-xvi, 1-338, 1 map, illus.

## JORDAN, DAVID STARR

1899. The Fur Seals and Fur-Seal Islands of the North Pacific. Washington: Government Printing Office, Part 3, pp. i-xii, 1-629, frontispiece, pls. 1-95, figs., maps.

## KUMLIEN, LUDWIG

1879. Contributions to the Natural History of Arctic America, Made in Connection with the Howgate Polar Expedition, 1877-78. Bull. U. S. Nat. Mus., no. 15, pp. 1-179.

## LEROY, PIERRE

1940. On the Occurrence of a Hair-Seal, *Phoca richardsi* (Gray), in the Coast of North China. Bull. Fan Mem. Inst. Biol. Zool. Ser., vol. 10, pp. 62-68, pl. 1, figs. 1-2.

## LINDSEY, ALTON A.

1937. The Weddell Seal in the Bay of Whales, Antarctica. Jour. Mammal., vol. 18, no. 2, pp. 127-144, figs. 1-2.

## LOW, A. P.

1896. Reports on Explorations in the Labrador Peninsula Along the East Main, Koksoak, Hamilton, Manicuaga and Portions of Other Rivers in 1892-93-94-95. Geol. Surv. Canada, Part L, Annual Report (n.s.), vol. 8, pp. 1-387, pls. 1-4.
1898. Report on a Traverse of the Northern Part of the Labrador Peninsula from Richmond Gulf to Ungava Bay. Geol. Surv. Canada, Part L, Annual Report, vol. 9, no. 657, pp. 1-43, pls. 1-4.
1902. Report on an Exploration of the East Coast of Hudson Bay from Cape Wolstenholme to the South End of James Bay. Geol. Surv. Canada, Part D, Annual Report, vol. 13, no. 778, pp. 1-84, 2 maps, pls. 1-2.

## NICHOLS, D. A.

1940. Arctic Tides and Currents. The Beaver, Outfit 270, no. 4, pp. 18-22, 1 map, 6 illus. March.

## OSGOOD, WILFRED H.

1904. A Biological Reconnaissance of the Base of the Alaska Peninsula. North American Fauna, no. 24, pp. 1-86, pls. 1-7.

## PALLAS, PETRO

1811. Zoographia Rosso-Asiatica, sistens Omnium Animalium. Petropoli: In Officina Caes, Academiae Scientiarum Impress. Edit. 1831, vol. 1, (pages 113-119).

## PLEHANOFF, P.

1933. The Determination of Age in Seals. *Abst. Works. Zool. Inst. Moscow Univ.*, pp. 88-91, pl. 20.

## RIDGWAY, R.

1912. *Color Standards and Color Nomenclature*. (Washington, D. C., published by the author), pp. i-iii, 1-44, pls. 1-53.

## SCHULTZ, A. H.

1923. Bregmatic Fontanelle Bones in Mammals. *Jour. Mammal.*, vol. 4, no. 2, pp. 65-77, figs. 1-28.

## SCHWEIKHER, FERDINAND PAUL

1930. Ectocranial Suture Closure in the Hyaenas. *Amer. Jour. Anat.*, vol. 45, no. 3, pp. 443-460, 1 fig. May 15.

## SMIRNOV, N.

1908. *Revus des Pinnipèdes Russes*. *Mémoires de l'Académie Impériale des Sciences de St.-Pétersbourg*, vol. 23, no. 4, pp. 1-75, pl. 1, figs. 1-30.
1929. Diagnoses of Some Geographical Varieties of the Ringed Seal (*Phoca hispida* Schreb.). *Comptes Rendus de l'Académie des Sciences de l'U. R. S. S.*, no. 4, pp. 94-96.

## SVERDRUP, OTTO

1904. *New Land: Four Years in the Arctic Regions*. London: Longmans, Green and Co., vol. 1, pp. i-xvi, 1-496, vol. 2, pp. i-xii, 1-504. Maps and illus., (scientific appendix in second volume).

## TASKER, FLORENCE A.

1908. A Woman Through Husky-Land. *Field and Stream*, pp. 823-828, illus., February. *Field and Stream*, pp. 937-943, 1 map, illus., March.

## TRUE, FREDERICK W.

1899. Mammals of the Pribilof Islands. In Jordan's "Report on the Fur Seals and Fur-Seal Islands of the North Pacific Ocean." Washington: Government Printing Office, Part III, pp. 345-354.

## WALLACE, DILLON

1905. *The Lure of the Labrador Wild*. New York: Fleming H. Revell Co., 6th Ed., pp. 1-339, maps, illus.

## WEBER, MAX

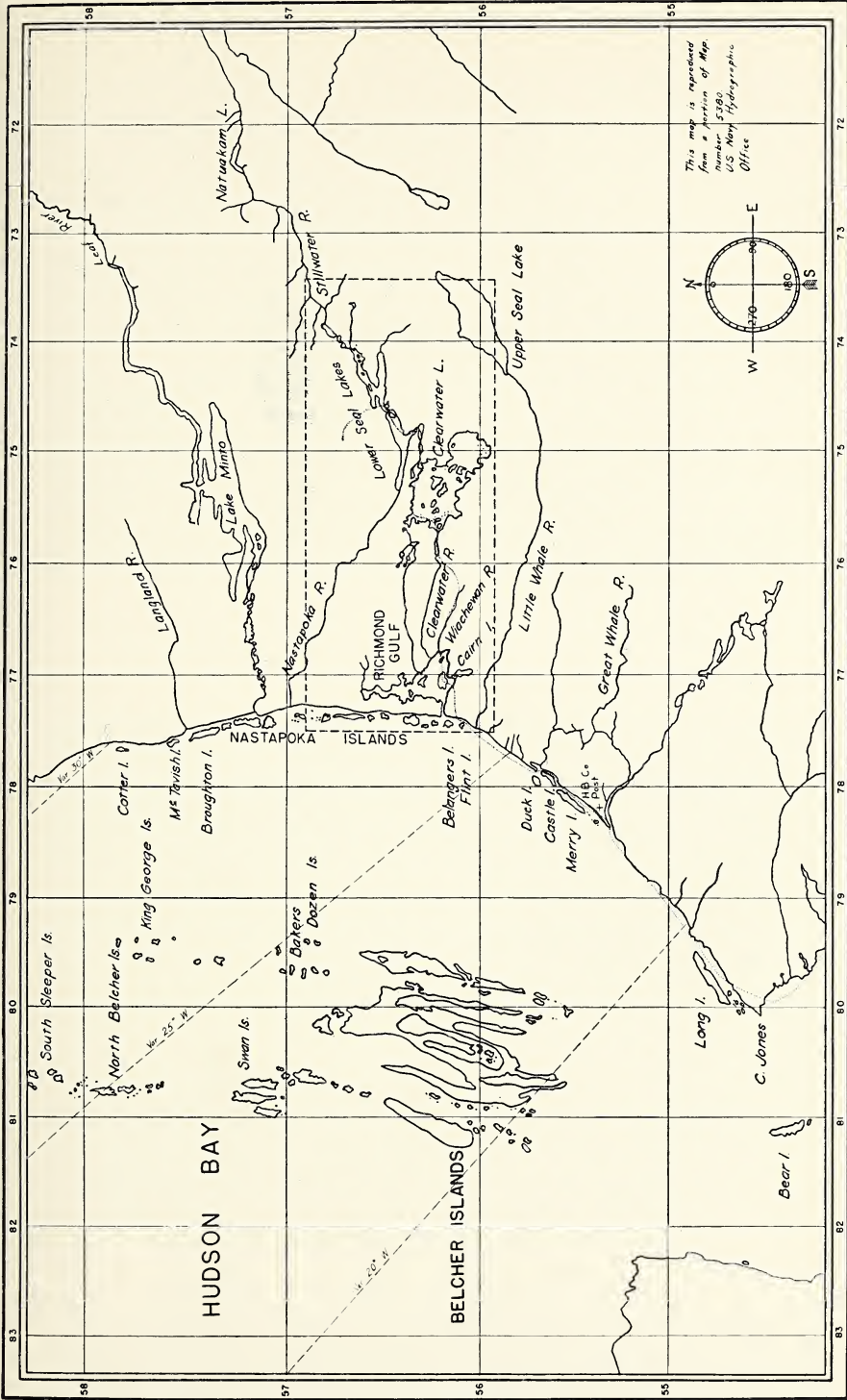
1927. *Die Säugetiere*. Jena: Gustav Fischer, vol. 1, pp. i-xv, 1-444, figs. 1-316.
1928. *Die Säugetiere*. Jena: Gustav Fischer, vol. 2, pp. i-xxiv, 1-898, figs. 1-573.

## WORTMAN, JACOB L.

1921. On Some Hitherto Unrecognized Reptilian Characters in the Skull of the Insectivora and Other Mammals. *Proc. U. S. Nat. Mus.*, vol. 57, pp. 1-52, figs. 1-16.







Map of a portion of Hudson Bay and adjacent parts of the Ungava Peninsula, showing the location of Seal Lake and other physical features along the route of the Expedition. The Swan, North Belcher, and Sleeper Islands are incorrectly shown on many maps, but are here labeled as they are known to the local residents.





FIG. 1. View of Lower Seal Lake, looking SE from point 10 on traverse map, March 28, 1938. Note the barren ridges and stunted spruce trees in the valleys.



FIG. 2. Two eskers at different levels. Station 32 on traverse map, March 30, 1938.





FIG. 1. White fox, *Alopex lagopus ungava*. Photographed near Cairn Island, Richmond Gulf, February 28, 1938.



FIG. 2. Rock Ptarmigan (*Lagopus rupestris*) near Clearwater Lake, April 4, 1938.



Dorsal views of skulls

One-half natural size

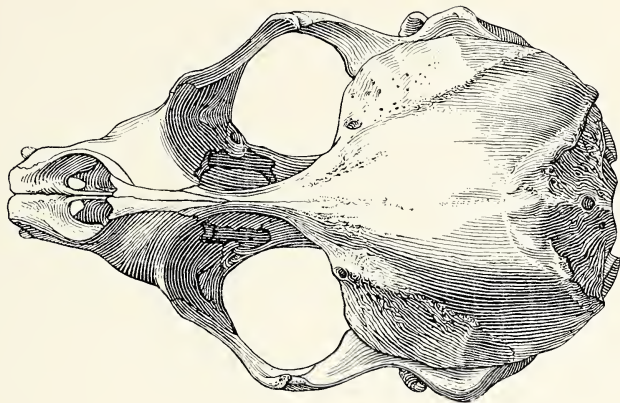


FIG. 1. *Phoca hispida* from Camsell Island, Belcher Islands, Hudson Bay; May 1938; Carnegie Museum, no. 15,277.

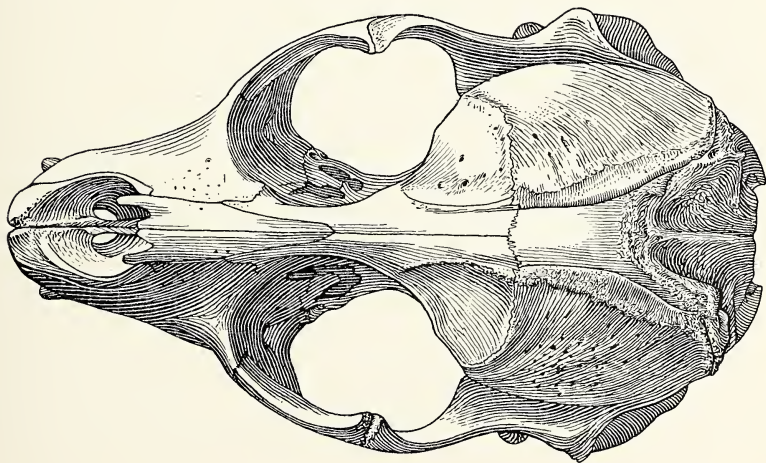


FIG. 2. *Phoca vitulina concolor*, female, from Portland Head, Maine; April 19, 1899; U. S. National Museum, no. 253,795.





Dorsal views of skulls

One-half natural size

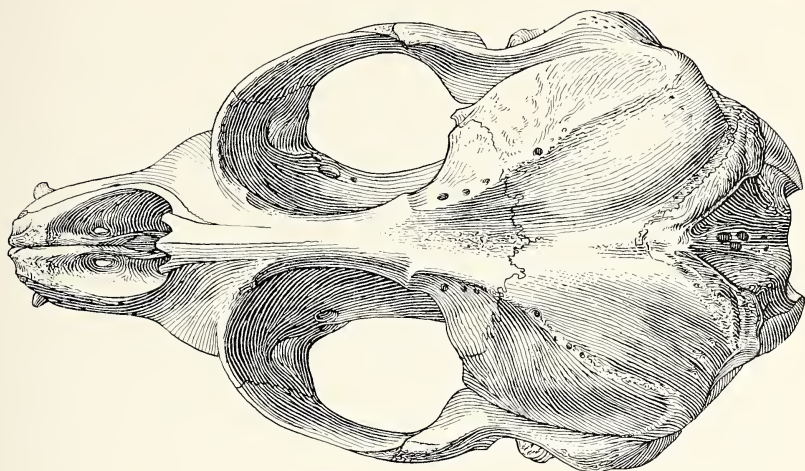


FIG. 1. *Phoca groenlandica*, male, from near La Tabatière, North Shore of Gulf of St. Lawrence, Quebec, Canada; winter of 1939-40; Carnegie Museum, no. 18,717.

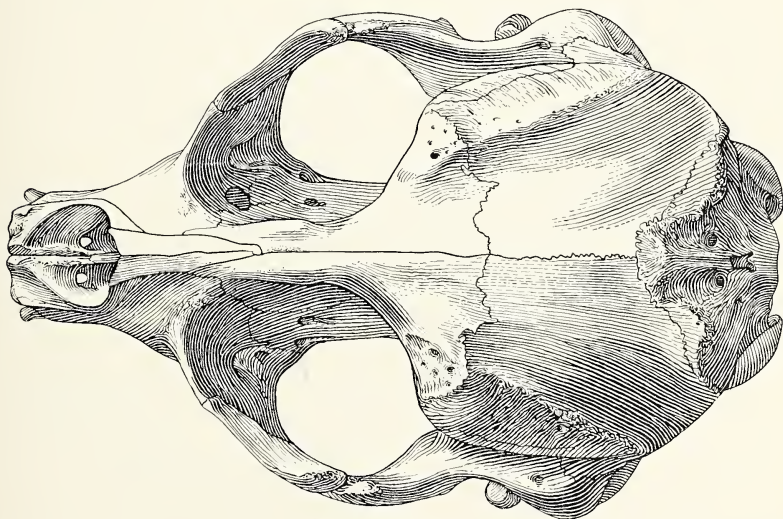


FIG. 2. *Phoca fasciata*, male, from northwest of Cape Sevookok, St. Lawrence Id., Bering Sea; June 23, 1931; Museum of Vertebrate Zoology, no. 51,387.



Lateral views of skulls

One-half natural size

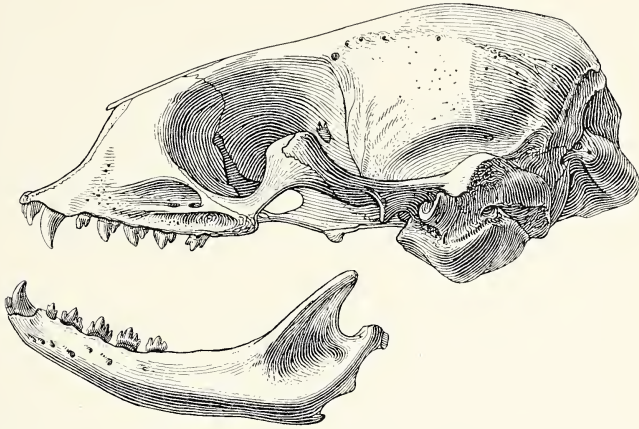


FIG. 1. *Phoca hispida* from Camsell Island, Belcher Islands, Hudson Bay; May 1938; Carnegie Museum, no. 15,277.

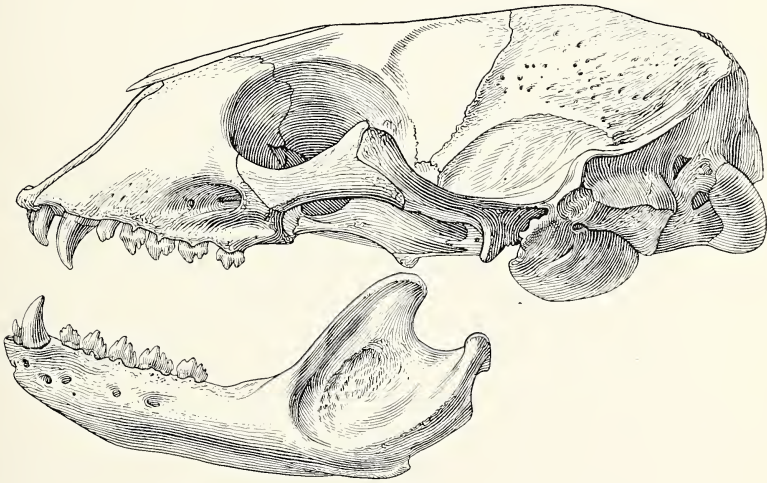


FIG. 2. *Phoca vitulina concolor*, female, from Portland Head, Maine; April 19, 1899; U. S. National Museum, no. 253,795.



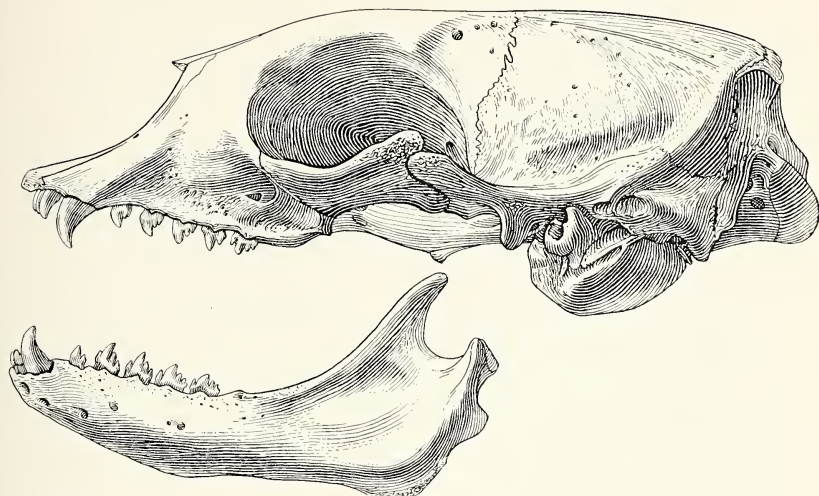
Lateral views of skulls  
One-half natural size

FIG. 1. *Phoca groenlandica*, male, from near La Tabatière, North Shore of Gulf of St. Lawrence, Quebec, Canada; winter of 1939-40; Carnegie Museum, no. 18,717.

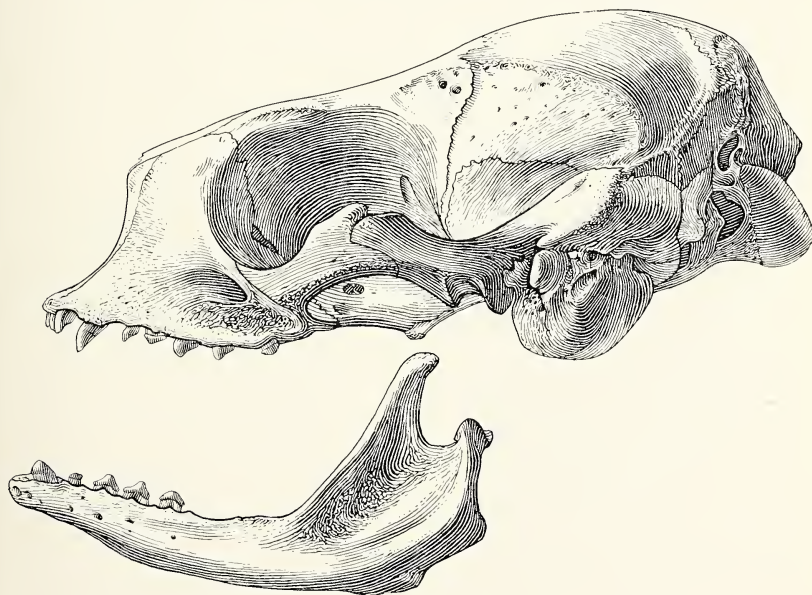


FIG. 2. *Phoca fasciata*, male, from northwest of Cape Sevookok, St. Lawrence Id., Bering Sea; June 23, 1931; Museum of Vertebrate Zoology, no. 51,387.



Palatal views of skulls

One-half natural size

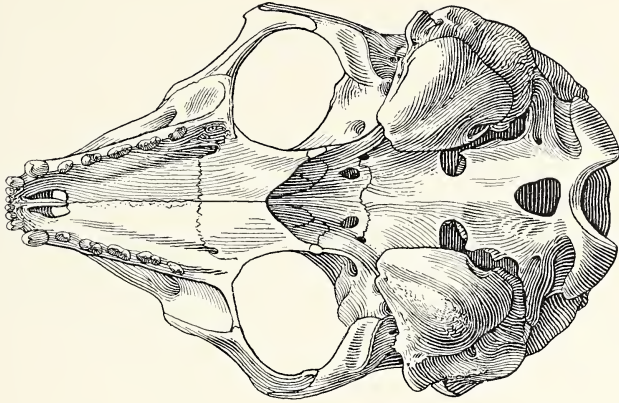


FIG. 1. *Phoca hispida* from Camsell Island, Belcher Islands, Hudson Bay; May 1938; Carnegie Museum, no. 15,277.

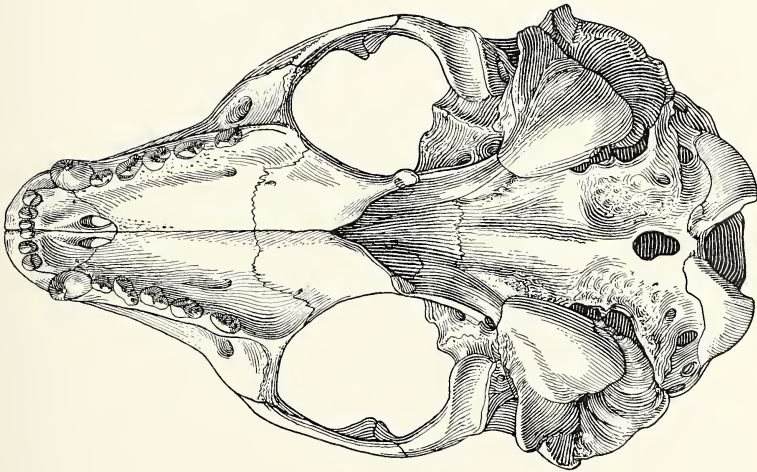


FIG. 2. *Phoca vitulina concolor*, female, from Portland Head, Maine; April 19, 1899; U. S. National Museum, no. 253,795.





Palatal views of skulls

One-half natural size

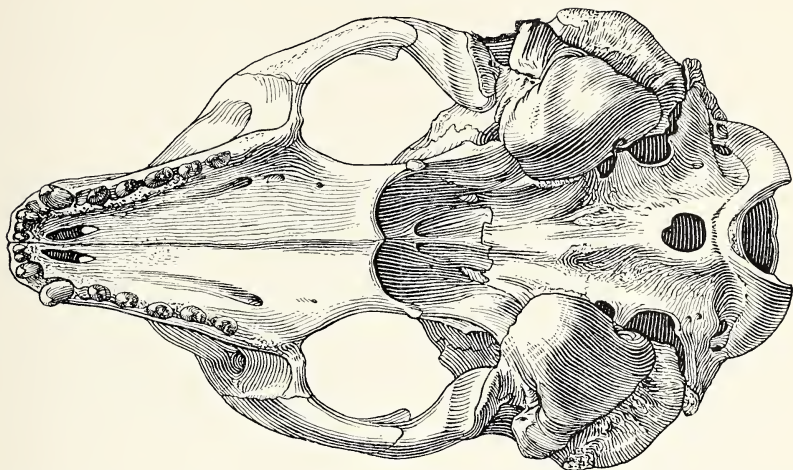


FIG. 1. *Phoca groenlandica*, male, from near La Tabatière, North Shore of Gulf of St. Lawrence, Quebec, Canada; winter of 1939-40; Carnegie Museum, no. 18,717.

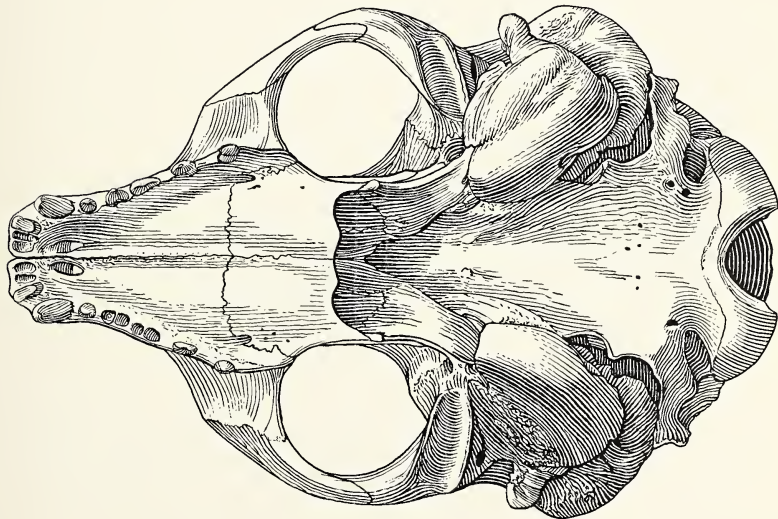


FIG. 2. *Phoca fasciata*, male, from northwest of Cape Sevookok, St. Lawrence Id., Bering Sea; June 23, 1931; Museum of Vertebrate Zoology, no. 51,387.



Views of skull of type  
One-half natural size

*Phoca vitulina mellonae* from Lower Seal Lake, Quebec, about 90 miles east of Richmond Gulf, Hudson Bay; March 23, 1938; Carnegie Museum, no. 15,215.

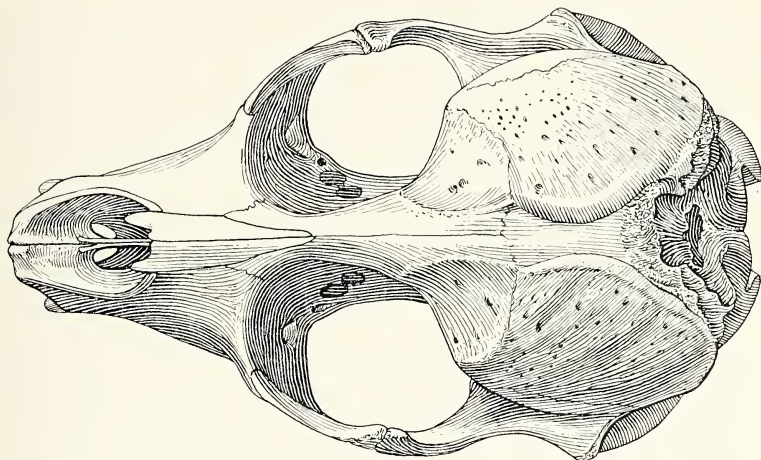


FIG. 1. Dorsal view.

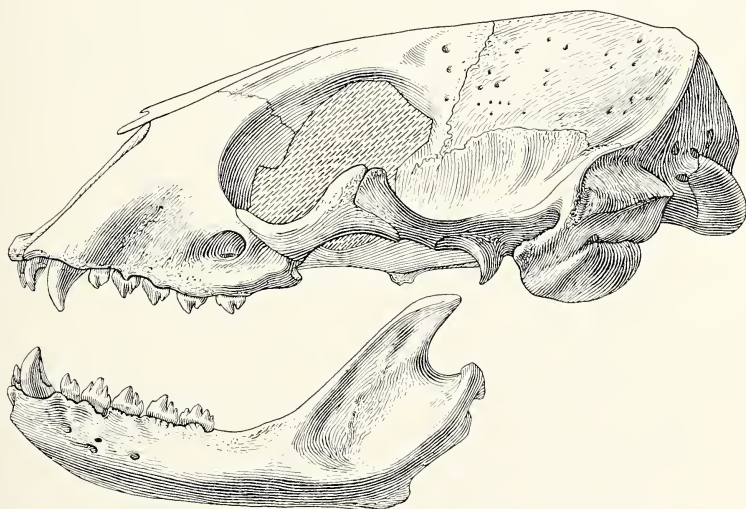


FIG. 2. Lateral view.



All figures one-half natural size

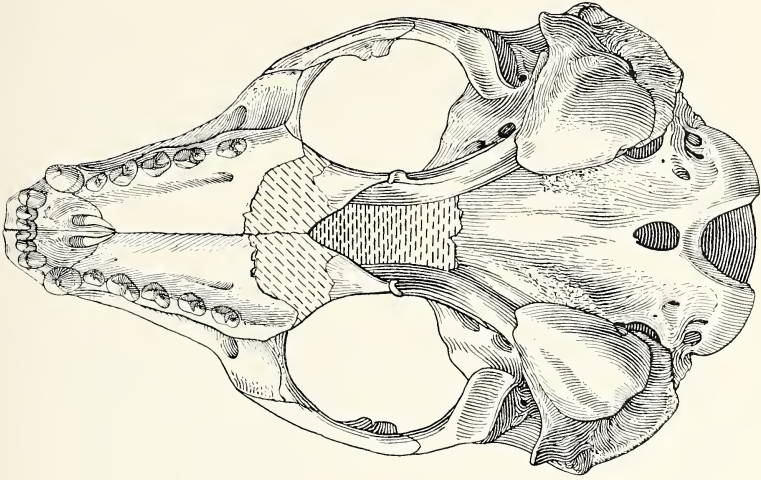


FIG. 1. Palatal view of skull of type of *Phoca vitulina mellonae* from Lower Seal Lake, Quebec, about 90 miles east of Richmond Gulf, Hudson Bay; March 23, 1938; Carnegie Museum, no. 15,215.

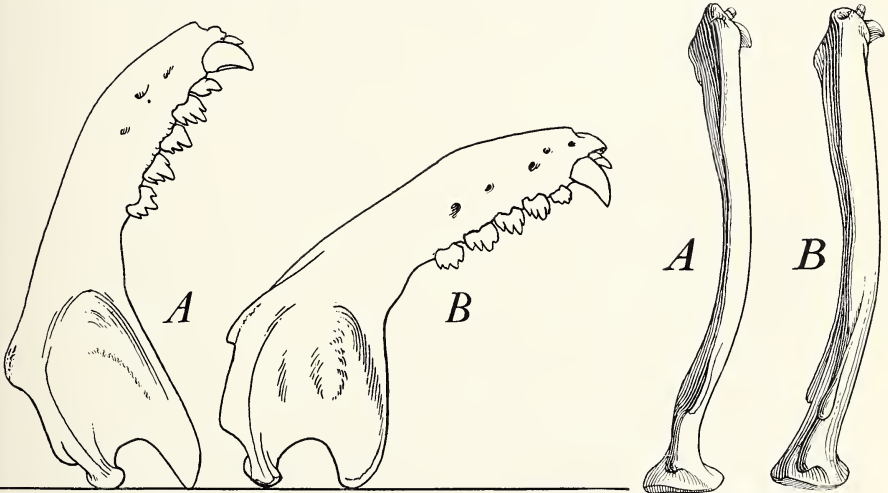


FIG. 2.

FIG. 3.

FIG. 2. Mandibles of *P. v. mellonae* (A), and *P. v. concolor* (B), can be recognized at once when placed on a flat surface as illustrated here. The long coronoid process enables the mandible of *P. v. mellonae* to stand so erect that it will balance in this position, while that of *P. v. concolor* leans forward so far that it topples over when the supporting hand is removed.

FIG. 3. Ventral view of the same mandibles illustrated in figure 2. *P. v. concolor* (B) is more robust than *P. v. mellonae* (A), and presents a slightly different curvature. This curvature is also a factor in the balance of the mandibles.



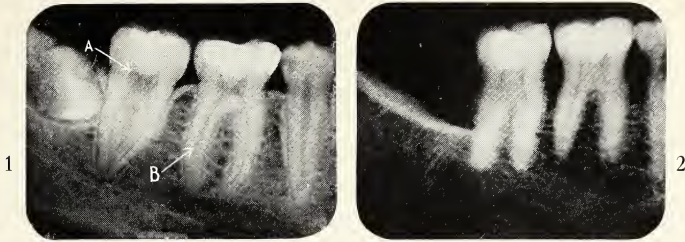


FIG. 1. Radiograph showing the left molar region of a human mandible made from a patient approximately fifteen years of age.

FIG. 2. Radiograph of same region made from a patient nearing fifty. Note the difference in the pulp chambers and canals, and in the finer lines of the bone cancellations.

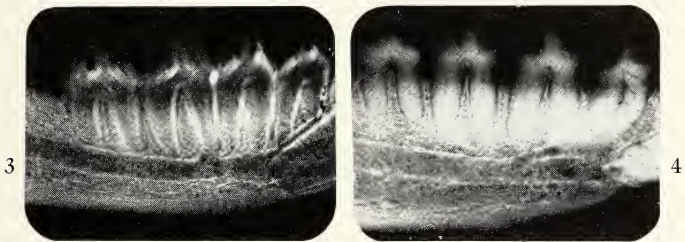


FIG. 3. Radiograph of teeth of left mandible of *Phoca vitulina*. Difference in age is readily seen by comparing the wide canals and thin walls of dentine of the teeth in this figure with the older specimen in the following figure.

FIG. 4. This radiograph also shows the left mandible. Note the fine canals and thick walls of dentine of the teeth. Greater density of the bone is also evident in this older specimen.



FIG. 5. *Phoca groenlandica*, from near Aklavik, N.W.T., the westernmost record of the species. Photograph received through the courtesy of Dr. R. M. Anderson.

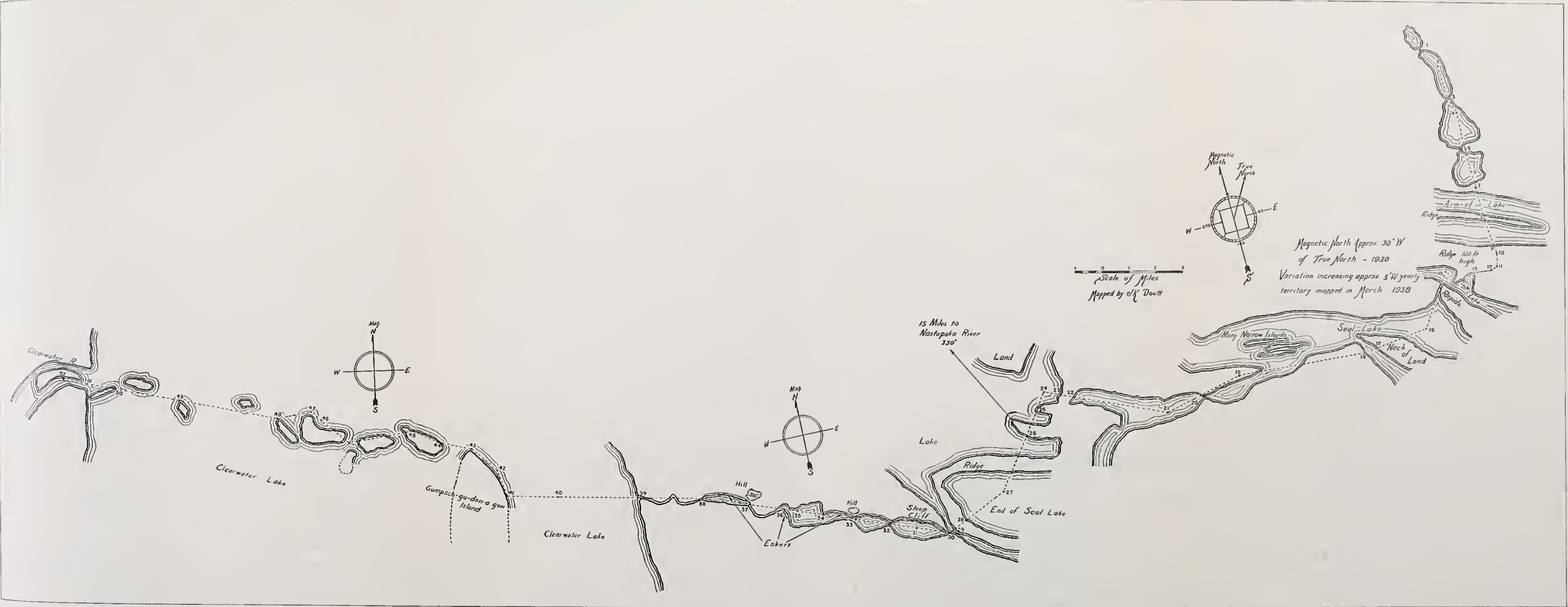




A.







Reconnaissance Survey showing route of the Expedition from Little Seal Lake to Clearwater River. Mapped by author with aid of compass, pedometer, and open sight alidade.



Ames

ART. V. THE CEPHALOPOD FAUNA OF THE CONEMAUGH SERIES IN WESTERN PENNSYLVANIA

BY A. K. MILLER AND A. G. UNKLESBAY  
THE STATE UNIVERSITY OF IOWA

(PLATES I-VIII)



INTRODUCTION AND ACKNOWLEDGMENTS

Very little information has heretofore been published in regard to the cephalopods of the Conemaugh series in Pennsylvania. Aside from incidental references by Rogers, Meek, Plummer and Scott, and others, the only significant data are those given by Raymond in 1910 and 1911 in his *Preliminary list of the fauna of the Allegheny and Conemaugh series in western Pennsylvania*. Essentially all of Raymond's cephalopods have been available to us for restudy, and they are therefore included in the following discussions.

The bulk of the specimens on which our study is based were collected by Mr. David Seaman, and any merit our report may possess is primarily a result of his diligence. Additional material was loaned by Dr. I. P. Tolmachoff, who collected some of the specimens himself, and by Dr. John W. Wells, who likewise assembled collections in the field. Some of the better specimens found by Dr. Wells were obtained by us indirectly in the John Britts Owen Collection, which is now at the State University of Iowa.

The photographs which accompany this report were retouched by Mr. Howard Webster, who also inked the line drawings. Finally, we wish to acknowledge our indebtedness to the Graduate College of the State University of Iowa and particularly to Mr. Frederick O. Thompson of Des Moines, who made the work financially possible.

STRATIGRAPHIC FAUNAL SUMMARY

Marine fossils occur in the Conemaugh of western Pennsylvania in at least five formations, the Brush Creek, Pine Creek, Woods Run, Ames, and Birmingham. The fauna known from the Woods Run and the Birmingham is not large, but the other three have yielded a variety of fossils at a good many localities. Their faunas are primarily molluscan but they also contain a few fusulinids, corals, crinoids, bryozoans, trilobites, fish teeth, and numerous brachiopods. Cephalopods are known from all five of these fossiliferous horizons.

In western Pennsylvania the Brush Creek limestone, about one hun-

dred feet above the base of the Conemaugh, carries a large and varied fauna in which molluscs predominate, and it has yielded far more cephalopods than any other Conemaugh formation. Altogether, representatives of nine genera of nautiloids and three of ammonoids are known from this formation as follows:

- Pseudorthoceras knoxense* (McChesney)
- Mooreoceras normale* Miller, Dunbar, and Condra
- Poterioceras curtum* (Meek and Worthen)
- Ephippioceras ferratum* (Cox)
- Megaglossoceras* sp.
- Liroceras* sp.
- Metacoceras cornutum* Girty
- Metacoceras perelegans* Girty
- Domatoceras* sp.
- Solenochilus brammeri* Miller, Dunbar, and Condra (?)
- Pennoceras seamani*, gen. et sp. nov.
- Eoasianites* sp.
- Schistoceras hildrethi* (Morton)
- Schistoceras missouriense* (Miller and Faber)

It should be emphasized that this list contains all of the cephalopod species known to occur in the entire Conemaugh of Pennsylvania except *Tainoceras monilifer* Miller, Dunbar, and Condra. That species has not been found below the Woods Run limestone. The fauna of the Brush Creek is especially large because that formation is widespread in western Pennsylvania, outcrops of it are relatively abundant, and lithologically it consists of limestone and shale in about the right proportions to preserve fossils well and to yield them readily.

The Pine Creek limestone, which occurs from sixty to ninety feet above the Brush Creek, also contains a considerable fauna, but good specimens can be obtained at only a few places. Raymond (1911, p. 88) states that at "almost every locality where fossils have been collected from this layer nautiloids have been found to be numerous, but not well preserved." The collections we are studying contain representatives of four nautiloid genera from this formation:

- Pseudorthoceras knoxense* (McChesney)
- Metacoceras cornutum* Girty
- Metacoceras perelegans* Girty
- Domatoceras* sp.
- Solenochilus brammeri* Miller, Dunbar, and Condra(?)

Raymond's lists indicate that *Pennoceras seamani* is also present in the Pine Creek, but none of his specimens that we have studied can be referred to that species or genus. It is worthy of note that all of the species represented in the Pine Creek occur also in the Brush Creek.

The Woods Run limestone is of very local distribution and only a few outcrops of it are known. It has yielded a meager fauna, but we now have representatives of four nautiloid and one ammonoid genera from it:

*Ephippioceras ferratum* (Cox)

*Metacoceras cornutum* Girty

*Tainoceras monilifer* Miller, Dunbar, and Condra

*Domatoceras* sp.

*Schistoceras hildrethi* (Morton)

*Tainoceras monilifer* apparently makes its appearance in the Conemaugh at this horizon. All of the other cephalopod species obtained from the Woods Run are also known from lower beds and, with a single exception, from younger ones.

The Ames limestone, which in western Pennsylvania occurs stratigraphically about 125 feet above the Pine Creek, is abundantly fossiliferous. However, as is so often the case, good specimens can be obtained at only a relatively few localities. This formation contains many brachiopods and crinoid columnals and also a considerable fauna of gastropods and fish teeth, as well as the following species of cephalopods:

*Pseudorthoceras knoxense* (McChesney)

*Mooreoceras normale* Miller, Dunbar, and Condra

*Poterioceras curtum* (Meek and Worthen)

*Metacoceras cornutum* Girty

*Metacoceras perelegans* Girty?

*Tainoceras monilifer* Miller, Dunbar, and Condra

*Domatoceras* sp.

*Schistoceras hildrethi* (Morton)

The Ames is the youngest abundantly fossiliferous marine formation in the Conemaugh of Pennsylvania. For the most part its fauna is strikingly similar to that of the Brush Creek.

According to Raymond the Birmingham shale generally varies from thirty-five to fifty feet in thickness, and its base is about thirty feet above the Ames limestone. A few marine fossils have been found in it. These consist of brachiopods, clams, gastropods, and three cephalopods. Two of the three cephalopods are poorly preserved fragments, but they are probably referable to *Tainoceras monilifer* Miller, Dunbar, and Condra,

which is fairly abundant in the Ames and occurs also in the Woods Run.

Insofar as cephalopods are concerned, the fauna of the Conemaugh is a unit, and it probably represents only one invasion. That is, the youngest abundant fauna known from the series, that of the Ames, is essentially the same as the oldest abundant fauna, that of the Brush Creek. Future collecting will almost certainly serve to emphasize the similarities and eliminate the apparent differences in the faunas of these two limestones.

Most of the nautiloid species found in the Conemaugh are not very valuable for precise correlations. Furthermore, of the four types of ammonoids known from the series, one represents a new genus and species, and the other three are long-ranging forms. Nevertheless, the cephalopod assemblage can be said to substantiate the generally accepted view that the Conemaugh is of about the same age as the McLeansboro of Illinois and the Kansas City and Lansing of Missouri, Kansas, and Nebraska.

TABLE 1. Stratigraphic distribution of cephalopods in the Conemaugh of western Pennsylvania.

Species \ Horizon	Brush Creek	Pine Creek	Woods Run	Ames	Birmingham
<i>Pseudorthoceras knoxense</i> .....	×	×	.	×	×
<i>Mooreoceras normale</i> .....	×	.	.	×	.
<i>Poterioceras curtum</i> .....	×	.	.	×	.
<i>Ephippioceras ferratum</i> .....	×	.	×	.	.
<i>Megaglossoceras</i> sp.....	×	?	.	.	.
<i>Liroceras</i> sp.....	×	.	.	.	.
<i>Metacoceras cornutum</i> .....	×	×	×	×	.
<i>Metacoceras perelegans</i> .....	×	×	.	×	.
<i>Tainoceras monilifer</i> .....	.	.	×	×	×
<i>Domatoceras</i> spp.....	×	×	×	×	.
<i>Solenochilus brammeri</i> ?	×	×	.	.	.
<i>Pennoceras seamani</i> .....	×	?	.	.	.
<i>Eoasianites</i> sp.....	×	.	.	.	.
<i>Schistoceras hildrethi</i> .....	×	.	×	×	.
<i>Schistoceras missouriense</i> .....	×	.	.	.	.



## SYSTEMATIC PALEONTOLOGY

Genus PSEUDORTHOCERAS Girty, 1911

**Pseudorthoceras knoxense** (McChesney)

(Plate I, figures 1-5)

This species was recently described in detail by Miller, Dunbar, and Condra (1933, pp. 77-85), who also listed its extensive synonymy; there is of course no need for us to duplicate this work. The most distinctive character of the species is perhaps the curved adapical portion of its conch, which is therefore a cyrtoceracone. Specimens of which the adapical portion of the conch is not preserved can be recognized by the peculiar deposits in the camerae. Miller, Dunbar, and Condra, who described these deposits in detail, concluded that they were formed in the adapical portion of the living chamber, but it now seems more probable that they were secreted in the camerae, a view that has recently been presented by both Teichert and Flower.

In the collections that we are studying, *P. knoxense* is associated with *Mooreoceras normale*. Even fragmentary specimens of these two forms are easily differentiated without sectioning by the fact that in *P. knoxense* the siphuncle is central in position whereas in *M. normale* it is distinctly ventrad of the center, though not marginal. Also, the conch of *P. knoxense* is more rapidly expanded than is that of *M. normale*. Most of the representatives of *P. knoxense* known from the Conemaugh of Pennsylvania are crushed and fragmentary and are not very well preserved. All of them appear to represent portions of the phragmacone.

*Occurrence:* This species is widely distributed in the Pennsylvanian of North America and may occur also in Europe (Carnic Alps). Stratigraphically it ranges from the Cherokee to the Wabaunsee and from the Bend to the Cisco; geographically it ranges from Pennsylvania on the east to Colorado on the west, and from Texas on the south to Michigan on the north. Representatives are known from the following horizons and localities in the Conemaugh of Pennsylvania: the Brush Creek limestone near Ambridge (about two miles east of), Creighton, Donohoe, Glassmere (Harvy Brick Company quarry), Witmer, Ligonier (Twin Echo Boy Scout camp), Stoops Ferry, and Wildewood; the Pine Creek limestone near Blackburn (one-half mile north of), Witmer (Refractory St.), and Woods Run; the Ames limestone near Glenwood, Pitcairn, and Pittsburgh (Brilliant Cut-off and Spring Garden); and the Birmingham Shale at Tenth Street tubes, Pittsburgh.

*Hypotypes:* Carnegie Museum, nos. 22,285-22,289.

## Genus MOOREOCERAS Miller, Dunbar, and Condra, 1933

**Mooreoceras normale** Miller, Dunbar, and Condra

(Plate I, figures 6, 7)

- (?) 1892. *Orthoceras colletti* Miller, Indiana Dept. Geol. and Nat. Resources Ann. Rept. 18, *Advance sheets*, pp. 67-68, pl. 10, fig. 1.
- (?) 1894. *Orthoceras colletti* Miller, Indiana Dept. Geol. and Nat. Resources Ann. Rept. 18, pp. 321-322, pl. 10, fig. 1.
1931. *Orthoceras colletti* Morse, Kentucky Geol. Survey, ser. 6, vol. 36, pp. 300, 325-326, pl. 54, figs. 1, 2.
1933. *Mooreoceras normale* Miller, Dunbar, and Condra, Nebraska Geol. Survey Bull. 9, ser. 2, pp. 87-89, pl. 2, figs. 5-7.
1934. *Mooreoceras normale* Miller and Owen, Univ. Iowa Studies Nat. Hist., vol. 16, pp. 203-205, pl. 11, figs. 1-8.
- (?) 1938. *Mooreoceras normale?* Miller and Moore, Jour. Pal., vol. 12, pp. 343-344.
1939. *Mooreoceras normale* Flower, Palaeontographica Americana, vol. 2, no. 10, pp. 146, 152.

This species is fairly abundant in the Conemaugh of Pennsylvania, and the collections we are studying contain about fifteen representatives of it. However, all of them are very incomplete, and our study has not enabled us to add to the existing morphological knowledge. It should, however, be stated that our specimens seem to be typical in all available particulars, though none of them is very large.

*Occurrence:* Representatives of this species are widely distributed in the Pennsylvanian system of the United States. Stratigraphically they are known to range from the Cherokee (and probably the Morrow) to the Wabaunsee. They have been found as far east as Pennsylvania, as far south as Texas, as far west as Colorado, and as far north as Michigan. In the Conemaugh of southwestern Pennsylvania they occur in the Brush Creek limestone near Creighton and Glassmere and in the Ames limestone near Ardara and Pittsburgh (Brilliant Cut-off).

*Hypotypes:* Carnegie Museum, no. 22,297.

## Genus POTERICERAS M'Coy, 1844

Genotype: *Orthocera fusiformis* Sowerby

Conch breviconic, cyrtoceraconic, subcircular to broadly subelliptical in cross section, and characteristically large. Aperture only slightly contracted; its margins are directly transverse or slope orad from the dorsum, and only a shallow hyponomic sinus is present. Early sutures are trans-

verse but later ones slope orad from the venter. Siphuncle small, located between the venter and the center of the conch, cyrtochoanitic in structure, and composed of elliptical to subspherical segments. Lower Mississippian to mid-Pennsylvanian.

There is considerable variation in the species that are at present referred to this genus. The Pennsylvanian forms are much more rapidly expanded orad than is the genotype, as are certain of the Mississippian species. In at least the mid-Pennsylvanian representatives the surface of the test bears conspicuous transverse markings which probably represent increments of growth. The two species known from the Cherokee, *P. bransoni* and *P. mehli*, have rounded transverse constrictions on the dorso-lateral zones of the living chamber, but apparently these are confined to the internal mold. Also, in both of these species at full maturity the adoral suture is unique in that it curves away from the preceding suture on the lateral zones though it is close to and parallel with that suture on the dorsal and ventral zones.

The genotype occurs in the Lower Carboniferous of Ireland and England. In America congeneric forms are widespread geographically, and stratigraphically they range from the Kinderhook to the Conemaugh and the Kansas City.

### **Poterioceras curtum** (Meek and Worthen)

(Plate II, figures 1-3; Plate V, figure 1)

1860. *Cyrtoceras curtum* Meek and Worthen, Philadelphia Acad. Nat. Sci. Proc., p. 468.
1860. *Cyrtoceras? dilatatum* Meek and Worthen, Philadelphia Acad. Nat. Sci. Proc., p. 468.
1861. *Cyrtoceras (Aploceras) curtum* Meek and Worthen, Philadelphia Acad. Nat. Sci. Proc., p. 148.
1866. *Cyrtoceras (Aploceras) curtum* Meek and Worthen, Illinois Geol. Survey, vol. 2, pp. 388-389, pl. 30, figs. 1a-1c.
1866. *Cyrtoceras? dilatatum* Meek and Worthen, Illinois Geol. Survey, vol. 2, p. 389, pl. 29, fig. 2.
1910. "*Cyrtoceras*" *curtum* Raymond, Carnegie Museum Annals, vol. 7, p. 156, pl. 25, fig. 6, pl. 26, fig. 8.
1911. "*Cyrtoceras*" *curtum* Raymond, Pennsylvania Topog. and Geol. Survey Comm., Rept. 1908-1910, p. 86, 87, 96, pl. 4, figs. 3, 4.
- (?) 1915. *Cyrtoceras?* sp. Girty, U. S. Geol. Survey Bull. 544, p. 247, pl. 32, figs. 4-5a.
- (?) 1924. *Cyrtoceras* sp. Morgan, [Oklahoma] Bur. Geol. Bull. 2, pl. 51, figs. 5, 5a.

The holotype of this species, which came from Illinois, is crushed and distorted and represents only an adapical portion of the conch, but we have additional specimens from Oklahoma and Pennsylvania that supplement it fairly well. The best one of these (Pl. II, figs. 1, 2) is from the Lansing of Oklahoma. It represents the adoral part of the phragmacone and the adapical part of the living chamber of what appears to be a mature individual. It is about 75 mm. long and the portion of the conch it represents is straight. In cross section it is circular, and at its adapical end it is about 50 mm. in diameter. Its sides diverge adorally at an angle of some 40 degrees. Near the adoral end of this specimen the test is about  $2\frac{1}{2}$  mm. thick. Its surface is marked by very distinct transverse striae, which appear to be confined to a surface layer of the test. Near the adapical end of the specimen these striae are less than 1 mm. apart, whereas on the adoral portion the distance between successive striae measures as much as  $2\frac{1}{2}$  mm. As in the holotype, the striae are sinuous and are not directly transverse. However, both their obliquity and their sinuosity may be the result of distortion during preservation for neither is symmetrical with respect to the siphuncular side of the conch. The siphuncle is small and is located fairly close to the venter; at the adapical end of the specimen under consideration, the siphuncle is about 2 mm. in diameter at its passage through a septum and its center is about 10 mm. from the venter.

The Pennsylvania specimens, all of which came from the Conemaugh, are rather fragmentary, but they represent various portions of the conch. Several of them retain the test, and it bears the same type of surface markings as does the holotype and the above-described Oklahoma specimen. Some of these Pennsylvania specimens are almost free from distortion, for example that represented by figure 1 on Plate V, and they show that the conch is circular (or nearly so) in cross section. Others, for example that represented by figure 3 on Plate II, show that the adapical portion of the conch is curved, as is the holotype.

*Remarks:* Although the specimens that we are referring to this species came from several rather widely separated localities, they seem to resemble each other in all available particulars. Furthermore, insofar as can be ascertained, all of them probably came from beds of the same general age. Better preserved uncrushed specimens may of course reveal significant differences, but we are convinced that for the present at least it will be best to regard all of them as representing only one species. Furthermore, as was suggested by Meek and Worthen, the holotype of *Cyrtoceras*?

*dilatatum* is almost certainly conspecific, and it merely represents a different portion of the conch than does the holotype of the species under consideration.

The specimens from the Wewoka formation of Oklahoma which Girty illustrated and described as *Cyrtoceras??* sp. and that from the same general horizon and locality which Morgan illustrated as *Cyrtoceras* sp. resemble *Poterioceras curtum* and are almost certainly congeneric with it. From the published data in regard to them, we are unable to tell whether or not they are conspecific. The holotype and only known representative of *Cyrtoceras peculiare* Girty, which also came from the Wewoka formation of Oklahoma, may also be a crushed representative of *Poterioceras*, but we are very uncertain in regard to its affinities.

*Occurrence:* The holotype came from the Pennsylvanian near Grayville, Illinois, and a conspecific specimen (the holotype of *Cyrtoceras? dilatatum*) has been described from the same general horizon near Springfield, Illinois. We have a single individual from the Eudora shale (Lansing) about 4½ miles northeast (4 miles north and 2 miles east) of Copan, Oklahoma; one from the Ames limestone on Davis Avenue near Brighton Road, and others from the Brush Creek limestone near Blackburn, Creighton, Donohoe, Glassmere (Harvy Brick Company quarry), and Stoops Ferry, all in southwestern Pennsylvania.

*Hypotypes:* University of Kansas, 23,420 (Pl. II, figs. 1, 2); Carnegie Museum (10 specimens including Pl. II, fig. 3, no. 22,291); and State University of Iowa, 3,116 (Pl. V, fig. 1) and 3,117 (unfigured specimen).

***Poterioceras subellipticum*, sp. nov.**

(Plate II, fig. 4; Plate IV, fig. 4)

Conch large, rapidly expanded orad, subelliptical in cross section as depressed dorso-ventrally, and cyrtoceraconic being concave dorsally and convex ventrally. Holotype is not complete adorally or adapically, but the preserved part of it is about 160 mm. long. Its maximum width is about 115 mm. Near its mid-length its width and height are about 85 mm. and 55 mm., respectively, and at its adapical end these two measurements are about 30 mm. and 18 mm. The lateral zones of the conch diverge orad at an angle of about 48 degrees. In cross section the specimen is not quite elliptical as the ventral side of the conch is slightly but distinctly more strongly convex than the dorsal. The curvature appears to be

restricted to the adapical third of the specimen, and even there it is slight (Pl. II, fig. 4).

On at least the adapical portion of the conch, the surface of the test bears fine transverse lines about a millimeter or so apart. These are not preserved on the ventral side of the specimen, but they curve slightly apicad as they cross the dorsal side. No trace of sutures or siphuncle is discernible on the holotype.

*Remarks:* This species is being based on a single specimen which is moderately well preserved in limestone. It differs from *P. curtum*, which occurs rather widespread in the Pennsylvanian, in that its conch is sub-elliptical in cross section rather than subcircular. The specimen is very symmetrical and therefore its shape is almost certainly not a result of distortion.

*Occurrence:* National Stone Company quarry, about two miles north-east of Louisville, Nebraska, probably from the Argentine member of the Wyandotte limestone.

*Holotype:* Nebraska Geological Survey, T101.

#### Genus EPHIPPIOCERAS Hyatt, 1884

#### **Ephippioceras ferratum** (Cox)

(Plate I, figures 14, 15)

Recently Miller, Dunbar, and Condra (1933, pp. 114-118) published an exhaustive study of this species, including its complete synonymy. We have only three small very incomplete specimens, and they seem to be quite typical in all respects. One of them is crushed, but the other two are essentially free from distortion and are rather well preserved.

*Occurrence:* This species is widely distributed in the Pennsylvanian of North America. It is known to range from Pennsylvania on the east to Nebraska on the west. Stratigraphically it ranges from the base of the Cherokee to the top of the Lansing. The collections that we are studying from the Conemaugh of Pennsylvania contain two specimens from the Brush Creek limestone at Creighton and one from the Woods Run limestone in Jacks Run, Allegheny County.

*Hypotypes:* Carnegie Museum (2 specimens), and State University of Iowa, 3,128 (Pl. I, figs. 14, 15).

Genus MEGAGLOSSOCERAS Miller, Dunbar, and Condra, 1933

**Megaglossoceras** sp.

(Plate I, figure 16)

The genus *Megaglossoceras* is represented in the available collections from the Conemaugh of Pennsylvania by a single specimen. It is an internal mold of the adapical portion of the living chamber, and fortunately it elucidates the shape of the adoral septum. The conch is broadly rounded ventrally, flattened ventro-laterally, and narrowly rounded laterally. The umbilicus appears to be rather large for this genus. No trace of surface markings of the test is discernible. The single suture portrayed forms a moderately high and narrow rounded ventral saddle, and on either side of it a broad shallow broadly rounded asymmetrical lateral lobe, and a rather low narrowly rounded saddle centering on the umbilical shoulder.

*Remarks:* The suture of this form is similar to that of the genotype, *M. montgomeryense* (Worthen) of the McLeansboro of Illinois. However, since the Conemaugh specimen is small and very incomplete, satisfactory comparisons are not possible. Congeneric forms have been described from the Cherokee of Kansas and Missouri, the Lower Pennsylvanian of Colorado, and the Kansas City of Nebraska; also, the collections of the State University of Iowa contain undescribed representatives of the genus from the Bogy of Oklahoma and the Lansing of Missouri.

*Occurrence:* Brush Creek limestone at Witmer, Pennsylvania; Pine Creek limestone at Trafford City, Pennsylvania (affinities uncertain).

*Figured specimen:* State University of Iowa, 1,414.

Genus LIROCERAS Teichert, 1940

**Liroceras** sp.

(Plate I, figure 13)

The Conemaugh of southwestern Pennsylvania has yielded a single incomplete specimen that is referable to *Liroceras*. It represents the adapical quarter-volution of the living chamber and the adoral quarter-volution of the phragmacone. Its sutures are essentially straight and directly transverse, and its siphuncle is small and is subcentral in position. The shape of its conch is shown by Text figure 1 A.

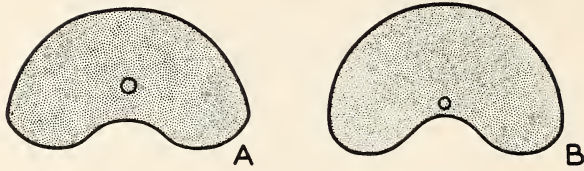


FIG. 1. Cross sections of two representatives of *Liroceras*,  $\times 2$ . *A* is from the Conemaugh (Brush Creek limestone) near Glassmere, Pennsylvania; whereas *B* is from the Allegheny (Vanport limestone) near Wampum, Pennsylvania (C. M. 22,298). Same specimens shown in figures 11-13 on Plate I.

*Remarks:* In all respects this specimen seems to be a typical representative of *Liroceras*, but it is so small and incomplete that its specific affinities cannot be ascertained. The collections of the Carnegie Museum contain a congeneric form from the Allegheny (Vanport limestone) of the same general area. Like the Conemaugh specimen it is small and represents only about one-half of a volution of the conch. It is an internal mold of the adapical portion of the living chamber. It differs from the Conemaugh form in that its conch is less rapidly expanded orad, its whorls are narrower and higher, and its siphuncle is smaller and is closer to the dorsum (compare figures 11, 12 and 14 on Plate I, and Text figures 1 A and 1 B).

The genus *Liroceras* is widely distributed both stratigraphically and geographically, and it is well represented in the Mississippian, Pennsylvanian, and Lower and Middle Permian of both Eurasia and North America. In North America it is known to range from the Upper Mississippian (Chester) to the Middle Permian (Phosphoria).

*Occurrence:* Brush Creek limestone in the Harvy Brick Company quarry near Glassmere, Pennsylvania.

*Figured specimen:* State University of Iowa, 1,415.

#### Genus METACOCERAS Hyatt, 1883

Genotype: *Nautilus (Discus) sangamonensis* Meek and Worthen

Some thirty-five species are now referred to this genus. There is, to be sure, considerable variation amongst them, but for the most part they resemble the genotype rather closely. With a few exceptions the genus is fairly distinct and easily recognized, but species appear to be quite variable and more or less gradational.



Stratigraphically, *Metacoceras* has a long range; it appears in the Pottsville and continues until near the close of the Permian. The youngest American representatives of the genus known to us are in the collections of the U. S. Geological Survey; they came from the South Wells member of the middle Delaware Mountain formation (upper Middle Permian) in the Guadalupe Mountain region of west Texas. In northern Italy congeneric forms occur in the Bellerophon limestone, which is probably Upper Permian in age. Altogether, the genus is now known to be abundant and widespread in the Pennsylvanian of the United States, England, Belgium, and Soviet Russia; and it is represented also in the Permian of the United States, Italy, Russia, China, and Sumatra.

### ***Metacoceras cornutum* Girty**

(Plate III, figures 1-5)

1910. *Temnocheilus winslowi* Raymond [not Meek and Worthen], Carnegie Museum Annals, vol. 7, p. 156.
1911. *Temnocheilus winslowi* Raymond [not Meek and Worthen], Pennsylvania Topog. and Geol. Survey Comm., Rept. 1908-1910, pp. 86, 88, 90, 96.
1911. *Metacoceras cornutum* Girty, New York Acad. Sci. Annals, vol. 21, pp. 145-146.
1915. *Metacoceras cornutum* Girty, U. S. Geol. Survey Bull. 544, pp. 240-242, pl. 29, figs. 4-5b.
1933. *Metacoceras cornutum* Miller, Dunbar, and Condra, Nebraska Geol. Survey Bull. 9, 2d ser., p. 168.

This form is by far the most abundant cephalopod species in the Cone-maugh of Pennsylvania, and we have more than 65 representatives of it available for study. The largest of these (Pl. III, figs. 1-3) attains a maximum diameter of about 80 mm. and a maximum height and width of conch of about 32 mm. and 50 mm., respectively; the adoral third of the outer volution of this specimen represents the living chamber. During adolescence the ventral side of the conch is rather strongly convex, though it is distinctly flattened along the venter (Pl. III, fig. 4). At this stage of growth, ventro-lateral nodes are starting to develop, though they are barely discernible on the internal mold. During later growth stages, the ventral side of the conch becomes progressively less convex, and the ventro-lateral nodes become progressively more prominent. At full maturity these nodes are about as wide as long, and they are quite distinct from each other. The nodes are of course more prominent on the exterior of the test than on the internal mold.

Well-preserved testiferous specimens show that the growth-lines form a deep rounded ventral sinus. On the flattened lateral zones of the conch, the growth-lines are very slightly sigmoidal forming a salient next to the ventro-lateral shoulder and a sinus next to the dorso-lateral shoulder. On the broad flat umbilical walls, the growth-lines form slight salients. Their course across the shallow dorsal impressed zone can not be followed satisfactorily on the specimens under consideration.

The umbilical shoulders are very abrupt and the umbilical walls are very steep forming almost a right-angle with the flattened lateral zones of the conch. The test is much thicker than normal on the umbilical shoulders and it serves to accentuate their abruptness, making them almost angular.

The sutures are largely an expression of the shape of the conch in this species, and they form shallow broadly rounded ventral, lateral, and dorsal lobes. On the internal mold there is a slight but very distinct raised line along the venter. At maturity the siphuncle is located slightly ventrad of the center of the conch. It is small in size and orthochoanitic in structure. The septal necks are short and straight, and the connecting rings are only slightly expanded within the camerae.

*Remarks:* The paratype of this species does not appear from the published illustrations to be particularly similar to the holotype. The specimens we are studying resemble the paratype more closely than they do the holotype. Past experience has gone to show that a considerable amount of variation should be expected within species of the genus *Metacoceras*.

*M. cornutum* resembles the genotype, *M. sangamonense* of the McLeansboro of Illinois, rather closely but differs in that the lateral zones of its conch are slightly convex rather than concave and its umbilical walls are steeper. *M. perelegans*, which occurs in association with *M. cornutum* in both the Wewoka and the Conemaugh, differs particularly in that its umbilical shoulders are nodose. Also, its ventro-lateral nodes are more elongate longitudinally, and during adolescence the ornamentation of its test is much more prominent.

*Occurrence:* This species was originally described from the Wewoka formation of central Oklahoma. We are referring to specimens from the following horizons and localities in the Conemaugh of southwestern Pennsylvania: the Brush Creek limestone near Creighton, Glassmere, Sewickley, Trafford, Valley Camp, Wildewood, Mars, Donohoe, Stoops Ferry, and Witmer; the Pine Creek limestone near Woods Run, Undercliff, Blackburn, Witmer, and Powers Run; the Woods Run limestone near

Jacks Run, Burke Glen, and Wilkinsburg; and the Ames limestone near Etna and Pittsburgh (Junction Hollow).

*Hypotypes*: State University of Iowa, 3,118 (Pl. III, figs. 1-5), 3,120-3,123 (several unfigured specimens), and 13,636, 13,637 (two unfigured specimens in the John Britts Owen Collection); and Carnegie Museum (numerous unfigured specimens).

### **Metacoceras perelegans** Girty

(Plate I, figures 8-10; Plate III, figures 6-8)

1858. *Nautilus decoratus* Rogers [not Cox], The geology of Pennsylvania, a government survey, vol. 2, pt. 2, p. 833, fig. 692.
1910. *Temnocheilus crassus* Raymond [not Hyatt], Carnegie Museum Annals, vol. 7, p. 156.
1911. *Temnocheilus crassus* Raymond [not Hyatt], Pennsylvania Topog. and Geol. Survey Comm., Rept. 1908-1910, pp. 86, 88, 90, 96.
1911. *Metacoceras perelegans* Girty, New York Acad. Sci. Annals, vol. 21, pp. 147-148.
1915. *Metacoceras perelegans* Girty, U. S. Geol. Survey Bull. 544, pp. 244-245, pl. 30, figs. 5-6.
1933. *Metacoceras perelegans* Miller, Dunbar, and Condra, Nebraska Geol. Survey Bull. 9, 2d ser., p. 167.

Both of the figured syntypes of this species are small, but we are referring to it some large specimens (Pl. III, fig. 6) as well as some small ones. The last resemble the better of the figured syntypes rather closely. On the adapical part of these small specimens (Pl. I, fig. 10) the lateral zones of the conch bear prominent transverse ribs. As ontogenetic development proceeds the mid-portion of these ribs becomes less and less prominent, and the ribs therefore grade adorally into ventro-lateral and dorso-lateral nodes. Even during early adolescence the ventro-lateral ornamentation is more prominent than the dorso-lateral, and this disparity continues throughout ontogenetic development. The nodes are of course much more prominent on testiferous specimens than on internal molds.

All of the large specimens that we are referring to this species are crushed and distorted. However, the moderate-sized fragment represented by figures 8 and 9 on Plate I shows that at least during early maturity the whorls are almost rectangular in cross section as they are wider than high, essentially flat laterally and ventrally, only slightly impressed dorsally, and subangular ventro-laterally and dorso-laterally.

Where the conch of this specimen is about 19 mm. wide, it is about 12 mm. high and is impressed dorsally to a depth of only about 1 mm.

At full maturity the diameter of the umbilicus is equal to about two-fifths that of the specimens. The umbilical walls are broad and they are fairly steep.

The growth-lines show that the ventral side of the conch bears a broad deep rounded hyponomic sinus. On the umbilical shoulders and on the lateral zones of the conch the growth-lines are almost straight. The sutures form broad shallow rounded ventral, lateral, and dorsal lobes, as in other representatives of this genus. The siphuncle is small and is located slightly ventrad of the center of the conch.

*Remarks:* This species occurs in association with *M. cornutum* in both the Wewoka and the Conemaugh. It is readily distinguished from that species, however, by means of the umbilical nodes on its shoulders. Also, its adolescent ornamentation is much more prominent, and at maturity its ventro-lateral nodes are more elongate longitudinally.

*Occurrence:* The syntypes of this species came from the Wewoka formation of central Oklahoma. We are referring to it specimens from the following horizons and localities in the Conemaugh of southwestern Pennsylvania: the Brush Creek limestone near Ambridge, Creighton, Donohoe, Glassmere, Stoops Ferry, Trafford, Sewickley, and Valley Camp; the Pine Creek limestone near Trafford, Witmer, Powers Run, Blackburn, and Woods Run; and the Ames limestone at Brighton Heights. Raymond's lists indicate that this species occurs also in the Ames at the Brilliant Cut-off in Pittsburgh, but we have not been able to verify this occurrence.

*Hypotypes:* Carnegie Museum (Pl. I, figs. 8-10, nos. 22,295-22,296; and 10 unfigured specimens); and State University of Iowa 3,124 (Pl. III, figs. 7, 8), 3,125 (Pl. III, fig. 6), 3,126 and 3,127 (two unfigured specimens), and 13,638 (two unfigured specimens in John Britts Owen Collection).

#### Genus TAINOCERAS Hyatt, 1883

#### **Tainoceras monilifer** Miller, Dunbar, and Condra

(Plate IV, figures 1-3)

(?) 1871. *Nautilus Occidentalis* Meek [not Swallow], West Virginia Univ., Board of Regents 3d Ann. Rept., p. 71.

1872. *Nautilus occidentalis* Meek [not Swallow], Final Rept. U. S. Geol. Survey Nebraska. . . (U. S. 42d Cong., 1st sess., House Ex. Doc. 19), pp. 234-236, pl. 11, fig. 17.

- (?) 1903. *Nautilus occidentalis* Meek [not Swallow], West Virginia Geol. Survey, vol. 2, p. 258 [but probably not p. 325].
1910. *Tainoceras occidentale* Raymond [not Swallow], Carnegie Museum Annals, vol. 7, pp. 147, 148, 149, 156, pl. 27, fig. 7.
1911. *Tainoceras occidentale* Raymond [not Swallow], Pennsylvania Topog. and Geol. Survey Comm., Rept. 1908-1910, pp. 90, 92, 93, 96, pl. 6, fig. 7.
- (?) 1912. *Tainoceras occidentale* Mark [not Swallow], Ohio Geol. Survey Bull. 17, 4th ser., pp. 279, 281, 299.
1933. *Tainoceras monilifer* Miller, Dunbar, and Condra, Nebraska Geol. Survey Bull. 9, 2d ser., pp. 148-151, pl. 10, figs. 1-5.

This easily recognized species is represented by about twenty-five specimens in the collections from the Conemaugh of Pennsylvania that we are studying. All of these are crushed and distorted, and most of them are fragmentary. However, they supplement each other fairly well and portray the general characteristics of the species. They do not seem to differ materially from the holotype in any available particular, and our study of them does not enable us to add to the existing knowledge of the shell morphology.

*Occurrence:* The holotype of this species came from the Finis shale (basal Cisco) near Jacksboro, Texas. Conspecific specimens are known from the Cisco elsewhere in Texas; the Lawrence shale (Douglas), the Kereford limestone (basal Shawnee), and the Burlingame limestone (Wabaunsee) of Kansas; the Iatan limestone (Douglas) of Nebraska; and the Conemaugh of Pennsylvania and probably West Virginia and Ohio. We have specimens from the following horizons and localities in the Conemaugh of Pennsylvania: the Woods Run limestone at Abers Creek about eight miles east of Wilkinsburg; the Ames limestone in or near Allegheny (Brighton Heights and Riverview Park), Glenwood, Pitcairn, and Pittsburgh (Monument Hill and Brilliant Cut-off); and the Birmingham shale at Kennywood Park.

The genus *Tainoceras* is abundantly represented in the Pennsylvanian and the Lower Permian of the United States, and it occurs also in the Pennsylvanian of Russia and probably the Permian of Italy. However, most of the known species are readily distinguished from *T. monilifer*.

*Hypotypes:* All of the specimens figured and discussed in this report are in the Carnegie Museum (nos. 149, 10,434, 22,299).

Genus *DOMATOCERAS* Hyatt, 1891***Domatoceras* spp.**

(Plate V, figures 2-4)

We are referring more or less tentatively to *Domatoceras* a number of fragmentary specimens, all of which are crushed. These represent at least two species, but they are so incomplete that their specific affinities are very uncertain. Furthermore, even the generic affinities of some of the small specimens are highly questionable. The nodose specimen represented by figure 2 on Plate V differs markedly from the somewhat smaller specimens represented by figures 3 and 4 on the same plate, and its general physiognomy suggests that it is more or less intermediate between typical *Domatoceras* and typical *Stenopoceras*—no trace of sutures or siphuncle is discernible on it.

*Occurrence:* The specimens being referred to *Domatoceras* came from the following horizons and localities in the Conemaugh of Pennsylvania: the Brush Creek limestone near Creighton, Donohoe, Glassmere (Harvy Brick Company quarry), Witmer, and Valley Camp; the Pine Creek limestone near North Trafford, Powers Run, Verona, Witmer, and Woods Run; the Woods Run limestone near Burke Glen; and the Ames limestone near Glenwood and Pittsburgh (Brilliant Cut-off). In the Allegheny (Vanport) *Domatoceras* sp. is found at New Castle, Pennsylvania. Congeneric forms range in age from Lower Pennsylvanian to Upper Permian, and they are widespread in North America, Europe, and Asia.

*Repository:* State University of Iowa, 1,416-1,418 (Pl. V, figs. 2-4), 1,408 and 1,419 (unfigured specimens), and 13,640 (unfigured specimen in John Britts Owen Collection); and Carnegie Museum (numerous unfigured specimens).

Genus *SOLENOCHILUS* Meek and Worthen, 1870***Solenochilus brammeri* Miller, Dunbar, and Condra?**

(Plate VI, figs. 1, 2; Plate VII, figs. 3-6)

1910. *Solenochilus collectus* Raymond [not Meek and Worthen], Carnegie Museum Annals, vol. 7, p. 156.

1911. *Solenochilus collectus* Raymond [not Meek and Worthen], Pennsylvania Topog. and Geol. Survey Comm., Rept. 1908-1910, pp. 86, 88, 96.

The collections under consideration contain eleven representatives of the genus *Solenochilus*. All of them are incomplete and most of them are crushed. There seems to be no good reason to assume that more than one species is represented, and since the largest of the lot (Pl. VI, figs. 1, 2) appears to be quite similar to *S. brammeri*, it seems probable that all of them are related to that species.

The largest of the Conemaugh specimens, which is also the best, is about one-half of a volution in length. It represents the adoral two camerae of the phragmacone and much of the living chamber. The conch is subelliptical in cross section being broadly rounded ventrally, rounded laterally, and considerably wider than high. The umbilicus is small and is closed or nearly so. The umbilical zones of the conch are flared and are more or less carinate. The sutures are directly transverse and are almost straight, but they form very shallow ventral and lateral lobes and similar ventro-lateral saddles. The siphuncle is fairly small and is ventral in position, being in contact with the ventral wall of the conch or essentially so.

*Remarks:* The holotype of this species is much larger than the specimens we are studying—its diameter measures about 300 mm., whereas that of the largest of the Conemaugh specimens measures only about 125 mm. This disparity in size may or may not be significant insofar as taxonomy is concerned. Aside from size, the Conemaugh specimens do not appear to differ materially from the holotype in any available particular.

*Occurrence:* This species was originally described from the Argentine limestone member of the Wyandotte formation (Kansas City). We are referring to it with question specimens from the Brush Creek limestone at the following localities in southwestern Pennsylvania: near Creighton, Glassmere (Harvy Brick Company quarry), and just west of Murrysville; and from the Pine Creek limestone at Powers Run, Pennsylvania.

Raymond states that *Solenochilus* is represented also in the Brush Creek at Donohoe and Blackburn, Pennsylvania, and in the Pine Creek at Allegheny, Pennsylvania, but we have not been able to verify his identifications. Congeneric forms are widespread in both Europe and North America, and they range in age at least from Lower Mississippian to Lower Permian.

*Repositories:* State University of Iowa, 13,639 (John Britts Owen Collection), 1,420 (Pl. VII, fig. 5), and 1,421 (unfigured specimen); Carnegie Museum (Pl. VII, fig. 6, no. 22,290; and 6 unfigured specimens); and Ohio State University (Pl. VII, figs. 3, 4).

## Genus PENNOCERAS, gen. nov.

Genotype: *Pennoceras seamani*, sp. nov.

Conch subglobular and whorls are broadly rounded ventrally and laterally. Living chamber at least a volution in length. Umbilicus small and closed or essentially so. Surface of test marked by prominent straight transverse lirae. Sutures consist of a rather broad bifid ventral lobe and on either side of it a rounded U-shaped first lateral saddle, a V-shaped but narrowly rounded first lateral lobe, a low broad rounded second lateral saddle, and a rounded lobe on the umbilical seam. The subdivisions of

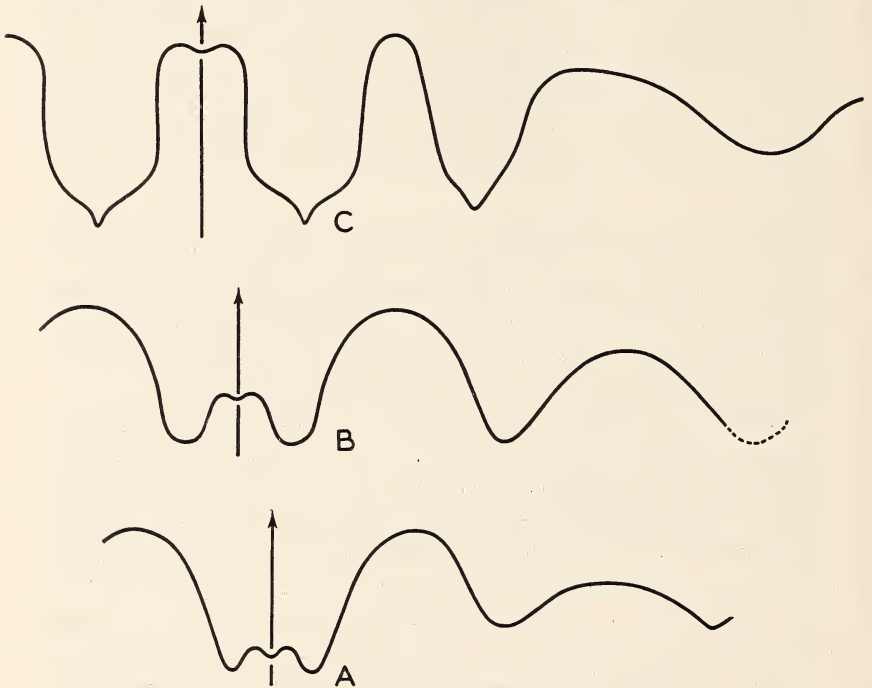


FIG. 2. Sutures of the genotypes of *Anthracoceras*, *Pennoceras*, and *Bisatoceras*.

- A. *Anthracoceras discus* Frech of the basal Upper Carboniferous of Hohenlohegrube in southwestern Germany, considerably enlarged. Adapted from Frech.
- B. *Pennoceras seamani*, sp. nov., of the Brush Creek limestone (Conemaugh) of southwestern Pennsylvania,  $\times 11$  (C. M. 22,292).
- C. *Bisatoceras primum* Miller and Owen of the Seminole formation (lower Missouri) of northeastern Oklahoma,  $\times 6$ .



the ventral lobe are rather short and are rounded. Conemaugh of Pennsylvania.

This genus is being established for three conspecific specimens in the collections that we are studying from the Conemaugh of southwestern Pennsylvania. It is possible that one of the type specimens of "*Goniatites*" *lunatus* Miller and Gurley may be congeneric. That species was based on three specimens from the Pennsylvanian of Elkhorn Creek, Kentucky. The largest of these and the second, which retains its sutures (Miller and Gurley, 1896, pl. 5, figs. 2, 4, and 5), are not closely related to the form under consideration, but the third (Miller and Gurley's pl. 5, fig. 3) has a subglobular conch and surface ornamentation similar to that of *P. seamani*. Until it is restudied its affinities will remain in question, but it is almost certainly not conspecific or even congeneric with the other two type specimens of "*G.*" *lunatus*.

*Pennoceras* resembles *Anthracoceras* and *Bisatoceras*. In *Anthracoceras* the sutures are in general similar, but the umbilicus is larger and the surface of the test does not bear prominent straight transverse lirae. *Bisatoceras* differs particularly in that the ventral lobe of its sutures is very broad and the subdivisions of that lobe are large, deep, and attenuate; also, the first lateral lobe is pointed and the first lateral saddle is relatively narrow.

***Pennoceras seamani*, sp. nov.**

(Plate VIII, figures 7-13)

1910. *Goniatites lunatus* Raymond [not Miller and Gurley], Carnegie Museum Annals, vol. 7, p. 156.

1911. *Goniatites lunatus* Raymond [not Miller and Gurley], Pennsylvania Topog. and Geol. Survey Comm., Rept. 1908-1910, pp. 85, 86, 88, 96.

Conch moderately large and subglobular. It attains a maximum diameter of at least 37 mm. Whorls broadly rounded ventrally and laterally and impressed dorsally. Where they are about 8 mm. high, they are about 9 mm. wide and are impressed to a depth of about  $3\frac{1}{2}$  mm. Corresponding dimensions of larger whorls can not be ascertained from the available specimens as they are distorted. Living chamber at least one full volution in length. Umbilicus small, inconspicuous, and closed or essentially so. Umbilical shoulders broadly rounded.

Surface of test bears prominent lirae which are straight and are directly transverse. These are very closely spaced on the umbilical regions

but are relatively far apart on the ventral zones of the conch. Traces of the lirae are present on the internal mold.

Each external suture consists of a rather broad bifid ventral lobe and on either side of it a rounded U-shaped first lateral saddle, a V-shaped but narrowly rounded first lateral lobe, a low broad rounded second lateral saddle, and a rounded lobe on the umbilical seam. The subdivisions of the ventral lobe are only about two-fifths as deep as the entire lobe. They are of about the same size as the secondary saddle that separates them and are rounded. Text figure 2 B illustrates the shape of the sutures of the specimen represented by figures 7-9 on Plate VIII at a diameter of about 8 mm. It should perhaps also be mentioned that it appears to represent the adoral suture of that specimen.

*Remarks:* The above description is based on three specimens, only one of which shows the shape of the sutures. This specimen is also the only one that is free from distortion. The largest of the three (Pl. VIII, figs. 10, 11) has been considerably crushed and flattened laterally.

*Occurrence:* Brush Creek limestone near Creighton (McFetridge Brick Yard quarry) and Witmer, Pennsylvania. Also Raymond's lists seem to indicate that this species occurs in the Brush Creek near Donohoe and Bens Creek, Pennsylvania, and in the Pine Creek near Witmer, Pennsylvania—we have a well-preserved specimen from Witmer but it was collected long after the publication of Raymond's paper and it came from the Brush Creek.

*Syntypes:* Carnegie Museum (nos. 22,292-22,294).

### ***Eoasianites* sp.**

(Plate VII, figs. 1, 2; Plate VIII, fig. 6)

We have six specimens from the Brush Creek limestone of southwestern Pennsylvania that are referable to *Eoasianites*. All are fragments of large septate individuals of 60 mm. or more diameter. Insofar as we can tell, they represent only one species. The whorls are low and broad and are broadly rounded ventrally but narrowly rounded laterally. The umbilicus is broad and deep. Sutures form a large prominently divided ventral lobe and on either side of it a high rounded first lateral saddle which is constricted near mid-height, a deep hastate acuminate first lateral lobe, a rounded asymmetrical second lateral saddle, and a small acuminate lobe on the umbilical shoulder. Although the umbilical walls are broad, the

sutures form no inflections on them. The internal sutures appear to be of the typical gastrioceran type.

*Remarks:* The above-described specimens are similar to *E. jonesi* (Miller and Owen) of the Seminole formation (basal Missouri) of Oklahoma, *E. excelsus* (Meek) of the basal Wabaunsee of Kansas, and possibly *E. globulosus* (Meek and Worthen) of the Pennsylvanian of Kansas and Oklahoma, as well as specimens from the Kansas City formation of Missouri recently described by Miller and Furnish (1940, p. 541, pl. 65, figs. 3-5) and compared with these species. The Conemaugh form differs particularly from equal-sized representatives of *E. jonesi* and *E. excelsus* in that the first lateral lobe of its sutures is relatively broad. No information is available in regard to the sutures of large specimens of *E. globulosus* and the Kansas City form if they exist.

*Occurrence:* Brush Creek limestone near Witmer, Glassmere, Sewickley, Donohoe, and Creighton, Pennsylvania.

*Repository:* State University of Iowa, 3,112 (Pl. VII, figs. 1, 2) and 3,113 (Pl. VIII, fig. 6); and Carnegie Museum (six unfigured specimens).

#### Genus SCHISTOCERAS Hyatt, 1884

Genotype: *Goniatites missouriensis* Miller and Faber

Conch subglobular to subdiscoidal and moderately large. Whorls somewhat depressed, rounded ventrally, slightly flattened laterally, and impressed dorsally. Living chamber appears to be about one revolution in length. Diameter of umbilicus, which becomes relatively smaller during late ontogenetic development, varies from about one-fourth to about one-half diameter of specimen. During adolescence umbilical shoulders are nodose but nodes are lost before or during early maturity. Surface of test at maturity is marked by transverse growth-lines and typically by longitudinal lirae. Growth-lines form a deep rounded ventral sinus, prominent rounded ventro-lateral salients, and shallow lateral sinuses. Sutures consist of a large very prominently bifid ventral lobe, four pairs of pointed-spatulate external lateral lobes, a narrow pointed dorsal lobe, and two pairs of similar internal lateral lobes—altogether each mature suture consists of fourteen lobes. Siphuncle ventral and marginal in position throughout ontogenetic development. At maturity septal necks are entirely prosiphonate and are about one-fourth as long as camerae. Connecting rings cylindrical; they extend through the septal necks and therefore form a continuous tube.

During rather early ontogenetic development the sutures pass through a gastrioceran stage in which each consists of eight lobes. Then the umbilical lobes become lateral in position and a paralegoceran stage is achieved

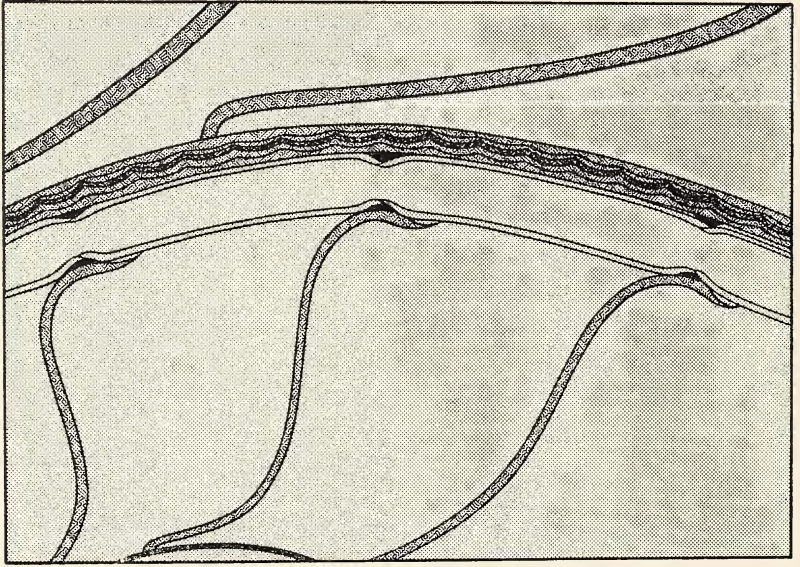


FIG. 3. Median longitudinal section of a portion of a mature whorl of *Schistoceras missouriense* (Miller and Faber) showing the structure of the siphuncle,  $\times 20$ . Based on a specimen (State University of Iowa, 3,119) from the Finis shale (basal Cisco) about 3 miles east of Jacksboro, Texas.

as on each side of the conch a lobe is developed in the umbilical zone. This lobe becomes trifid and evolves into three lobes, the dorsal one of which is internal in position. In some cases the ventral one of these three becomes bifid, but this character is variable and apparently is to be accorded little taxonomic value. The sutures of *Schistoceras* are never comparable to those of *Metalegoceras*; in that genus the umbilical lobe of the gastrioceran stage becomes trifid and evolves into three lobes. In *Texoceras* and other adrianitids both external and internal lateral lobes are added consecutively in the umbilical zone rather than developed from a trifid umbilical lobe. The *Paralegoceras-Schistoceras* stock is one of the most important in the Pennsylvanian, but apparently it became extinct at or near the end of that period.

In spite of the fact that several paleontologists have emphasized that

all of the known representatives of *Schistoceras* are very similar, they have been divided into eleven species and three genera. In collaboration with W. M. Furnish we have assembled a large collection from various horizons and localities, and a direct comparison of specimens has convinced all three of us that only two forms are distinct enough to be recognized as species. One of these, which should be called *S. hildrethi* (Morton), is characterized by a large umbilicus, nodose umbilical shoulders during early maturity, and relatively prominent reticulate ornamentation. In the second species, *S. missouriense* (Miller and Faber), the umbilicus is relatively small during early maturity, the umbilical shoulders are smooth, and the ornamentation of the test is relatively fine and inconspicuous. All of these features are of course gradational, and forms are known that are intermediate between the two species. Furthermore, the two occur at several localities in direct association.

Smith proposed the name *S. hyatti* for the specimen on which the genus is based. However, as Miller and Furnish recently pointed out, that specific name should be suppressed as a synonym of *S. missouriense*, which then becomes the genotype. *Paraschistoceras* and *Metaschistoceras* are to be regarded as synonyms of *Schistoceras*.

The genus *Schistoceras* is now known from the lower Conemaugh of eastern Ohio and western Pennsylvania and the McLeansboro of central Illinois. In the Missouri-Kansas-Oklahoma Mid-Continent region it occurs at numerous horizons and localities ranging in age from the basal Missouri Seminole formation of Oklahoma to the Douglas group of the Virgil series in Kansas. In north-central Texas this genus is known from the upper Strawn, the Canyon, the lower Cisco, and possibly the Wichita; and in west Texas it ranges throughout most of the Gaptank. The specimen from central Asia which in 1931 Miller tentatively placed in this genus almost certainly does not belong here, but one species, *S. uralense* Ruzhencev, is known from the Upper Carboniferous of the southern Urals.

### ***Schistoceras hildrethi* (Morton)**

(Plate VIII, figures 1-3)

1836. *Ammonites Hildrethi* Morton, Am. Jour. Sci. and Arts, vol. 29, pp. 40, 149, pl. 1, fig. 24 [probably not p. 137, pl. 28, figs. 48, 50, 53, 54].
1889. *Goniatites hildrethi* Miller, North American geology and palaeontology . . . , p. 439.
1898. *Agathiceras Hildrethi* Haug, Soc. géol. France Mém. Paléont., no. 18, pp. 33, 105-107, pl. 1, figs. 40a-c.

1903. *Schistoceras hildrethi* Smith, U. S. Geol. Survey Mon. 42, pp. 107-108, pl. 3, figs. 1, 2.
1930. *Schistoceras reticulatum* Miller, Jour. Pal., vol. 4, pp. 403-406, pl. 39, figs. 6-9.
1937. *Schistoceras unicum* Miller and Owen, Jour. Pal., vol. 11, pp. 420-422, pl. 52, figs. 16, 17.
1937. *Paraschistoceras hildrethi* Plummer and Scott, Texas Univ. Bull. 3701, pp. 17, 18, 22, 30, 33, 207, 240, 244, 247, 248, 250-251, 253, 255, 257, 379, 380, 387, 389, 390, pl. 14, figs. 1-14.
1937. *Paraschistoceras reticulatum* Plummer and Scott, Texas Univ. Bull. 3701, pp. 16, 17, 21, 22, 34, 246, 247, 253-255, 380, 382, 387, 388, 394, 399, pl. 14, figs. 15-18.
1937. *Paraschistoceras strawnense* Plummer and Scott, Texas Univ. Bull. 3701, pp. 16, 17, 247, 248-249, 387, pl. 14, figs. 22, 23.
1937. *Paraschistoceras costiferum* Plummer and Scott, Texas Univ. Bull. 3701, pp. 17, 252-253, 255, pl. 14, figs. 19-21.
1940. *Schistoceras hildrethi* Miller and Furnish, Jour. Pal., vol. 14, pp. 539-540 pl. 65, figs. 10, 11.

In 1836 Morton figured several specimens on which he based this species, but from his illustrations we are able to recognize the generic affinities of only one of them (Morton's pl. 1, fig. 24). This one may well be the same individual that Haug later found in a collection which Hildreth, who collected the types, had sent to France. Because of the measurements given by Morton, Haug concluded that he was probably not studying one of the original type specimens, but Morton's measurements elsewhere in the same paper are inconsistent. Furthermore, it is probably significant that Morton's illustrations are of almost precisely the same size as Haug's specimen, that in each case the specimens are stated to be silicified internal molds, and that insofar as it is possible to make comparisons the figures appear to be identical. Since Morton's illustrations are quite inadequate and his specimens are lost, whereas Haug's figures are quite satisfactory, the specimen studied by Haug is regarded as the type of the species.

The available collections from the Conemaugh of southwestern Pennsylvania contain four specimens that appear to be conspecific. Two of these, however, are crushed and therefore their specific affinities are somewhat questionable. The largest of the four, which is septate throughout, shows that the phragmacone attains a diameter of at least 45 mm. Where the specimen represented by figures 1 and 2 on Plate VIII is about 30 mm. in diameter, its conch is about 12 mm. high and about 18 mm. wide, and its umbilicus is some 12 mm. in diameter. The whorls are rather

low and broad. They are broadly rounded ventrally and laterally and are impressed dorsally. The umbilical shoulders are abrupt and are slightly nodose. It is estimated that there are about 25 nodes on each umbilical shoulder of the outer volution of the specimen represented by figures 1 and 2 on Plate VIII. The nodes appear to be somewhat elongate transversely.

The surface of the test is reticulate as it bears rather prominent longitudinal lirae and transverse growth-lines. The growth-lines are sinuous and each forms a rounded ventral sinus and on either side of it a similar ventro-lateral salient and a shallow lateral sinus. The shape of the external sutures is shown by Text figures 4 and 5 A. The ventral lobe is very

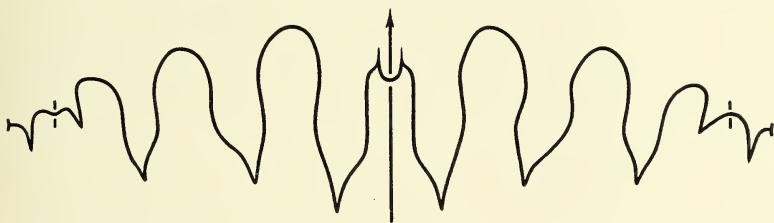


FIG. 4. Suture of *Schistoceras hildrethi* (Morton) at a diameter of about 30 mm.,  $\times$  3. Based on the specimen represented by figures 1 and 2 on Plate VIII, which came from the Brush Creek limestone in the McFetridge quarry near Creighton, Pennsylvania.

prominently bifid and its subdivisions are as large as the first lateral lobe. The first and second lateral saddles are contracted near their mid-height. The first and second lateral lobes are acuminate and are asymmetrical. The third lateral saddle is very asymmetrical. The third lateral lobe is somewhat irregular in its development in that in some cases it is bifid whereas in others it is undivided. In the specimen represented by Text figure 5 A and by figure 3 on Plate VIII, the suture is preserved on only one side of the conch, and the third lateral lobe is bifid there. As shown by Text figure 4, in the specimen represented by figures 1 and 2 on Plate VIII the third lateral lobes are undivided, but there is a small lobe developed in the fourth lateral saddle on the right but not on the left side of the conch. The lobe on the umbilical wall is in all cases narrow and V-shaped.

*Remarks:* In this species the shape of the conch and the nature of the ornamentation and the sutures vary throughout ontogenetic development. During adolescence the umbilicus is relatively large, the umbilical

shoulders are conspicuously nodose, and the surface ornamentation of the test is relatively prominent. These ontogenetic variations, together with differences in preservation, are sufficient to explain most of the characters on which species that we regard as invalid have been based. Without an abundance of material it has been difficult to compare satisfactorily species established for testiferous specimens and those based on internal molds. Even topotypes are not infallible, for the large collections now available show that widely different types occur in direct association. There is, to be sure, more or less gradation between *S. hildrethi* and *S. missouriense*, but the extremes within the group are worthy of specific recognition.

*Occurrence:* The only one of the original type specimens of which we can recognize the generic affinities came from the Cambridge limestone near Cambridge, Ohio—this may be the specimen that was figured by Haug in 1898. We have a congeneric specimen from the same horizon and locality, but it is clearly not conspecific, being referable to *S. missouriense*. In the Conemaugh of southwestern Pennsylvania *S. hildrethi* occurs in the Brush Creek limestone near Creighton (McFetridge Brick Yard quarry) and Glassmere, in the Woods Run limestone at Abers Creek about 8 miles east of Wilkinsburg, and in the Ames limestone in Pittsburgh (Schenley Park)—the specific affinities of the specimens from the last two horizons and localities are somewhat questionable. Elsewhere, conspecific specimens have been found in the McLeansboro of Sangamon County, Illinois; the Muncie Creek member of the Iola formation (Kansas City group) at Kansas City, Missouri; the Iatan limestone of the Pedee group and the Stranger formation of the Douglas group in Douglas County, Kansas; the Seminole and Nellie Bly formations of Tulsa County, Oklahoma; the Nelagoney formation of Osage County, Oklahoma; the upper Strawn of Palo Pinto County, north-central Texas; the Graford formation of Palo Pinto and Wise counties, north-central Texas; the Graham formation (lower Cisco) of Brown, Jack, McCulloch, Stephens, and Young counties, north-central Texas; and the upper Gaptank formation of Brewster County, west Texas.

*Hypotypes:* State University of Iowa, 3,115 (Pl. VIII, figs. 1, 2) and 3,114 (Pl. VIII, fig. 3); and Carnegie Museum (two unfigured specimens of questionable specific affinities).



**Schistoceras missouriense** (Miller and Faber)

(Plate VIII, figures 4, 5)

1884. *Schistoceras* sp. Hyatt, Boston Soc. Nat. Hist. Proc., vol. 22, p. 336.
1892. *Goniatites missouriensis* Miller and Faber, Cincinnati Soc. Nat. Hist. Jour., vol. 14, pp. 164-165, pl. 6, fig. 1.
1896. *Goniatites fullonensis* Miller and Gurley, Illinois State Mus. Nat. Hist. Bull. 11, pp. 39-40, pl. 4, figs. 15-17.
1896. *Paralegoceras iowense* Smith [part], Am. Phil. Soc. Proc., vol. 35, pp. 263, 265.
1898. *Agathiceras Fullonensis* Haug, Soc. géol. France Mém. Paléont., no. 18, p. 33.
1903. *Schistoceras fullonense* Smith, U. S. Geol. Survey Mon. 42, pp. 106-107, pl. 16, figs. 15-17.
1903. *Schistoceras hyatti* Smith, U. S. Geol. Survey Mon. 42, pp. 108-111, pl. 20, figs. 1-8; pl. 21, figs. 10a-13.
1903. *Schistoceras missouriense* Smith, U. S. Geol. Survey Mon. 42, p. 111, pl. 8, fig. 1.
1919. *Schistoceras smithi* Böse, Texas Univ. Bull. 1762, pp. 93-95, pl. 3, figs. 9-16.
1919. *Schistoceras diversecostatum* Böse, Texas Univ. Bull. 1762, pp. 96-99, pl. 4, figs. 1-36.
1921. *Schistoceras hyatti* Plummer and Moore, Texas Univ. Bull. 2132, pp. 145, 146, 149, pl. 22, fig. 10.
1924. *Schistoceras fullonense* Morgan, [Oklahoma] Bur. Geol. Bull. 2, p. 124, pl. 53, figs. 8, 8a.
1929. *Schistoceras diversecostatum* Smith, Am. Jour. Sci. 5th ser., vol. 17, pp. 76-77, figs. B1-B13.
1930. *Schistoceras missouriense* Sayre, Kansas Univ. Sci. Bull., vol. 19, pt. 2, p. 158, pl. 21, figs. 4, 4a.
1930. *Schistoceras smithi* Miller, Jour. Pal., vol. 4, pp. 406-407, pl. 39, figs. 14-16.
1932. *Schistoceras hyatti* Sellards, Texas Univ. Bull. 3232, p. 114.
1937. *Schistoceras missouriense* Plummer and Scott, Texas Univ. Bull. 3701, pp. 17, 18, 30, 33, 201, 202-204, 206, 388, 399, pl. 19, figs. 1-15; pl. 20, fig. 11.
1937. *Schistoceras smithi* Plummer and Scott, Texas Univ. Bull. 3701, pp. 17, 22, 32, 34, 201, 205-206, 303, 387, 388, pl. 18, figs. 1-7; pl. 41, figs. 6-8.
1937. *Schistoceras diversecostatum* Plummer and Scott, Texas Univ. Bull. 3701, pp. 17, 22, 32, 34, 201, 206-207, 251, 255, 389, pl. 20, figs. 1-10.
1937. *Metaschistoceras heilprini* Plummer and Scott, Texas Univ. Bull. 3701, pp. 247, 256-257, 380, pl. 41, figs. 1-5.
1940. *Schistoceras missouriense* Miller and Furnish, Jour. Pal., vol. 14, pp. 540-541, pl. 65, figs. 6-9.

The holotype of this species, which came from the Kansas City group at Kansas City, Missouri, represents only one side of the conch. It is a rather well-preserved internal mold. Small fragments of the reticulate test adhere to the holotype, and conspecific testiferous specimens are known from the Graham formation (lower Cisco) of north-central Texas. Moderate-sized specimens have rather inconspicuous shell ornamentation, but during late maturity rather prominent longitudinal lirae are developed. On large specimens these longitudinal markings are distinctly more prominent than the transverse growth-lines.

The collections that we are studying from the Conemaugh of Pennsylvania contain three representatives of this species, and Plummer and Scott (1937, pl. 41, fig. 8) recently figured a specimen that is probably conspecific. Also, we have an exceptionally well-preserved internal mold from the Cambridge limestone of southeastern Ohio. All three of the available specimens from Pennsylvania are crushed and are none too well

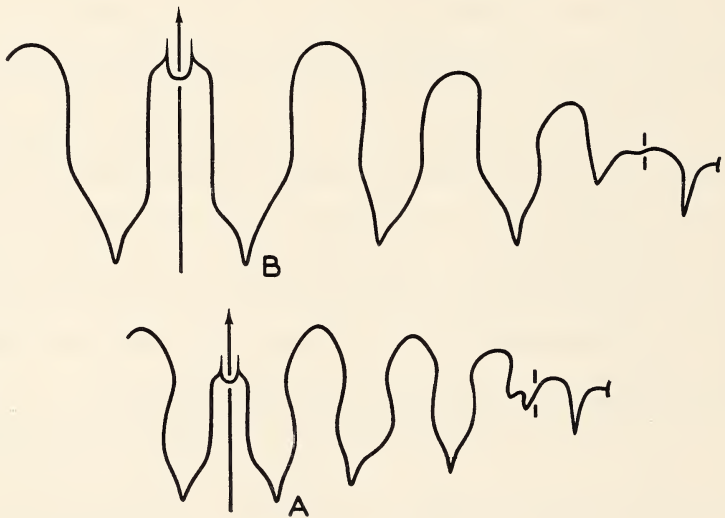


FIG. 5. Sutures of two species of *Schistoceras*.

- A. *S. hildrethi* (Morton) at a diameter of about 25 mm.,  $\times 4$ ; based on the specimen represented by figure 3 on Plate VIII, which came from the Brush Creek limestone near Glassmere, Pennsylvania.
- B. *S. missouriense* (Miller and Faber) at a diameter of about 37 mm.,  $\times 3$ ; based on the specimen represented by figures 4 and 5 on Plate VIII, which came from the Cambridge limestone about 4 miles northeast of New Concord, Ohio.

preserved. They are septate throughout and therefore represent only the phragmacone. All are of the same general size, and they show that the phragmacone attained a diameter of at least 77 mm. Where the diameter of one of these Pennsylvania specimens measures about 65 mm., its umbilicus is only about 13 mm. in diameter; corresponding measurements near the adoral end of the well-preserved Ohio specimen are about 45 mm. and 10 mm., respectively. The outer volution of the conch is flattened laterally, rounded ventrally, and impressed dorsally. The maximum width of the conch is attained at the umbilical shoulders. Near the adoral end of the Ohio specimen mentioned above, the conch is about 22 mm. high and about 24 mm. wide. As all of the Pennsylvania specimens are crushed, corresponding measurements can not be obtained.

Longitudinal lirae are prominent on even the adoral portion of the largest specimen being studied. They are distinctly more prominent there than are the sinuous transverse growth-lines. The shape of the sutures in this species is shown by text figure 5 B, which is based on the Ohio specimen. The sutures of the Pennsylvania specimens are quite similar in all available particulars.

*Remarks:* In general the characters of this species are slightly more advanced than are those of *S. hildrethi*, but all features are not consistent in this respect. In *S. hildrethi* the umbilicus is larger and the umbilical nodes and prominent reticulate ornamentation of the test are retained until a much larger size is attained by the conch. At least insofar as the size of the umbilicus is concerned, the specimen recently figured by Plummer and Scott appears to be more or less intermediate between typical *S. hildrethi* and *S. missouriense*.

*Occurrence:* The holotype of this species came from the Kansas City group at Kansas City, Missouri. The collections that we are studying from the Conemaugh of Pennsylvania contain conspecific specimens from the Brush Creek limestone in brick-yard quarries near Mars and Creighton—Plummer and Scott's specimen came from the same horizon at the latter locality. Also, we have a similar specimen from the Cambridge limestone in an abandoned quarry in the SW $\frac{1}{4}$ , NE $\frac{1}{4}$ , sec. 24, Adams Township, Guernsey County, southeastern Ohio. Other representatives of this species are known from the following horizons and localities: the Winterset, Westerville, and Iola (Muncie Creek member) formations at or near Kansas City, Missouri; the McLeansboro? of Fulton County, Illinois; the LaSalle limestone (McLeansboro) of LaSalle County, Illinois; the Belle City limestone of Seminole County, Oklahoma; the Graford

formation of Wise County, north-central Texas; the Graham formation of Brown, Jack, Stephens, and Young counties, north-central Texas; the Gaptank formation of Brewster and Pecos counties, west Texas; and possibly the Belle Plains formation (Wichita) of Callahan County, north-central Texas.

*Hypotypes*: State University of Iowa, 1,437 (Pl. VIII, figs. 4, 5); and Carnegie Museum (3 specimens).

## REFERENCES

- FLOWER, R. H.  
1939. *Study of the Pseudorthoceratidae*: Palaeontographica Americana, vol. 2, no. 10, pp. 1-215, pls. 1-9.
- FRECH, FRITZ  
1899. *Die Steinkohlenformation*: Lethaea geognostica, Theil 1, Lethaea palaeozoica, Bd. 2, Nr. 2, pp. 257-433, 9 pls., Stuttgart.
- GIRTY, G. H.  
1915. *Fauna of the Wewoka formation of Oklahoma*: U. S. Geol. Survey Bull. 544, pp. 1-353, pls. 1-35.
- MEEK, F. B.  
1872. *Report on the paleontology of eastern Nebraska, with some remarks on the Carboniferous rocks of that district*: Final Rept. U. S. Geol. Survey Nebraska . . . (U. S. 42d Cong., 1st sess., House Ex. Doc. 19), pp. 83-239, pls. 1-11.
- MEEK, F. B., AND WORTHEN, A. H.  
1866. *Descriptions of invertebrates from the Carboniferous system*: Illinois Geol. Survey, vol. 2, pp. 143-411, pls. 14-32.
- MILLER, A. K.  
1931. *Two new genera of Late Paleozoic cephalopods from central Asia*: Am. Jour. Sci., 5th ser., vol. 22, pp. 417-425.
- MILLER, A. K., DUNBAR, C. O., AND CONDRA, G. E.  
1933. *The nautiloid cephalopods of the Pennsylvanian system in the Mid-Continent region*: Nebraska Geol. Survey Bull. 9, 2d ser., pp. 1-240, pls. 1-24.
- MILLER, A. K., AND FURNISH, W. M.  
1940. *Studies of Carboniferous ammonoids*: Jour. Pal., vol. 14, pp. 356-377, 521-543, pls. 45-49, 62-65.
- MILLER, A. K., AND OWEN, J. B.  
1934. *Cherokee nautiloids of the northern Mid-Continent region*: Univ. Iowa Studies Nat. Hist., vol. 16, pp. 185-272, pls. 8-19.  
1939. *An ammonoid fauna from the Lower Pennsylvanian Cherokee formation of Missouri*: Jour. Pal., vol. 13, pp. 141-162, pls. 17-20.
- MILLER, S. A., AND GURLEY, W. F. E.  
1896. *New species of Palaeozoic invertebrates from Illinois and other states*: Illinois State Mus. Nat. Hist. Bull. 11, pp. 1-50, pls. 1-5.

MORGAN, G. D.

1924. *Geology of the Stonewall quadrangle, Oklahoma*: [Oklahoma] Bur. Geol. Bull. 2, pp. 1-248, pls. 1-53.

PLUMMER, F. B., AND SCOTT, GAYLE.

1937. *Upper Paleozoic ammonites in Texas*: Univ. Texas Bull. 3701, pp. 1-516, pls. 1-41.

RAYMOND, P. E.

1909. *Some sections of the Conemaugh series between Pittsburgh and Latrobe, Pennsylvania*: Carnegie Museum Annals, vol. 5, pp. 166-177.

1910. *A preliminary list of the fauna of the Allegheny and Conemaugh series in western Pennsylvania*: Carnegie Museum Annals, vol. 7, pp. 144-158.

1911. *A preliminary list of the fauna of the Allegheny and Conemaugh series in western Pennsylvania*: Pennsylvania Topog. and Geol. Survey Comm., Rept. 1908-1910, pp. 81-98, pls. 3-6.

ROGERS, H. D.

1858. *The geology of Pennsylvania, a government survey*, vol. 1, pp. 1-586; vol. 2, pp. 1-1046, pls. 1-23, Philadelphia.

SMITH, J. P.

1903. *The Carboniferous ammonoids of America*: U. S. Geol. Survey Mon. 42, pp. 1-211, pls. 1-29.

STURGEON, M. T.

1938. *A specimen of Solenochilus peculiare from the Pottsville series of Ohio*: Ohio Jour. Sci., vol. 38, pp. 277-279, pl. 1.

TEICHERT, CURT.

1933. *Der Bau der actinoceroiden Cephalopoden*: Palaeontographica, Bd. 78, Abt. A, pp. 1-230, Taf. 8-15.

## EXPLANATION OF PLATE I

All figures in natural size unless indicated otherwise.

- FIGS. 1-5. *Pseudorthoceras knoxense* (McChesney)
1. A moderately large specimen, representing part of the phragmacone; from the Brush Creek limestone near Creighton, Pennsylvania, (C. M. 22,287).
  2. A smaller specimen, the adoral end of which is crushed; from the same formation in Harvy quarry, Glassmere, Pennsylvania, (C. M. 22,285).
  3. The extreme adapical portion of the conch; from the same formation near Donohoe, Pennsylvania,  $\times 4$  (C. M. 22,289).
  4. A longitudinal section showing the siphuncle and the cameral deposits; from the same formation at the Twin Echo Boy Scout camp near Ligonier, Pennsylvania,  $\times 4$  (C. M. 22,286).
  5. An internal mold showing the sutures; from the same horizon and locality as the preceding (C. M. 22,288).
- FIGS. 6, 7. *Mooreoceras normale* Miller, Dunbar, and Condra.
- Septal and dorsal views of a portion of a phragmacone; from the Brush Creek limestone near Creighton, Pennsylvania (C. M. 22,297).
- FIGS. 8-10. *Metacoceras perelegans* Girty.
- 8, 9. Two views of an early mature portion of the conch; from the Brush Creek limestone near Creighton, Pennsylvania (C. M. 22, 295).
  10. A distorted adolescent specimen; from the Pine Creek limestone near Witmer, Pennsylvania (C. M. 22,296).
- FIGS. 11-13. *Liroceras* spp.
- 11, 12. Two views of an internal mold of the adapical part of the living chamber; from the Vanport limestone near Wampum, Pennsylvania (C. M. 22,298).
  13. Ventral view of a specimen representing part of the phragmacone and the living chamber; from the Brush Creek limestone near Glassmere, Pennsylvania,  $\times 1\frac{1}{2}$ .
- FIGS. 14, 15. *Ephippioceras ferratum* (Cox).
- Lateral and ventral views of a typical specimen from the Brush Creek limestone at Creighton, Pennsylvania.
- FIG. 16. *Megaglossoceras* sp.
- Ventral view of a fragment of an internal mold from the Brush Creek limestone at Witmer, Pennsylvania.



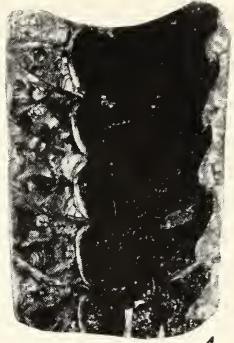
1



2



3



4



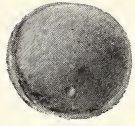
8



9



5



6



7



10



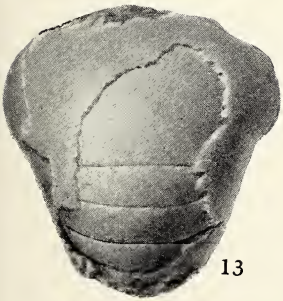
11



14



15



13



12



16

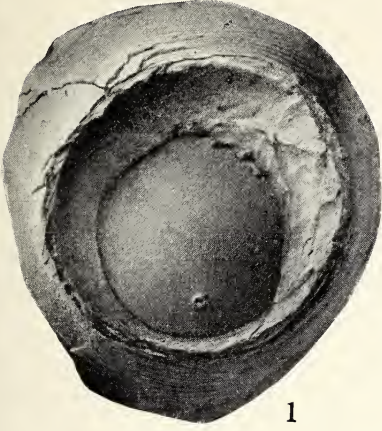






## EXPLANATION OF PLATE II

- FIGS. 1-3. *Poterioceras curtum* (Meek and Worthen).  
1, 2. Apical and ventro-lateral views of a testiferous specimen from the Eudora shale northeast of Copan, Oklahoma,  $\times \frac{3}{4}$ .  
3. A somewhat crushed testiferous specimen from the Brush Creek limestone, Glassmere, Pennsylvania,  $\times \frac{3}{4}$  (C. M. 22,291).
- FIG. 4. *Poterioceras subellipticum*, sp. nov.  
Lateral view of the holotype, which came from the Wyandotte limestone northeast of Louisville, Nebraska,  $\times \frac{3}{4}$ . (See Plate IV for a dorsal view of this specimen.)



1



2



3



4





## EXPLANATION OF PLATE III

All figures in natural size.

FIGS. 1-5. *Metacoceras cornutum* Girty.

1, 2. Ventral and lateral views of a large, essentially complete, internal mold from the Brush Creek limestone near Glassmere, Pennsylvania.

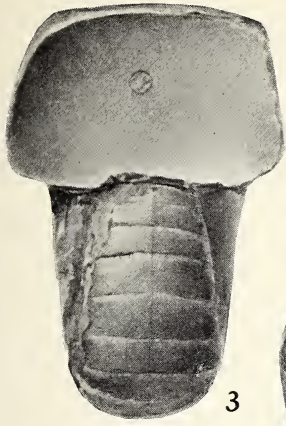
3. Ventral view of the phragmacone of the same specimen.

4, 5. Two views of an adolescent portion of a phragmacone from the same horizon and locality.

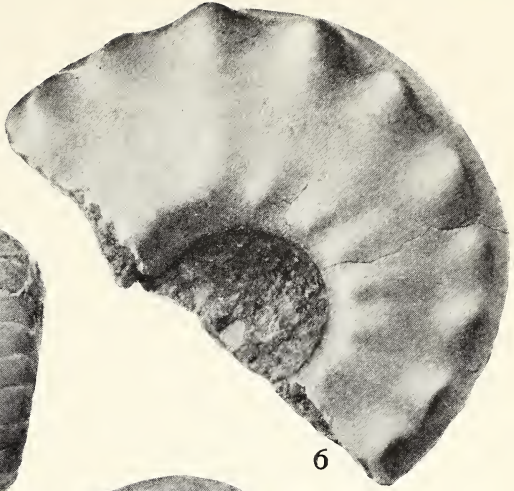
FIGS. 6-8. *Metacoceras perelegans* Girty.

6. Lateral view of a large mature testiferous specimen from the Brush Creek limestone near Creighton, Pennsylvania.

7, 8. Two views of an adolescent portion of the conch from the same horizon near Glassmere, Pennsylvania. The specific affinities of this specimen are somewhat questionable.



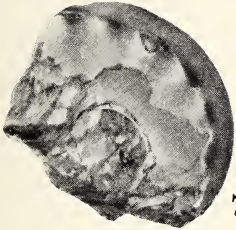
3



6



4



7



5



8



1



2







## EXPLANATION OF PLATE IV

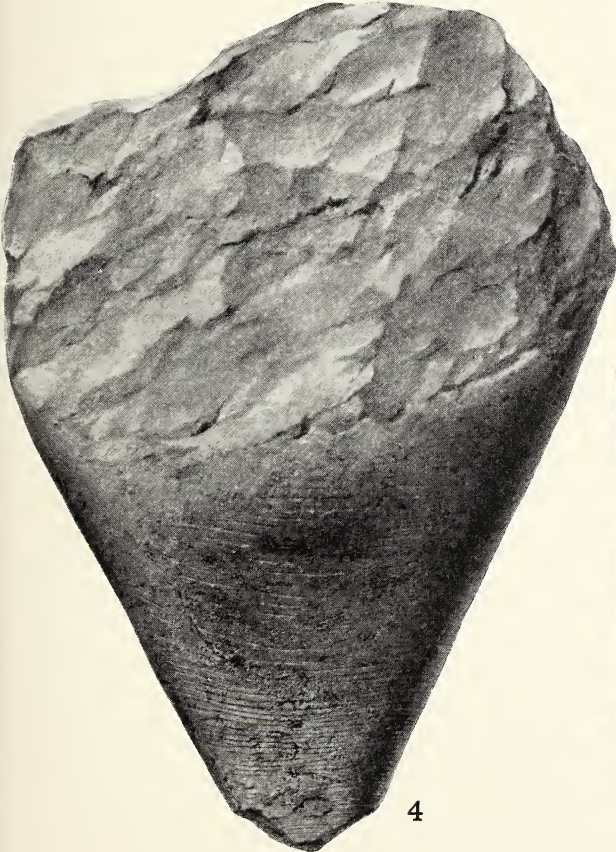
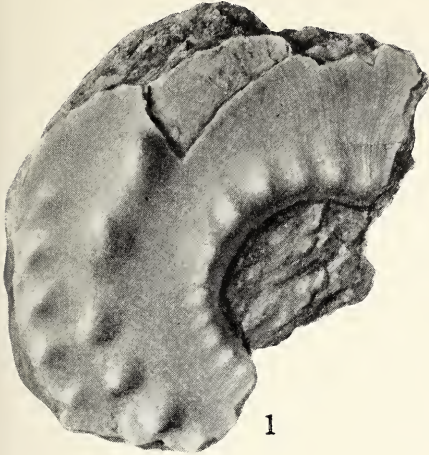
All figures in natural size unless indicated otherwise.

FIGS. 1-3. *Tainoceras monilifer* Miller, Dunbar, and Condra.

Three testiferous specimens, all of which are crushed and fragmentary; from the Ames limestone near Pitcairn, Pennsylvania. (Fig. 1, C. M., no. 10,434; fig. 2, C. M., no. 22,299). The specimen that was illustrated in 1910 and 1911 by Raymond (C. M. 149) is shown in figure 3.

FIG. 4. *Poterioceras subellipticum*, sp. nov.

Dorsal view of the holotype, which came from the Wyandotte limestone northeast of Louisville, Nebraska,  $\times \frac{3}{4}$ . (See Plate II for a lateral view of this specimen.)







## EXPLANATION OF PLATE V

All figures in natural size.

- FIG. 1. *Poterioceras curtum* (Meek and Worthen).  
Apical view of a small partially testiferous specimen from the  
Brush Creek limestone near Glassmere, Pennsylvania.
- FIGS. 2-4. *Domatoceras* spp.  
Three testiferous specimens from the Brush Creek limestone  
near Glassmere (figs. 2, and 3) and Creighton (fig. 4), Pennsylvania.



1

2



3



4







## EXPLANATION OF PLATE VI

All figures in natural size.

- FIGS. 1, 2. *Solenochilus brammeri* Miller, Dunbar, and Condra (?).  
Ventral and lateral views of a mature specimen, from the Brush  
Creek limestone near Hites, Pennsylvania.



2



1





## EXPLANATION OF PLATE VII

All figures in natural size.

FIGS. 1, 2. *Eoasianites* sp.

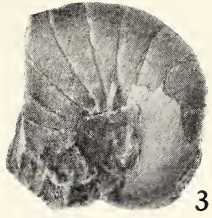
Ventral and lateral views of a fragment of a large septate specimen from the Brush Creek limestone near Witmer, Pennsylvania.

FIGS. 3-6. *Solenochilus brammeri* Miller, Dunbar, and Condra (?).

Three internal molds, two of which (figs. 5 and 6) are crushed; from the Brush Creek limestone near Murrysville (figs. 3 and 4), and Glassmere (figs. 5 and 6, C. M. 22,290) Pennsylvania.



1



3



4



2



5



6



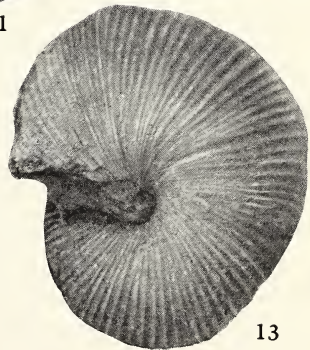
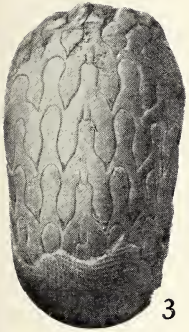




## EXPLANATION OF PLATE VIII

All figures in natural size unless indicated otherwise.

- FIGS. 1-3. *Schistoceras hildrethi* (Morton).  
1, 2. Lateral and ventral views of an internal mold from the Brush Creek limestone in McFetridge Brick Yard quarry near Creighton, Pennsylvania.  
3. Ventral view of a partially testiferous specimen from the Brush Creek limestone near Glassmere, Pennsylvania,  $\times 1\frac{1}{2}$ .
- FIGS. 4, 5. *Schistoceras missouriense* (Miller and Faber).  
Two views of a silicified specimen from the Cambridge limestone about 4 miles northeast of New Concord, Ohio.
- FIG. 6. *Eoasianites* sp.  
Ventral view of a well-preserved but incomplete specimen from the Brush Creek limestone near Glassmere, Pennsylvania.
- FIGS. 7-13. *Pennoceras seamani*, sp. nov.  
7-9. Three views of the best of the syntypes, from the Brush Creek limestone near Creighton, Pennsylvania,  $\times 3$  (C. M. 22,292).  
10, 11. Ventral and lateral views of the largest of the syntypes, which is crushed and flattened laterally, from the Brush Creek limestone in McFetridge Brick Yard quarry near Creighton, Pennsylvania (C. M. 22,294).  
12, 13. Two views of the third syntype, from the Brush Creek limestone near Witmer, Pennsylvania,  $\times 3$  (C. M. 22,293).





Pittsburgh, Carnegie Museum  
Annals

ART. VI. DESCRIPTIONS OF TWO NEW SALAMANDERS  
FROM PENINSULAR FLORIDA

BY M. GRAHAM NETTING, CARNEGIE MUSEUM  
AND  
COLEMAN J. GOIN, UNIVERSITY OF FLORIDA

(ONE PLATE)



During the course of our studies of Florida amphibians it became apparent that the peninsular populations of two salamanders differ trenchantly from the respective populations to the north. It was our intention to include the descriptions of these apparently undescribed forms in our general report upon the amphibians of Florida, but Dr. Sherman C. Bishop encouraged us to describe the new forms without delay, so that they might be included in his forthcoming salamander manual.

One of the new subspecies is a *Pseudotriton* of the *montanus* group, for which we propose the name

***Pseudotriton montanus floridanus***, new subspecies

(Plate I, figure 5)

RUSTY MUD SALAMANDER

*Pseudotriton montanus flavissimus* Dunn (part), 1926: 291-293.

(measurements; records)

Carr, 1940: 49-50

(records; habits and habitat)

*Holotype*.—Carnegie Museum, no. 16850, adult male, collected on April 19, 1936, by A. F. Carr, Jr.

*Allotype*.—Department of Biology, University of Florida, no. 598, adult female, collected April 10, 1936, at the type locality.

*Type locality*.—A seepage area along "C" Creek, on the University of Florida campus, in Gainesville, Alachua County, Florida.

*Paratypes*.—Thirteen, all from Florida, as follows: CM 16851-53,<sup>1</sup> from

<sup>1</sup> *Abbreviations*.—The following abbreviations have been used in the listing of paratypes, and in referring to particular specimens: AMNH, American Museum of Natural History; CFW, private collection of Charles F. Walker; CJG, private collection of Coleman J. Goin; CM, Carnegie Museum; DBUF, Department of Biology, University of Florida; FMNH, Field Museum of Natural History; MCZ, Museum of Comparative Zoölogy; UMMZ, University of Michigan, Museum of Zoology; and USNM, United States National Museum.

JUN 19 1942

"C" Creek, University of Florida campus, Gainesville, Alachua County; DBUF 641, from a swamp near the University of Florida campus, Gainesville; DBUF 692, from Hogtown Creek near Gainesville; DBUF 599, from near Gainesville; CM 20129 and FMNH 35419, from 4 miles east of Gainesville; UMMZ 56646 and UMMZ 86419(2), from Alachua County; UMMZ 68855, from Marianna, Jackson County; and USNM 22819, from Chuluota, Seminole County.

*Diagnosis.*—A slender *Pseudotriton*, of the *montanus* group, with a very short, bluntly rounded snout; costal grooves 18 (rarely 17); costal folds between appressed toes 7-9 in adults; a series of short, horizontal, pinkish-buff bars on each side of the body, beginning just above the arm, continuing backward over the legs, and fading out on the proximal third of the tail; no round, black spots on the upper surfaces of the head, trunk, or limbs (such spots may occur on dorsal surface of the tail); a few to many, small, scattered, roughly circular dark spots on lower sides, throat, belly, and underside of tail. The new race differs structurally from *Pseudotriton montanus flavissimus* Hallowell in having a shorter, blunter snout, one or two more costal grooves, and a greater number of costal folds between appressed toes. In coloration it differs from *flavissimus* in lacking round, black dots on the dorsum anteriorly, in having pinkish-buff dorsolateral bars, and in having a considerably darker dorsal ground color.

*Description of holotype.*—Skin smooth and lustrous on dorsum, heavily wrinkled on sides; no large glands present. A few large mucous pores beginning in front of eye; a row extending backward over eye; another curving beneath eye, then forking into a short row that curves upward and backward behind eye, and a short row that undulates downward and backward above angle of jaw. A group of pores beginning anteriorly on each side of chin, diverging backward in a zigzag row, becoming more numerous anterior to gular fold, and passing vertically upward on side of head.

Head (as seen from above) rectangular posteriorly, increasing slightly in width to just behind eyes where it begins to taper to short, bluntly rounded snout; (as seen from side) truncate, flat beneath, slightly rounded anteriorly, and slightly arched above, with a depression between eyes; upper jaw projecting slightly beyond lower. Outline of mouth straight anteriorly, curving slightly downward posteriorly; angle of jaw slightly back of hind angle of eye. No canthus rostralis. Nostrils small, crescentic slits, placed antero-laterally, just visible from above. Internarial distance three-fourths that between anterior points of upper eyelids.

Nasolabial grooves without a tubercle at lower ends. Eye moderate in size, length of upper eyelid slightly longer than the distance from its anterior corner to tip of snout; both eyelids fitting under fold of skin behind. A slightly undulant, horizontal groove from eye to rear of head, where it forks, a weak branch extending horizontally to, and a strong branch curving downward to, diagonal gular fold, thus forming a narrow triangular prominence; a weak vertical groove crossing horizontal groove behind angle of jaw, followed by another short, weak, vertical groove. Gular fold curving forward ventrally, slanting backward on sides to horizontal groove, then extending vertically upward as a mere wrinkle. Head width 5.7 times in body length; head length 4.9 times in body length.

Body slender for a *Pseudotriton*, almost circular in cross-section, only slightly depressed, with little or no constriction at neck, no mid-dorsal groove, a shallow mid-ventral depression. Costal grooves 18, including an indistinct axial, extending vertically to dorsum but not reaching median line, some connecting faintly across abdomen. Costal folds between appressed toes 9. Vent a short, longitudinal slit; internal lips covered with a mass of papillae anteriorly.

Tail shorter than head-body, 1.4 times in snout-to-vent length; not constricted at base; nearly square, with rounded corners (in cross-section at base), becoming gradually compressed to flattened tip. Dorsal surface rounded anteriorly, then rising to a low keel that changes insensibly to a low, fleshy fin on terminal half. Ventral surface flat anteriorly and developing a minute keel and fin on terminal half.

Forelimbs stout and short in length. Fingers four, short, slightly tapering, rounded at tips; not webbed but joined at bases; 3-2-4-1 in order of decreasing length. No metacarpal tubercles present.

Hindlimbs stout and short in length. Toes five, short, slightly tapering, rounded at tips; minutely webbed and joined at bases; 3-4-2-5-1 in order of decreasing length, third and fourth nearly equal. No metatarsal tubercles present.

Tongue nearly circular, free all around, protrusible. Premaxillary-maxillary teeth uniform, short, sharply pointed; in a single, continuous series (of 57 teeth, counting spaces) ending opposite posterior end of groove from naris. Mandibular teeth uniform, short, sharply pointed; in a single, continuous series (26 on right side only) ending below rearmost maxillary teeth. Vomeroparasphenoid teeth short, sharply pointed, arranged in two continuous series beginning behind center of naris, each curving inward toward the median line, extending backward, parallel to

its fellow series, but separated from this by half the width of a naris, becoming a double row and diverging abruptly from its fellow series at a point on a line with the rear margin of orbit; the teeth in each series becoming more numerous posteriorly to form an elongate patch, the individual teeth of which are arranged in short, diagonal rows of five or six each. Internal nares moderate, oval, with their longest diameters transverse, drained by a deep groove, curving outward and backward.

*Coloration.*—Ground color of dorsum dull reddish-brown, somewhat mottled with indistinct darker areas and a few small, irregular, light pinkish spots, but without any round dark spots. Dorsal surface of tail dull reddish-brown, with small, circular, scattered black spots. Upper portions of sides mottled with streaks of dorsal ground color, with even more numerous short, staggered, streaks of pinkish-buff, and with a very few irregular, indistinct blackish spots. The entire venter and lower halves of sides on trunk and tail buffy-cream, sparsely spotted with small, irregular blackish spots; a larger number of spots on sides, chiefly along a line connecting upper insertions of limbs, and along a line connecting lower insertions of limbs; numerous, scattered spots on sides of tail. Venter with but 6 brownish-black spots on throat, 6 between forelimbs, only 5 on central portion of belly, somewhat more numerous, but well-spaced, on underside of tail. Limbs uniform brown above. Head uniform dark brown, without any light or dark spotting, and without the faintest suggestion of a light line from eye to naris; outer portions of upper and lower eyelids pale; a dark gray band around anterior edge of lower lip.

*Measurements* (in millimeters).—Head width, 9; head length, 10.5; forelimb, 9.8; hindlimb, 11.6; body length, 51.5; tail length, 45; total length, 107.

*Description of allotype.*—Department of Biology, University of Florida, no. 598, adult female, collected at the type locality, differs structurally from the holotype as follows: head, sub-rectangular posteriorly; costal grooves, 17; costal folds between appressed toes, 7.5; lining of vent grooved vertically, not papillate; fleshy dorsal fin on distal two-thirds of tail; fingers slightly webbed; and vomero-parasphenoid series of teeth beginning behind outer border of naris. In coloration, the allotype differs in having the upper surfaces of the head, tail, and limbs gray-brown; the center of the back unicolor dull reddish-brown; and the entire venter and lower halves of sides thickly spotted with small, irregular brownish spots. The measurements and proportions of the allotype are: head width, 8.1; head length, 10.5; forelimb, 9.5; hindlimb, 11.0; body length, 51; tail



length, 36.5; total length, 98; head width 6.3 times in body length; head length 4.9 times in body length; and tail length 1.7 times in snout-to-vent length.

*Description of larva.*—Department of Biology, University of Florida, no. 599, from near Gainesville, has: costal grooves, 18; costal folds between appressed toes, 6; dorsal tail fin beginning above hind legs; and ventral tail fin on distal two-thirds of tail. The larva is much lighter in coloration than are adults, but its upper sides are sufficiently streaked to make identification easy. In detail, it has the upper surfaces of the trunk and tail brown, heavily mottled with small, irregular, buffy areas; the upper sides with short streaks of cream; the lower sides lightly streaked with brown; the sides of the tail creamy, with narrow brown reticulations; and the throat and belly immaculate. The measurements and proportions of the larva are: head width, 7.2; head length, 8.5; forelimb, 7; hindlimb, 9.5; body length, 32.5; tail length, 33; total length, 74; head width 4.5 in body length; head length 3.8 in body length; and tail 1.2 in snout-to-vent length.

*Variation in paratypes.*—The paratypes exhibit only minor variations in structure and pattern. The three largest males (holotype included) range in total length from 97-107 mm; in tail length from 37-45 mm; in snout-to-vent length from 60-62 mm; in head length from 10-10.5 mm; and in head width from 8.3-9 mm. These specimens have tail length in snout-to-vent length ratios of 1.4-1.6; head length in trunk length ratios of 4.9-5.2; and head width in trunk length ratios of 5.7-6. The largest female has a total length of 118 mm, a tail length of 47.5, and a snout-to-vent length of 70.5, but this specimen has a damaged head. The three largest females in good condition vary in total length from 91.5-98 mm; in tail length from 36-41 mm; in snout-to-vent length from 50.5-61.5; in head length from 9-10.5; and in head width from 6.9-8.1. The ratios for these females are: tail length in snout-to-vent length, 1.2-1.7; head length in trunk length, 4.6-4.9; and head width in trunk length, 6-6.3. In the single larva, and in a number of recently transformed specimens, the trunk length is only a little greater than the tail length, whereas in fully adult specimens the trunk is usually considerably longer than the tail. This difference in proportion may be the result of a more rapid growth rate in the trunk, or it may be due to the greater frequency of tail injury in large specimens. *Pseudotriton* and *Gyrinophilus* seem especially susceptible to accidental caudal amputation; if only the tip of the tail has been lost, superficial evidence of the injury is often wanting. Total

length measurements are, therefore, far less dependable in these genera than in many others; and, in series that are too small to offer statistically significant figures, statements about their growth differentials can scarcely be more than guesses.

The allotype has 17 costal grooves; the remaining specimens have 18 by maximum count; *i.e.*, axial counted even though indistinct, and all forks of last complete groove counted. Small specimens have 5.5-8 costal folds between appressed toes; mature specimens, 7-9.

Each of the paratypes exhibits the characteristic light pinkish or buffy lateral bars (or streaks); these are plainly visible on every specimen, although they vary in contrastiveness according to the darkness of the surrounding ground color. The bars are usually present only along the upper halves of the sides, but many of the specimens have flecks of the same color on the dorsum. Most of the specimens have the sides of the body and tail sprinkled with numerous dots, varying from brown to blackish, which apparently become darker and more circular with age. In the larva, and in three recently transformed specimens, the lower sides of the body and tail are marked with light brown, in a striated or vermiculated pattern, but the pigment is not gathered into circular dots.

In dorsal color, the paratypes range from almost black in CM 20129 (which may have been abnormally darkened by the type of preservation) to dark gray-brown, reddish-brown, or light reddish-tan; the latter shade occurs only in a subadult female (DBUF 641). All of the specimens, with the exception of the last, are considerably darker above than are specimens of *flavissimus* from Mississippi. No discrete black dots are visible on the upper surface of the body in front of the hind legs, but in the larger members of the series such spots do occur from the pelvic region, or the base of the tail, to the end of the tail. The dots may actually be present in some specimens, but, if so, they are obscured by the dark dorsal ground color and are not apparent, following preservation. The dorsum of *floridanus* is characteristically *dark* reddish-brown or *dark* gray-brown without black dots, but it may be either unicolor, or mottled with flecks of pinkish or buff; specimens of Gulf Coast *flavissimus*, on the other hand, have a *light* reddish-brown ground color, upon which black dots are invariably present and distinct. We have seen only a few Atlantic Coast examples of *flavissimus*; these are spotted like Alabama and Mississippi specimens, but differ in having grayer and more clouded dorsa.

The only *floridanus* with an immaculate belly is the larva (DBUF 599).

An 88-mm female (CM 16851) has a few brown spots on the chin, about four in the pectoral region, and the remainder of the belly immaculate, except for a few extremely tiny dots. The remaining specimens all exhibit a considerable number of small, irregularly shaped, roughly circular brown spots, which are well separated, except in a 98-mm female (DBUF 598), in which the spots are more numerous, some even confluent. All specimens have the ventral surface of the tail spotted. The edge of the lower lip is dark brown or dark gray in all specimens, this border being broadest anteriorly; but in no instance is it as striking as in some forms of the *ruber* group.

*Secondary sex characters.*—The only observed external sexual dimorphism in *floridanus* is the greater size attained by females. The largest female examined by us measured 118 mm in total length, and the largest male, 107 mm.

*Life history.*—Extremely little is known of the life history of *floridanus*. The allotype, which was collected on April 10, contains numerous large eggs, so *floridanus* may be presumed to lay in April, at least. Two recently transformed specimens (CM 16852-53), with gill stubs still evident, have snout-to-vent measurements of 42.5 and 38 mm, and the first of these, which has a complete tail, measures 74 mm in total length. A large larva (DBUF 599) measures 41 mm in snout-to-vent length, and 74 mm in total length. The measurements of these three specimens indicate that *floridanus* transforms, in the Gainesville area at least, at a snout-to-vent length of 38-43 mm and a total length of about 74 mm. The only reference to enemies of the form is that of Carr (1940: 50), "A large female was disgorged by a gartersnake (*T. s. sirtalis*)."

*Habitat.*—The preferred habitat of *floridanus* appears to be small, shallow streams that flow through hardwood hammocks, or areas of mixed forest. The majority of the fifteen known specimens of *floridanus* were taken in streams of this character in and near Gainesville, and Carr (1940: 50) states that the specimens he collected along "C" Creek, on the University of Florida campus, were taken, "in mucky seepage areas just at the point of contact between the leaf-mold and the white sand beneath, and usually among begonia roots." Carr (*loc. cit.*) also reports finding a 22-mm larva "in the sandy bottom of a rill draining a seepage area," and he mentions that a specimen of *Thamnophis sirtalis sirtalis*, which later disgorged a large female *floridanus* (DBUF 692), "was emerging from a begonia patch when collected." The only additional habitat information, on the specimens that we have seen, accompanies CM 20129, which

was collected under a log, near the edge of a muddy pond in a hardwood hammock, 4 miles east of Gainesville.

*Distribution.*—We have seen only fifteen specimens of *floridanus*, all from Florida. Thirteen of these were collected in Alachua County; one (USNM 22819) was collected at Chuluota, Seminole County; and the final specimen (UMMZ 68855) was taken at Marianna, Jackson County. We have not seen the specimen (AMNH 6383—now missing) from Valdosta, Lowndes County, Georgia, listed by Dunn (1926: 293). This specimen is reported to have 18 costal grooves, and should, therefore, be either *floridanus*, or an intergrade between *floridanus* and *flavissimus*. The only specimens which we have seen that appear to be *floridanus* × *flavissimus* intergrades are two (USNM 11961) from Milton, Santa Rosa County, Florida. These specimens agree with *floridanus* in having 18 costal grooves, but they lack distinct light streaks on the sides, they are well sprinkled with small brown dots on the dorsum, and their dorsal ground color is lighter than in most *floridanus*. Specimens of *flavissimus* from Mobile, Alabama, and Biloxi, Mississippi, have the lower costal groove count characteristic of this race and do not show *floridanus* tendencies in coloration or pattern. It appears, therefore, that *floridanus* ranges from about the Georgia-Florida boundary, southward to Seminole County, Florida, and westward to Jackson County, Florida. Intergradation between *floridanus* and *flavissimus* occurs in the area between Jackson County, Florida, and Mobile County, Alabama, and specimens from Santa Rosa County, Florida, appear to be veritable intergrades. On the Atlantic Coastal Plain, intergradation between *flavissimus* and *floridanus* is to be expected somewhere between Alachua County, Florida, and Liberty County, Georgia (the type locality of *flavissimus*).

We have examined the specimen from Indian Key, Monroe County, Florida, listed by Cope (1889: 181) as *Spelerpes ruber ruber*, since Dunn suggested (*loc. cit.*) that this might prove to be a specimen of *flavissimus*. The specimen (USNM 11583) is in a badly shriveled condition which makes definite determination hazardous, but it is unquestionably a member of the *ruber* group. This fact casts considerable doubt upon the validity of the locality data, for *Pseudotriton ruber vioscai* appears to be confined, in Florida, to the western panhandle. Furthermore, in spite of its state of preservation, the discernible pattern of the specimen is reminiscent of a more northern form of *ruber* than *vioscai*.

The other new salamander is a peninsular Florida race of *Pseudobranchus striatus*, for which we propose the name

***Pseudobranchus striatus axanthus*<sup>2</sup>**, new subspecies

(Plate I, figures 1-2)

NARROW-STRIPED SIREN

- Pseudobranchus striatus* Cope, 1878: 64 (record)  
 Cope (part), 1889: 230-232 (record)  
 Brimley, 1910: 10 (record)  
 Fowler & Dunn, 1917: 7 (record)  
 Dury, 1932: 27 (record)  
 Van Hyning, 1932: 37 (record; enemy)  
 Van Hyning, 1933: 3 (record; habitat; abundance)  
 Carr, 1940: 52 & 78 (records; habits & habitat)  
*Pseudobranchus* Noble, 1927: 42 (eggs)  
 Noble & Richards, 1932: 14-18, fig. 5 (record; induced egg-laying).

*Type*.—Carnegie Museum, no. 20339. An adult female, collected on February 9, 1940, by Coleman J. Goin.

*Type locality*.—Eastern edge of Payne's Prairie, where Prairie Creek enters the River Styx, about five miles southeast of Gainesville, Alachua County, Florida.

*Paratypes*.—Two hundred and ninety-seven, all from Alachua County, Florida, as follows: CM 20130 (45), CM 20131 (21), CJG 452 (26), CFW 704-6, CFW 707 (29), from eastern edge of Payne's Prairie, where Prairie Creek enters the River Styx; CM 6171-72, CM 9399 (17), CM 9511-17, CM 20132, DBUF 1159 (27), FMNH 25007, MCZ 23735-44 (+2), UMMZ 77150 (6), UMMZ 79594 (3), from Payne's Prairie; AMNH 23156, AMNH 32055-67, AMNH 32150-55, AMNH 32755, AMNH 32757-72, AMNH 32899-901, AMNH 32902 (7), AMNH 34244-45, AMNH 35840, AMNH 37151 (11), AMNH 37508, AMNH 37582-83, AMNH 38001-06, AMNH 38025-31, CM 10998-99, UMMZ 84470 (3), USNM 67352-53, USNM 92566, from Gainesville; USNM 107288-94, from Newman's Lake; CM 12175-76 and DBUF 1142 (3), from Lochloosa Lake.

*Diagnosis*.—A slender, very elongate *Pseudobranchus*, with a truncate head; costal grooves 34-37 (usually 35); gray ground color, with a narrow, pale gray lateral stripe, a broken, indistinct ventrolateral stripe; and a maximum length of 210 mm. It differs from *P. s. striatus* (Le Conte) in having the head bluntly rounded, rather than acute in outline, as seen

<sup>2</sup> Gr. *a*, without, + *xanthus*, yellow.

from above; in having, on the average, one more costal groove; and in attaining a greater length. In coloration, *axanthus* differs from *striatus* in having a gray, rather than a brown, ground color; both lateral and ventrolateral light stripes narrow and pale gray, rather than broad and yellow buff; a uniform gray venter without yellow spots; and much less distinct head stripes.

*Description of type.*—Skin generally smooth in appearance, but head thickly pocked with distinct pits of variable size, and body sprinkled with smaller pits, visible under magnification; no large glands present. Two parallel rows of large mucous pores on each side: a dorsolateral row, beginning on side of head anterior to gills, extending backward above lateral stripe, and breaking up into a few, irregularly placed linear groups on distal half of tail; and a lateral row, beginning behind forelimb, extending along upper edge of indistinct ventrolateral stripe, and terminating above vent. Individual pores well spaced at anterior end of upper row, thereafter grouped in short, sunken lines of from 3 to 5 almost tangent pores, each line usually occurring on a costal fold, but occasionally straddling a costal groove; pores in lower row similarly grouped, but the lines slightly shorter, and centered more consistently on costal folds. Sculpturing on head consisting of shallow depressions, rather than definite grooves, as follows: a depression from anterior upper border of eye curving forward, then inward and backward to median depression; another from upper border of eye extending diagonally backward and inward toward, but not reaching, median depression; another from upper posterior border of eye, paralleling the preceding; a median longitudinal depression, beginning as a narrowing between the eyes of the flattened anterior portion of the head, and continuing longitudinally backward until it merges with the narrower, and more distinct, mid-dorsal groove at the back of the head; and an undulating, transverse depression, scalloped across top of head behind parietal swellings, and becoming indistinct on each side.

Head elongate, of almost uniform width to eyes, where it begins to taper slightly to a bluntly rounded snout; a noticeable swelling on each parietal, produced by large jaw muscles. Head bluntly acute in outline, as seen from side; profile of top straight to end of parietal swellings, followed by a depression, and then by a low arch passing above gills to dorsum of trunk. Mouth extremely small, ventral in position, counter-sunk, and stump-shaped in outline, with the inward curving arc, on each side, ending posteriorly slightly in front of a line dropped from anterior border of eye. Outline of upper jaw convex, as seen from side, due to pendulous upper

lip; upper jaw projecting beyond lower. No canthus rostralis. Loreal region convex. Nostril an elongate, longitudinal slit, ventrolateral in position, its anterior corner on a line with anterior point of upper lip, not visible from above. Internarial distance (ventrally) twice diameter of eye. Eye small, not protuberant, without eyelids, but completely covered with a thin membrane, its diameter slightly less than its distance from posterior corner of nostril. Interorbital distance about 3 times diameter of eye. Head width 14.5 times in body length; head length 8.8 times in body length.

Body slender, circular in cross-section; no constriction at neck; a narrow, mid-dorsal groove; a longitudinal depression anteriorly, along center of lateral stripe; a shallow, mid-ventral groove, from between forelimbs to middle of tail. Costal grooves 35, very distinct, extending well up on sides, slanting backward and then forward to, but not entering, mid-dorsal groove, connecting across abdomen; vertical grooves on tail indistinct. Vent, a short, longitudinal slit, with internal lips heavily folded.

Tail 1.66 times in snout-to-vent length; ovoid in vertical cross-section at base, and gradually becoming more and more compressed to flat tip. Dorsal surface with a keel beginning almost above vent, changing rapidly to a low fin on the distal four-fifths; fin never quite as broad as tail musculature, except at extreme tip. Ventral surface flat at base, with a narrow fin on terminal third.

Forelimbs present, minute. Fingers 3, short, stout, 2-1-3 in order of decreasing length, not webbed; with brown, clawlike horny caps, one-half diameter of toes, covering the tips. No metacarpal tubercles present.

External gills 3. On left side, uppermost longest, extending slightly posterior to the tips of the fingers when the forelimb is appressed; middle gill slightly shorter, not quite reaching horny caps of fingers; lowermost, half the length of middle. Uppermost gill consisting of a primary stem with secondary branches on each side, tertiary branches along the ventral edges of the longer secondaries, filaments attached to the under surfaces of both secondary and tertiary branches; middle and lowest gills the same, but without any branching along their inner edges. On right side, gills uniformly shorter, the uppermost just reaching the bases of the fingers. A single branchial opening, ventrad to base of middle gill, and covered by base of lowermost gill when this is appressed.

Tongue small, well back in mouth, its acutely-pointed anterior half free (the upper surface remaining tightly pressed against the roof of the mouth in preserved specimens, even though mouth has been cut open at angles

of jaws). A black horny sheath present at the anterior end of each jaw, that of the upper jaw very short, oval in shape and arched, that of the lower jaw being a well-developed transverse ridge, curving backward at its outer ends. Lower jaw with rather long, recurved, sharply pointed, well-separated teeth, arranged in two rather irregular rows on the anterior portion of each mandible, ending at a point approximately below the eye; the two groups separated anteriorly by about the width of each series, and diverging rapidly posteriorly. Two elongate patches of prevomerine teeth, beginning slightly behind the horny sheath in the upper jaw; the two patches separated anteriorly by a narrow groove, which widens rapidly posteriorly, the rearmost teeth in each patch being separated by almost twice the length of a naris; the teeth in each patch long (for a salamander of this size), sharply pointed, about 12 in number, arranged in a narrow series, at least two teeth in width, that ends about opposite the middle of the internal naris. Internal nares long, longitudinal openings slightly diagonal in position, each deeply buried in a fold of tissue that is apparently capable of tight closure.

*Coloration and markings* (preserved).—Top of head and dorsum Blackish Mouse Gray,<sup>3</sup> with numerous faint spots of Deep Mouse Gray, the intermixing of these two shades giving the dorsum the general appearance of Dark Mouse Gray. An indistinct, broken, Grayish Olive stripe on each side of the head, from eye to gills. A faint, narrow mid-dorsal stripe of Deep Mouse Gray, originating on the head just posterior to the eyes, and extending posteriorly to the dorsal caudal fin, where it becomes Drab. A narrow, but distinct, Dark Olive-Buff lateral stripe, less than 1 mm in width, arises under the gills and extends posteriorly, becoming broken into short spots on the anterior third of the tail, and persisting as scattered light spots to the end of the tail; this stripe bordered by a much broader area of dark brown color that extends backward to the tip of the tail, and contains numerous indistinct spots, similar to those of the dorsum, but slightly more distinct. A very much broken, pale Olive-Gray ventrolateral stripe originates below the insertion of each forelimb, and continues posteriorly, becoming less and less distinct, to just above the vent. Gills Sooty-Black. Chin and throat Olive-Gray. Entire venter, between ventrolateral stripes, Light Olive-Gray, with occasional minute flecks of Pale Olive-Gray. No distinct mid-ventral stripe on tail; both

<sup>3</sup> All colors capitalized are from Ridgway, "Color Standards and Nomenclature."



dorsal and ventral portions of caudal fin Pale Olive-Gray, heavily stippled with minute black flecks.

*Measurements* (in millimeters).—Head length (tip of snout to base of foremost gill), 11.5; body length, 101.5; tail length, 68; forelimb length, 4.5; total length, 181; head width (maximum), 7; body width (maximum), 7; body depth (maximum), 7.2.

*Variation in paratypes*.—The 297 paratypes are rather uniform in most characters. They all exhibit the bluntly rounded snout and the slender build that are characteristic of *axanthus*. The gills are well developed and fringed in most of the paratypes, but in six of 97 Carnegie Museum specimens the three gills, with all of their filaments, are compressed into a knob-like structure, and covered with a membrane, so that, until examined closely, the gills appear to be reduced.

The fingers are normally 2-1-3 in order of decreasing length, rarely 1-2-3 (two specimens), or 2-3-1 (one specimen). No specimen has been examined in which the fingers have been reduced to two on both sides; but three exhibited such a reduction on one side only, with the second toe longer than the first in two, and the first longer than the second in the other. One adult female has the middle finger of the right hand missing, and the first finger bifurcated. Sharp, brown, claw-like horny caps usually cover the tips of the fingers. The caps are almost invariably lost in specimens that died before preservation, but occasional individuals, of all sizes and both sexes, lack the caps, regardless of locality or date of collection. In the Carnegie Museum series of paratypes, composed largely of carefully preserved specimens, the caps are missing in 15 of the 97.

In *Pseudobranchus* costal grooves cannot be counted accurately in poorly preserved specimens, in most juvenile specimens, or in those numerous adults that have the grooves indistinct in the axial or inguinal regions. Of 98 paratypes, on which accurate counts were possible, the counts ranged from 34 to 37, with a mode of 35 and an average of 35.5, excluding a single specimen that had an abnormally low count of 30.

The point of origin of the dorsal tail fin varies with age. In young specimens it usually originates on the dorsum anterior to the base of the tail, whereas in older individuals it begins on the proximal fifth of the tail.

Specimens of *axanthus* thus far measured range from 24 to 210 mm in total length, and from 17 to 117 mm in snout-to-vent length. The minimum size at which breeding occurs has not been established, but mature specimens usually exceed 115 mm in total length, or 70 mm in snout-to-vent length. The ratio of snout-to-vent length in total length varies

from 1.26 to 1.92. Although the progression is somewhat irregular, the smaller specimens tend to have the lower ratios (*i.e.*, relatively shorter tails), while the larger specimens have the higher ratios.

The principal variations in the pattern of *axanthus* appear to be developmental rather than individual. Very young specimens have a maximum of seven longitudinal stripes, varying from grayish to creamy, separated by ribbons of darker ground color. The sequence from dorsum to venter is: (1) a narrow, usually grayish, stripe, occupying the mid-dorsal groove; (2) an area of slightly darker ground color, about twice the width of the mid-dorsal stripe; (3) a dorsolateral stripe, usually slightly narrower than the mid-dorsal, but similar to it in color; (4) an area of ground color about three times the width of the mid-dorsal stripe; (5) a broad, distinct, from creamy to buffy lateral stripe, two or three times the width of the mid-dorsal; (6) an area of ground color as wide as that above the lateral stripe; (7) a ventrolateral stripe, slightly paler and usually narrower than the lateral, and frequently much broken; (8) and finally, the ventral ground color, invariably lighter than that of the dorsum. In numerous young specimens the dorsolateral stripes are absent or very indistinct; in a smaller number, the dorsolaterals are distinct, and the mid-dorsal absent; and in a still smaller minority, the ventrolaterals are broken into a series of spots, or are only slightly distinct against the paler ventral ground color. The always present lateral stripes are invariably the most distinct, and the ventrolaterals are usually second only to the laterals in prominence. The three central stripes usually disappear in specimens of intermediate size, apparently as a result of general darkening of the dorsal ground color, although the mid-dorsal may be faintly visible if specimens are immersed in fluid. Most mature individuals have almost unicolor dorsa of from dark-gray to olive buff, but the continued accumulation of dark pigment, in the original areas of ground color, results in the formation of irregular dark spots; these may serve to delimit the unspotted areas of the juvenile mid-dorsal and dorsolateral stripes. The lateral and ventrolateral light stripes do not show any evidence of darkening with age; the light stripes on the head, however, are generally distinct in juveniles and obscure in adults. All of the paratypes of *axanthus*, regardless of age, lack yellow spots on the venter.

*Secondary sex characters.*—The most evident sexual dimorphism in *axanthus* is the greater size attained by females. Of the 297 paratypes, the largest female measured 210 mm in total length, and the largest male,

183 mm. Furthermore, in a series of 45 specimens of all sizes, collected on a single day, the five longest females ranged from 156-190 mm (average, 179); the five longest males, from 119-148 (average, 140). Tabulation of snout-to-vent/tail ratios demonstrates a trend toward proportionately longer tails as size increases, and this trend is more rapid in males than in females, although the latter reach the maximum size, and hence develop the longest tails. When mature specimens of equivalent sizes are compared, the females frequently have actually shorter tails, and in any series from a single population, the tails of the females average proportionately shorter than those of the males. The same ten specimens mentioned above have snout-to-vent/tail ratios of 1.27-1.53 (average, 1.40) in the males, and 1.47-1.79 (average, 1.56) in the females.

We have not observed, in *axanthus*, any external or cloacal character that would serve to separate non-breeding individuals of the two sexes. In certain breeding series the males have short vents, with the internal lips broadly folded and with a white, circular area surrounding the vent externally, whereas females have longer vents, with the internal lips narrowly folded and with more pigmentation externally. In other series, these sex characters are much less marked; we have not been able to determine whether they become more pronounced at a particular stage of the breeding cycle, or whether they result from differences in preservation. Mature females, collected during the spring months, may have thickened bodies, due to the presence of eggs, or external swellings around the vent. Except for such specimens, dissection is necessary to determine sex.

*Remarks.*—Specimens of *axanthus* from north central Florida are remarkably constant in structure and pattern. The few specimens available from southern Florida, however, are so variable that they are referred to *axanthus* only tentatively. A specimen (USNM 38165) from Dade County differs from typical *axanthus* in having a more pointed head; head stripes that extend to the gills (although these stripes are only faintly visible); a buffy, rather than gray, lateral stripe that expands on the basal third of the tail; and a more distinct and buffy ventrolateral stripe. Although resembling *striatus* in head pattern and shape, this specimen differs from it in having narrower lateral and ventrolateral stripes which are not yellow in color, in lacking yellow spots on the venter, and in lacking light spots on the lateral areas of ground color. Three specimens (1 mature female and 2 juveniles) from Englewood, Sarasota County, (Charleston Museum 39.277.6 A-C) differ from typical *axanthus* in having the lateral stripe considerably broader and pearl gray in color.

Unfortunately, the westernmost specimens of *Pseudobranchus* are two very small individuals (CM 20160; total lengths, 27 and 22 mm) from 5.4 miles south of Telogia, Liberty County, Florida. These specimens have distinct head stripes from the snout to the gills, distinct lateral stripes, and a dorsolateral row of disconnected light spots, rather than the dorsolateral stripe usually evident in Alachua County specimens of similar size. In each, the dorsal fin extends forward as a fold of skin to between the gills. In view of their small size, it is virtually impossible to allocate these specimens to either race of *Pseudobranchus*. Five specimens, DBUF 52 from Tallahassee and DBUF 1855(4) from Lake Iamonia, Leon County, Florida, although faded and in poor condition, appear to be more nearly intermediate between *striatus* and *axanthus* than any other Florida specimens we have seen.

A mature specimen (USNM 84610) from Chesser Island, Okefinokee Swamp, Georgia, appears to be a veritable *striatus* × *axanthus* intergrade. This specimen has the wide, yellow lateral stripe of *striatus*, but the brownish gray dorsum and the unicolor gray venter of *axanthus*. The ventrolateral stripe is more distinct and continuous than in most *axanthus*, but it is gray in color, rather than yellow as in *striatus*. The costal groove count of 34 occurs in both races, although more commonly in *striatus*. In head shape and pattern the specimen agrees most closely with *axanthus*. A good photograph of this specimen has been published by Harper (1935: 280, fig. 3). A 62-mm Georgia specimen (USNM 62095, from Berrien Co.) is too faded for the original color of the stripes to be determined, but it appears to be intermediate in having the lateral stripe broadened posteriorly, the ventrolateral stripe broadened anteriorly, and the belly heavily spotted. Typical *striatus* is known from less than thirty preserved specimens, collected over a period of more than a century; *axanthus*, from over three hundred specimens, collected mainly by the junior author since 1935. It is easy, therefore, to say that a given specimen is not typical *axanthus*, but it is far more difficult to say whether an individual specimen from southern Georgia should be considered intermediate or referable to *striatus*.

*Life history*.—The original observations embodied in the following account were made by the junior author during the preparation of his Master's thesis, "The Striped Siren, *Pseudobranchus striatus* (Le Conte)," University of Florida, 1941.

Mature females, collected near Gainesville in the spring months, have their ovaries packed with unpigmented eggs, less than one millimeter in

diameter. From February through April most of the females also contain pigmented eggs, from 1.0-3.1 mm in diameter, free in the body cavity. Actual dates of collection of females containing such eggs were: February 8, 9, 14, 18, and 28, March 7 and 14, April 22, and October 14 (one specimen), although specimens were examined for pigmented eggs in all months of the year, except June, July, and August. Individual females contained from 18 to 36 pigmented eggs by actual count, but a few large specimens, seen previously, may have contained as many as 50 eggs. Not one of over a hundred pigmented eggs that were examined showed any indications of cleavage furrows.

On March 31, 1941, a single egg was found attached, without a stalk, to a water-hyacinth root, in the water near the edge of Newman's Lake, about four miles east of Gainesville. The transparent capsule measured 6 mm in diameter, and contained a developing embryo, 6 mm in length. The embryo exhibited a distinct cervical flexure, but there were no limb buds, external gills, or eye spots present. The yolk sac, which was broken when the egg was removed from the vial, extended from the region just posterior to the cervical flexure to a point 1.5 mm from the tip of the tail. Somites were evident, but because of particles of yolk clinging to the embryo, it was impossible to get an exact count (from the anterior end to a region about halfway between the posterior border of the yolk sac and the tip of the tail, 37 were counted). The embryo was sinistrally coiled, with the tail making about three-fourths of a complete loop.

Noble (1927: 42) states, "*Pseudobranchus* and possibly *Siren* lay small eggs singly or in small bunches in ponds, according to Mr. A. [sic] S. Alexander, who sent me specimens of the former a few days after hatching." This constitutes the first reference to the eggs of *axanthus*, since we are now informed that the Mr. Alexander referred to is Mr. J. S. Alexander, who subsequently sent the American Museum the specimens of *Pseudobranchus* from Gainesville, Florida, from which Noble and Richards (1932: 14) obtained eggs artificially. At all events, the description of *Pseudobranchus* eggs, given by Noble and Richards, and their figure of an egg, refer to *axanthus*. The size of the egg found by Mr. Goin, and the situation in which it was found, agree with their findings, for they gave 5.5-6.0 mm as the diameter of the outer capsule of five fresh eggs, and they also state (*loc. cit.*), "By using pituitary implants we have found no difficulty in making ten of the largest females deposit eggs in crystallizing dishes half full of water and provided with abundant water-weed. The eggs are laid singly or in small groups. Each is provided

with a thick, opaque, outer capsule which is very adhesive and usually forms a broad attachment to the bottom of the dish or to the more resistant [*sic*] weed. Closely adherent to the outer capsule is a transparent, much firmer, less adhesive inner capsule."

Further observations, that apparently refer to *axanthus* exclusively, are given by Carr and Van Hyning. Carr (1940: 52) states, "The 'voice' of this species is proportionally as well developed and as frequently heard as that of *S. lacertina*; individuals which are picked up or whose tails are squeezed with forceps often yelp faintly. They have been found hibernating in deep mud. . . . In twenty-five stomachs, only amphipods and chironomid larvae were found."

Van Hyning (1932: 37) found *axanthus* in two of nine food-containing stomachs of *Liodytes alleni*, taken in Alachua County, and Carr (1940: 78) reports finding *Farancia abacura abacura* eating *Pseudobranchius*.

*Habitat*.—The original habitat of *axanthus* can only be conjectured, for at the present time the roots of the introduced water-hyacinth, *Piaropus crassipes*, form the principal habitat of this salamander. Carr (1940: 52) states, "Marshes; hyacinth beds in shallow water; ponds and canals in submerged vegetation. . . . I have found the eggs throughout the spring months attached singly to the filamentous leaves of *Cabomba* and *Ceratophyllum* and to water-hyacinth roots," but points out that the form "may be collected most successfully by rolling up mats of water-hyacinths." Van Hyning (1933: 3) states that the salamander is found "among roots of the water hyacinth and other aquatic vegetation." Mr. Van Hyning has since informed us that he has sometimes found *axanthus* among the roots of *Osmunda* (cinnamon and royal ferns). In spite of its occasional occurrence in situations other than among the roots of water-hyacinths, extensive collecting has demonstrated that, in Alachua County at least, far more specimens occur in this habitat than in all other situations combined. The very complete cover provided by *Piaropus* roots may account for the adoption by *axanthus* of this introduced plant as living quarters.

*Distribution*.—*P. s. axanthus* appears to be a strictly peninsular Florida race, although its area of intergradation with *striatus* extends slightly beyond the boundaries of Florida. In addition to the type and paratypes from Alachua County, we have seen undoubted *axanthus* from Lake, Marion, Pasco, St. Lucie, and Volusia counties; a few somewhat aberrant specimens from Dade and Sarasota counties; a few apparent intergrades from Leon and Liberty counties; and a single *striatus* × *axanthus* inter-

grade from the Okefinokee Swamp in southeastern Georgia. Records, in literature, of *striatus* in Charlotte County, Florida (Carr, 1940: 52) and at Orlando, Orange County, Florida (Brimley, 1910: 10), should probably be referred to *axanthus* on geographic grounds. The known ranges of the two forms are:

*P. s. striatus*.—The Atlantic Coastal Plain from Charleston, South Carolina, south to about the Okefinokee Swamp where intergradation with *axanthus* occurs, the area of intergradation possibly extending westward along the Georgia-Florida border to about the Apalachicola River.

*P. s. axanthus*.—Peninsular Florida, from the area of intergradation with *striatus*, south to Dade County.

*Acknowledgments*.—We are especially indebted to Dr. A. Avinoff, Director of the Carnegie Museum, who prepared the drawings of the two races of *Pseudobranchus*; to Dr. Sherman C. Bishop and Mr. Ray Maas, who generously permitted us to reproduce their photograph of a specimen of *Pseudotriton montanus floridanus*; and to Miss Caroline A. Heppenstall, who edited the manuscript. We are also indebted to the following persons, and to their respective institutions, for the loan of specimens, for permission to examine specimens in their care, or for other aid in connection with this study: Dr. Thomas Barbour and Mr. Arthur Loveridge, Museum of Comparative Zoölogy; Dr. Sherman C. Bishop and Mr. Arnold B. Grobman, University of Rochester; Mr. Charles M. Bogert, American Museum of Natural History; Dr. A. F. Carr, Jr. and Mr. J. C. Dickinson, Jr., University of Florida; Mr. E. B. Chamberlain, Charleston Museum; Dr. E. R. Dunn, Academy of Natural Sciences of Philadelphia; Mrs. Helen T. Gaige, University of Michigan, Museum of Zoology; Mr. Karl P. Schmidt and Mr. Clifford H. Pope, Field Museum of Natural History; Dr. Leonhard Stejneger and Dr. Doris M. Cochran, United States National Museum; and Dr. Charles F. Walker, Stone Laboratory.

## LITERATURE CITED

BRIMLEY, CLEMENT SAMUEL.

1910. Records of some reptiles and batrachians from the southeastern United States. *Proc. Biol. Soc. Washington*, 23: 9-18.

CARR, ARCHIE FAIRLY, JR.

1940. A contribution to the herpetology of Florida. *Univ. Florida Biol. Sci. Ser.*, 3, no. 1: 1-118.

COPE, EDWARD DRINKER.

1878. On some new and little known reptiles and fishes from the Austroriparian Region. *Proc. Amer. Philos. Soc.*, 17: 63-68.

1889. The Batrachia of North America. *Bull. U. S. Nat. Mus.*, no. 34: 1-525, pls. 1-86, figs. 1-120.

DUNN, EMMETT REID.

1926. The salamanders of the family Plethodontidae. Northampton, xii+444, 3 pls., text-figs. 1-86.

DURY, RALPH.

1932. Recent acquisitions to the Department of Herpetology. *Proc. Jr. Soc. Nat. Sci. (Cincinnati)*, 3, no. 2: 26-28.

FOWLER, HENRY WEED, AND EMMETT REID DUNN.

1917. Notes on salamanders. *Proc. Acad. Nat. Sci. Philadelphia*, 69: 7-28, pls. 3-4.

HARPER, FRANCIS.

1935. Records of amphibians in the southeastern states. *Amer. Midl. Nat.*, 16, no. 3: 275-310, figs. 1-17.

NOBLE, GLADWYN KINGSLEY.

1927. The value of life history data in the study of the evolution of the Amphibia. *Ann. N. Y. Acad. Sci.*, 30: 31-128, pl. 9.

NOBLE, GLADWYN KINGSLEY, AND L. B. RICHARDS.

1932. Experiments on the egg-laying of salamanders. *Amer. Mus. Novitates*, no. 513: 1-25, figs. 1-7.

VAN HYNING, OATHER C.

1932. Food of some Florida snakes. *Copeia*, 1932, no. 1: 37.

1933. Batrachia and Reptilia of Alachua County, Florida. *Copeia*, 1933, no. 1: 3-7.





## EXPLANATION OF PLATE

All figures from drawings by A. Avinoff, except figure 5. Natural size unless otherwise noted.

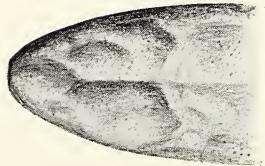
- FIGS. 1, 2. *Pseudobranchus striatus axanthus*, new subspecies. 1. Type, CM 20339, adult female, from eastern edge of Payne's Prairie, Alachua Co., Florida. 2. Dorsal view of head of type ( $\times 3$ ).
- FIGS. 3, 4. *Pseudobranchus striatus striatus* (Le Conte). 3. USNM 5051a, adult female, from Georgia. 4. Dorsal view of head of same specimen ( $\times 3$ ).
- FIG. 5. *Pseudotriton montanus floridanus*, new subspecies. Paratype, UMMZ 86419a, adult female, from Alachua Co., Florida. Photograph of preserved specimen by Sherman C. Bishop and Ray Maas.



1



3



2



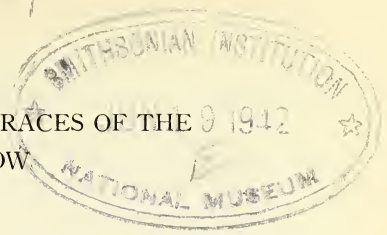
4



5



Pittsburgh, Carnegie Museum  
Andale, vol. 29



ART. VII. CRITICAL REMARKS ON THE RACES OF THE SHARP-TAILED SPARROW

By W. E. CLYDE TODD<sup>1</sup>

In the Auk for January, 1938 (vol. 55, p. 116), I described a new race of the Sharp-tailed Sparrow under the name *Ammospiza caudacuta altera*; the description was based on a series of specimens from southern James Bay. The type selected was a breeding bird, but the majority of the specimens (adults and immature) were in fresh fall plumage. This plumage shows the characters of the new form even to better advantage than does that of more worn breeding birds. *A. c. altera* is intermediate between the plainly colored race, *subvirgata*, of the New Brunswick and Nova Scotia coast and the richly colored form, *nelsoni*, of the upper Mississippi Valley and adjoining parts of Canada. In describing it, I surmised that its migration route bore eastward to the Atlantic coast rather than southward to the Great Lakes—a supposition that would account for the number of presumed intergrades between *nelsoni* and *subvirgata* known from the former region. I found that specimens (in the collection of the U. S. National Museum) from the type locality of *nelsoni* (northern Illinois) all belonged to the richly colored form, of which I had an ample series of breeding specimens from Saskatchewan. A series of fall birds from Erie, Pennsylvania, also appeared to be referable to the same race.

Dr. Harry C. Oberholser, after examination of certain pertinent material, now advises me that both these races (*nelsoni* and *altera*) occur in migration all over the Mississippi Valley in general and in northern Illinois in particular. Moreover, there are specimens of both (so he claims) among the type series collected by E. W. Nelson himself. Relying on Dr. Nelson's statement that the specimen he was sending J. A. Allen for identification was a fair average of the birds he had collected, I felt that I was justified in assuming that his other specimens were like it. If there was a chance, however, that two races were involved in the series from the type locality, a re-examination of the actual type specimen was

<sup>1</sup> This paper was written in 1939, but was held over pending the expected acquisition of more pertinent material. In the summer of 1941 I went to James Bay with the special object of securing additional breeding specimens of the form of the Sharp-tailed Sparrow of that region. These were sent to Mr. Peters for study and comparison, and his report thereon has been elaborated into the paper that follows herewith.

needed to determine the true application of the name *nelsoni*. At Dr. Oberholser's instance, Mr. J. L. Peters undertook the re-examination and used for comparison a carefully selected specimen which had been compared with the type of *altera*. Mr. Peters' conclusion was that the type of *nelsoni* is the same as the birds I have recently called *altera*, and that there were, indeed, two forms represented in the series of birds collected by Nelson at the type locality.

Unfortunate nomenclatural complications thereupon ensue. The race so long known under the name *nelsoni* would have to be called *Ammospiza caudacuta becki* (Ridgway), a name given to a vagrant example taken in California. The intermediate race would then take the name *nelsoni* (with *altera* as a synonym). Before accepting these confusing shifts in the names I felt it would be well to make a further and independent study of the points involved. The results of this review deserve to be put on record.

*Ammodromus caudacutus* var. *nelsoni* was described by Dr. Allen in the Proceedings of the Boston Society of Natural History for March, 1875 (vol. 17, p. 293). It was based on a single specimen received from Dr. Nelson—presumably one of several collected by the latter on September 17, 1874, in the Calumet Marshes at Ainsworth (now South Chicago) near Chicago, Illinois. The describer compared it with a series of Sharp-tailed Sparrows "taken at the same season in the Charles River marshes, in Cambridge," from which he found it to differ "very markedly." Almost certainly, Dr. Allen's comparison was made with specimens of the race now known as *subvirgatus*, and not with true *caudacutus*. Despite Dr. Allen's definite statement that he had only one specimen before him for description, Outram Bangs listed *two* specimens as co-types (Bulletin Museum of Comparative Zoölogy, 70, 1930, 383). These (Nos. 24,407-8) were collected in the Calumet Marshes in October, 1874. Through Mr. Peters' courtesy I have had the opportunity of examining these specimens and comparing them with others in the U. S. National Museum from the same locality and collector. I doubt the propriety of considering these specimens as the types. The discrepancies in the dates and in the number of specimens are certainly suggestive. Both specimens unfortunately lack original labels. On the Museum of Comparative Zoölogy label of one is penciled in Dr. Allen's handwriting the word "type." In the catalogue both are marked "types of description"—also in Dr. Allen's characteristic handwriting.

There is another specimen of Nelson's Sparrow (No. 24,802) in the

Museum of Comparative Zoölogy. This example bears Dr. Nelson's original label, with the locality Ainsworth, Illinois, and the date September 17, 1874. The catalogue entry on this bird, however, seems to be confused, since the date of collection is given there as September 28, 1875, and the date of receipt January, 1876. Mr. Peters thinks that the entry date is probably correct, as all the other entries in the catalogue between 24,456 and 24,803 are also dated in 1876. But in view of the several discrepancies in the records I am led to suspect a mixup involving the identity of the type. In my opinion it is far likelier that No. 24,802 is the actual type of *A. c. nelsoni* and that Dr. Allen inadvertently marked the other two specimens as types at a later date.

However this may be, it so happens that all three specimens are virtually alike. They are a little paler and duller, it is true, than most of the other specimens from the region, but all are clearly and unmistakably referable to one and the same race. When compared with fall specimens from James Bay, the differences stand out distinctly. Individual variation exists in both series, but it is not excessive. The single specimen in the collection of the U. S. National Museum that Dr. Oberholser calls an intermediate (No. 83,497) I have no difficulty in placing with *nelsoni* (as that form is generally understood). Whichever specimen we accept as the actual type of *nelsoni*, I would unhesitatingly include it in the richly colored series. The slightly paler coloration is fully within the range of individual variation in that form; it has no geographical significance.

Although naturally reluctant to question the conclusions of such distinguished authorities as Dr. Oberholser and Mr. Peters, I find myself unable to follow them after having again gone over my material with great care. I think the names ought to stand as given in my first paper. Further study and comparison have indicated that our series from Erie, Pennsylvania, collected in the fall of 1900, is not quite typical of *nelsoni*, yet is not referable to *altera*. Is it possible that these birds have come from a distinct and probably intermediate breeding ground, as yet undiscovered? In view of what we know at present of the respective ranges of *altera* and *nelsoni*, direct intergradation between these two forms would seem unlikely.

I am indebted to the authorities of the U. S. National Museum, the Field Museum of Natural History, and the Museum of Comparative Zoölogy, for the loan of specimens, without which this study would have been impossible.







ART. VIII. THE CANADIAN FORMS OF THE  
SHARP-TAILED SPARROW, *AMMOSPIZA CAUDACUTA*

BY JAMES L. PETERS

MUSEUM OF COMPARATIVE ZOOLOGY

A few months after Mr. W. E. Clyde Todd described a new race of sharp-tailed sparrow from James Bay,\* Dr. H. C. Oberholser wrote to me expressing his doubts as to the distinctness from *nelsoni* of Mr. Todd's bird, requested information about the co-types of *nelsoni* in the Museum of Comparative Zoölogy and sent specimens representing his conception of the two interior races of sharp-tailed sparrows for comparison with the co-types. My belief at that time was that *altera* was the same as *nelsoni* and that the bird of the Prairie Provinces of Canada was something else. Just how this decision was reached will be explained further on. After hearing from me, Dr. Oberholser took up the question with Mr. Todd, whom he did not entirely convince.

During the spring of 1939, Mr. Todd visited Cambridge and together we went over more of his James Bay material along with the co-types of *nelsoni* and other specimens. I was not inclined to recede from my original opinion; Mr. Todd was not entirely willing to yield his ground and thus the matter rested until 1941 when he sent me additional new material, breeding birds in fresh plumage from James Bay, suggesting that in view of the variability of a series from a given locality that further investigation was desirable.

I therefore set about to amass good series of breeding sharp-tails from the range of this species in the interior of North America to supplement the rather meagre representation in the Museum of Comparative Zoölogy. Specimens from North Dakota were loaned by the Fish and Wildlife Service; the National Museum of Canada (through Mr. P. A. Taverner) supplied skins from Alberta, Saskatchewan, Manitoba, and Quebec; the Royal Ontario Museum of Zoology (through Mr. L. L. Snyder) sent their series from Alberta, Saskatchewan, Manitoba, Ontario, and Quebec as well as some migrants from points within the United States; the Carnegie Museum (Mr. W. E. C. Todd) provided a nice series from Saskatchewan,

\**Ammospiza caudacuta altera* Todd, Auk, 55, 1938, p. 117.

the entire James Bay series and a run of migrants from Erie County, Pennsylvania. Dr. Wetmore of the United States National Museum authorized the loan of the type of *becki*, Ridgway. Dr. J. Van Tyne supplied some interesting specimens from the collection of the University of Michigan's Museum of Zoology and from the collection of Dr. Max M. Peet.

This array of material when spread out shows two well marked forms; a more generally distributed western one extending from northern Alberta to southeastern Manitoba and south to North Dakota and northwestern Minnesota, and a more local form inhabiting the salt marshes at the southern end of James Bay. This last form is cut off from its western relative by an area some 600 miles wide in which no form of sharp-tailed sparrow is known to occur; from Kamouraska, Quebec, the nearest known colony of *subvirgata*, the James Bay population is segregated by 475 miles of Quebec wilderness.

There are several points that must be constantly borne in mind when dealing with *Ammospiza caudacuta*. The first of these is that the plumage abrades very rapidly and the more the birds become worn the more the races resemble one another; birds shot during July are not entirely satisfactory for comparison; those taken after August first are practically useless for this purpose. Second, the species has two complete moults annually, so that fresh plumage may be observed from some time in September to the end of November; then ensues a gradual obscuring of characters through wear, followed by a moult in late March and April, resulting in the attainment of nuptial plumage by May. Third, there is much variation in comparable series from any given locality, chiefly observable in a greater or lesser amount of streaking beneath, the depth of the buff markings on the sides of the head, and the shade of reddish brown on the wing coverts.

I can discover no correlation between these types of color variation that might be associated with either geography or sex, and efforts to correlate them with age have failed since the number of birds taken in the autumn whose age has been determined, on condition of the skull by the collector, as adult or immature is very small, and it is of course not practicable to attempt to "age" birds in the spring.

The extent of individual variation coupled with the uncertainty as to whether there is any difference between adult winter and immature first winter plumage complicates the situation of the allocation of the types of *nelsoni*; these were taken in September or October, probably as migrants,

on the Calumet marshes, near Chicago, and the sex was not determined in either case. In view of what is now known, their allocation as representing the James Bay population or the Prairie Province populations could not be any too certain with the material available in 1939, nor without a better understanding of the individual and seasonal variations of the two races than I possessed at that time.

While it is hardly correct to say that *Ammospiza caudacuta* has two color phases, it is essential to distinguish a more rufescent type and a less rufescent type. Taken in conjunction with the rapid wear of plumage, comparisons between series from different localities should be made only with birds strictly comparable in degree of abrasion and the same degrees of rufescence. This process of sorting and re-sorting skins eventually cuts down the amount of material that may be taken under consideration for final conclusions, but it seems the most reliable course. After extensive winnowing in the manner set forth above, it is now my definite opinion that the co-types of *nelsoni* are based on *less rufescent* examples of the breeding bird of the prairies and that Mr. Todd's *altera* is the name of the localized James Bay race.

To understand the relationships of *altera* it is also necessary to have a clear idea of the variation of *subvirgata*, and for that reason a summary of the characters and plumages of the latter race is given in the following synopsis of the interior races.

#### ***Ammospiza caudacuta subvirgata* (Dwight)**

*Ammodramus caudacutus subvirgatus* Dwight, Auk, 4, 1887, p. 223, (Hillsborough, Albert Co., New Brunswick). Type in American Museum of Natural History; not examined.

*Nuptial plumage, male and female.*—The general effect above is that of a greenish olivaceous gray; coronal stripe relatively broad, enclosed laterally by a stripe of brownish feathers with dark centers; scapulars conspicuously edged with ashy or pale gray (never with white); feathers of back with conspicuous dark centers; rump unstreaked, upper tail coverts usually with narrow shaft lines; outer edgings of wing coverts and secondaries usually dull rusty; sides of head buffy with a conspicuous gray auricular patch and narrow dark postocular stripe; throat white or buffy with more or less distinct traces of a gray malar stripe; pectoral band and flanks buffy becoming more olivaceous on the flanks; breast invariably streaked, the streaks somewhat obscured by the buffy edges of the feathers; flank

streaks broader and more conspicuous; center of abdomen white; under tail coverts whitish to pale buffy.

In the more rufescent type, the sides of the head, edges of the secondaries, and greater wing coverts, are more richly colored and the dorsal feathers appear to have more extensive dark centers; this type shades through a long series of intermediates into the less rufescent type, characterized by paler and grayer coloration generally, a reduction of dark feather centers above, and scapular borders, contrasting less with the coloration of the upper parts.

As the breeding season advances and abrasion of the plumage becomes more pronounced, the brighter colors gradually wear away, the streaking across the breast is more fully revealed and the loreal portion of the supra-ocular stripe becomes distinctly pale yellow; this last feature never seems to be the case either in *altera* or *nelsoni*.

*First winter and adult winter plumage.*—Similar to the nuptial plumage, but generally duller with less contrasting of colors above and the gray scapular borders, in some cases (first winter only?) so overrun with the ground color of the upper parts as to be very inconspicuous. The streaks across the breast appear to be broader and heavier.

*Measurements.*—Based on breeding examples only.

QUEBEC: 3 ♂, wing 55.9–58.9 (57.5); tail 47.8–50.3 (49.1); bill 11.7–12.1 (11.9).

PRINCE EDWARD ISLAND (all worn August birds): 4 ♂, wing 55.9–56.8 (56.25); tail 46.0–49.9 (47.9); bill 11.7–13.0 (12.45).

NOVA SCOTIA (males all worn August birds, females fresh): 4 ♂, wing 56.1–57.5 (56.8); tail 44.9–51.6 (48.2); bill 11.0–12.1 (11.5).

3 ♀, wing 53.7–53.9 (53.8); tail 46.1–50.6 (48.7); bill, 11.5–12.2 (11.9).

*Range.*—Breeds in the tidal marshes of the lower St. Lawrence River (Kamouraska), Prince Edward Island, Magdalen Islands?, Nova Scotia, New Brunswick and eastern Maine. Winters regularly on the coastal marshes from South Carolina to northern Florida; casually farther north. On migration along the Atlantic seaboard; casual (?) in the lower Hudson Valley (Sing Sing).

*Specimens examined.*—All in Museum of Comparative Zoölogy except where noted.

QUEBEC: KAMOURASKA, 1 ♂, June 22, 1936 (R.O.M.Z.); 1 ♂, June 23, 1941 (R.O.M.Z.); 1 ♂, July 1, 1932 (Nat. Mus. Canada).

NEW BRUNSWICK: HAMPTON, 2 ♂, June 21, 1881; WICKHAM, 1 ♀, August 1, 1911.

PRINCE EDWARD ISLAND: 1 ♂, August 2, 1873 (C.F.B.); 3 ♂, August 3, 1876.

- NOVA SCOTIA: BARRINGTON, 3 ♂, August 2, 1907; 1 ♂, 1 juv. ♂, August 3, 1907 (all A. C. B.); WOLFVILLE, 2 ♀, June 28, 1926; 1 ♀, June 30, 1926.
- MAINE: SCARBORO, 1 ♂, May 22, 1897.
- MASSACHUSETTS: PLUM ISLAND, 1 not sexed, Oct. 13, 1919 (J.L.P.); IPSWICH, 1 ♀, Nov. 2, 1884 (A.C.B.); 1 imm. —, Oct. 2, 1922; 1 ad. ♂, 2 imm. ♂, 2 imm. ♀, Oct. 22-23, 1922; 1 imm. ♀, Sept. 22, 1924 (all J. L. P.); SAUGUS, 6 ♂, 3 ♀, 1 not sexed, Oct. 9, 1890; 1 ♂, 1 ♀, May 29, 1893; 2 ♂, Sept. 23, 1893; SWAMPSCOTT, 1 ♂, Nov. 5, 1881; REVERE, 1 ♂, May 24, 1879; 1 ♂, 1 ♀, Oct. 17, 1885 (C.F.B.); 1 ♂, 2 ♀, Oct. 23, 1888; 2 ♂, 2 ♀, Oct. 24, 1885; 1 ♂, Oct. 28, 1888; 1 not sexed, Oct. 1888; 1 not sexed, Oct. 8, 1889; 5 ♂, 1 ♀, 1 not sexed, May 26, 1890; 1 not sexed, May 31, 1890; 1 ♂, 1 ♀, Sept. 3, 1890; 1 ♂, Oct. 8, 1891; EAST WATERTOWN, 1 ♂, June 1, 1869; CAMBRIDGE, 1 ♀, Oct. 7, 1869; 1 ♂, Oct. 10, 1869; 2 ♂, 1 ♀, Oct. 9, 1871; SOUTH DUXBURY, 1 ♂, Nov. 1, 1885; PLYMOUTH, 1 ♂, May 28, 1911; 1 ♂, May 30, 1913; 1 ♂, 2 ♀, May 25, 1922; 2 ♂, May 28, 1931; WAREHAM, 2 ♀, Sept. 28, 1884; WESTPORT POINT, 1 ♀, June 2, 1916 (A.C.B.).
- NEW YORK: SING SING, 1 ♂, Oct. 1, 1880; 1 ♂, Oct. 7, 1885; 1 ♂, Sept. 29, 1886.
- SOUTH CAROLINA: MOUNT PLEASANT, 1 ♂, Oct. 10, 1885; 2 ♂, Nov. 30, 1889; 1 ♂, Dec. 13, 1890; 1 ♂, Jan. 24, 1891; 4 ♂, Feb. 7 and 11, 1891; 1 ♀, Oct. 21, 1891; 1 ♀, Nov. 4, 1891; 1 ♂, 1 ♀, Feb. 1 and 2, 1893; 2 ♂, Oct. 23 and 26, 1893; 1 ♂, Nov. 16, 1895; 1 ♂, Dec. 22, 1896; 3 ♂, May 9 and 22, 1899; 1 ♂, May 25, 1900; 2 ♂ (1, R.O.M.Z.), 1 ♀, May 26, 1900; 1 ♂, Dec. 2, 1911; 1 ♂, Jan. 21, 1915 (A.C.B.); 1 ♂, 1 ♀, Feb. 1 and 6, 1915 (A.C.B.); 1 ♂, May 29, 1915; 1 ♂, May 17, 1920 (A.C.B.); NEAR FROGMORE, 1 ♂, 1 ♀, Mar. 19, 1896; 1 ♀, April 20, 1896.
- GEORGIA: CAMDEN Co., 1 ♀, April 4, 1877.
- FLORIDA: AMELIA ISLAND, 1 ♀, May 18, 1906; 1 ♀, Dec. 1, 1906 (both R.O.M.Z.); NASSAU Co., 1 ♂, 1 ♀, Feb. 2, 1914 (F.H.K.).

### *Ammospiza caudacuta altera* Todd

*Ammospiza caudacuta altera* Todd, Auk, 55, 1938, p. 117 (East Main, James Bay, Quebec). Type in Carnegie Museum; examined.

*Nuptial plumage, male and female.*—Similar to *A. c. subvirgata*, but with general tone of upper parts more brownish, less grayish, the scapular borders paler gray, sometimes pure white; streaks on breast more variable, sometimes lacking, but when present narrower and better defined.

*First winter and adult winter plumage.*—Exceedingly close to the corresponding plumage of *subvirgata*, in fact I can find no characters that will definitely separate the more rufescent specimens of *subvirgata* from the less rufescent specimens of *altera*; the latter form usually presents a slightly more contrasting appearance above and the breast streaks of *subvirgata*

average heavier. Phase for phase *altera* is more richly colored than *subvirgata*; the more rufescent type predominates; the loreal spot never becomes yellow in worn summer plumage.

Size about the same as that of *subvirgata*.

*Measurements*.—Based on breeding birds only.

JAMES BAY: 12 ♂, wing 52.6\*–59.5 (57.7), tail 49.4\*–53.7 (51.1), bill 11.1\*–12.5 (11.9).

3 ♀, wing 54.6–57.5 (55.8), tail 45.9–50.5 (47.7), bill, 11.4–11.6 (11.5).

*Range*.—Breeds locally in the marshes about the southern shore of James Bay from Moosonee to East Main, and north on the west shore at least to the mouth of the Attawapiskat River. Winters along the Atlantic coast from South Carolina to Florida (one record for Louisiana). On migration recorded from the southern shore of Lake Erie, the lower Hudson Valley, and the coast of Massachusetts.

*Specimens examined*.—All in Carnegie Museum except where noted.

QUEBEC: (JAMES BAY), EAST MAIN, 1 ♂, June 29, 1926 (Type).

ONTARIO: (JAMES BAY), SANDY ISLAND, 1 ♂, 1 imm. ♂, 1 juv. ♂, Sept. 3, 1923; BIG STONE, 1 ♀, June 26, 1912; PARTRIDGE CREEKS, 2 ♂, 1 ♀, Sept. 6, 1923; 1 ♂, Sept. 13, 1927; 3 ♂, 1 imm. ♂, Sept. 15, 1923; 2 ♂, June 12, 1941; 3 ♂, June 13, 1941; 2 ♂, June 10, 1941; NATTABISHA POINT, 1 ♂, 1 ♀, June 17, 1941; 1 ♂, June 18, 1941; MISSISSIKABE RIVER, 1 ♂, June 25, 1941; GULL POINT, 1 ♀, Sept. 21, 1935; MOOSE FACTORY, 1 ♂, July 5, 1908; MOOSONEE, 3 ♂, July 8, 1939 (R.O.M.Z.); 1 ♂, July 12, 1939 (R. O. M. Z.); ATTAWAPISKAT POST, 1 ♀, Aug. 3, 1939 (R.O.M.Z.); 1 juv. ♂, Aug. 8, 1938 (R.O.M.Z.).

OHIO: RICHMOND, LAKE CO., 1 not sexed, Sept. 29, 1931 (Cleveland Museum).

PENNSYLVANIA: PRESQUE ISLE, ERIE CO., 1 ♂, 1 imm. ♂, 2 imm. ♀, Sept. 25, 1900; 1 imm. ♂, Oct. 2, 1900.

NEW YORK: SING SING, 1 ♂, Sept. 30, 1880; 1 ♂, Oct. 17, 1885; 1 ♀, Oct. 4, 1888; LONG ISLAND, 1, no data (all M.C.Z.).

MASSACHUSETTS: SWAMPSCOTT, 1 ♀, Nov. 2, 1878; 1 ♂, Oct. 25, 1879 (both M.C.Z.).

SOUTH CAROLINA: MT. PLEASANT, 1 ♀, Feb. 9, 1891; 1 ♂, Jan. 31, 1893; 1 ♂, Dec. 6, 1896; 2 ♂, May 15 and 28, 1897; 1 ♂, 1 ♀, May 22 and 24, 1899; 1 ♂, May 28, 1900 (all M.C.Z.); 1 ♂, Dec. 6, 1911 (A.C.B.).

GEORGIA: SAPELO ISLAND, 1 ♀, Dec. 14, 1887 (M.C.Z.).

\*The minima for wing, bill and tail were all taken from the same specimen (Carnegie Mus., K. W. Haller, orig. no. 1150), evidently an abnormally small bird; if these minima are disregarded the next smallest are wing 56.0, tail 49.8, bill 11.3.

***Ammospiza caudacuta nelsoni*** (J. A. Allen)

*Ammodramus caudacutus* var. *nelsoni* J. A. Allen, Proc. Boston Soc. Nat. Hist., 17, 1875, p. 293 (Calumet Marshes, Cook Co., Illinois), co-types in Museum of Comparative Zoology; examined.

*Ammodramus caudacutus becki* Ridgway, Proc. U. S. Nat. Mus., 14, 1891, p. 483 (Milpitas, Santa Clara Co., California), type in U. S. National Museum; examined.

*Nuptial plumage, male and female.*—Distinguishable at a glance from *subvirgata* and *altera* by its smaller size and darker coloration above; there is a great extension of the dark areas, brown tones predominate; the gray coronal stripe is darker and narrowed by an invasion of the dark borders of the crown; scapular edgings pure white or very pale gray, broader than in the other two races; sides of head more richly colored and in the most rufescent examples this color overruns the gray auricular patch so that it is not contrasted against the buffy background. Streaking below variable, often absent, but when present is "penciled" in appearance.

*First winter and adult winter plumage.*—Less readily distinguishable from *altera* than in the preceding plumage, but averaging browner in series, coronal stripe narrower and scapular borders rather paler; streaks across breast darker, narrower and more sharply defined.

*Measurements.*—Based on breeding birds only.

ALBERTA: 11 ♂, wing 55.0–58.1 (55.9); tail 43.6–49.6 (47.2); bill 11.2–12.6 (11.9).  
1 ♀, wing 55.5; tail 47.5; bill 12.3.

SASKATCHEWAN: 14 ♂, wing 53.0–57.5 (55.9); tail 45.6–50.8 (47.7); bill 11.6–12.6 (11.9).  
3 ♀, wing 52.5–53.7 (53.0); tail 43.4–45.9 (43.9); bill 11.9–12.3 (12.1).

MANITOBA: 11 ♂, wing 53.9–57.7 (56.2); tail 42.9–51.0 (46.5); bill 11.1–12.3 (11.9).  
2 ♀, wing 51.8–52.5 (52.1); tail 45.5–45.6; bill 12.0–12.2 (12.1).

NORTH DAKOTA: 13 ♂, wing 54.0–57.0 (55.6); tail 43.5–53.3 (47.4); bill 11.3–12.4 (11.9).

4 ♀, wing 52.5–55.2 (53.5); tail 43.6–46.5 (44.8); bill 11.5–12.3 (12.1).

Co-types of *nelsoni*

M.C.Z. 24,407, not sexed, wing 55.7; tail 49.6, bill 11.4. 24,408, not sexed, wing 54.8; tail 46.8, bill 11.

Type of *becki*

U. S. Nat. Mus. 120,310, not sexed (= ♀ by measurement), wing 53.5; tail 46.7; bill 10.8.

*Range*.—Breeds in the fresh water prairie marshes from extreme west central Alberta (Peace River Landing), southern Mackenzie (Great Slave Lake), central Saskatchewan (Emma Lake) and central Manitoba (north to The Pas and Sturgeon Creek) south to south-central Alberta (Red Deer), southern Saskatchewan (Last Mountain Lake, Yorkton), no record for Montana, southeastern North Dakota (chiefly east of the 100th Meridian), (northeastern South Dakota *vide* A. O. U.), and north-western Minnesota (Kittson and Marshall counties); possibly bred formerly near Chicago, Illinois, but reports of its breeding there unsubstantiated, as are also similar reports from eastern Kansas and from Lake Koshkonong and the Horicon Marshes, Wisconsin. Winters in the salt marshes of the Atlantic and Gulf Coasts from South Carolina (occasionally North Carolina ?) to Texas, south to Merritts Island and Tampa Bay on the Florida peninsula (casual at Cape Sable), and to Corpus Christi, Texas.

Migrates down the Mississippi Valley and southeastward through southern Ontario, reaching the Atlantic coast as far north as Maine; no spring records on the Atlantic coast north of Staten Island. Recorded as a transient in the following states (in addition to those mentioned above or from which specimens are listed): Nebraska, Iowa, Missouri, Arkansas, Tennessee, Indiana, Vermont, Maine, Rhode Island, Connecticut, New Jersey, Maryland, Virginia, and District of Columbia.

The extreme southeastern boundary of the breeding range of *nelsoni* is given in the fourth edition of the A. O. U. Check-List as northeastern South Dakota. I am unable to find on what basis this statement is made.

The southernmost example examined is a bird from the collection of Dr. Max Minor Peet, collected by J. C. Howell at Cape Sable, Florida, Dec. 22, 1932. This bird is interesting in more ways than one since it contains such an accentuation of the dark markings as to constitute a partial melanism; the crown is entirely black; the dark areas on the back are greatly extended and the flanks are broadly streaked with black. It is a typical *nelsoni* in size, with a wing 55.4; tail 45.9; and bill 12.8 (a little long). I regard this bird as an aberrant *nelsoni*; it is inconceivable that there should be an isolated colony at Cape Sable.

The type of *becki* was collected by Rollo H. Beck at Milpitas, Santa Clara Co., California, on May 6, 1891. The specimen is of the more rufescent type, with the auriculars overrun by the color of the sides of the head; the pectoral band is marked with a few short, narrow, dark brown shaft lines.



As previously stated in this paper, the co-types of *nelsoni* appear to be specimens in the less rufescent phase of this form; in measurements also they conform to those of the Prairie bird and not to the larger James Bay race.

*Specimens examined.*—All in Museum of Comparative Zoölogy except where stated.

- ALBERTA: PEACE RIVER LANDING, 1 ♂, June 20, 1903 (Nat. Mus. Canada); SLAVE RIVER, 1 ♂, June 12, 1901 (Biol. Surv.); 15 miles N.W. of Chipewyan, 1 ♂, July 7, 1920 (M.C.Z.); ATHABASKA DELTA, 1 ♂, 1 not sexed, June 15, 1920 (Biol. Surv.); 1 ♀, June 19, 1920; 1 ♂, June 20, 1920 (both M.C.Z.); 2 ♂ June 22, 1920 (Biol. Surv.); 1 ♂, July 11, 1920 (M.C.Z.); LAC LA NONNE, 1 ♂, June 30, 1926; 1 ♂, July 13, 1926; 1 juv. ♂, 1 juv. ♀, Aug. 4, 1926; 1 imm. ♂, BEAVER HILL LAKE, Aug. 24, 1925 (all Nat. Mus. Canada); CAMROSE, 1 ♂, Sept. 6, 1929 (R.O.M.Z.); RED DEER, 1 ♂, June 20, 1906 (R.O.M.Z.).
- SASKATCHEWAN: EMMA LAKE, 1 juv. ♂, July 14, 1939 (R.O.M.Z.); ELSTOW, 1 ♂, May 21, 1936 (M.M.P.); LAST MOUNTAIN LAKE, 1 ♀, July 15, 1920 (Nat. Mus. Canada); 12 ♂, 1 ♀, May 24–June 17, 1932 (Carnegie Mus.); KUTAWAGAN LAKE, 1 ♂, 1 ♀, June 4-5, 1920 (Nat Mus. Canada).
- MANITOBA: THE PAS, 2 ♂, June 8-10, 1937 (Nat. Mus. Canada); LAKE WINNEPEGOSIS, 1 ♀, June 9, 1913 (A.C.B.); LAKE ST. MARTIN INDIAN RESERVATION, 1 ♂, June 22, 1934; STURGEON CREEK, juv. ♂, Sept. 9, 1931 (both R.O.M.Z.); DAUPHIN, 1 ♀, June 22, 1938; SHOAL LAKE, 1 ♀, Sept. 21, 1917, 1 ♂, June 13, 1918; 1 ♀, Sept. 10, 1918; OAK LAKE, 2 ♂, July 14, 1921; 1 imm. ♂, Sept. 13, 1921; WHITEWATER LAKE, 1 ♂, June 5, 1925; DOUGLAS, 1 ♂, May 22, 1916 (all Nat. Mus. Canada); ROSSER, 1 ♂, June 30, 1 ♂, July 20, 1 juv., Sept. 10, 1932; VIVIAN, 1 ♂, July 12, 1932 (all R.O.M.Z.).
- ONTARIO: TORONTO, 1 not sexed, Sept. 22, 1894; 1 ♀, Oct. 28, 1896; 1 ♀, Oct. 9, 1897 (R.O.M.Z.).
- CALIFORNIA: MILPITAS, 1 not sexed, May 6, 1891 (type of *becki*, Ridgway).
- NORTH DAKOTA: (all in coll. U. S. Biol. Surv.), Towner, 1 ♂, 1 ♀, 1 not sexed, July 24-25, 1915; FORT TOTTEN, 1 ♂, 1 ♀, July 12, 1915; LARIMORE, 2 ♂, June 23-24, 1915; DAWSON, 3 ♂, 1 ♀, July 27, 1915; 1 imm. ♀, Sept. 6, 1922; OAKES, 1 ♂, June 26, 1915; LUDDEN, 1 ♂, June 14, 1912; SPRING LAKE, 1 ♂, 1 ♀, July 7, 1915; LIDGERWOOD, 1 ♂, June 14, 1915; HANKINSON, 2 ♂, July 21-22, 1912.
- KANSAS: NEOSHO FALLS, 1 not sexed, Oct. 19, 1881.
- WISCONSIN: LAKE KOSHKONONG, 4 ♂, Sept. 17-24, 1893; 7 ♂, Sept. 7-24, 1894 (one, U. of Mich); 2 ♀, Sept. 23, 1897 (1 R.O.M.Z., 1 M.C.Z.); 1 ♂, Oct. 2, 1898 (R.O.M.Z.).
- MICHIGAN: JACKSON Co., 1 ♀, Sept. 23, 1934; 1 ♀, Oct. 16, 1935; 1 ♂, Oct. 4, 1936; 1 ♂, Sept. 30, 1939; MONROE Co., 1 ♀, May 29, 1939; WAYNE Co., 1 ♂, Sept. 27, 1893 (all U. of Mich.).
- ILLINOIS: near CHICAGO (*i.e.* Calumet Marshes), 2 not sexed, Oct. 1874 (co-types of *nelsoni*); CHICAGO, 1 ♂, May 27, 1922 (M.M.P.); AINSWORTH, 1 ♂, Sept. 17, 1874; WARSAW, Oct. 11, 1883; GRAND CROSSING, 1 ♂, Oct. 29, 1893.

OHIO: GENEVA, 1 ♂, May 17, 1902 (Carnegie Mus.).

PENNSYLVANIA: ERIE, 1 ♂, 3 imm. ♂, 4 imm. ♀, Sept. 15-25, 1900 (all in Carnegie Museum).

NEW YORK: SING SING, 2 ♂, 2 ♀, Sept. 30-Oct. 1, 1880; 2 ♀, Oct. 5, 1883; 1 ♀, Sept. 28, 1885.

MASSACHUSETTS: IPSWICH, 1 imm. ♀, Sept. 29, 1922 (J. L. P.); SAUGUS, 2 ♀, Oct. 9, 1890; REVERE, 1 ♀, Oct. 23, 1885 (C.F.B.); 1 ♀, Oct. 8, 1899; 1 not sexed, Oct. 8, 1891; CAMBRIDGE, 1 imm. ♂, Oct. 9, 1871; WAREHAM, 1 ♀, 1 not sexed, Sept. 28, 1884; BARNSTABLE, 1 ♂, 1 not sexed, Feb. 8-9, 1901.

NORTH CAROLINA: SWAN ISLAND, 2 ♀, Jan. 29, 1891; SMITHVILLE, 1 ♀, Nov. 24, 1876; PLEASANT BAY, Nov. 7, 1900; NEW RIVER, Nov. 18, 1900 (A.C.B.).

SOUTH CAROLINA: MT. PLEASANT, 1 ♂, Oct. 8, 1884; 1 ♂, 3 ♀, Oct. 6-19, 1 ♂, Dec. 1, 1885; 3 ♂, Jan. 2-23, 1 ♀, March 10, 1 ♂, Oct. 12, 1886; 2 ♂, 2 ♀, Oct. 10-30, 1889; 8 ♂, 3 ♀, Oct. 11-22, 2 ♂, Nov. 1 and 22, 1890; 2 ♂, Jan. 21 and 24, 7 ♂, 3 ♀, Oct. 13-21, 1891; 1 ♂, Feb. 2, 2 ♂, Sept. 29, 1 ♀, Oct. 25, 1893; 1 ♂, Dec. 4, 1896; 1 ♂, Oct. 26, 1897; 1 ♂, Oct. 21, 1898 (R.O.M.Z.); 1 ♀, Nov. 14, 1898; 1 ♂, Jan. 12, 1 ♂, May 5, 1899; 1 ♂, Oct. 14, 1900 (R.O.M.Z.); 1 ♀, Jan. 10, 1911 (A.C.B.); 1 imm. ♂, Oct. 20, 1917; near FROGMORE, 1 ♂, 1 ♀, Feb. 18, 2 ♂, 1 ♀, March 19, 1 ♀, May 13, 1886.

GEORGIA: CHATHAM Co., 1 not sexed, Oct. 20, 1907 (R.O.M.Z.); 1 ♂, Nov. 26, 1908 (F.H.K.); MCINTOSH Co., 2 ♀, Jan. 23 and 25, 2 ♀, Feb. 13 and 14, 1890; SAPELO ISLAND, 1 ♂, Dec. 14, 1887.

FLORIDA: NASSAU Co., 1 ♂, Jan. 28, 1 ♀, Feb. 5, 1914; AMELIA ISLAND, 3 ♂, March 8-13, 1906 (R.O.M.Z.); 1 ♀, March 12, 1918; NEW SMYRNA, 1 ♂, March 30, 1877; CAPE SABLE, 1 not sexed, Dec. 22, 1932 (M.M.P.).

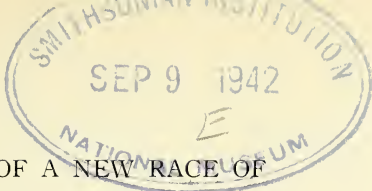
TEXAS: GALVESTON COUNTY (High Island), 2 ♂, Dec. 13 and 24, 1916; CORPUS CHRISTI, 8 ♂, 4 ♀, Oct. 2-30, 1909.

*Calif. Santa Clara Co. = type of Auklet*

11 one other in USNM







ART. IX. DESCRIPTION OF A NEW RACE OF  
*SIREN INTERMEDIA* LE CONTE

BY COLEMAN J. GOIN  
UNIVERSITY OF FLORIDA<sup>1</sup>

In the course of my studies of the Sirenidae it has become evident that *Siren intermedia* is composed of two valid subspecies. Typical *intermedia* is confined to the coastal plain from Virginia to the Florida Parishes of Louisiana and south to central Florida, while the population west of this region represents a race for which no name is available. As the full discussion, now in preparation, of the salamanders of this family will not be completed for several years, it seems desirable to describe this form at the present time so that it may be included in Dr. Sherman C. Bishop's forthcoming manual of the salamanders. It gives me great pleasure to name this race after M. Graham Netting, who first suggested that I study the Sirenidae.

***Siren intermedia nettingi***, new subspecies

PALE LESSER SIREN

*Type*.—Carnegie Museum, no. 7580, adult female, collected in May, 1928, by Byron C. Marshall.

*Type locality*.—Imboden, Lawrence County, Arkansas.

*Paratypes*.—One hundred and eighty-eight, as follows:<sup>2</sup> ARKANSAS—AMNH 36285-89, 37232, ANSP 21962, SCB (5 specimens), CM 7581, ChM 39.277.5 (2), UMMZ 68381 (2), 68382 (2), UR 948-49, from Imboden, Lawrence County; AMNH 22923-28, from six miles south of Imboden, Lawrence County; and UMMZ 84356, from near Paragould, Greene County. ILLINOIS—ANSP 552, from Alton, Madison County; CM 19078-81, from five miles east of Du Quoin, Perry County; MCZ 941; MNSS 272 (33 specimens + 96 unnumbered specimens), from one mile northeast of Herrin, Williamson County; and MNSS 273 (2), from five miles northeast of

<sup>1</sup> Contribution from the Department of Biology, University of Florida.

<sup>2</sup> AMNH, American Museum of Natural History; ANSP, Academy of Natural Sciences of Philadelphia; SCB, private collection of Sherman C. Bishop; CM, Carnegie Museum; ChM, Charleston Museum; FMNH, Field Museum of Natural History; MCZ, Museum of Comparative Zoölogy; MNSS, Museum of Natural and Social Sciences, Southern Illinois Normal University; UMMZ, University of Michigan, Museum of Zoology; UR, University of Rochester, Museum of Natural History.

Jonesboro, Union County. INDIANA—MCZ 8601-04, from Vigo County. LOUISIANA—CM 20142-55, from Forest Hill, Rapides Parish; and MCZ 250, from New Orleans, Orleans Parish. TENNESSEE—UMMZ 84354, from Bayou du Chien, Walnut Log, Obion County; UMMZ 84355, from near Memphis, Shelby County; and UMMZ 86391, from near Nashville, Davidson County. TEXAS—FMNH 31797, from College Station, Brazos County.

*Diagnosis.*—A *Siren* with from 33 to 37 costal grooves, mode 35; an average tail length in total length ratio of 3.21; and a maximum total length of 396 mm. *S. i. nettingi* characteristically has a dorsum shading from olive to gray, with scattered minute black spots; the venter is marked with well defined light spots. It can be distinguished from *intermedia* by its larger size, by the presence of about two more costal grooves (usually 33 in *intermedia*, 35 in *nettingi*), and in having the venter marked with light spots rather than being uniformly dark. From *lacertina* it differs in its smaller size, the smaller number of costal grooves, and in lacking the numerous, circular, well-defined, black spots on the top of head, dorsum, and sides.

*Description of type.*—Skin generally smooth in appearance, but head pocked with indistinct pits of variable size, and body sprinkled with smaller pits visible under magnification; no large glands present. Two parallel rows of small, indistinct mucous pores on each side: a dorsolateral row beginning on side of head anterior to gills, extending backward and fading out on posterior third of body, and a lateral row beginning behind limb and continuing posteriorly to region above vent. Individual pores grouped in short series of two or three almost tangent pores, each series usually placed in the center of a costal fold. A faint, shallow depression on head extending from region between eyes to top of head; another shallow depression on each side of head extending from top of head downward and backward about three millimeters, then curving downward for about the same distance, then curving forward and downward, terminating at a point between the eye and base of lower gill; a median longitudinal depression beginning in region above and anterior to base of gills and continuing longitudinally backward until it merges insensibly with a shallow mid-dorsal groove at back of head.

Head somewhat elongate, narrowing gradually from widest point, which is just behind base of jaws, to about level of eyes where it begins to taper to a rounded snout; a slight swelling on each parietal produced by jaw muscles. Head bluntly pointed in outline as seen from side, profile of top a smooth curve to parietal swellings, followed by a very slight de-

pression from parietal swellings to region above limbs. Mouth small, consisting of a crescentic, transverse portion anteriorly, followed by an inward curving arc on each side, ending on the ventral surface on a line dropped from anterior border of eye. Outline of upper jaw convex as seen from side due to pendulous upper lip; upper jaw projecting beyond lower. No canthus rostralis. Loreal region slightly convex. Nostril an elongate longitudinal slit, ventrolateral in position, its anterior corner on a line with the anterior point of the upper lip, not visible from above. Internarial distance (ventrally) three times diameter of eye. Eye small, not protuberant, without eyelids, but completely covered with a thin membrane; its diameter about one-third its distance from posterior corner of nostril. Interorbital distance about three times diameter of eye. Head width 10.8 times in body length; head length 7.2 times in body length.

Body slender, ovate in cross section, slightly deeper than wide, without any noticeable constriction at neck; a narrow mid-dorsal groove, a shallow longitudinal dorsolateral depression extending from base of gills to proximal third of tail, a shallow midventral depression from region between limbs to vent. Costal grooves 36, distinct, connecting across abdomen, extending well up on sides where they become indistinct. Vent small, ovate; internal lips heavily folded.

Tail 2.3 times in snout-to-vent length; ovoid in vertical cross section at base, becoming more and more compressed to flat tip. A low dorsal keel beginning on posterior eighth of body and continuing posteriorly, changing to a low fin on distal four-fifths of tail, fin never quite so broad as tail musculature except at extreme tip. Ventral surface flat at base with a narrow fin on distal two-thirds; tip of tail rounded.

Forelimbs present, small. Fingers four, short, stout, 2-3-1-4 in order of decreasing length, not webbed. Fingers three and four of both feet with brown, claw-like, horny caps covering the tips. No metacarpal tubercles present.

External gills three; the gills, with all their filaments, are compressed into a knob-like structure and covered with a membrane so that the gills appear to be reduced unless examined closely (but not so in most of the paratypes). On left side, upper gill longest, extending to insertion of limb when appressed, middle gill shorter, about two-thirds length of upper, lower gill half length of middle, no distinct secondary branches or filaments; branchial openings three, anterior the smallest, middle the largest, covered by bases of gills when these are appressed. On right side, gills uniformly longer, upper extending beyond insertion of limb when ap-

pressed, middle shorter, extending to base of limb, lower much shorter, one-third length of middle, reduced but with secondary branches on upper and middle gills; branchial openings two, anterior smallest, covered by bases of gills when these are appressed.

Tongue small, well back in mouth, its acutely pointed anterior third free (the upper surface remains tightly pressed against the roof of the mouth in preserved specimens even though mouth has been cut open at angles of jaws). A dark horny sheath present at anterior end of lower jaw in the form of a poorly developed transverse ridge curving backward at its outer ends; a small oval horny patch at anterior edge of upper jaw which is but slightly darker than the surrounding tissue. Lower jaw with rather long, recurved, sharply pointed, well-separated teeth arranged in two rather irregular rows on the anterior portion of each mandible, ending at a point approximately below the eye, the two groups separated anteriorly by more than the width of each series and diverging rapidly posteriorly. Two elongate patches of prevomerine teeth beginning in anterior portion of roof of mouth, the two patches separated anteriorly by a narrow groove which widens rapidly posteriorly, the rearmost teeth in each patch being separated by almost twice the length of a naris; the teeth in each patch long for a salamander of this size, sharply pointed, about 32 in number; arranged in short diagonal rows of four or five teeth each for about five rows, then a short diastema preceding several short oblique rows. Internal nares elongate, longitudinal openings slightly diagonal in position, each deeply buried in a fold of tissue that is apparently capable of tight closure.

*Measurements of type* (in millimeters).—Head length (tip of snout to base of foremost gill), 19.5; body length, 140; tail length, 69.5; forelimb length, 12; total length, 229; head width (maximum), 13; body width (maximum), 12; body depth (maximum), 13.

*Coloration of type* (preserved).—Top of head, dorsum, and sides Deep Mouse Gray<sup>3</sup> with minute black spots on top of head, dorsum, and dorsolateral regions, most heavily concentrated in dorsolateral regions. An indistinct, broken, Olive Lake stripe on each side of head from eye to base of gill. Gills, chin, and legs Light Grayish Olive. Entire venter Deep Olive-Gray. Dorsal and ventral tail fins between Mouse Gray and Deep Mouse Gray, with minute scattered spots of black pigment.

*Variation*.—In size the paratypes of *nettingi* range from 20 to 396 mm

<sup>3</sup> All colors capitalized are from Ridgway, "Color Standards and Nomenclature," 1912.



in total length, and from 15 to 282 mm in snout-to-vent length. The ratio of tail length in total length in one hundred mature individuals ranges from 2.84 to 4.24, average 3.21. In twenty-three mature specimens of typical *intermedia* the ratio of tail length in total length ranges from 1.40 to 3.47, average 2.80. Although there is overlapping between the two races in this character, it is apparent that *nettingi* tends to have a relatively shorter tail than does *intermedia*.

In the paratypes on which costal grooves can be counted it was found that they vary from 33 to 37, 33 occurring three times, 34 thirty times, 35 fifty-five times, 36 twenty-two times, and 37 once. Here again we find some overlapping with *intermedia*, which, in the specimens on which costal grooves can be counted, has 31 occurring once, 32 eleven times, 33 sixteen times, and 34 eight times.

The fingers are normally 2-3-1-4 in order of decreasing length but sometimes they are 2-1-3-4 (9 specimens), more rarely 3-2-1-4 (1 specimen). Sharp, brown, claw-like horny caps are usually present on all fingers in specimens that have not died before preservation, but occasionally they are absent on one or more fingers in otherwise perfect specimens.

In most of the paratypes the gills are fringed and well developed, but in some specimens (including the type) they are compressed into knob-like structures that appear to lack filaments unless examined with care.

Coloration and markings in the extensive series of paratypes range from nearly uniformly black (specimens which have been long preserved or which died before preservation), to a light gray above with scattered, small black spots and with a pale venter on which numerous spots and blotches of light immaculate areas occur. Young specimens tend to have more light markings on the head than do mature individuals. In many immature specimens the tip of the snout is immaculate and there is a longitudinal light bar above each eye and another transverse light bar across the top of the head.

*Coloration in life* (based on CM 20154-55, from Forest Hill, Rapides Parish, La.).—Top of head Olive-Citrine to Brownish-Olive changing to Serpentine-Green on the sides. Dorsum Dark Olive to Deep Olive. Venter Pallid Quaker Drab with minute black pigment spots thus giving the general appearance of Deep Violet-Gray to Dark Violet-Gray. A faint Buff Brown vertebral line on posterior third of body and dorsal keel of tail. Chin Pale Rose-Purple with superimposed minute black pigment spots, thus giving appearance of gray. Top of head flecked with small spots of Olive-Brown. Chin, sides and venter with numerous

lighter spots of Marguerite Yellow which sometimes tend to form more or less distinct rows on the sides. Tip of snout Ecru-Olive; Deep Olive-Buff spots on top of head. Lateral head stripes running from tip of snout to gills Isabella Color. Legs Pale Olive-Buff ground color with minute black pigment spots. Gills Olive-Citrine at base approaching Clove-Brown distally; gill filaments Mikado Brown to Orange Cinnamon.

*Non-paratypic material.*—A series of specimens in the United States National Museum from Upson, Maverick County, Texas (USNM 10853, 10855, 10857, 10860), and another series in the same institution from Matamoros, Tamaulipas, Mexico (USNM 4048-7 specimens, 4075), were purposely omitted from the list of paratypes and are only tentatively included in *nettingi*. In the specimens on which costal grooves can be counted, 36 occurs once, 37 five times and 38 twice. They are much larger than *nettingi* from other regions, the largest specimen, a female, having a total length of 612 mm and a snout-to-vent length of 423 mm. Noble and Marshall (1932, Amer. Mus. Novitates, no. 532: 5) also report that some of the specimens from the former locality have larger ovarian eggs than do specimens from the vicinity of Imboden. Furthermore, specimens that I have seen from both of these localities, have more pointed tails than do typical *nettingi*. Unfortunately, the material from southern Texas and northern Tamaulipas is inadequate, old, and poorly preserved, and the decision as to its true status is deferred until a field trip to this region can provide a series of fresh specimens.

*Remarks.*—The recognition of this new race should help to clarify the taxonomic situation in the genus *Siren*. Much of the difficulty in the past has been brought about by the attempt to make more than one form fit under a single name. Others have recognized that there is more than one race of *intermedia*. Noble and Marshall (*op. cit.*: 7) have stated in this connection: "Our smallest breeding females and all those with only thirty-one and thirty-two costal grooves come from Georgia and South Carolina. Future work may show that this is not identical with the *Siren* of the central states, which have from thirty-four to thirty-six costal grooves and rarely thirty-three." Furthermore, Percy Viosca, Jr., in a letter dated Jan. 27, 1941, says, "The eastern ones are black and those west of St. Tammany Parish are greenish grey with lighter spots underneath."

Thus on the Atlantic Coastal Plain there are two species of *Siren*, *lacertina* and *intermedia*, which have, on the average, 38 and 33 costal grooves respectively. While *lacertina* is not known west of Florida, typical *intermedia* ranges westward along the coastal plain to the Florida

Parishes of Louisiana, where it meets the western form, *nettingi*. Throughout most of its range *nettingi* has from 34 to 36 costal grooves, but specimens from the southwestern portion of its range have 37 or 38, and may, when sufficient fresh material is available from this region, prove to constitute still another race.

The following diagnoses should serve for the identification of most specimens of *Siren* except poorly preserved material on which costal grooves cannot be counted. It should be remembered that the salamanders of this genus tend to lose their color pattern rapidly in preservatives, and that the costal groove count is therefore of primary importance in identifying museum specimens.

Olive above with numerous circular black spots on top of head, dorsum and sides; light markings on body, if present, restricted to lateral and ventrolateral rows of very narrow, short white bars; 38 costal grooves. (District of Columbia south to southern Florida, in the coastal plain.)

*Siren lacertina* Linné

Usually uniformly dark above, somewhat lighter below, with no pronounced light spots; 31-34 costal grooves. (In the coastal plain from South Carolina to Pasco Co., Florida, and west to the Florida Parishes of Louisiana. Also reported from Virginia by Noble and Marshall, *op. cit.*: 7.)

*Siren intermedia intermedia* Le Conte

Light olive to gray above, black pigment restricted to very small dots; sides and venter often with numerous light spots; 34-36 costal grooves, rarely 33 or 37-38. (Southern Louisiana northward to southern Illinois and Indiana, west and south to Maverick Co., Texas, and northern Tamaulipas, Mexico.) . . . . . *Siren intermedia nettingi* Goin

*Acknowledgments.*—I am indebted to the following persons for the loan of material: Dr. Leonhard Stejneger and Dr. Doris M. Cochran, United States National Museum; Dr. Thomas Barbour and Mr. Arthur Loveridge, Museum of Comparative Zoölogy; Dr. Sherman C. Bishop, University of Rochester; Dr. E. R. Dunn, Academy of Natural Sciences of Philadelphia; Mr. Charles M. Bogert, American Museum of Natural History; Mrs. Helen T. Gaige, Museum of Zoology, University of Michigan; Mr. Clifford H. Pope, Field Museum of Natural History; Mr. E. B. Chamberlain, Charleston Museum; and Mr. Fred R. Cagle for the specimens in the Museum of Natural and Social Sciences, Carbondale, Illinois. Mr. Percy Viosca, Jr., has kindly presented me with both living and preserved material from Louisiana. Finally I wish to thank Dr. J. Speed Rogers of the University of Florida and Mr. M. Graham Netting of the Carnegie Museum for many helpful suggestions during the course of this study and the preparation of this manuscript.



ART. X. THE CHAZY CONULARIDA AND  
THEIR CONGENERS



BY G. WINSTON SINCLAIR

Annals of the Carnegie Museum

Vol. XXIX, p. 219-240

Issued October 1, 1942

Pittsburgh, Pa.



ART. X. THE CHAZY CONULARIDA AND  
THEIR CONGENERS

BY G. WINSTON SINCLAIR  
SIR GEORGE WILLIAMS COLLEGE  
MONTREAL, QUEBEC

(PLATES I-III)

INTRODUCTION

The Chazy limestone in the St. Lawrence and Champlain Valleys has been studied by Billings, Raymond, Hudson, Ruedemann, Twenhofel, and others, and its large and diverse fauna is well known. Among the many species described from the Upper Chazy (Valcour formation) are two species of *Conularia*, *C. triangulata* Raymond, 1905, and *C. par-roquetensis* Twenhofel, 1938. Four new species from equivalent beds near Montreal, Quebec, can now be added to these.

The six species exhibit in themselves such differences of structure that it has been thought necessary to assign them to three genera. *C. par-roquetensis* has already been discussed and referred to *Metaconularia* (Sinclair, Trans. Royal Soc. Canada, 1940, sec. iv, p. 104). The other five species, for which two new generic names are proposed, together with some allied species form the subject of this paper.

These conularids are of particular interest because they are the earliest definite representatives of the group to appear in America. Two older forms have been described, but *C. cambria* Walcott, 1890, has been shown to be a trilobite fragment (Raasch, Geol. Soc. Am., Spec. Paper 19, p. 104, fn.), and *C. pristina* Clark, 1924 (Bull. Amer. Pal., 41, p. 84), is a very doubtful fossil. Undoubtedly other species will be found in the earlier Ordovician, but so far these Chazyan forms are the oldest known from this continent.

I have been able to study some of the specimens described here through the kindness of the following curators and individuals: Miss M. A. Fritz, Royal Ontario Museum of Palaeontology; Percy E. Raymond, Museum of Comparative Zoölogy; Charles E. Decker, University of Oklahoma; Carl O. Dunbar, Peabody Museum of Natural History; T. H. Clark, Peter Redpath Museum; Harry S. Ladd, U. S. National Museum; I. P. Tolmachoff and E. R. Eller, Carnegie Museum; and James A. Calder,

Jr., of Ottawa, Canada. To these I owe my thanks, as well as to Archie Lamont, Birmingham; E. D. Currie, Glasgow; and Per Thorslund of Stockholm, for information concerning foreign species.

### **Conularina**, new genus

Conularida in which each face bears a low mesial ridge flanked by shallow depressions which appear on the inner side of the shell as low ridges, and in which the surface is ornamented by fine irregular striae.

*Genotype: Conularina triangulata* (Raymond).

Most of the species referred to the genus also agree in having the striae crossed by finer oblique folds near the shoulders of the angles. These may be true growth-lines, indicating the course of the apertural edge of the shell. If such is the case, this margin was produced in high triangular lobes. There is no direct evidence of the nature of the aperture. All the known specimens are broken apically, and the nature of the apex is unknown. No apical diaphragm has been seen.

The two longitudinal depressions forming internal ridges suggest possible relationship with *Metaconularia*. In the latter genus, however, the surface shell layers are not involved in the making of the "septa"; there is no evidence of an internal rod in *Conularina*. In several specimens there is a distinct tendency for one of the mesial depressions to be stronger than its mate. If this tendency were pursued until the shallower depression disappeared, a shell much like *Conularia kjerulfi* Holm (1884, p. 130)<sup>1</sup> would result.

The four Chazy species and that from the Black River, all described below, are the only known forms. None of the described European species seem to be congeneric.

### **Conularina triangulata** (Raymond)

(Plate I, figures 4-10)

1905. *Conularia triangulata* Raymond, Amer. Jour. Sci. xx, p. 379.

1908. *Conularia triangulata* Raymond, Ann. Carnegie Mus., iv, p. 216, pl. liv, fig. 18.

Raymond's description is quite sufficient to identify the species, but as some additional notes are desirable a new description incorporating them is offered:

<sup>1</sup> See bibliography appended.



Shell of medium size, slightly curved, tapering more rapidly towards the apex. Test very thin, becoming thicker at the angles; in places of at least four layers; usually black in colour. Faces slightly concave, equal, apical angle 13-15° near the apex, becoming about 9.5° towards the aperture. Cross-section, an equilateral triangle with the angles slightly truncated. Marginal grooves rather wide (0.8-1.5 mm.), flat and shallow, with sharp borders, the bottom sometimes marked by a low mesial ridge; near the apex the internal cast shows a sharp mesial depression. Mid-line of the face marked by a low ridge about 0.3 mm. wide, flanked by shallow depressions; both the ridge and the depressions more prominent on the cast. The surface marked by numerous fine lirae (16-20 in a length of one mm.) which cross the face in a shallow double-sigmoid curve, being almost horizontal at the mid-line, and rising to the shoulder of the angle where they turn slightly apicad. These lirae are low and frequently obscure near the middle of the face, but become sharp and bifurcate once or twice towards the shoulder; they are smooth except on the shoulder of the angle, where they are serrated by still finer threads which cross them obliquely. The internal cast usually bears the impression of the transverse striae, much less clear than on the surface. Apart from the oblique threads there is no longitudinal ornamentation. Apex and aperture unknown.

Length of the type, 39 mm.; of the plesiotype, plate I, figures 4-7, 23 mm. Width of face, 7 and 8.5 mm., in the two specimens, respectively.

*Types:* The holotype, a well-preserved specimen partially imbedded in the matrix, bears number 2,099, in the Carnegie Museum. Plesiotypes are in the collections of James A. Calder Jr., of Ottawa, and of the author.

*Occurrence:* Raymond's type came from the Valcour at Cystid Point, Valcour Island, and he also mentioned its occurrence at Smugglers' Bay. Fragments are somewhat common in a bryzoan-brachiopod coquina at Village Belanger, just north of Montreal. At this locality most of the specimens owe their preservation to encrustation by bryzoans. Mr. Calder's specimen was found about eight miles north-east of this locality, and about two miles south of Terrebonne. The beds at these Quebec localities are believed to be equivalent in age to the Valcour.

*Remarks:* The most striking feature of this species is, of course, its shape. Three-sided specimens of conularids are not unknown, but in other cases it is demonstrable that the specimen is an abnormal individual of a species ordinarily possessing the usual four faces. Over a dozen specimens of *C. triangulata* have been seen, all showing the same cross-

section, and it is apparent that this was the normal form of the species. The ornamentation is constant and distinctive. Even isolated fragments of the shell, showing no cross-section, are unmistakable.

Raymond described the species as having six sides, and it has been referred to in this way by other writers. There seems to be no reason for regarding the short "sides" as such: they are no wider proportionately than are the marginal grooves in many other species. That they are flat instead of concave is not significant. The lengthwise curvature of the shell is not seen in all specimens, but it is presumed that this is due to the fragmentary nature of many of them. All specimens of any length show at least a trace of bending. It is very possible that the shell became comparatively straight with age, but too few good specimens are known to be certain.

**Conularina undosa, sp. nov.**

(Plate II, figures 1, 2)

*Description:* Shell of moderate size, straight, tapering regularly. Test thin, of two layers except when thickened near the angles, black or blue-black in colour. Faces equal, flat or a little concave, apical angle  $9^{\circ}$ . Cross-section square. Marginal grooves wide and deep; the edges broadly rounded, to such an extent that the angles of the shell are materially truncated; the bottom of the groove apparently smooth, underlain by about five layers of shell material. Mid-line of the face with a very low, flat ridge, 0.3 mm. wide, flanked by shallow linear depressions. No internal structure seen. Surface with low, rather broad, ill-defined striae, 7 in 2 mm. of length; apparently smooth; stopping abruptly at the mesial depressions and at the shoulders of the grooves; curving across each half-face to make an arc convex towards the apex. Interspaces smooth, from one to two times as wide as the striae. Aperture and apex unknown.

Length, 36 mm; width of face, at least 7.5 mm.

*Type:* An external impression of two faces, and a length of 14 mm. of the original specimen; number 617 in the author's collection.

*Occurrence:* In the Upper Chazy near Cap St. Martin, north of Montreal. The precise locality is a quarry one-quarter mile east of the hamlet of Village Belanger.

*Remarks:* The preservation of the only specimen is not sufficiently good to permit a definite statement that the oblique shoulder striation,

seen in other species, is absent. The low, indistinct striae, and the course of these across the face, distinguish the species from the genotype, fragments of which might otherwise be confused with it.

***Conularina irrasa*, sp. nov.**

(Plate I, figures 1-3)

*Description:* Shell large, slightly curved in its present condition, tapering regularly. Test multilamellar, of 20 or more layers in places, thickest at the angles; the outer layer black, the inner layers usually brownish. Cross-section rhombic. Faces gently convex, equal, apical angle about  $13^{\circ}$ . Marginal grooves wide and shallow; the edges more or less rounded, angulate on the internal cast; the bottom almost flat and smooth. Mid-line with a narrow sub-median ridge flanked by shallow indefinite depressions. Surface with small, low, undefined folds; 3-4 in one mm.; horizontal or gently arched across each half-face, dying out at the mid-line; crossed near the angles by sharper grooves directed obliquely apicad. At one place, very fine, short, transverse grooves are seen at the mid-line of the face. The first inner shell layer bears fine, smooth, distant, thread-like striae, extremely irregular but roughly parallel to the surface folds. Apex and aperture unknown.

Length, 90 mm.; width of face, 30 mm.

*Type:* A partially exfoliated and somewhat crushed free specimen, number 335 in the author's collection.

*Occurrence:* With *C. undosa*, *q.v.* This locality, which has yielded most of the specimens of *C. triangulata*, also has *Blastoidocrinus*, *Camarotoechia*, *Hebertella*, *Eoharpes*, and other fossils including a host of unstudied bryzoans.

*Remarks:* One face of the shell is bent inwards at the larger end, but the crushed condition of the specimen makes its significance doubtful. For the same reason the straightness of the shell as a whole cannot be definitely stated. The size and ornamentation, especially that of the inner shell layer, are distinctive.

***Conularina raymondi*, sp. nov.**

(Plate II, figure 3)

*Description:* Shell small, straight, tapering regularly. Test very thin, of two layers, dark brown in colour. Faces evenly and strongly convex,

equal, apical angle  $10.5^{\circ}$ . Cross-section circular, indented at the margins of the faces. Marginal grooves 0.15 mm. wide (0.6 mm. on the cast), deep, the edges broadly rounded, the bottom flat due to extensive shell thickening. On the internal cast the groove shows as a sharply rounded V. Mid-line of the face marked by a low rounded ridge, on either side of which there is a slight depression. On each face the depression to the left of the mid-line is the stronger. Surface with many very fine, obscure transverse wrinkles, about 5 in one mm., slightly arched across the face. Apex and aperture unknown.

Length of holotype, 21 mm.; of the paratype, 13.5 mm. Width of face in the two specimens, 6.5 and 5 mm.

*Types*: Holotype in the author's collection, number 3; paratype in the Museum of Comparative Zoölogy at Harvard College, number 27,935. Both are free specimens in fairly good preservation.

*Occurrence*: The MCZ specimen was collected by Mr. Henry Seton at Valcour Island, in the Upper Chazy. The holotype was found at Cap St. Martin, Quebec, in a coquina similar to that at Village Belanger, although no other conularids were found in it. Besides many bryozoans this bed contains a large brachiopod fauna, with *Camarotoechia orientalis* most abundant.

*Remarks*: In the holotype the oblique striae on the shoulders are represented by extremely obscure wrinkles, only seen in oblique light. As usual, they cross the transverse ornamentation at a small angle. The sharper of the two depressions bordering the mesial elevation is sufficiently inflected to produce a distinct linear groove on the cast. The shape and the indistinct, arched ornamentation distinguish the species.

### ***Conularina narrawayi*, sp. nov.**

(Plate II, figure 4)

*Description*: Shell small, straight, tapering regularly. Test very thin, of two layers, black in colour. Faces slightly convex, equal, apical angle about  $14^{\circ}$ . Cross-section apparently square (not well seen). Marginal groove narrow (0.3 mm.), rather deep, the edges sharply rounded, the bottom marked by very irregular transverse wrinkles and internal thickening of the shell. Mid-line of the faces with a very narrow ridge, the flanking depressions inconspicuous. Surface with numerous (8 in one mm.), irregular, low, smooth folds or wrinkles, whose course across the face is slightly arched but very irregular. Aperture and apex unknown.

Length, 21 mm.; width of face, 9 mm.

*Type*: Royal Ontario Museum of Palaeontology, number 18,905. A somewhat distorted, free specimen, with the surface well-preserved in places. Collected by Mr. James A. Narraway of Ottawa, for whom it is named.

*Occurrence*: In the Ottawa limestone, at a horizon containing an abundant fauna of the age of the Leray in New York; at Tetreauville, Quebec, on the Ottawa River opposite the city of Ottawa. These are the beds in which Mr. Narraway found the type of *Metaconularia* ? *dubia* Sinclair (Trans. Royal Soc. Can., 1940, sec. iv, p. 107).

### **Climacoconus**, new genus

Small conularids bearing relatively large, smooth, transverse ridges which meet a prominent longitudinal keel at the mid-line of the faces.

*Genotype*: *Climacoconus quadratus* (Walcott).

The test as ordinarily seen is smooth, and usually black in colour. Exceptionally well-preserved specimens show that there was another external shell-layer which was extremely thin, lighter in colour, and capable of wrinkling. The cross-section of the shell as a whole may be rectangular or square; the specimens which are variously rhomboid are considered to be distorted. The keel is usually as high as the transverse ridges, and its prominence contrasts with the corresponding region in other conularids; it may be straight or zig-zag, and of course the latter condition is only possible where the ridges reach the mid-line alternately. There is no thickening of the shell or other internal structure at the mid-line, so far as is known. The preservation of the type of *C. clarki* (page 229) indicates a weakness of the test along the mid-line, and such a zig-zag keel might tend to strengthen it. It should be pointed out, however, that such a zig-zag course is known in one of the earliest species, *C. humilis*.

The marginal grooves are usually rather wide, and the shell thickened, so that on the internal cast the grooves are quite deep. The bottom of the groove is commonly marked by transverse wrinkles and by oblique extensions of the ridges. In some species the edges of the grooves are raised into definite ridges. The aperture is not known, nor is the nature of the apex clearly seen in any specimen. There is no evidence of an apical diaphragm, and some specimens suggest strongly that the shell continued to a point.

An examination of several specimens of *C. quadratus* from the upper

Trenton at Montreal indicates a consistency within the species in size and in the arrangement of the ridges and their number at any point. The apical angle, and the density of the ridges, and their arrangement, vary with the growth of the individual, but this variation is orderly and specimens of the same size exhibit the same characteristics. The criteria used in discriminating species (considering specimens of comparable growth) are: course of the keel; apical angles; and density, direction, and height of the ridges. The general size of the shell is also significant within limits.

Specimens of *Climacoconus* are usually very rare, but occur in America throughout the Middle and Upper Ordovician, from the Chazy to the Richmond. In Europe three species have been described, all from the Ordovician. The genus has not been reported elsewhere. It is evident from the appearance of "*Conularia quadrata*" in many faunal lists that the occurrences known and given below are not exhaustive.

The order of specific descriptions is: (a) the genotype, (b) other American species in order of age, and (c) European species.

### ***Climacoconus quadratus* (Walcott)**

(Plate III, figures 1-5)

1879. *Conularia quadrata* Walcott, 28th Ann. Rept., N. Y. State Museum, p. 93.

Walcott's original description is very brief, and the species has never been figured. For these reasons it has been subject to some confusion. The description here offered is drawn from the type, and from some additional specimens from Montreal.

Shell small, straight, tapering more rapidly towards the aperture. Test of two layers, both extremely thin; the outer creamy-white in colour, the inner black. Cross-section rectangular. Faces plane, unequal (about as 5:4), apical angle about  $12^{\circ}$  near the smaller end, increasing to  $18^{\circ}$  at the apertural end of large specimens. Marginal groove wide, open, deep; the edges sharp but not ridged; the bottom with minute transverse wrinkles. From between the ends of each two ridges an obscure elevation runs obliquely into the groove, in the direction of the aperture. Mid-line with a straight keel, not as high as the ridges. Surface with smooth transverse ridges, highest halfway between the margins and the keel, with sharply rounded crests, especially near the aperture. The ridges meet at the keel

at an angle of 135-140°. Apically the ridges tend to be straighter, more rounded on top, and proportionately wider. They alternate at the keel near the aperture, but apically they are opposite. There are about eight ridges in a length of 2 mm. near the apex, three or four at the middle of the shell, and two at the larger end. Interspaces smooth, about 1.5 times as wide as the ridges, somewhat less apically. Apex and aperture unknown, but some specimens indicate that the latter was probably pointed (see plate III, figure 5).

The larger end of the type specimen is not well preserved, and it is not possible to give accurate measurements of the whole shell. The length was at least 20 mm.; the greatest width of face actually preserved is 4 mm. Length of a typical Montreal specimen (plate III, figure 4) is 22 mm.; width of the faces, 6.5 and 5.5 mm.

*Type:* The holotype, number 27,933 in the Museum of Comparative Zoölogy at Harvard College, is imbedded in black limestone and exposes most of two adjacent faces. Figured specimens are in the collections of James A. Calder, Jr., and of the author.

*Occurrence:* Walcott's type was found in the "upper third of the Trenton limestone" at Prospect Bridge, Trenton Falls, New York. This would place it in the Lower Cobourg (Hallowell) formation. The Central Ontario divisions cannot be applied in the Montreal area, but the upper beds of the Trenton at Montreal, in which the species occurs, are believed to be of Cobourg age. Fragments are not uncommon in an old quarry just east of Sherbrooke Street in the town of Pointe aux Trembles, where they occur in an impure brown limestone with *Serpulites*, *Calymene*, *Sowerbyella* and *Rafinesquina*.

*Remarks:* It should be noted that the ridges do not enter the marginal grooves; the short oblique elevations which occur there originate opposite the interspaces.

*Climacoconus quadratus* has also been listed from various beds in the Cincinnati area, and from the Decorah in the upper Mississippi Valley. Since no specimens from these localities have been examined, no opinion is offered on their identity with the eastern species. A fragment, apparently of this species, was found in the lower Trenton near Bath, Ontario. Another fragment, from the Guttenberg member of the Decorah at Galena, Illinois, has been listed by Kay as *Conularia trentonensis* (Jour. Geol., xxvii, p. 659). Both these specimens are too poor to warrant specific identification, but they indicate the presence of a species of the *C. quadratus* type of structure.

**Climacoconus rallus**, sp. nov.

(Plate II, figures 11, 12)

*Description:* Shell small, straight, tapering regularly. Test very thin, only one layer seen, black in colour. Faces plane or slightly concave, equal, apical angle  $11.5^{\circ}$ . Cross-section unknown. Marginal grooves rather wide (0.5-0.6 mm.), deep; the edges sharp and raised; the bottom bearing obscure ridges running obliquely aperturad, as well as minute transverse wrinkles. Mid-line with a low straight keel, not as high as the ridges. These are extremely thin, very high, and sharp, the tops usually broken off; highest at the middle of the half-face, becoming lower at the keel and the margins; 9 in a length of 5 mm.; smooth, opposite at the keel, or nearly so; meeting at an angle of  $150^{\circ}$ ; stopping at the marginal groove, where they are alternately placed with reference to those on the adjacent face. Interspaces wide, 3 to 4 times as wide as the ridges, smooth. Apex and aperture unknown.

Length, 15 m.; width of face, 5 mm.

*Type:* A free flattened specimen belonging to James A. Calder, Jr., of Ottawa.

*Occurrence:* A quarry on the south side of provincial highway 18, two miles south of Terrebonne, Quebec, in the Upper Chazy.

*Remarks:* The transverse ridges are more distant than in any other species except *C. clarki*, and the largest specimens of *C. quadratus*. From both of these, *C. rallus* is distinguished by the sharpness of the ridges and the width of the interspaces. Whether the rate of tapering in more complete specimens would be uniform cannot be judged from those at hand.

**Climacoconus humilis**, sp. nov.

(Plate II, figures 6, 7)

*Description:* Shell small, straight, tapering regularly. Test extremely thin, one black layer seen. Faces plane, slightly unequal, apical angle about  $7^{\circ}$ . Cross-section rectangular. Marginal groove rather narrow, deep; the edge prominent and forming a slight ridge which is highest where the ridges cross it; the bottom marked by the interlocking ends of the transverse ridges. Mid-line marked by a broad mesial keel, not as high as the ridges, but highest where two of them meet at the same point; straight where the ridges are opposite, slightly zig-zag where they alternate. Surface with rather wide, prominent, smooth, nearly straight,



transverse ridges, 4-4.5 in a length of 2 mm.; alternating at the keel on one face, but opposite on the other; meeting at an angle of  $143^\circ$ ; bending abruptly towards the aperture on entering the marginal grooves. Interspaces about 1.5 times as wide as the ridges, and smooth. Aperture and apex unknown.

Length, 7 mm.; width of wider face, 3 mm.

*Type:* Number 4,753 in the Carnegie Museum. The specimen is imbedded in a grey sandstone, and exposes two faces.

*Occurrence:* Faribault, Minnesota, in the St. Peter sandstone.

*Remarks:* The zig-zag course of the keel is not seen in other early species, but it is prominent in the Richmond forms. The present species is quite similar to *C. quadratus*, but the size and small apical angle will distinguish it. Many specimens of the Trenton species are known in which the ridges alternate, but the keel is always straight.

### ***Climacoconus clarki*, sp. nov.**

(Plate II, figures 8, 9)

*Description:* Shell of medium size, straight, tapering more rapidly towards the aperture. Test of two layers, as in the genotype. Faces plane, apparently equal, apical angle varying from  $10^\circ$  near the apex to  $16^\circ$  at the larger end. Cross-section square or rectangular (the equality of the faces is not certain). Marginal groove wide (one mm. at the larger end of the shell), deep, the edge angular with a slight ridge; the bottom marked by irregular transverse wrinkles and by the obscure extensions of the transverse ridges. Mid-line unknown. Surface with rather wide, high, transverse ridges, with smooth and broadly rounded crests, thinner and more sharply rounded on the internal cast; 9, 6.5 and 7 of these ridges occur in lengths of 5 mm., taken near the apex, at the middle of the shell and near the larger end, respectively. Ridges straight apically, but sharply geniculate near the aperture; bending towards the aperture in the marginal groove. Interspaces a little wider than the ridges, on the cast about 1.5-2 times as wide; smooth. Aperture and apex unknown.

Length, 30 mm.; width of half-face, 5 mm.

*Type:* In the Peter Redpath Museum, McGill University.

*Occurrence:* In the basal Trenton at Le Page Station, Quebec, about twenty miles north-west of Montreal. Collected by Prof. T. H. Clark, for whom it is named.

*Remarks:* The only specimen preserves halves of two adjacent faces, the

shell being broken evenly along the mid-line of each; there is no trace of the usual mesial keel. The specimen is otherwise undistorted, and the preservation of the delicate outer shell-layer indicates that it was not exposed to great attrition before burial. This species is larger than most of the genus; the geniculate transverse ridges and their density are distinctive.

***Climacoconus bromidus*, sp. nov.**

(Plate II, figure 5)

*Description:* Shell small, straight, tapering more rapidly towards the apex. Test very thin, only one layer seen, of a light brown colour. Faces angularly concave (crushed?), equal, apical angle about  $13^{\circ}$  in the apical portion, becoming smaller in the younger part of the shell. Marginal groove rather shallow, 0.5 mm. wide at the larger end of the shell, the edge marked by a prominent ridge which is highest where met by the transverse ridges. Mid-line marked by a straight mesial keel, of the same height as the ridges. Surface with rather wide, smooth, sharply rounded transverse ridges, highest halfway between the margins and the keel; nearly straight, usually opposite at the keel, meeting at an angle of  $145^{\circ}$  near the aperture,  $135^{\circ}$  apically; 5 occur in one mm. of length near the apex, 3.5 nearer the aperture. Interspaces smooth, 1.5-2 times as wide as the ridges. Aperture and apex unknown, but the latter seems to have been pointed.

Length, 10.5 mm.; width of face, 2.7 mm.

*Type:* Number A 8,952, in the Museum of Paleontology, University of Oklahoma. The type is a flattened specimen, showing one face and most of an adjacent one.

*Occurrence:* Collected by Dr. Charles E. Decker in zone 6 of the Viola limestone, Sec. 2-2S-7E, Witch Hole, southwest of Bromide, Oklahoma. The fauna listed from this zone (Decker, Bull. Amer. Assoc. Petrol. Geol., xvii, p. 1419) seems to indicate a Middle or Upper Trenton age.

*Remarks:* The ridges are usually opposite at the keel, but in some places they alternate. This alternation may take place where there is continuity on the adjacent face. The ridges continue into the marginal groove, at the bottom of which they alternate and interlock; they are bent sharply towards the aperture on entering the groove. This species is distinguished by its small size, crowded ridges, and the ridged nature of the edges of the grooves. This is the species which has been listed from Witch Hole as "*Conularia trentonensis*," but there are other species of conularids in the Viola.

**Climacoconus pumilus**, sp. nov.

(Plate II, figure 10)

1929. *Conularia pumila* Ladd, Ann. Rept. Iowa Geol. Survey, xxxiv, p. 384 (*nom. nud.*)

*Description:* Shell minute, straight, tapering regularly. Test unknown. Faces plane, equal, apical angle  $9.5^{\circ}$ . Cross-section square. Marginal groove narrow, rather deep, the edges sharply rounded but not ridged, the bottom angular. Mid-line of the faces marked by a regular zig-zag ridge, of which the elements meet at an acute angle. Surface with smooth, wide, low, straight, rounded transverse ridges, 9 in a length of 1.6 mm.; alternating at the keel, stopping at the shoulders of the marginal grooves. Interspaces smooth, 1-1.5 times as wide as the ridges. Aperture and apex unknown.

Length, 1.7 mm.; width of face, 0.8 mm.

*Type:* A free cast, preserving two faces well; collected by Dr. Harry S. Ladd, and now in the U. S. National Museum.

*Occurrence:* In the "Depauperate" zone of the Maquoketa, Clermont Township, Fayette County, Iowa. The precise locality is described by Ladd in the paper cited, page 376.

*Remarks:* As is the case with the other "depauperate" Maquoketa species, this is not a small specimen of some other species, but is a unique form. It is not liable to confusion with other species.

**Climacoconus batteryensis** (Twenhofel)

(Plate III, figure 7)

1929. *Conularia batteryensis* Twenhofel, Mem. Geol. Survey Canada, 154, p. 255, pl. xxvi, 9.

*Description:* Twenhofel's description may be arranged, with some minor additions, to read: Shell small, straight, tapering regularly. Test thin. Faces flat or very slightly convex, equal, apical angle about  $18^{\circ}$ . Cross-section rhombic. Mid-line marked by a zig-zag ridge, made up of components which are about one mm. long, and which meet at a right angle. Marginal grooves concave, with sharp edges. Transverse ridges distant, 8 per 5 mm. at the smaller end of the shell, 11 at the larger; straight, almost smooth, slightly rounded; meeting the keel at the projecting angles to form with them an angle of about  $140^{\circ}$ . Interspaces wide, nearly flat, smooth.

Length, 23 mm.; greatest width of face, 6 mm.

*Type:* A well-preserved free specimen in the Peabody Museum of Natural History, Yale University, numbered 10,367.

*Occurrence:* In zone 4 of the Vauréal formation, at Battery Point, Anticosti Island, Quebec. This zone carries an abundant and varied fauna which has been described in detail by Twenhofel in the memoir cited. The Vauréal is correlated with the upper Richmond of the Mississippi Valley.

*Remarks:* The strongly zig-zag keel is sufficient to distinguish the species from all the earlier forms. Fragments of a similar species have been found in beds of Richmond age at Deer Island, Lake Winnipeg, but they are too poor to permit detailed comparison. The form listed by Ladd (1929, p. 394) from the Fort Atkinson member of the Maquoketa as *Conularia sp.* is another similar species, also too fragmentary for description. A third form related to *C. batteryensis* is indicated by a specimen found in the drift near Winnipeg, Manitoba, and likely derived from the Cat Head formation north of that place.

### ***Climacoconus bottnicus* (Holm)**

(Plate III, figure 9)

1893. *Conularia bottnica* Holm, Sver. Geol. Unders. C112, p. 136, text figure.

1908. *Conularia bottnica* Wiman, Bull. Geol. Inst. Upsala, viii, p. 142.

Holm's description may be freely translated:

Medium sized species. Shell tapering regularly, apical angle about 25°. Cross-section quadratic. Faces plane, with a mesial narrow, sharp, ridge, of about the same height and form as the transverse ridges, but a little thinner. Marginal groove comparatively wide, shallow and flat, the edges sharply angulated.

Sculpture fairly coarse, of obtusely angulated ridges only. These are very high and sharp, numbering 7-8 in 5 mm. The crests are not seen, being broken in the matrix. Interspaces about three times as wide as the ridges, rounded and smooth on the bottom, without any longitudinal furrows except near the point of the shell, where very feeble and thin ones occur. The marginal groove also has obtusely angulated transverse ridges with the angle directed forward, but here they are considerably weaker, disappearing towards the mid-line of the groove, and most often arranged more or less zig-zag.

Almost complete fragments have a breadth at the aperture of 12.5 mm., marginal groove at the same place 1.5 mm., and length at least 30 mm.

The species was found in the Östersjö limestone (Upper Ordovician) at Upland, Sweden. Wiman reports it from the same beds.

This species is much wider than any American form, and its regularly

opposite transverse ridges are not seen in any of our species. In this feature, but in this one only, it agrees with *C. scoticus* (Lamont).

***Climacoconus scoticus* (Lamont)**

(Plate III, figure 8)

1934. *Conularia scotica* Lamont, Geol. Mag., lxxi, p. 224, pl. xi, figures 8-9, text figure 1.

Lamont's description:

Shell small, thin, tapering more rapidly towards the apex. Marginal grooves well developed, with raised rims between which there is a fine longitudinal furrow. Faces, flat to slightly concave, ornamented with strong transverse ridges, evenly distributed, narrower and less rounded than the interspaces, forming rounded angles of about  $135^\circ$  and also bending forward at the lateral ends.

Apertural lobes and apex unknown.

*Type:* In the Hunterian Museum, University of Glasgow.

*Horizon and locality:* Mudstones (Caradocian), Balclutchie, Girvan, Scotland.

*Remarks:* The transverse ribs [number] 34 in 9 mm. Ridges fully observed are smooth. The apical angle appears to be as much as  $25^\circ$ , but towards the aperture the sides are increasingly parallel and only make an angle of about  $17^\circ$ . Adjacent faces probably slightly unequal in width.

On the left posterior edge of the specimen, the narrow, longitudinal furrow of the marginal groove is seen lying between rims much broader than itself. Part of one rim is seen carrying an additional fine longitudinal striation. The rim-material conceals the lateral extension of the ridges. On the right side of the specimen, the superficial rim-material has been detached. The ridges seem to swell slightly where they encroach upon the marginal groove, within which they are bent somewhat forward.

In general aspect this species is similar to some of the American forms, but the regularly opposite ridges distinguish it. The course of the ridges is unique, and affords a ready distinction from *C. bottnicus*. None of the American specimens examined throw any light on the interesting structure of the edges of the marginal grooves described by Lamont.

***Climacoconus ? lanceolatus* (Krause)**

(Plate III, figure 6)

1877. *Conularia lanceolata* Krause, Zeits. d. d. geol. Gesell., xxix, p. 24, pl. i, 10.

Krause's brief description may be freely translated:

A small form with rhombic cross-section, 4 mm. in length and 1.5 mm. wide at the base (*i.e.* the maximum diagonal, not the width of the face), apex only slightly

rounded. The four angles with a deep furrow; the faces with numerous angulated transverse ridges and a median line uniting the points of geniculation. In the present specimen 26 such ridges occur, so that there are 6 or 7 in one line.

In view of this slight description the species is placed in this genus with some hesitancy, but it would seem likely that this is its proper position. Krause's specimen came from the drift and was supposed (with some doubt) to be derived from the Beyrichia limestone (Lower Ordovician).

#### BIBLIOGRAPHY

HOLM, GERHARD.

1893. Sveriges Kambrisk-Siluriska Hyolithidae och Conularidae; *Sver. Geol. Unders.*, vol. C112.

KRAUSE, A.

1877. Die Fauna der sogen. Beyrichien- oder Choneten-Kalke des norddeutschen Diluviums; *Zeits. d. d. geol. Gesell.*, xxix.

LADD, HARRY S.

1929. Stratigraphy and Paleontology of the Maquoketa Shale of Iowa; *Ann. Rept. Iowa Geol. Survey*, xxxiv.

LAMONT, ARCHIE.

1934. A New Species of *Conularia* from Girvan; *Geological Mag.*, lxxi.

RAYMOND, PERCY E.

1905. The Fauna of the Chazy Limestone; *Amer. Jour. Sci.*, xx.  
1908. Gastropoda of the Chazy Formation; *Annals Carnegie Museum*, iv.

TWENHOFEL, W. H.

1928. Geology of Anticosti Island; *Geol. Survey Canada, Memoir* 154.

WALCOTT, C. D.

1879. Description of new species of fossils from the Trenton Limestone; *New York State Mus.*, 28th *Ann. Rept.*



## EXPLANATION OF PLATE I

FIGS. 1-3. *Conularina irrasa*, sp. nov.

1, 2. The specimen,  $\times .75$ . The author's collection, no. 335. Upper Chazy, Village Belanger, Quebec.

3. The surface of the same,  $\times 2$ , showing the distant thread-like striae on the inner shell-layer.

FIGS. 4-10. *Conularina triangulata* (Raymond).

4. Specimen from Mr. Calder's collection. Upper Chazy, near Terrebonne, Quebec. Part of the surface,  $\times 7.5$ , to show the oblique striations on the shoulder.

5. The same specimen. Surface,  $\times 7.5$ .

6. The same specimen,  $\times 2$ , from one of the angles.

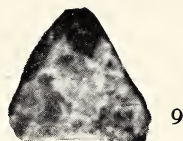
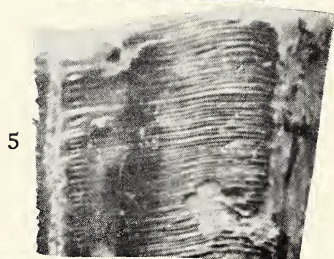
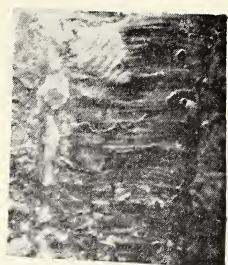
7. The same specimen,  $\times 2$ , from one face.

8. The holotype,  $\times 2$ . no. 2,099, the Carnegie Museum. Upper Chazy, Valcour Island, N. Y.

9. View of the larger end of the specimen shown in figures 4 to 7,  $\times 2$ .

10. An internal cast, no. 76 in the author's collection,  $\times 2$ . Showing the mesial ridge and the faint impression of the surface striae.









## EXPLANATION OF PLATE II

- FIGS. 1-2. *Conularina undosa*, sp. nov.  
 1. An impression of two faces,  $\times 1.25$ . The author's collection, no. 617. Upper Chazy, Village Belanger, Quebec.  
 2. Counterpart of the same specimen,  $\times 2$ , to show the structure of the mid-line and the nature of the transverse striae.
- FIG. 3. *Conularina raymondi*, sp. nov.  
 The holotype,  $\times 1.5$ . The author's collection, no. 3. Upper Chazy, Cap St. Martin, Quebec.
- FIG. 4. *Conularina narrawayi*, sp. nov.  
 The holotype,  $\times 2$ . Royal Ontario Museum of Palaeontology no. 18,905. Ottawa limestone (Leray horizon), Tetreauville, Quebec.
- FIG. 5. *Climacoconus bromidus*, sp. nov.  
 The holotype,  $\times 2.5$ . Museum of Paleontology, University of Oklahoma, no. A8,952. Viola limestone, Witch Hole, Oklahoma.
- FIGS. 6-7. *Climacoconus humilis*, sp. nov.  
 6. One side of the type,  $\times 2$ . Carnegie Museum, no. 4,753. St. Peter sandstone, Faribault, Minn. To show the opposite ridges and straight keel.  
 7. The same specimen, an adjacent face,  $\times 2$ . To show the alternation of the ridges at the zig-zag keel.
- FIGS. 8-9. *Climacoconus clarki*, sp. nov.  
 Two views of the type,  $\times 2$ . Redpath Museum, McGill University. Basal Trenton, Le Page Station, Quebec.
- FIG. 10. *Climacoconus pumilus*, sp. nov.  
 The type,  $\times 9.5$ . The U. S. National Museum. Depauperate zone of the Maquoketa, Fayette County, Iowa.
- FIGS. 11-12. *Climacoconus rallus*, sp. nov.  
 Two views of the type,  $\times 2$ . From Mr. Calder's collection. Upper Chazy, near Terrebonne, Quebec. To show the thin ridges, and the projections into the marginal grooves.



1



2



3



4



5



6



7



8



9



10



11



12





## EXPLANATION OF PLATE III

- FIGS. 1-5. *Climacoconus quadratus* (Walcott).
1. The type,  $\times 2$ . Museum of Comparative Zoölogy, no. 27,933. Upper Trenton, Trenton Falls, N. Y. Photograph supplied by Professor Raymond.
  - 2-3. Two views of a specimen from Mr. Calder's collection,  $\times 2$ . Upper Trenton, Montreal East. To show the inequality of the faces; the specimen shows evidence near the smaller end of an injury suffered during the life of the animal.
  4. A large specimen,  $\times 2$ . The author's collection, no. 249. Upper Trenton, Pointe aux Trembles, Montreal.
  5. A flattened specimen,  $\times 2$ . From Mr. Calder's collection.
- FIG. 6. *Climacoconus ? lanceolatus* (Krause).  
After Krause. Lower Ordovician, north Germany. About eight times natural size.
- FIG. 7. *Climacoconus batteryensis* (Twenhofel).  
The type specimen,  $\times 2$ . Peabody Museum of Natural History, no. 10,367. Vauréal formation, Battery Point, Anticosti. Photograph by the Department of Mines of Canada.
- FIG. 8. *Climacoconus scoticus* (Lamont).  
After Lamont. The type specimen,  $\times 5$ . Hunterian Museum, Glasgow. Caradoc; Girvan, Scotland.
- FIG. 9. *Climacoconus bottnicus* (Holm).  
Reduced from Holm. Upper Ordovician, Sweden. The figures are: *a*, the specimen,  $\times 1.5$ ; *b*, cross-section of the smaller end,  $\times .75$ ; *c*, the mid-line,  $\times 3$ ; and *d*, the marginal groove,  $\times 3$ .





1



2



3



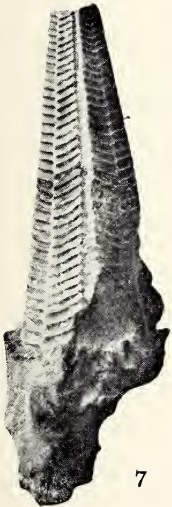
4



5



6



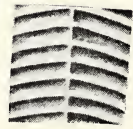
7



8



9



c



d

a



b

9











ART. XI. SCOLECODONTS FROM THE ERINDALE,<sup>1943</sup>  
UPPER ORDOVICIAN, AT STREETSVILLE, ONTARIO <sup>E</sup>

BY E. R. ELLER

(PLATES I-IV)



Close to the water's edge at Streetsville, Ontario, on the Credit River, occur sandstone layers of the Erindale member of the Meaford formation (Cincinnatian series of Ordovician age), which are extremely rich in scolecodonts, or the fossil jaws of polychaete worms. The surface of some of the layers is darkened by their presence and more than five hundred jaws or fragments of jaws were counted from a single square inch (plate IV). It is surprising that this locality is not better known since it is situated within a few miles of Toronto.

Very little work had been done along that part of the Credit River until the late Dr. Dyer (1923) published on the paleontology of the section. Murray (1843) was the first to refer to the rocks of the Credit River. He called all the strata between the Utica and Queenston shales the "bluish shales and sandstones." Logan (1863) in the "Geology of Canada," p. 212, mentioned the outcrop along the Credit River. Nicholson (1875) described a few species from the Credit River as belonging to the Hudson River group. Parks (1913) mentions briefly the Streetsville locality. The first detailed work appeared in a memoir by Foerste (1916) in which the section was measured, the fossils were listed, and correlations were made. The layers in which the scolecodonts are found were referred to the Waynesville member of the Richmond by Foerste (1924). Scolecodonts are known to occur in the Upper Ordovician of Ohio and it will be interesting to make correlations with the various species when that fauna has been studied. None of these workers mentioned or described scolecodonts as a part of the Erindale fauna, even though annelid jaws had been described from the vicinity of Toronto and Hamilton by Hinde in 1879.

The general habits of modern polychaetes suggest that the nearly pure sand matrix, in which the fossil jaws are contained at the Streetsville locality, was not their habitat. Many of the recent forms are sedentary, spending most of their lives in burrows or tubes, a short distance off shore or in the inter-tidal zones.<sup>1</sup> They seem to prefer a muddy bottom

<sup>1</sup> Many recent forms, however, are found at great depths.



containing vegetable matter which is more suitable for the construction of their burrows and the providing of their food. This would seem to indicate that the jaws now under consideration were brought there by currents or by wave action. Probably many of the jaws were washed in from a short distance and they may have rolled about considerably since many of them are water-worn. Just why there should be so many is a difficult problem to answer; unless some catastrophe overcame the annelids here. Certain polychaetes are known to come out of their burrows to spawn at a particular time once each year. M'Intosh (1885) received information with some specimens from Samoa . . . "that annelids appear regularly in the months of October and November, during portions of two days in each month, *viz.*, the day before and the day on which the moon is in her last quarter. They occur in much greater numbers on the second than on the first day of their rising and are observed only for two or three hours in the early morning. At the dawn of the day, they may be felt by the hand swimming on the surface of the water; and as the day advances their numbers increase, so that by the time the sun has risen, thousands may be observed in a very small space. The second day they appear at the same time, and in a similar manner, but in such countless myriads that the surface of the ocean is covered with them for a considerable time."

The presence of so many annelids in the Erindale could be explained in a similar way. What caused them to die at that time and their jaws to be deposited is not known. Many theories might be presented in answer to this question. Perhaps some calamity overtook them at the time of spawning, or a change in the environment caused the annelids to issue forth from their burrows, at which time great masses of them were killed by some sudden disaster.

The nearly pure sandstone layer in which most of the jaws are found is very slightly ripple-marked. Most of the jaws are deposited on the tops of the very low crests. The sandstone has a varve-like appearance and there is an indication of about twenty-five layers to the inch. Probably the jaws were deposited on shallow-water flats in which there was not too much disturbance afterward. Since the jaws are much lighter in weight than the material making up the matrix, they were sorted out by the movements of the water and deposited on the highest places. On some layers, jaws were found to be deposited in what might be wave or swash marks. Since the jaws occur in hard, nearly pure, sandstone, containing very little calcium carbonate as the cementing agent, it was found that



they could not be removed by the use of hydrochloric acid, and it was necessary to use hydrofluoric acid to remove them from the matrix. The jaws were separated from the residue by a gravity separation with the use of heavy liquids, Eller (1941). Most of the species described are represented by several scores of specimens. Species represented by only a few or by broken specimens are not described.

#### ACKNOWLEDGMENT

The author is very grateful for a grant-in-aid received through the Pennsylvania Academy of Science from the American Association for the Advancement of Science.

#### DESCRIPTIONS OF SPECIES

Genus *LUMBRICONEREITES*, Ehlers, 1868

***Lumbriconereites marlenediesae* sp. nov.**

Maxilla I, plate I, figs. 1, 2.

The jaw is angular with parallel margins. There are generally twelve large, backward directed denticles which extend along the inner margin nearly to the truncate posterior extremity. The inner margin, when viewed directly from the lower side, curves at the anterior end or at about the fourth denticle and continues in a straight line to the posterior end. The first three denticles are small and blunt. The next four or five increase in size and are conical and pointed. The remaining denticles decrease in size to the posterior. The fang is small and is not as large as some of the denticles. The outer margin is slightly incurved to the angular shank. Posterior to the shank, the outer margin is notched by a shallow bight. A wide fossa extends for about two-thirds the length of the jaw. The margin that surrounds the fossa, except on part of the outer margin, is thickened and rounded. The upper surface is convex except at the outer parts of the fossa. The under surface is irregularly concave. Specimens range from .72 mm. to 1.67 mm. in length.

Very little variation was noted in this species among the several scores of specimens examined. Except for the width, the narrow shank, and the truncate posterior, it resembles *Lumbriconereites hibbardi* Eller (1940) in a general way. There is a similarity between *Lumbriconereites marlenediesae* and *Lumbriconereites obliquus* (Eichwald) (1854). The latter has more curved margins, a different shaped shank and larger fossa.

**Lumbriconereites proclivis** sp. nov.

Maxilla I, plate I, figs. 3, 4.

The jaw is elongate with from twelve to fourteen sharp, conical backward directed denticles which extend along the inner margin nearly to the posterior end. The denticles are not large nor do they decrease in size appreciatively to the posterior. Measurements of the specimens range in length from .89 mm. to 1.45 mm. A small fang points in a forward direction. The margins are irregularly curved to an acute posterior end that is knob-like in shape. The outer margin incurves slightly from the fang to a rounded shank and continues from a very shallow bite to the posterior. The inner margin bearing the denticles curves at the third or fourth denticle and continues straight to the posterior. A flange is present on the inner margin at the posterior half. The under side is slightly concave with irregular convex areas. The upper side is convex with some flattened areas. A narrow, medium sized fossa occupies a little more than one-half of the length of the jaw. The margin of the fossa is thickened and rounded.

This form is perhaps the left jaw of an asymmetrical right and left Maxilla I. At present the writer is not able to decide which species of *Lumbriconereites* might be the right jaw and be paired with *Lumbriconereites proclivis*. There is a resemblance between the left jaw of *Lumbriconereites cooperi* Eller (1938) and *Lumbriconereites proclivis* in the general shape of the jaws and the arrangement of the denticles. The shank, the presence of a flange, the shape of the denticles and hook differ in these species.

**Lumbriconereites deflexus** sp. nov.

Maxilla I, plate I, figs. 5, 6.

The jaw is wide at the mid-region, but narrows to an acute posterior extremity. There are usually twelve, large, backward directed denticles, which extend along the inner margin, nearly to the posterior end. When viewed from the under side, the denticles are perpendicular to it. The first denticle is large, conical, and pointed; the next two, minute. Following are three or four large, blunt denticles. The remaining ones are more conical and decrease in size to the posterior end. The hooked fang is short, thick, and appears to be a continuation of the heavy margins. On the outer margin, in the posterior half, a shank is present that is

nearly at right angles with the jaw. The inner margin is gently curved. The under side is slightly concave at the right of the denticles. At the left of the denticles and at the anterior, the surface is convex. The upper side reflects the convex and concave areas of the underside. A wide, shallow fossa occupies nearly two-thirds of the jaw. The margins of the fossa are thickened and well rounded. In length the specimens measure between 1.02 mm. and 1.97 mm.

This species resembles in a general way several described forms. It differs, mostly in the anterior arrangement of the denticles and the angular shape and position of the shank. In most species of this genus, the denticles, when viewed from the under side, extend in a straight row from the posterior nearly to the anterior, where they turn abruptly and point to the right or backwards. Good examples of this character are *Lumbriconereites basalis?* Hinde (1880), *Lumbriconereites austini* Foerste (1888), *Lumbriconereites crenatus* Stauffer (1933), *Lumbriconereites cooperi* Eller (1938), and *Lumbriconereites hibbaridi* Eller (1940). The anterior denticles of *Lumbriconereites deflexus* reverse this character and are directed to the left.

#### ***Lumbriconereites copiosus* sp. nov.**

Maxilla I, plate I, figs. 7-12)

The jaw is narrow and elongate with from nine to fifteen sharp, conical, backward directed denticles which extend along the inner margin nearly to the posterior extremity. The average number of denticles is twelve. The inner margin when viewed directly from the under side, is nearly straight. The first denticle after the fang is small, but slightly larger than the following two. The fourth denticle is about the same size as the first. The remaining denticles are very large, but diminish in size at the posterior end. A large conical, sharp-pointed fang is a continuation of the outer margin. An angular shank is present on the posterior half of the irregular outer margin. The under side is slightly concave except in the area of the shank. A large, deep, fossa is present on the convex upper side. The fossa extends about two-thirds the length of the jaw. It is wide at the anterior and narrows to an acute posterior end. The inner margin of the fossa is thickened and rounded, while the outer margin is much thinner. Specimens measure from .91 mm. to 1.43 mm. in length.

There is a slight resemblance between *Lumbriconereites copiosus* and *Lumbriconereites cooperi* Eller (1938). The size and shape of the denticles

is similar, but the arrangement on the inner margin is not the same. Both have fossa very much alike, but the shanks differ widely. Stauffer (1939) describes *Lumbriconereites spectabilis*, which except for the denticles and the pointed shank, is similar to *Lumbriconereites copiosus* in a general way.

Genus NEREIDAVUS, Grinnell, 1877

**Nereidavus ineptus** sp. nov.

Maxilla I, plate I, figs. 16, 21

The jaw is large and elongate, and the straight parallel inner and outer margins terminate in a truncate or slightly oblique truncate posterior extremity. Specimens range from 1.37 mm. to 2.06 mm. in length. A series of sixteen denticles varying from blunt to conical, are present along the inner margin. The first two denticles are very large and are pointed in a forward direction. The remaining denticles are small and are often compact. In the smaller specimens the posterior denticles may be sharp and conical, and directed backwards. When viewed from the upper side, a small, narrow flange in the inner margin may extend slightly beyond the denticles at the middle part of the jaw. The fang is not large, but about the same size as the first two denticles. It is straight, conical, or blunt, and directed forward. In the smaller specimens the posterior half and in the larger ones the posterior third is occupied by a wide, shallow fossa. A thickened well rounded margin surrounds the fossa except at the posterior end. The upper side is irregularly convex. The under surface is flattened or slightly convex except at the posterior where it is regularly concave.

The arrangement of the denticles at the anterior part of this form is unlike any other species known to the writer. In general shape, width of jaw, shape of fossa and posterior end, it is similar to various species of *Nereidavus*.

**Nereidavus hamus** sp. nov.

Maxilla I, plate I, figs. 19, 20.

The figured specimen measures 1.67 mm. in length. The fang is large, conical, sharply pointed and well hooked. The presence or absence and arrangement of the denticles at the anterior half of the inner margin is not uniform or consistent. The first denticle, if present, is usually thin, long, sharp and pointed abruptly backward. Following the first denticle

a few small blunt teeth may be present at various intervals along the margin. On some specimens only suggestions of denticles were observed. At the posterior half or third of the inner margin a series of from six to eight conical, backward directed denticles extends to the end of the jaw. The outer margin is straight from the fang to the posterior where a shank is formed by a large angular bight. The posterior extremity is very narrow due to this indentation. A narrow, deep irregular fossa is present at the anterior third of the jaw. It is surrounded by a wide thickened margin. The upper surface is convex while the lower one is irregularly concave except along the outer margin where it is convex.

There are many species of *Nereidavus* in which the left jaw is very similar to this form. *Nereidavus hamus* differs from *Nereidavus invisibilis* Eller (1940), *Nereidavus perlongus* Eller (1934), and *Nereidavus harbisonae* Eller (1941), in the width of the posterior end and the arrangement of the denticles. *Ænonites aspersus* Hinde (1882) resembles *Nereidavus hamus* especially in the posterior end. The form quite closely related to *Nereidavus hamus* is *Nereidavus ontarioensis* Stauffer (1939). They differ somewhat at the posterior area and in the type and arrangement of the denticles.

***Nereidavus procurvus* sp. nov.**

Maxilla I, plate I, figs. 22, 23.

The jaw is angular, elongate, narrow anteriorly, wide posteriorly, and ends in an obliquely truncate, posterior extremity. A series of fourteen denticles extends along the straight inner margin from the anterior nearly to the posterior end of the jaw. The first eight denticles are blunt and triangular in shape. They increase from a very small size anteriorly to a much larger size at about the center of the jaw. The six remaining denticles are sharp, conical, and are backward directed. The fang and second denticle are very similar to each other and no doubt functioned in the same manner. Both are large, round in cross-section, and forward directed. The outer and inner margins are nearly straight in the anterior part, but form a wide obtuse angle at the posterior where the jaw narrows to its extremity. The upper surface is convex. Anteriorly, the under side is also convex, but the posterior end is quite irregular with several ridges and furrows parallel to the length of the jaw. A shallow fossa occupies about one-half of the posterior part of the jaw. The margin of the fossa is thickened and on the inner side is quite wide. An average specimen measures 1.7 mm. in length.

*Nereidavus perlongus* Eller (1934) from the upper Devonian of New York, seems to show close relationship to *Nereidavus procurvus*. While the second denticle of *Nereidavus perlongus* is much larger than the remaining denticles, it is not quite as large as the second denticle of *Nereidavus procurvus*. The fangs and second denticle of both species are, however, closely analogous. *Nereidavus procurvus* and *Nereidavus perlongus* differ from each other in the general shape of the jaws, and in the number and size of the denticles. The fossa in each form is quite similar.

Genus **ILDRAITES**, Eller, 1936

**Ildraites exquisitus** sp. nov.

Maxilla I, plate II, figs. 1, 2.

The jaw is small, wide anteriorly and tapers to an acute posterior extremity. Along the slightly curved inner margin a series of large, conical, sharply pointed denticles extends nearly to the posterior end. The denticles are irregular in size. The first three or four are small and are followed by denticles that increase in size at the middle of the jaw. The remaining denticles decrease rapidly in size and become blunt and compact. The fang is conical, pointed and may be directed slightly forward. The outer margin curves abruptly to a small, blunt shank. A large, wide, shallow fossa that tapers to an acute posterior end occupies nearly all the upper surface of the jaw. The margin of the fossa is thickened and rounded. The under surface is irregularly convex. Specimens measure from .86 mm. to 1.37 mm. in length.

*Ildraites exquisitus* does not resemble any other species very closely and a synopsis of its relationships will not be attempted at this time.

**Ildraites fritzae** sp. nov.

Maxilla I, plate II, figs. 3, 4.

The jaw is long and narrow especially at the posterior end. It measures from .97 mm. to 1.37 mm. in length. On the slightly curved inner margin a series of from nine to thirteen conical, pointed denticles are directed backward. The first two denticles are small and are followed by very large ones that decrease in size to the posterior extremity. A large, wide fang is well hooked. The outer margin is slightly incurved to about one-half of the length of the jaw, where it is notched by a small crescent-

shaped bight. A narrow fossa, beginning at about the base of the fang, extends to the posterior end. The fossa is deep at its margins, but slightly convex in the central area. The margin of the fossa is thickened and rounded. The under surface is irregularly convex.

*Ildraites peramplus* Eller (1940) is very similar to *Ildraites fritzae* except that the latter is not as wide, the bight is not as deep, and it has the two small denticles following the fang.

***Ildraites patulus* sp. nov.**

Maxilla I, plate II, figs. 5, 6.

The jaw is wide and sub-triangular in shape. Measurements of length range between .78 mm. and 1.35 mm. The inner margin is nearly straight from the short, heavy fang. Along the inner margin is a series of eight or nine conical, backward directed denticles which begin just adjacent to the fang, and which extend to the acute and narrow posterior end. The fang and denticles are slightly oblique to the under-surface of the jaw. The outer margin curves slightly, then continues straight to form a wide, heavy shank. A small, narrow bight emphasizes the width and shortness of the shank. Three-quarters of the length of the jaw is occupied by a wide, shallow fossa. The margin surrounding the fossa is thickened and rounded. The upper surface of the jaw is convex at the margins. The central part of the under-surface is flat or concave and the remainder is convex.

The posterior of *Arabellites anatinus* Stauffer (1939) is similar to *Ildraites patulus*, the anterior not at all. There is a general resemblance between *Arabellites spicatus* var. *contractus* Hinde (1882) and *Ildraites patulus*. The differences are in the length of the fang, the length of the outer margin and shank, and the width and length of the jaws.

***Ildraites peramplus* Eller**

Maxilla I, plate II, figs. 7, 8.

*Ildraites peramplus* Eller, 1940, *Annals, Carnegie Museum*, Vol. 28, pp. 31, 32, pl. 7, figs. 7-9.

Measurements of jaws range between .97 mm. and 1.8 mm. In most respects the jaws examined in this study are similar to the Manitoulin (Silurian) forms. The description of the species, Eller (1940), seems sufficient although the figures are inadequate.

**Ildraites horridus** Eller

Maxilla I, plate II, figs. 9-12.

*Ildraites horridus* Eller, 1940, *Annals, Carnegie Museum*, Vol. 28, p. 30, pl. 6, figs. 6-9.

The asymmetrical left and right jaws of this Manitoulin (Silurian) species are present in the Erindale in large numbers. The denticles of the Erindale specimens are longer and thinner and the fossa is not as wide as in the forms from the Manitoulin beds.

**Paleænonites** gen. nov.

Maxilla II, plate II, figs. 17, 18.

The jaws vary from triangular to rectangular in shape, with an incurved anterior margin that ends in a forward directed shank. The posterior may range from an acute extremity to a broad truncated margin. It may be rounded, straight, incurved, or obliquely truncate. The fossa ranges from narrow to broad and from deep to shallow. The inner and outer margins may be straight, or incurved, or rounded. On the inner margin a series of denticles are present which may be sharp and conical or small and blunt.

Genotype, **Paleænonites accuratus**, sp. nov.

The writer is rather hesitant about erecting new genera for the fossil polychaeta until such a time as when more study has been accomplished on the group. However, a number of very closely related species, described by Hinde, Stauffer, and Eller under the genera *Ænonites* and *Arabellites*, are so unlike any other forms found under those genera that a new genus seems necessary at this time. *Arabellites quadratus* Hinde (1879), *Arabellites scutellatus* Hinde (1879), *Ænonites radula* Hinde (1882), *Ænonites securis* Hinde (1882), *Arabellites erectus* Stauffer (1933), *Ænonites kopfi* Eller (1940), *Ænonites fornicatus* Eller (1940); and the three species, *Paleænonites latissimus*, *Paleænonites edentulus*, and *Paleænonites accuratus* described in this paper will be included under the new genus *Paleænonites*. Several species in the recent polychaete genus *Ænone* have maxillae II that are similar to those in the forms included under *Paleænonites*.



**Paleœnonites latissimus** sp. nov.

Maxilla II, plate II, figs. 13, 14.

The jaw is triangular in outline and the length is about equal to the width. Specimens average .86 mm. in length. The irregular under surface is slightly concave. The inner margin is straight and bears a series of ten small, conical denticles that extends nearly to the acute posterior extremity. The first denticle or fang is slightly larger than the other denticles and is more hooked. The denticles decrease in size to the posterior and are pointed in a backward direction. The outer margin is irregular and is usually broken in most specimens. From the first denticle the anterior margin is incurved to a large shank. A long, narrow fossa extends the full length of the jaw. Its lower or under margin is thickened and rounded. The upper surface adjacent to the fossa is convex while a concave area is present between the margin of the fossa and the denticles.

Many specimens of this species are found in the collection. Except for the width of the jaw and the narrowness of the fossa, it is similar to *œnonites kopfi* Eller (1940). *œnonites radula* Hinde (1882) from the Silurian of Gotland is similar to *Paleœnonites latissimus* except for the width of the jaw, fossa and the size, arrangement, and type of denticles. Stauffer (1933) describes a species, *Arabellites erectus*, in which the anterior end is like *Paleœnonites latissimus*, but in which the posterior end and the denticles are dissimilar.

**Paleœnonites edentulus** sp. nov.

Maxilla II, plate II, figs. 15, 16.

The jaw is irregularly rectangular in outline and its margins are nearly parallel. The inner margin is straight and bears a series of from eleven to fourteen small, blunt, compact denticles that extends nearly to the posterior extremity. Adjacent to the denticles is a narrow flange that extends for about two-thirds the length of the jaw. The denticles are perpendicular to the under surface and increase in size from the anterior to the posterior end. The anterior margin is incurved from the first denticle and extends into a long, narrow shank. The outer margin is thickened and the ridge thus formed extends into the shank. The shank appears to be twisted and composed of a triad of thickened margins. A wide, shallow fossa occupies nearly the complete area of the upper surface. The margins of the fossa are thickened and rounded. The upper surface

is slightly convex except for the fossa and the narrow area adjacent to the outer margin. The under side is concave except for the margins. Most specimens range between .52 mm. and 1.16 mm. in length.

Hinde (1882) figured two specimens of *Cenonites securis* from the Silurian of Gotland that are somewhat unlike each other. Both figured specimens have details that resemble *Paleænonites edentulus*. *Arabellites quadratus* Hinde (1879) is rectangular and has a long, narrow shank like *Paleænonites edentulus*.

***Paleænonites accuratus* sp. nov.**

Maxilla II, plate II, figs. 17, 18.

In outline, the jaw is nearly a rectangle and its inner and outer margins taper slightly to the wide, obliquely, truncate posterior extremity. The inner margin is straight and bears a series of from ten to twelve small conical, compact denticles that extends nearly to the posterior end. The first denticle or hook is slightly larger than the others and points in a forward direction. The remaining denticles are directed mostly backward and increase in size to the posterior. The anterior margin incurves from the hook to the small acute shank. A narrow fossa extends from the anterior nearly to the posterior end. The margins of the fossa are thickened and well rounded. The upper surface is convex except the area between the margin of the fossa and the denticles. The under surface is slightly concave or flat. A narrow ridge extends from the last denticles across the posterior and curves along the outer margin. An average specimen measures .67 mm. in length.

This species is common in the fauna. The posterior of *Arabellites erectus* Stauffer (1933) is similar to *Paleænonites accuratus* except for the ridge and a less oblique posterior margin.

Genus EUNICITES, Ehlers, 1868

***Eunicites denticulatus* sp. nov.**

Maxilla IV?, plate II, fig. 19.

The jaw is small, flattened, and conical. It tapers abruptly to a narrow sharply hooked fang. In width it measures .64 mm. and in length .35 mm. The outer margin is notched by a deep crescent-shaped bight. A large, narrow fossa is present on the upper surface. The margin of the fossa is slightly thickened and rounded.

It is difficult to know just how to orient jaws of this kind. From the shape of the fossa it is suggested that the figured specimen was attached to the left and upper side of the mouth and pointed to the right and downward. *Arabellites? conus* Eller (1938) is slightly similar to *Eunicites denticulatus*.

**Eunicites purus** sp. nov.

Maxilla I, plate II, fig. 20.

The jaw or forcep is long and narrow, measuring from 1.21 mm. to 1.91 mm. in length. From an acute posterior extremity it tapers anteriorly to a slightly curved, pointed fang. In cross-section, the jaw is flattened. An irregular, oval fossa is present in the posterior quarter of the jaw. The margin of the fossa is slightly thickened. Except for the central area of the upper side the jaw is convex.

This form has a general likeness to several species of *Eunicites*. It differs primarily in cross-section and in the character of the fossa.

**Eunicites** sp.

Maxilla IV?, plate II, figs. 21, 22.

Several specimens of this form are found in the fauna, but all of them seem to be incomplete and the writer hesitates to describe them at this time.

**Eunicites** sp. indet.

Maxilla III or IV, plate III, figs. 18, 19.

Jaws of this type are present in many collections of scolecodonts. In the scolecodonts from the Potter Farm formation of Michigan, the writer (1938) grouped a number of jaws that resembled each other in general but which had wide individual differences under the species *Eunicites divergens*. Specimens of this type seem to be uncommon in this collection, while specimens of the other species described in this paper are present by the hundreds. There is always the possibility that jaws of this kind are only fragments of larger forms. Due probably to the thin margins, all specimens in this collection were incomplete. Until a more thorough and detailed study of this type of jaw is made, a specific determination will not be attempted.

Genus *ÆNONITES*, Hinde, 1879

***Ænonites conterminus* sp. nov.**

Maxilla I, plate III, figs. 1, 2.

The jaw is long and narrow. From 16 to 18 conical denticles are present on the inner margin, which vary from blunt to sharp, and are mostly directed backward nearly to the posterior end. The fang is narrow, well hooked and pointed. The first denticle is extremely large, nearly the size of the fang. The following five or six denticles are small, blunt, and may be directed forward. The remaining sharp, conical denticles increase in size to about the middle and then decrease to the acute posterior extremity. The inner and outer margins are nearly straight and parallel to each other. A narrow, deep fossa is present in the posterior half of the jaw. The margin of the fossa is slightly thickened, except along the inner margin where a distinct ridge is formed that extends for a short distance anterior to the fossa and parallel to the inner margin and denticles. The upper side is convex except between the inner margin and the heavy margin of the fossa. The under side is convex in the anterior area but has two distinct furrows in the posterior part, one short and the other longer. The jaw measures from 1.02 mm. to 1.72 mm. in length.

This form is only slightly similar to *Ænonites bidens*, Eller (1940). Both species have a denticle of large size supporting the fang. The general shape, the fossa, and the number and arrangement of the denticles is different.

***Ænonites crepitus* sp. nov.**

Maxilla I, plate III, figs. 3, 4.

The jaw is long and the nearly straight inner margin and slightly curved outer margin terminate in a rounded posterior extremity. There are usually sixteen conical, sharp pointed denticles along the inner margin that extend nearly to the posterior end. The first four or five denticles are small, but increase in size at the middle of the jaw. They then decrease in size to the posterior. Most of the denticles are perpendicular to the margin, but in some specimens, especially at the posterior, they may be directed backward. The fang is small, conical, and slightly hooked or straight. It may point forward or be directed slightly backward. A large, wide, deep fossa occupies from three-quarters to two-thirds the length of the jaw. The margin of the fossa is thickened and well

rounded. On the inner side of the fossa the margin often extends beyond the fossa and parallel to the denticles. The upper surface is convex except between the inner margin of the fossa and the denticles. The under surface is irregularly concave or flattened. Specimens measure from .97 mm. to 1.08 mm. in length.

This species resembles *Ænonites orthodontus* Eller (1938) in a general way, but in the shape of the fossa, the distribution of the denticles and the form of the posterior end, it differs quite widely. Although the figure of *Ænonites amplus* Hinde (1879) is rather poor, the species is typical of *Ænonites crepitus* except for the arrangement of the denticles and the posterior end. Hinde (1882) figured a number of specimens of variable shape as *Ænonites naviformis* Hinde which, while not closely related, are of the same general character as *Ænonites crepitus*.

***Ænonites sinuatus* sp. nov.**

Maxilla I, plate III, figs. 5, 6.

The jaw is of medium width and measures 1.02 mm. in length. A straight inner margin bears a series of about thirteen denticles, which begin about one-third the way from the anterior end and extend almost to the posterior extremity. The denticles are not uniform in shape, nor do they all point in the same direction. Most of the denticles are triangular and blunt, but some may be long, sharp, and conical. The fang is large, angular in cross-section, and is strongly hooked. The outer margins are nearly parallel and curve gently to form a slightly obtuse, but not truncate, posterior extremity. The upper side is generally convex, but a concave area extends along the inner margin of the fossa. The under side is convex with a slightly concave area in the posterior half. A deep, broadly oval, fossa occupies about one-half the posterior part of the jaw. It is located somewhat in a plane, more perpendicular to the denticles, than parallel to them. The margins of the fossa are thickened into a large, rounded rim. The inner margin begins slightly anterior to the fossa and continues in a straight line to the posterior where it extends around it.

*Ænonites cuneatus* Hinde (1879) from near Toronto, Ontario, is similar to *Ænonites sinuatus* in its outline, but differs in the shape and arrangement of the denticles. The upper side of Hinde's species containing the fossa is not illustrated; thus comparison cannot be made between the two

forms. Foerste (1888) described a species, *Ænonites deripiens*, from the Ordovician of Ohio that has a slight resemblance to *Ænonites sinuatus*. The posterior end and shape of the fossa of *Ænonites peracutus* Eller (1940) is similar to *Ænonites sinuatus*.

**Ænonites caducus** sp. nov.

Maxilla II, plate III, fig. 20.

The jaw is narrowly elongate and measures .78 mm. in length. On the inner margin from twelve to fifteen medium-sized, sharp, conical denticles extend nearly to the rounded posterior extremity. The denticles are directed slightly backward. The first denticle is large and is followed by one or two slightly smaller ones. The remaining denticles are uniform in size to the posterior end where they decrease in size. The parallel outer margins are thin and usually broken. A deep fossa extends nearly the full length of the jaw. The upper and under surfaces are irregularly convex.

This form is similar to *Ænonites cadwaladeri* Eller (1941), except for the size and arrangement of the denticles. There is also a slight resemblance to *Eunicites acuminatus* Eller (1934).

GENUS LEODICITES, Eller, 1940

**Leodicides acclivis** sp. nov.

Maxilla I, plate I, figs. 13-15, 17, 18.

The jaw is sub-triangular in outline and tapers to an acute posterior extremity. Measurements of the length range between .67 mm. and .99 mm. A series of from seven to eleven sharp, narrow, conical, backward directed denticles is nearly perpendicular to the under surface. They extend in a curved line from the anterior end to the posterior extremity. The fang or first denticle is sharply hooked and in some specimens points slightly forward. The second, and sometimes a third denticle, is small. The remaining denticles are large, but do not always decrease uniformly to the posterior end. The inner margin is curved anteriorly, but becomes nearly straight posteriorly. The outer margin is notched by a deep crescent-shaped, bight which forms a narrow shank. A wide, shallow fossa begins at the shank and extends to the narrow posterior end. A slightly thickened

and rounded margin is present around the fossa. The under surface is concave near the shank, but otherwise convex. Anterior to the fossa, the upper surface is slightly convex.

*Leodicites acclivis* does not resemble most of the species of this genus. A slight similarity may be noted with *Lumbriconereites cooperi* Eller (1938), figure 7. The general shape of *Lumbriconereites clavatus* Eller (1941) is similar to *Leodicites acclivis* but otherwise the details of the forms do not resemble each other. It has the general shape of most species of *Leodicites* except for the arrangement of the denticles.

***Leodicites streetsvillensis* sp. nov.**

Maxilla II, plate III, figs. 7, 8.

In outline the jaw is triangular, wide anteriorly, and tapers to a narrow posterior extremity. The length and width of the jaw is nearly equal. Measurements of the length range between .48 mm. and .89 mm. Along the curved inner margin a series of six or seven denticles, ranging from conical to blunt, extends nearly to the posterior end. The denticles are of various size and do not point in a backward direction. The first two denticles are large and conical or pointed. They are directed in a forward position. The remaining ones are small and blunt and decrease only slightly to the posterior end. The anterior margin is straight from the first denticle to the shank which curves forward. The outer margin is slightly incurved. A narrow fossa extends along the outer margin for about two-thirds of the length of the jaw. The margin of the fossa is thickened and rounded, especially at the posterior end. The under surface is irregularly and slightly concave. The upper surface is convex, except near the anterior margin.

Except for a general likeness there is not enough similarity between *Leodicites streetsvillensis* and other species of the genus to make comparisons necessary.

***Leodicites creditensis* sp. nov.**

Maxilla II, plate III, figs. 9, 10.

The jaw is triangular in shape and measures .59 mm. to .97 mm. in length. A series of seven or eight blunt denticles, ranging from conical

to triangular, extends the full length of the slightly curved inner margin. The denticles are of various sizes and point generally in a backward direction. The first denticle is of medium size and appears to be a continuation of the thickened anterior margin. The second denticle is small and is followed by large powerful denticles that decrease in size to the posterior extremity. The anterior margin is fully curved from the first denticle to the acutely pointed shank. A deep, crescent-shaped bight on the outer margin emphasizes the narrowness of the shank. The fossa is narrow and deep and extends from the end of the shank to the posterior extremity. A slightly thickened margin is present on all sides of the fossa. The upper surface is convex while the under side is irregularly concave.

This species is represented by a large number of individuals. Many forms have been described under the genera *Arabellites*, *Leodicites*, and *Eunicites* that may be compared with this species. Except for the width of the shank and the arrangement of the denticles, *Leodicites reimanni* Eller (1941) is similar to *Leodicites creditensis*. Differences between *Eunicites anchoralis* Eller (1934) and *Leodicites creditensis* are mostly in the width of the shank and the depth of the bight, otherwise they are somewhat similar.

***Leodicites summus* sp. nov.**

Maxilla II, plate III, figs. 11, 12.

In outline the jaw is triangular—the length is from .89 mm. to 1.48 mm. Along the curved inner margin, a series of from eight to twelve blunt, wide denticles extends nearly to the posterior extremity. The denticles are large at the anterior, but rapidly decrease in size to the posterior. All of the denticles are directed slightly backward. The fully curved anterior margin when viewed from the under side is thickened and extends from the first denticle to the blunt shank. A shallow bight on the outer margin emphasizes the width and bluntness of the shank. The fossa is wide and shallow and extends the full length of the jaw. A rounded margin, which is very thick, is present on all sides of the fossa. The under side of the jaw is slightly concave while the upper surface is convex.

*Leodicites summus* does not closely resemble any other species. *Eunicites hebis* Hinde (1882) is similar in some respects, but the size and shape of the denticles are different, and the types of margins are dissimilar.



**Leodicites barbatus** sp. nov.

Maxilla II, plate III, fig. 13, 14.

The jaw is triangular in shape and the anterior margin is nearly at right angles with the inner and outer margins. Measurements of the length range between .86 mm. and 1.35 mm. Along the slightly curved inner margin a series of from seven to ten sharply pointed, conical, denticles extends to the posterior extremity. The denticles point in a backward direction. The first denticle is small; the second is large, narrow, and slightly hooked. The first two are followed by denticles of large size, which decrease in size to the posterior end. The anterior margin is nearly straight or only slightly incurved. It terminates in a short narrow shank which is nearly at right angles with the jaw. From the shank the outer margin is slightly incurved. A wide, shallow fossa extends the full length of the jaw, and nearly occupies the complete area of the upper side. The margin of the fossa is slightly thickened and rounded. The under surface is concave except at the anterior end near the shank.

There is a slight resemblance between *Arabellites magnificus* Stauffer (1939) from the Devonian of Ohio and Ontario, *Leodicites magnificus* (Stauffer) figured by Eller (1940) from the Windom of New York, and *Leodicites barbatus*. The outlines of the jaws and the first and second denticles are similar, but the species differ in the size of the shank and the curvature of the margins of the jaws.

**Leodicites densus** sp. nov.

Maxilla II, plate III, figs. 15, 16.

The shape of the jaw is triangular, the length is .78 mm. Along the nearly straight inner margin, a series of seven blunt, conical, denticles extends nearly to the posterior extremity. The first denticle is large, wide and pointed. The remaining ones are large, but decrease uniformly to the posterior end. All denticles are directed slightly backward. The anterior margin is slightly curved from the first denticle to the short, wide, blunt shank. The outer margin is slightly incurved from the shank. A narrow fossa extends nearly the complete length of the jaw. The margin of the fossa is slightly thickened and rounded. The upper surface is slightly concave while the lower one is convex.

*Leodicites densus* does not closely resemble any other species. *Leodicites summus* is similar in some respects, but the size and shape of the fossa is unlike that of *Leodicites densus*.

## Genus STAUROCEPHALITES, Hinde, 1879

**Staurocephalites cuspis** sp. nov.

Maxilla I or II, plate III, figs. 17, 23.

The jaw is long, narrow, and measures .99 mm. to 2.43 mm. in length. On the inner margin a series of fifteen or more sharp, conical, backward directed denticles extends nearly to the posterior end. The anterior margin is obliquely truncate and forms an acute anterior end. The first denticle or fang is large and triangular and extends from the outer margin. The remaining denticles are quite uniform in shape and decrease slightly in size to the posterior end. The outer margin is nearly straight, but is thin and usually broken. A large, deep fossa extends the complete length of the jaw. The posterior extremity is rounded. Both the upper and the under sides are irregularly convex.

*Staurocephalites niagarensis* Hinde (1879) is similar to *Staurocephalites cuspis* in a general way. Stauffer (1933) described two species, *Staurocephalites dentatus* and *Staurocephalites acutidentatus* which resemble *Staurocephalites cuspis* except for the length of the jaw and the size and the shape of the denticles.

## Genus ARABELLITES, Hinde, 1879

**Arbellites perpensus** sp. nov.

Maxilla I, plate III, figs. 21, 22.

The jaw is elongate, measuring from .75 mm. to 1.18 mm. in length. Most of the specimens are less than one millimeter. A straight inner margin bears a series of from seven to eleven sharp, conical, backward directed denticles that extends to the posterior extremity. The first denticle is often small. The denticles diminish slightly in size posteriorly. The fang is small, thin, and strongly hooked. The outer margin of the jaw is slightly curved and nearly parallel to the inner margin. The margins terminate in a wide, truncate, often obliquely truncate posterior end. In some specimens the posterior end may appear to be broken. The under surface is convex except in the central area which is flattened or slightly concave. The upper surface is flattened in most specimens. A large wide fossa extends from opposite the first denticle to the posterior extremity. The fossa is deep along the inner margin, but otherwise shallow and flattened or slightly convex. The margin of the fossa is thickened and rounded, especially the inner margin.

This form is placed in the genus *Arabellites* with some hesitation. The fossa does not resemble that of most species of *Arabellites*, but is more like that found in the genus *Ænonites*. The under side, truncate posterior, the fang, and the dental arrangement, are similar to those of many species of *Arabellites*. The upper side and the fossa of *Arabellites priscus* Stauffer (1933) is not illustrated, but the under side is similar to *Arabellites perpensus* except for a ridge that is weakly developed on the former.

Genus DIOPATRAITES, Eller, 1938

***Diopatrites fustus*** sp. nov.

Mandible, plate III, figs. 24-27.

Measurements of the mandible range from 1.08 mm. to 1.48 mm. in length. The frontal plate is heavy, elongate, and rounded in outline and is connected obliquely with the shaft at about a forty-five degree angle. Its upper surface is convex anteriorly and concave at the posterior end. The shaft is long and narrow and tapers to an acute posterior extremity. The upper surface of the shaft is convex. On the under surface of the mandible there is no line of demarcation between the frontal plate and the shaft. The surface is irregularly convex with a furrow extending from the anterior nearly to the posterior end.

Mandibles are very common in this fauna, but the anterior edges are usually broken. The species was placed in this genus with some question since the anterior end is not like that defined for the genus. The remainder of the mandible conforms very well. Except for the teeth at the anterior end of *Diopatrites conformis* Eller (1938), this form would be very similar to that species.

## BIBLIOGRAPHY

- A. MURRAY.  
1843. Geol. Surv., Canada, Rept. of Prog.
- SIR WILLIAM LOGAN.  
1863. Geol. Surv., Canada, Rept. of Prog., (from its commencement).
- H. A. NICHOLSON.  
1875. The Paleontology of Ontario.
- G. B. GRINNELL.  
1877. Amer. Jour. Sci., 3rd series, vol. 14, p. 229.
- A. J. HINDE.  
1879. Quart. Jour. Geol. Soc., London, vol. 35, pp. 370-389, pls. 18-20.  
1880. *Idem.*, vol. 36, pp. 368-378, pl. 14.  
1882. Bihang till k. Svensk Akad. Handl, vol. 7, N:05, pp. 1-28, pls. 1-3.
- WM. C. M'INTOSH.  
1885. H.M.S. "Challenger," Reports, vol. XII, pp. 258.
- C. R. FOERSTE.  
1888. Amer. Geologist, vol. 2, pp. 219-412.  
1916. Geol. Surv., Canada, Mem. 83.  
1924. Geol. Surv., Canada, Mem. 138.
- W. A. PARKS.  
1913. Geol. Surv., Canada, Guide Book, no. 5.
- W. S. DYER.  
1923. Ont. Dept. Mines, Ann. Rept., vol. 32, pt. 7, pp. 47-88, 117-134.
- C. R. STAUFFER.  
1933. Bull. Geol. Soc. Amer., vol. 44, pp. 1173-1218, pls. 59-61.  
1939. Jour. Paleon., vol. 13, no. 5, pp. 500-511, pls. 57-58.
- E. R. ELLER.  
1934. Ann. Carnegie Mus., vol. 22, pp. 303-316, pls. 22, 23.  
1934. Ann. Carnegie Mus., vol. 24, pp. 51-56, pl. 1.  
1936. Ann. Carnegie Mus., vol. 25, pp. 73-76, pl. 11.  
1938. Ann. Carnegie Mus., vol. 27, pp. 275-286, pls. 28-29.  
1940. Ann. Carnegie Mus., vol. 28, pp. 9-46, pls. 1-7.  
1941. Ann. Carnegie Mus., vol. 28, pp. 323-340, pls. 37-38.  
1941. Proc. Penna. Acad. Sci., vol. 15, pp. 119-120.

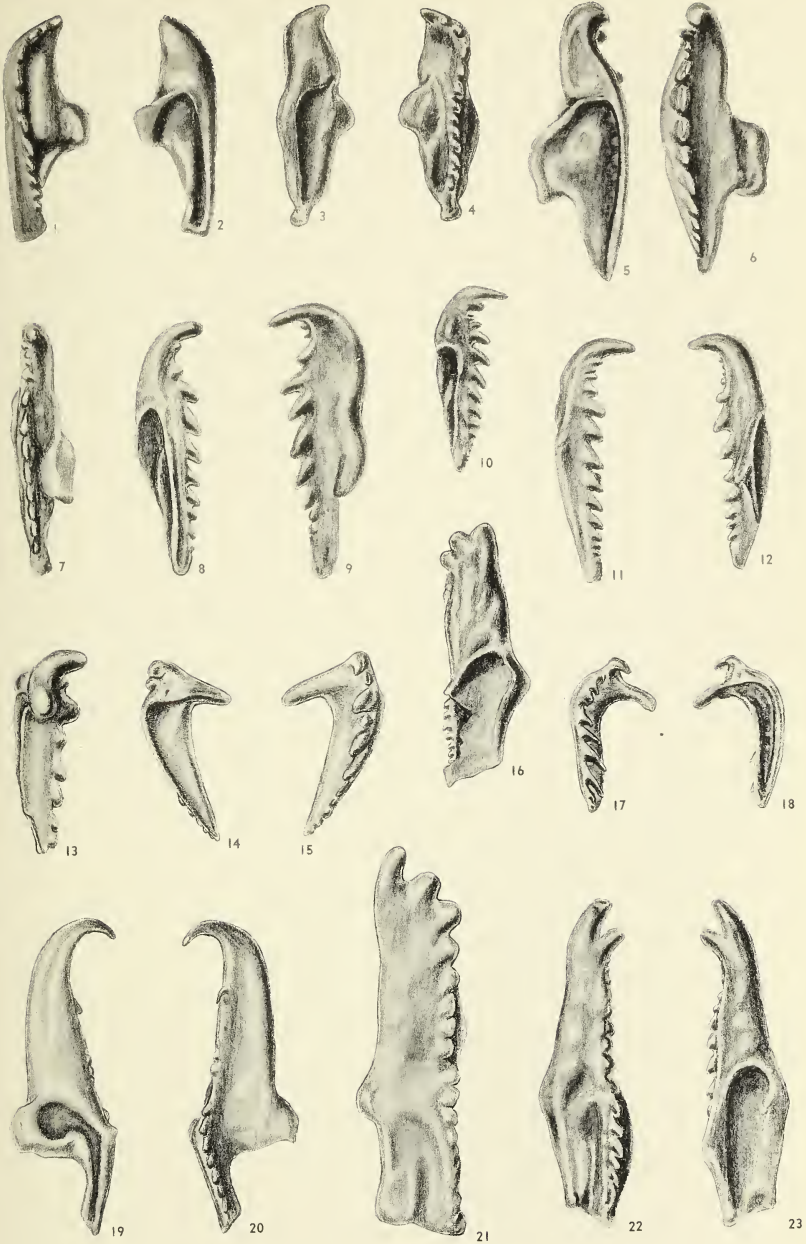


## EXPLANATION OF PLATE I

Figures magnified about 25 times.

Numbers in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective type specimens.

- FIGS. 1, 2. *Lumbriconereites marlenediesae* sp. nov.  
Maxilla I, left jaw (23583).  
Fig. 1. Under side.  
Fig. 2. Upper side.
- FIGS. 3, 4. *Lumbriconereites proclivis* sp. nov.  
Maxilla I, right jaw (23601).  
Fig. 3. Upper side.  
Fig. 4. Under side.
- FIGS. 5, 6. *Lumbriconereites deflexus* sp. nov.  
Maxilla I, left jaw (23491).  
Fig. 5. Upper side.  
Fig. 6. Under side.
- FIGS. 7, 8. *Lumbriconereites copiosus* sp. nov.  
Maxilla I, left jaw (23462).  
Fig. 7. Under side.  
Fig. 8. Upper side.
- FIG. 9. *Lumbriconereites copiosus* sp. nov.  
Maxilla I, left jaw, Under side (23460).
- FIG. 10. *Lumbriconereites copiosus* sp. nov.  
Maxilla I, left jaw, Upper side (23463).
- FIGS. 11, 12. *Lumbriconereites copiosus* sp. nov.  
Maxilla I, left jaw, Side view (23461).
- FIG. 13. *Leodicites acclivis* sp. nov.  
Maxilla II, right jaw, Side view (23528)
- FIGS. 14, 15. *Leodicites acclivis* sp. nov.  
Maxilla II, right jaw (23529).  
Fig. 14. Upper side.  
Fig. 15. Under side.
- FIG. 16. *Nereidavus ineptus* sp. nov.  
Maxilla I, right jaw, Upper side (23649).
- FIGS. 17, 18. *Leodicites acclivis* sp. nov.  
Maxilla II, left jaw (23530).  
Fig. 17. Under side.  
Fig. 18. Upper side.
- FIGS. 19, 20. *Nereidavus hamus* sp. nov.  
Maxilla I, left jaw (23614).  
Fig. 19. Upper side.  
Fig. 20. Under side.
- FIG. 21. *Nereidavus ineptus* sp. nov.  
Maxilla I, right jaw, Under side (23650).
- FIGS. 22, 23. *Nereidavus procurvus* sp. nov.  
Maxilla I, right jaw (23485).  
Fig. 22. Under side.  
Fig. 23. Upper side.







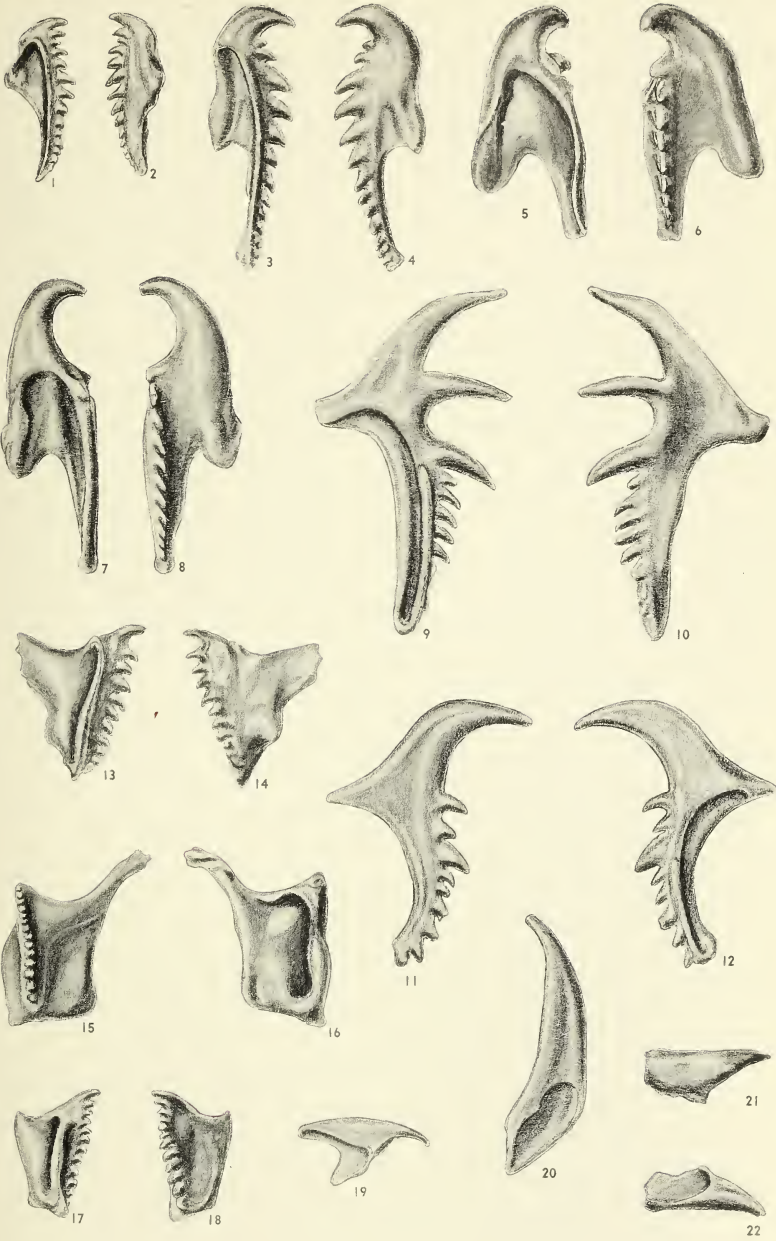


## EXPLANATION OF PLATE II

Figures magnified about 25 times.

Numbers in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective type specimens.

- FIGS. 1, 2. *Ildraites exquisitus* sp. nov.  
Maxilla I, left jaw (23607).  
Fig. 1. Upper side.  
Fig. 2. Under side.
- FIGS. 3, 4. *Ildraites fritzae* sp. nov.  
Maxilla I, left jaw (23472).  
Fig. 3. Upper side.  
Fig. 4. Under side.
- FIGS. 5, 6. *Ildraites patulus* sp. nov.  
Maxilla I, left jaw (23511).  
Fig. 5. Upper side.  
Fig. 6. Under side.
- FIGS. 7, 8. *Ildraites peramplus* Eller  
Maxilla I, left jaw (23616).  
Fig. 7. Upper side.  
Fig. 8. Under side.
- FIGS. 9, 10. *Ildraites horridus* Eller  
Maxilla I, left jaw (23538).  
Fig. 9. Upper side.  
Fig. 10. Under side.
- FIGS. 11, 12. *Ildraites horridus* Eller  
Maxilla I, right jaw (23537).  
Fig. 11. Under side.  
Fig. 12. Upper side.
- FIGS. 13, 14. *Paleænonites latissimus* sp. nov.  
Maxilla II, left jaw (23551).  
Fig. 13. Upper side.  
Fig. 14. Under side.
- FIGS. 15, 16. *Paleænonites edentulus* sp. nov.  
Maxilla II, left jaw (23521).  
Fig. 15. Under side.  
Fig. 16. Upper side.
- FIGS. 17, 18. *Paleænonites accuratus* sp. nov.  
Maxilla II, left jaw (23478).  
Fig. 17. Upper side.  
Fig. 18. Under side.
- FIG. 19. *Eunicites denticulatus* sp. nov.  
Maxilla I or V, left jaw, Upper side (23518).
- FIG. 20. *Eunicites purus* sp. nov.  
Maxilla I, right jaw, Upper side (23595).
- FIGS. 21, 22. *Eunicites* sp.  
Maxilla IV or V. (23629).  
Fig. 21. Under side.  
Fig. 22. Upper side.





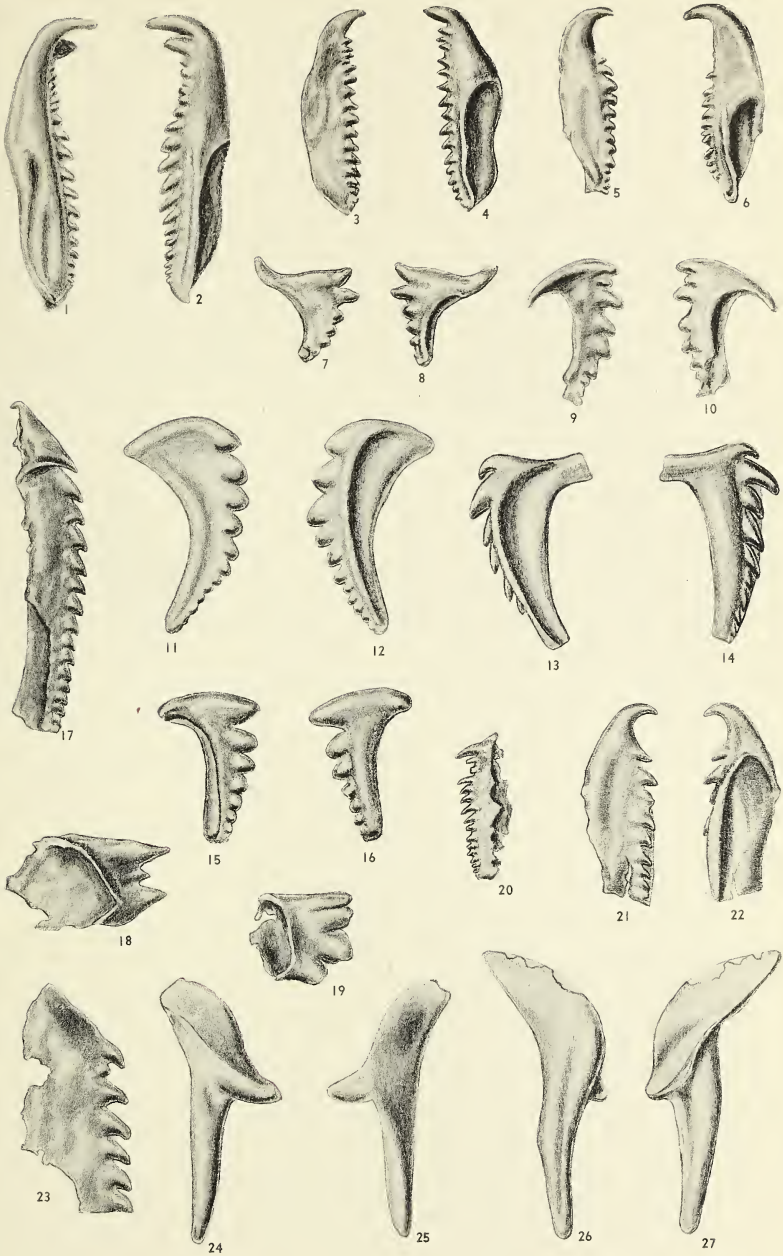


## EXPLANATION OF PLATE III

Figures magnified about 25 times.

Numbers in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective type specimens.

- FIGS. 1, 2. *Enonites conterminus* sp. nov.  
Maxilla I, right jaw (23589).  
Fig. 1. Under side.  
Fig. 2. Upper side.
- FIGS. 3, 4. *Enonites crepitus* sp. nov.  
Maxilla I, right jaw (23612).  
Fig. 3. Under side.  
Fig. 4. Upper side.
- FIG. 5. *Enonites sinuatus* sp. nov.  
Maxilla I, right jaw, Under side (23652).
- FIG. 6. *Enonites sinuatus* sp. nov.  
Maxilla I, right jaw, Upper side (23651).
- FIGS. 7, 8. *Leodicites streetsvillensis* sp. nov.  
Maxilla II, right jaw (23576).  
Fig. 7. Under side.  
Fig. 8. Upper side.
- FIGS. 9, 10. *Leodicites creditensis* sp. nov.  
Maxilla II, right jaw (23623).  
Fig. 9. Under side.  
Fig. 10. Upper side.
- FIGS. 11, 12. *Leodicites summus* sp. nov.  
Maxilla II, right jaw (23497).  
Fig. 11. Under side.  
Fig. 12. Upper side.
- FIGS. 13, 14. *Leodicites barbatus* sp. nov.  
Maxilla I, right jaw (23563).  
Fig. 13. Upper side.  
Fig. 14. Under side.
- FIGS. 15, 16. *Leodicites densus* sp. nov.  
Maxilla II, left jaw (23545).  
Fig. 15. Upper side.  
Fig. 16. Under side.
- FIG. 17. *Staurocephalites cuspis* sp. nov.  
Maxilla II, right jaw, Under side (23503).
- FIG. 18. *Eunicites* sp. indet.  
Maxilla III or IV, right jaw, Upper side (12593).
- FIG. 19. *Eunicites* sp. indet.  
Maxilla III or IV, right jaw, Upper side. (23631).
- FIG. 20. *Enonites caducus* sp. nov.  
Maxilla II, (23569).
- FIGS. 21, 22. *Arabellites perpensus* sp. nov.  
Maxilla I, right jaw (23557).  
Fig. 21. Under side.  
Fig. 22. Upper side.
- FIG. 23. *Staurocephalites cuspis* sp. nov.  
Maxilla II, left jaw, Upper side (23504).
- FIGS. 24, 25. *Diopatraites fustis* sp. nov.  
Mandible, left (23642).  
Fig. 24. Upper side.  
Fig. 25. Under side.
- FIGS. 26, 27. *Diopatraites fustis* sp. nov.  
Mandible, left (23641).  
Fig. 26. Under side.  
Fig. 27. Upper side.









## EXPLANATION OF PLATE IV

Magnified about two times.

The surface of a layer of sandstone from the Erindale, at Streetsville, Ontario, demonstrating the great abundance of annelid jaws.









507.73  
P4PG842

**ART. XII LIST OF THE HUMMINGBIRDS IN THE  
COLLECTION OF THE CARNEGIE MUSEUM**

**BY W. E. CLYDE TODD**



**Annals of the Carnegie Museum**

**Vol. XXIX, p. 271-370**

**Issued December 31, 1942**

**Pittsburgh, Pa.**





ART. XII. LIST OF THE HUMMINGBIRDS IN THE  
COLLECTION OF THE CARNEGIE MUSEUM

BY W. E. CLYDE TODD

INTRODUCTION

In preparing the present paper I have followed the same plan as that for the Tinamous, a list of which appeared in an earlier number of this volume. The Hummingbirds (Family Trochilidæ) are represented in the collection of the Carnegie Museum by 5,004 specimens, belonging to 324 species and subspecies. This figure includes all specimens of known origin which appear in the Museum catalogue, whether now in the collection or alienated therefrom by exchange; it excludes several hundred skins which lack exact data and which the Museum acquired in its early days. Nearly all the specimens in this latter class, however, have been weeded out of our cabinets.

Geographically considered, our Hummingbird collection is unevenly distributed. Because we have virtually no material from Ecuador and Peru, the metropolis of the family, numerous genera and species peculiar to these countries are wanting. But in forms inhabiting the Andes of Colombia and Venezuela, and the lowlands adjacent, the collection is especially rich. Bolivia, too, is well represented. From French Guiana we have good series of specimens of nearly all the species originally described from that country. The same is true of the Amazon Valley in Brazil and of the Rio Tapajóz and Rio Purús. In Central America only Costa Rica and British Honduras are well represented, and in the West Indies only Porto Rico, the Isle of Pines, and the Bahama Islands. We have a fair series of most of the forms found in the United States and a scattered representation from Mexico. Since in many cases the study and identification of our collection involved critical comparisons with material from other regions, it became necessary to draw upon the resources of other institutions. For the loan of such comparative material my thanks are due the authorities of the American Museum of Natural History, the Museum of Comparative Zoölogy, the United States National Museum and the Field Museum of Natural History.

The literature pertaining to the family is extensive and began at an early date. The earlier writers, down even to Elliot (1878), were perforce content with very indifferent material, the exact source of which was seldom known. As a result much confusion and uncertainty still surround many of these early names, the exact application of which remains conjectural. In some cases, however, study of the type-specimens has cleared up the confusion and has placed the names on a stable basis. In the present paper some of these perplexing nomenclatural points are discussed in the light of the new material available. The main contribution the paper makes, however, is toward a better understanding of the geographic distribution of the various forms listed. Not all of the locality-names here used, it must be explained, appear on published maps; but their positions are definitely known, and in an appendix to the present paper they are approximately indicated.

The sequence of genera in the present list follows, in the main, that adopted by M. Eugene Simon (1921), the latest monographer of the group. Simon, however, was a "splitter" and recognized far too many generic names as valid. The present tendency is the other way. Mr. J. L. Peters, to whom we are looking for a new and revised list of this family in the next volume of his "Check-List of the Birds of the World," has been good enough to advise me of certain changes in names and of mergers which he intends to adopt. With most of these I am in full accord, and I am quoting him as authority. I am greatly indebted to Mr. Peters, not only for his courtesy in placing these notes at my disposal, but also for his comments on and corrections of this paper, which he has read in manuscript.

It remains to add that in a few cases, where errors were glaring, I have taken the liberty of emending names for the sake of consistency. I maintain that this can be done under present rules. The double "ii" has been dropped in patronymic names, as in the American Ornithologists' Union "Check-List."

The types of seven valid forms of Hummingbirds are already in the Carnegie Museum Collection; to these the present paper adds eight more. It is hoped that the paper will be found useful by students of this interesting group of birds.

All measurements are in millimeters, and the length of the bill is that of the exposed culmen.

## LIST OF SPECIES

***Doryfera ludoviciæ ludoviciæ*** (Bourcier and Mulsant).

Four specimens: Las Ventanas, Rio Negro, and Bitaco Valley, Colombia.

A single male from the last-named locality extends the known range of this hummingbird to the Subtropical Zone of the Western Andes. Three females have shorter bills than the male, but in coloration they resemble that sex.

***Doryfera ludoviciæ veraguensis*** Salvin.

Three specimens: La Hondura, Costa Rica.

Although ranked by Ridgway (1911, 343) as a full species, this form is certainly only racially distinct from *D. ludoviciæ* of Colombia. However, the differences between the two are well pronounced. Ridgway describes the female as having the forehead dusky bronze, like the rest of the pileum, but our single female has a glittering forehead like that of the male.

***Androdon æquatorialis*** Gould.

Four specimens: Andagoya and Potedó, Colombia.

Only one of these has the bill hooked and strongly serrate. The color of the crown and nape also varies considerably. Chapman (1917, 279) noticed the variation in the bill character but doubted its racial value. I think Simon (1921, 3, note) is right in claiming that it is a matter of age and season.

***Threnetes leucurus leucurus*** (Linnæus).

Two specimens: Arimã, Brazil.

This form is already known from Teffé and the Rio Madeira, and these specimens extend its known range to the Rio Purús. The female example is much paler below than the male; it may be immature.

***Threnetes ruckeri venezuelensis*** Cory (?)

Seven specimens: Santa Elena and Guachi, Venezuela.

So far as I can discover this form has heretofore been known from the type alone. Our specimens (one of which came from the same general region as the type itself) may justly be considered to represent it correctly. It is easily distinguishable from *darienensis* of Colombia (its

nearest geographical representative) by the color of the underparts, in which the gray shade is well pronounced, although the cinnamon area on the breast is duller and less prominent. The terminal white area on the tail is perhaps less in extent. In all these characters, however, it approaches true *ruckeri*; and when it is actually compared with topotypes of that form, no constant differences between them appear. The resemblance must be due to parallelism, since the intervening race is sufficiently distinct. How to treat the case from a nomenclatural standpoint is an open question. Should we retain the name *venezuelensis* for the Venezuelan population, or should we suppress it in favor of *ruckeri*, to which a discontinuous range would have to be ascribed? For the present I prefer the former alternative.

***Threnetes ruckeri darienensis*** Bangs and Barbour.

Ten specimens: Don Diego, El Cauca, El Tambor, Soatata, Andagoya, and Malagita, Colombia.

Bangs and Penard (1924, 77) have studied the races of this species and tried to determine their proper names. After checking their work, I fully agree that *Trochilus ruckeri* Bourcier was almost certainly based on an immature example of the green-backed southern bird. In the present series are two young birds that fit Bourcier's description. One of these has no cinnamon whatever on the breast; the other only a trace. Adults have the back greener, the tail darker, and the underparts grayer, with less cinnamon on the breast, than do Costa Rican examples. They answer the description of the race *darienensis* and differ from topotypical specimens of *ruckeri* precisely as the describers claim. The range assigned to this race by Bangs and Penard (*l.c.*) is based on our specimens. The specimens from Andagoya and Malagita show that this form ranges southward along the Pacific coast of Colombia at least to the Chocó region.

***Threnetes ruckeri ventosus*** Bangs and Penard.

Thirteen specimens: Volcano Turrialba, Guacimo, Cuabre, Guapiles, and El Hogar, Costa Rica.

Bangs and Penard (1924, 77) have renamed this well-marked race *ventosus*, on the ground that *ruckeri* was based on the bird of western Ecuador heretofore called *fraseri*. Some of our specimens incline more to greenish above than to bronzy, so that this character is not consistently diagnostic.

***Glaucis hirsuta insularum*** Hellmayr.

Eleven specimens: Carenage, Heights of Aripo, and Poole, Trinidad.

I accept Hellmayr's name for the Trinidad birds of this species, but I am not strongly impressed with its characters. The separation was based mainly on size; and while our specimens do average a little larger than those from the mainland, yet the measurements of the two series overlap. Trinidad birds are generally dark-colored, but no more so than some mainland specimens.

***Glaucis hirsuta hirsuta*** (Gmelin).

Thirty-nine specimens: Upata, El Peru Mine, Altagracia, Las Quiguas, El Hacha, El Trompillo, Sierra de Carabobo, Santa Lucia, and Cumanao, Venezuela; Cayenne and Mana, French Guiana; Benevides, Itaituba, and São Paulo de Olivença, Brazil; Buena Vista (Rio Surutu), Bolivia.

Variation in this hummingbird is of such a nature and covers such a wide range that the discrimination of geographic races is difficult indeed. The gloss of the upperparts runs from bronzy to dark green, and it has no racial significance. The black subterminal band and the terminal white area on the tail also vary widely in extent. Ridgway attributes this variation to age.

It is by no means certain that the above listed specimens all belong to one and the same form; in fact, it is probable that they do not. On geographical grounds the series from El Trompillo and the Sierra de Carabobo should be referred here, but in their duller coloration they approach *affinis*. One male (No. 47,083) is especially dark-colored. Specimens from the coast region of Venezuela are more brightly colored (*i.e.*, more decidedly buffy rufous) below than those from French Guiana and the lower Amazon. Females are particularly pale by comparison. If separable, these north coast birds might stand as *rojasi* Boucard, 1895. In general, however, the birds which I call *hirsuta* agree in being decidedly rufescent below—some more than others. There is also a wide divergency in size, at least as regards the length of the wing. But the series as a whole grades so insensibly into the western race (*affinis*) that I do not know exactly where to draw the line of separation. I have examined three specimens from Bahia, Brazil (American and U. S. National Museums); they agree essentially with our series. The status of Bolivian birds is doubtful; I refer them here provisionally. They are relatively paler below, like the three skins from São Paulo de Olivença, on the upper Amazon.

***Glaucis hirsuta affinis* Lawrence.**

Forty specimens: Don Amo, Don Diego, Fundación, Trojas de Cataca, Dibulla, Turbaco, Puerto Zapote, Monteria, Jaraquiel, El Tambor, Murindó, and Yumbo, Colombia; Santa Elena and Guachi, Venezuela.

On the differential characters of this race compare Todd and Carriker, 1922, 272. Specimens from other parts of Colombia agree with those from the Santa Marta region, except that two male birds, from Jaraquiel and Monteria respectively, are uncommonly small (wing, 61, 58.5) and may indicate the existence of a dwarf race in this part. The Venezuelan specimens, coming as they do from the same general region as the type of *fusca* Cory, doubtless represent that supposed form. While they answer Cory's description well, they are obviously the same as Colombian specimens. Apparently he did not compare his birds with *affinis*, but only with *hirsuta*, from which they differ as he says. One of his topotypes is matched very closely by our No. 90,500. Chapman has compared Colombian specimens with the type of *affinis* and found them identical.

Young birds differ from adults in lacking any decided buffy rufous on the breast, this part being barred with buffy on a dusky greenish background; the wing-coverts, wings, and upperparts generally also show more or less buffy feather-tipping.

***Glaucis ænea* Lawrence.**

Seven specimens: Andagoya and Cordoba, Colombia; El Hogar and El Pozo de Terraba, Costa Rica.

This form I have little hesitation in keeping specifically distinct from *G. hirsuta*. The distribution of the two forms in question would argue to this effect. I know of no place where they actually occur together, but their respective ranges certainly overlap.

**Genus PHAETHORNIS Swainson.**

This generic name has usually been cited from the *Zoological Journal*, 3, December, 1827, p. 357, where it appears as *Phæthornis*. As correctly pointed out by Oberholser (*Proceedings Biological Society of Washington*, 32, 1919, p. 48), however, it will have to be taken from Swainson's earlier article in the *Philosophical Magazine*, n. s., 1, June, 1827, p. 441, where it is differently spelled *Phæthornis*. In both places diphthongs are

used. There might be some doubt as to which was intended, were it not that a few pages farther back (p. 436) there is an unmistakable "œ" diphthong, which is obviously different. From a classical point of view the use of a diphthong here is an error, and this is one case where it can be discarded with good grace.

In the present paper I follow Peters in including all the Hermit Hummingbirds under the one genus, whereas Simon would recognize six genera. The present group is a beautiful example of the persistence of color characters (clearly indicative of affinity) through the changes and modifications that so-called structural characters have undergone.

**Phaethornis guy[i] guy[i]** (Lesson).

Nine specimens: Carenage, Heights of Aripo, and Heights of Orepouche, Trinidad; San Rafael and El Yaque, Venezuela.

I venture to emend the original *guy* of Lesson to the genitive form.

Our mainland specimens (one male, three females) all have longer tails than those from Trinidad—perhaps because of their fresher condition, or perhaps because of an actual racial difference. It is a curious and significant fact that this species is not known from the coast region of Venezuela west of Cumaná, nor from the Santa Marta region of Colombia. The present race is thus completely isolated from the others.

**Phaethornis guy[i] apicalis** (von Tschudi).

Twelve specimens: El Cauca, Bucaramanga, Rio Negro, Bitaco Valley, and Pavas, Colombia.

On the substitution of *apicalis* for *emiliæ* compare Zimmer, 1930, 272. Our females are about as small as those from Peru to which he refers and thus there can be little doubt but that he is correct in changing the name. Specimens from western Colombia tend to be darker below and bluer above than those from eastern Colombia; thus they approach *coruscus*.

**Phaethornis guy[i] coruscus** Bangs.

Thirteen specimens: Volcano Irazú, Volcano Turrialba, La Hondura, Juan Viñas, Ujuras de Terraba, and Peralta, Costa Rica.

This is a strongly marked race, well set off by the rich, deep coloration of the adult males.

**Phaethornis yaruqui sancti-johannis** Hellmayr.

Sixteen specimens: El Tambo, Andagoya, Potedó, Malagita, and Cordoba, Colombia.

The localities represented are all in the Tropical Zone of the Pacific coast. Some variation obtains in the depth of the color of the underparts in these specimens, but they have not been compared with typical *yaruqui* from Ecuador.

**Phaethornis superciliosus** (Linnæus).

Twenty specimens: Rio Yuruan and Altagracia, Venezuela; Pied Saut, French Guiana; Obidos, Brazil.

*P. superciliosus* may be distinguished from its near relatives by its buffy underparts, grayish white crissum and lateral edgings to the rectrices, and relatively short bill. The median throat-stripe is also well marked. I use a binomial name because I am convinced that all four of the forms subordinated by Hellmayr (1912, 52) under *superciliosus* are really distinct species. Simon (1921, 13, 352) has described a supposed race from the upper Orinoco as *saturatior*, but after comparing our French Guiana specimens with fifteen others from the Orinoco (Rothschild Collection), I can find no grounds for the distinction.

**Phaethornis insignis** Todd.

Seven specimens: Villa Braga and Itaituba, Brazil.

This form was originally described (Annals Carnegie Museum, 25, 1937, 246) as a race of *P. superciliosus*, but further study has convinced me that it should be ranked as a species. Intergradation is definitely contra-indicated; the color differences are constant; and the tail averages shorter. It is a much smaller bird than *P. ochraceiventris*. (For further remarks see the original description, *l.c.*)

**Phaethornis muelleri** Hellmayr.

Seven specimens: Benevides, Colonia do Mojuy, and Miritituba, Brazil.

This is a strongly marked form, which I would call a species. Its gray color beneath, grayish white crissum, and buffy gray edgings to the rectrices are distinctive. It ranges on the south side of the Amazon, between the Rio Tapajóz and the Rio Tocantins, and perhaps still farther east.



**Phaethornis ochraceiventris** Hellmayr.

Six specimens: Arimã and São Paulo de Olivença, Brazil.

These have been handled and identified by Hellmayr himself. (See his critical remarks in *Novitates Zoologicae*, 14, 1907, 393.) Simon (1921, 254) reduces this form to a race of *bolivianus*, and in this conclusion he is followed by Hartert (1922, 404). To this I disagree, although I admit the close relationship of these forms. Nor can I bring myself to consider *ochraceiventris* conspecific with either *P. superciliosus* or *P. longirostris*. I believe it should stand alone. It has a bill as large as that of *P. malaris*, and a long tail by comparison. The pale median gular stripe is more or less indicated.

**Phaethornis bolivianus** Gould.

Three specimens: Cerro Hosáne and San José, Bolivia.

At first glance this little-known form might be considered conspecific with *P. ochraceiventris*, from which it differs in its smaller size, smaller, weaker bill, shorter tail, and darker, less purely buff underparts. Hellmayr (1912, 52) calls it a race of *P. superciliosus*, but to this I cannot agree. In *bolivianus* the crissum is uniform with the rest of the underparts. The female is obviously paler than the male and has the upperparts more greenish, less bronzy.

**Phaethornis moorei** Lawrence.

Five specimens: Tonantins, Brazil.

On geographical grounds these should belong to this form, described from the Rio Napo, eastern Ecuador. Six Ecuador skins lent by the American Museum of Natural History, however, differed in certain minor respects; accordingly I was constrained to send our birds to John T. Zimmer for comparison with Lawrence's type and with more material from the same general region. The differences I had noted disappeared in this comparison, and Mr. Zimmer was able to state definitely that the east-Ecuadorean and the Tonantins birds belong to the same form as the type of *moorei*.

Although the identity of these specimens is thus settled, the relationships of the form they represent are not yet clear. Most authors to the contrary notwithstanding, *P. moorei* is almost certainly not a race of *P. superciliosus*, than which it is much larger and grayer, and has a less distinct median gular stripe. In all these respects it is in fact much closer to

*P. malaris*, although it is smaller in size. Its pileum is slightly glossed with green, as in *malaris*. Nevertheless, I cannot see my way clear to making the two conspecific—largely on geographical grounds—and so for the present I propose to consider *moorei* as specifically distinct from its allies.

***Phaethornis malaris* (Nordmann).**

Thirty-three specimens: Cayenne, Tamanoir, and Pied Saut, French Guiana.

Salvin (1892, 271) relegates *P. malaris* to the synonymy of *P. superciliosus* with few misgivings, but later authors have discriminated the two. *P. malaris* is much larger, darker (more grayish, less buffy), and longer-billed than the other; its throat has a very indistinct median stripe. Since the two occur together, they must be distinct species.

***Phaethornis longirostris susurrus* Bangs.**

Twenty-four specimens: Onaca, Cincinnati, Minca, Las Taguas, Don Diego, Pueblo Viejo, Chirua, and Heights of Chirua, Colombia.

This is a strongly marked isolated race, peculiar to the Santa Marta region of Colombia; it shows no signs of intergradation with any other form and might well be ranked as a species.

***Phaethornis longirostris cassini* Lawrence.**

Seventeen specimens: El Cauca, El Tambor, Soatató, and Murindó, Colombia.

Colombian specimens of *P. longirostris* differ slightly from Costa Rican skins (*cephalus*) in the less buffy, more grayish tone of their underparts, with more obsolete barring or spotting. They are barely separable as a subspecies and will take the name *cassini*, as pointed out by Bangs and Barbour (1922, 203) and by Griscom (1932a, 329). Lawrence's type came from Turbo, and our specimens from the lower Atrato must be the same. Lawrence based his separation on the "reddish bronze" (instead of greenish) color of the upperparts, but this character is actually not significant, since it varies with the individual.

This hummingbird does not appear in Chapman's list (1917), although it was taken by Salmon at Remedios in Antioquia, and by Carriker at two points in Santander. It is thus a Tropical Zone form, inhabiting the lower Atrato Valley and the middle Magdalena Valley.

***Phaethornis longirostris cephalus* (Bourcier and Mulsant).**

Twenty specimens: Pozo Azul de Pirris, Guapiles, Cuabre, Rio Sicsola, El Hogar, and El Pozo de Terraba, Costa Rica.

Birds from southwestern Costa Rica are perhaps a little greener on the back, on an average, than those from eastern Costa Rica, but the difference is slight, in spite of Griscom's findings to the contrary (1932a, 329). He thinks that *cephalus* must be accepted for "elements which are easily separable from each other in series," or else that the range of *P. longirostris* is discontinuous. In any case, I cannot follow him in holding *superciliosus* and *longirostris* conspecific. Their respective ranges do not touch, as far as I know.

***Phaethornis syrmatophorus syrmatophorus* Gould.**

Three specimens: Bitaco Valley, Colombia.

On the nomenclature and systematics of this form compare Hellmayr, 1911, 1179.

***Phaethornis hispidus* (Gould).**

Fourteen specimens: Rio Mocho, Venezuela; Buena Vista (Rio Surutu), Bolivia; Palmar, Colombia; Hyutanahan, Nova Olinda, and Arimã, Brazil.

According to von Berlepsch and Hartert (1902, 81) no races of this species are admissible, but Hellmayr (1910, 374) recognizes a northern race *villosus*. Chapman (1917, 282) also admits the latter, after changing its name to *oseryi*, but later (1926, 286) he insists that after all the species is indivisible. Myself, I am not so sure, although the distinctive characters do not lie in the color of the upper tail-coverts, as Hellmayr supposes, but in the general coloration. Our birds from Venezuela and eastern Colombia are easily separable from the Bolivian specimens by their darker, more grayish, less brownish underparts, and by their darker green upperparts. The Rio Purús skins agree with those from Venezuela and Colombia, although Hellmayr (*l.c.*) ranges Rio Madeira specimens with those from Bolivia without question.

***Phaethornis anthophilus anthophilus* (Bourcier and Mulsant).**

Twenty-four specimens: Buritaca, Don Amo, Don Diego, La Tigrera, Trojas de Cataca, Turbaco, Puerto Zapote, Gamarra, Aguachica, and

Loma Larga, Colombia; El Hacha, Aroa, Sabana de Mendoza, Santa Elena, and Puerto La Cruz, Venezuela.

Our Venezuelan examples are precisely like those from Colombia; they lend no support whatever to the claims of *fuscicapillus* of Cory as a valid race.

#### ***Phaethornis rupununii*<sup>1</sup> rupununii** Boucard.

Four specimens: Maripa, El Callao, and El Llagual, Venezuela.

Two examples that I take to be females have less dark mottling on the throat than those I call males (the sexing of the specimens is faulty, I think). Chubb (1916, 386) describes a bird collected by Whitely in British Guiana as having the "tail-feathers bronze-green edged and tipped with white, the outer feathers darker." Although the feather-edgings in our Venezuelan birds are pale buffy rufous rather than white, I cannot believe that specimens from these two adjacent countries are really different.

#### ***Phaethornis rupununii amazonicus*** Hellmayr.

Five specimens: Santarem, Brazil.

In addition to these I have examined two other specimens, from Itaituba and Urucurituba respectively (Rothschild Collection), which, when compared with our two males from Venezuela, differ much as Hellmayr says. I am inclined to believe that two races can be recognized, as Hellmayr claims. In the Santarem series the buffy rufous edgings of the outer rectrices are wider and more richly colored by comparison. In Venezuelan birds these edgings are obvious, as already noted, but they are narrower and paler.

#### ***Phaethornis pretrei*** (Lesson and Delattre).

Six specimens: Yacuiba and Samaipata, Bolivia.

Five specimens from Bahia, Brazil (American Museum), are precisely like ours from Bolivia. Hellmayr (1929, 384) is quite right in stating that Bolivian specimens of this species are not different, but he made a curious mistake in referring my *P. subochraceus* to *P. pretrei*. They are entirely different species. But the *P. garleppi* of Boucard (1893) from the descrip-

<sup>1</sup>I do not see why the specific name should not be corrected, as above; it was meant to refer to the Rupununi River in British Guiana.

tion must be *pretrei*. Hellmayr refers to two specimens from Samaipata—doubtless the two in our collection, above listed—but the one from Santa Cruz de la Sierra is *subochraceus*.

### ***Phaethornis subochraceus* Todd.**

Seven specimens: Santa Cruz de la Sierra, Buena Vista, Warnes, and Rio Quiser, Bolivia.

*Description*.—Above bronzy green with buffy brownish feather-edgings, the pileum and nape more brownish; wings dusky purple; median rectrices bronzy green basally, broadly white terminally; other rectrices similar, with a black area separating the green bases from the white tips, which diminish in size from the middle pair outward; outermost pair of rectrices with white external margins; broad superciliary and malar stripes warm buff, enclosing an auricular patch of mummy brown; entire underparts warm buff to cinnamon buff, more or less suffused with dusky, and the chin and throat dusky brownish in contrast (but the transition not abrupt); "iris dark brown; feet brown; bill black, the basal half or more of the lower mandible yellow." Wing (type), 50; tail, 55; bill, 29.

With a series of seven specimens now available, instead of the single one on which the name was originally based, it is evident that this is a well-characterized species. It was compared at the time with *P. squalidus*, with which it has actually nothing to do, since it belongs to the subgeneric group *Anisoternus*, in which the rectrices next the middle pair are also elongated. I am at a loss to understand how Hellmayr, who examined the type, could have identified it with *pretrei*—unless on the supposition that he picked up by some mischance our specimens of the latter (lying side by side in the same tray) and got them mixed in his notes (compare 1929, 384). *P. pretrei* is much larger; the upper tail-coverts are cinnamon rufous, and the upperparts more greenish; the underparts are more deeply colored, and the throat has a pale, not a dark, median stripe. They are perfectly distinct species.

### ***Phaethornis augusti augusti* (Bourcier).**

Twenty-seven specimens: El Peru Mine, La Cumbre de Valencia, San Esteban, Guarico, Anzoategui, El Trompillo, Sierra de Carabobo, Tabay, Pie del Cerro, and El Yaque, Venezuela; Ocaña, Chinivaque, and La Colorada, Colombia.

Simon (1921, 16, 257) discriminates two races of this species, neither of

which is validated by our series. The characters he alleges are all variable, but not according to locality. He refers to "Bogotá" specimens, and we have such from both slopes of the Eastern Andes, although Chapman omits the species from his list. Our Ocaña specimen is indeed closely matched by the one from farthest east (El Peru Mine). But since Chapman (1931, 70), with topotypical material at his disposal, has indorsed the race from Mt. Roraima, a trinomial name becomes necessary.

**Phaethornis bourcierii** (Lesson).

Five specimens: Tamanoir, French Guiana; Tonantins and Manacapuru, Brazil.

Amazonian birds tend to be darker (more greenish, less bronzy) above, and grayer, less buffy, below, than those from French Guiana. Chapman (1926, 287) has also noted slight differences, but a larger series would be necessary to bring them out.

This species is the type of *Ametrornis* Reichenbach (1854), characterized by its nearly straight bill as compared with typical *Phaethornis*, which, however, it resembles in other characters.

**Phaethornis philippii** (Bourcier).

Eight specimens: Hyutanahan, Nova Olinda, and São Paulo de Olivença, Brazil.

All these are new localities for this rare species, which also belongs to *Ametrornis*.

**Phaethornis longuemareus** (Lesson).

Two specimens: Cayenne, French Guiana.

In my opinion the close relationship of this species to *P. striigularis* may be admitted without thereby considering the two conspecific.

**Phaethornis striigularis ignobilis** Todd.

Eleven specimens: Las Quiguas, El Trompillo, Sabana de Mendoza, Santa Elena, and Santa Lucia, Venezuela.

This form was described on the basis of the three specimens from Las Quiguas, which were compared with "Bogotá" skins of typical *striigularis* in the U. S. National Museum, and found to differ therefrom as said (Todd, Proceedings Biological Society of Washington, 26, 1913, 173).

With a larger series of both *striigularis* and *ignobilis* now available, the differences between them stand out well. *P. s. ignobilis* is distinctly more buffy below than the typical race and has the throat less distinctly streaked.

***Phaethornis striigularis striigularis* Gould.**

Eight specimens: Don Diego, Chirua, El Cauca, and El Tambor, Colombia.

Compare our previous remarks on this form (Todd and Carriker, 1922, 272). I cannot follow Griscom (1932a, 330) in reducing it to a race of *P. longuemareus*.

***Phaethornis striigularis subrufescens* Chapman.**

Nine specimens: Soatata, Murindó, Quibdó, Andagoya, and Cordoba, Colombia.

If, as I believe, these are correctly identified as *subrufescens* (= *atri-mentalis* auctorum nec Lawrence), they seem to be far more closely related to *saturatus* than to *striigularis*, which forms they serve to connect. Soatata skins have less dark mottling on the throat than those from farther up the Atrato River.

According to Griscom (1932a, 330) *Phaethornis adolphi nelsoni* Bangs and Barbour (= *fraterculus* Nelson nec Gould) is a synonym of *subrufescens*. I would not go so far as to consider any of these western forms conspecific with *P. longuemareus*, whose range is moreover removed and isolated.

***Phaethornis striigularis saturatus* Ridgway.**

Thirteen specimens: Escazú, Guapiles, Volcano Turrialba, Rio Sicsola, El Hogar, Miravalles, and El Pozo de Terraba, Costa Rica; Manatee Lagoon and Freetown, British Honduras.

No. 26,741, from El Hogar, is Ridgway's type. According to this authority the color-variation observable in this series is sexual. Peters (1929, 428) thinks that Ridgway erred in considering birds from Guatemala and British Honduras referable to *saturatus* (he actually called them intermediates). Our two examples from British Honduras, however, are just like the type of *saturatus*. Thus I agree (inferentially) with Griscom (1932b, 197) as to the range of *saturatus*, but I do not agree with him (1932a, 330) in reducing this form to a race of *P. longuemareus* of French Guiana. With a fair series of *subrufescens*, *striigularis*, and *ignobilis*,

available for comparison with *saturatus*, I should rate these four as races of the same species; and since *striigularis* is the earliest name, the present form would then stand as above.

***Phaethornis griseogularis* Gould.**

Two specimens: El Cauca and Rio Negro, Colombia.

***Phaethornis ruber ruber* (Linnæus).**

Five specimens: Benevides, Colonia do Mojuy, Hyutanahan, Nova Olinda, and Arimã, Brazil.

No. 74,518, a female from Colonia do Mojuy, differs from others of the same sex in the color of the median rectrices subterminally being black below the rufous area, instead of bronzy brown. Hellmayr (1906, 375) refers to this character as belonging to the northern race *episcopus*, but it may have some other significance.

***Phaethornis ruber episcopus* Gould.**

Three specimens: Rio Mocho and Rio Yuruan, Venezuela; Obidos, Brazil.

I accept this race mainly on the authority of Hellmayr (1906, 375, and 1907, 75). He has handled these particular specimens. One male has the tips of the middle rectrices narrowly white, succeeded by a broad sub-terminal band of dark steel blue (almost black). Hellmayr claims this as one of the characters of *episcopus*, but I doubt its constancy. Both the Venezuelan specimens are adults, showing the black pectoral band.

***Phaethornis stuarti* Hartert.**

Nine specimens: Buena Vista (Rio Yapacani and Rio Surutu), Bolivia.

These correspond very well with the original description, except that the under tail-coverts and the tips of the lateral rectrices are not white, but rufescent buffy—at least in most specimens. Hellmayr has handled the series, and his identification appears on one label.

***Eutoxeres aquila munda* Griscom.**

Three specimens: Andagoya and Heights of Caldas, Colombia.

Chapman (1917, 284) calls birds of this species from western Colombia *salvini*, but the above differ from Costa Rican specimens of the latter race



in smaller size, less bronzy green upperparts, more bluish rump, and less buffy streaking below. Thus they agree better with the description of *munda* Griscom (1932a, 330) than with that of *viridior* (*l.c.*, 331), to which on geographical grounds they should belong. They have been compared with four males and three females of *munda* from the type-series. Our No. 66,412, ♂, is quite the same, as are also Nos. 66,219, ♀, and 67,040, "♂," when laid beside the females. Ridgway describes the sexes of this species as alike, but there are some slight differences observable. The males are darker and blacker below, and they often have a slight tinge of bright color (violaceous or bronzy), while the light stripes are whiter. Females are duller, more dusky, below; the light stripes are definitely more buffy. I have also examined a single topotype of *viridior* (No. 124,577, Museum of Comparative Zoölogy). While it is sexed as a male, it agrees well with the females from eastern Panama and from western Colombia. To my mind this agreement signifies identity, and I can see no reason for recognizing more than one form in western Colombia, the proper name for which is *munda*.

#### **Eutoxeres aquila salvini** Gould.

Nine specimens: Volcano Turrialba, Costa Rica.

One of these is peculiar in having a very decided bronzy shade to the feathers of the hindneck, upper back, and breast; this probably denotes high plumage.

#### **Phæochroa cuvieri berlepschi** Hellmayr and von Seilern.

Six specimens: Turbaco, Gamarra, and Aguachica, Colombia.

When I described this race (at Oberholser's suggestion) and named it *notia* (Proceedings Biological Society of Washington, 30, 1917, 5) I had unfortunately not seen the earlier description by Hellmayr and von Seilern, whose name will of course supplant the one I gave.

#### **Phæochroa cuvieri maculicauda** Griscom.

Six specimens: Bebedero, Miravalles, Esparta, and Buenos Aires, Costa Rica.

Griscom (1932a, 332) insists that birds of this species from western Costa Rica differ enough from those from Panama to merit a name, as above.

**Campylopterus curvipennis curvipennis** (Lichtenstein).

Three specimens: Palitla (San Luis Potosi), Axtla (San Luis Potosi), and Tamazunchale (San Luis Potosi), Mexico.

Following Peters (*in litt.*), I would merge *Pampa* with *Campylopterus*. These two groups resemble each other in coloration—the females in particular.

*Trochilus curvirostris* of Lichtenstein appears to have priority over *Ornismya pampa* of Lesson.

**Campylopterus largipennis** (Boddaert).

Forty-one specimens: Rio Mocho and El Dorado, Venezuela; Cayenne, Tamanoir, and Pied Saut, French Guiana; Obidos, Brazil.

Simon (1921, 29) describes a supposed race *maronicus* from the Maroni, the river separating French from Dutch Guiana. The assigned characters do not impress me as important, and I can find no geographical variations in our series that would justify subdivision of the species.

**Campylopterus obscurus obscurus** Gould.

Six specimens: Benevides and Miritituba, Brazil.

I unhesitatingly keep this form specifically distinct from *C. largipennis*, although Berlioz (1931, 86) merges them under one specific head. The birds from the east bank of the Rio Tapajóz I place with the topotypical Pará (Benevides) specimens.

**Campylopterus obscurus æquatorialis** Gould.

Twenty-three specimens: Buena Vista (Rio Surutu and Rio Yapacani), Cerro del Amboró, Cerro Hosáne, and Samaipata, Bolivia; Itaituba, Apacy, and Arimã, Brazil.

These have been compared with six specimens from eastern Ecuador (American Museum), with which they appear to be identical. This race tends to be greener, less bronzy, above than true *obscurus*, and the terminal spots of the outer rectrices are paler gray and more extended (but never purer white, as sometimes described). The difference between specimens from the west bank is slight, but on the whole the former agree better with Bolivian birds, which are ranged by Hellmayr (1910, 375) with *æquatorialis*. According to this authority specimens from the Rio Madeira show intermediate tendencies.

**Campylopterus ensipennis** (Swainson).

Eighteen specimens: San Rafael, Mirasol, and El Yaque, Venezuela.

Immature males may be singled out by their wings, in which the outer primaries are nearly normal, instead of enlarged and flattened.

**Campylopterus falcatus** (Swainson).

Twenty-three specimens: La Palmita, Rio Negro, and Chinivaque, Colombia; Guamito, La Azulita, and Colonia Tovar, Venezuela.

So far as I can see birds from Colombia and Venezuela are alike. The width of the terminal green band on the tail is a variable quantity.

**Campylopterus hemileucurus** (Lichtenstein).

Twenty specimens: Volcano Irazú, Escazú, Navarro, La Hondura, Juan Viñas, Ujuras de Terraba, and La Estrella de Cartago, Costa Rica; Las Panitas and Catacombas, Honduras; Manatee Lagoon and Cockscomb Mountains, British Honduras.

No geographical differences appear in this series, so I do not recognize a southern race *mellitius*. Berlioz, the latest reviewer of this group (1931, 87), also discounts *mellitius*, although he notes the average shorter bill of Mexican birds. In immature males, in which the blue feathers are just coming in, the shafts of the primaries are much less thickened than in adults.

As said by Carriker (1910, 522) and by Griscom (1932b, 198), this species is properly one of the Subtropical Zone, but the Manatee Lagoon records (July 17 and August 1) suggest that at times it descends to lower levels.

**Eupetomena macroura macroura** (Gmelin).

Five specimens: Arucaú and Santarem, Brazil.

The Arucaú birds are near-topotypes. The exposed portions of the tail-feathers of the Santarem specimen are not steel blue, but dull dusky bronze. The blue color is less extended on the breast, but this may be due to the make of the skin.

Hellmayr (1929, 387), in referring to *macroura*, says that it has "less acuminate lateral rectrices," but our specimens certainly have these feathers conspicuously pointed.

**Eupetomena macroura** subsp.?

Two specimens: Rio Quiser, Bolivia.

These can scarcely be the same as the Arucauá specimens, since the outer rectrices are narrower and have rounded tips; the blue of the throat is less extended over the breast and a little less intense. But perhaps these characters are signs of immaturity? Simon (1921, 33) comments on birds from Rio Beni, Bolivia, which he considers intermediates between *macroura* and *hirundo*. Our specimens have been compared with four males from Peru (American Museum), representing *hirundo*. In this form the blue of the head has a greenish tinge and is much duller and more restricted than in *macroura*. Our Bolivian specimens agree with *hirundo* in having the blue thus restricted, especially on the breast; the color is only a little duller than in *macroura*. A specimen from San Lorenzo River, Matto Grosso, Brazil (No. 127,392, Collection American Museum), agrees best with the Bolivian specimens. They represent a form that is probably worthy of recognition, but what name it should bear is a question. Mrs. Naumburg (1930, 148) thinks that Simon is probably correct in predicating the existence of an intermediate race. Hellmayr (1929, 387), however, insists that Simon's *prasina* is a pure synonym of *macroura*. Unfortunately, Simon designated no type or type-locality, but his description might be construed to apply to the above specimens. If it does not, then I think they are worthy of a name.

**Florisuga mellivora** (Linnæus).

One hundred and fourteen specimens: Buena Vista (including Rio Surutu and Rio Yapacani), Cerro del Amboró, and Cerro Hosáne, Bolivia; Benevides, Apacy, Nova Olinda, Arimã, Tonantins, and Manacapurú, Brazil; Cayenne, Tamanoir, and Pied Saut, French Guiana; La Bomba, Las Quiguas, and Santa Elena, Venezuela; Don Amo, Don Diego, Minca, Cincinnati, La Tigrera, Dibulla, El Cauca, El Tambor, Murindó, Quibdó, Andagoya, and La Cumbre, Colombia, Guapiles, Volcano Turrialba, and El Hogar, Costa Rica; Manatee Lagoon, British Honduras.

A study of this fine series reveals a certain amount of geographical variation—possibly enough for the recognition of a southern race. In adult males from Bolivia (thirteen specimens examined) the green band below the blue area of the throat is wide and thus rather conspicuous. In the northern birds, on the other hand, this band tends to be comparatively narrow, and in some examples it is not in evidence at all—the blue

is abruptly followed by white. Females from Bolivia (seven specimens) afford even better differential characters: they are obviously paler and grayer below than northern birds; the white of the abdomen is more "solid," less mottled with dark color, and is thus purer. However, in some Central American male examples the blue pectoral band is almost as well developed as in those from Bolivia, and the matter is further complicated by the makeup of the skin, which must always be taken into account. Even if the Bolivian bird is really racially distinct, its proper name would still be an open question. Boucard (*Genera of Humming Birds*, 1895, 340) set up *Florisuga peruviana* as a provisional name for four specimens from Ecuador and Peru. His description is not diagnostic, but it is fair to take Pebas, Peru, as the restricted type-locality. I have handled thirteen skins from (northern and eastern) Ecuador and six from eastern Peru, including three males from Pebas collected by Hauxwell (American Museum and U. S. National Museum). Also, we have one male from Tonantins, on the Rio Solimoës. Two males from Pebas agree better with those from Bolivia; a third is like those from French Guiana; and the Peruvian and Ecuadorean series as a whole is obviously intermediate with respect to the characters above pointed out. The results of the comparison are thus inconclusive, and I do not venture to make any formal separation at this time, but content myself with drawing attention to the case.

At first glance French Guiana birds seem different, but it is only because the series contains a great many immature and wrongly sexed specimens. These young birds do not have distinctly buffy cheeks and sides of the throat, as do the Colombian and Venezuelan birds; these parts are dull brown or grayish white, or (in one case) nearly pure white. I do not understand the significance of this aberration. Adult females from French Guiana agree with others from Central America and northern South America in general in their relatively darker coloration as compared with Bolivian females; adult males have the reduced greenish pectoral band characteristic of the northern birds.

A male from Santa Elena, Venezuela (No. 67,575), measures: wing, 74; tail, 43, and is thus comparable in size with the Tobago birds whose measurements Ridgway gives (1911, 577, note). Some of our specimens from the Santa Marta region are also large. I do not think that *tobagensis* of Ridgway can be maintained under the circumstances.

There is one specimen in the collection which must be a hybrid between this species and some other—perhaps an *Amazilia*. It is No. 56,974 (sexed as a male), and comes from Cayenne, French Guiana. It has the

characteristic tail- and throat-pattern of the female of *Florisuga mellivora*, but the upper breast and the back are strongly glossed with green, and the lower breast and sides are decidedly dusky. The white margins of the throat-feathers are also less prominent.

***Colibri coruscans* (Gould).**

Eighty specimens: Buena Vista (Rio Yapacani), Cerro Hosáne, Samaipata, Cochabamba, Caluya, Molle-molle, Incachaca, San José, Vacas, Guaqui, La Paz, Tiraque, and Pocona, Bolivia; Galera, Peru; Lloa, Ecuador; Ocana, Las Ventanas, Paramo Guerrero, Ramirez, Paramo de San Pedro, La Colorada, and San Lorenzo, Colombia; Guarico, Anzoategui, Paramo de Rosas, Guamito, Teta de Nequitao, Las Mesitas, Tabay, Colonia Tovar, Pico Naiguata, and Petare, Venezuela.

Mr. Peters calls my attention to the fact that the specific name *coruscans* of Gould (1846) has priority over the same author's *iolotus* (1847), and is in fact not invalidated by the earlier use of *coruscus* by Lichtenstein (1830) and by Fraser (1840).

At one time I thought that a northern race of this hummingbird could be recognized, but after a study of our present large series I am decidedly of the opinion that the species is not divisible. Birds from the several parts of the range are subject to precisely the same variations in both size and coloration, and I fail to find a single character for their separation. Compare, in this connection, Zimmer, 1930, 273, and Chapman, 1926, 300.

***Colibri cyanotus crissalis*, subsp. nov.**

Five specimens: Incachaca, Bolivia.

*Type*, No. 85,666, Collection Carnegie Museum, adult male; Incachaca, Bolivia, September 11, 1921; José Steinbach.

*Subspecific characters*.—Similar to *Colibri cyanotus cyanotus* (Bourcier and Mulsant) of Colombia and Venezuela, but under tail-coverts almost uniform buff, with the greenish centers of the feathers reduced or wanting.

*Range*.—Andes of Bolivia (Subtropical Zone).

*Remarks*.—Ridgway (1911, 485) was the first to suspect that Peruvian and Bolivian specimens of *C. cyanotus* might prove to be racially distinct, as indeed they are, although the fact evidently escaped the notice of Salvin and other authors. Certain examples of typical *cyanotus* (particularly immature birds) approach this southern race in their characters,

but in the series the difference holds good. This would suggest that the new race is the ancestral form, from which the others have been derived.

**Colibri cyanotus cyanotus** (Bourcier and Mulsant).

Forty-one specimens: La Cumbre de Valencia, Guarico, Guamito, Tabay, Colonia Tovar, El Yaque, and La Elvecia, Venezuela; Cincinnati, San Lorenzo, La Palmita, Pueblo Nuevo, La Pica, La Colorada, and Vista Nieve, Colombia.

Compare my previous remarks on this form (1922, 263). Specimens from the states of Santander and Boyaca, Colombia, agree essentially with toptypical Venezuelan examples. Santa Marta specimens tend towards *cabanidis*.

**Colibri cyanotus cabanidis** (Heine).

Eight specimens: Volcano Irazú, Volcano Turrialba, and La Estrella de Cartago, Costa Rica.

Compare my remarks under the last form. In my opinion *cabanidis* is an easily recognizable race.

**Colibri serrirostris** (Vieillot).

Nine specimens: Santa Cruz de la Sierra, Buena Vista, and Samaipata, Bolivia.

Two young birds, apparently referable to this species, are dull buffy gray below, with the under tail-coverts white and fluffy, as in the adults; there is a buff malar stripe, and the pileum and nape have rusty buff feather-tipping.

**Colibri thalassinus** (Swainson).

Eleven specimens: San Bartolo (Distrito Federal) and Contreras (Distrito Federal), Mexico.

**Colibri delphinæ** (Lesson).

Thirty-eight specimens: Buena Vista, Bolivia; Bonda, Cincinnati, Dibulla, Heights of Chirua, and La Cumbre, Colombia; San German de Upata, Altagracia, and La Azulita, Venezuela; Escazú and Miravalles, Costa Rica; Manatee Lagoon, British Honduras.

This is another species of wide range but with no apparent geographical variation.

***Anthracothorax nigricollis nigricollis* (Vieillot).**

Eighty-eight specimens: Buena Vista and Cerro del Amboró, Bolivia; Benevides, Santarem, Manacapurú, and Rio Manacapurú, Brazil; Mana and Pied Saut, French Guiana; Poole, Trinidad; El Dorado, La Bomba, San German de Upata, Guarico, El Trompillo, Sierra de Carabobo, Santa Elena, Puerto La Cruz, Mariches, and Cumanacoa, Venezuela; Bonda, Don Amo, Cincinnati, Fundación, Turbaco, Cartagena, and Soatata, Colombia.

Variation, affecting nearly all features of coloration, is much in evidence in this series, but I cannot satisfactorily make out any geographic races. Birds from Bolivia, it is true, agree in being more bronzy or golden green above than most northern specimens, but they are closely matched by some of the latter. I would consider all the specimens above listed as belonging to one variable form.

Hellmayr (1929, 388) says that this species "has yet to be discovered" in French Guiana. It must be rare there compared with *A. viridigula*, but we have one specimen from Mana and one from Pied Saut.

In a young bird from Guarico (February 9) the bill is only about half grown. In coloration this bird resembles the adult female, but the median black stripe below is very narrow, and ends with the breast. The pileum is dusky, barred with vandyke brown, with an indication of a paler median stripe anteriorly. There is a white spot behind the eye. Female and immature birds make up about half of our series.

***Anthracothorax nigricollis iridescens* (Gould).**

Two specimens: Yumbo, Colombia.

It is no surprise to find that these two specimens, the first of this species known from western Colombia, should prove to belong to the race *iridescens*, described from western Ecuador. They are probably intermediate but fit the description in that their bills are longer than in typical *nigricollis* and that the black of the throat is margined with green.

***Anthracothorax prevosti prevosti* (Lesson).**

Nine specimens: Cofradia, Honduras; Manatee Lagoon, Half Moon Cay, Freetown, Middle Cay, and Northeast Cay, British Honduras; Axtla (San Luis Potosi) and Tamazunchale (San Luis Potosi), Mexico.

In males the general coloration varies from dull green to bright bronzy green, and the tail from steel blue to bright purple.



***Anthracothorax prevosti gracilirostris* Ridgway.**

One specimen: Bebedero, Costa Rica.

A specimen of *prevosti* from Honduras has an even shorter bill than this Costa Rican bird.

***Anthracothorax prevosti viridicordatus* Cory.**

One specimen: Guarico, Venezuela.

Ridgway (1911, 465) doubtfully attributes *A. p. gracilirostris* to Venezuela, mainly on the strength of Salvin and Godman's remarks (*Biologia Centrali-Americana*, 2, 1892, 279) on specimens they had examined from that country. In 1913 Cory described a male bird from the Rio Aurare in Venezuela under the above caption, but the characters he gave are all variables and inconstant in the species. It is most unlikely, however, in view of its separated range, that the Venezuelan bird could be the same as that of Costa Rica; therefore for the present I accept Cory's race and refer the above specimen thereto. It is a female, and certainly agrees much better with females of *prevosti* than with those of *nigricollis*.

***Anthracothorax viridigula* (Boddaert).**

Fifty-eight specimens: Arucauá, Santarem, Obidos, and Islands near Obidos, Brazil; Cayenne and Mana, French Guiana.

This species has usually been called *A. gramineus* (Gmelin). For the change of name compare Mathews, *Austral Avian Record*, 3, 1915, 41.

***Anthracothorax dominicus* (Linnæus).**

Two specimens: Jérémie and La Grotta, Haiti.

***Anthracothorax aurulentus* (Audebert and Vieillot).**

Seven specimens: Loiza, Guayama, and Santa Isabel, Porto Rico.

A young male and a young female, with short bills, are dated March 12 and 20, respectively.

***Anthracothorax viridis* (Audebert and Vieillot).**

Eleven specimens: Adjuntas and Utuado, Porto Rico.

Several immature examples are included (April 4, 23). The general coloration is duller than in adults, and the white tips to the rectrices

average wider. The chin and sides of the throat are grayish white spotted with dusky; the glittering green feathers are confined to a triangular patch on the middle of the throat.

***Sericotes holosericeus holosericeus* (Linnæus).**

Three specimens: Fajardo, Porto Rico.

These compare favorably with other examples from the Lesser Antilles. They are at present the only known specimens from Porto Rico, although the species is common on the outlying island of Vieques.

***Chrysolampis elatus* (Linnæus).**

Ninety-nine specimens: Bonda, Don Diego, Cincinnati, Dibulla, Turbaco, Cartagena, Aguachica, El Cauca, Ocaña, Yumbo, and Mariquita, Colombia; Savonet and Fuik, Curaçao; Ciudad Bolivar, San Felix, San German de Upata, El Trompillo, Sierra de Carabobo, Sabana de Mendoza, La Azulita, Petare, and Cumanacoa, Venezuela; Mana, French Guiana.

Much variation prevails in this series, but it is not correlated with locality. Age accounts for a good deal of this variation. Immature males may usually be picked out by the new glittering feathers coming in on the head and throat. A series from San Felix taken in February show this moult, and specimens from other localities, taken in May, June, and August, also illustrate it. In certain of these young males some of the rectrices are extensively chestnut; these feathers grow with the others in asymmetrical pattern, but in most young males the rectrices are all grayish basally, as in the young female. So few of the females in our series have chestnut rectrices that I suspect that this is a character which some individuals never acquire, and in any case, it is pretty certain that these birds breed in this imperfect stage of plumage.

***Orthorhynchus exilis exilis* (Gmelin).**

Two specimens: Vieques Island, Porto Rico; Port Castries, Santa Lucia, Lesser Antilles.

***Klais guimeti* (Bourcier and Mulsant).**

Nine specimens: Lagunita de Aroa and Santa Lucia, Venezuela; Guapiles, Carrillo, Miravalles, and Buenos Aires, Costa Rica.

A supposed race of this species from Peru has been described by Sztolcman (*Annales Zoologici Musei Polonici Historiae Naturalis*, 5, 1926, 213); if this is valid, a trinomial name would be necessary.

***Paphosia helenæ*** (Delattre).

Two specimens: Juan Viñas, Costa Rica.

Mr. Peters writes me that he proposes to merge *Paphosia* and *Dialia*, both of which genera are recognized by Simon as valid.

***Paphosia adorabilis*** (Salvin).

Two specimens: Juan Viñas and San Pedro, Costa Rica.

***Lophornis ornatus*** (Boddaert).

Seventeen specimens: Heights of Aripo, Trinidad; Cayenne and Pied Saut, French Guiana; San Rafael and Mirasol, Venezuela.

Only one fully adult male is included. Variation is excessive, especially among females; several of these are almost uniformly cinnamomeous below, while others conform more to the description in the "British Museum Catalogue" (1892, 421).

***Lophornis gouldi*** (Lesson).

One specimen: Benevides, Brazil.

A young male, referred here solely on geographical grounds—*cf.* Hellmayr, 1906, 379.

***Lophornis delattrei*** (Lesson).

Ten specimens: Buena Vista, San Carlos, and Cerro Hosáne, Bolivia.

I fully agree with Simon (1921, 285) in transferring Lesson's name to the South American species formerly known as *regulus*. In describing the Central American form Ridgway makes no mention whatever of any spangles in the crest-feathers, such as are a prominent feature in adult males of our series, above listed.

***Lophornis stictolophus*** Salvin and Elliot.

Four specimens: La Azulita and Santa Lucia, Venezuela.

**Popelairia conversi æquatorialis** (von Berlepsch and Taczanowski).

Thirteen specimens: El Tambo, Colombia.

Chapman did not at first (1917) recognize *æquatorialis* (as does Ridgway for this form), but in his Ecuador report (1926, 327) he admits it. The exact region whence come specimens ("Bogotá" skins) of true *conversi* remains to be discovered.

**Discosura longicauda** (Gmelin).

Four specimens: Cayenne and Pied Saut, French Guiana.

**Chlorostilbon notatus** (Reichenbach).

Eighty-nine specimens: Benevides, Santarem, Hyutanahan, Arimã, São Paulo de Olivença, Tonantins, and Manacapurú, Brazil; Cayenne, Mana, and Pied Saut, French Guiana; Heights of Aripo and Heights of Ore-pouche, Trinidad; La Lajita, Rio Mocho, El Llagual, Rio Yuruan, El Dorado, La Bomba, El Peru Mine, El Callao, Altagracia, Las Quiguas, El Hacha, Lagunita de Aroa, El Trompillo, and Santa Lucia, Venezuela.

A. L. Butler (Ibis, 1926, 335) insists that the female of this species resembles the male, and that the supposed females described by authors are really immature birds. His claim is not borne out by our series—unless on the basis of uniformly incorrect sexing by all our collectors. Some females, however, are decidedly green below, while others are white, spangled with green. Immature males have the abdomen more or less extensively grayish white. I find no mention of the white flank-tufts in the description of this species, nor are they shown on Gould's plate. In adult males the bill runs from 15 to 18 mm. in length.

Some difference of opinion has arisen among later writers over the validity of a supposed southern race of this species. In 1913 Riley described a hummingbird from the Rio Purús as *Chlorostilbon puruensis*, a name which two years later he discovered would have to be transferred to *Chlorestes "cæruleus"* (= *notatus*) as a subspecies thereof. Simon (1921, 309) and Hellmayr (1929, 393) both discount the validity of the supposed race. Dunajewski (1938, 320) compared specimens from Peru with topotypes of *notatus* from Cayenne, and found them the same. At one time I thought that *puruensis* (of which we possess topotypes) could be maintained on the ground of the small, barely suggested blue chin-spot, but now I find that Rio Purús birds resemble those from Bahia in

this respect, as Simon claims. In the Bahia specimens examined, the color of the upperparts is more bronzy, a feature which I find repeated in some examples of our French Guiana series. Hellmayr notes these differences, but says they are not constant. More recently Griscom and Greenway (1941, 174), after a study of their series, have reached a different conclusion. They claim that birds from the lower Amazon differ "very markedly and strikingly" from those from Surinam, Trinidad, and east Ecuador "in being glittering bluish green on most of the underparts, the chin violet passing rapidly to bluish green, only the lower edge of the abdomen glittering green or golden green." I fail to make out these differences in our series. We have eighteen adult males from French Guiana for comparison with Brazilian specimens; if anything, the difference is the other way around, but I should certainly not consider the two series as racially distinct. Nor can I discover any actual racial variation in our series as a whole. These authors, however, are of course quite correct in adopting Wied's name *cyanogenys* as the earliest name for such a southern race if it were recognizable.

I am inclined to merge *Chlorestes* with *Chlorostilbon*, although most authors keep it distinct and place it near *Hylocharis*.

#### ***Chlorostilbon aureoventris aureoventris***

(D'Orbigny and Lafresnaye).

Seventy-nine specimens: Puerto Suarez, Santa Cruz de la Sierra, Buena Vista, Caiza, Yacuiba, Cerro Hosáne, Samaipata, Cochabamba, and Comarapa, Bolivia.

In juvenal dress, represented by specimens dated October 25 and November 6, the male is much duller even than the adult female; it has buffy brownish gray underparts and cinnamon-tipped feathers on the upperparts. Adults vary greatly in the color of the posterior underparts; some have a strong coppery sheen, while others are more golden. Several young birds taken in December and January are undergoing postjuvenal moult.

Hellmayr (1929, 389) rejects the supposed race *tucumanus* of Simon without hesitation, but Mrs. Naumburg (1930, 155) accepts it on the basis of a slight difference in size and quotes the measurements of three Bolivian skins from Simon. Our three males from Cochabamba (the type-locality) vary in size as follows: wing, 51, 54, 55; tail, 30, 33, 35; bill, 19.5, 20.5. Two males from Yacuiba, southern Bolivia; wing, 48, 49; tail, 29, 30;

bill, 16, 17.5. Eight males from the Santa Cruz region: wing, 48-51.5; tail, 28-30.5; bill, 17-18.5. Thus it appears that Cochabamba birds are a little larger than those from southern Bolivia, so that, if any subdivision is made on this basis, the latter would be entitled to the name *tucumanus*.

***Chlorostilbon caniveti caniveti* (Lesson).**

Four specimens: Manatee Lagoon, British Honduras; Tamazunchale (San Luis Potosi), Mexico.

In a young male in moult (July 17) new glittering green feathers are coming in on the sides of the neck and on the median underparts; the rectrices are shaped like those of the adult female but are colored like those of the adult male, although the tail is not so deeply forked. This is one of the species of hummingbirds in which the female has a longer bill than the male.

***Chlorostilbon caniveti salvini* (Cabanis and Heine).**

Two specimens: Miravalles and La Estrella de Cartago, Costa Rica.

The Miravalles bird is an immature male in transition dress; its median rectrices are tipped with green instead of gray.

***Chlorostilbon auriceps* (Gould).**

One specimen: Chilpancingo (Guerrero), Mexico.

A young bird, not exactly fitting the description of the adult female, is provisionally referred to this species.

***Chlorostilbon gibsoni* (Fraser).**

Eight specimens: Mariquita, Colombia.

This adds another locality to those from which this species is definitely known. It is perfectly distinct from *C. haeberlini*.

***Chlorostilbon haeberlini* (Reichenbach).**

Twenty-nine specimens: Mamatoco, Calamar, Turbaco, Cartagena, Puerto Zapote, El Cauca, La Palmita, Pueblo Nuevo, Ocaña, and Fonseca, Colombia.

Compare my previous remarks on this species (1922, 257). As I pointed out then, its true home is the lower Magdalena Valley, west at least to

the Rio Sinu, east to the edge of the Santa Marta region, and south at least to the latitude of Ocaña, where the species appears on the eastern slope of the Andes. Farther up the Magdalena Valley it is replaced by *C. gibsoni*, from which it differs in its glittering crown and in longer tail, with narrower outer rectrices and deeper furcation. It differs from *C. nitens* in the same ways and also in coloration of its bill, in which the lower mandible is pale (in the skin; flesh-colored in life).

#### ***Chlorostilbon nitens nitens* Lawrence.**

Fourteen specimens: Aroa, Tocuyo, Sabana de Mendoza, and Motatan, Venezuela; Rio Hacha, Colombia.

These agree with each other, and differ from toptotypical specimens of *C. caribæus* from Curaçao, in having the under mandible pale (except terminally) in the skin, almost as in the Colombian *C. haeberlini*. On the labels the color of the bill is marked "black; blood-red below," or "black, flesh below basally." In some few cases it is simply "black," but it is fair to assume that in these it is meant to describe the upper mandible only. In this series the general green coloration of the males would seem to be a little darker than in *caribæus*. It agrees with this form in proportions, especially as regards the length and furcation of the tail, and by this very token differs from *haeberlini*, which has a much longer and more deeply forked tail.

I had referred our specimens from Rio Hacha to *caribæus*, although I remarked their peculiarities at the time (1922, 258). On re-examination I find them to agree with the Venezuelan series above listed. These fit the description of *Chlorostilbon nitens* Lawrence (Annals Lyceum Natural History New York, 7, 1861, 305), described from Venezuela. The type-specimen of this form, kindly placed at my disposal by Mr. John T. Zimmer of the American Museum of Natural History, is a male in good condition and fresh plumage. It is rather more golden green above and below than our birds, but it is approached in this respect by some individuals, No. 36,564, for example. It agrees absolutely with our series in the color of the bill and in the furcation of the tail. Salvin, Hartert, and Simon all quote *nitens* as a synonym of *haeberlini*, apparently because it was described as having a bicolored bill as does that species. Actually, however, it is much closer to *caribæus*, and it has a tail of the same shape. If, as I believe, it is conspecific therewith, the two forms will stand as *C. nitens nitens* and *C. nitens caribæus*.

The locality attributed to the type-specimen is thus fully confirmed. (Salvin lists a second specimen from Lawrence under the head of *C. haeberlini*.) The range of *nitens* proper comprises all that region west and north of the Andes of Merida in Venezuela, east nearly to the Caribbean Sea, and west across the Gulf of Maracaibo to the Goajira Peninsula in Colombia. In other words, it takes in the Maracaibo Basin.

#### ***Chlorostilbon nitens caribæus* Lawrence.**

Thirty-seven specimens: Chacachacare Island, Trinidad; San Felix, Upata, El Callao, San German de Upata, Altigracia, El Trompillo, Sierra de Carabobo, and Pie del Cerro, Venezuela; St. Patrick, Savonet, and Fuik, Curaçao.

In accordance with the foregoing considerations Lawrence's name *nitens*, which has ten years' priority over *caribæus* of the same author, will become the proper specific appellation for this form. I agree with Wetmore (1939, 206) that *lessoni* of Simon and Dalmas is not recognizable. Some of our specimens have a bluish sheen below in certain lights, like the birds he describes. This supposed form was based on examples from the coast of Venezuela east of Caracas. Nor can I make out the race *nanus*, described by von Berlepsch and Hartert (1902, 86) from the Orinoco region, although the latter author (1921, 406) insists on its validity. I cannot verify any of the characters ascribed to this form in the series at my command. It is true that there is much variation in color, but these variations are not correlated with locality. Some specimens have a bright golden sheen, very prominent on the glittering areas of the upper- and underparts, while others show a decided bluish tinge in the same light. Young birds (shot in February) resemble the female, but they are suffused with buffy below and "scaled" with rusty cinnamon above. One taken February 20 is in full postjuvinal moult, and others taken on Curaçao as late as May 10 still show signs of immaturity.

#### ***Chlorostilbon nitens orinocensis* (Simon) (?)**

One specimen: La Colorada, Colombia.

A juvenal example, which might on geographical grounds be referable to this supposed form, is in the collection. It may be remarked in passing that Simon places von Berlepsch and Hartert's *nanus* in the synonymy of *C. daphne subfurcata*.



**Chlorostilbon melanorhynchus** Gould.

Thirteen specimens: Caldas, Bitaco Valley, and La Cumbre, Colombia.

On the proper name of this form compare Chapman (1917, 290), who says that the characters ascribed to *pumilus* are covered by individual variations in the series examined. In his later remarks (1926, 296) he recognizes *pumilus* as a slightly differentiated race of the Tropical and lower Subtropical Zones in Ecuador, but he says that in Colombia the difference does not hold, although Simon has described the bird of western Colombia as *perviridis* (1921, 63, 290). Under the circumstances I think a binomial is sufficient. Still later Chapman (1931, 72) by inference makes this form conspecific with *prasinus*. The two forms are certainly close in coloration, but their differently shaped tails are to my mind good specific characters—unless, indeed, *subfurcatus* is considered as a connecting form.

**Chlorostilbon assimilis** Lawrence.

Four specimens: Boruca and Buenos Aires, Costa Rica.

**Chlorostilbon prasinus prasinus** (Lesson).

Twenty-one specimens: Cayenne and Mana, French Guiana.

The *Chlorostilbon brevicaudatus* of Gould, 1861, was described from Cayenne, but von Berlepsch (1908, 267) and Hellmayr (1929, 389, note) both opine that Lesson's *prasinus* (1830) is an earlier and pertinent name for the same form. Lesson supposed that his type-specimen came from Brazil. The sheen of the throat and breast varies from golden green to blue, according to the way the light falls.

**Chlorostilbon prasinus phæopygus** (von Tschudi).

Two specimens: Buena Vista, Bolivia.

A series of ten specimens of this form from Peru (Rio Cayumba, Chinchao, Chunchomayo, Huánuco, and Vista Alegre), lent for examination by the Field Museum, divide into two groups, according to coloration. Males from the last three localities are greener above and have the throat decidedly bluish in sheen as compared with those from the other localities. These differences are sufficiently obvious, and could be held of subspecific value were the localities represented not so close together and in the same faunal area. Our male from Buena Vista agrees fairly well with specimens from Chinchao in its bronzy coloration above and

below. It may possibly represent a recognizable subspecies, but for the present I must refer it to *phæopygus* of von Tschudi, which according to Zimmer (1930, 275) is an earlier name for *daphne* Bonaparte. This form bears a strong superficial resemblance to *C. aureoventris*, of which we have a large series from Bolivia. Its real relationships, however, appear to be with *C. prasinus*, which it resembles in the shape of its tail and in its wholly black bill. In coloration it is a close replica of *aureoventris*, from which it may readily be distinguished, however, by its differently colored bill and relatively shorter, less forked tail. In the male the furcation is only 4 mm., as against an average of 8 mm. in *aureoventris*. It is a larger bird than *prasinus* and is easily separable therefrom by the golden sheen of the body plumage.

***Chlorostilbon poortmani poortmani*** (Bourcier and Mulsant).

Four specimens: Chinivaque, Boca del Monte, and La Colorada, Colombia.

Like those recorded by Chapman, these come from the eastern slope of the Eastern Andes. On the western slope it is represented by

***Chlorostilbon poortmani euchloris*** (Reichenbach).

Fifteen specimens: Pueblo Nuevo, Ocaña, Bucaramanga, and Peña Blanca, Colombia.

There is a previous record from Bucaramanga (von Berlepsch), but the other localities are new and serve to establish its range as above given. Its longer bill is its best differential character.

***Chlorostilbon russatus*** (Salvin and Godman).

Eleven specimens: Cincinnati, Minca, Pueblo Viejo, and San Miguel, Colombia.

This very distinct species is confined to the Santa Marta region, where it appears to inhabit the Upper Tropical Zone. Compare my remarks in an earlier paper (1922, 256).

***Chlorostilbon aliciaë***<sup>2</sup> (Bourcier).

Five specimens: El Trompillo, Sierra de Carabobo, and San Rafael, Venezuela.

<sup>2</sup>The original spelling is *alice*.

Our specimen from San Rafael agrees with two males from Rancho Grande (U. S. National Museum). The others have the upperparts and wing-coverts more bronzy—a difference that I lay to season (April–June, instead of November).

***Chlorostilbon stenurus stenurus*** (Cabanis and Heine).

Fifteen specimens: Guamito and Tabay, Venezuela.

In its extremely narrowed outer rectrices this species is extreme for a *Chlorostilbon*. The emargination of the tail is slight. In the female the narrowing of the rectrices is less marked.

Merida is the type-locality for this form, and the above specimens are virtual topotypes. The occurrence of this species at Ocaña, Colombia, as claimed by Salvin (1892, 72) on the strength of a female example collected by Wyatt, is open to question. We have only *C. poortmani euchloris* from that locality.

***Chlorostilbon stenurus ignotus***, subsp. nov.

Fourteen specimens: La Cumbre de Valencia, Guarico, and Anzoategui, Venezuela.

*Type*, No. 34,974, Collection Carnegie Museum, adult male; La Cumbre de Valencia, Carabobo, Venezuela, October 5, 1910; M. A. Carriker, Jr.

*Subspecific characters*.—Similar to *Chlorostilbon stenurus stenurus* (Cabanis and Heine) of the Merida region of Venezuela, but size smaller, general coloration more yellowish green, and tail duller, darker green.

*Measurements*.—Male (type): wing, 40; tail, 21; bill, 14. Female (No. 36,801): wing, 39; tail, 22; bill, 14.

*Range*.—Coast range of Venezuela (west of Lake Valencia) and southward in the highlands to the extreme southern part of the State of Lara.

*Remarks*.—The characters of this well-marked race are obvious in both sexes, although they are more conspicuous in the male. So far as I can discover this species is unrecorded from the coast range of Venezuela. It is interesting to find that both races maintain their characters where their respective ranges approximate each other.

***Riccordia maugæa*** (Audebert and Vieillot).

Nine specimens: Guayama and Adjuntas, Porto Rico.

This species, usually placed in *Riccordia*, Ridgway (1911, 548, 550) transfers to *Chlorostilbon*, where, however, it seems decidedly out of place

when compared with the species of the "*Panychlora*" group or with those having the tail only slightly forked. Moreover, one of Ridgway's diagnostic characters (p. 307), "adult male with tail less than two-thirds as long as wing," breaks down with reference to *maugaa*, as shown by his own measurements on p. 550. I see no reason for splitting off the present species from its West Indian congeners, and I would recognize *Riccordia* on the basis of its lengthened tail with relatively wider rectrices. Peters, however, would unite it with *Chlorostilbon*. Admittedly the two genera are closely related, but in my opinion they are taxonomically as well as geographically recognizable.

***Riccordia swainsoni* (Lesson).**

One specimen: Constanza, Santo Domingo.

***Riccordia ricordi ricordi* (Gervais).**

Seventeen specimens: Los Indios, Sigüanea, and Nueva Gerona, Isle of Pines.

***Riccordia ricordi æneoviridis* (Palmer and Riley).**

Eighteen specimens: Staniard Creek (Andros); Sand Bank, Spencer's Point, Strangers Cay, and Powel Cay (Abaco); Hawksbill Creek (Grand Bahama). (All in the Bahama Islands.)

Compare my previous remarks on this form (Annals Carnegie Museum, 7, 1911, 423-4). I have no new light to throw on the pertinence of the name *bracei*.

***Cyananthus latirostris latirostris* Swainson.**

Five specimens: Tuxpan (Jalisco), Chilpancingo (Guerrero), Cuesta Texquedo (Hidalgo), and Linares (14 miles southwest) (Nuevo Leon), Mexico.

***Cyananthus sordidus* (Gould).**

Six specimens: Taxco (Guerrero) and Chilpancingo (Guerrero), Mexico. Following Peters, I merge *Phæoptila* with *Cyananthus*.

**Lepidopyga cœruleogularis** (Gould) and allies.

Compare, in this connection, my previous remarks on this group (1922, 259), also the later discussions by Darlington (1931, 394) and by Griscom (1932, 333-4). My conclusions were, in brief, that Simon was in error in attempting to transfer the name *cœlina* of Bourcier (1856) to the green-throated bird later described by Lawrence under the specific name *luminosa* (1862); and that the alleged type-locality of *cœlina*, "Santa Marta," was probably a mistake, since "we now know that the region in question is inhabited by a form (*lilliae*) in which not only the throat, but also the entire under parts are glittering blue."

But now comes Darlington with an announcement of the discovery (supported by the capture of two specimens) of the blue-throated species on the edge of the Santa Marta region. He claims that the blue-bellied birds (*lilliae*) and blue-throated birds are the same and that the difference is probably due to age. Both types were encountered in the same place, he says. Unfortunately he adopts Simon's nomenclature, which I have been at some pains to discredit. What he actually did was to rediscover Bourcier's *cœlina* and validate the ascribed type-locality—contrary to my prediction. But even after actually examining the two specimens in question I cannot believe that *lilliae* is merely the blue-throated bird in extremely high plumage. I would point out that such extreme variants are unknown in other parts of the range of the blue-throated bird.

Griscom has reviewed the whole case, pointing out Darlington's misuse of names from following Simon. Although I agree that *cœlina* must be a recognizable race of *cœruleogularis*, I cannot follow him in making *lilliae* also conspecific therewith. The case is most interesting, however, and requires further study in the field and in the laboratory.

**Lepidopyga cœruleogularis confinis** Griscom.

Eight specimens: Soatata, Colombia.

The adult males fit Griscom's description in having the throat-gorget glittering violet, while the locality is not far removed from eastern Panama, whence his birds came.

**Lepidopyga luminosa luminosa** (Lawrence).

Thirty-one specimens: Fundación, Turbaco, Cartagena, Puerto Zapote, Loricá, Monteria, Jaraquiel, Gamarra, Aguachica, and Fonseca, Colombia.

Compare my previous remarks on the name and range of this species (1922, 260). Griscom fully indorses my conclusions (1932a, 333). A trinomial will be necessary, however, since Venezuelan birds prove to be recognizably different.

***Lepidopyga luminosa phæochroa*, subsp. nov.**

Nineteen specimens: Sabana de Mendoza and Santa Elena, Venezuela.

*Type*, No. 90,557, Collection Carnegie Museum, adult male; Santa Elena, Merida, Venezuela, August 12, 1922; M. A. Carriker, Jr.

*Subspecific characters*.—Similar to *Lepidopyga luminosa luminosa* (Lawrence) of Colombia, but general coloration much darker, and the back and median rectrices more greenish, less bronzy, in sheen.

*Range*.—Maracaibo region of Venezuela.

*Remarks*.—These are readily distinguishable from our Colombian birds by the uniformly darker upperparts. The pileum in particular is darker colored and inclines to bluish. Females show the same characters; they also show considerable individual (or age) variation in the amount of white on the underparts—the same as in typical *luminosa*.

This species is new to the Venezuelan list, and it is no surprise to find that the population of the Maracaibo region is appreciably different. Naturally I supposed at first that our specimens must represent the *Lepidopyga goudoti zulixæ* of Cory (1918, 182). I presumed he had inadvertently referred his specimens to *goudoti*. The Field Museum sent me for examination three of the specimens upon which his description was based (excluding the type), and one additional skin identified as the same form. These four specimens represent no less than three species. Number one (minus the bill) is probably *Chlorostilbon nitens*, number two is the form I am describing herewith, and numbers three and four belong to a species which I do not recognize. The diagnosis of *zulixæ*, just as it appears in print, is penciled on the back of the label of the second skin above listed. Incidentally, this particular bird comes from La Uraca, Tachira, Venezuela, and is obviously the same as is listed by Cory as "La Vaca, Trinidad." The identity of the type itself thus became important to settle. According to E. R. Blake, who examined it at my request, it belongs to the same form as the other two specimens from the same locality—Rio Aurare. These three birds probably represent another species of *Lepidopyga*, for which Cory's name will be available. Further comment on the character and value of his systematic work would be superfluous.

**Lepidopyga goudoti** (Bourcier).

Seven specimens: Mariquita, Colombia.

**Lepidopyga boucardi** (Mulsant).

Twelve specimens: Coronado de Terraba, Costa Rica.

**Thalurania fannyi fannyi** Delattre and Bourcier.

Sixteen specimens: Andagoya, Heights of Caldas, Bitaco Valley, and La Cumbre, Colombia.

Griscom (1932a, 337) refers birds from the higher altitudes (Subtropical Zone) to his new subspecies *subtropicalis*, characterized by generally lighter coloration and shorter tail. There is much variation in the length of the tail and in the extent of its furcation in specimens from the same locality (Bitaco Valley). No. 67,141 might possibly be referable to this new race, since its tail is only 39 mm. long and is forked for 17 mm. Our specimens of *fannyi* all come from the region south of the Rio Atrato, but according to Chapman (1917, 291) and Griscom (*l.c.*) this form ranges northward into eastern Panama. It is represented in Ecuador by a green-backed race, *verticeps*, and in the Magdalena Valley and Santa Marta region of Colombia by

**Thalurania colombica colombica** (Bourcier).

Thirty-nine specimens: Las Nubes, Onaca, Valparaiso, Don Amo, Cincinnati, Las Taguas, Sierra Nevada de Santa Marta (6000 ft.), Las Vegas, Don Diego, La Palmita, and La Colorada, Colombia; La Azulita, Venezuela.

In his paper already referred to, Griscom points out that the range of the blue-crowned forms (*colombica* and *venusta*) is discontinuous, and that *fannyi*, a form with a green crown, separates them. On this ground (following Berlioz, 1930, 65-69) he proposes to consider *colombica* and *fannyi* conspecies and to alter their names accordingly. I see no need of such treatment. A discontinuous range does not necessarily invalidate the integrity of a species. Even if some of the adult males in our series of *fannyi* do show blue-tinged feathers on the crown, no sufficient evidence of a full connection is yet forthcoming (so far as I am aware). Griscom

indeed positively asserts that *fannyi* and *colombica* "intergrade completely," but specifies no intermediates. Where the ranges of the two forms approximate each other the occurrence of hybrids would naturally be expected. To my mind the color of the crown in the adult seems to be a good specific character.

I am unable to distinguish specimens from La Colorada and La Azulita from others from the Santa Marta region. The range of this form is thus shown to invade the eastern slope of the Eastern Andes of Colombia and to reach even the northern slope of the Andes of Merida in Venezuela, where, however, it appears to be rare.

***Thalurania colombica venusta* (Gould).**

Thirty-eight specimens: Pozo Azul de Pirris, Guapiles, Volcano Turrialba, Cuabre, Rio Sicsola, El Hogar, Miravalles, El Pozo de Terraba, Boruca, and Tucurriqui, Costa Rica.

This is a strongly marked subspecies, and has good distinguishing characters in both sexes. Possibly it should be rated as a full species. I am, however, unable to verify the differences between birds from western and eastern Costa Rica alleged to exist by Griscom (1932a, 336). Immature males are dated in March and April. Several specimens shot in August and September are undergoing postnuptial moult.

***Thalurania furcata refulgens* Gould.**

Five specimens: San Rafael and Mirasol, Venezuela.

This is a slightly differentiated race of *furcata*, with the blue of the interscapulum interrupted and less purplish in tone. Originally ascribed to Trinidad, it is now known to be restricted to the Cumaná region of Venezuela.

***Thalurania furcata fissilis* von Berlepsch and Hartert.**

Two specimens: Rio Mocho and Rio Yuruan, Venezuela.

A female from Rio Mocho I refer here on geographical grounds. The adult male from Rio Yuruan fits the original description. Simon (1921, 303) would call this well-marked race *forficata* of Cabanis and Heine on the basis of Gould's later and fuller description. But I agree with Hartert (1922, 407) that it is not wise to exchange a certainty for an uncertainty.



***Thalurania furcata furcata*** (Gmelin).

Thirty-nine specimens: Cayenne, Tamanoir, and Pied Saut, French Guiana; Obidos, Brazil.

In the coloration of its upperparts this is the darkest of all the races of this species. The under tail-coverts vary somewhat, but in all specimens more or less white is in evidence. Two males from Obidos tend somewhat towards *furcatoides*.

Salvin (1892, 84) remarks that "some Cayenne skins have the tail longer and more deeply forked than others." I note the same diversity in our series; in every case the longer-tailed birds have the rectrices narrowed. I take it that these are fully adult males, and the others younger.

***Thalurania furcata*** subsp.

Three specimens: Manacapurú and Rio Manacapurú, Brazil.

The single adult male does not "fit in" with any of the geographically near forms of this group. Hellmayr (1905, 297) says that "specimens from Manáos in the Vienna Museum (coll. Natterer) belong also to *T. f. furcatoides*." Manacapurú is close to Manáos, but above the mouth of the Rio Negro. But our male specimen is certainly not *furcatoides*, than which its upperparts are much greener, while its under tail-coverts are almost solid steel blue. From *fissilis* it differs in its greener upperparts and in the different shade of blue below. It is apparently not *nigrofasciata*, but it resembles a green-backed example of *simoni*, from which, however, it is at once distinguishable by its uniform and dark-colored under tail-coverts. The bright blue of the abdomen is separated from the green of the throat by an indefinite band of duller blue (cerulean blue of Ridgway, pl. 8).

It is approached by a single male from Mount Duida, Venezuela, which Chapman refers to *orenocensis* of Hellmayr (1921). It has the underparts of the same deep blue (Lyons blue), greenish upperparts (with a few blue feathers intermixed), and blue-black under tail-coverts. It differs from the Mount Duida specimen, however, in having no white feathers on the lower abdomen, and in having the blue more extended on this part (this may possibly be due to age). Two males of *orenocensis* from the type-locality (Nericagua) are much duller blue below, and I suspect that the Mount Duida bird after all may not be the same. The combination of characters shown by the Manacapurú specimen would seem to indicate

the existence of a distinct race in the region between the Amazon and the Rio Negro, but I hesitate to describe it on the basis of a single male specimen.

***Thalurania furcata furcatoides* Gould.**

Eight specimens: Pará and Benevides, Brazil.

In color this race is close to *furcata*, except that in the male there is more white on the under tail-coverts, and that the tail is shorter and more deeply forked. Our specimens are topotypical.

***Thalurania furcata balzani* Simon.**

Nine specimens: Santarem, Colonia do Mojuy, Villa Braga, Miritituba, Hyutanahan, and Arimã, Brazil.

Griscom and Greenway (1941, 176) say that specimens from the right (east) bank of the Rio Tapajóz are "inseparable from the Pará series." As a matter of fact, our male specimens from opposite banks of this river are inseparable from each other, but are easily separable from Pará males by the color of the under tail-coverts, which are nearly pure white. Hellmayr (1910, 376) by inference restricts *balzani* to the left bank of the Rio Tapajóz, but this conclusion is clearly in error. However, our single male from Hyutanahan, on the Rio Purús, is appreciably greener above than the Rio Tapajóz birds, and has the blue interscapular band interrupted medially. Hellmayr (*l.c.*) adds that specimens from the Rio Madeira are identical with those from eastern Bolivia. Direct comparison of the Rio Tapajóz series with topotypical examples of *balzani* from the "Yungas de Bolivia" is desirable.

***Thalurania furcata nigrofasciata* (Gould).**

Three specimens: Tonantins, Brazil.

Owing to the loose makeup of these skins, the black breast-band is not obvious at first glance. Although it is in a sense a new character, I am inclined in this case to allow it only racial value and therefore to unite *nigrofasciata* conspecifically with the *furcata* group.

***Thalurania furcata simoni* Hellmayr.**

Five specimens: São Paulo de Olivença, Brazil.

Coming as they do from the south bank of the Amazon, these specimens obviously belong to the same form as was described by Hellmayr from

Teffé, farther down the river on the same side (1907, 77). The form is clearly conspecific with *furcata*, however. Males vary considerably among themselves, from coppery bronze above to decidedly greenish.

***Thalurania furcata baeri* Hellmayr.**

Three specimens: Puerto Suarez and Rio Quiser, Bolivia.

These three skins are undoubtedly referable to *baeri*, which according to Hellmayr (Bulletin British Ornithologists' Club, 21, 1907, 28) is known from Chiquitos, Bolivia. Compare the same author on its subspecific status (1929, 392), also Oliveira Pinto, Revista Museu Paulista, 20, 1936, 66.

***Thalurania furcata boliviana* Boucard.**

Sixty-seven specimens: Buena Vista, Cerro del Ambaró, Cerro Hosáne, Santa Cruz de la Sierra, and San José, Bolivia.

Following Hellmayr and other authorities, I had at one time identified this series as *jelskii* of Taczanowski, described from Peru, but more recently Zimmer (1930, 275) has conclusively shown that this name is a synonym of *tchudii* of Gould. Boucard's name *boliviana* will therefore be applicable. I think it will have to stand as a race of *furcata*.

For critical remarks on this whole group compare Berlioz, 1939, 287-290. He calls attention to the disagreement among other authors as to the names and status of the several forms.

Males vary with regard to the color of the under tail-coverts, which are uniform steel blue in some examples, but more or less mixed with white in others. I take it that individuals with dusky feathers on the abdomen are immature.

***Panterpe insignis* Cabanis and Heine.**

Nineteen specimens: Volcano Irazú, Escazú, Volcano Turrialba, and Ujuras de Terraba, Costa Rica.

***Damophila juliaë juliaë*<sup>3</sup> (Bourcier).**

Twenty-six specimens: Cincinnati, Fundación, Turbaco, Gamarra, El Tambor, and Soatata, Colombia.

The range of this hummingbird in Colombia comprises the western edge

<sup>3</sup> The original spelling is *julie*.

of the Santa Marta region, the Magdalena Valley, and the northern littoral. It is a Tropical Zone species, but it appears to be wanting in the Pacific coast region, if one may judge from the lack of records. It reappears in Ecuador in modified form (*feliciana*.)

**Hylocharis cyana rostrata** Boucard.

Fifty-one specimens: Buena Vista, Bolivia.

**Hylocharis cyana** subsp.

One specimen: Cayenne, French Guiana.

A single female example was identified at one time by Oberholser as *viridiventris*, but it is certainly different from our females of that race from elsewhere. It is very dark green above, with no bronzy on the upper tail-coverts, and no distinct grayish tips to the outer rectrices. If not an abnormally colored individual, it probably represents an undescribed race. Von Berlepsch (1908, 267) quotes an old record given by Bonaparte as the only one from Cayenne.

**Hylocharis cyana viridiventris** von Berlepsch.

Forty-seven specimens: Itaituba, Brazil; El Llagual, Rio Yuruan, El Dorado, La Bomba, El Callao, San German de Upata, Altagracia, Sabana de Mendoza, Santa Elena, Guachi, San Rafael, and El Limon, Venezuela; Buritaca, Don Amo, Don Diego, Dibulla, and Loma Larga, Colombia.

This well-marked race of *H. cyana* has an extensive range, reaching from eastern Brazil to the Santa Marta region of Colombia, but not beyond the latter. In his original description von Berlepsch attributes it to Trinidad, but this must be a mistake. It is a common bird at lower elevations in Venezuela.

**Hylocharis sapphirina** (Gmelin).

Thirty-three specimens: Upper Arucauá, Santarem, and Itaituba, Brazil; Cayenne and Pied Saut, French Guiana; El Dorado, Venezuela.

This series shows much variation, which seems to be due to age. Fully adult males have chestnut under tail-coverts and tails (for the most part), and green abdomens. Younger birds have the posterior underparts more or less dusky; the blue of the throat is more or less restricted, and the chestnut of the tail and under coverts is not so pronounced. Gray-tipped

rectrices are the rule with these younger birds. Females vary in a similar manner.

Hellmayr (1906, 376) says that if this species is divisible it is the southern bird that will require separation. Some later authors recognize it as *latirostris* (Wied), but I have no material serving to show its validity.

#### **Hylocharis eliciae** (Bourcier and Mulsant).

Twelve specimens: Miravalles and Boruca, Costa Rica.

Carriker and de Schauensee (1935, 422) point out peculiarities in their single skin from Guatemala which, if constant, might necessitate the subdivision of this species.

#### **Hylocharis chrysura chrysura** (Shaw).

Fifty-six specimens: Puerto Suarez, Santa Cruz de la Sierra, Buena Vista, Pampas de Taperas, and Caiza, Bolivia.

Puerto Suarez skins are geographically nearest to being topotypical; they are not separable from the others. Hartert (1922, 405) insists that *maxwelli*, from Rio Beni, Bolivia, is valid, but both Simon (1921, 312) and Mrs. Naumburg (1930, 151) declare that it is not recognizable. The latter author, however, says that birds from Rio Grande do Sul and Argentina "appear to constitute a separable race," for which Oliveira Pinto (Revista Museu Paulista, 17, 1932, 737) has set up the name *platensis*. In a later paper (*ibid.*, 22, 1937, 262), however, he abandons this name.

#### **Hylocharis oenone** (Lesson).

Fifty-three specimens: Las Quiguas, La Azulita, Puerto La Cruz, San Rafael, Mirasol, and El Yaque, Venezuela; Rio Negro, Chinivaque, Palmar, and La Colorada, Colombia.

I can see no sufficient reason to keep this species generically distinct from *Hylocharis*. In the color of the tail it resembles *H. eliciae*.

Colombian skins should be *longirostris* von Berlepsch, but I cannot see that they have longer bills than the others. Chapman (1926, 295) says that he can find no variations worthy of recognition in a series ranging from Venezuela to the Rio Maranon. Since I agree with him in considering *josephinae* a distinct species, no trinomial name seems to be necessary. Carriker (1935a, 346) insists that *intermedia* of Hartert, 1898, from the middle Maranon, is a valid race, but according to Zimmer (in *litt.*) the characters on which it rests are variable and not dependable.

The range of this species lies entirely east of the Andes in Colombia and Ecuador, but in Venezuela it occupies an apparently disconnected strip on the northern slope of the coast mountains. I find no records for the Orinoco Valley or the Merida region.

Immature males have the blue of the throat restricted and the abdomen grayish white rather than greenish. Adult males vary individually with regard to the color of the tail and of the upper and under tail-coverts. Some have these parts decidedly bronzy, and others more coppery.

***Hylocharis josephinæ*** (Bourcier and Mulsant).

Thirty-four specimens: Buena Vista, Cerro del Amboró, Cerro Hosáne, and San José, Bolivia.

Zimmer (1930, 276) allows but two valid "races" of *oenone*, the second being *josephinæ*. But I agree with Chapman in considering these two forms specifically distinct. Carriker (1935, 345) has described a supposed race of *josephinæ* (*peruwiana*) from Moyobamba, Peru, in which region he claims a race (*intermedia*) of *oenone* also occurs. Mr. Zimmer writes me, however, that in his opinion *peruwiana* is a variant of *josephinæ*. The question will bear further investigation. (Compare also Hartert, 1922, 406.)

***Hylocharis grayi meridionalis*** (Simon).

Three specimens: "Quito," Ecuador (Söderstrom).

Chapman ignores this race in his Ecuador report. The above specimens differ from Colombian birds precisely as Simon claims, and they are beyond doubt worthy of subspecific segregation.

***Hylocharis grayi grayi*** (Delattre and Bourcier).

Six specimens: Caldas, Heights of Caldas, and La Cumbre, Colombia.

These are brighter-colored than those from Ecuador, and their crowns are more violaceous. Ridgway (1911, 384) is mistaken in asserting that in this species the sexes are alike.

***Hylocharis leucotis leucotis*** (Vieillot).

Fourteen specimens: Taxco (Guerrero), Chilpancingo (Guerrero), San Bartolo (Mexico), Contreras (Mexico), Desierto de Leones (Distrito Federal), and La Joya (Vera Cruz), Mexico.

**Hylocharis leucotis borealis** Griscom.

One specimen: Cave Creek, Arizona.

**Hylocharis xantusi** (Lawrence).

Ten specimens: San José del Cabo, Santa Anita, Sierra de la Laguna, and San José del Rancho, Lower California.

**Polytmus guainumbi guainumbi** (Pallas).

Two specimens: El Llagual, Venezuela; Demonty, Brazil.

The specimen from El Llagual is a young bird in juvenal dress; it is wholly rusty buff below, fading to white posteriorly. Some years ago it was identified by Oberholser as *chrysobronchos*—a name now considered a synonym of *guainumbi*.

**Polytmus guainumbi thaumantias** (Linnæus).

Thirty-five specimens: Buena Vista, Bolivia.

According to Hellmayr (1929, 394), Bolivian and Brazilian birds are alike and even may be the same as those from Guiana. But Mrs. Naumburg (1930, 158) says that the latter are easily distinguishable.

This fine series shows all the various stages from the young bird to the adult. There is much variation in the color of the back; some individuals are bronzy, and others incline to greenish. The color of the rectrices also varies from blue to green.

**Smaragdites thesisiæ thesisiæ** (Da Silva).

Six specimens: Cayenne, French Guiana; Benevides and Villa Braga, Brazil.

On the change of the generic name from *Psilomycter* see Simon, 1921, 316.

Two Brazilian males have the tail decidedly tinged with blue. In the Cayenne male it is pure shining green.

**Smaragdites thesisiæ leucorrhous** (Sclater and Salvin).

One specimen: Arimã, Brazil.

According to Hellmayr, birds from the Rio Madeira are typical *thesisiæ*, but farther west, on the Rio Purús, this form takes its place.

**Leucippus chionogaster hypoleucus** (Gould).

Sixty-five specimens: Santa Cruz de la Sierra, Buena Vista (including Rio Dolores and Rio Surutu), Caiza, Yacuiba, Cerro del Amboró, Cerro Hosáne, Cafeces, Samaipata, Cochabamba, and Comarapa, Bolivia.

Ridgway (1911, 305, note) would exclude this and other species from *Leucippus*, but after comparison with *L. fallax* I see no special reason for separating them generically. According to Zimmer (1930, 277), Peruvian specimens (typical *chionogaster*) differ from Bolivian birds by having the flanks more broadly and strongly green. However, not one of the above series has a bill as long as is called for in Gould's description of *hypoleucus* (28 mm.). Considerable variation in the extent of the white area on the tail is in evidence, so that I attach no importance to this as a racial character, as suggested by Carriker (1935a, 317). The few specimens with scattered cinnamon rufous feathers on the throat I take to be immature males.

**Leucippus fallax fallax** (Bourcier and Mulsant).

Twelve specimens: Tocuyo, Venezuela; Rio Hacha, Colombia.

This is properly a species of the Arid Tropical Zone of northern Venezuela. It is known to range west to the Goajira Peninsula in Colombia, but it is very doubtful if it reaches French Guiana towards the east. The Margarita Island bird has been separated on certain slight differences in coloration, but whether these would hold in series comparable for season is an open question. Our Rio Hacha birds are noticeably duller-colored than those from Tocuyo, but this dullness is most likely due to the fact that they were taken in May instead of in January.

**Talaphorus hypostictus peruvianus** (Simon).

Two specimens: Cerro del Amboró and Samaipata, Bolivia.

These agree well with a specimen from Rio Seco, Peru (American Museum).

Genus **AMAZILIA** Lesson.

I follow Peters in including under this generic name the species placed by authors in *Agyrtrina*, *Saucerottia*, *Uranomitra*, *Polyerata*, and *Arenella*. These groups are admittedly not trenchantly defined, and it seems to me that maintaining them serves no good purpose.



***Amazilia chionopectus chionopectus* (Gould).**

Five specimens: Carenage, Heights of Aripo, and Poole, Trinidad; Cumanacoa, Venezuela.

***Amazilia chionopectus whitelyi* (Boucard).**

Sixteen specimens: Maripa, El Llagual, Rio Yuruan, El Dorado, La Bomba, El Peru Mine, and Altagracia, Venezuela.

This is merely a slightly differentiated form of true *chionopectus* of Trinidad. Its bill is slightly smaller, and its underparts are whiter, since the green color of the sides is more restricted. I am unable to appreciate the alleged differences in the color of the tail; there is considerable variation, however, in this respect in the present series.

Bangs and Penard (1918, 62) transfer the name *brevirostris* of Lesson to the present form, and set up a new name for the form usually called *brevirostris*. But I agree with Simon (1921, 328-9) that this shift is unnecessary. Bangs and Penard's remarks were based on certain specimens from Paramaribo which I have been privileged to examine. Whatever these may be, they have certainly nothing to do with *A. chionopectus*. On the label of one, Peters has a note suggesting affinity to *A. viridiceps* of Ecuador.

***Amazilia chionopectus orienticola*, subsp. nov.**

*Type* (and only specimen), No. 62,985, Collection Carnegie Museum, adult female; Mana, French Guiana, August 18, 1917; Samuel M. Klages.

*Subspecific characters*.—Similar to *Amazilia chionopectus chionopectus* of Trinidad and northeastern Venezuela, but upperparts in general, and the tail in particular, much more bronzy, as well as the spots on the sides of the body; bill markedly shorter. Wing, 50; tail, 29; bill, 15.

*Range*.—French Guiana.

*Remarks*.—Unfortunately this form is represented by a single specimen only, but its characters are so well marked that I have little hesitation in considering it to represent a new race. Although sexed as a female, it is brightly colored throughout, and the determination may be in error. According to von Berlepsch (1908, 266), there is a specimen of *A. chionopectus* from French Guiana in the Paris Museum, where, however, Hellmayr searched for it in vain.

**Amazilia leucogaster** (Gmelin).

Nine specimens: Cayenne, French Guiana.

Three specimens from Bahia (American Museum) I am unable to distinguish in any way from the above series; for this reason I consider *bahiae* of Hartert as a synonym.

**Amazilia milleri** (Bourcier).

Two specimens: Palmar, Colombia; Obidos, Brazil.

Hellmayr (1929, 396, note) unites this form with *versicolor* ("affinis") and *nitidifrons* as conspecies, but I cannot agree with this disposition. Griscom and Greenway (1941, 171) consider that their specimens from Obidos belong to a form which they leave unnamed, because of the "hopeless nomenclatural complications" in which Simon involved this group. They add that "Hellmayr's note on his female from Obidos [in *Novitates Zoologicae*, 14, 1907, 33] clearly describes the present subspecies," and that "true *milleri* (Bourcier) ranges from the Rio Negro northwestward and northward to Colombia and Venezuela, where further racial variation may prove to take place." But Hellmayr (*l.c.*) states that, except for being slightly smaller, his specimen from Obidos agrees with females from the Orinoco, and our specimen from the same place (also a female) is identical with one from eastern Colombia, except that its bill is one mm. shorter. Inferences drawn from such scanty material are always open to revision, and I have seen no specimens fitting Griscom and Greenway's description of "true *milleri*;" nevertheless, I have received the impression that only one form is involved. Gould does not state the source of the specimen which he portrays, but his figure fits our specimens, and Bourcier's original description is also in agreement. Need for examination of the type-specimen (if extant) and of authentic topotypical material is strongly indicated.

**Amazilia hollandi** (Todd).

Twelve specimens: El Dorado, El Callao, El Peru Mine, and San German de Upata, Venezuela.

*Description*.—Above dark green; crown glittering dark blue, becoming paler blue on the sides of the head and throat; wings dark purple; tail dull green, with a dark subterminal band and grayish tip; throat, middle of the breast and abdomen, and under tail-coverts white, the last centered

with gray; sides of the breast spangled with glittering blue; sides of the abdomen dull green; "feet black; bill black, flesh-color below." Wing (type), 51; tail, 30; bill, 17.

This very distinct form has an apparently restricted range, confined (so far as known) to the headwaters of the Rio Cuyuni, in extreme eastern Venezuela, adjoining the British Guiana frontier. It is most nearly related to *A. milleri*, from which it differs conspicuously in its differently colored crown and sides of the breast.

***Amazilia versicolor nitidifrons* (Gould).**

One specimen: Benevides, Brazil.

Griscom and Greenway (1941, 170) have inadvertently overlooked this specimen. The female they list from Santarem, however, is *A. fimbriata nigricauda*.

Compare Hellmayr, 1929, 395, who considers that intergradation between *versicolor* and *nitidifrons* has been demonstrated.

***Amazilia fimbriata nigricauda* (Elliot).**

Two specimens: Santarem and Itaituba, Brazil.

Griscom and Greenway (1941, 170) list one of these under *A. versicolor nitidifrons* (as already said), and omit the second specimen entirely.

These specimens, compared with others from Bahia, Goyaz, and Matto Grosso (Collection American Museum), have less purely white under tail-coverts and darker, less yellowish green throats and breasts. No. 77,461, ♂, agrees well with the description of *nigricauda*; No. 71,850, ♀, not so well. They confirm Hellmayr's statement (1929, 325) that "the few specimens seen by me from the Tapajóz River appear to be intermediate between *nigricauda* and *fimbriata*."

***Amazilia fimbriata fimbriata* (Gmelin).**

Seventeen specimens: Cayenne and Mana, French Guiana; Manacapurú, Brazil.

After suffering several nomenclatural vicissitudes, this species is now called *fimbriata*, which according to von Berlepsch (1908, 266) is the earliest pertinent name. In our toptotypical series from French Guiana the upper mandible is dark-colored (in the skin), and the sheen of the median rectrices is decidedly greenish. The sexes are similar, although the females average duller-colored. Two specimens from Manacapurú,

on the north bank of the Amazon, seem to have more white below than the French Guiana birds, but I refer them to *fimbriata* provisionally.

***Amazilia fimbriata maculicauda* (Gould).**

Ten specimens: La Bomba and San German de Upata, Venezuela.

Clearly these are not the same as typical *fimbriata* from French Guiana. They are greener above, and duller, without bronzy reflections; the upper mandible is decidedly light-colored ("reddish flesh-color"); and the under tail-coverts tend to be whiter. They agree perfectly with two specimens from British Guiana (Annai) in the collection of the American Museum—as indeed they should since the localities are so close together. On geographical grounds Elliot's name *nitidicauda* (1878) would apply to this form, although the description does not quite fit. However, there is an earlier pertinent name in *Thaumatias maculicauda* of Gould, 1861. Simon rejects this name on the ground that it is based on a variation due to age—which of course is no reason at all. Griscom and Greenway (1941, 173) reject *nitidicauda* because its characters "have no geographic constancy." They compared a "series of 36 topotypes from Surinam" with eight specimens from British Guiana. It appears, therefore, that birds from British and Dutch Guiana are alike, but collectively they differ from French Guiana birds as already pointed out. The significant point to remember in this connection is that Cayenne (not Surinam) is the designated type-locality for *Trochilus fimbriatus* Gmelin. The median rectrices of *maculicauda* are greenish, as in typical *fimbriata*.

***Amazilia fimbriata apicalis* (Gould).**

Ten specimens: Ciudad Bolivar and San Felix, Venezuela.

Comparison with a series from the type-locality of *fimbriata* (French Guiana) at once shows that Orinoco specimens are not quite the same; they tend somewhat toward those coming from the north coast of Venezuela. In the Guiana series the upper mandible is dark-colored (in the skin), and the median rectrices are greenish. In the Orinoco birds the upper mandible is usually light-colored (reddish in life ?), the rectrices are as a rule bronzy, and the underparts are not so "solidly" green. Eight specimens from the Orinoco in the Rothschild Collection agree in general with ours, although they show some variation in the color of the bill and of the upperparts. Some are more greenish above, and others more bronzy.

Von Berlepsch and Hartert (1902, 83) listed these specimens as *Agyrtria albiventris* (Lesson). Now, there is a "Bogotá" skin of a hummingbird in the Rothschild Collection (No. 479,907, Collection American Museum) which is marked, apparently by Hartert himself, as "*terpna*," also "agrees with type of *apicalis*." It is absolutely identical with our two females from San Felix. Chapman (1917, 286) records a specimen of *A. "viridissima"* from Villavicencio, at the eastern foot of the Eastern Andes in Colombia. He did not allocate this specimen subspecifically, but after examination I venture to place it with the present race, for which *apicalis* appears to be the proper name. *Agyrtria terpna* of Heine, 1863, is a synonym. This form is thus shown to range in the Orinoco Valley in Venezuela west to the base of the Eastern Andes in Colombia.

***Amazilia fimbriata elegantissima*, subsp. nov.**

Twenty-eight specimens: San Esteban, El Trompillo, Sierra de Carabobo, Puerto La Cruz, and Santa Lucia, Venezuela.

*Type*, No. 104,914, Collection Carnegie Museum, adult male; Santa Lucia, Miranda, Venezuela, August 12, 1929; E. G. and M. L. Holt.

*Subspecific characters*.—Similar to *Amazilia fimbriata fimbriata* (Gmelin) of French Guiana, but bill above lighter-colored and upper tail-coverts and median rectrices decidedly coppery bronze (instead of dark green).

*Range*.—Northern Venezuela, in the States of Miranda, Aragua, and Carabobo.

*Remarks*.—This is the most richly colored of the northern races of this species. It differs from *apicalis* in its more "solid" green underparts (with less white in evidence) and its coppery (rather than bronzy) median rectrices. From *maculicauda* it is easily distinguished by its uniformly more bronzy (less greenish) upper parts and by the different sheen of the median rectrices.

It is odd that (so far as I am aware) *Amazilia fimbriata* has not heretofore been recorded from northern Venezuela, and it is no surprise to find that the population of that section belongs to an undescribed race, set off from its conspecific allies by characters that, although subject to individual variation, hold good in the ample series at hand.

***Amazilia franciæ* (Bourcier and Mulsant).**

Sixteen specimens: Heights of Caldas, Bitaco Valley, La Cumbre, and Mariquita, Colombia.

This species is the type of *Uranomitra* Reichenbach, which Peters (I think rightly) merges with *Amazilia*. It is a Subtropical Zone form, peculiar to the Central and Western Andes in Colombia.

***Amazilia candida candida*** (Bourcier and Mulsant).

Five specimens: Manatee Lagoon, British Honduras; Las Penitas and Catacombas, Honduras.

The female specimen from Manatee Lagoon has obvious cinnamomeous tips to the rectrices and cinnamomeous centers to the under tail-coverts.

***Amazilia saucerottei saucerottei***<sup>4</sup> (Delattre and Bourcier).

Eight specimens: Caldas and La Cumbre, Colombia.

***Amazilia saucerottei warscewiczii*** (Cabanis and Heine).

Thirty-eight specimens: Bonda, Don Amo, Cincinnati, Agua Dulce, Minca, Mamatoco, La Tigrera, Fundación, Dibulla, Turbaco, Aguachica, El Cauca, Pueblo Nuevo, and Ocaña, Colombia.

I have already (1922, 264-6) discussed this series and the nomenclatural questions involved, and so need not repeat. This hummingbird is a Tropical Zone form and is a common species in the Santa Marta region of Colombia, whence it ranges to the lower and middle Magdalena Valley. Its occurrence at Ocaña, on the eastern slope of the Eastern Andes, would suggest that it crosses the mountains to intergrade with the Venezuelan race *braccata*. But as yet there is no indication as to just where its range to the west meets that of typical *saucerottei*.

***Amazilia saucerottei braccata*** (Heine).

Thirty-two specimens: Sabana de Mendoza, Motatan, Guamito, and Tabay, Venezuela.

This form is barely separable from *warscewiczii* by its slightly lighter, more yellowish green, general coloration. The alleged difference in size is inconsequential. If the labels were removed, it would be hard to discriminate the two races; accordingly, I accept the present one with due reservations. However, both *warscewiczii* and *braccata* are easily distinguished from true *saucerottei* of western Colombia by the lighter blue color of the under tail-coverts, which are narrowly fringed with gray.

<sup>4</sup> The original spelling is *saucerrottei*.

***Amazilia hoffmanni*** (Cabanis and Heine).

Thirty-six specimens: Escazú, San Miguel, Bebedero, Miravalles, and Esparta, Costa Rica.

On the correct name of this form compare Hellmayr, *Novitates Zoologicae*, 20, 1913, 249, also the reference under *A. saucerottei warscewiczii, antea*. It will have to bear the name *hoffmanni* for the present, or until the true application of Gould's term *caligatus* can be determined by an examination of the type (if extant).

Comparison of this series with the several South American races of *A. saucerottei* convinces me that the Costa Rican form known by the above name ought to be ranked as a distinct species. There is first the matter of its separated range. I have searched in vain for records to substantiate its presence in Panama, or that of any member of this group. Even in southwestern Costa Rica it is unknown. In coloration it is constantly although not conspicuously different from *saucerottei*, since it is uniformly more brightly colored and has the rump decidedly purplish. The main differences, however, are the decidedly longer wings (reaching almost or quite to the end of the tail in well-made skins) and the much broader rectrices. In *saucerottei* the wings are relatively much shorter, falling far short of the end of the tail, and the rectrices are obviously narrower. I consider these differences to be specific rather than racial.

***Amazilia viridigaster*** (Bourcier).

Ten specimens: Palmar and La Colorada, Colombia.

Like those listed by Chapman (1917, 288), all these come from the eastern slope of the Eastern Andes. Although Simon (1921, 120, 335) recognizes *iodura* Reichenbach as a race of *viridigaster*, he ascribes to it a range which overlaps the range of the latter. I have examined a male specimen supposed to be *iodura* which is in the collection of the Field Museum, and I consider it specifically distinct from *viridigaster*. Simon also describes a new race, which he calls *melanura*, on the basis of a "Bogotá" skin. Chapman (1929, 14) thinks that *melanura* is based on an individual variation—a supposition which is more than probable. Under these circumstances I think that a binomial name for the present form will suffice.

***Amazilia edward[i] edward[i]*** (Delattre and Bourcier).

One specimen: Capira, Panama.

***Amazilia niveoventer* (Gould).**

Twenty-three specimens: Boruca, Costa Rica.

Many of these have the tips of the rectrices distinctly purple. I do not know the significance of this character.

***Amazilia tobaci erythronota* (Lesson).**

Twenty-three specimens: Carenage, Heights of Orepouche, and Chacachacare Island, Trinidad; San Felix, Upata, El Callao, El Dorado, El Peru Mine, and San German de Upata, Venezuela.

Females are rather duller below than males and have the under tail-coverts grayish, more brownish mesially. However, one bird sexed as a female has them cinnamon rufous.

Von Berlepsch and Hartert (1902, 84) have set up the name *caurensis* for the birds of the Orinoco and Caura rivers. I have seen no specimens from this latter region, but in view of the fact that the present series, coming from the region to the eastward of the Caura, includes some specimens more or less fitting the description of *caurensis*, together with others quite indistinguishable from the average Trinidad bird, I doubt whether such a distinction can be maintained. Females from the two respective regions are quite alike, and males practically so, although the under tail-coverts are apparently more often purplish vinaceous in the Trinidad examples.

***Amazilia tobaci aliciaë* Richmond.**

Six specimens: San Rafael, Cumanacoa, and Mirasol, Venezuela.

Compared with one male and four females from Margarita Island (Collection Field Museum), these mainland birds differ in having the pileum, upperparts generally, and wing-coverts more greenish, less bronzy. With a larger series available they might possibly be separated on this basis. The underparts in the male are darker, less yellowish green. In all specimens but one the under tail-coverts show a pronounced rufous coppery coloration.

***Amazilia tobaci feliciaë* (Lesson).**

Twenty-nine specimens: La Cumbre de Valencia, El Trompillo, Sierra de Carabobo, Pie del Cerro, Puerto La Cruz, Mariches, Petare, and Santa Lucia, Venezuela.



The differences between this race and *erythronota* of Trinidad are subtle and not any too constant. Lesson's description is brief and unsatisfactory. He supposed that his bird came from Brazil—clearly a mistake. Hellmayr and von Seilern (1912, 139) substitute therefor the "north coast of Venezuela," but this is not sufficiently explicit. Our series from the north coast exhibits a variation from west to east, affecting the color of the under tail-coverts. In the western birds these are bronzy or greenish with paler edgings, but towards the east the tendency to coppery or rufous color becomes more pronounced and reaches a maximum in specimens from Cumanacoa, which I refer to *aliciae*. In order to properly validate *feliciae*, I propose to further restrict the type-locality to the region of Caracas, from which Lesson's type may actually have come.

Males are readily distinguishable from females by the darker, more "solid" green of the underparts, with less gray edgings to the feathers.

#### ***Amazilia tobaci monticola* (Todd).**

Ten specimens: Tocuyo and Guarico, Venezuela.

The acquisition of the present series, taken at a higher elevation than this species had previously been reported in Venezuela, led to the discrimination of a Subtropical Zone race in this region. Compared with specimens from La Guaira, etc., in the U. S. National Museum, the Guarico birds differ in being uniformly darker, less bronzy green, in general coloration, with the crown and back less glittering. After comparison with our series, Wetmore (1939, 203) refers two males from El Sombrero, some seventy-odd miles south of Caracas, and at an elevation of only four hundred feet, to this race. I cannot understand this, because our specimens from the region southeast of Lake Valencia (El Trompillo and Sierra de Carabobo) are clearly *feliciae*. Oddly enough, Carriker failed to secure additional specimens of *monticola* anywhere else in the Andes of Merida. The single example from Tocuyo is somewhat intermediate between *monticola* and *feliciae*. The color of the under tail-coverts is subject to so much variation that it is valueless as a distinguishing character, just as Salvin claims (1892, 226).

#### ***Amazilia tzacatl[i] jucunda* (Heine).**

Seven specimens: El Tambo, Andagoya, and Cordoba, Colombia.

"On general faunal principles" Chapman (1917, 288) would "limit the range of *jucunda* in Colombia to that part of the Pacific coast from the

San Juan river southward." The above-listed specimens came from this region, but they are scarcely distinguishable from the series from other parts of Colombia. The females are perhaps a little paler below.

***Amazilia tzacatl*[i] *tzacatl*[i]** (De la Llave).

Eighty-nine specimens: Bonda, Buritaca, Don Amo, Fundación, Mamatoco, Don Diego, Dibulla, Turbaco, Puerto Zapote, Loricá, Aguachica, El Tambor, Murindó, Quibdó, and Fonseca, Colombia; Tocuyo, Sabana de Mendoza, Motatan, Tabay, and La Azulita, Venezuela; Juan Viñas, Pozo Azul de Pirris, Escazú, Guapiles, El Hogar, Miravalles, Esparta, and Boruca, Costa Rica; Manatee Lagoon, Manatee District, El Cayo, Duck Run, All Pines, and Freetown, British Honduras.

This common and well-known species inhabits the Tropical Zone from Mexico south to western Ecuador and east to the Maracaibo region of Venezuela. Geographical variation in this large area is so little in evidence that only the birds from the extreme southern part of the range are recognizably distinct. I fail to distinguish by any constant characters our Venezuelan specimens from others from Central America.

***Amazilia violiceps violiceps*** (Gould).

Three specimens: Chilpancingo (Guerrero), Mexico.

In the male the crown is bright blue; in the female it is dull blue or greenish ("the so-called *viridifrons* Elliot"). Compare Griscom, 1934, 376-8.

***Amazilia cyanocephala guatemalensis*** (Gould).

Eleven specimens: Manatee Lagoon, All Pines, and Freetown, British Honduras; Catacombas, Honduras.

Griscom (1932, 203) remarks certain slight peculiarities of coloration in British Honduras specimens, but after comparing them with a small series from Guatemala, I can find no differences.

***Amazilia amazilia amazilia*** (Lesson).

Two specimens: Lima, Peru.

***Amazilia yucatanensis yucatanensis*** (Cabot).

One specimen: Manatee Lagoon, British Honduras.

***Amazilia yucatanensis chalconota* Oberholser.**

Five specimens: Brownsville, Texas; Saltillo (Coahuila), Rio Corona (Tamaulipas), and Tamazunchale (San Luis Potosi), Mexico.

The specimen from the last-named locality has been identified by Sutton as *cerviniventris*, but I refer it to *chalconota* instead, since it resembles the specimen from Saltillo—as on geographical grounds it should do.

***Amazilia beryllina viola* Miller.**

Four specimens: Taxco (Guerrero) and Chilpancingo (Guerrero), Mexico.

***Amazilia rutila rutila* (Delattre).**

Fifteen specimens: Bebedero, Miravalles, and Esparta, Costa Rica; Cofradia, Honduras; Coyuca (Guerrero) and Acapulco (Guerrero), Mexico.

Some specimens are more bronzy, and others more greenish. Those from Miravalles vary, but none is like the type of *A. bangsi* Ridgway. Bangs claims that the example on which this name is based is a hybrid between *rutila* and *tzacali*.

***Amazilia amabilis amabilis* (Gould).**

Seventeen specimens: El Tambor, Soatata, and Murindó, Colombia.

I agree with Peters in reducing *Polyerata* to a subgenus of *Amazilia*.

This species was described from Colombia, and Gould's description of the color of the tail, "greenish bronze," would apply better to the Colombian birds. In these the tail tends to be bronzy or greenish rather than purplish (as in those from Costa Rica), and the purplish sheen on the rump and upper tail-coverts is scarcely in evidence; moreover, the upper-parts in general are more greenish, less bronzy. Two specimens in the collection of the American Museum (Puerto Valdivia and Alto Bonito, Colombia) agree with our series in this respect. Our specimens from El Tambor confirm other reports tending to show that this form ascends the Magdalena Valley almost to the latitude of Bogotá, and that it is thus not so restricted in range as Chapman implies.

***Amazilia amabilis costaricensis*, subsp. nov.**

Nine specimens: Guapiles and El Hogar, Costa Rica.

*Type*, No. 26,676, Collection Carnegie Museum, adult male; El Hogar, Costa Rica, December 10, 1905; M. A. Carriker, Jr.

*Subspecific characters*.—Similar to *Amazilia amabilis amabilis* (Gould) of Colombia, but upperparts in general more bronzy, less greenish; and tail (median rectrices), upper tail-coverts, and rump with a decided purplish (instead of greenish) sheen.

*Range*.—Nicaragua (Caribbean slope) to Panama.

*Remarks*.—Ridgway (1911, 523) remarked no variation in this species; his description, however, is clearly based on Central American specimens. The differences between these and Colombian examples are too obvious and constant to be disregarded. These differences hold in both sexes but are better pronounced in the male. I have examined two skins in the Elliot Collection from "New Granada" which agree perfectly with our Costa Rican birds; I judge that they probably came from Panama.

***Amazilia decora* (Salvin).**

Nineteen specimens: Pozo Azul de Pirris, El Pozo de Terraba, and Boruca, Costa Rica.

Notwithstanding the fact that the characters separating this form from *amabilis* are not conspicuous, they are constant and well defined; accordingly I am inclined to maintain the two as distinct species.

***Amazilia rosenbergi* (Boucard).**

Twenty specimens: Quibdó, El Tambo, Andagoya, Potedó, and Malagita, Colombia.

This is a very distinct species, the male of which entirely lacks a glittering crown. It is confined to the Tropical Zone of the Pacific coast in Colombia, in which section its range appears to inosculate with that of *amabilis*; although so far as I am aware, the two species have not been actually found together.

***Microchera parvirostris* (Lawrence).**

Three specimens: Volcano Turrialba and Carrillo, Costa Rica.

**Eupherusa egregia** Sclater and Salvin.

Five specimens: Juan Viñas and Ujuras de Terraba, Costa Rica.

**Eupherusa eximia eximia** (Delattre).

Seven specimens: Cockscomb Mountains, British Honduras.

A common species in Guatemala, but this is I think the first record for British Honduras.

**Eupherusa nigriventris** Lawrence.

One specimen: La Hondura, Costa Rica.

**Chalybura buffoni buffoni** (Lesson).

In describing his new species *Trochilus buffonii* in 1832, Lesson guessed that it came from Brazil, but his guess was a bad one. Not until 1854, when Gould figured the species in his "Monograph of the Trochilidae" (vol. 2, pl. 89), did it come out in print that the sources of the specimens reaching Europe were "Bogotá," Colombia, and Caracas, Venezuela. Hellmayr and von Seilern (1912, 140) inferentially substitute "Bogotá" as the type-locality, stating that specimens purporting to come from that region have the bluish black tail called for in Lesson's description and plate. Chapman (1917, 293) considers specimens from the Magdalena Valley "essentially topotypical," although he is at pains to point out that their tails are more bronzy than those of specimens from the Pacific coast. And now come Bangs and Barbour (1922, 204), who describe under the name *micans* this very bird with the bluish black tail and give its range as western Colombia and eastern Panama. These authors also refer to the bronzy tail of Magdalena Valley specimens.

It is significant that bronzy tails are the rule in the only specimens surely known to have been taken in the Magdalena Valley. So-called "Bogotá" skins with uniform bluish black tails (of which we have two examples), therefore, must have had their origin in some other region—western Colombia or eastern Panama. Through the courtesy of the authorities of the Museum of Comparative Zoölogy I have had the privilege of examining and comparing six specimens from the type-series of *micans*. These obviously represent a form distinct from both that of the Magdalena Valley and that of the coast region of Venezuela. They differ not only in having the tails more solidly bluish black, as the describers claim, but

also in the color of the underparts, which have a decided bluish sheen (benzol green of Ridgway)—much more marked than is shown by any of our specimens from other regions. Also, the underparts have the gray feather-edgings wider and more prominent. As these are precisely the characters emphasized in the original description by Lesson, I do not see how we can avoid using his name *buffoni* for this form in place of *micans* Bangs and Barbour.<sup>5</sup> This procedure leaves the Magdalena Valley bird without a name. I propose to call it

***Chalybura buffoni interior*, subsp. nov.**

Fifteen specimens: El Cauca and El Tambor, Colombia; Santa Elena and Guachi, Venezuela.

*Type*, No. 90,529, Collection Carnegie Museum, adult male; Santa Elena, Zulia, Venezuela, August 12, 1922; M. A. Carriker, Jr.

*Subspecific characters*.—Similar to *Chalybura buffoni aeneicauda* Lawrence, but smaller; the upperparts with little bronzy sheen; and the underparts darker, more bluish green (vivid green of Ridgway).

*Range*.—Magdalena Valley (middle and upper) of Colombia and the region south of Lake Maracaibo in western Venezuela.

*Remarks*.—Ten adult males of the present form average: wing, 67.6; tail, 44; bill, 25. The same number of *aeneicauda*: wing, 71.7; tail, 46.4; bill, 25.8. They differ from birds from eastern Panama, as already pointed out, in the more bronzy hue of the tail, the more greenish sheen of the underparts, and the narrower pale feather-edgings. Lesson's description and plate fit the Panama bird better than they do any other, and there is every reason to believe that his type-specimen could not have come from the vicinity of Bogotá. According to present information the range of this interior race is discontinuous, but in all probability it is

<sup>5</sup> It will be noted that my conclusion here is at variance with the position I took in the case of *Trogon sulphureus* Spix (*cf.* Proceedings Biological Society of Washington, now in press). The two cases are not exactly parallel, however. In the Trogon case there is a discrepancy between Spix's figure and type-specimen on the one hand, and his description and assigned type-locality on the other; of the two alternatives I accept the latter as correct. In the case of *Chalybura buffoni* my contention is that Lesson's figure and description are sufficiently accurate and diagnostic, and should be accepted, but I cannot accept Hellmayr and von Seilern's designation of a type-locality, since we now know that examples fitting Lesson's description certainly do not come from Bogotá. It is of course well known that so-called "Bogotá" skins may have come from any part of Colombia.

actually not so. There is doubtless a connection somewhere across or around the Eastern Andes.

***Chalybura buffoni æneicauda* Lawrence.**

Fifty-six specimens: Las Quiguas, El Hacha, Aroa, Lagunita de Aroa, El Trompillo, Sierra de Carabobo, Puerto La Cruz, El Limon, Pie del Cerro, Mariches, and El Encatado, Venezuela; Cacagualito, Bonda, Don Amo, Don Diego, Cincinnati, Mamatoco, La Tigra, Minca, and Dibulla, Colombia.

Since my previous remarks on this form (1922, 267) I have altered my views considerably, as already said, but not as regards the validity of *æneicauda*. The color of the tail varies through wide limits, from almost black in one example to dark green glossed with steel blue, and even coppery purple. Specimens from the Santa Marta region of Colombia agree with those from northern Venezuela in size and coloration. In adults the underparts (typically) are nearest Scheele's green of Ridgway, but brighter. A male from El Hacha approaches *interior* in the darker green of its underparts, but another specimen from a point higher up (Aroa) is definitely *æneicauda*. These come from the region where intergrades between the two forms might be expected to occur. The present race does not seem to range eastward beyond the State of Miranda. A series in fine fresh plumage (May-June) from El Trompillo and the Sierra de Carabobo show the extreme development of the bronzy lustre. Some specimens show a decided coppery color on the chin and submaxillaries. Younger males have the green of the underparts less "solid."

***Chalybura cæruleogaster* (Gould).**

Two specimens: La Colorada, Colombia.

Two females from this locality are referred here on geographic grounds; they are noticeably grayer below than females of *æneicauda*.

***Chalybura urochrysa urochrysa* (Gould).**

Sixteen specimens: Quibdó, El Tambo, Potedó, Malagita, and Cordoba, Colombia.

Griscom (American Museum Novitates No. 293, 1928, 3), in describing a race from Tacarcuna, eastern Panama, insists that *urochrysa*, *isauræ*, and his intermediate form *incognita* must be either distinct species or representative subspecies. So for the present I use a trinomial name.

**Chalybura melanorrhoa** Salvin.

Twenty-three specimens: Guapiles, Cuabre, Río Sicsola, and El Hogar, Costa Rica.

On the evidence of two specimens from the Almirante region of western Panama which show intermediate characters, Griscom (Auk, 50, 1933, 301) would reduce *melanorrhoa* to a subspecies of *isauræ*.

**Lampornis hemileucus** (Salvin).

Two specimens: La Hondura and Juan Viñas, Costa Rica.

**Lampornis calolæma** (Salvin).

Ten specimens: Escazú, La Hondura, and Juan Viñas, Costa Rica.

Females of this species closely resemble those of *L. cinereicauda*, and where both species occur together, as at Escazú, their identification is not easy.

**Lampornis cinereicauda** (Lawrence).

Twelve specimens: Escazú and Ujuras de Terraba, Costa Rica.

Bangs (Proceedings Biological Society of Washington, 19, 1906, 106) says that out of sixty-three males of this form examined, thirty-three had the throat violet and white mixed. But only three (of five) of the above show on close inspection a trace of violet, concealed by the white feathers, along the lower edge of the white throat.

**Lampornis clemenciæ clemenciæ** (Lesson).

Ten specimens: La Venta (Distrito Federal), San Bartolo (Distrito Federal), and Contreras (Distrito Federal), Mexico.

**Lampornis clemenciæ bessophilus** (Oberholser).

Eighteen specimens: Pine Canyon and Juniper Canyon, Texas; Chiricahua Mountains, Carr Canyon, and Cave Creek, Arizona.

Compared with Mexican specimens of true *clemenciæ*, these are obviously paler, purer gray on the underparts. I disagree with Van Tyne (Auk, 46, 1929, 205) in referring birds from the Chisos Mountains, Texas, to *clemenciæ*. Three adult males from these mountains are to my eye indistinguishable from Arizona birds. In immature males the blue area on the throat is more or less restricted.



**Adelomyia melanogenys melanogenys** (Fraser).

Thirty-seven specimens: Guarico, Anzoategui, and Guamito, Venezuela; La Palmita, Pueblo Nuevo, Las Ventanas, and Rio Negro, Colombia.

I cannot satisfactorily distinguish Venezuelan from Colombian specimens. Much variation exists; this affects the sheen of the upperparts (from green to bronzy), and the spotting and the amount of buffy below.

**Adelomyia melanogenys æneosticta** Simon.

Eighteen specimens: La Cumbre de Valencia and Galipán, Venezuela.

In my opinion this is a very poor subspecies, scarcely recognizable even in series. It is a little paler, less buffy, below, and has fewer and smaller spots on the throat, than typical *melanogenys*. The bill averages a little shorter. In order to recognize it at all it is necessary to restrict its range to the coast mountains of Venezuela, since birds from the region surrounding the Maracaibo basin are absolutely indistinguishable from true *melanogenys*.

Simon (1921, 346) says that the name as written was a slip of the pen; he intended to write *æneotincta*.

**Adelomyia cervina** Gould.

Eighteen specimens: Bitaco Valley, La Cumbre, and Sancudo, Colombia.

Although Chapman (1917, 304) records a specimen indicating the non-intergradation of *melanogenys* with *cervina*, he nevertheless treats them as conspecies. I prefer to consider *cervina* as a full species.

**Adelomyia inornata** (Gould).

Fourteen specimens: Samaipata, Incachaca, and San José, Bolivia.

**Anthocephala floriceps** (Gould).

Four specimens: Las Taguas, Pueblo Viejo, and Chirua, Colombia.

Following Simon (1921, 347) and Butler (Ibis, 1926, 335), I revert to *Anthocephala* as the generic name in this case, as the International Code authorizes.

***Eugenes spectabilis*** (Lawrence).

Seven specimens: Escazú, Volcano Turrialba, and Ujuras de Terraba, Costa Rica.

This is another species in which the female has a decidedly longer bill than the male.

***Eugenes fulgens fulgens*** (Swainson).

Fourteen specimens: Taxco (Guerrero), San Bartolo (Distrito Federal), Contreras (Distrito Federal), Jacala (Hidalgo), and Rio Frio (Mexico), Mexico.

These obviously represent true *fulgens*, described from Temascaltepec, Mexico. The northern bird will stand as

***Eugenes fulgens aureoviridis*** Van Rossem.

Eight specimens: Chiricahua Mountains, Huachuca Mountains, and Mount Graham (Turkey Flat), Arizona; OK Bar Ranch and Turkey Spring, New Mexico.

Males of this hummingbird are readily separable from Mexican specimens by their more greenish, less bronzy, general coloration, and in particular by the uniformly lighter, more grayish, less dusky, coloration of the posterior underparts, in which moreover the green wash is less extended. This race, recently discriminated by Van Rossem, is easily distinguishable when smoothly made-up skins are used for making comparisons.

***Heliodoxa rubinoides æquatorialis*** (Gould).

Two specimens: Bitaco Valley, Colombia.

***Heliodoxa leadbeateri leadbeateri*** (Bourcier).

Forty-four specimens: Las Quiguas, La Cumbre de Valencia, Lagunita de Aroa, Galipán, Loma Redonda, Guamito, La Azulita, and Santa Lucia, Venezuela; Bucaramanga and Rio Negro, Colombia; San José and Incachaca, Bolivia.

This series affords no grounds for the recognition of a southern race (*otero*). The exact shade of the bluish purple of the pileum in the male varies somewhat, as also does the length of the bill, but these variations are not geographical.

While females of this form are readily distinguishable from those of *parvula*, they closely resemble those of *henryi* (the northern race of *jacula*), from which they differ only in their slightly longer bill, more bluish green forehead, and brighter green median rectrices. These characters are apparent in immature individuals as well and indicate the close relationship existing between the two species *jacula* and *leadbeateri*.

***Heliodoxa leadbeateri parvula*** von Berlepsch.

Our specimens from Bucaramanga and Rio Negro above listed might be expected to belong to this form, but they do not; nor do the specimens listed by Chapman (1917, 296) from the same general region. However, there are (or were) in the Museum collection ten "Bogotá" skins which are obviously *parvula*. It is a strongly marked form—perhaps a distinct species. Besides being much smaller than *leadbeateri*, it is much brighter-colored, more bronzy green, above, while the median rectrices, which are very dark greenish or even purplish bronze in the latter, are bright bronzy in both sexes of *parvula*. The female of *parvula* is not so heavily spotted below as the female of *leadbeateri*, and in all the skins of the former examined, the abdomen is buffy. It appears, therefore, that we are dealing with a valid form, the exact home of which remains to be discovered.

***Heliodoxa jacula henryi*** Lawrence.

Ten specimens: Volcano Irazú, Volcano Turrialba, La Hondura, and Juan Viñas, Costa Rica.

***Sternoclyta cyanopectus*** (Gould).

Sixteen specimens: Las Quiguas, San Esteban, El Hacha, Aroa, Lagunita de Aroa, El Limon, and Santa Lucia, Venezuela.

Immaturity in both sexes is denoted by cinnamon color on the abdomen. A bird in this stage is figured by Gould and also described by Salvin as the adult female. No. 36,356 closely corresponds to Gould's plate, while No. 36,421, which is apparently an older individual, shows but a trace of cinnamon below. This is a species in which the female has a longer bill than the male.

***Topaza pella pella*** (Linnæus).

Thirty-seven specimens: Tamanoir and Pied Saut, French Guiana.

Surinam is the type-locality. Simon (1921, 152, 353) claims that French Guiana birds are different and accepts for them the name "*smarag-*

*dina*" Bosc (*lege smaragdula*—*cf.* Chubb, Bulletin British Ornithologists' Club, 31, 1912, 39). I am unable to check his results, but I cannot see that his description of this supposed form applies any better to our series than does the description of *pella*.

Over half the males, otherwise adult in plumage characters, lack the long rectrices. Females vary in the amount of sheen and in its color.

***Topaza pella microrhyncha* Butler.**

One specimen: Benevides, Brazil.

Butler (Bulletin British Ornithologists' Club, 46, 1925, 56) describes this race on the basis of its smaller size, and in particular of its shorter bill. In adult males from French Guiana the bills are from 23 to 26 mm. long, while in the Pará bird the bill is said to be only 20 mm. Our single specimen is a subadult female, whose measurements (wing, 76; bill, 23.5) do not bear out Butler's figures. Direct comparison of adult males from the two respective regions would be desirable.

***Oreotrochilus estellæ*<sup>6</sup> (D'Orbigny and Lafresnaye).**

Fifteen specimens: Cochabamba, Molle-molle, La Paz, Colomi, Oruro, Guaqui, and Tiraque, Bolivia.

Two immature males (Nos. 81,268, 120,296) differ from adults of the same sex in having the throat soiled white (like the abdomen), with broken spots or streaks of deep steel blue; both show a few new green adult feathers coming in. While No. 120,296 has the abdomen medially chestnut (as in adults), this part shows a few steel blue feathers intermixed. In No. 81,268, on the other hand, the median abdominal stripe is wholly steel blue. There is also a male bird (No. 81,417), apparently adult, which has this part steel blue instead of chestnut. Thus it approaches the supposed species *O. bolivianus* Boucard, as described by Simon and Hellmayr (1908, 4). I cannot make out the characters of the tail-pattern as they describe them; however, our series show a wide variation in this respect in both sexes. I feel convinced that the above series belong to one and the same species, despite the discrepancies in question, and I suspect that two color phases may be involved. In view of such a possibility, the status of *bolivianus* should be reinvestigated. Hellmayr (1932, 236) suggests its intermediacy. Compare, however, Berlioz and Rousseau-Decelle, Oiseau, 3, 1933, 343-347 (not seen by the writer).

<sup>6</sup> Originally written *estella*.

**Oreotrochilus adelæ**<sup>7</sup> (D'Orbigny and Lafresnaye).

Four specimens: Molle-molle and Tiraque, Bolivia.

**Oreotrochilus chimborazo jamesoni** Jardine.

Two specimens: Guagua Pichincha, Ecuador.

Chapman (1926, 302) believes this form to be conspecific with *chimborazo*. Rothschild (Bulletin British Ornithologists' Club, 48, 1927, 41) thinks that they will eventually prove to be dimorphic forms of one species.

**Patagona gigas peruviana** Boucard.

Twenty-two specimens: Maimará, Argentina; Arani, Vacas, Cochabamba, Molle-molle, Guaqui, and Tiraque, Bolivia; Lima and Galera, Peru; Cumbayá, Ecuador.

On the races of this species compare Hellmayr, 1932, 230-233. It would seem that all our specimens belong to *peruviana*, although they vary greatly among themselves. Some are much duller below than others and more mottled with dusky; others are almost "solid" cinnamon rufous below. I cannot make out the significance of this variation; it seems uncorrelated with sex or season, but may perhaps depend on age.

Our Argentine specimens were taken on November 17 and January 16, which dates would suggest breeding, although Hellmayr says that he has seen no undoubted breeding examples from that country.

**Aglæactis cupripennis cupripennis** (Bourcier and Mulsant).

Seventeen specimens: Paramo de Guerrero, Ramirez, Paramo de Cachirí, Peña Blanca, and El Cardon, Colombia; Lloa and Mount Pichincha, Ecuador.

Most of these are immature, and the glittering area on the back is restricted or even wanting. Colombian and Ecuadorian birds are alike.

**Aglæactis pamelæ**<sup>8</sup> (D'Orbigny and Lafresnaye).

Seventeen specimens: Incachaca, Cerro de Incachaca, Cejas del Juno, and Cejas de San Benito, Bolivia.

<sup>7</sup>Originally written *adela*.

<sup>8</sup>Originally written *pamela*.

**Lafresnaya lafresnayi lafresnayi** (Boissonneau).

Fifteen specimens: Peña Blanca, Sancudo, and Leonera, Colombia.

I have already discussed this series of specimens (1922, 253) and remarked on the variations it shows. Some examples are like Quito specimens of *saül* in the color of the outer rectrices, while others fit the description of *lafresnayi*. Intergradation between these two forms is thus indicated. The pertinence of the name *lafresnayi* to the population of the Bogotá region would have to be admitted on geographical grounds, if for no better reason. Immature males with buffy chin and throat outnumber the adults in the series.

**Lafresnaya lafresnayi liriopae** Bangs.

One specimen: San Miguel, Colombia.

This race rests on a slender basis, and more specimens are urgently needed to confirm or disprove its validity. Compare my previous remarks on this question (1922, 253).

**Lafresnaya lafresnayi saül[æ]** (Delattre and Bourcier).

Two specimens: Guamito and Tabay, Venezuela.

Zimmer (1930, 281) thinks that the name *gayi* of Bourcier and Mulsant, which has a slight priority over *saül*, should be dropped because of its uncertain application. He would refer Venezuelan specimens to *liriopae* of the Santa Marta region. Our male from Guamito, however, does not agree with the Santa Marta specimen, since its tail is somewhat differently colored and the dark tips to the lateral rectrices are smaller. These characters may of course be variable. Chapman (1926, 308) remarks that the range of the white-tailed form is interrupted by that of the buff-tailed one—a suspicious circumstance, suggesting that further comparisons are in order.

**Pterophanes cyanopterus cyanopterus** (Fraser).

Eight specimens: Paramo de Guerrero, Leonera, and Santa Ignacia, Colombia.

All of these (except a juvenal example, October 22) show a very decided deep blue sheen on the underparts. Simon (1921, 164) mentions this but discounts it as having no geographic significance. Immature males may readily be distinguished by the admixture of rufous cinnamon feathers

on the underparts, and by the plain primaries, without any blue. Even in this stage, however, there is a decided blue sheen to the underparts.

***Pterophanes cyanopterus peruvianus* Boucard.**

Eleven specimens: Incachaca, Bolivia.

These differ decidedly from Colombian specimens in lacking any blue sheen on the underparts, which are plain dark green. They are entitled to the name *peruvianus* Boucard (1895, 263). Zimmer, however (1930, 282), claims that Peruvian and Colombian birds are alike, and that "such differences as exist are evidently those of age and individual variation." If this is the case, then the Bolivian bird would have to be renamed, as it is certainly subspecifically separable from that of Colombia, as represented by our series. I have examined no less than thirteen males from Ecuador (Goodfellow and Hamilton, collectors) in the U. S. National Museum. While they are just a trifle bluer below (viewed from the side) than Bolivian males, they are obviously different from Colombian birds as regards this character. Consequently, I have no longer any hesitation about accepting *peruvianus* for all the birds of this species from Ecuador to Bolivia inclusive.

Genus *CÆLIGENA* Lesson.

As shown by Stone, Auk, 24, 1907, 196, the type of *Cæligena* Lesson, 1832, by the rule of tautonymy, is *Ornismya cæligena* Lesson. If we consider that this species is congeneric with *Ornismya helianthea* Lesson, the type of *Helianthea* Gould, 1848 (also by tautonymy), the former name will supplant the latter for this generic group. I am indebted to Mr. Peters for calling my attention to this necessary change.

***Cæligena helianthea* (Lesson).**

Seventeen specimens: Ramirez, La Pica, Peña Blanca, and El Cardon, Colombia.

Chapman's single specimen came from the eastern slope of the Eastern Andes, in the Temperate Zone. Ours come from the same zone, but on the western slope of the range.

The glittering crown-spot varies greatly in size; in one male it is barely suggested, and in another entirely absent. Possibly some males do not acquire this ornamental character. Females have longer bills than males.

***Cœligena eos*** (Gould).

Seven specimens: Paramo de Rosas, La Cuchilla, and Heights of Tabay, Venezuela.

In what is apparently a younger female (No. 37,297, March 16) the throat is cinnamon (darker than in the adult), streaked with dusky; the bill is shorter (23.5 mm.); and the outer rectrices are shaded subterminally with greenish.

***Cœligena phalerata*** (Bangs).

Thirty-three specimens: El Libano, Cincinnati, San Lorenzo, Sierra Nevada de Santa Marta (6000 feet), Heights of Chirua, San Miguel, and Cerro de Caracas, Colombia.

Compare my former remarks on this species (1922, 255).

***Cœligena violifera violifera*** (Gould).

Thirteen specimens: Incachaca and Cejas del Juno, Bolivia.

Of four females there are two which have a few glittering violet blue feathers on the throat.

***Cœligena lutetiæ*** (Delattre and Bourcier).

Five specimens: Sancudo and Leonera, Colombia; Lloa, Ecuador.

Chapman (1926, 305) is against the recognition of *hamiltoni*, or even of two races of *lutetiæ*. Our single male from Ecuador is precisely like those from Colombia.

***Cœligena conradi*** (Bourcier).

Six specimens: Paramo de Rosas and Guamito, Venezuela.

The single female has the throat buffy instead of green, but this may be due to immaturity.

***Cœligena torquata*** (Boissonneau).

Nine specimens: Las Ventanas, Boca del Monte, and Sancudo, Colombia.

***Cœligena inca*** (Gould).

Eleven specimens: Incachaca, Bolivia.



***Cœligena boliviana*** (Gould).

Five specimens: Samaipata, Incachaca, and San José, Bolivia.

Both Simon and Hartert make this form conspecific with *C. cœligena*—with which it may indeed be connected through *obscura* of Peru (not seen by me)—but for the present I keep it distinct.

Nos. 80,811 and 85,493 I take to be females or young (one is marked ♀, the other ♂). They are very much duller above (less blackish), especially on the crown, than the others.

***Cœligena cœligena*** (Lesson).

Seven specimens: La Cumbre de Valencia and Colonia Tovar, Venezuela.

Chapman (1917, 298) thinks that this form may be a species distinct from its Colombian allies *colombiana* and *ferruginea*, and there is much to be said for this view, especially now that we know that *colombiana* occurs in Venezuela too, at no great distance. The range of the present form is confined to the coast mountains of Venezuela, in the Subtropical Zone.

***Cœligena colombiana colombiana*** (Elliot).

Fifteen specimens: Guarico and Anzoategui, Venezuela; La Palmita, Pueblo Nuevo, and Las Ventanas, Colombia.

The type-specimen of *colombiana*, in the Elliot Collection in New York, has been almost destroyed by dermestes, but other specimens fully confirm the above identification. Carriker's discovery of this form in the mountains southwest of Barquisimeto added it to the Venezuelan list and brought its range within measurable distance of that of *cœligena*. These Venezuelan specimens are precisely like those from Colombia and show no approach to the form of the coast range, *cœligena*. Under the circumstances I think the latter should stand alone.

***Cœligena colombiana ferruginea*** Chapman.

Seven specimens: Bitaco Valley, Colombia.

***Ensifera ensifera*** (Boissonneau).

Three specimens: Ramirez, Colombia; Incachaca, Bolivia; El Angel, Ecuador.

I agree with Chapman (1926, 308) that the recognition of more than one

race of this species is inexpedient. The recently described race *cærulescens* (Lowe, Ibis, 1939, 73) might be a color aberration (except for its shorter bill). Its locality is unknown. The Incachaca specimen is the first record for Bolivia; it is of course conceivable that it might represent a new race.

**Sephanoides fernandensis fernandensis** (King).

Eight specimens: Mas-a-tierra Island, Chile.

**Sephanoides sephanioides** (Lesson and Garnot).

Nine specimens: Mas-a-tierra Island, Guafo Island, Puerto Sarjento, Rio Huemules, and Puerto Melinca, Chile.

**Boissonneaua matthewsi** (Bourcier).

One specimen: Baños, Ecuador.

**Boissonneaua flavescens flavescens** (Loddiges).

Forty specimens: Las Ventanas, Ramirez, Paramo de San Pedro, La Pica, Cachirí, Rio Negro, Bitaco Valley, and Sancudo, Colombia; Guamito, Venezuela.

No geographic variation is in evidence in this series. Females have the green of the underparts less "solid," *i.e.*, more interrupted by buff; they also average smaller.

**Heliangelus mavors** Gould.

Thirty-eight specimens: Anzoategui, Paramo de Rosas, Guamito, La Cuchilla, and Las Piedras, Venezuela.

**Heliangelus exortis** (Fraser).

Sixteen specimens: Sancudo, Colombia.

While in coloration some females approximate the males, they are smaller in size. Chapman has shown (1917, 305) that *soderstromi* Oberholser was based on a female of the present form.

**Heliangelus clarissæ**<sup>9</sup> (Longuemare).

Twenty-six specimens: Las Ventanas, Ramirez, La Pica, Rio Negro, and Boca del Monte, Colombia.

<sup>9</sup> The original spelling is *clarisse*.

These localities are all in the Subtropical Zone of the Eastern Andes (both slopes), in the region of Cocui. Chapman did not encounter this species. The "varieties" mentioned by Simon (1921, 367) are in my opinion aberrations or hybrids. Several examples in excessively worn breeding dress are included; they appear almost dusky below, with a streaked effect. Adult females usually have some rosy red on the throat, but the color is less extensive than in the males and is bounded posteriorly by a black line. Immature males are similar.

***Heliangelus amethysticollis*** (Lafresnaye and D'Orbigny).

Twelve specimens: Incachaca, Bolivia.

Carriker (1935, 346-7) would reduce *clarissæ* to subspecific status under *amethysticollis*, with *laticlavius* as a connecting link. But I am not prepared to follow him in this, and in my opinion the two forms should be separated for the present.

***Heliangelus spencei*** (Bourcier).

Four specimens: Tabay and Heights of Tabay, Venezuela.

***Vestipedes cupreiventris*** (Fraser).

Twelve specimens: Paramo de Guerrero, Paramo de San Pedro, Ramirez, Peña Blanca, El Cardon, and Boca del Monte, Colombia; Paramo de Frias, Venezuela.

Chapman's collectors did not secure this species. The above list of localities where it occurs is accordingly welcome information. It is thus shown to be a Temperate Zone species, found in the Eastern Andes of Colombia and the Andes of Merida in Venezuela. The series includes two young birds, which lack the coppery sheen of the underparts.

***Vestipedes vestitus*** (Lesson).

Eight specimens: Paramo de Guerrero, Ramirez, and Cachirí, Colombia; Paramo de Frias and La Culata, Venezuela.

Our four males from Colombia are immature, as their buffy lores indicate. Viewed from in front, they show somewhat of a black band below the blue gular spot. Of two adult males from the Andes of Merida, one has this dark band broad and distinct; in the other it is virtually lacking. Our birds compare favorably with Ecuador skins, but even so, I cannot

escape the impression that we are dealing here with an individual rather than a geographical variation, and I would therefore consider *smaragdinipectus* a pure synonym of *vestitus*.

Chapman (1917, 300) found this species at only one place in the southern Central Andes. Our specimens extend its known range to the Eastern Andes and thence to the Andes of Merida in Venezuela.

***Vestipedes derbyi longirostris* Hartert.**

Ten specimens: Sancudo and Leonera, Colombia.

Like those recorded by Chapman, these come from the Central Andes. Typical *derbyi* has been recorded from southern Colombia (Pasto); however, all the above fit the description of *longirostris* as to length of bill.

The peculiarities of the tail in this species have caused it to be set aside generically as *Erebenna*.

***Vestipedes mosquera*[i] (Delattre and Bourcier).**

Twelve specimens: Leonera, Colombia.

These agree with two specimens in the American Museum from Santa Isabel and the Andes west of Popayan. It may here be noted, however, that *mosquera* (from Pasto, Colombia) is described and figured as having the underparts "bright reddish copper, more bronzy on the breast," whereas our birds from the Central Andes have green underparts, and the breast merely tinged with bronzy. In adult males the outer rectrices are narrower and greener than in females.

***Vestipedes glaucopoides* (D'Orbigny and Lafresnaye).**

Two specimens: Incachaca, Bolivia.

***Haplophædia aureliæ caucensis* (Simon).**

Sixteen specimens: Heights of Caldas, Bitaco Valley, and La Cumbre, Colombia.

***Ocreatus underwoodi underwoodi* (Lesson).**

Forty-seven specimens: Anzoategui, Guamito, and La Azulita, Venezuela; La Palmita, Las Ventanas, Cachirí, Heights of Caldas, Bitaco Valley, and La Cumbre, Colombia.

In this fine series of specimens from Colombia and the Merida region of

Venezuela I can discover no racial differences; consequently I agree with Simon (1921, 375) in considering *discifer* of Heine a pure synonym of *underwoodi*. Young males generally have more spotting on the underparts than adult females, and usually also some traces of the glittering green feathers of the adult stage.

***Ocreatus underwoodi polystictus*, subsp. nov.**

Twelve specimens: Galipán and Silla de Caracas, Venezuela.

*Type*, No. 53,746, Collection Carnegie Museum, adult female; Galipán, Cerro del Avila, Venezuela, March 7, 1914; Samuel M. Klages.

*Subspecific characters*.—Similar to *Ocreatus underwoodi underwoodi* (Lesson) of Colombia and the Andes of Merida in Venezuela, but adult male averaging more bronzy above, and adult female more heavily spotted below with green.

*Range*.—Coast Range of Venezuela (Subtropical Zone).

*Remarks*.—Hellmayr and von Seilern (1912, 145) have referred specimens from Silla de Caracas to *discifer*, which in my opinion is a synonym of *underwoodi*. I consider that the above specimens belong to a slightly differentiated race peculiar to the coast range of Venezuela. The males are scarcely different from those of *underwoodi*, but the females stand out well in comparison by reason of their more heavily spotted underparts. There are some specimens of *underwoodi* which are similar, but they are marked as young males. The possibility exists that the individuals above described may also be young males, but I think it hardly likely that all four of them have been wrongly sexed.

***Ocreatus addæ* (Bourcier).**

Five specimens: Samaipata and San José, Bolivia.

Simon (1921, 376, note) thinks that *rufocaligatus* Gould should be used for this species. According to Sherbourne ("Index Animalium") both names appeared in November, 1846, and there is no way of telling which was first. So I follow the rule of *auctorum plurimorum* in this case.

***Lesbia victoriæ æquatorialis* (Boucard).**

Two specimens: Lloa, Ecuador.

For the use of *Lesbia* instead of *Psolidoprymna* see Zimmer, 1930, 290.

**Lesbia victoriae victoriae** (Bourcier and Mulsant).

One specimen: Lagunillas, Colombia.

**Lesbia gouldi gracilis** (Gould).

Two specimens: Lloa, Ecuador.

**Sappho sappho** (Lesson).

Twenty-nine specimens: Samaipata, Chilon, Vacas, Cochabamba, and Comarapa, Bolivia.

Wetmore (1926, 231) and Butler (Ibis, 1926, 406) have shown that the name under which this species has been passing really applies to the other species of the genus, heretofore called *phaon*.

Adult males are in the minority; most of the series is composed of immature males (with short tails) and females.

**Sappho sparganura** (Shaw).

Three specimens: La Paz and Guaqui, Bolivia.

This is the species formerly called *Lesbia phaon*, as above noted.

**Ramphomicron microrhynchum microrhynchum** (Boissonneau).

Twenty-six specimens: Ramirez, La Pica, El Cardon, and Sancudo, Colombia.

Immature males, showing the transition into adult dress, greatly predominate over old birds in this series. Juvenal males resemble adult females but have longer tails.

**Ramphomicron microrhynchum andicola** Simon.

One specimen: Paramo de Frias, Venezuela.

A female example, apparently not different from Colombian birds. Chapman (1926, 319) inferentially indorses the validity of this race.

**Metallura williami** (Delattre and Bourcier).

Fifteen specimens: Leonera, Paramo de Ruiz, and Santa Ignacia, Colombia.

All these localities are in the Paramo Zone of the Central Andes.

***Metallura malagæ*** von Berlepsch.

Five specimens: Incachaca, Bolivia.

Four males and one female of this species, heretofore known only from the type in the von Berlepsch Collection. It was described from a female, and the description fits our female closely. A fuller description will be in order. Adult male: general color green, uniform above, duller below, but the throat glittering when viewed from in front; underparts with dusky brown bases to the feathers; flank-tufts white; under tail-coverts bronzy, with broad rufescent edgings; wings brown with a bronzy or purplish shade; edge of wing cinnamon; a small white spot behind the eye; tail above showing bluish, bronzy, or purple reflections in certain lights, below rich shining coppery purple. Female similar but duller, the underparts buffy spangled with green; tail also duller, and the outer rectrices with grayish buffy tips. Male: wing, 64, 64, 63, 63; tail, 44, 45, 43, 44; bill, 20, 20, 20, 22. Female: wing, 57; tail, 39; bill, 20.

*M. malagæ* has its nearest relative in *M. aneocauda* (Gould), but its bill is much longer and its tail is differently colored. Whether the two are representative forms or have overlapping ranges, I cannot say. Simon (1921, 201) thinks that *malagæ* may be based on a hybrid or young bird, but I am convinced that it is a valid form.

***Metallura smaragdinicollis smaragdinicollis***

(Lafresnaye and D'Orbigny).

Twenty-seven specimens: Incachaca and Cejas del Juno, Bolivia.

Zimmer (1930, 289) follows Hartert (1922, 410) in making this form conspecific with *tyrianthina*. Their close relationship may be admitted, however, without resort to the trinomial. The different color of the tail seems to me a good specific character.

Carriker (1935, 347) has discussed the ranges of *smaragdinicollis* and its northern race, *septentrionalis*, in Peru.

***Metallura tyrianthina tyrianthina*** (Loddiges).

Thirty-two specimens: Las Ventanas, Ramirez, Paramo de Guerrero, Cachirí, La Pica, Peña Blanca, Boca del Monte, and Sancudo, Colombia.

Considerable variation is in evidence, but as a series these are easily distinguishable from Venezuelan birds. By comparison they are light-colored, purer green above, and with considerable white mottling on the

underparts; the under tail-coverts are edged with light buff. Our specimens all come from the Eastern Andes except two from Sancudo, which is located in the Western Andes.

***Metallura tyrianthina oreopola* Todd.**

Thirty-one specimens: Paramo de Rosas, Teta de Niquitao, Heights of Tabay, La Culata, and Paramo de Frias, Venezuela.

Compared with "Bogotá" skins of *tyrianthina*, males differ in their darker general coloration, and especially in the color of the tail, which is a deep maroon purple, instead of bronzy or coppery. The edgings of the under tail-coverts also average darker—rufescent rather than buff. The difference in the color of the tail holds good for females also. Of course, the specimens must be viewed from the right angle with reference to the light.

With the additional material received since the original description appeared, it turns out that *oreopola*, the form of the Andes of Merida, is a race intermediate in its characters between true *tyrianthina* of the Colombian Andes and the dark race, *chloropogon*, of the coast range of Venezuela. It differs from *tyrianthina* as already said, and from *chloropogon* in being greener above and below (in both sexes), with less dusky color when viewed from in front. It is confined to the Andes of Venezuela, where it ranges through the Temperate Zone.

Simon (1921, 382) refers *oreopola* and a synonym (*harterti* Schlüter, published a few months later) to the synonymy of *tyrianthina* without any misgivings, and he intimates that comparison must have been made with *quitensis*, instead of *tyrianthina*. In this supposition he is quite mistaken, and the series now available fully confirms the validity of the form in question.

***Metallura tyrianthina chloropogon* (Cabanis and Heine).**

Twenty-three specimens: Galipán, Silla de Caracas, El Limon, Colonia Tovar, and Pico Naiguata, Venezuela.

Simon (1921, 199, note) quotes the original Latin diagnosis of this form, which he considers hypothetical, and adds that the two specimens on which it was based had been in alcohol. They lacked data, and later authors have merely copied the description. Now I find that Hellmayr, who handled our specimens some years ago, has penciled the above name on the labels of several of them. He must have seen the types at one time



and has evidently satisfied himself as to the application of the name to the form of *tyrianthina* inhabiting the coast range of Venezuela. All the characters appearing in *oreopola* of the Merida region are carried a step further in *chloropogon*. It is a dark-colored race; males viewed from front appear almost black. The crown is blackish green, and the tail also is more deeply colored than in *oreopola*. In all respects it answers the original description, and I am satisfied that Hellmayr's identification is correct.

In the coast mountains this form appears to be a bird of the Subtropical Zone.

#### ***Metallura districta* Bangs.**

Thirty-three specimens: Valparaiso, El Libano, San Lorenzo, Las Taguas, Cincinnati, Sierra Nevada de Santa Marta (6,000 and 8,000 feet), Heights of Chirua, San Miguel, and Cerro de Caracas, Colombia.

This form is restricted to the Sierra Nevada de Santa Marta, where it ranges through the Subtropical and Temperate Zones. Compare my former remarks on the above series (1922, 250).

#### ***Chalcostigma stanleyi vulcani* (Gould).**

One specimen: Colomi, Bolivia.

#### ***Chalcostigma heteropogon* (Boissonneau).**

Thirteen specimens: Paramo de Guerrero, Paramo de San Pedro, Ramirez, La Pica, and Lagunillas, Colombia.

These localities all lie in the Eastern Andes (Temperate and Paramo Zones). Young males of this species lack any trace of the long colored throat-plumes; the throat and breast are colored like the rest of the underparts.

#### ***Oxyopogon guerini* (Boissonneau).**

Twenty-two specimens: Lagunillas, Colombia.

These come from the Paramo Zone of the Eastern Andes, southeast of Bucaramanga. This species was not taken by Chapman's collectors, and has been known heretofore mainly from "Bogotá" skins. Our series includes a number of immature males, which differ from adults in having the long plumes of the crest and throat merely indicated.

**Oxypogon lindeni** (Boissonneau).

Thirty-seven specimens: Teta de Niquitao, Paramo de Merida, and Paramo de Frias, Venezuela.

Immature males resemble the adults, but the long feathers of the crest and throat are less developed, and the colors in general are duller.

**Oxypogon stübeli** Meyer.

One specimen: Paramo de Ruiz, Colombia.

This is a female, and it is the fourth specimen on record of this rare species. The locality is practically the same as that from which Chapman's specimens came.

**Oxypogon cyanolæmus** Salvin and Godman.

Seventeen specimens: Paramo de Mamarongo and Paramo de Chiruqua, Colombia.

Compare my previous discussion of this species and series (1922, 248).

**Opisthoprora euryptera** (Loddiges).

Three specimens: Leonera, Colombia.

**Agelaiocercus emmæ** (von Berlepsch).

Seven specimens: Bitaco Valley and Sancudo, Colombia.

For the use of this generic term, compare Zimmer, 1930, 290.

**Agelaiocercus caudatus** (von Berlepsch).

Thirty-seven specimens: Anzoategui and Paramo de Rosas, Venezuela; La Palmita, Pueblo Nuevo, Ramirez, and Cachirí, Colombia.

Several authors have put forward suggested arrangements of this generic group, no two of which are alike. I find myself most nearly in agreement with Simon (1921, 385), who ranks all the described forms as species. In any case, I do not see how *caudatus* can be conspecific with *kingi*—the differences between the two are too pronounced and constant. In the series examined there are several short-tailed males, which are otherwise like the longer-tailed birds. Presumably these are younger individuals, but not one of them shows a white sub-loral streak, which seems to characterize immature birds of the other forms of this group.

The present series supplies proof that *caudatus*, the green-throated, blue-tailed form of this genus, inhabits the Eastern Andes of Colombia as well as the Andes of Venezuela. Its range thus overlaps that of *kingi*, which according to Chapman (1917, 307) inhabits the Subtropical Zone of the Eastern Andes as far north at least as Bucaramanga. Adult males of *caudatus* from Colombia differ from Venezuelan birds, on an average, in the greener shade of the tips of the rectrices (except the outermost). These differences, however, are too slight and inconstant to justify any formal separation.

***Agelaiocercus smaragdinus* (Gould).**

Thirteen specimens: Incachaca and San José, Bolivia.

After considering its distinctive characters, I have little hesitation in ranking this as a full species, after Simon.

***Agelaiocercus kingi* (Lesson).**

Six specimens: Rio Negro, Colombia.

Simon (1921, 387) has described two "varieties" of this species, both from the "Savanna of Bogotá," but on general principles I doubt their validity. From the descriptions I would infer that they are based on individual variants.

***Agelaiocercus margarethæ* (Heine).**

Eleven specimens: La Cumbre de Valencia, Silla de Caracas, Galipán, Colonia Tovar, and El Limon, Venezuela.

An immature example from La Cumbre de Valencia, with a short tail and a white subloral streak, but without a gular spot or glittering crown, is the only specimen from that locality, but Hellmayr and von Seilern (1912, 147) have examined a good series, including long-tailed adults.

This form, with its greenish outer rectrices and conspicuous gular spot, is certainly specifically distinct from *caudatus*, as Chapman contends (1917, 308). I would go still further, and keep it specifically distinct from *kingi*, on account of its shorter and differently colored tail, which has the exposed part of the rectrices (except the outermost pair) largely green. It is confined to the coast range of Venezuela, in the region of Caracas, and is a species of the Subtropical Zone. Further to the eastward it is replaced by a different form,

**Aglaiocercus berlepschi** (Hartert).

Six specimens: El Limon and La Elvecia, Venezuela.

In this form the female is nearly white below; the tail of the male is intermediate between that of *kingi* and *margarethæ*. On these grounds I consider *berlepschi* specifically distinct, although Hartert (1922, 411) somewhat caustically insists on its subspecific status. Our two females have the white tail-spot larger than in those of the allied forms.

**Schistes geoffroyi geoffroyi** (Bourcier and Mulsant).

Three specimens: La Cumbre de Valencia, Venezuela; La Palmita, Colombia.

This is apparently the first Venezuelan record for this species. Unfortunately the single specimen is an immature bird and therefore not exactly comparable with our Colombian examples; however, it closely resembles a presumed Colombian specimen of approximately the same age in the collection of the American Museum.

**Schistes geoffroyi bolivianus** Simon.

One specimen: San José, Bolivia.

This form was originally described as a race of *S. albogularis*, but is placed with *geoffroyi* by Chapman (1926, 323). Our specimen differs from Simon's description in having the under tail-coverts plain buff.

**Schistes albogularis** Gould.

Four specimens: Heights of Caldas, La Cumbre, and Sancudo, Colombia.

**Heliothryx aurita** (Gmelin).

Twenty-nine specimens: El Llagual, Venezuela; Cayenne, Tamanoir, and Pied Saut, French Guiana; Obidos, Manacapurú, and Rio Manacapurú, Brazil.

Females of this form are spotted below with dusky.

Lönnerberg and Rendahl (Arkiv för Zoologie, 14, No. 25, 1922, 61) describe a supposed race (*major*) of this species from the western slope of the Andes. It was based on a single male bird with a wing of 69 mm., as opposed to 61 mm. recorded for Guiana specimens. Our Guiana males, however, have the wing 60-67 mm., so the difference is in my opinion too slight for formal recognition.

***Heliotheryx auriculata phainolæma* Gould.**

Five specimens: Pará, Benevides, Colonia do Mojuy, Aveiros, and Santarem, Brazil.

All are sexed as females. Three are immaculately white below, while two have very light spotting. Otherwise I can discover no differences between them and females of *aurita* from north of the Amazon. The name here used is given solely in geographical grounds (*cf.* Hellmayr, 1905, 297-8).

I consider *H. aurita* and *H. auriculata* specifically distinct.

***Heliotheryx auriculata auriculata* (Nordmann).**

Three specimens: Buena Vista, Bolivia; Hyutanahan and São Paulo de Olivença, Brazil.

These are females and are assigned here on geographical grounds alone (*cf.* Hellmayr, 1905, 297-8, and Naumburg, 1930, 158). The specimen from Bolivia constitutes (I think) the first record for that country.

***Heliotheryx barroti* (Bourcier).**

Thirteen specimens: Jaraquiel, El Tambor, Quibdó, El Tambo, Andagoya, and Malagita, Colombia; Pozo Azul de Pirris, Carrillo, La Hondura, and Tucurriqui, Costa Rica.

Two Costa Rican females seem to be adult; they both have longer tails than the males, a spotted throat and breast, and a black bar on the outer rectrices. Ridgway does not refer to this last feature in his description, and he attributes the spotting of the underparts to immaturity—wrongfully, as I believe. A female from Jaraquiel, in the swampy forest region south of the mouth of the Rio Sinu, tends to confirm Chapman's surmise as to the origin of the type-specimen. But he is clearly wrong in intimating that in Colombia this species is confined to the Pacific coast and humid lower Cauca-Magdalena region; our specimens from El Tambor disprove that. They are smaller than the rest of the series and probably represent an unnamed interior race.

**Genus HELIOMASTER Bonaparte.**

I follow Peters (*in litt.*) in merging *Anthoscenus* Richmond with *Helio-master*.

***Heliomaster furcifer* (Shaw).**

Fifteen specimens: Santa Cruz de la Sierra, Buena Vista, Buyuivi, Yacuiba, and Chilon, Bolivia; Embarcación, Argentina.

Only two adult males are included, but there are a goodly number of young males in transition dress.

***Heliomaster longirostris longirostris* (Audebert and Vieillot).**

Thirty-three specimens: Buena Vista, Bolivia; Itaituba and Obidos, Brazil; El Llagual, Upata, El Dorado, La Bomba, San Rafael, and Mirasol, Venezuela; Dibulla, El Tambor, Soatata, La Cumbre, and Yumbo, Colombia; Escazú, Guapiles, La Hondura, Boruca, and Buenos Aires, Costa Rica.

After a careful study of this fine series I agree with Ridgway (1911, 346) that the recognition of more than one form in the immense area which they cover is unjustified. Variation is excessive, it is true, but it is not geographical. Chapman (1917, 311) calls Colombian specimens *stewartae* because of their slightly shorter bills. Ridgway's measurements, however, show to the contrary; and looking at our series, I should certainly not divide it on that account. Furthermore, I cannot distinguish our Bolivian skins by the characters ascribed to specimens from that country by Bond and deSchauensee (*Notulae Naturae*, 93, 1941, 3); consequently I cannot recognize their form *caeruleiceps*. Simon separates Costa Rican birds under the name *chalcura* (1921, 219, 392)—another supposed race which I am unable to make out. Again, Sassi (*Temminckia*, 4, 1939, 147) recognizes a race *veraguensis* (*ex* Boucard, 1895) for the bird of Panama—a region from which I have seen no specimens.

***Heliomaster constanti constanti* (Delattre).**

Nine specimens: Bebedero and Miravalles, Costa Rica.

Ridgway inadvertently listed this species from Boruca, Costa Rica, but the specimen in question belongs to *H. l. longirostris*. It is doubtful if the ranges of the two species really overlap; the San José records may not refer exactly to the same locality. *H. constanti* may be readily distinguished from the other by its larger size, less distinctly dark-centered under tail-coverts, and in particular by the color of the lateral rectrices, which are always grayish beneath basally instead of bronzy greenish as in *longirostris*. These differential characters hold good in immature as well as in adult birds.

**Thaumastura cora** (Lesson and Garnot).

Two specimens: Lima, Peru.

**Calliphlox amethystina** (Gmelin).

Twenty-four specimens: San Felix, El Callao, San German de Upata, Sierra de Carabobo, and La Azulita, Venezuela.

Zimmer, who has handled this series, comments on the age variation which it exhibits. Not one of the males has the throat "solid" ruby red, and in some this color is reduced to a mere trace. Few of them have the tail-feathers elongated, either. Females vary with regard to the amount of cinnamomeous suffusion below, the amount of dusky spotting on the throat, and the development of the pectoral band.

**Calliphlox mitchelli** (Bourcier).

One specimen: La Cumbre, Colombia.

I am not strongly impressed with the characters on which Ridgway based his genus *Nesophlox*, but if it is recognized, both this species and *Doricha bryantæ* Lawrence would either have to be referred thereto or else separated under the generic name *Philodice* Mulsant and Verreaux (1866), as Simon has already done. In the former case *Philodice* would supplant the later *Nesophlox*. No great violence would be done to the facts, however, by combining all these forms under *Calliphlox*.

**Calliphlox bryantæ** (Lawrence).

Four specimens: Volcano Irazú, Costa Rica.

In coloration this species is close to *C. mitchelli* of western Colombia.

**Calliphlox evelynæ** (Bourcier).

Twelve specimens: Blue Hills (New Providence), Staniard Creek (Andros), Sand Bank (Abaco), Powel Cay (Abaco), Strangers Cay (Abaco), and Walker Cay (Abaco), Bahama Islands.

**Calliphlox lyrura lyrura** (Gould).

Twelve specimens: Alfred Sound (Great Inagua) and Mathewtown (Great Inagua), Bahama Islands.

***Microstilbon burmeisteri*** (Sclater).

Thirty-five specimens: Buena Vista, Bolivia.

This is the bird that I described (Proceedings Biological Society of Washington, 26, 1913, 174) as *Microstilbon insperatus*, after Oberholser had advised me that it must be new. We were both deceived into so thinking by the inadequate descriptions consulted, which failed to mention the peculiar shape of the tail. Hellmayr wrote me shortly thereafter stating that the specific name was antedated, but that in his opinion the genus was acceptable. The species is clearly out of place in *Chætocercus*, and I think justly deserves generic separation. Only one of the males shows some scattered glittering red feathers on the sides of the throat. The type I selected is undoubtedly immature, as is evident by a comparison with the plate in Sclater and Hudson's "Argentine Ornithology," which purports to represent the type-specimen of *burmeisteri*. Furthermore, our birds differ from the plate in having no rufous whatever on the tail, but according to Lillo (Annales Museo Nacional de Buenos Aires, 8, 1902, 197) the plate and description are erroneous in this respect. There is of course a possibility that Bolivian birds might be racially distinct from those from northern Argentina, the type-locality.

Females fall into two groups: one, a larger bird, with the tail more extensively rufous terminally, and with the underparts more decidedly and more uniformly buff; the other a smaller bird, with reduced rufous tail-spots, and with the underparts not so richly or uniformly buff. The latter group correspond in size to the males, but this difference may not be significant, since in the allied genus *Chætocercus* the females are uniformly larger than the males. What its real significance may be I do not know.

***Calothorax lucifer*** (Swainson).

Six specimens: Morales (San Luis Potosi) and Chilpancingo (Guerrero), Mexico; Juniper Canyon and Hot Springs, Texas.

***Archilochus colubris*** (Linnaeus).

Forty-six specimens: Juan Viñas and Volcano Irazú, Costa Rica; El Cayo, British Honduras; Acapulco (Guerrero) and Chilpancingo (Guerrero), Mexico; Durham County, North Carolina; White Sulphur, West Virginia; Alexandria County, Virginia; Washington, District of Columbia;



Round Grove, Illinois; Brookville, Indiana; Laughlinton, Cresson, Wilksburg, Tamarack Swamp (Clinton County), Leasuresville, Cherry Spring, Pittsburgh, Sewickley, Hartstown, Linesville, Wildwood, and Leetsdale, Pennsylvania; London and North Bay, Ontario.

A specimen from Chilpancingo taken October 5, with a few glittering feathers coming in on the throat, marks the beginning of the moult in the young male. One from Costa Rica (April 3) and one from British Honduras (April 4) also show the throat-gorget being renewed by moult.

**Archilochus alexandri** (Bourcier and Mulsant).

Forty-two specimens: Arroyo de la Presa (Tamaulipas) and Gato Canyon (Lower California), Mexico; Marathon, Hot Springs, Boquillas, Glass Mountains, and Combs Ranch, Texas; Apache, Double Adobes, OK Bar Ranch, and Turkey Spring, New Mexico; Tucson, Carr Canyon, Sunnyside, and Cave Creek, Arizona; San Diego and Fort Jones, California; Cottonwood Springs, Utah.

**Calypte annæ**<sup>10</sup> (Lesson).

Eighteen specimens: San Quintin, Gaudalupe Island, and Valladares, Lower California; Fort Jones, San Diego, and Nicasio, California.

**Calypte costæ** (Bourcier).

Twenty-five specimens: San Quintin, San Pedro, Valladares, Cape Colnett, San Fernando, Turtle Bay, Todos Santos Islands, and San Benito Island, Lower California; San Diego and San Felipe Canyon, California.

**Calypte helenæ** Lembeye.

Ten specimens: Caleta Grande and Los Indios, Isle of Pines.  
Only one adult male in the series.

**Stellula calliope calliope** (Gould).

Thirty-nine specimens: Apache, Bingham, and San Ysidro, New Mexico; San Jacinto Mountains, California; Glendale, Spanish Lake, and Fort Klamath, Oregon; Barriere, British Columbia.

A southern race of this species from Guerrero, Mexico, described by Griscom, necessitates the use of a trinomial name for the northern bird.

<sup>10</sup> Originally written *anna*.

**Myrtis fanny**[æ] Lesson.

One specimen: Lima, Peru.

**Chætocercus jourdani** (Bourcier).

Seven specimens: Colonia Tovar, San Rafael, and Mirasol, Venezuela.

This species is ascribed to Trinidad, where, however, it must be very rare or accidental (*cf.* Hellmayr, *Novitates Zoologicae*, 12, 1905, 59). Its true habitat appears to be the eastern part of the coast range of Venezuela.

**Chætocercus rosæ** (Bourcier and Mulsant).

Twelve specimens: La Cumbre de Valencia, Guarico, and El Limon, Venezuela; La Palmita and Pueblo Nuevo, Colombia.

Colombian and Venezuelan specimens are alike. An immature male bird has the underparts nearly white, instead of cinnamon as in the female.

**Acestrura mulsanti** (Bourcier).

Seven specimens: Incachaca and San José, Bolivia.

An immature male dated June 21 has the throat-gorget restricted and broken, and the white of the underparts more extended.

**Acestrura heliodor**[i] (Bourcier).

Eleven specimens: Las Ventanas, Ramirez, and Cachirí, Colombia; La Azulita, Venezuela.

The Colombian localities are all in the Eastern Andes. Venezuelan and Colombian specimens agree.

**Acestrura astreans** Bangs.

Twenty specimens: Las Taguas and Cincinnati, Colombia.

**Selasphorus platycercus platycercus** (Swainson).

Twenty-seven specimens: Carr Canyon and Tucson, Arizona; Apache, Cowles, and Bingham, New Mexico; Laguna, Texas; Silverton, Bailey's, and Estes Park, Colorado; Blue Mountain, Indian Canyon, Ashley Canyon, Vernal (20 miles north), and Green Lake, Utah.

Post-mortem change is indicated by the markedly brighter coloration of recently collected specimens. A Guatemalan race of this species has been discriminated by Griscom and makes a trinomial name necessary.

**Selasphorus flammula** Salvin.

Seven specimens: Volcano Irazú and Volcano Turrialba, Costa Rica.

Only one adult male is included in this series. Females of this species are close to those of *S. torridus*, but they may be readily distinguished from those of *S. scintilla* by their larger size and less cinnamonaceous suffusion below.

**Selasphorus simoni** Carriker.

One specimen: Volcano Barba, Costa Rica.

**Selasphorus scintilla** (Gould).

Fourteen specimens: Escazú, La Hondura, Juan Viñas, Ujuras de Terraba, and La Estrella de Cartago, Costa Rica.

The tail-pattern varies so much in this species that it is obvious that *S. underwoodi* Salvin must have been based on an extreme example, as suggested by Carriker and by Ridgway.

**Selasphorus sasin[i] sasin[i]** (Lesson).

Ten specimens: Nicasio, San Geronimo, and Cerrito Hill, California; Huachuca Mountains, Arizona.

For this bird I accept the change of name proposed by Grinnell, Condor, 33, 1931, 77.

Arizona records for this species, according to Swarth, are still few in number. Our specimens were taken in 1919 and 1920 by Wilmot W. Brown, Jr., on July 15, 19, and 29, and were received in exchange from Dr. L. C. Sanford.

**Selasphorus rufus** (Gmelin).

Seventy-seven specimens: Chilpancingo (Guerrero), Contreras (Distrito Federal), Valley de las Palmas (Lower California), Mexico; San Diego and Donner, California: "Reef Road" (Huachuca Mountains) and Mount Graham, Arizona; Apache, Bingham, and San Ysidro, New Mexico; Beaverton, Corvallis, Grants Pass, Oceanside, and Newport, Oregon; Comox and Merville, British Columbia.

## LITERATURE CITED

- BANGS, OUTRAM, AND PENARD, THOMAS E.  
 1918. Notes on a Collection of Surinam Birds.—*Bulletin Museum of Comparative Zoölogy*, 62, April, 1918, 25-93.  
 1924. The identity of *Trochilus ruckeri* Bourcier.—*Occasional Papers Boston Society of Natural History*, 5, April 7, 1924, 77-78.
- BERLEPSCH, HANS GRAF VON.  
 1908. On the Birds of Cayenne. Part II.—*Novitates Zoologicae*, 15, November, 1908, 261-324.
- BERLEPSCH, HANS GRAF VON, AND HARTERT, ERNST.  
 1902. On the Birds of the Orinoco Region.—*Novitates Zoologicae*, 9, April 10, 1902, 1-134, pl. 13.
- BERLIOZ, J.  
 1930. Note critique sur quelques Trochilidés du genre *Thalurania*.—*Bulletin Muséum d'Histoire Naturelle*, (2), 2, 1930, 65-69.  
 1931. Revision des Trochilidés du groupe "Campyloptère".—*Bulletin Muséum d'Histoire Naturelle*, (2), 3, 1931, 82-90.  
 1939. Note critique sur le *Thalurania tschudii* Gould (Trochilidés).—*Bulletin Muséum d'Histoire Naturelle*, 11, 1939, 287-290.
- BOUCARD, ADOLPHE.  
 1895. Genera of Humming Birds. London, 1892-1895, pp. xiv + 412.
- CARRIKER, MELBOURNE A., JR.  
 1910. An Annotated List of the Birds of Costa Rica including Cocos Island.—*Annals Carnegie Museum*, 6, Sept. 7, 1910, 314-915, map.  
 1935a. Descriptions of New Birds from Peru and Ecuador, with critical notes on other little-known species.—*Proceedings Academy of Natural Sciences of Philadelphia*, 87, October 25, 1935, 343-359.  
 1935b. An Annotated List of two Collections of Guatemalan Birds in the Academy of Natural Sciences of Philadelphia.—*Proceedings Academy of Natural Sciences of Philadelphia*, 87, December 27, 1935, 411-455.
- CHAPMAN, FRANK M.  
 1917. The Distribution of Bird-Life in Colombia.—*Bulletin American Museum of Natural History*, 36, 1917, pp. x + 729, 41 pls.  
 1926. The Distribution of Bird-Life in Ecuador.—*Bulletin American Museum of Natural History*, 55, 1926, pp. xiv + 784, 10 pls., map.  
 1931. The Upper Zonal Bird-Life of Mts. Roraima and Duida.—*Bulletin American Museum of Natural History*, 63, November 20, 1931, 1-135.
- CHUBB, CHARLES.  
 1916. The Birds of British Guiana. Vol. 1, 1916, pp. liii + 528, 10 pls., map.

CORY, CHARLES B.

1918. Catalogue of the Birds of the Americas and the adjacent islands.—*Field Museum of Natural History Zoological Series*, 13, Part 2, No. 1, March, 1918, 5-315, pl. 1.

DARLINGTON, P. J., JR.

1931. Notes on the Birds of Rio Frio (near Santa Marta), Magdalena, Colombia.—*Bulletin Museum Comparative Zoölogy*, 71, March, 1931, 349-421, map.

DUNAJEWSKI, ANDRZEJ.

1938. Über einige interessanten Vögel aus Peru (non *Passeriformes*).—*Acta Ornithologica Musei Zoologici Polonici*, 2, June 8, 1938, 319-325.

GRISCOM, LUDLOW.

- 1932a. The Ornithology of the Caribbean coast of Extreme Eastern Panama.—*Bulletin Museum Comparative Zoölogy*, 72, January, 1932, 303-372.
- 1932b. The Distribution of Bird-Life in Guatemala.—*Bulletin American Museum of Natural History*, 64, May 7, 1932, pp. ix + 439, 2 maps.
1934. The Ornithology of Guerrero, Mexico.—*Bulletin Museum Comparative Zoölogy*, 75, January, 1934, 365-422, 1 pl.

GRISCOM, LUDLOW, AND GREENWAY, JAMES C., JR.

1941. Birds of Lower Amazonia.—*Bulletin Museum Comparative Zoölogy*, 88, June, 1941, 83-344.

HARTERT, ERNST.

1922. Types of Birds in the Tring Museum. [Continued from 1920, 505].—*Novitates Zoologicae*, 29, October 25, 1922, 365-412.

HELLMAYR, C. E.

1905. Notes on a Collection of Birds, made by Mons. A. Robert in the district of Pará, Brazil.—*Novitates Zoologicae*, 12, September 20, 1905, 269-305.
1906. Notes on a second Collection of Birds from the district of Pará, Brazil.—*Novitates Zoologicae*, 13, July 10, 1906, 353-385.
1907. On a Collection of Birds from Teffé, Rio Solimoes, Brazil.—*Novitates Zoologicae*, 14, March 20, 1907, 40-91.
1910. The Birds of the Rio Madeira.—*Novitates Zoologicae*, 17, December, 1910, 257-428.
1911. A Contribution to the Ornithology of Western Colombia.—*Proceedings Zoological Society of London*, December, 1911, 1084-1213.
1929. A Contribution to the Ornithology of Northeastern Brazil.—*Field Museum of Natural History Zoological Series*, 12, March 4, 1929, 235-501, map.
1932. The Birds of Chile.—*Field Museum of Natural History Zoological Series*, 19, June 13, 1932, pp. 472.

HELLMAYR, C. E., AND SEILERN, J. GRAF VON.

1912. Beiträge zur Ornithologie von Venezuela.—*Archiv für Naturgeschichte*, 78, A, September 20, 1912, 34-166.

NAUMBURG, ELSIE M. B.

1930. The Birds of Matto Grosso, Brazil.—*Bulletin American Museum of Natural History*, 60, 1930, pp. vii + 432, 17 pls., map.

PETERS, JAMES L.

1929. An Ornithological Survey in the Caribbean Lowlands of Honduras.—*Bulletin Museum Comparative Zoölogy*, 69, October, 1929, 397-478.

RIDGWAY, ROBERT.

1911. The Birds of North and Middle America.—*Bulletin United States National Museum*, No. 50, Part 5, November 29, 1911, pp. xxiii + 859, 33 pls.

SALVIN, OSBERT.

1892. Catalogue of the Picariæ in the Collection of the British Museum. Upupæ and Trochili.—*Catalogue of the Birds in the British Museum*, 16, 1892, 3-433, pls. 1-9.

SIMON, EUGÈNE.

1921. Histoire Naturelle des Trochilidæ (Synopsis et Catalogue). Paris, February, 1921, pp. vi + 416.

SIMON, EUGÈNE, AND HELLMAYR, C. E.

1908. Notes critiques sur quelques *Trochilidae*.—*Novitates Zoologicae*, 15, June, 1908, 1-12.

SNETHLAGE, EMILIA.

1914. Catalogo das Aves Amazonicas contendo todas as Especies descritas e mencionadas até 1913.—*Boletim Museu Goeldi (Museu Paraense) de Historia Natural e Ethnographia*, 8, 1914, pp. 530 + 2, 6 pls., 1 map.

TODD, W. E. CLYDE, AND CARRIKER, MELBOURNE, A., JR.

1922. The Birds of the Santa Marta Region of Colombia: A Study in Altitudinal Distribution.—*Annals Carnegie Museum*, 14, October, 1922, 3-611, 9 pls.

WETMORE, ALEXANDER.

1926. Observations on the Birds of Argentina, Paraguay, Uruguay, and Chile.—*Bulletin United States National Museum*, No. 133, 1926, pp. iv + 448, 20 pls.
1939. Observations on the Birds of Northern Venezuela.—*Proceedings United States National Museum*, 87, 1939, 173-260.

ZIMMER, JOHN T.

1930. Birds of the Marshall Field Peruvian Expedition.—*Field Museum of Natural History Zoological Series*, 17, December 10, 1930, 233-480, map.

## LIST OF LOCALITIES

So many of the localities used in this connection do not appear on current maps that it seems desirable to indicate their approximate position for the purposes of the present paper. The subjoined lists of locality-names from certain South American countries, with the outline maps, may be found useful. Fuller lists, with descriptions of the localities, will be reserved for the projected series of faunal papers dealing with the regions involved.

*Colombia.*—For all localities in the Santa Marta region, see the Annals of the Carnegie Museum, vol. 14, 1922, pp. 106-130. Our specimens from other parts of Colombia were collected by Mr. M. A. Carriker, Jr., at the following places (numbers refer to the map):

- |  |   |
|--|---|
| 1. Soatata (or Sautatá), Rio Atrato.                       | 24. Leonera.<br>Frailejonal, just east of Leonera.                                |
| 2. Boca Murindó, Rio Atrato.                               | Santa Ignacia, just north of Paramo de Ruiz.                                      |
| 3. Murindó.  |   |
| 4. Quibdó, Rio Atrato.                                     | 25. Paramo de Ruiz (Paramo of Santa Isabel of Chapman's map).                     |
| 5. El Tambo.   |   |
| 6. Andagoya, Rio San Juan.                                 | 26. Mariquita.  |
| 7. Potedó, Rio San Juan.                                   | 27. Gamarra.  |
| 8. Malagita, Rio San Juan.                                 | 28. Aguachica.  |
| 9. Cordoba.  | 29. El Cauca.   |
| 10. Espinal.   | 30. La Palmita.<br>Pueblo Nuevo, between La Palmita and Ocaña.                    |
| 11. Caldas.  |   |
| 12. Bitaco Valley.<br>Pavas (north of La Cumbre).          | 31. Ocaña.  |
| 13. La Cumbre (probably the Las Lomitas of Chapman's map). | 32. Las Ventanas.   |
| 14. Yumbo (Yumba on map).                                  | 33. Ramirez.<br>Paramo de San Pedro, between Las Ventanas and Paramo de Guerrero. |
| 15. Cartagena.   |   |
| 16. Turbaco.   | 34. Paramo de Guerrero.   |
| 17. Calamar, Rio Magdalena.                                | 35. Cachirí.  |
| 18. Rio Sinu Delta.  | 36. Paramo de Cachirí.  |
| 19. Puerto Zapote.   | 37. El Tambor.  |
| 20. Lorica.  | 38. Bucaramanga.  |
| 21. Jaraquiel.   | 39. La Pica.  |
| 22. Monteria.  |   |
| 23. Sancudo.   |   |

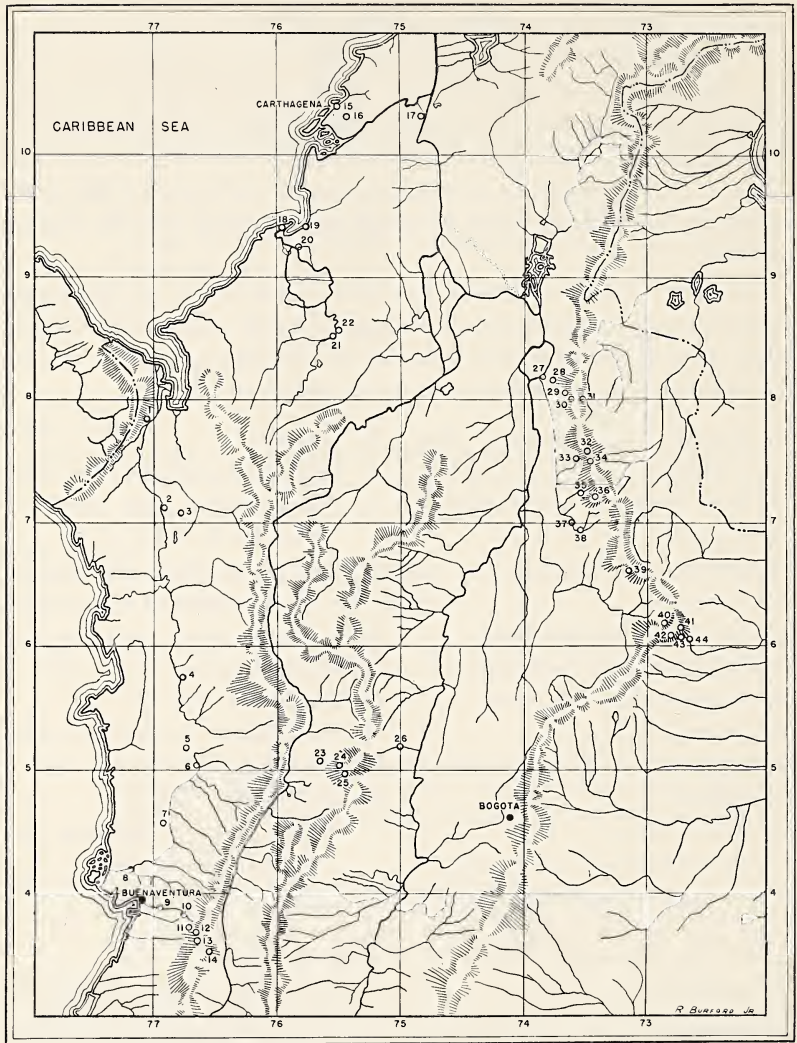


FIG. 1. Map of Colombia, to show localities mentioned in text.

- |  |  |
|--|--|
| 40. Peña Blanca.<br>El Cardon, the pass above<br>Peña Blanca.  | 43. Chinivaque.  |
| 41. Lagunillas.  | 44. Rio Negro.<br>La Colorada and Palmar, on<br>the eastern foothills of the<br>Eastern Andes, south and<br>east of Rio Negro, but exact<br>positions not known. |
| 42. Peña Negra.<br>Boca del Monte, northwest of<br>Chinivaque. |  |



Venezuela.—Unless otherwise specified, collecting-stations in Venezuela are those of Mr. Carriker. Mr. Samuel M. Klages, Mr. Ernest G. Holt, and Mr. Harold J. Clement have sent us specimens from various points on the north coast. Most of these locality-names may be found in Lecuna's Atlas of Venezuela (1921).

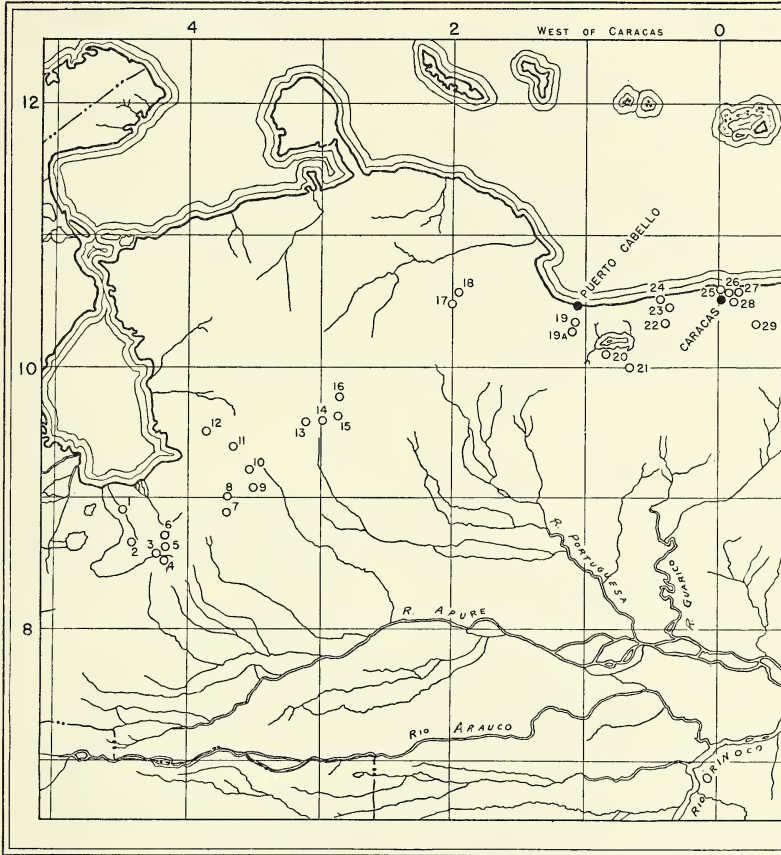


FIG. 2. Map of western Venezuela, to show localities mentioned in text.

- |                                 |                           |
|---------------------------------|---------------------------|
| 1. Guachi.                      | Heights of Tabay.         |
| 2. Santa Elena, close to No. 1. | 6. La Culata.             |
| 3. La Azulita.                  | 7. Las Piedras.           |
| 4. Merida.                      | 8. La Cuchilla.           |
| 5. Chama, just south of No. 3.  | 9. Las Mesitas.           |
| 6. Paramo de Merida.            | Teta de Niquitao, between |
| 7. Paramo de Frias.             | Nos. 9 and 10.            |
| 8. Tabay.                       | 10. Guamito.              |

- |                                       |  |
|---------------------------------------|--|
| 11. Motatan.                          | Las Quiguas, south of San Esteban.         |
| 12. Sabana de Mendoza.                |  |
| 13. Paramo de Rosas.                  | 19. La Cumbre de Valencia.                 |
| 14. Anzoategui.                       | Naguanagua, west of No. 19.                |
| 15. Guarico.                          | 20. El Trompillo (Klages).                 |
| 16. Tucuyo.                           | 21. Sierra de Carabobo (Klages).           |
| 17. Aroa.                             | 22. Pie del Cerro (Holt).                  |
| Lagunita de Aroa, above No. 17.       | 23. Colonia Tovar (Holt).                  |
| 18. El Hacha.                         | El Limon, south and east of No. 24 (Holt). |
| San Esteban, south of Puerto Cabello. | 24. Puerto La Cruz (Holt).                 |
|                                       | 25. Galipán (Klages).                      |



FIG. 3. Map of eastern Venezuela and Trinidad, to show localities mentioned in text.

- |   |  |
|---|--|
| 26. Silla de Caracas (Klages).<br>Loma Redonda, close to No. 26 (Klages).   | 37. El Llagual.                                      |
| 27. Pico Naiguata (Holt).   | 38. Ciudad Bolivar.                                  |
| 28. Petare (Holt).<br>Mariches, near No. 28 (Holt).<br>El Encontado, southeast of No. 28 (Holt).                        | 39. San Felix.                                       |
| 29. Santa Lucia (Holt).   | 40. Altagracia.                                      |
| 30. Cumanacoa (Clement).  | 41. Upata.<br>San German de Upata, (close to Upata). |
| 31. San Rafael (Clement).   | 42. El Callao.<br>El Peru Mine, south of No. 42.     |
| 32. Mirasol (Clement).  | 43. La Bomba.  |
| 33. El Yaque (Clement).<br>El Limon, close to No. 33 (Clement).<br>La Elvecia, 3 miles southwest of El Limon (Clement). | 44. El Dorado.                                       |
| 34. Rio Mocho.  | 45. Rio Yuruan.                                      |
| 35. La Lajita.  | 46. Chacachacare Island (Trinidad).                  |
| 36. Maripa.   | 47. Heights of Aripo (Trinidad).                     |
|   | 48. Carenage (Trinidad).                             |
|   | 49. Heights of Orepouche (Trinidad).                 |
|   | 50. Poole (Trinidad).                                |

*French Guiana*.—Specimens from this colony were all collected by Mr. Klages at the following localities:

Cayenne.

Mana.

Tamanoir, on the Mana River, in latitude 5° 8' N.

Pied Saut, Oyapock River, at the foot of the rapids above St. Georges.

*Brazil*.—Mr. Klages' collecting-stations were as follows:

Demonty, on the right bank of the Oyapock River, not far above its mouth.

Arucaú, in the extreme northern part of the State of Pará, near the French Guiana frontier. This locality was wrongly given as "Rocana" in some of my earlier papers.

Upper Arucaú, about twenty miles upstream (*i.e.*, south) of the last locality.

Benevides, near Pará.

Obidos, on the Amazon (north bank).

Islands near Obidos, in the Amazon River.

Manacapurú, on the Amazon above Manãos.

Rio Manacapurú, near the last.

Tonantins, on the north bank of the Rio Solimoës.

São Paulo do Olivença, on the south bank of the River Solimões.

Hyutanahan, Nova Olinda, and Arimã are situated on the Rio Purús. For their exact position see Sheet S. B.-20 of the International Map of the World.

Santarem is at the mouth of the Rio Tapajóz. Colonia do Mojuy is south of Santarem, on the Rio Curuá, in about latitude 3° S. Itaituba, Villa Braga, and Apacy are on the west bank of the Rio Tapajóz, and Mirirituba and Aveiros on the east bank of the same stream.

*Bolivia.*—Our Bolivian material came from the late José Steinbach and his son, Francisco B. Steinbach. Most of their collecting-stations may be found on the 1934 map published by the Bolivian Government, or on Pando's map of 1901. In the present paper the following names occur:

Santa Cruz de la Sierra.

Buena Vista, near the last. Rio Surutu, Rio Yapacani, and Rio Dolores are streams near by.

San Carlos, northwest of Buena Vista.

Cerro Hosáne, an elevation west of Buena Vista.

Cerro del Amboró, an elevation south of Buena Vista.

Samaipata, Warnes, Comarapa, and Chilon, in the Province of Valle Grande.

Taperas, south and east of Samaipata.

Buyuivi, in southern Chuquisaca, northwest of Machareti.

Yacuiba and Caiza, in Tarija, southern Bolivia.

Puerto Suarez, in extreme eastern Bolivia, lat. 19° S.

Cafeces (not on map), east and north of Santa Cruz de la Sierra.

Cochabamba.

Rio Quiser, Chiquitos (exact position unknown).

Molle-molle (not on map), close to Cochabamba.

Incachaca, northeast of Cochabamba.

San José, north of Incachaca.

Cerro de Incachaca, the elevation above Incachaca.

Vacas, Pocona, Tiraque, Arani, and Colomi are in the Cochabamba region.

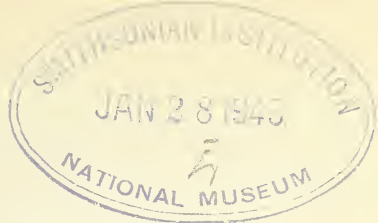
Oruro, southwest of Cochabamba.

La Paz.

Guaqui, at the southern end of Lake Titicaca.

Caluya, position not known, but probably equal to Caluyo, between Palca and Victoria, north of Cochabamba.

Cejas del Juno and Cejas de San Benito, exact positions unknown.



ART. XIII. A COLLECTION OF LEPIDOPTERA  
(RHOPALOCERA) FROM THE CAYMAN ISLANDS\*

BY G. D. HALE CARPENTER

HOPE DEPARTMENT OF ENTOMOLOGY, UNIVERSITY MUSEUM, OXFORD

AND

C. B. LEWIS

MUSEUM OF THE INSTITUTE OF JAMAICA

FOREWORD

The collection upon which this report is based was made in 1938. The senior author prepared his first taxonomic account by the end of June, 1939, and passed the manuscript on to the junior author, who, being unable to complete it before his departure from England, took it with him to New York and later to Jamaica. The correspondence between the two authors, and eventually the manuscript, were lost in enemy action. Some time elapsed before a copy of the study was received at Oxford, then the queries raised by the junior author had to be examined and settled, involving a visit to the British Museum (Nat. Hist.) and the forwarding of the specimens to Tring.

Grateful acknowledgements are here made to the following persons who have kindly given expert advice and assistance: Dr. A. S. Corbet, of the British Museum (Nat. Hist.); Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., who is responsible for the identifications of the HesperIIDae; Mr. F. Goodson at Tring; Mr. A. Hall at South Kensington; Dr. Karl Jordan, F.R.S.; Mr. G. Talbot; and Mr. Frank E. Watson of the American Museum of Natural History.

The comprehensive account, by Marston Bates, of the butterflies of Cuba (1935, Bulletin of the Museum of Comparative Zoölogy, 78(2): 63-258) has been so useful, and it is so convenient to follow it in the present paper, that I have used the arrangement and names given by him, for easy comparison. The names for HesperIIDae are supplied by Brigadier Evans. The senior author is responsible for the identifications of the specimens; remarks by the junior author, and field notes, are prefaced by C.B.L. (G. D. H. C.).

\*Results of the Oxford University Biological Expedition to the Cayman Islands of 1938.

## INTRODUCTION

(C. B. L.) The three Cayman Islands are political dependencies of Jamaica. Cayman Brac lies 125 miles north-west of Jamaica and about 120 miles from the nearest point of Cuba. Little Cayman lies 5 miles to the west of Cayman Brac. Grand Cayman lies 60 miles west-south-west from Little Cayman, about 150 miles south of the Isle of Pines and 300 miles from Honduras. Cayman Brac and Little Cayman are each about 13 miles long, east to west, by  $1\frac{1}{2}$  miles wide; Grand Cayman is about 23 miles long, east to west, and has a maximum width of 7 miles.

The Caymans are projecting peaks of a submarine range of mountains continuous with the Sierra Maestra Range of Cuba. The geological formation of the islands is, of course, limestone, but it is interesting to note that it is of two ages. The central portions of each island are Oligocene and Miocene, while the coastal formation is recent calcareous sand and marl with a hard "beach rock" crust. Cayman Brac attains an altitude of 140 feet in the east, grading to sea level in the west. The maximum elevation of any hill on Grand Cayman and Little Cayman might be placed at 70 feet above sea level.

The Oxford University Expedition collected on Grand Cayman from April 17 to August 27, 1938. Three members, including the entomologists, also visited the other islands, remaining on Cayman Brac from May 18 to 28, and on Little Cayman from May 28 to June 10.

Until this expedition visited the Caymans, the natural history of the islands had been largely neglected and only the birds had been studied to any extent. Ornithologists and other visitors have no doubt collected a few butterflies but this is undoubtedly the first butterfly collection of any size.

The junior author believes that the collection covered in this report is fairly complete for the Islands. There will in all probability prove to be several additional species which fly during the winter months only. *Phoebis agarithe* has been authoritatively reported from Grand Cayman, but it was definitely not seen by the Expedition members. Some of the large "whites," seen flying high over Georgetown in April, may have been *Pieris amaryllis* for they seemed very large for *P. phileta*.

The junior author again visited Cayman Brac for the first week of April, 1940, and at that time saw a battered specimen of an undetermined species of *Kricogonia*. Residents reported them to be very seasonal and occasionally appearing in great numbers. At the same time, *Papilio andraemon*, abundant at the end of May 1938, was not seen at all, certainly suggesting seasonal occurrence.

## PAPILIONIDAE

**Papilio polydamas polydamas** Linnaeus

Grand Cayman: 3 males, 3 females.

The Cayman examples resemble specimens from the mainland, as Bates found to be the case with Cuban specimens; the Jamaican form, *polydamas jamaicensis* R. & J., is a distinct subspecies.

(C. B. L.) The species, found only on Grand Cayman, did not appear until early June and was at no time common. It apparently is not widely distributed over the island as it was never seen outside the Georgetown area. A strong flier, the butterfly was usually seen above the bush. No early stages were discovered.

**Papilio aristodemus temenes** Godart

Little Cayman: 1 male, 3 females.

The Cuban race, previously known only from Cuba.

(C.B.L.) Our collection of butterflies from Little Cayman was small in number of specimens, but I think it contains representatives of most of the butterfly fauna. Butterflies were very abundant, perhaps more so than on any of the other Caymans, but curiously, however, they stayed more under the dense bush on this island, instead of along the paths, and could rarely be netted. *P. aristodemus temenes* was one of the less common species which fortunately did frequent the paths. On the wing it was easily distinguished from the abundant *andraemon* by being larger, a slower and less erratic flier, and by showing a larger and slightly darker expanse of yellow beneath. The species was not observed on the low hills or in the eastern half of the island although, it must be admitted, these sections were poorly explored owing to the virtually impenetrable bush.

No early stages were found.

**Papilio andraemon tailori** Rothschild and Jordan

Grand Cayman: 16 males, 11 females.

The yellow spot in area 7 of fore wing short, and deeply incised externally, as in the type specimen.

Four specimens approach to a degree the Bahaman form, *bonhotei* Sharpe, in which the fore wing bears a submarginal series of more or less lunular spots. The specimen most nearly approaching *bonhotei* has curvilinear markings from areas 1 b to 7; the specimen least like *bonhotei*

has these markings faintly shown in areas 1 b to 3 only. All four specimens come from Georgetown.

(C.B.L.) This butterfly is found in all parts of Grand Cayman where there is *Citrus*. While abundant in the Georgetown area, it is uncommon elsewhere and none was seen in the interior or at the eastern end of the island.

Early stages were commonly found on *Citrus* of all kinds. Birds take a heavy toll of the larvae and, of the many under observation, none reached the chrysalid stage. Owing to the fact that we were usually in the field and only at our headquarters in Georgetown for a few days at a time, breeding in captivity was not attempted. Larvae were photographed however, and chrysalids preserved.

Individuals from around Georgetown were noticeably very large. Specimens from other and drier areas were much smaller. These insects are strong fliers but pause frequently and are not very difficult to catch. The species was flying throughout the four and one-half months of our sojourn.

#### ***Papilio andraemon andraemon* (Hübner)**

Little Cayman: 4 males, 5 females; Cayman Brac: 4 males, 8 females.

These specimens are all small, some exceptionally small, but are of the Cuban race in which the spot in area 7 of the fore wing is much longer than broad and externally truncate or feebly sinuate. In the majority of the specimens, the black mark forming the proximal boundary of the blue lunule in area 4, on the underside of the hind wing, is a narrow transverse bar; but in three specimens it is quite lunular in shape, as in many Cuban specimens. Many specimens have the black mark on the disco-cellular vein of the hind wing broader in proportion than in others.

(C.B.L.) When we visited the Lesser Caymans, during the latter part of May and early June, this species was very abundant, in parts of both islands. Our series is rather poor because these butterflies stayed in or over the dense bush, and rarely came into the open. On Cayman Brac the species was particularly abundant beneath the bluff on the north coast, but scarce in the interior or on the south coast. Here again the extent of the food plant probably determined the abundance of the butterfly in any particular part of the islands. On Little Cayman, *andraemon* was abundant in the western half of the island and not observed in the east.

I believe that Lesser Cayman butterflies differ subspecially from the



Cuban type in as much as the band across the fore wing is narrower and the pale areas are lighter and purer yellow than in the Cuban specimens which have a slight orange tinge. The length of the tails certainly varies, but in many they are extremely long and only slightly spatulate.\* One specimen shows the curvilinear markings of *bonhottei*.

It may be of interest to note that no specimens of the species were to be seen when the junior author visited Cayman Brac for a week, early in April 1940. This may indicate a definite seasonal occurrence of the species, probably correlated with the rains.

#### PIERIDAE

#### *Pieris phileta phileta* Fabricius

Grand Cayman: 41 males, 20 females; Little Cayman: 3 males, 1 female; Cayman Brac: 21 males, 8 females.

In the majority of the specimens the black, bordering the apical part of the fore wing, shows a dentate pattern at the edge, but in a few specimens the black border is narrow and only faintly indicated.

(C.B.L.) This species presented some very interesting aspects which our limited time did not permit to be studied. It was found on all three of the Cayman Islands but was less abundant on Little Cayman.

On Cayman Brac it was found in swarms, particularly on the bluff near the eastern end. It appears that the swarms may form nearly anywhere, however, and at almost any time of year. During the junior author's

\*Specimens from the Lesser Caymans selected for greatest perfection were sent to Dr. Jordan, for comparison with the Cuban specimens at Tring, to test Mr. Lewis's suggestion of sub-species difference. He kindly replied that they show "a shifting of characters, perhaps the beginnings of sub-specific separation. . . In the Tring series of some sixty Cuban specimens, there are paler and darker specimens, one of which is as pale as the Cayman Brac male sent." This male, on the underside shows "a larger black patch at the apex of the cell of the forewing than the Cuban males, and the tawny patch on the hindwing is shorter": these characters are not so in other specimens from Little Cayman. Dr. Jordan found no difference in the width of the yellow band on the forewing of the Cayman Brac male. Regarding the females "the Lesser Cayman specimens show nothing by which they could be recognized with any degree of certainty: nevertheless, on an average the yellow band is narrower than in Cuba and the tawny patch on the underside of the hindwing shorter. In none of the Cuban females (over 30) are the narrow sub-marginal spots on the upperside of the forewing as distinct as in one of the specimens from Little Cayman." The latter, however, is exceptional in this respect: these spots are only present in two other specimens.

visit to Cayman Brac, in April 1940, he found them in the forest about half-way across the island opposite Stake Bay, and other swarms near the middle of the south coast. The butterflies congregated about an hour before sunset in the more open places and then took until dusk to get settled for the night. In the forest the butterflies commenced settling in the middle of the afternoon. They usually settled on *Croton lineare* Jacq., known locally as "Rosemary," and occasionally on *Pisoma discolor* Spreng., the "Wild-Cabbage tree."

From the day of our arrival in Georgetown, Grand Cayman, April 17, 1938, occasional specimens were seen flying very rapidly, and usually high, above the bush, but it was over a month before the first was caught. During August the species occurred in swarms at North Side. The butterflies remained close to the coast, not over a quarter-mile inland. The species was so abundant that there was scarcely room for them always to settle on their favourite plants, which again seemed to be "Rosemary." It was interesting to note that during the day all the butterflies which passed our camp proceeded in an east to west course. The steady migration began each morning at about 7:30, and continued until about 2 P.M. During the peak of the flight, between 10 and 10:30 A.M., an approximation was made of the number which passed our door, between the house and a clump of trees about 40 yards away. Our estimate, made in consultation, was 300 per minute; the band of migrating butterflies was about 300 yards in width. The speed of flight slackened after 11 A.M., and the numbers gradually became reduced; toward 2 P.M., the butterflies began to fly in small circles. Curiously we never saw the butterflies, which had proceeded so numerous and rapidly, returning, nor were they seen leaving the island. The migration was observed day after day, but the species was never found to be abundant in the west. It would seem that unobserved by us, they must have circled back at some point.

Larvae were abundant on *Croton lineare* but they probably feed on other plants as well.

#### *Appias drusilla peregrina* Röber

Little Cayman: 2 males, 2 females; Cayman Brac: 3 males, 3 females.

The very fine, black border on the fore wing comes abruptly to an end at vein 3. The males show no tint of yellow above, but the base of the hind wing of the female is strongly tinted with yellow above.

Below, in three of the males, there is a yellowish tinge at the base of the fore wing; in two others it is very faintly shown. The costal margin of

the hind wing is faintly yellow in both sexes. This identification is due to the kindness of Mr. A. Hall. Bates (p. 118) seems doubtful of the occurrence of this butterfly on Cuba.

(C.B.L.) A few specimens of this rather delicate butterfly were found near the old phosphate working at the western end of Cayman Brac. On Little Cayman the species was taken near South Town in the sandy waste-land. None of the specimens was really fresh or in good condition. The butterfly was observed to be a weak flier and was never seen to rise many feet above the ground; flights were short. Weakness of flight probably accounts for the large percentage of lizard-marked wings.

#### ***Eurema elathea* (Cramer)**

Grand Cayman: 26 males, 22 females.

Mr. A. Hall considered these to be of the wet-season form. Underside of the hind wing white in males, yellowish in females, with a slight, irregular and ill-marked, brownish band across the middle in a few cases. Apices of fore wings in males yellow beneath, in females yellow extends over whole of anterior half of wing; black bar along inner margin of fore wing in male well-developed in every case and black at its base. In all males, the black outer border of the fore wing extends to the torial angle, in some females it ends at vein 2; there is every grade of transition in the females to the pattern of the male.

(C.B.L.) A butterfly of the low bush and grasslands of Grand Cayman, not found in the forested interior of the island. It flutters slowly along through the bush and grass near the ground and is easily caught once it is in the open.

#### ***Eurema messalina messalina* (Fabricius)**

Grand Cayman: 7 males, 12 females.

Bates commented on the "astonishing variation in size, the length of the forewing varying from 10 to 18 mm. in our series": the sexes are not stated. The same variation is noticeable in the Cayman series: the smallest is a male with length of fore wing, from root to end of vein 6, measuring 12 mm.; the largest male has a measurement of 17 mm., and the largest female, 18 mm. The colouration of the under surface of the male is variable: in the specimen in which the pinkish blotch at the angle of the hind wing is most developed, it falls very little short of the degree to which it is present in the least strongly-marked female; the black sub-

apical mark of the fore wing shows a similar relationship, and the pink of the apex in that female is absent, as in the males.

(C.B.L.) This butterfly, like *elathea*, flies close to the ground, but remains even more in the bushy (but not forest) areas, rarely coming into the open.

#### **Eurema nicippe** (Cramer)

Grand Cayman: 3 females; Cayman Brac: 6 males, 1 female.

(C.B.L.) This species, which ranges widely over Middle America, did not appear on Grand Cayman until June and then it was never abundant and was observed only in the Georgetown area. On Cayman Brac it was also limited in its distribution and only found in the eastern part of the north coast.

#### **Eurema lisa** (Boisduval and Leconte)

Grand Cayman: 26 males, 16 females.

A specimen from Old Man Bay is extremely small, and abnormal in appearance.

This species, widely distributed over North and Middle America, was very common in all open parts of Grand Cayman. It seems rather remarkable that it did not turn up on the Lesser Caymans.

#### **Phoebis sennae sennae** (Linnaeus)

Grand Cayman: 22 males, 19 females; Cayman Brac: 4 males, 2 females.

The females show much variation in colour, ranging from a yellow green, little darker than the male, to a dull pinkish orange.

(C.B.L.) A common species in open parts of each island but not always easily caught. No specimens were obtained on Little Cayman although several were seen.

#### **Phoebis neleis** (Boisduval and Leconte)

Grand Cayman: 1 male.

This species has, according to Bates, not previously been recorded from anywhere else but Cuba; Talbot (Lep. Cat. 23:544) gives its known distribution as "Cuba, Mexico, Guatemala, ? Porto Rico."

(C.B.L.) The single specimen, a fine fresh male, was taken by Mr.

Thompson. It was the only example seen as far as we know, although the species could easily have been mistaken for *sennae* when on the wing.

#### DANAIDAE

##### *Danaus plexippus plexippus* (Linnaeus)

Grand Cayman: 5 males; Cayman Brac: 3 males, 2 females.

The variation in the tint of the two spots on the fore wing, just beyond the end of the cell, is of interest. Among the five Grand Cayman specimens, taken on the same day at one locality, these spots are brown in two cases, in one of which they are almost lost in the black which has encroached upon them in both specimens; another has these spots large and pale brown; in another they are pale brown; in the remaining specimen they are white. In the Cayman Brac specimens these spots are pure white in the two females, pale brown in two males, and brown in one male. The last mentioned specimen also has the subapical row of spots in areas 4-5-6 brown. The character of the apical brown in areas 4, 5 and 6 of the fore wing agrees with that of Cuban specimens in the British Museum. Mr. G. Talbot, who is revising the Danaidae in the British Museum, identifies the Cayman specimens as *menippe megalippe* Hubn.\*

(C.B.L.) The species did not appear on Grand Cayman until June. It

\*Austin Clark's "Notes on some North and Middle American Danaid butterflies (Proc. U. S. Nat. Mus., vol. 90, no. 3118, 1941)" appeared after the senior author had completed his taxonomic study. Applying the sub-specific classification, as set out in Clark's paper, to the six specimens from the Cayman Islands which have been retained in the Oxford Museum, Professor Carpenter writes as follows:

"Four males (Cayman Brac 1; Grand Cayman 3) agree with Clark's, *p. plexippus*. A smaller, rather pale, male from Cayman Brac is almost the same as the picture of *p. tobagi*; the apex of the fore wing shows very little brown and the spots at the end of the cell have only the faintest trace of brown tint; the border spots along the middle section of the border of the hind wing are not quite so faint as in the picture of *tobagi*. Another small male from Grand Cayman is of the same rich colour as of the four *p. plexippus*, but, although it has a good orange apical patch like *plexippus*, the two spots at the end of the cell are very minute and dark orange, in this respect almost *portoricensis*, the new sub-species which Clark describes. The hind border of this specimen shows faint brown spots though they are not so 'obsolete' as in the figure of *portoricensis*, from which this specimen differs also in the larger size of the spots at the base of areas 4 and 5 of the fore wing."

It is regrettable that the other four specimens from the Cayman Islands, which had been deposited in the British Museum, were not available for re-examination.

was then very limited in its distribution and only in the meadows between Georgetown and the Great Sound. On Cayman Brac the species was observed only in the eastern region of the north coast where it was found behind the high hurricane beach.

### **Danaus gilippus berenice** (Cramer)

Grand Cayman: 14 males, 21 females; Cayman Brac: 1 male, 3 females.

There is considerable variation in size, colouration, and pattern, in this series. The largest is a male with wing expanse of 76 mm., the smallest is a male with an expanse of 50 mm.; both are from Grand Cayman. The colour varies from deep red brown to a shade matching the ground-colour of the female Cayman *plexippus* and very nearly as pale as some specimens of *jamaicensis*. The pattern varies mainly on the border of the hind wing upper surface which may be black without any spots, or have a complete admarginal row of white points and the anterior and posterior ends of an inner row.

One dark female from Grand Cayman is of the form *strigosa* Bates; another female with the same data, and also one of the females from Cayman Brac, show the grey streaks to a smaller degree. The form *strigosa*, is represented in the British Museum (Nat. Hist.) by specimens from the Bahamas and from Cuba.

One male shows a white mark, like a broad arrow-head, occupying the angle at the base of area 2 on the upper side of the fore wing; this mark is also shown on the under surface, and there is a smaller white mark at the base of area 3, and a linear mark at the base of area 1 b, at the root of vein 2. The small white mark in area 2 on the under surface is usually present, being altogether absent only in two males and five females; but the development into an arrow-head occurs in only one male and two females.

(C.B.L.) This is another species which likes open grasslands, and such conditions are mostly confined to the south-eastern part of Grand Cayman where the butterflies are abundant. No specimens were taken in the eastern regions of the island and the few taken in the interior were very dwarfed.

The species was taken in the north-east of Cayman Brac; not in the west, where it was most expected. While no specimens were taken on Little Cayman, several were seen in the savannah-land behind the high beach in the south-east, but not elsewhere.

**Danaus eresimus** (Cramer)

Grand Cayman: 30 males, 18 females.

The series shows considerable variation in the degree of development of white spots in areas 1 b, 2, and 3, on the upper side of the fore wing. Four males and three females show no trace; from this condition there is every stage to clear white spots in areas 3 and 2, and a faint, though possibly large, one in area 1 b. The depth of ground-colour also varies, but, when compared with the specimens in the British Museum (Nat. Hist.) (none from Cuba or the Caymans), the Cayman specimens are, on the whole, of a richer, darker, brown. This is possibly due to the recent date of capture. The breadth of the black border of the hind wing also varies considerably. Bates speaks (p. 146) of "a dark form, very like *berenice*, which agrees well with the dark Ecuadorean *erginus*," among the Cuban specimens. There are none like these in the Cayman series. The type specimen of *erginus* in the British Museum has very large and pure white spots in areas 2-3 of the fore wing; the white spots on each side of the black border to the hind wing are much more prominent than in any Cayman specimen; there is a clearer distinction between the darker basal and paler peripheral parts of the hind wing than in Cayman specimens. The pale spot at the base of area 2 on the under-surface of the fore wing, mentioned under *berenice*, is invariably represented in *eresimus*; usually faintly brown and ill-defined, in one specimen it is pure white and distinct.

(C.B.L.) Bates remarks on the resemblance to *berenice*, which, he believes, accounts for its scarcity in collections. The species was found to be more common than *berenice* on Grand Cayman, in the same situations and with *berenice*, but *eresimus* was not found on the Lesser Caymans. In spite of its wide range of variation, *eresimus* was always easily distinguished on the wing from *berenice*, the latter being much darker. No early stages were found.

## NYMPHALIDAE

**Heliconius charithonia charithonia** (Linnaeus)

Grand Cayman: 14 males, 21 females.

This series shows an unusually high proportion of females. There is remarkably little variation except in size: the two largest, both females, having an expanse of wing of 94 and 93 mm., respectively, the smallest,

64 mm. The two large females correspond to Hall's form *punctata* (Entomologist, 1936, 69:276), with an additional yellow spot in area 3 of the fore wing, and the yellow bar in area 3 crossing vein 4 to enter the anterior part of area 3. According to Hall, this form is practically a geographical race in St. Kitts; specimens showing the same variation are in the British Museum (Nat. Hist.) from Santo Domingo, St. Thomas, and Jamaica.

(C.B.L.) Abundant in south-eastern portions of Grand Cayman and especially in the vicinity of Georgetown.

#### ***Colaenis julia cillene* Cramer**

Grand Cayman: 8 males, 3 females.

The black spot on the costa of the fore wing varies in development, but the specimens correspond to those designated *cillene* in the British Museum (Nat. Hist.). The Cuban specimens are termed *nudeola* by Bates but, according to Seitz's account of *nudeola*, the "ground-colour" is "dull buff" which does not accord with the Cayman specimens; the latter are of the form ascribed to *cillene* by Seitz.

(C.B.L.) This species was found to be quite local in its distribution and nowhere very common. It was one of the few species found in the interior along the forest paths. Females were definitely scarce.

#### ***Dione vanillae* (Herrich-Schäffer)**

Grand Cayman: 31 males, 13 females; Little Cayman: 21 males, 4 females; Cayman Brac: 13 males, 8 females.

These specimens do not seem to correspond to the form *insularis* which, according to Seitz, has the terminal border of the hind-wing "often only with some black ante-terminal arches"; in the Cayman specimens there is what Seitz calls the "chain pattern."

There is considerable variation in size, those from Little Cayman being on the whole smaller than the Grand Cayman specimens which are larger than Jamaican specimens; the Jamaican and Lesser Cayman examples are of about the same size. The largest specimen, a male from Grand Cayman, has a wing expanse of 70 mm.; the smallest, a male from Cayman Brac, 48 mm.

The large silver spot, in area 6 on the underside of the hind wing, presents some interesting features. A projection backwards into it from vein 7 occasionally traverses it completely, as far as vein 6, dividing it



into two sections. This occurs in four males from Grand Cayman and in one male and two females from Little Cayman. This feature is not shown in any of the specimens in the British Museum (general collection) from the mainland, except in peculiar aberrations from Georgia; it occurs in one female from Bermuda, two from Barbados, and one from St. Lucia. Another character is that this backward projection in mainland specimens is very markedly hooked outwards at its posterior end, which is not the case in Cayman specimens.

The black spot at the end of the cell of the fore-wing nearest the costa usually has a silver center; this is not the case in four males from Grand Cayman and one from Little Cayman, in which only a trace of silver dusting can be seen.

(C.B.L.) Abundantly found in all open sections of each island. Like several other species usually not found in the bush, this butterfly was found in numbers flying in the dense but thinly canopied bush which covers much of Little Cayman. Also, like most other species of butterflies, specimens from the vicinity of Georgetown, Grand Cayman, were very large and rich in colour, while specimens from the Lesser Caymans were small and paler in colour.

Larvae were commonly found on *Passiflora* and allied plants.

#### **Euptoieta hegesia** (Cramer)

Grand Cayman: 23 males, 10 females; Little Cayman: 9 males, 15 females; Cayman Brac: 4 males, 6 females.

The series as a whole shows a slightly more reddish tint than the series in the British Museum (Nat. Hist.), possibly due to the freshness of the specimens. The smallest specimen, a male from Cayman Brac, has a wing expanse of only 35 mm.; the largest, a female from Grand Cayman, gives a measurement of 64 mm.

(C.B.L.) Found abundantly wherever the food plant, *Turnera ulmifolia* L. is found. The plant and the butterfly were especially abundant along the south-eastern coast of Little Cayman. The wide variability of pattern and ground-colour were noticeable even in the field.

#### **Phyciodes phaon phaon** (Edwards)

Grand Cayman: 19 males, 24 females.

(C.B.L.) This species apparently breeds on *Wedelia trilobata* (L.) Hitchc., known as "Marigold," as it was always associated with this plant.

On several occasions careful search was made in an extensive clump which swarmed with the butterflies, but no early stages were found.

**Phyciodes phaon f. maya** Hall

Grand Cayman: 4 males, 1 female.

These specimens were considered by Mr. A. Hall to be probably summer forms of *maya*, of which the type is a winter form.

**Precis lavinia f. zonalis** (Felder and Felder)

Grand Cayman: 20 males, 17 females; Cayman Brac: 3 males, 5 females.

*Transitional*: Grand Cayman: 11 males, 2 females; Cayman Brac: 4 males.

**Precis lavinia f. genoveva** (Cramer)

Grand Cayman: 1 male, 11 females; Little Cayman: 1 male, 1 female.

The identification of the Cayman *Precis* has been rendered easier and more interesting by the paper on "Variation in *Junonia lavinia* (Lepidoptera, Nymphalidae)," by Wm. T. M. Forbes, 1928, *Journal of the New York Entomological Society*, 36: 305-322. It seems that, as set out above, the majority of the Cayman specimens are of the form which Forbes (*l.c.*, p. 307) terms *zonalis* Felder, and has "commonly passed for *genoveva*."

The other form is that termed *genoveva* Cr. by Forbes (*l.c.*, p. 309) and has the characteristics of a dry-season form, with the ocelli on the under-surface greatly reduced and inconspicuous, and the general colouration more uniform.

I am unable to follow Bates in making *zonalis* and *genoveva* two different species.

Forbes (*l.c.*, p. 305) discusses the fact that what he terms the "northern" and "central" types meet in the Greater Antilles, and that "two stocks have reached Cuba by different routes (*via* North and South America)." The Cayman series, however, differs from the Cuban in this respect, for there are none of the North American species, *coenia* Hübner. A very few specimens show a trace of the "definite red semicircle" which Forbes describes as "absolutely distinctive of this form" so that it may be said that the northern form has exerted a very slight influence.

I have examined very carefully a considerable number of preparations of the male genital armature, both of *zonalis* and of *genoveva*, but have found no character by which to distinguish them from each other. In certain minor points there is great variation, and even considerable variation between the same parts, on the two sides of the body. The valve is considerably narrowed posteriorly and, viewed dorsally, is seen to be deeply cleft, forming two finger-like processes with a fold dipping between their bases like the web of human fingers. Each of these digits has a complicated arrangement of teeth on the inner aspect of the extremity; the external digit projects backwards a little beyond the internal and its rosette of minute teeth lies beyond the larger teeth on the internal digit. The rosettes are so variable and small that they can be disregarded. The larger teeth on the internal digit are most interesting and figures 1 to 9 show several of the forms. In their typical appearance, when flattened for drawing, they strongly suggest canine and incisor teeth, and these names may be conveniently used. The canine in its normal position projects horizontally inwards from the internal surface of the valve, and has to be flattened out into the same plane as the valve under the cover slip, by which it is sometimes broken or doubled back. The incisor teeth lie on, or just anterior to, the rosette of the external digit. A series of specimens was examined, the right valve being dissected off and the teeth on its internal surface drawn under a medium power. Comparison of these drawings with the butterflies showed that there was no correlation between colouration and teeth, while the genital armature as a whole showed no appreciable variation in structure between *zonalis* and *genoveva*.

Preliminary drawings of different types having been made, second specimens of butterflies, approaching as nearly as possible to those from which the first preparations had been made, were selected for examination of their genitalia, and the results were quite unharmonious. It was even found that the teeth might be different on the two sides of the body.

A few specimens of the *zonalis* form from Jamaica, St. Kitts, Mexico and Guatemala, were examined, but came within the range of variation of the Cayman specimens, as did one from Cuba and one from Honduras, for which I am indebted to the Dept. of Entomology, British Museum (Nat. Hist.).

The variations in the teeth are shown in the figures.



## EXPLANATION OF FIGURES

1. Canine and one incisor. In one specimen the incisor was divided on the right side of the body into two, equal sized, smaller teeth.
2. Canine and two incisors of equal size, the commonest type.
3. Canine and two incisors, with an accessory smaller tooth at the base of the canine.
4. Canine and one incisor, with two unequal, smaller, accessory teeth at the base of the canine. Drawing from left valve.
5. Canine and two incisors, with a large accessory of about equal size.
6. Canine and three small incisors, with a minute accessory behind the incisor and another half-way along the canine.
7. Canine (doubled back in the picture) and four incisors.
8. A very different arrangement; there are two incisors but the canine has divided into two teeth of equal, but smaller, size, and an accessory tooth has developed behind the base.
9. Three anterior and two posterior teeth. The posterior teeth, unfortunately, could not be flattened out so that the drawing is not quite comparable to the others. This is from the left valve of the specimen, of which fig. 8 shows the teeth of the right valve.

TABLE

The following are the specimens examined, assigned to the particular type of teeth enumerated above.

Type of teeth	Specimen	Locality	Pattern of underside	Condition of anterior ocellus (hind wing)
1	D (R)	Grand Cayman	<i>genoveva</i>	Small and black.
1	G (R)	" "	<i>zonalis</i>	Small and black.
1	M (L)	Mexico	<i>genoveva</i>	Fairly large; few blue scales.
1	P (R)	Jamaica	<i>zonalis</i>	Small, one-third blue.
1	*R (L)	Jamaica	<i>zonalis</i>	Small, few blue scales.
1	S (L)	Jamaica	<i>zonalis</i>	Fairly large, black.
1	B.M. (L.R.)	Mexico	Not specified.	Not specified.
2	B (R)	Grand Cayman	<i>zonalis</i>	Small, black.
2	C (R)	" "	<i>zonalis</i>	Slightly enlarged, black.
2	D (L)	" "	<i>genoveva</i>	Small and black.
2	E (R)	" "	<i>genoveva</i> trans. to <i>zonalis</i>	Small, half blue.
2	H (R)	" "	<i>zonalis</i>	Slightly enlarged, few blue scales.
2	I (R)	" "	<i>zonalis</i>	Small, black.
2	J (R)	Cayman Brac	<i>zonalis</i> , trans. to <i>genoveva</i>	Small, black.
2	M (R)	Mexico	<i>genoveva</i>	Large, few blue scales.
2	N (L.R.)	Guatemala	<i>zonalis</i>	Small, few blue scales.
2	O (R)	Jamaica	<i>zonalis</i>	Slightly enlarged, black
2	Q (L)	Jamaica	<i>zonalis</i> , trans. to <i>genoveva</i>	Small, black.
2	T (L.R.)	St. Lucia	<i>zonalis</i>	Small, black.
2	B.M. (L.R.)	Honduras	Not specified.	Not specified.
3	F (R)	Grand Cayman	<i>genoveva</i>	Large, half blue.
4	O (L)	Jamaica	<i>zonalis</i>	Slightly enlarged, black
4	†P (L)	Jamaica	<i>zonalis</i>	Small, one-third blue.
4	Q (R)	Jamaica	<i>zonalis</i> , trans. to <i>genoveva</i>	Small, black.
4	†S (R)	Jamaica	<i>zonalis</i>	Fairly large, black.
5	K (R)	Little Cayman	<i>genoveva</i> trans. to <i>zonalis</i>	Small, few blue scales.
6	D (R)	Grand Cayman	<i>genoveva</i> trans. to <i>zonalis</i>	Small, half blue.
7	L (L.R.)	Cayman Brac	<i>genoveva</i> trans. to <i>zonalis</i>	Small, black.
8	H (R)	Grand Cayman	<i>zonalis</i>	Small, black.
9	H (L)	Grand Cayman	<i>zonalis</i>	Small, black.

\*This specimen had the incisor divided into two, smaller, equal teeth.

†These (two) did not show the minute second accessory on the canine.

(C.B.L.) *Precis* was found to be very interesting in the field as well as under the microscope. On Grand Cayman both *zonalis* and *genoveva* occur; *genoveva* was the only form found along the tops of the beaches and within one hundred yards of the shore; *zonalis* was never taken in this area, but was found to be the meadow and pasture form with occasional *genoveva* and transitionals in the same regions. I found it easy to distinguish the two forms by their flight; *zonalis* flew erratically and for short distances only, while *genoveva* took long, rapid, and fairly straight flights. Transitional forms were noticed to take rather short flights, and were not as erratic in their course as the more typical *zonalis*.

The situation on the Lesser Caymans seemed very remarkable. The two islands are quite similar, as far as the coastal habitats are concerned, but only *genoveva* was found on Little Cayman and only *zonalis* on Cayman Brac— islands only five miles apart.

The butterflies were definitely scarce on Little Cayman; only one pair was secured and but a few more were seen. On Cayman Brac, *Precis* was found only within 200 yards of the coast; where, according to our experience on Grand Cayman and Little Cayman, we would have expected *genoveva*, we found *zonalis*! For the most part the Brac specimens were quite typical in pattern, colour, and manner of flight.

#### ***Anartia jatrophae jamaicensis* Möschler**

Grand Cayman: 18 males, 9 females.

(C.B.L.) On the first day of our visit to Cayman Brac, as we were landing, a much battered individual was seen. At the time, I made no attempt to capture the example thinking the species would be found as commonly as on Grand Cayman; it was the only example seen. On the latter island the species showed wide variation in colour, both of the pattern and ground.

#### ***Victorina stelenes insularis* Holland**

Grand Cayman: 1 pair *in copula*; 2 males.

All four specimens have two well-marked spots in the cell of the forewing, agreeing with Bates' account of Cuban specimens.

Specimens of *stelenes* in the British Museum (Nat. Hist.) from Jamaica, St. Kitts, St. Domingo, and Haiti, have only one cell spot in the forewing, or even none; a specimen from Mexico is like the Cuban and Cayman specimens with two spots.

Seitz (p. 463) ignores Holland's name *insularis* and figures (pl. 95a) a form which he calls *biplagiata*: this corresponds to the Cayman specimens and it would seem that *biplagiata* is synonymous with *insularis* and must yield to it.

(C.B.L.) The specific name of this species has been misspelled by many authors and is incorrect in the British Museum (Nat. Hist.). Linnaeus probably intended *steneles* following the Greek, but the fact remains that he wrote *stelenes*. Bates and Kaye (Trans. Ent. Soc. London, 1926) are recent writers who have followed the correct nomenclature.

The species was always scarce, and, unlike those of the Bath region of Jamaica, was difficult to catch on Grand Cayman. Our four specimens, all in poor condition, are the fruits of four and a half months of trying to obtain a series of the species. None was ever seen outside of Georgetown where they were occasionally observed throughout our stay, from April to September.

Representatives of *stelenes* in Jamaica are fairly consistent in pattern and colour but these Cayman specimens varied greatly. One of the pair, taken May 18, seems to be almost exactly like Fruhstorfer's type of *pallida* from Central America, and of a pattern and colour exhibited by many specimens from Nicaragua and Panama in the British Museum collection. The other specimen resembles those of the Cuban series.

#### **Anaea verticordia echemus** (Doubleday, Westwood, and Hewitson)

Grand Cayman: 30 males, 15 females; Little Cayman: 5 males, 2 females; Cayman Brac: 1 male, 2 females.

The type of *echemus* in the British Museum (Nat. Hist.) is from Honduras and shows a trace of a white spot on the hind wing in area 4 at the proximal end of the black spot. There is, among the Cayman series, a difference in the number of these small white spots; there may be one (in area 3), two (in areas 2 and 3), three (in areas 1, 2, 3) or four (in areas 1, 2, 3, 4). The series in the British Museum (Nat. Hist.) from Cuba shows the spot in area 4 in only one female out of twenty, and in none of the twenty-two males. On the other hand, in the British Museum (Nat. Hist.) series from the Bahamas all three males and four of the six females have the spot in area 4, and two of the females also have one in area 5; in one of these females there is another spot in area 6.

The Honduras specimens in the British Museum (Nat. Hist.) do not have the white spots as well developed: the type specimen is the only

female out of five which has spot 4 even faintly represented, though it is shown in one of the three males. In the development of the white spots the Cayman series agrees more closely with the specimens in the British Museum (Nat. Hist.) from the Bahamas than with those from Cuba; the fourth spot is present in ten out of fifty-five specimens.

(C.B.L.) A species of the bush and forest, and probably the most uniformly distributed butterfly on the islands. It may be expected almost anywhere except in open meadows and along the beaches.

Activity began at sunrise when I observed the butterfly flying freely in the open above the bush. As the sun rose and the light and heat became more intense, these butterflies retreated beneath the bush, flitting about just above the ground. In areas where the foliage was fairly high, the insects remained just below the canopy, frequently resting on the trunk or main branches of the trees. Activity is apparently suspended entirely from about 11 A.M. until 3 P.M.

The butterflies' habit of alighting on trees, makes them easy prey for the lizards (*Anolis conspersus* on Grand Cayman, *Anolis sagrei* and *Anolis maynardi* on Little Cayman, and *Anolis luteosignifer* on Cayman Brac), so abundant on the Caymans.

One rarely catches a specimen that does not bear evidence of attacks by lizards. Thus most of our specimens had tears and nicks in the secondaries.

#### LYCAENIDAE

##### **Strymon martialis** (Herrich-Schäffer)

Little Cayman: 1 male, 1 female.

(C.B.L.) This pair was taken fluttering about the low vegetation at the top of the beach near South Town, Little Cayman. No others were seen although little time was spent looking for them.

##### **Strymon acis** (Drury)

Grand Cayman: 6 males, 3 females; Little Cayman: 1 female; Cayman Brac: 13 males, 1 female.

The specimens from Grand Cayman differ appreciably from those from Little Cayman and Cayman Brac by being much more distinctly marked. The anal lobe is more strongly orange, and there is a triangular orange patch on the hind wing separated from the base of the shorter tail by a round black spot. This orange patch is absent from specimens from



Little Cayman and Cayman Brac except for a trace in one from the latter locality. Dr. K. Jordan kindly reported on species from the Caymans, sent him for comparison, as the genus is being closely studied at Tring.

"The name is evidently *acis* Drury 1770, said to have been received by Drury from New York, where it does not occur. In most specimens the hind wing upperside bears a red submarginal spot in front of the long tail: sometimes this spot is reduced to a few scales not entirely absent from any of the specimens I have here. In your two pairs from Cayman Brac and Little Cayman the spot is reduced, in those from Grand Cayman fairly large. In our series from various places in Cuba there is only one male with the spot so much reduced, in the other males it is small or fairly distinct to the naked eye. In our single female from Grand Cayman the spot is as conspicuous as in your females from that island. The description of *mars* F. 1777 fits the species. Fabricius identifies this in 1793 with Drury's *acis* and with Cramer's fig. 175 (Cape of Good Hope!); in both figures the orange patch on the underside of the hind wing is exaggerated; at least we have no female in which it is as large as in the figures."

Regarding the red spot on the upperside of the hind wing it may be said that all of the specimens from Grand Cayman show a good development, whereas not one of those from Lesser Cayman shows so much: indeed in only two (females) from Cayman Brac is there an approach to a definite spot, and in most there are only a few scales discernible with a lens, or even none.

(C.B.L.) A species reported from Florida, Cuba, Jamaica, and Dominica as uncommon. It is interesting to note that examples from Florida exhibit the same orange triangular patch on the hind wing as shown by those from Grand Cayman. Another case of a mainland, rather than an Antillean form, on Grand Cayman.

### **Strymon columella (Fabricius)**

Grand Cayman: 8 males, 12 females.

(C.B.L.) A species always found at the tops of beaches where *Suriana*, known as "Bay cedar" or "Juniper" is found. The plant and butterfly are common on all shores of Grand Cayman except those of the Great Sound. In all probability the species will also be found on both of the Lesser Caymans where the food plant occurs.

**Hemiargus filenus** (Poey)

Grand Cayman: 18 males, 4 females.

Dr. A. S. Corbet of the British Museum has kindly examined Cayman specimens and sent the following note: "The [form of] *Hemiargus* from Cayman is named *hanno* Stoll in the British Museum, but I cannot see that Stoll's figure can be applied to this species or that named *filenus* Poey in the Museum collection. Nor does *antibubastus* Hbn. represent the same species. As far as I can trace it, the oldest name for the Cayman specimens is *filenus* Poey, with *pseudoptilates* Bsdv. & Lec. as a synonym or race. From this it follows that the name *filenus* Poey is incorrectly applied in the Museum collection. Again, the male genitalia of the Cayman specimens are distinct from those of *catalina* and *ammon*." According to Bates, West Indian specimens are *filenus*.

(C.B.L.) The species was found in open areas all around the coast of Grand Cayman.

**Hemiargus ammon** (Lucas)

Grand Cayman: 32 males, 21 females.

(C.B.L.) Abundantly found with *H. filenus* in all open areas around the coast of Grand Cayman.

**Hemiargus catalina** (Fabricius)

Little Cayman: 3 males; Cayman Brac: 1 male, 1 female.

Dr. A. S. Corbet kindly examined these specimens and made the following remarks about the species: "The type of *catalina* Fab. is probably lost and the original description can be applied to the specimens thus named in the British Museum. The original description of *ammon* Lucas is accompanied by a figure which clearly represents the species so named in the British Museum. These two species are quite distinct, the males differing in genitalia and in androconia."

The female from Cayman Brac is a very dark specimen with the blue on the upper surface more restricted than in the *ammon* females.

(C.B.L.) Specimens in the British Museum (Nat. Hist.) are from Nevis, Haiti, and St. Domingo.

**Brephidium exilis thompsoni** subsp. nov.

Grand Cayman: 15 males, 17 females.

The identification of this butterfly has been difficult, in the absence of an authoritatively named series of good specimens in England. Neither

the British Museum (Nat. Hist.) in Cromwell Road, nor its annex at Tring, enabled Mr. Lewis and myself to decide upon the specimens of which he and Mr. Thompson obtained a good series at a single locality. The original descriptions of *isophthalma* by Herrich-Schäffer (1862) and of *exilis* by Boisduval (1852) were too indefinite to allow a decision, especially as *exilis*, the species to which the Cayman examples seemed to belong, has apparently not been recorded off the American mainland. Mr. Frank E. Watson, of the American Museum of Natural History, New York, very kindly sent typical specimens of both species, which showed that the Cayman series belongs to *exilis* but is sufficiently different to be described as a new geographical race. I have much pleasure in naming it after Mr. G. H. Thompson who was responsible for its discovery. Mr. Watson kindly indicated the following characteristics about the specimens which he sent.

- A. The small white spot on the primaries at the outer angle in *exilis*, due to the interruption of the white fringes, holds in most individuals but occasionally fails in brown specimens; when it fails the other differences will easily separate the species.
- B. In *isophthalma* the wings above and below, as well as the fringes, are dull uniform brown.
- C. The primaries in *exilis* have the underside with the inner half grey and the outer half brown.

*Description:* Males differ from *exilis exilis* by the much darker tint of the upper surface of the outer half of each wing which is dull black. There is a difference on the under surface in the series of paired white submarginal linear markings which occur in each interspace on the fore wing, parallel with the outer (hind) margin. In *thompsoni* these paired markings are equally conspicuous in each of the two rows, and obviously represent the accentuated proximal and distal borders of six internervular spots; in *e. exilis*, however, the proximal marking is much less developed, so that in the four areas in the middle of the series it is scarcely visible, and even at the anterior and posterior ends of the series it is less marked than in *e. thompsoni*. Consequently in *e. thompsoni* there is an apparently wider area of the brown ground-colour free from spots until examined very closely.

*Holotype:* ♂, Grand Cayman, English Sound, off Great Sound; June 23, 1938; C. B. Lewis and G. H. Thompson; 14 paratypes, with data previously given.

The females show the same characters beneath, but are not quite so black on the upper surfaces of the wings.

*Allotype*: ♀, same data as for holotype; 16 paratypes with data previously given. Types will be placed in the British Museum (Nat. Hist.), paratypes at Oxford, the American Museum of Natural History, and the Carnegie Museum.

(C.B.L.) The tiny butterfly is indeed limited in its distribution for it was not found outside of an area of about fifty square yards, on the edge of a secluded lagoon, known as English Sound, lying to the east of and off of the Great Sound. The vegetation of this area is low, but not unusual, and is typical of such situations which are numerous on the island. No early stages were found.

#### **Leptotes theonus** (Lucas)

Grand Cayman: 4 males, 2 females; Little Cayman: 1 female; Cayman Brac: 1 male, 3 females.

(C.B.L.) This species was never very common but was occasionally taken in open areas along with the species of *Hemiargus*.

#### HESPERIIDAE

The names given are according to Brigadier W. H. Evans, who has kindly identified the specimens and has written the following comments: "The species of the genera *Urbanus*, *Hylephila*, and *Cymaenes*, represented in the collection, occur unchanged commonly throughout the West Indies as does *Panoquina sylvicola*. The incidence of the two forms of the latter is of interest. The *Phocides* form occurs only in Cuba, not very commonly; in a slightly modified form rarely in the Bahamas, and in another slightly modified form in Florida more commonly; the originally described form, *pigmalion*, looking very different, occurs throughout Central and South America. The occurrence of *Panoquina panoquinoides* is remarkable and of very great interest; the members of any future expedition should try to discover the food plant and early stages."

#### **Phocides pigmalion batabano** (Lucas)

Little Cayman: 4 males.

One of the specimens, captured on May 31, has an extremely clear imprint of a lizard's jaw on the right forewing, near the apex, from the costa backwards.

(C.B.L.) Our field notes for May 31, read as follows: "The trip across Salt Rocks Hill was a hard battle through the bush. We were probably the first to cross that section since the days of the pirates. Directly at the top of the hill we caught three specimens of an Hesperid new to us. Two were quite perfect but unfortunately became rubbed in our fight through the bush going down."

Only seven or eight examples of this species were seen during our stay on Little Cayman; they were all in the west. Capturing this form is a real task as they fly above the trees and alight in the foliage at considerable heights. It is really amazing to me that a lizard was ever able to get near enough to make an imprint on the wing of one of the specimens. The lizard responsible was probably *Anolis maynardi*.

#### **Urbanus proteus proteoides** Plötz

Grand Cayman: 8 males, 22 females; Cayman Brac: 2 females.

One female from Grand Cayman has the tails and hind margins cleanly shorn from the hind wings symmetrically.

(C.B.L.) Many other specimens seen and caught show these evidences of attacks, presumably by lizards. Common in open areas in the north, south, and west, of Grand Cayman, but curiously it was not taken in the east; it probably was overlooked. While no specimens were collected or seen on Little Cayman, I expect that it occurs.

#### **Hylephila phylaeus phylaeus** (Drury)

Grand Cayman: 9 males, 6 females; Cayman Brac: 2 males, 1 female.

(C.B.L.) Found in grasslands and frequently at the top of beaches in dry clumps of vegetation.

#### **Cybaeus tripuncta tripuncta** (Herrich-Schäffer)

Grand Cayman: 22 males, 14 females.

#### **Panoquina panoquinoides panoquinoides** (Skinner)

Grand Cayman: 4 males, 7 females; Little Cayman: 1 female; Cayman Brac: 1 male, 4 females.

Brigadier Evans remarked upon this insect as follows: "This is a rare insect; it was described from Florida, and the British Museum has only seven males from there. The Cayman specimens seem typical. Godman

and Salvin subsequently described *eugeon* from Grenada as a good subspecies. It is curious that *panoquinooides* does not seem to occur in Jamaica." Bates mentions two specimens from Pinar del Rio, Cuba.

(C.B.L.) The species was found only within a hundred yards of the sea in the scrubby vegetation growing at the top of and behind the beaches of the north and east coasts of Grand Cayman. On the Lesser Caymans it was taken in pasture lands much further from the sea.

#### ***Panoquina sylvicola woodruffi* Watson**

Grand Cayman: 7 males, 16 females.

Evans wrote: "This form has the underside of the hind wing, plain brown in the female, and the spots in both sexes have no pale blue tinge." Watson described this form in 1937 (Am. Mus. Nov.) from Jamaican material.

#### ***Panoquina sylvicola sylvicola* (Herrich-Schäffer)**

Grand Cayman: 1 male, 1 female.

Evans wrote of this form: "The costal half of the hind wing on the underside is shining purple-blue and the white spots are of a distinctly bluish tinge. This is the prevalent Cuban form and *P. s. woodruffi*, the Jamaican."

#### DISCUSSION

Of the forty-one forms and species listed in this paper, all but six occur on Grand Cayman, of these six all occur on Little Cayman and three on Cayman Brac; three are found only on Little Cayman, none are peculiar to Cayman Brac; six species were taken on Grand Cayman and Cayman Brac, but not on Little Cayman.

(C.B.L.) A few affinities are of interest: *Papilio polydamas*, *Phyciodes phaon*, and the new form of *Brephidium exilis*, all found on Grand Cayman, seem to be mainland forms; also *Dione vanillae* and *Hemiargus filenus*, found on all three islands. *Victorina stelenes* is represented on Grand Cayman by forms resembling mainland and Cuban examples. *Papilio aristodemus temenes*, from Little Cayman, *Phoebis neleis*, and *Panoquina sylvicola sylvicola*, from Grand Cayman, are Cuban species. *Panoquina sylvicola woodruffi* is a Jamaican form. *Papilio andraemon* and *Anaea verticordia echemus* tend to resemble Bahaman material.









ART. XIV. NEW AND RARE ITHOMIINAE (LEPIDOPTERA)  
IN THE CARNEGIE MUSEUM

BY RICHARD M. FOX  
READING PUBLIC MUSEUM  
READING, PENNSYLVANIA

(ONE PLATE)

Through the kindness of Dr. Avinoff and Dr. Sweadner, I have been able to examine the Carnegie Museum's collection of *Ithomiinae* (*Nymphalidae*) and to work through the undetermined material. The collection itself was arranged by Dr. Avinoff some years ago, and at that time he set aside several species as probably new. Some of them are described here; others have been identified as obscure or recently described species. All types are in the collection of the Carnegie Museum.

***Melinaea maelus purusana* Riley**

(Plate I, figure 1)

Riley, 1919, *Entomologist*, 52: 181 (Allianca, Rio Purus).

*M. madeira purusana* Aurivillius, 1929, *Ent. Tidskr.*, 50: 155 (Hyutanahan, Rio Purus).

The figure is of a male, one of a series captured at Hyutanahan and Nova Olinda, Rio Purus, Brazil, by Samuel M. Klages and now in the Carnegie Museum. Judging by the descriptions, the species of Riley and of Aurivillius are identical; the specimen here figured comes from the same locality as the Aurivillius type. By coincidence, Aurivillius published his species as new, using the same name which had been applied to it ten years earlier by Riley. I have not seen anything to which the name *Melinaea hicetas brunnea* Riley, 1919, might be applied. It is possible that *M. brunnea* is not a form of *M. maelus*, but belongs to another species, a theory only, as the description is terse, but I gather from it that the light spot of the anal angle is wanting on the upper side, whereas it is always present in forms of *maelus*.

MAR 10 1943

*Hypothesis meterus deëmae*, subsp. nov.

(Plate I, figure 8)

Hewitson's *Mechanitis meterus*<sup>1</sup> appears in Haensch's work in Seitz, 1909, as a *Mechanitis*. Forbes<sup>2</sup> first recognized its true place as a species in *Hypothesis*, although he was forced to base his judgement on published illustrations. Two females of this apparently rare species were collected by Woytkowski for the Carnegie Museum, in the Department of San Martin, Peru; they agree in detail with Hewitson's figure, and beyond question belong in *Hypothesis*.

Two females of a subspecies of *meterus* have come to me, one collected near San Pedro, Peru, by Woytkowski for the Carnegie Museum; the other from the Rio Jatunyan (Jatun yacu?), eastern Ecuador, probably collected by Macintyre, sent to me by the U. S. National Museum. These two specimens have the two yellow, submarginal dots characteristic of *meterus*, and agree with it in the arrangement of black markings on the fore wing; the hind wing black is broken into its components, however. The two females here described as *deëmae* may prove to be separate races, but I do not feel justified by the material at hand in making a division between them at present. A yellow, postdiscal band is present in the fore wing, a variation to be expected of the pattern and comparable to the differences between the patterns of the two subspecies of *Mechanitis mazaesus*, *M. deceptus* Butler and *M. messenoides* Felder.

*Female*: Fore wing above with entire apical portion broadly black, its proximal boundary an irregular line running diagonally across the wing from just beyond the beginning of  $R_2$  to the middle of  $M_3-Cu_1$ , there connected with a black projection comparable to the comma mark in *Mechanitis*, but its end rounded, not hooked, lying just behind  $Cu_1$ , its marginal part wider. Two small, round, yellow, submarginal spots puncture this black, one between  $M_3$  and  $Cu_1$ , the other between  $Cu_1$  and  $Cu_2$ . Costal margin narrowly black; a black streak over the basal half of  $Sc$ ; a wedge-shaped, black spot in the cell; a very small or faintly indicated black spot in the base of  $Cu_1-Cu_2$ ; two discocellular spots, separated, small; a black streak over the anal vein and along the hind margin to about two-thirds of the distance to the anal angle. In the type specimen, the anal streak is broader, the streak over  $Sc$  is shorter, the cell spot is continued to the base and there is another short streak just below the base

<sup>1</sup> Hewitson, 1860, Exot. Butt., 2: *Mechanitis*, 15.

<sup>2</sup> Forbes, 1924, Journ. N. Y. Ent. Soc., 32: 155.

of the radius. A yellow, postdiscal fascia extending proximad as far as the discocellulars and  $Cu_1$ .

Hind wing, black and tawny. A wide, black, costal streak from the base to the end of the cell, including the proximal half of the cell and covering  $Sc$ ; a black streak in the cell above  $M_3-Cu_1$ , wanting in the paratype; veins along the posterior side of the cell always tawny. Posterior of the cell a large, black spot running to the margin. In the type specimen this is separated by a narrow, tawny line into a median band and a submarginal-marginal band; in the paratype, instead, tawny cuts off the median-submarginal black from the marginal line as far as  $Cu_2$ . The distal margin narrowly black; the rest of the wing tawny. A suggested black spot  $R-M_1$ , midway between discocellulars and wing apex, narrow.

Fore wing beneath as above; a limited friction area behind the anal vein. Hind wing beneath as above; costal margin narrowly tawny; humeral angle yellow.

Antennae yellow, black at the base; head black with yellow-white spots; collar and patagia tawny; proximal leg segments with yellow scaling; abdomen black-brown above, yellow beneath.

*Male*: A male of this form was recently sent to me by Mr. F. M. Brown. It agrees in detail with the type. The hair patch is characteristic of *Hypothyris*, as are the genitalia. I designate this male, which comes from Sani Beni, Peru, through the Brown collection, and is now in the American Museum of Natural History (genitalia slide, no. 432), as the "allotype."

*Type*: Female; vicinity of San Pedro, Peru; June 1-5, 1935; 900 m.; Woytkowski; Carnegie Museum.

*Paratype*: Female; Rio Jatunyan, eastern Ecuador; Dec. 27, 1936; U. S. National Museum.

### ***Hyaliris deuscula*, sp. nov.**

(Plate I, figure 2)

This is readily distinguished from *coeno*, Doubleday and Hewitson,<sup>3</sup> by the brown antennal clubs, the yellow scaling on the fore wing, and the yellow tinge on the humeral spot; in *coeno* the antennae are entirely black, the fore wing transparent areas are very slightly whitish, and the humeral

<sup>3</sup> Doubleday & Hewitson, 1847, Gen. Diurn. Lep., 1: 127; pl. 18, fig. 2 (Venezuela).

spot is gray-white. *H. atagalpa* Haensch,<sup>4</sup> *H. latilimbata* Weymer,<sup>5</sup> and *H. statilla* Hewitson,<sup>6</sup> are all more or less similar to the present species, but in all of them the humeral spot is confined proximad of the humeral vein, while in *deuscula* and *coeno* it crosses the vein and is, consequently, elongated, not round. *H. deuscula* is found in the Venezuelan mountains around Caracas, apparently at relatively high altitudes; probably it has been confused with *coeno* in collections.

*Male*: Costal margin of fore wing black, at the base extending in to the radius, but narrowing somewhat a few millimeters out, so that a transparent streak appears between the radius and Sc, and only narrowly black from cell apex to wing apex, the bases of the radial cells being transparent-blackish; distal margin uniformly black, about 1.5 mm. wide, its proximal edge not very sharply defined, with black scaling running in to the transparent part of the wing; anal margin behind the cubitus black, narrowing toward the anal angle so that there is a transparent area below Cu<sub>2</sub>. A row of small, round, gray-white, submarginal spots between the veins, R<sub>4</sub> to Cu<sub>2</sub>, placed at the inner edge of the border. Rest of wing transparent, very lightly yellowish near the base; all veins narrowly black.

Hind wing with a straw-gray hair pencil on a pearly-black friction area; distal margins a little wider than on the fore wing, about 3 mm. wide at Cu<sub>1</sub>, rather even from apex to anal angle, where it narrows to a slender line along the anal margin; inner edge of border color indefinite, leaving a transparent-black stripe along its proximal side; five small, white spots in the middle of the border, a little stronger than those of the fore wing, between the veins R to Cu<sub>2</sub>, and sometimes an additional pair behind Cu<sub>2</sub>; in the transparent-black stripe the veins are thickened slightly with opaque black scales; within this stripe the transparent wing is clouded with sulphur-yellow, but not heavily; the veins here are narrowly black.

Beneath, the fore wing is exactly like the upper side, except that generally there is an additional, white, submarginal spot behind Cu<sub>2</sub>, and the anal margin is a pearly-black friction area. Hind wing is as above; the costal margin black, including the radius itself, but very little of the anterior side of the cell; a gray to yellow-white spot on the humeral angle,

<sup>4</sup> Haensch, 1905, Berl. Ent. Zeit., 50: 156 (Cuzco, Peru).

<sup>5</sup> Weymer, 1890, in Stübel, Lep. Reiss S. Amer.: 105; pl. 2, fig. 8 (LaViña, Peru).

<sup>6</sup> Hewitson, 1874, Exot. Butt., 5: *Ithomia*, 217 (Chanchamayo).

surrounding the black humeral vein; the extreme base of the hind wing is blackened, visible from above as well.

*Female*: Like the male, but the margins of both wings are slightly broader, so that the submarginal spots of the fore wing are entirely surrounded by black, especially at the apex; sulphur-yellow clouding of the transparent areas a little stronger than in the male, particularly on the hind wing; costal margin of hind wing, between the black radius and the narrow, black line on the margin itself, pearly white, extending out just beyond the cell apex. In one female paratype, on the hind wing above in the position where the submarginal spot between the anals would appear, there are some tawny scales, scarcely noticeable.

Antennae black, the clubs dark reddish-black; head and thorax black with white markings; abdomen black-brown above, ashen beneath.

*Holotype*: Male; Pie de Cerro, Aragua, Venezuela; 2700-3700 ft.; June 9, 1929; Ernest G. Holt; genitalia slide, no. 252, Carnegie Museum.

*Allotype*: Female; Pie de Cerro, (La Victoria), Aragua, Venezuela; May 6, 1929; Holt Expedition; Carnegie Museum.

*Paratypes*: Three males, same data as the holotype; two of them in the Carnegie Museum, one in the Reading Museum collection. Eight females with same data as the allotype, seven of them in the Carnegie Museum, one in the Reading Museum collection. One female; Colonia Tovar, Aragua, Venezuela; 6000-7000 ft.; Holt Expedition; Carnegie Museum.

### ***Hyalýris munda*, sp. nov.**

(Plate I, figure 3)

I cannot immediately associate this with any of the known species, though genitalic analysis probably would establish its relationship, hence I assign *munda* the status of a species, probably temporarily. It has the general appearance of *coeno*, Doubleday & Hewitson (*loc. cit.*), from which it is immediately separated by the lack of the spot on the humeral lobe, by the yellow-brown clubs of the antennae, and by the sharply defined and peculiarly shaped margins of the hind wing. There are traces of red scaling in the anal angle of the hind wing.

*Female*: Fore wing transparent with velvety black margins, black veins, and a whitish hue on the disc. Seven submarginal spots placed in the middle of the border, R<sub>4</sub> to the anal angle, the posterior four faint and gray-black. Black of costal margin invading the top of the cell slightly opposite Cu<sub>2</sub>; costal margin about 3 mm. wide, quite uniform in width except at

Cu<sub>1</sub>, where it sends a streak along the vein about half-way in to the cell; anal margin behind cubitus-Cu<sub>2</sub>, black, overlaid with white scales between Cu<sub>2</sub> and the anal vein to form a long, indefinite spot; basal half of cell sprinkled with black scales.

Hind wing with a transparent-white spot over the end of the cell, fading into semi-transparent, sulphur-yellow below the cell to the anal margin; borders velvety black with a series of submarginal spots R to 2A, only the one in M<sub>1</sub>-M<sub>2</sub> white, the others gray-black, scarcely visible. Black costal border includes base of wing and the anterior half of the cell; at the discocellulars the black angles down to the middle of M<sub>2</sub>-M<sub>3</sub> (leaving a small transparent-white spot in the base of M<sub>2</sub>-M<sub>3</sub>), then runs to the anal angle in a flat arc; thus, the distal marginal color is 8 mm. broad over M<sub>2</sub>, 7 mm. over Cu<sub>2</sub>; its proximal boundary is clear-cut compared to that of similar species. Between the sulphur-yellow color and the black border in 2A-3A there are traces of red scales, and a little of the adjacent black becomes brownish.

Beneath, both wings exactly as above, the submarginal spots white and strong; red scaling of hind wing present below as well; no spot in humeral lobe.

Antennae black, the clubs orange-brown; head, thorax, and legs black, very few white spots.

*Type:* Female; Vicinity of Pampa Hermosa, Peru; May 1-5, 1935; 1600 ft.; Woytkowski; Carnegie Museum.

### ***Napeogenes astarte*, sp. nov.**

(Plate I, figure 4)

The relationships of the species of the genus *Napeogenes* are so little understood at the present that I hesitate to designate this form as a subspecies of any known species. In general it resembles *N. pyrois* Bates,<sup>7</sup> and *N. pharo* (Felder)<sup>8</sup>, but is not exactly like either. The shadowy cell-bar of the fore wing, the narrow, tawny-red, submarginal line of the hind wing, the black collar and patagia, the antennae with their black shafts and orange clubs with black tips, combine to separate *N. astarte* from any previously described species. The present series of three males comes from the Rio Purus, and was collected by Samuel M. Klages.

<sup>7</sup> Bates, 1862, Proc. Linn. Soc. London, 23: 534-5 (Cupari).

<sup>8</sup> Felder, 1862, Wien. Ent. Monats., 7: 76 (Upper Amazons).

*Male:* Fore wing translucent yellow with black margins: costal margin black from base to end of cell, in as far as and including the radius; connected with the dark, discocellular band which is widest at the costal margin, its proximal edge straight, continued along  $Cu_1$  to the distal margin, its distal edge a gentle curve giving the band in general a wedge-like shape, but this curve is broken over the proximal end of  $M_3$  by a rounded projection into the subapical area; costal marginal black a mere line at the yellow costal spot beyond the cell apex, then greatly widening at the wing apex, cutting across to the distal margin toward the outer end of  $M_2$ - $M_3$ , then proceeding with an even width to the anal angle; entire anal margin behind cubitus- $Cu_2$  connected with a triangular area filling the base of  $Cu_1$ - $Cu_2$ . Except along the radius, the opaque black markings are bordered with transparent-black; transparent-black forms a shadowy bar across the cell opposite the proximal end of  $Cu_2$ ; the posterior end of this cell bar is more opaque. Thus the translucent-yellow is found in a post-discal fascia which just crosses  $M_3$  posteriorad and is connected with the opaque, yellow, costal spot at the other end, and to a fascia which crosses the outer end of the cell and fills most of  $Cu_1$ - $Cu_2$ , the cubital segment being yellow (in one paratype the yellow in  $Cu_1$ - $Cu_2$  is constricted a little in the middle by transparent-black), and to the filling at the base of the cell. The subapical white spots of the under side are faintly visible in the apical black.

Hind wing with a gray hair pencil on a pearly-black friction area; central part of wing transparent-yellow with yellow veins; an opaque, black tooth over the discocellulars, ending at the proximal end of  $M_3$ , set in a narrow band of transparent-black which separates the dark margins from the central area in which veins are black; margins black, 4 mm. wide at  $Cu_1$ , 2 mm. at  $M_2$ , with a tawny-red, submarginal streak set in it between  $Cu_1$  and 2A.

Beneath, the pattern of both wings as above, but the color of the margins different. Some tawny-red scaling at the costal end of the fore wing, discocellular band, in the apex and along the distal margin; three white, subapical spots on the fore wing. Six round, white, submarginal dots on the hind wing, R to 3A, placed on scalloped projections from the otherwise narrowly-black margins. A complete tawny-red, submarginal band running from the apex around to the anal angle, where the entire marginal color ends; this is proximally edged with an opaque, black line which is a little broader at the cubitals. Costal margin and humeral angle tawny-red.

Antennae black, the clubs tawny, but the terminal six or seven segments black; I have not noticed this double coloring of the antennal club in any other species of *Napeogenes*. Head, thorax, and legs, black with white streaks; collar and patagia black, white spotted. Abdomen black-brown above, ashey-white beneath.

*Type*: Male; Arima, Rio Purus, Brazil; Nov. 1922; S. M. Klages; Carnegie Museum (genitalia slide, no. 389).

*Paratypes*: Two males; Hyatanahan, Rio Purus, Brazil; March 1922; Klages. One is in the Carnegie Museum, the other in the Reading Museum.

### ***Oleria bocca* Riley.**

(Plate I, figure 5)

*Leucothyris onega bocca* Riley, 1919, *Entomologist*, 52: 184 (Bocca de Acre).

*Leucothyris romani* Aurivillius, 1929, *Ent. Tdskr.*, 50: 156-7 (Hyutanahan, Rio Purus).

Although Riley's description is terse, it compares well enough with that of Aurivillius, who seems to have overlooked completely Riley's 1919 paper. Klages collected a small series of males and females at several localities on the Rio Purus; one of the males is illustrated.

### ***Oleria crispinella hemina*, subsp. nov.**

(Plate I, figure 6)

In size and pattern, this is similar to *O. crispinella* Hoppfer<sup>9</sup> and agrees with it genitally. The chief differences are as follows: the straight, not curved, band of the fore wing across the discocellulars and Cu<sub>1</sub>, the slightly narrower border of the hind wing, the absence of smokey-transparent against the hind wing border, and the stronger submarginal spots beneath on both wings.

In passing, it might be noted that Haensch's diagnosis of *O. didymaea* Hewitson in Seitz reads as though it might be the present form; this is entirely misleading for the figure of *didymaea*<sup>10</sup> much more closely resembles *Oleria victorine* Guerin of Bolivia, and *O. graciella* Oberthür of Venezuela, both of which are well known.

*Male*: Fore wings transparent and colorless with black margins and

<sup>9</sup> Hoppfer, 1874, *Ent. Zeit. Stettin*, 35: 340.

<sup>10</sup> Hewitson, 1876, *Exot. Butt.*, 5: *Ithomia*, 226.



bands and a white-transparent postdiscal band. The entire costal margin anterior of the radius is black, indented by an opaque, white spot beyond the end of the cell; a narrow, black, cell bar placed a little proximad of  $Cu_2$ ; discocellular bar broad, 4 mm. at the costa, continued across the base of  $M_3-Cu_1$  and along  $Cu_1$  to the distal margin in the end of  $Cu_1-Cu_2$ , its distal end being about 1.5 mm. wide near the margin; this whole band gradually tapers from the costa and both edges of it are straight. Distal margin and broad apex black, 2 mm. at  $M_3$  to  $Cu_2$ . Thus the major part of the cell and most of  $Cu_1-Cu_2$  is transparent and colorless; the cubital segment is black. Continuous with the white costal spot is a suboval, transparent area, its proximal edge straight, containing a narrower transparent-white band in which the veins are white.

Hind wing transparent, borders black-brown, 2 mm. wide at  $M_3$  and tapering to a point in the anal angle; transparent area dusted with very faint whitish which is a little stronger against the marginal color; no smokey-transparent band within the margin.

Beneath, the costal margin of the fore wing is red-brown bordered on each side with black; a red-brown band swings around the apex within the black and runs evenly down the distal border; a few red-brown scales in the discocellular band; some faint, white, double spots over the veins in the terminal black of the apex. Humeral lobe and costal margin anterior of Sc of the hind wing red-brown, slightly more yellow than in the fore wing; a similar submarginal band edged proximad with black in the distal margin; blue-white, double marginal spots over the veins, stronger at the apex, faint toward the anal angle.

Antennae black-brown; head, thorax, and legs, black-brown, spotted white; abdomen black-brown above, ashen beneath.

*Type*: Male; Lower Rio Mamore, Bolivia; Steinbach; Dec. 1913; genitalia slide, no. 342; Carnegie Museum.

### ***Corbulis xantho inturna* Fox.**

(Plate I, figure 7)

Fox, 1941, Sci. Publ. Reading Museum, 2: 27-8; fig. 6 (Rio Huallaga).

*Dircenna rufa* Forbes, 1942, Jour. N. Y. Ent. Soc., 50: 41, 42-3; fig. 9 (Rioja).

Woytkowski collected a single female of *Corbulis xantho inturna* Fox. This species was described from a unique male collected on the Rio Huallaga, Peru, by Dr. Bassler, which is now in the collection of the

American Museum of Natural History. Compared with the male, this female exhibits the similarities and differences to be expected in the *Dircenna-Callithomia* group, particularly the more rounded apex of the fore wing, and the more emphatic black markings and the greater extent of color suffusion over the hyaline areas of the wings. Since this is the first female I have seen of this subspecies, a description is in order.

*Female:* Fore wing apex more rounded than in the male; costal, apical, and distal margins black-brown just as in the male, but a little wider at the apex and the distal margin toothed below  $Cu_1$ ; discocellular band much stronger than in the male and continued over  $Cu_1$  to the margin, with  $M_3$  blackened narrowly between the margin and the discocellular band; entire anal area posterior of cubitus- $Cu_2$  black-brown, continuous with a long, rounded spot in the cell resting on the cubitus between the base and  $Cu_2$ ; all veins black except  $M_2$  and the basal third of  $M_1$ , which are tawny, and under the yellow costal spot. Remainder of wing hyaline, heavily suffused with russet-tawny, except for an indefinite yellow-scaled spot against the black margin in  $Cu_1$ - $Cu_2$  and similar spots in  $M_2$ - $M_3$ , the anterior outer corner of  $M_3$ - $Cu_1$  and the posterior outer corner of  $M_1$ - $M_2$ ; between these yellow spots and the costal spot there is the faintest suggestion of a yellow fascia.

The disc of the hind wing is hyaline, heavily suffused with russet-tawny, the veins red-orange; margins black-brown, much wider than in the male, especially at the apex, and the border wider from  $Cu_1$  to the anal margin; the abrupt indentation of the margin at  $Cu_1$  reaches two-thirds of the way to the bottom of the cell. Beneath, colored just as in the male, with, of course, the wider black markings and somewhat stronger white, submarginal spots. The antennae and the body characters are exactly as in the male.

Specimen examined: a female; vicinity of Rioja, Department of San Martin, Peru; jungle; 900 m.; September 17, 1936; Woytkowski; Carnegie Museum. Had I seen this specimen a few months earlier I would have designated it the "allotype." However, the original description has been published for some time and there seems no justification under existing usage to designate this female with any particular term.



## EXPLANATION OF PLATE I

All figures in natural size.

- FIG. 1. *Melinaea maelus purusana* Riley. ♂; Hyatanahan, Rio Purus, Brazil; Klages.
- FIG. 2. *Hyalyris deuscula*, sp. nov. Type, ♂; Pie del Cerro, Aragua, Venezuela; 2700-3700 ft.; June 9, 1929; Ernest G. Holt.
- FIG. 3. *Hyalyris munda*, sp. nov. Type, ♀; vicinity of Pampa Hermosa, Peru; 1600 m.; May 1-5, 1935; Woytkowski.
- FIG. 4. *Napeogenes astarte*, sp. nov. Type, ♂; Hyatanahan, Rio Purus, Brazil; Klages.
- FIG. 5. *Oleria bocca* Riley. ♂; Nova Olinda, Rio Purus, Brazil; Klages.
- FIG. 6. *Oleria crispinella hemina*, subsp. nov. Type, ♂; Lower Rio Mamore, Bolivia; Steinbach.
- FIG. 7. *Corbulis xantho inturna* Fox. ♀; vicinity of Rioja, San Martin, Peru; 900 m.; Sept. 17, 1936; Woytkowski.
- FIG. 8. *Hypothyris meterus deëmae*, subsp. nov. Type, ♀; vicinity of San Pedro, Peru; 900 m.; June 1-5, 1935; Woytkowski.







ART. XV. BIRDS COLLECTED DURING TWO CRUISES OF THE  
"VAGABONDIA" TO THE WEST COAST OF SOUTH AMERICA

BY RUTH TRIMBLE

INTRODUCTION

To Mr. William Larimer Mellon, trustee of the Carnegie Institute and member of the Committee on the Museum, warmest thanks are due for the generous interest that prompted him to utilize his yacht "Vagabondia" in enriching the scientific collections of the Carnegie Museum. In 1936, Mr. Reinhold L. Fricke of the Section of Education was invited to join Mr. Mellon's cruise to South America in order to collect birds and other natural history specimens in the waters of the Pacific. For a similar voyage in 1939, Dr. Arthur C. Twomey of the Section of Ornithology was chosen to be the representative of the Museum. Mr. Fricke's activities in the first trip were devoted primarily to the collecting of sea birds, with the particular objective of securing specimens and materials for a habitat group of the famed guano birds of Peru, now on exhibition in the bird hall. During the second expedition, Dr. Twomey directed his attention more to the land birds of little-known areas on the southern coast of Chile.

The eminent success of the ventures is attested by the rich and varied additions to the bird collections of the Museum. All praise is due Mr. Mellon, who so willingly co-operated in directing his yacht to worthwhile collecting sites and in aiding the actual work of collecting. As testimony to the industry and zeal of Mr. Fricke and Dr. Twomey, the ensuing list of the birds secured may be offered. There are in all 766 specimens (198 taken in 1936; 568 in 1939), representing 213 forms. Of these, 125 were previously unrepresented in the Carnegie Museum collection, which is now richer by 21 genera (indicated by \*), 79 species (‡), and 46 subspecies (†).

A large proportion of the material comes from Chile, and Dr. C. E. Hellmayr's valuable work on the birds of this region<sup>1</sup> has been an indispensable guide in the identification and study of the specimens. The collections add a few species to the Chilean list and extend the known ranges

<sup>1</sup> "Birds of Chile," *Field Museum of Natural History Zoological Series*, vol. 19, 1932.

of a number of forms. The material from the Galapagos Islands, including many of their remarkable endemic birds, likewise forms a valuable accession to the Carnegie Museum. Mr. H. S. Swarth's report<sup>2</sup> has facilitated the naming of the species and races.

For comparative material the writer has consulted the extensive collections of the American Museum of Natural History in New York City and of the Field Museum of Natural History in Chicago. Thanks are extended to the representatives of these institutions for the loan of specimens and for advice in the naming of the birds. To Dr. Andrey Avinoff, Director of the Carnegie Museum, and to Mr. W. E. Clyde Todd, Curator of Ornithology, the writer is grateful for the opportunity of publishing the results of her studies. Popular accounts of the two expeditions have already been contributed by Mr. Fricke and by Dr. Twomey to the "Carnegie Magazine."<sup>3</sup>

Since collections of birds were made at various localities from Panama to the Straits of Magellan, the list of specimens is arranged in systematic rather than geographic order. The collecting-stations for the two expeditions are listed below. Those in southern Chile appear on the charts issued by the Hydrographic Office of the U. S. Navy Department, and numbered 454, 1315, and 2243, respectively. A few specimens were secured from other sources, as indicated in the text under the species involved.

#### LIST OF LOCALITIES

##### COLLECTIONS MADE BY REINHOLD L. FRICKE IN 1936

- February 10. Cocos Island.
- February 13. Galapagos Islands: Seymour and Daphne Major.
- February 22. Chile: off coast, 24° S. Latitude.
- February 24. Chile: Valparaiso.
- February 28-29. Chile: Mas-a-tierra, Juan Fernandez Islands.
- March 3. Chile: off coast, 35° 39' S., 72° 51' W.
- March 5. Chile: Puerto Quellon, Chiloé Island (43° 8' S.).
- March 7. Chile: Estuario Ringdove, Messier Channel (49° 48' S.).
- March 8. Chile: Magellan Straits (Pacific entrance).

<sup>2</sup> "The Avifauna of the Galapagos Islands," *Occasional Papers California Academy of Sciences*, no. 18, 1931.

<sup>3</sup> Carnegie Magazine, vol. 10, 1936, pp. 99-108; vol. 13, 1940, pp. 227-233, 269-275.



- March 9, 11. Chile: 25 miles north of Magallanes (now Punta Arenas),  
Tierra del Fuego.
- March 10. Chile: Agostini Bay, Tierra del Fuego ( $54^{\circ} 25' S.$ ).
- March 13. Chile: Puerto Bueno ( $51^{\circ} 0' S.$ ).
- March 14. Chile: Wide Bay ( $50^{\circ} 40' S.$ ).
- March 15. Chile: Eden Harbor, English Narrows ( $49^{\circ} 8' S.$ ).
- March 16. Chile: Bahía San Quintín ( $46^{\circ} 50' S.$ ).
- March 17. Chile: Puerto Casma, Península de Taitao ( $46^{\circ} 45' S.$ ).
- March 18. Chile: Puerto Lagunas, Melchor Island ( $45^{\circ} 18' S.$ ).
- March 19. Chile: Guafo Island.
- March 20. Chile: off coast,  $38^{\circ} 58' S.$ ,  $75^{\circ} 55' W.$
- March 25. Chile: Salado Bay.
- April 3. Peru: off coast,  $9^{\circ} 58' S.$ ,  $78^{\circ} 26' W.$
- April 4. Peru: Lobos de Tierra (Island).
- April 6. Ecuador: La Plata Island.

COLLECTIONS MADE BY ARTHUR C. TWOMEY IN 1939

- February 12. Peru: Callao.
- February 22. Chile: Puerto Harchy, Humos Island ( $45^{\circ} 42' S.$ ).
- February 23-26. Chile: Golfo Elefantes, Península de Taitao ( $46^{\circ} 30' S.$ ).
- February 24. Chile: Laguna San Rafael ( $46^{\circ} 38' S.$ ).
- March 2. Chile: Punta Arenas, Tierra del Fuego.
- March 4. Chile: Puerto Demonto, Ainsworth Bay, Tierra del Fuego  
( $54^{\circ} 26' S.$ ).
- March 5. Chile: Contra Almirante Martínez Bay (head), Tierra del  
Fuego ( $54^{\circ} 40' S.$ ).
- March 6. Chile: Mintiroso Bay, Tierra del Fuego (on the last, in lat.  
 $54^{\circ} 29' S.$ ).
- March 9. Chile: Molyneux Sound ( $50^{\circ} 18' S.$ ).
- March 10. Chile: Arthur Island, Messier Channel ( $48^{\circ} 22' S.$ ).
- March 11. Chile: Puerto Sarjento, Río Huemules ( $47^{\circ} 40' S.$ ).
- March 12. Chile: Río de la Pascua (mouth) ( $48^{\circ} 16' S.$ ).
- March 14. Chile: Kelly Harbor ( $47^{\circ} 0' S.$ ,  $74^{\circ} 0' W.$ ).
- March 15. Chile: Puerto Casma, Península de Taitao ( $46^{\circ} 45' S.$ ).
- March 16. Chile: Port Slight, Península Tres Montes ( $46^{\circ} 48' S.$ ).
- March 17. Chile: Río Huemules ( $45^{\circ} 47' S.$ ).
- March 19. Chile: Puerto Melinca, Ascension Island, Guaitecas Islands  
( $43^{\circ} 55' S.$ ).

- March 20-21. Chile: Puerto Montt ( $41^{\circ} 30' S.$ ).  
 March 24-25. Chile: Valparaiso.  
 March 27. Chile: Bahía Constitución.  
 March 28. Chile: Tocopilla.  
 March 31. Peru: Lima (10 mi. east by south).  
 April 1. Peru: Galera, Yauli, Junin.  
 April 6. Galapagos Islands: Seymour Island.  
 April 7. Galapagos Islands: Conway Bay, Indefatigable Island.  
 April 7. Galapagos Islands: James Island.  
 April 8. Galapagos Islands: Tower Island.  
 April 10. Cocos Island.  
 April 13. Panama: Capira and Parita.

## LIST OF SPECIES

## Family TINAMIDAE. TINAMOUS.

‡*Nothoprocta perdicaria perdicaria* (Kittlitz). CHILEAN TINAMOU.

Chile: ♂, Valparaiso, March 24, 1939.

## Family SPHENISCIDAE. PENGUINS.

*Eudyptes crestatus* (J. F. Miller). ROCKHOPPER PENGUIN.

Chile: ♂, Puerto Demonto, March 4, 1939; ♂, ♀, Mintiroso Bay, March 6, 1939.

These three specimens are young birds with the yellow tufts indicated but not elongated.

*Spheniscus magellanicus* (J. R. Forster). MAGELLANIC PENGUIN.

Chile: im., Agostini Bay, March 10, 1936; 2 ♂, 1 ♀, 1 im., Bahía San Quintin, March 16, 1936; ♀, Puerto Lagunas, March 18, 1936; ♂, Golfo Elefantes, February 26, 1939; ♂ im., Puerto Demonto, March 4, 1939.

‡*Spheniscus humboldti* Meyen. PERUVIAN PENGUIN.

Chile: ♂, Salado Bay, March 25, 1936.

## Family COLYMBIDAE. GREBES.

*Colymbus chilensis* (Lesson). CHILEAN GREBE.

Chile: 2 ♂, 1 ♀, Bahía San Quintin, March 16, 1936; 4 ♂, 1 ♀, Golfo Elefantes, February 26, 1939.

All of these specimens are molting into winter plumage.

†**Colymbus occipitalis occipitalis** (Garnot). BRIGHT-CHEEKED GREBE.

Chile: 1 ♂, 3 ♀, 1 not sexed, Puerto Lagunas, March 18, 1936; ♂, Kelly Harbor, March 14, 1939.

Dr. Hellmayr suggests that Chilean birds may be separable from Falkland Island specimens, but comparison with topotypical material in the American Museum of Natural History shows no appreciable difference between the series from Chile and birds from the Falkland Islands, and from Chubut, Argentina.

‡**Aechmophorus major** (Boddaert). GREAT GREBE.

Chile: 5 ♂, Golfo Elefantes, February 23-26, 1939; ♂ juv., Kelly Harbor, March 14, 1939.

The Kelly Harbor specimen is still downy with the postjuvinal molt just beginning. It is half the size of the adults, and still shows the streaked head-pattern.

Family DIOMEDEIDAE. ALBATROSSES.

**Diomedea bulleri** Rothschild. BULLER'S ALBATROSS.

Chile: ♂, Salado Bay, March 25, 1936.

The identification of this specimen has been verified by Dr. Robert Cushman Murphy.

**Diomedea exulans exulans** Linnaeus. WANDERING ALBATROSS.

Chile: ♂, subadult, 38° 58' S., 75° 55' W., March 20, 1936.

**Diomedea melanophris** Temminck. BLACK-BROWED ALBATROSS.

Chile: ♀, Wide Bay, March 14, 1936; ♂, Bahía Constitución, March 27, 1939.

Dr. Murphy has examined the adult female from Wide Bay and has verified the identification. The other specimen is evidently a young bird in worn plumage. Its bill is dark-colored, the "brow" is but faintly indicated, and the feet are much paler than those of the adult female.

Family PROCELLARIIDAE. SHEARWATERS and FULMARS.

**Macronectes giganteus** (Gmelin). GIANT FULMAR.

Chile: 2 ♂, 3 ♀, Guafo Island, March 19, 1936.

**Puffinus creatopus** Coues. PINK-FOOTED SHEARWATER.

Chile: ♂, Valparaiso, February 24, 1936.

**Puffinus griseus** (Gmelin). SOOTY SHEARWATER.

Chile: ♂, Bahia San Quintin, March 16, 1936; ♂, Salado Bay, March 25, 1936.

**Puffinus lherminieri subalaris** Ridgway. GALAPAGOS SHEARWATER.

Galapagos Islands: 1 ♂, 2 ♀, between Seymour and Daphne Major, February 13, 1936; 1 ♂, 2 ♀, Tower Island, April 8, 1939.

**Procellaria aequinoctialis** Linnaeus. SHOEMAKER.

Chile: ♀, Salado Bay, March 25, 1936.

## Family HYDROBATIDAE. STORM PETRELS.

**Oceanodroma tethys tethys** (Bonaparte). GALAPAGOS STORM PETREL.

Galapagos Islands: ♀, Tower Island, April 8, 1939.

**Oceanites gracilis galapagoensis** Lowe. LOWE'S STORM PETREL.

Galapagos Islands: ♂, Seymour Island, April 6, 1939; 1 ♂, 3 ♀, Conway Bay, Indefatigable Island, April 7, 1939; ♂, Tower Island, April 8, 1939.

## Family PELECANOIDIDAE. DIVING PETRELS.

‡**Pelecanoides garnotii** (Lesson). POTOYUNCO; PERUVIAN DIVING PETREL.

Chile: 2 ♀, Bahia Constitución, March 27, 1939.

‡**Pelecanoides magellani** (Mathews). MAGELLANIC DIVING PETREL.

Chile: 2 ♂, 1 ♀, Puerto Demonto, March 4, 1939.

## Family PHAETHONTIDAE. TROPIC-BIRDS.

**Phaëthon aethereus mesonauta** Peters. CARIBBEAN RED-BILLED TROPIC-BIRD.

Galapagos Islands: 3 ♂, 2 ♀, Daphne Major, February 13, 1936; ♂, Seymour Island, April 6, 1939.

## Family PELECANIDAE. PELICANS.

‡**Pelecanus occidentalis thagus** Molina. PERUVIAN PELICAN.

Peru: ♀, juv. not sexed, Lobos de Tierra, April 4, 1936.

## Family SULIDAE. BOOBIES.

‡*Sula nebouxi* Milne-Edwards. BLUE-FOOTED BOOBY.

Peru: 1 ♂, 3 ♀, 4 im., Lobos de Tierra, April 4, 1936. Ecuador: 2 downy yg., La Plata Island, April 6, 1936. Galapagos Islands: 2 ♂, Seymour Island, April 6, 1939.

‡*Sula variegata* (Tschudi). PERUVIAN BOOBY.

Peru: 1 ♂, 2 ♀, 4 im., Lobos de Tierra, April 4, 1936.

†*Sula leucogaster etesiaca* Thayer and Bangs. COLOMBIAN BOOBY.

Cocos Island: ♂, ♀, April 10, 1939.

## Family PHALACROCORACIDAE. CORMORANTS.

*Phalacrocorax olivaceus olivaceus* (Humboldt). BIGÜÁ CORMORANT.

Chile: ♂, Puerto Bueno, March 13, 1936.

This specimen is in non-breeding plumage and is without any tufts of white filoplumes. It compares favorably with birds from Bolivia and Colombia.

‡*Phalacrocorax magellanicus* (Gmelin). ROCK SHAG.

Chile: 3 ♀, Estuario Ringdove, Messier Channel, March 7, 1936; ♀, Bahia San Quintin, March 16, 1936; 4 ♀, Puerto Melinca, March 19, 1939.

Three of these birds are adults in postnuptial plumage; the others apparently are immature, as shown by the brownish mottling on the underparts.

‡*Phalacrocorax bougainvillii* (Lesson). GUANAY.

Peru: albino, not sexed, Mazurka Island, February, 1936; ♀, 9° 58' S., 78° 26' W., April 3, 1936; 1 ♂, 2 ♀, Lobos de Tierra, April 4, 1936.

In the albino specimen the areas that are normally black are colored a light grayish brown; the scapulars and quills are somewhat paler, and the belly and throat are white.

‡*Phalacrocorax gaimardi* (Lesson). RED-FOOTED SHAG.

Chile: 2 ♂, 1 ♀, Bahia San Quintin, March 16, 1936; 2 ♂, 1 ♀, Golfo Elefantas, February 23 and 26, 1939.

The female from Bahia San Quintin is immature. The white neck-patches are merely indicated by a scattering of white feathers, and the

underparts are browner than in the adult plumage. One male from this locality (C. M. 120,831) retains some of the brown body plumage and the quills of the immature dress.

†**Phalacrocorax atriceps atriceps** King. BLUE-EYED SHAG.

Chile: ♂, ♀, Puerto Bueno, March 13, 1936; 2 ♂, Golfo Elefantes, February 24-25, 1939; ♂ juv., Mintiroso Bay, March 6, 1939.

A female from Puerto Bueno and a male from Golfo Elefantes are immature and are placed here mainly on geographic grounds. The downy, young bird from Mintiroso Bay could be either *atriceps* or *albiventer*, since both breed in Tierra del Fuego and at this stage are indistinguishable from each other.

Family ARDEIDAE. HERONS.

†**Ardea herodias cognata** Bangs. GALAPAGOS GREAT BLUE HERON.

Galapagos Islands: ♂, James Island, April 7, 1939.

**Ardea cocoi** Linnaeus. COCOI HERON.

Chile: ♂, Golfo Elefantes, February 25, 1939.

**Casmerodius albus egretta** (Gmelin). AMERICAN EGRET.

Chile: 2 ♂, Puerto Melinca, March 19, 1939.

**Nycticorax nycticorax tayazu-guira** (Vieillot). PARAGUAYAN NIGHT HERON.

Chile: ♂, Mintiroso Bay, March 6, 1939.

J. L. Peters<sup>4</sup> recognizes but a single race of the Black-crowned Night Heron from southern South America, although it has long been evident that specimens from Chile are almost invariably of much darker coloration than those of the Falkland Islands and southeastern South America. Dr. Chapman<sup>5</sup> called the darker western specimens, *N. cyanocephalus* Molina, and the lighter eastern ones, *tayazu-guira* Vieillot. He was forced to admit that in some regions light and dark birds were found side by side. It is difficult to deny subspecific validity to the ordinary dark-colored birds of the Chilean coast, for which, according to Dr. Hellmayr, the name *obscurus* Bonaparte must now be used. Molina's description of *cyanocephalus* he finds altogether inaccurate.

<sup>4</sup>"Check-List of Birds of the World," vol. 1, 1931, p. 115.

<sup>5</sup>Bull. U. S. Nat. Mus., 117, 1921, p. 51.

Dr. Twomey collected only one specimen within the region of the lighter form. It is a fully adult male from Tierra del Fuego and is closely similar in coloration to adults from the Falkland Islands. It is somewhat darker gray on the sides of the neck and underparts than *hoactli* and likewise slightly darker than many specimens from eastern South America. The validity of a Falkland Island race has not been admitted by Dr. Chapman and other recent writers, hence the bird must be referred to *tayazu-guira*.

† ***Nycticorax nycticorax obscurus*** Bonaparte. CHILEAN NIGHT HERON.

Chile: 3 ♂, Puerto Melinca, Guaitecas Islands, March 19, 1939.

Series of night herons from southern South America have been examined in the Carnegie Museum, the Museum of Comparative Zoölogy, the Field Museum, and the American Museum of Natural History. Many of the specimens are heavily washed with brownish gray on the cheeks, sides of neck, and lower underparts. First year specimens of *obscurus* are much more broadly striped with brown than are those of *tayazu-guira* or *hoactli*. Nowhere have I seen a single bird that even approaches Dr. Twomey's three examples from Puerto Melinca in the extreme depth of pigmentation. One specimen, C.M. 123,552, seems to be virtually adult. It has no buffy streaking, the primaries and primary coverts are apparently those of a fully adult bird, and nearly the entire upperparts from the fore-crown to the tail are brownish black with a pronounced oily green luster. The cheeks, sides of neck, breast, and abdomen are blackish brown with only the faintest trace of diffuse light brown spotting on the lower foreneck and abdomen. Even the thighs and under tail coverts are sooty blackish, while all the upper wing coverts are nearly as black as the back and somewhat glossed with green. Chin and throat are dark brown and nuchal plumes are wanting. One is tempted to speculate on whether these plumes would be black or white. The feet are wholly black, as naturally is the bill.

The specimen C.M. 123,553 is probably not quite adult. It retains some buffy streaks at the very tips of the greater wing coverts. Its coloration is not quite so black, although the back and crown are well glossed with green. The underparts are very dark brown with buffy median streaks on throat and foreneck, and diffuse barring of reddish brown on the breast and abdomen. The example has no nuchal plumes, but the longest crest feathers are dark sooty gray and have probably been held over from an earlier plumage. The primaries are not worn at the tips, have no trace

of the usual spotted tips of juvenal quills, and thus would indicate that the bird was a little over one year in age.

The remaining specimen, C.M. 123,551, appears to be the youngest of the three. In general coloration it is a little browner, less blackish, than the two foregoing, and is only slightly glossed with green on the back. Moreover, it has well-marked buffy streaks from throat to abdomen and under tail coverts. Its primaries show no light spots at their tips, but the soft texture of the back feathers and wing coverts, which all have narrow median streaks of buff or pale brown, suggests that this may be a bird in an unusually dark first-year plumage.

At first glance these three specimens might seem to represent some remarkably distinct form, yet the fact that they were all taken at the same locality suggests that they really represent a small localized melanistic population. In this opinion both Dr. Chapman and Mr. John T. Zimmer concur. It would be extremely interesting to have additional specimens from the same district. Measurements of the three birds in millimeters are as follows: wing, 311-322; tail, 126-132; tarsus, 83-86; exposed culmen, 73.5-81.

†**Nyctanassa violacea pauper** (Sclater and Salvin). GALAPAGOS YELLOW-CROWNED NIGHT HERON.

Galapagos Islands: ♂, Seymour Island, April 6, 1939.

**Butorides striatus striatus** (Linnaeus). SOUTH AMERICAN GREEN HERON.

Cocos Island: ♂, ♀, April 10, 1939.

Wetmore (1931) and Gifford (1913) identify their birds from Cocos Island as *B. virescens*, but these two specimens are clearly referable to *striatus*. In comparison with birds from Venezuela, Brazil, and Colombia, the male shows paler gray wings. The female is immature, but has quills that are as dark as those of the continental specimens.

‡**Butorides sundevalli** Reichenow. GALAPAGOS HERON.

Galapagos Islands: ♀, Seymour Island, April 6, 1939; 2 ♂, Conway Bay, Indefatigable Island, April 7, 1939.

Family THRESKIORNITHIDAE. IBISES.

†**Theristicus melanopsis** (Gmelin). BLACK-FACED IBIS.

Chile: ♀, Golfo Elefantes, February 25, 1939.



## Family PHOENICOPTERIDAE. FLAMINGOS.

**Phoenicopterus ruber** Linnaeus. AMERICAN FLAMINGO.

Galapagos Islands: ♂, James Island, April 7, 1939.

## Family ANATIDAE. SWANS, GEESE, DUCKS.

‡**Cygnus melancoriphus** (Molina). BLACK-NECKED SWAN.

Chile: ♂, Golfo Elefantes, February 25, 1939.

\*‡**Chloëphaga poliocephala** Sclater. ASHY-HEADED GOOSE.

Chile: ♀, Punta Arenas (25 mi. N.), March 11, 1936; not sexed, Bahia San Quintin, March 16, 1936; 6 ♂, 1 ♀, Golfo Elefantes, February 24-26, 1939; ♀, Molyneux Sound, March 9, 1939; ♂, Rio de la Pascua, March 12, 1939.

‡**Chloëphaga hybrida hybrida** (Molina). KELP GOOSE.

Chile: 2 ♂, 5 ♀, Puerto Bueno, March 13, 1936; ♂, ♀, Wide Bay, March 14, 1936; 2 ♂, Bahia San Quintin, March 16, 1936; ♂, Puerto Casma, March 17, 1936; ♂, ♀, Puerto Harchy, February 22, 1939; ♀ juv., Contra Almirante Martinez Bay, March 5, 1939.

‡**Chloëphaga picta** (Gmelin). UPLAND GOOSE.

Chile: ♂, Punta Arenas, March 2, 1939.

‡**Chloëphaga dispar** (Philippi and Landbeck). BARRED UPLAND GOOSE.

Chile: 2 ♂, Contra Almirante Martinez Bay, March 5, 1939; ♂, ♀, Mintiroso Bay, March 6, 1939.

Dr. Hellmayr (1932) considers this to be a dimorphic form of *Chloëphaga picta*, but other authors disagree, and his view can scarcely be regarded as proved. It is more likely, as Mr. Todd suggests, that this is a case parallel with that of *Chen hyperborea* and *Chen caerulescens* in North America.

**Tachyeres pteneres** (Forster). MAGELLANIC FLIGHTLESS STEAMER DUCK.

Chile: ♂, Agostini Bay, March 10, 1936; ♂, Puerto Bueno, March 13, 1936; ♂, Wide Bay, March 14, 1936; ♂, 1 not sexed, Eden Harbor, English Narrows, March 15, 1936; ♀, Bahia San Quintin, March 16,

1936; ♀, Puerto Lagunas, March 18, 1936; ♂ juv., ♀ juv., Puerto Melinca, March 19, 1939; ♂ juv., Contra Almirante Martinez Bay, March 5, 1939; ♂ juv., Mintiroso Bay, March 6, 1939.

‡**Tachyeres patachonicus** (King). FLYING STEAMER DUCK.

Chile: 1 ♂, 2 ♀, 2 im., Agostini Bay, March 10, 1936.

‡**Anas galapagensis** (Ridgway). GALAPAGOS PINTAIL.

Galapagos Islands: 2 ♂, 1 ♀, James Island, April 7, 1939.

†**Anas specularioides specularioides** King. CRESTED DUCK.

Chile: ♂, Agostini Bay, March 10, 1936; ♂, ♀, Puerto Demonto, March 4, 1939; 2 ♂, Contra Almirante Martinez Bay, March 5, 1939.

‡**Anas specularis** King. BRONZE-WINGED DUCK.

Chile: ♂, ♀, Golfo Elefantes, February 23, 1939.

**Anas spinicauda** Vieillot. BROWN PINTAIL.

Chile: 1 ♀, 1 not sexed, Punta Arenas (25 mi. N.), March 9, 1936.

†**Anas flavirostris flavirostris** Vieillot. YELLOW-BILLED TEAL.

Chile: 1 ♀, 1 not sexed, Punta Arenas (25 mi. N.), March 9, 1936; ♀, Bahia San Quintin, March 16, 1936; 2 ♂, 2 ♀, Golfo Elefantes, February 24-26, 1939; ♂, Rio de la Pascua, March 12, 1939; 3 ♂, 1 ♀, Kelly Harbor, March 14, 1939.

There is a good deal of variation in the size and density of the spots on the underparts of these birds, but in all the spotting is more or less distributed throughout. The lower abdomen is never immaculate as it is in specimens from the highlands of Bolivia (Lake Titicaca and Tiraque).

‡**Mareca sibilatrix** (Poeppig). CHILEAN WIDGEON.

Chile: 5 ♂, Golfo Elefantes, February 26, 1939; ♂, Kelly Harbor, March 14, 1939.

One specimen (C.M. 123,416) is a young bird with patches of down still adhering to the feathers.

**Anas cyanoptera cyanoptera** Vieillot. CINNAMON TEAL.

Chile: 2 ♂, San Esteban, March 16, 1936.

## Family CATHARTIDAE. NEW WORLD VULTURES.

- †**Cathartes aura falklandica** (Sharpe). FALKLAND ISLAND VULTURE.  
Chile: 2 ♂, Contra Almirante Martinez Bay, March 5, 1939.

**Vultur gryphus** Linnaeus. ANDEAN CONDOR.

Peru: 1 ♂, 1 not sexed, near Lima, March 23, 1936.

## Family ACCIPITRIDAE. HAWKS.

- Buteo polysoma polysoma** (Quoy and Gaimard). PATAGONIAN HAWK.  
Chile: ♀, Puerto Sarjento, Rio Huemules, March 11, 1939.

- †**Buteo polysoma exsul** Salvin. JUAN FERNANDEZ HAWK.  
Chile: ♂, Mas-a-fuera Island, March 23, 1936.

- †**Buteo galapagoensis** (Gould). GALAPAGOS HAWK.  
Galapagos Islands: 2 ♂, 3 ♀, James Island, April 7, 1939.

**Buteo magnirostris ruficauda** (Sclater and Salvin). LARGE-BILLED HAWK.

Panama: ♂, Capira, April 13, 1939.

## Family FALCONIDAE. FALCONS, CARACARAS.

- ‡**Milvago chimango temucoensis** W. L. Sclater. CHIMANGO CARACARA.  
Chile: 2 ♀, Punta Arenas, March 9, 1936; ♂, ♀, Agostini Bay, March 10, 1936; 3 ♂, 2 ♀, Golfo Elefantes, February 23-26, 1939.

- ‡**Polyborus plancus plancus** (J. F. Miller). COMMON CARACARA.  
Chile: ♂, Punta Arenas, March 9, 1936, and 2 ♂, March 2, 1939; 1 ♂, 1 ♀, 1 not sexed, Punta Arenas (25 mi. N.), March 11, 1936; 2 ♂, Golfo Elefantes, February 24-25, 1939; ♀, Rio de la Pascua, March 12, 1939.

**Falco sparverius cinnamominus** Swainson. CHILEAN KESTREL.

Chile: ♀, Punta Arenas, March 2, 1939; 2 ♀, Puerto Montt, March 20, 1939; ♂, ♀, Valparaiso, March 24, 1939.

- †**Falco sparverius fernandensis** (Chapman). JUAN FERNANDEZ KESTREL.

Chile: ♀, Mas-a-tierra Island, February 28, 1936.

## Family RALLIDAE. RAILS, COOTS.

†**Rallus sanguinolentus landbecki** Hellmayr. LANDBECK'S RAIL.

Chile: ♂, Valparaiso, March 25, 1939; 2 ♂, Kelly Harbor, March 14, 1939.

†**Fulica armillata** Vieillot. RED-GARTERED COOT.

Chile: ♂, ♀, Golfo Elefantes, February 25-26, 1939; ♂, Kelly Harbor, March 14, 1939.

## Family HAEMATOPODIDAE. OYSTER-CATCHERS.

†**Haematopus ostralegus pitanay** Murphy. PERUVIAN OYSTER-CATCHER.

Chile: ♂, ♀, Bahía Constitución, March 27, 1939.

†**Haematopus leucopodus** Garnot. FUEGIAN OYSTER-CATCHER.

Chile: yg., not sexed, Bahía San Quintín, March 16, 1936; 2 ♀, Golfo Elefantes, February 23 and 26, 1939; ♀, (Mintiroso Bay?), Tierra del Fuego, March (6), 1939.

†**Haematopus ater** Vieillot and Oudart. BLACK OYSTER-CATCHER.

Chile: 3 ♂, 1 ♀, Estuario Ringdove, Messier Channel, March 7, 1936; ♂, Puerto Bueno, March 13, 1936; ♂, Puerto Demonto, March 4, 1939; 2 ♂, Contra Almirante Martínez Bay, March 5, 1939.

## Family CHARADRIIDAE. PLOVERS.

†**Belonopterus chilensis fretensis** Brodkorb. CHILEAN LAPWING.

Chile: 1 not sexed, Punta Arenas (25 mi. N.), March 9, 1936; ♂, Punta Arenas, March 2, 1939.

**Oreopholus ruficollis** (Wagler). RUFOUS-THROATED PLOVER.

Chile: ♂, Punta Arenas (25 mi. N.), March 11, 1936.

**Zonibyx modestus** (Lichtenstein). WINTER PLOVER.

Chile: 1 ♂, 2 ♀, 2 not sexed, Punta Arenas (25 mi. N.), March 11, 1936; ♂, 3 ♀, Punta Arenas, March 2, 1939; ♂, Puerto Harchy, February 22, 1939; 1 ♂, 2 ♀, Golfo Elefantes, February 23 and 25, 1939.

**Charadrius falklandicus** Latham. FALKLANDIC PLOVER.

Chile: 3 ♂, Golfo Elefantes, February 25, 1939; ♀ yg., Punta Arenas, March 2, 1939.

Family SCOLOPACIDAE. SNIPE, SANDPIPERS.

**Numenius phaeopus hudsonicus** Latham. HUDSONIAN CURLEW.

Chile: 2 ♂, Salado Bay, March 25, 1936; 2 ♂, 2 ♀, Golfo Elefantes, February 23-26, 1939.

**Actitis macularia** (Linnaeus). SPOTTED SANDPIPER.

Chile: ♀, Salado Bay, March 25, 1936.

This is apparently the first record of this species in Chile and represents an extension of the known winter range.

**Arenaria interpres morinella** (Linnaeus). RUDDY TURNSTONE.

Chile: ♀, Salado Bay, March 25, 1936.

**Heteroscelus incanus** (Gmelin). WANDERING TATTLER.

Galapagos Islands: ♂, Conway Bay, Indefatigable Island, April 7, 1939.

**Crocethia alba** (Pallas). SANDERLING.

Chile: 3 ♂, Golfo Elefantes, February 24 and 26, 1939.

The southernmost locality for this highly migratory species.

†**Capella paraguaiae magellanica** (King). PATAGONIAN SNIPE.

Chile: 2 ♂, 2 ♀, Punta Arenas (25 mi. N.), March 9 and 11, 1936; ♂, ♀, Punta Arenas, March 2, 1939; ♂, Golfo Elefantes, February 26, 1939.

‡**Capella stricklandii** (Gray). STRICKLAND'S SNIPE.

Chile: ♂, Puerto Sarjento, Rio Huemules, March 11, 1939.

**Himantopus himantopus mexicanus** (P. L. S. Müller). BLACK-NECKED STILT.

Galapagos Islands: ♂, ♀, Conway Bay, Indefatigable Island, April 7, 1939.

## Family STERCORARIIDAE. SKUAS, JAEGERES.

**Catharacta skua chilensis** (Bonaparte). CHILEAN SKUA.

Chile: ♂, Magellan Straits (Pacific entrance), March 8, 1936; ♂, ♀, Punta Arenas, March 9, 1936, and March 2, 1939; 2 ♀, Guafo Island, March 19, 1936; ♂, Puerto Demonto, March 4, 1939; 2 ♂, Contra Almirante Martínez Bay, March 5, 1939.

Dr. R. C. Murphy has examined the two Skuas from Guafo Island, and in a letter of December 31, 1936, to Mr. Todd, pronounces them "absolutely typical examples of *Catharacta skua chilensis*, agreeing with breeding birds from Tierra del Fuego." All but one of the specimens listed above have grayish brown underparts, evidence of immaturity.

## Family LARIDAE. GULLS, TERNS.

**Larus dominicanus** Lichtenstein. KELP GULL.

Chile: im., Estuario Ringdove, Messier Channel, March 7, 1936; ♂, ♀, Punta Arenas, March 9, 1936; 2 ♂, Puerto Harchy, February 22, 1939. Peru: ♂, ♀, Lobos de Tierra, April 4, 1936.

‡**Larus maculipennis** Lichtenstein. BROWN-HOODED GULL.

Chile: ♀, Puerto Quellon, Chiloé Island, March 5, 1936; ♂, ♀ juv., Golfo Elefantes, February 23 and 26, 1939.

‡**Larus modestus** Tschudi. GRAY GULL.

Chile: ♂, Kelly Harbor, March 14, 1939; 4 ♂, 2 ♀, Bahía Constitución, March 27, 1939.

The southern limit of the Gray Gull has heretofore been considered as Valdivia. Dr. Twomey's specimen from Kelly Harbor extends the range of this gull.

**Larus pipixcan** Wagler. FRANKLIN'S GULL.

Peru: ♂ [im.], Callao, February 12, 1939.

‡**Larus fuliginosus** Gould. DUSKY GULL.

Galapagos Islands: ♂, Conway Bay, Indefatigable Island, April 7, 1939.

\*‡**Creagrus furcatus** (Nébox). SWALLOW-TAILED GULL.

Galapagos Islands: ♂, Seymour Island, April 6, 1939.

\*†*Leucophaeus scoresbii* (Traill). DOLPHIN GULL.

Chile: ♂, ♀, Bahía San Quintín, March 16, 1936; 2 ♂, Puerto Harchy, February 22, 1939; 3 ♂, 1 ♀, Golfo Elefantes, February 23 and 26, 1939; ♀, Kelly Harbor, March 14, 1939.

‡*Sterna hirundinacea* Pontoppidan. SOUTH AMERICAN TERN.

Chile: ♂, ♀, Puerto Harchy, February 22, 1939.

†*Gygis alba candida* (Gmelin). COCOS FAIRY TERN.

Cocos Island: 2 ♂, April 10, 1939.

†*Anous stolidus galapagensis* Sharpe. GALAPAGOS NODDY.

Galapagos Islands: 1 ♂, 3 ♀, Seymour Island, April 6, 1939.

## Family COLUMBIDAE. PIGEONS, DOVES.

*Columbina picui picui* (Temminck). PICUI DOVE.

Chile: 2 ♂, Valparaíso, March 24, 1939.

*Columbigallina minuta elaeodes* (Todd). TODD'S PYGMY GROUND DOVE.

Panama: ♂, ♀, Capira, April 13, 1939.

†*Columbigallina minuta amazilia* (Bonaparte). BONAPARTE'S PYGMY GROUND DOVE.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939.

\*†*Nesopelia galapagoensis galapagoensis* (Gould). GALAPAGOS DOVE.

Galapagos Islands: ♀, Seymour Island, April 6, 1939; ♀, James Island, April 7, 1939; 2 ♂, Tower Island, April 8, 1939.

*Columba livia* Gmelin. ROCK PIGEON.

Chile: ♀, Mas-a-tierra Island, February 28, 1936.

The Rock Pigeon has become established in a feral colony on Mas-a-tierra.

‡*Columba araucana* Lesson. CHILEAN PIGEON.

Chile: ♂, ♀, Golfo Elefantes, February 24, 1939; ♂, Puerto Montt, March 21, 1939.

†*Zenaidura auriculata auriculata* (Des Murs). VIOLET-EARED DOVE.

Chile: ♂, Valparaíso, March 25, 1939.

## Family PSITTACIDAE. PARROTS.

**Pionus menstruus** (Linnaeus). BLUE-HEADED PARROT.

Panama: ♂, Parita, April 13, 1939.

**Amazona ochrocephala panamensis** (Cabanis). PANAMA YELLOW-HEADED PARROT.

Panama: ♂, Parita, April 13, 1939.

†**Psilopsiagon aurifrons aurifrons** (Lesson). GOLDEN-FRONTED PARAKEET.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939; 1 ♂, 2 ♀, Galera, April 1, 1939.

\*†**Microsittace ferruginea minor** Chapman. CHILEAN PARAKEET.

Chile: 6 ♂, 1 ♀, Port Slight, Peninsula Tres Montes, March 16, 1939.

## Family CUCULIDAE. CUCKOOS, ANIS.

‡**Coccyzus ferrugineus** Gould. COCOS ISLAND CUCKOO.

Cocos Island: ♂, April 10, 1939.

**Piaya cayana thermophila** P. L. Sclater. CENTRAL AMERICAN SQUIRREL CUCKOO.

Panama: ♂, Parita, April 13, 1939.

**Crotophaga sulcirostris sulcirostris** Swainson. GROOVE-BILLED ANI.

Peru: ♂, ♀, Lima (10 mi. E. by S.), March 31, 1939. Panama: ♀, Capira, April 13, 1939.

## Family TYTONIDAE. BARN OWLS.

**Tyto alba tuidara** (J. E. Gray). CHILEAN BARN OWL.

Chile: ♂, Valparaiso, March 25, 1939.

## Family STRIGIDAE. OWLS.

‡**Glaucidium nanum** (King). PATAGONIAN PYGMY OWL.

Chile: ♀, Arthur Island, March 10, 1939; 1 ♂, 3 ♀, Puerto Montt, March 20-21, 1939; ♀, Valparaiso, March 25, 1939.



†**Speotyto cunicularia nanodes** Berlepsch and Stolzmann. PERUVIAN  
BURROWING OWL.

Peru: 2 ♀, Lima (10 mi. E. by S.), March 31, 1939.

Family MICROPODIDAE. SWIFTS.

†**Micropus andecolus parvulus** (Berlepsch and Stolzmann). ANDEAN  
SWIFT.

Peru: 2 ♂, 1 ♀, Galera, April 1, 1939.

Family TROCHILIDAE. HUMMINGBIRDS.

**Patagona gigas peruviana** Boucard. PERUVIAN GIANT HUMMING-  
BIRD.

Peru: ♀, Lima (10 mi. E. by S.), March 31, 1939; ♂, Galera, April 1,  
1939.

**Colibri coruscans** (Gould). GOULD'S VIOLET-EAR.

Peru: ♂, Galera, April 1, 1939.

\*‡**Sephanoides sephaniodes** (Lesson and Garnot). CHILEAN FIRE-  
CROWN.

Chile: 1 ♂, 2 ♀, 1 not sexed, Mas-a-tierra Island, February 28-29,  
1936; im., Puerto Bueno, March 13, 1936; 1 not sexed, Guafo Island,  
March 19, 1936; ♀, Puerto Sárjento, Rio Huemules, March 11, 1939; ♀,  
Rio Huemules, March 17, 1939; ♂, Puerto Melinca, March 19, 1939.

Of these specimens only three are adult.

**Thaumaste fernandensis fernandensis** (King.). JUAN FERNANDEZ  
HUMMINGBIRD.

Chile: 2 ♂, 4 ♀, Mas-a-tierra Island, February 28-29, 1936.

‡**Saucerrotia edward edward** (Delattre and Bourcier). EDWARD'S  
HUMMINGBIRD.

Panama: ♂, Capira, April 13, 1939.

Family ALCEDINIDAE. KINGFISHERS.

†**Megaceryle torquata stellata** (Meyen). SOUTHERN RINGED KING-  
FISHER.

Chile: ♂ im., Puerto Bueno, March 13, 1936; 4 ♀, Golfo Elefantes,  
February 24-26, 1939; ♂, Kelly Harbor, March 14, 1939.

**Megaceryle torquata torquata** (Linnaeus). GREAT RINGED KINGFISHER.

Panama: ♂, Parita, April 13, 1939.

**Chloroceryle americana isthmica** (Goldman). ISTHMIAN GREEN KINGFISHER.

Panama: ♂, ♀, Parita, April 13, 1939.

Family MOMOTIDAE. MOTMOTS.

†**Momotus subrufescens conexus** Thayer and Bangs. SMALL-BILLED MOTMOT.

Panama: ♂, Capira, April 13, 1939.

Family PICIDAE. WOODPECKERS.

\*†**Ipocrantor magellanicus** (King). MAGELLANIC WOODPECKER.

Chile: ♂, ♀, Puerto Montt, March 20, 1939.

‡**Colaptes pitius pitius** (Molina). CHILEAN FLICKER.

Chile: 1 ♂, 2 ♀, Puerto Montt, March 20, 1939.

**Dyctiopicus lignarius** (Molina). RED-NAPED WOODPECKER.

Chile: ♀, Puerto Montt, March 21, 1939; ♂, Valparaiso, March 24, 1939.

**Centurus rubricapillus wagleri** (Salvin and Godman). WAGLER'S WOODPECKER.

Panama: ♂, Capira, April 13, 1939.

Family FURNARIIDAE. OVENBIRDS.

†**Geositta cunicularia fissirostris** (Kittlitz). CHILEAN MINER.

Chile: 2 ♂, 2 ♀, Valparaiso, March 24, 1939.

‡**Cinclodes patagonicus patagonicus** (Gmelin). PATAGONIAN CINCLODES.

Chile: ♂, Punta Arenas (25 mi. N.), March 9, 1936.

†*Cinclodes patagonicus chilensis* (Lesson). CHILEAN CINCLODES.

Chile: 3 ♂, 1 ♀, Puerto Harchy, February 22, 1939; ♀, Golfo Elefantes, February 25, 1939; ♀, Puerto Montt, March 20, 1939; 1 ♂, 2 ♀, Valparaiso, March 25, 1939.

In the Valparaiso birds the upperparts are slightly browner and the cinnamon wing-patches and tail-markings are more prominent than in the birds from farther south. The latter, however, are not in completely fresh plumage.

‡*Cinclodes oustaleti oustaleti* Scott. OUSTALET'S CINCLODES.

Chile: ♀, Puerto Bueno, March 13, 1936; ♂, Golfo Elefantes, February 25, 1939.

Compared with two males from Caldera, Province Atacama, March 21 and 22 (Field Museum collection), the specimens listed above are much grayer and have paler wing-markings. They are only slightly grayer than two males from Ancud, Chiloé Island (American Museum collection). In fact, the Carnegie Museum birds, which are in freshly molted plumage, are even grayer above and on the flanks than are two specimens of *C. o. hornensis* from Cape Horn (American Museum collection). In size they are well within the range of measurements of *C. o. oustaleti* given by Hellmayr. Dr. Hellmayr was not convinced that the variation in color is of racial significance, and it seems best to follow him in calling these birds typical *oustaleti*. Both localities are considerably south of Chiloé Island, which Hellmayr gives as the southern limit. Measurements of the specimens are: ♂: wing, 93; tail, 69; bill, 19; tarsus, 29; ♀: wing, 90; tail, 72; bill, 19.5; tarsus, 25.

†*Cinclodes fuscus fuscus* (Vieillot). DUSKY CINCLODES.

Chile: ♀, Punta Arenas (25 mi. N.), March 9, 1936; ♂, Puerto Bueno, March 13, 1936; ♂, Golfo Elefantes, February 25, 1939; 2 ♂, Rio de la Pascua, March 12, 1939; ♂, ♀, Kelly Harbor, March 14, 1939.

‡*Upucerthia dumetaria saturatior* Scott. CHILEAN EARTH-CREEPER.

Chile: ♂, Valparaiso, March 24, 1939.

\*‡*Sylviorthorhynchus desmursii* Gay. DES MURS'S SPINE-TAIL.

Chile: 3 ♂, Molyneux Sound, March 9, 1939; ♂, Puerto Sarjento, Rio Huemules, March 11, 1939; ♂, Rio de la Pascua, March 12, 1939.

\*†**Aphrastura spinicauda fulva** Angelina. CHILOÉ ISLAND CREEPER.

Chile: ♀, Puerto Lagunas, March 18, 1936.

Although Dr. Hellmayr calls this the only endemic form of Chiloé Island, Mr. Fricke's specimen comes from Melchor Island of the Guaitecas and is apparently the only record of the occurrence of this species away from Chiloé Island.

†**Aphrastura spinicauda spinicauda** (Gmelin). THORN-TAILED CREEPER.

Chile: 1 ♂, 1 not sexed, Bahía San Quintín, March 16, 1936; ♂, ♀, Golfo Elefantes, February 25, 1939; ♀, Punta Arenas, March 2, 1939; ♂, Molyneux Sound, March 9, 1939; ♂, Puerto Casma, March 15, 1939.

‡**Leptasthenura aegitholides aegitholides** (Kittlitz). TITLIKE SPINE-TAIL.

Chile: ♂, ♀, Valparaíso, March 24, 1939.

These specimens have been compared with the type of *L. fuscescens* Allen (American Museum of Natural History), which is said by Hellmayr to be a synonym of *L. ae. aegitholides*.

‡**Asthenes anthoides** (King). KING'S SPINE-TAIL.

Chile: ♂, Punta Arenas, March 2, 1939.

\*†**Pygarrhicus albo-gularis** (King). WHITE-THROATED TREE-RUNNER.

Chile: ♀, Puerto Sarjento, Río Huemules, March 11, 1939; 2 ♂, Río de la Pascua, March 12, 1939; ♀, Port Slight, Peninsula Tres Montes, March 16, 1939.

Family RHINOCRYPTIDAE. TAPACULOS.

\*†**Pteroptochos tarnii** (King). HUET-HUET.

Chile: ♂, ♀, Arthur Island, March 10, 1939; ♀, Puerto Sarjento, Río Huemules, March 11, 1939; 2 ♂, Río de la Pascua, March 12, 1939.

\*†**Scelorchilus rubecula** (Kittlitz). CHUCAO.

Chile: ♀, Bahía San Quintín, March 16, 1936; ♀, Puerto Lagunas, March 18, 1936; 4 ♂ (2 im.), 1 ♀, Golfo Elefantes, February 24-26, 1939.

Freshly molted specimens from Golfo Elefantes present an opportunity to confirm Dr. Hellmayr's suspicion that *S. r. nemorivaga* Wetmore is not tenable. These birds have been compared with the material from the Field Museum studied by Dr. Hellmayr. The two adult males are cer-

tainly not "darker" on the upper surface and tail than the Rio Inio specimen which Dr. Hellmayr had designated as most like the type of *nemorivaga*. They are less rufous, and the throat and chest are cinnamon rather than ferruginous. Birds from throughout the range vary individually but afford no evidence for the recognition of any valid races.

‡**Scytalopus magellanicus magellanicus** (Gmelin). MAGELLANIC BABBLER.

Chile: ♂, Puerto Harchy, February 22, 1939; 1 ♂, 3 ♀, Golfo Elefantes, February 25-26, 1939.

The male from Golfo Elefantes is the only fully adult specimen. The others have the buffy cross-barring that Dr. Hellmayr attributes to an immature stage of plumage.

\*‡**Eugralla paradoxa** (Kittlitz). KITTLITZ'S BABBLER.

Chile: ♀, Puerto Montt, March 20, 1939.

Family PIPRIDAE. MANAKINS.

**Manacus vitellinus vitellinus** (Gould). GOULD'S MANAKIN.

Panama: ♂, Capira, April 13, 1939.

Family TYRANNIDAE. TYRANT FLYCATCHERS.

‡**Xolmis pyrope** (Kittlitz). FIRE-EYED PEPOAZA.

Chile: ♂, Guafo Island, March 19, 1936; ♀, Port Slight, Peninsula Tres Montes, March 16, 1939; ♂, Rio Huemules, March 17, 1939; 2 ♂, 1 ♀, Valparaiso, March 24, 1939.

‡**Muscisaxicola macloviana mentalis** Lafresnaye and d'Orbigny. SMOKE-FRONTED GROUND-TYRANT.

Chile: 2 ♂, 2 ♀, Golfo Elefantes, February 25-26, 1939; 2 ♂, Arthur Island, March 10, 1939.

Four of these specimens are young birds with streaked throats and buffy edgings to the wing coverts. Wing measurements for two adult males are 104.5 and 100.5 mm.

‡**Lessonia rufa rufa** (Gmelin). RUFIOUS-BACKED GROUND-TYRANT.

Chile: 3 ♂, 1 ♀, Punta Arenas, March 2, 1939; ♂, Puerto Montt, March 20, 1939.

**Myiotheretes striaticollis striaticollis** (Sclater). STREAKED-THROATED  
GROUND-TYRANT.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939; ♂, Galera, April 1, 1939.

**Pyrocephalus rubinus obscurus** Gould. PACIFIC SCARLET FLY-  
CATCHER.

Peru: 3 ♂, 1 ♀, Lima (10 mi. E. by S.), March 31, 1939.

†**Pyrocephalus rubinus nanus** Gould. GALAPAGOS VERMILION FLY-  
CATCHER.

Galapagos Islands: 2 ♂, 2 ♀ [im.], James Island, April 7, 1939.

**Muscigralla brevicauda** Lafresnaye and d'Orbigny. SHORT-TAILED  
GROUND-TYRANT.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939.

**Muscivora tyrannus monachus** (Hartlaub). FORK-TAILED FLY-  
CATCHER.

Panama: 2 ♂, Parita, April 13, 1939.

**Tyrannus melancholicus chloronotus** Berlepsch. BERLEPSCH'S KING-  
BIRD.

Panama: 3 ♂, Parita, April 13, 1939.

**Myiozetetes similis columbianus** Cabanis and Heine. COLOMBIAN  
VERMILION-CROWNED FLYCATCHER.

Panama: ♂, ♀, Parita, April 13, 1939.

**Myiarchus ferox panamensis** Lawrence. PANAMA FLYCATCHER.

Panama: ♂, Parita, April 13, 1939.

\*†**Eribates magnirostris** (Gould). GALAPAGOS FLYCATCHER.

Galapagos Islands: 2 ♂, James Island, April 7, 1939.

\*†**Nesotriccus ridgwayi** Townsend. COCOS ISLAND FLYCATCHER.

Cocos Island: 2 ♂, February 10, 1936, and 3 ♂, 1 ♀, April 10, 1939.

An immature plumage, not hitherto described, is represented by the specimen C.M. 123,826, taken on April 10. It differs from the adult in the rusty buff color of the wing-bars and wing-edgings. Remains of juve-

nal plumage on the crown and nape indicate that these areas were also rusty buff. The under surface is duller and less yellowish than that of the adult, and the tail is more rufous. A more advanced stage is represented by the specimen C. M. 123,855, in which all the rusty buff color has disappeared from the crown and nape; the edgings of the wing feathers are paler, but the bars retain a rusty buff shade, less bright than in specimen No. 123,826. The tail is worn, but the body plumage has been almost entirely renewed.

‡**Spizitornis parulus parulus** (Kittlitz). TIT-LIKE TYRANT.

Chile: ♂, Molyneux Sound, March 9, 1939; ♂, Valparaiso, March 25, 1939.

Dr. Hellmayr gives Chiloé Island as the southern limit of typical *parulus*. The locality Molyneux Sound is farther south by more than six and one-half degrees of latitude. The specimen so labelled might be expected to represent the Tierra del Fuego race, *S. p. lippus* Wetmore. It is, however, indistinguishable from the Valparaiso specimen listed above and from Chiloé Island examples in the American Museum of Natural History.

‡**Spizitornis fernandezianus** (Philippi). JUAN FERNANDEZ TIT-LIKE TYRANT.

Chile: 2 ♂, Mas-a-tierra Island, February 28, 1936.

‡**Spizitornis reguloides albiventris** Chapman. WHITE-BELLIED TIT-LIKE TYRANT.

Peru: 2 ♂, Galera, April 1, 1939.

\*‡**Colorhamphus parvirostris** (Darwin). SMALL-BILLED TYRANT.

Chile: ♂, Puerto Montt, March 21, 1939.

**Elaenia flavogaster subpagana** Sclater and Salvin. NORTHERN YELLOW-BELLIED ELAENIA.

Panama: 2 ♀, Capira, April 13, 1939.

†**Elaenia albiceps modesta** Tschudi. PERUVIAN ELAENIA.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939.

†**Elaenia albiceps chilensis** Hellmayr. CHILEAN ELAENIA.

Chile: ♂, off coast, 35° 39' S., 72° 51' W., March 3, 1936; ♂, Puerto Harchy, February 22, 1939; ♂, Laguna San Rafael, February 24, 1939; ♂, Golfo Elefantes, February 25, 1939; ♂, Punta Arenas, March 2, 1939; 3 ♂, 1 ♀, Puerto Montt, March 20-21, 1939.

## Family PHYTOTOMIDAE. PLANT-CUTTERS.

†**Phytotoma rara** Molina. CHILEAN PLANT-CUTTER.

Chile: 2 ♂, Puerto Montt, March 20-21, 1939.

## Family HIRUNDINIDAE. SWALLOWS.

†**Progne modesta modesta** Darwin. GALAPAGOS MARTIN.

Galapagos Islands: ♀, Seymour Island, April 6, 1939.

**Pygochelidon cyanoleuca peruviana** Chapman. PERUVIAN SWALLOW.

Peru: ♂, Galera, April 1, 1939.

**Orochelidon murina** (Cassin). BROWN-BELLIED SWALLOW.

Peru: ♂, Galera, April 1, 1939.

†**Iridoprocne leucopyga** (Meyen). CHILEAN SWALLOW.

Chile: ♂, Golfo Elefantes, February 23, 1939.

## Family CORVIDAE. CROWS, JAYS.

**Cyanocorax affinis zeledoni** Ridgway. TALAMANCA JAY.

Panama: ♂, ♀, Parita, April 13, 1939.

## Family TROGLODYTIDAE. WRENS.

†**Cistothorus platensis hornensis** (Lesson). CAPE HORN GRASS WREN.

Chile: ♂, ♀, Golfo Elefantes, February 25, 1939; ♀, Puerto Sarjento, Rio Huemules, March 11, 1939; ♀, Rio de la Pascua, March 12, 1939.

**Thryophilus modestus elutus** (Bangs). PANAMA WREN.

Panama: ♂, Capira, April 13, 1939.

†**Troglodytes musculus atacamensis** Hellmayr. ATACAMA HOUSE WREN.

Chile: ♂, ♀, Tocopilla, March 28, 1939.



†**Troglodytes musculus chilensis** Lesson. CHILEAN HOUSE WREN.

Chile: ♀, Salado Bay, March 25, 1936; ♂, Puerto Montt, March 20, 1939; ♂, Valparaiso, March 24, 1939.

Family MIMIDAE. MOCKING THRUSHES.

**Mimus thenca** (Molina). CHILEAN MOCKINGBIRD.

Chile: ♂, ♀, Valparaiso, March 24-25, 1939.

**Nesomimus parvulus parvulus** (Gould). ALBEMARLE ISLAND MOCKINGBIRD.

Galapagos Islands: ♂, ♀, Seymour Island, February 13, 1936; ♂, ♂ juv., Conway Bay, Indefatigable Island, April 7, 1939.

†**Nesomimus parvulus bauri** Ridgway. TOWER ISLAND MOCKINGBIRD.

Galapagos Islands: ♂, Tower Island, April 8, 1939.

Family TURDIDAE. THRUSHES.

**Turdus falcklandii magellanicus** King. CHILEAN ROBIN.

Chile: ♂, ♀, ♂ juv., Mas-a-tierra Island, February 28-29, 1936; ♂, Agostini Bay, March 10, 1936; 4 ♂, 1 ♂ juv., Golfo Elefantes, February 24-26, 1939; ♂, ♂ juv., Kelly Harbor, March 14, 1939.

**Turdus grayi casius** (Bonaparte). BONAPARTE'S THRUSH.

Panama: ♂, Capira, April 13, 1939.

**Turdus chiguanco chiguanco** Lafresnaye and d'Orbigny. D'ORBIGNY'S OUZEL.

Peru: ♂, ♂ juv., Galera, April 1, 1939.

Family MOTACILLIDAE. WAGTAILS, PIPITS.

†**Anthus correndera chilensis** (Lesson). CHILEAN PIPIT.

Chile: 2 ♂, 1 ♀, Punta Arenas, March 2, 1939.

Family COMPSOTHTLYPIDAE. WOOD WARBLERS.

†**Dendroica petechia aureola** (Gould). GALAPAGOS GOLDEN WARBLER.

Cocos Island: 1 ♂, 2 ♀, February 10, 1936, and April 10, 1939. Galapagos Islands: ♀, Seymour Island, April 6, 1939; 2 ♂, 1 ♀, Conway Bay, Indefatigable Island, April 7, 1939.

## Family ICTERIDAE. TROUPIALS.

**Molothrus bonariensis bonariensis** (Gmelin). SHINY COWBIRD.

Chile: ♀, off coast, lat. 24° S., February 22, 1936.

According to Mr. Fricke, this bird, an immature female in streaked plumage, flew on board ship. Its measurements agree with those of *Molothrus b. bonariensis*.

**Icterus galbula** (Linnaeus). BALTIMORE ORIOLE.

Panama: ♂, Capira, April 13, 1939.

†**Agelaius thilius thilius** (Molina). CHILEAN YELLOW-SHOULDERED MARSH BIRD.

Chile: 2 ♂, 1 ♀, Valparaiso, March 24, 1939.

\*†**Notiopsar curaeus** (Molina). CHILEAN BLACKBIRD.

Chile: 2 ♂, Guafo Island, March 19, 1936; ♀, Golfo Elefantes, February 25, 1939; 3 ♂, 1 ♀, Valparaiso, March 24-25, 1939.

**Pezites militaris bellicosa** (Filippi). PACIFIC RED-BREASTED STARLING.

Peru: ♂, Galera, April 1, 1939.

**Pezites militaris militaris** (Linnaeus). RED-BREASTED STARLING.

Chile: ♂, ♀, Punta Arenas, March 2, 1939; 6♂, 2 ♀, Puerto Montt, March 20-21, 1939; 3 ♂, Valparaiso, March 24, 1939.

## Family THRAUPIDAE. TANAGERS.

**Tanagra luteicapilla** (Cabanis). YELLOW-CROWNED EUPHONIA.

Panama: ♂ im., Parita, April 13, 1939.

**Pipraeidea melanonota venezuelensis** (Sclater). WESTERN DARK-BACKED TANAGER.

Peru: "♂" [plumage indicates ♀], Galera, April 1, 1939.

**Thraupis episcopus diaconus** (Lesson). NORTHERN GRAY TANAGER.

Panama: ♂, ♀, Capira, April 13, 1939.

**Thraupis bonariensis darwini** (Bonaparte). DARWIN'S TANAGER.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939; ♂, ♀, Galera, April 1, 1939.

**Habia gutturalis erythrolaema** (Slater). SOUTHERN DUSKY-TAILED  
ANT Tanager.

Panama: ♂, Capira, April 13, 1939.

Since this specimen is immature, it has been placed here mainly on geographic grounds.

Family FRINGILLIDAE. FINCHES.

**Pheucticus chrysopleplus chrysogaster** (Lesson). GOLDEN-BELLIED  
GROSBEAK.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939; ♂, Galera, April 1, 1939.

\*† **Geospiza magnirostris** Gould. LARGE-BILLED GROUND FINCH.

Galapagos Islands: 4 ♂, 1 ♀, Tower Island, April 8, 1939.

The female is a black-billed adult in worn plumage, heavily streaked below. Three males are in full breeding dress and have black bills. One male, C.M. 123,791, is a young bird with the feathers of the upperparts edged with rust-color, paler on the back and more pronounced on the wing coverts; the throat and breast are heavily streaked with black, but the middle of the abdomen is unstreaked and grayish in color; the lower mandible is yellow with a triangular brownish spot at its base.

† **Geospiza fortis** Gould. STURDY GROUND FINCH.

Galapagos Islands: 2 ♂, 2 ♀, Seymour Island, April 6, 1939; 8 ♂, 1 ♀, Conway Bay, Indefatigable Island, April 7, 1939; 4 ♂, 1 ♀, James Island, April 7, 1939.

Seven of these specimens are black-billed males in breeding dress. One, C.M. 123,736, is evidently a young bird with new wing quills and the tail not fully grown; its bill is brown above and particolored below.

† **Geospiza fuliginosa fuliginosa** Gould. SOOTY GROUND FINCH.

Galapagos Islands: ♂, Daphne Major, February 13, 1936; 2 ♂, Seymour Island, April 6, 1939; 4 ♂, 2 ♀, Conway Bay, Indefatigable Island, April 7, 1939; 2 ♂, James Island, April 7, 1939.

Among these specimens are two black-billed males and one black-billed female. Two of the others are clearly immature.

‡*Geospiza difficilis acutirostris* Ridgway. SHARP-BILLED GROUND FINCH.

Galapagos Islands: 7 ♂, 1 ♀, Tower Island, April 8, 1939.

Five males are black with black bills; two are obviously immature.

‡*Geospiza scandens intermedia* Ridgway. INTERMEDIATE GROUND FINCH.

Galapagos Islands: 2 ♀, Daphne Major, February 13, 1936; 2 ♂, 2 ♀, Seymour Island, April 6, 1939; 5 ♂, 2 ♀, Conway Bay, Indefatigable Island, April 7, 1939.

Four males from Indefatigable Island are black adults with black bills.

‡*Geospiza conirostris propinqua* Ridgway. TOWER ISLAND GROUND FINCH.

Galapagos Islands: 2 ♂, 1 ♀, Tower Island, April 8, 1939.

The males are black-billed adults.

\*‡*Platypiza crassirostris* (Gould). DARWIN'S GROUND FINCH.

Galapagos Islands: ♂, James Island, April 7, 1939.

\*‡*Camarhynchus parvulus parvulus* (Gould). BLACK-HEADED GROUND FINCH.

Galapagos Islands: 1 ♂, 2 ♀, James Island, April 7, 1939.

\*‡*Certhidea olivacea mentalis* Ridgway. LEAD-COLORED CERTHIDEA.

Galapagos Islands: ♂, Tower Island, April 8, 1939.

†*Certhidea olivacea olivacea* Gould. OLIVACEOUS CERTHIDEA.

Galapagos Islands: ♂, James Island, April 7, 1939.

*Pinaroloxias inornata* (Gould). COCOS ISLAND FINCH.

Cocos Island: 3 ♂, 1 ♂ im., February 10, 1936; 2 ♂, 3 ♀, April 10, 1939.

All the males except a single immature are in black adult plumage with black bills.

*Sporophila telasco* (Lesson). CHESTNUT-THROATED SEED-EATER.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939.

†*Sporophila minuta centralis* Bangs and Penard. PANAMA SEED-EATER.

Panama: ♂, Parita, April 13, 1939.

**Catamenia analis analoides** (Lafresnaye). LAFRESNAYE'S SEED-EATER.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939; ♂, Galera, April 1, 1939.

†**Volatinia jacarina peruviansis** (Peale). PACIFIC BLUE-BLACK GRASS-QUIT.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939.

**Spinus magellanicus capitalis** (Cabanis). CABANIS'S SISKIN.

Peru: ♂, Lima (10 mi. E. by S.), March 31, 1939.

‡**Spinus barbatus** (Molina). BLACK-CHINNED SISKIN.

Chile: ♂, ♀, Molyneux Sound, March 9, 1939; ♀, Puerto Sarjento, Rio Huemules, March 11, 1939; ♀, Rio de la Pascua, March 12, 1939; ♂, Puerto Montt, March 20, 1939; 2 ♂, Valparaiso, March 24, 1939.

**Diuca diuca diuca** (Molina). CHILEAN DIUCA FINCH.

Chile: ♂, ♀, Puerto Montt, March 20, 1939; ♀, Valparaiso, March 24, 1939.

‡**Phrygilus patagonicus** Lowe. PATAGONIAN GRAY-HEADED FINCH.

Chile: ♀, Puerto Bueno, March 13, 1936; ♂, "♂" [apparently ♀], Golfo Elefantes, February 23, 1939; 2 ♂, 1 ♀, Arthur Island, March 10, 1939; 2 ♂, 1 ♀, Puerto Sarjento, Rio Huemules, March 11, 1939.

‡**Atlapetes nationi nationi** (Sclater). NATION'S ATLATPETES.

Peru: ♂, ♀, Galera, April 1, 1939.

†**Arremonops conirostris striaticeps** Ridgway. MARACAIBO SPARROW.

Panama: ♂, Capira, April 13, 1939.

†**Zonotrichia capensis antofagastae** Chapman. ANTOFAGASTA SPARROW.

Chile: 2 ♂, Tocopilla, March 28, 1939.

These specimens were a part of the series upon which Dr. F. M. Chapman based his description of the race.

†*Zonotrichia capensis chilensis* (Meyen). CHILEAN SPARROW.

Chile: 2 ♂, Golfo Elefantes, February 23, 1939; ♂ juv., ♀ juv., Puerto Montt, March 20-21, 1939.

The black crown-stripes in the specimens from Golfo Elefantes are indicated but are more or less incomplete or broken. They mark the transition to *australis*. The breeding form at Puerto Montt is *chilensis*; the adults collected there, however, are regarded by Dr. Chapman as migrants belonging to the race *australis*.

†*Zonotrichia capensis australis* (Latham). PATAGONIAN SPARROW.

Chile: ♂, ♀, Punta Arenas (25 mi. N.), March 11, 1936; 2 ♂, Puerto Sarjento, Rio Huemules, March 11, 1939; ♂, ♂ juv., Puerto Casma, March 15, 1939; 2 ♂, 1 ♀, Puerto Montt, March 20-21, 1939.

Dr. Chapman has commented on the Puerto Sarjento birds as being "nearer *australis*, with which one of them, in head-markings, agrees, while the other has broken black crown-stripes, as in the Elefantes birds." The adults from Puerto Montt he considers migrants, as stated above. Puerto Casma specimens represent the transition to *chilensis*.

#### REFERENCES

BRODKORB, PIERCE.

Geographical variation in *Belonopterus chilensis* (Molina).—*Occasional Papers Museum of Zoology, University of Michigan*, No. 293, June 29, 1934, p. 1-13.

CHAPMAN, FRANK M.

The distribution of bird life in the Urubamba Valley of Peru.—*Bulletin U. S. National Museum*, 117, 1921, p. 1-138.

The post-glacial history of *Zonotrichia capensis*.—*Bulletin American Museum of Natural History*, vol. 77, December 10, 1940, p. 381-438.

CORY, CHARLES B.

Catalogue of birds of the Americas and the adjacent islands.—*Field Museum of Natural History, Zoological Series*, vol. 13, part 2, no. 1, 1918; no. 2, 1919.

CORY, CHARLES B., and HELLMAYR, CHARLES E.

Catalogue of birds of the Americas and the adjacent islands.—*Field Museum of Natural History, Zoological Series*, vol. 13, part 3, 1924; part 4, 1925; part 5, 1927.

FISHER, ALBERT K., and WETMORE, ALEXANDER.

Report on birds recorded by the Pinchot Expedition of 1929 to the Caribbean and Pacific.—*Proceedings U. S. National Museum*, vol. 79, 1931, article 10, p. 1-66.

GIFFORD, EDWARD WINSLOW.

Expedition of the California Academy of Sciences to the Galapagos Islands, 1905-1906. VIII.—*Proceedings California Academy of Sciences*, vol. 2, 1913, p. 1-132; XIII (notes on birds), *idem.*, vol. 2, p. 189-258.

GRISCOM, LUDLOW.

The ornithology of the Republic of Panama.—*Bulletin Museum of Comparative Zoölogy*, vol. 78, 1935, p. 261-382.

HELLMAYR, CHARLES E.

Catalogue of birds of the Americas and the adjacent islands.—*Field Museum of Natural History, Zoological Series*, vol. 13, part 6, 1929; part 7, 1934; part 8, 1935; part 9, 1936; part 10, 1937; part 11, 1938.

HELLMAYR, CHARLES E.

The birds of Chile.—*Field Museum of Natural History, Zoological Series*, vol. 19, 1932, p. 1-472.

MORRISON, ALASTAIR.

Brief notes on the birds of south Chile.—*Ibis*, April, 1940, p. 248-256.

MURPHY, ROBERT CUSHMAN.

Oceanic birds. Vols. 1-2, 1936, p. i-xxii, 1-1245.

PETERS, JAMES LEE.

Check-list of birds of the world. Vols. 1-4, 1931-1940.

SWARTH, HARRY S.

The avifauna of the Galapagos Islands.—*Occasional Papers California Academy of Sciences*, vol. 18, 1931, p. 1-299.

WETMORE, ALEXANDER.

New subspecies of birds from Patagonia.—*University of California Publications in Zoology*, vol. 21, June 16, 1923, p. 333-337.

ZIMMER, JOHN T.

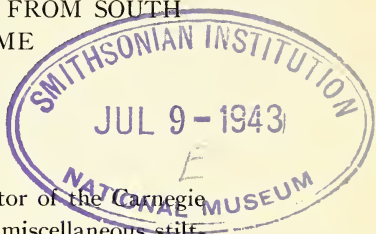
Birds of the Marshall Field Peruvian Expedition, 1922-1923.—*Field Museum of Natural History, Zoological Series*, vol. 17, 1930, p. 233-480.





ART. XVI. NEW NEIDIDAE (HEMIPTERA) FROM SOUTH  
AMERICA, WITH NOTES ON SOME  
LITTLE-KNOWN SPECIES

BY HALBERT M. HARRIS  
IOWA STATE COLLEGE, AMES, IOWA.



Through the courtesy of Doctor A. Avinoff, Director of the Carnegie Museum, I have had the privilege of studying some miscellaneous still bugs belonging to the museum's collections. Although only a few individuals were represented, they included five new species. Two of these new forms are so unlike any previously known *Neididae* that it has been necessary to erect new genera for them.

In the descriptions the measurements given, cited as proportions, were made with an eye-piece micrometer on which 23 lines equal one millimeter. The holotypes of the new forms are deposited in the Carnegie Museum.

**Xenoloma**, new genus

Body small, moderately stout, shiny. Head short, unarmed, the vertex tumid, and in front distinctly separated from the tylus. Eyes moderate. Ocelli wide apart, placed near inner angle of eyes, slightly projecting laterally, about equidistant from eyes and pronotum. Antennae moderately slender, shorter than the body, inserted rather high in front of eyes, the basal segment slightly shorter than second and third segments conjoined, enlarged on distal one-fourth; second faintly shorter than third, and subequal to four, the latter stoutest. Rostrum extending between hind coxae, the basal segment long, barely reaching prosternum. Pronotum swollen and strongly arched, only feebly constricted between the lobes, strongly punctate and clothed with erect, pale hairs, the front lobe much raised above the head, the hind lobe with a conspicuous raised smooth, pale, median line, the posterior area laminate explanate, angularly produced backward over scutellum and clavus, the apex of the produced portion deeply angularly excised so that it is bifid. Scutellum not visible, completely covered by the pronotum. Hemelytra complete, narrowed basally, hyaline, impunctate, the outer cell of corium narrowed distally, extending to middle of membrane. Sides of prothorax strongly

punctate, produced into a conspicuous laterally projecting tuberosity. Metapleuron rather sharply rounded behind, unarmed, shiny except for the triangular evaporative area occupying the upper anterior angle, punctate behind the wide, shallow, ostiolar channel. Sternum and basal segment of venter channeled for the reception of the rostrum, the venter smooth, impunctate. Legs slender, the femora enlarged on distal half. Segment III of venter long, in female as long as remaining segments combined, in male apparently fused with IV and these together about twice as long as the more apical segments conjoined. Male genital capsule slightly swollen.

Genotype, *Xenoloma princeps* sp. nov.

On the basis of the nature of the head, the unpunctate venter, and the general facies, this new genus belongs to the *Metacanthinae*. It is distinct from previously known genera by reason of the unarmed and hidden scutellum and the peculiar characters of the pronotum.

#### ***Xenoloma princeps*, sp. nov.**

Testaceous, the head, front lobe of pronotum, thorax laterally and beneath, except for front and middle acetabula, the base and apex of rostrum, the coxae, femora in large part, bases of front and middle tibiae, and the hind tibia except at apex, darker, varying through brownish- to fuscous-black. Smooth median line of pronotum yellowish-testaceous to luteous. Antennal fossa, margin of produced basal part of pronotum, trochanters, apical parts of tibiae, and distal segments of venter before genital segments, whitish-testaceous. Head faintly broader than long, vertex sometimes with median pale line, with pale hairs along the middle and in an irregular row on each side extending forward to antennal insertion. Interocular groove distinct, more-or-less hidden from above by the prominent front of pronotum; distance from ocellus to eye not greater than diameter of an ocellus. Antennal I not two-thirds as long as head and pronotum; proportions, 24:12:14:12. Rostral proportions, 10:10:6:9. Pronotum prominently pilose, the smooth median line extending from interlobe constriction to the declivent post-humeral part; edge of expanded basal portion reflexed. Hemelytra pale, the vein at base of membrane dark; membrane extending beyond apex of abdomen, with five or six straight veins. Legs setose, the middle and hind femora and the hind tibiae somewhat bowed; tarsi three-segmented, the basal segment longest, the second shortest. Male genital segments pilose beneath.

*Length*, 3.8—4.0 mm. *Width*, across humeri, 1.0 mm.

*Holotype*, male, *allotype*, female, and two *paratypes*, Chapada, Brazil, Acc. no. 2966, Carnegie Museum (holotype and allotype in collection of Carnegie Museum).

The specimens show some variation in the size of the lateral prothoracic prominences, the shape of the notch of basal extension of the pronotum, as well as color. These differences may be sexual.

### **Phaconotus**, new genus

Small, slender, and shiny. Head relatively long and slender, distinctly longer than broad; postocular part fully as long as antecular, its sides parallel; vertex slightly arched, not produced in front, distinctly separated from tylus. Eyes relatively small. Ocelli about as far from eyes as from each other, equidistant from lateral margins of head and front of pronotum. Antennae slender, the basal joint only slightly enlarged distally, the apical joint stout, segment I only slightly longer than head and pronotum together, II a little longer than III, II and III together a little longer than I, IV subequal to III. Rostrum extending on metasternum, segment I reaching to middle of postocular head.

Pronotum sharply divided into two lobes, the front lobe only moderately raised, smooth, shiny; armed with eleven white, ovate tubercles each of which gives off a pale seta at its summit, two of the tubercles at the front angles, five in a row across the transverse impression, two on the disc and one on each side between front angle and transverse impression; hind lobe unarmed, arched, coarsely punctate, declivent behind; the hind margin explanate, slightly reflexed, sharply roundly excised in front of scutellum. Scutellum small, its apical part produced almost vertically into a short, stout, ivory-white spur. Hemelytra hyaline, slightly embrowned. Propleuron shiny, smooth in front of transverse constriction except for a few punctures on collar, with a calloused spot above the acetabulum; behind the constriction coarsely punctate, the ventral edge forming a short, calloused ridge posterior to acetabulum. Mesopleuron with a calloused, ivory spot above the acetabulum. Metapleuron with the front half dull, the rest shiny, without evidence of an ostiolar spine. Legs moderately long, and moderately stout, the femora gradually thickened distally, the hind femora distinctly surpassing apex of abdomen.

Genotype, *Phaconotus ensis* sp. nov.

Belonging to the *Metacanthinae*, but distinct from other known genera

by virtue of the peculiar armature of the pronotum and scutellum, and the characters of the head and metapleuron.

**Phaconotus ensis**, sp. nov.

Testaceous, a median line on vertex, a calloused line in front of each eye, reflexed basal margin of pronotum, and venter paler; armature of pronotum and scutellum ivory white, legs and first two antennal segments annulate with brown; distal antennal segment fuscous, apices of rostrum and tarsi piceous. Head longer than broad, the inter-ocular groove strongly concave. Antennae sparsely pilose, the basal segment with seven or eight dark rings, and the second segment with five or six; proportions, 26:15:12:12. Bucculae very low and short. Gula slightly swollen. Rostral proportions, 7:6:7:6.

Pronotum about one-third longer than broad, the collar set off by a row of faint punctures, the humeral corners and the transverse impression before the reflexed basal margin embrowned to fuscous; the tubercles of the front lobe varying in size, the median one in the transverse impression being largest and obovate in shape. Scutellar spine pointed, as seen from the side about one and one-half times as high as broad. Hemelytra less strongly widened from the base than in *Pronotacantha annulata* Uhler, the venation apparently about as in that species. Legs slender, pilose, the hind tibiae as long as distance from apex of head to base of genital segments. Venter slightly enlarged distally. Male genital segment angularly produced at the middle of its upper hind margin.

*Length*, 3.0 mm. *Width* of pronotum, 0.6 mm.

*Holotype*, male, Bahia, Brazil, October 26, 1907 (Carnegie Museum).

In this species the metapleuron is constructed much as in *Pronotacantha annulata* Uhler, but is larger, without evidence of the pale protuberance on the dull, front portion, and the upper hind margin is slightly more sharply produced. The basal segments of the venter are somewhat obscured but apparently are united as in related genera.

**Protacanthus nexus**, sp. nov.

Pale yellowish- to whitish-testaceous; the head shiny black except for a rectangular spot between ocelli and the collum beneath; apical antennal segment fuscous, the basal segment and the femora speckled or irregularly annulate with brown; tibiae finely annulate with brown. Antennal proportions, 52:28:22:16. Rostrum extending on metasternum, the basal

segment barely attaining collum. Pronotum strongly raised and widened behind the constriction, the hind lobe with distinct median carina, the front lobe small, flat, impunctate between constriction and collar, the front margin calloused, pale, ending on each side in a short, stout upwardly and outwardly projecting tooth. Scutellar spine long, slender, curved. Hemelytra pale. Upper margin of male genital capsule slightly, angularly produced at the middle between the claspers.

*Length* to tip of membrane, 4.1—4.3 mm. *Width*, 0.65 mm.

*Holotype*, male and *allotype*, female, Bahia, Brazil, Oct. 24, 1907 (in Carnegie Museum). *Paratypes*, male, Bahia, Brazil; male, Rio de Janeiro, Brazil; female, Entre Rios, Brazil, and female, Ururahy, near Rio de Janeiro, Brazil.

This small species is almost exactly like *Protacanthus decorus* Uhler, in size, markings, and proportional lengths of the segments of the appendages. It appears distinct by reason of the armature of the front pronotal angles, the teeth there being only about as long as they are broad. The basal margin of the pronotum is a little more sharply, and more deeply excavated in front of the scutellum than in Uhler's species. The structure of the metapleuron and its ostiole is exactly as in *decorus*, and of the same general nature as in *Gampsocoris elegans* (Curtis), although the ostiolar process is narrower and less broadly expanded at the tip. Further study of *Gampsocoris* Fuss and *Protacanthus* Uhler (= *Anchenoplus* Bergroth) possibly may show that the latter deserves only subgeneric rank.

### **Jalysus sobrinus Stål**

1862. *Jalysus sobrinus* Stål, Rio Janeiro Hemip., 2:60.

1921. *Jalysus sobrinus* Pennington, List Hemipt. Heterop. Repub. Argentina, 2:17.

A long series of an apparently somewhat variable species that I take to be *sobrinus* Stål is at hand from Chapada, Bahia, Entre Rios, Boqueirao, Rio de Janeiro, E. Santo, Munez Freite, and Santarem, Brazil; Cacagualito, Colombia; Santa Lucia, Miranda and Puerto la Cruz, Dist. Federal, Venezuela; Los Juntas, Cuatro Ojos, and Villa Bella, Bolivia; and Rio Bermejo, Prov. Salto, Argentina. I have previously seen it from Venezuela and Panama, and it is recorded in the literature from Brazil and Argentina.

The male always has a conspicuous, although small, shiny brown point on each side of the genital segment beneath, and the apical margin of the

genital segment is deeply, somewhat rectangularly excised. The claspers are curved and pointed. The legs and basal antennal segment are speckled and the ostiolar spine is pale with the tip dark. Antennal IV is slender, black, with the apical fourth, excepting extreme tip, white. Unless I confuse two very closely related species there is considerable variation in the length of the scutellar spine.

### **Parajalysus nigrescens** Distant

1903. *Parajalysus nigrescens* Distant, Ann. Soc. Ent. Belg., 47:44.

Two female specimens, Chapada, Brazil, November.

Allied to *andinus* Horvath, but vertex without discrete protuberance between base of antennae, the front lobe of pronotum not so strongly raised, with distinct callosities in anterior lateral angles, the spines black, stouter than in *andinus*, the median basal one longest, before its base subequally as thick as club of antennal I. Antennal proportions, 90:37:-40:35. Rostrum extending on metasternum, segment I reaching behind eyes; proportions, 12:12:10:11. Bucculae short and high as in *andinus* Horvath.

### **Parajalysus andinus** Horvath

1905. *Parajalysus andinus* Horvath, Ann. Mus. Nat. Hung., 3:60.

Several specimens that appear to agree in all respects with Horvath's description are at hand from Las Juntas, Bolivia, Cuatros Ojos, Bolivia, and Villa Bella, Bolivia. There is, also a mutilated male specimen from Santarem, Brazil. Heretofore the species has been known from Peru and Bolivia. The following descriptive notes may aid in its recognition.

Head shiny, impunctate, vertex distinctly produced into a short, obtuse, forward projecting prominence. Antennae black, the extreme base of first segment pale; proportions, 125:52:57:40; the length of club on first segment subequal to width of vertex. Bucculae short, high. Rostrum reaching on metasternum, segment I hardly reaching a point opposite hind margin of eyes; proportion of segments, 9:13:11:13. Pronotum with indistinct collar, strongly, almost vertically raised in front, coarsely punctate except for a broad area around base of spine on front lobe; spines black, relatively slender, plainly not as stout basally as the club of antennal I, the one on anterior lobe almost straight and vertical, the median basal spine longest, as long as distance between humeral spines. In

female, front pronotal lobe not so rounded or globose, the two lobes separated by a distinct, rather deep, transverse impression. Legs long, fuscous to black.

***Parajalysus pallidus*, sp. nov.**

Small and paler than *andinus* Horvath, with legs and basal antennal segment speckled with black. Pronotal spines pale with black tips, the humeral spines sometimes infuscate. Vertex swollen, from above, distinctly angular in front, but not as strongly so as in *nigrescens* Dist., sharply declivent and carinate between the antennae. Antennal proportions, 93:42:40:30. Bucculae low, longer than high. Rostrum with basal segment proportionately longer than in *andinus*, reaching opposite ocellus; proportions, 12:12:10:12. Pronotum from above with a calloused prominence in front behind each ocellus, the front corners distinctly angular; broadly constricted between the lobes, the surface as seen from the side strongly sinuate, the median basal spine semi-erect, plainly not continuing the contour of the hind lobe; front spine faintly curved forward, slightly longer than median basal one, the humeral spines shortest. Male genital capsule angularly produced at upper hind margin.

*Length*, 6.0 mm. *Width*, 1.1 mm.

*Holotype*, male, Chapada, Brazil (in Carnegie Museum). *Paratypes*, 3 males, Chapada, Brazil (in Carnegie Museum and collection of author).

The pronotum is punctate in front and on the hind lobe and its basal margin is broadly, shallowly sinuate in front of the scutellum.

***Parajalysus nannus*, sp. nov.**

Pale flavo-testaceous, the apical antennal segment fuscous, the tips of pronotal spines and of rostrum and tarsi piceous; the basal antennal segments and the femora and tibiae speckled with brown. Vertex evenly rounded, in front without evidence of protuberance or carina. Antennae fine, the third segment sometimes embrowned; proportions, 73:36:32:28. Bucculae low. Rostrum extending on metasternum, segment I attaining a point opposite ocelli; proportions, 10:12:10:12.

Pronotum sharply differentiated into two lobes, the front lobe comparatively low, impunctate except for area anterior to spine, the front margin nearly straight, the front angles distinct, but not raised-calloused as in *pallidus*; hind lobe high, thickly punctate, with distinct median smooth line; pronotal spines long, the anterior one almost upright but

curving slightly forward, the others oblique and curved backward, the median basal one longest. Scutellum small, the tip calloused and white. Hemelytra hyaline, the membrane with a brownish patch at its base. Front acetabulum and propleuron dorsal to it, impunctate. Metastethium about as in other species of the genus, the pale raised part on the evaporative area proportionately larger and higher. Femoral clubs stout. Male genital capsule narrowed apically, its upper margin sharply produced at the middle; the claspers short, broad.

*Length*, 4.7 mm. *Width* at base of pronotum, 0.95 mm.

*Holotype*, male, and *allotype*, female, Chapada, Brazil (in Carnegie Museum). *Paratypes*, male and 2 females, Chapada, Brazil.

In some of the specimens there is an indication of the darker markings that occur on the head of other species. As seen from the side, the front pronotal lobe is mostly a conical base for the discal spine.





## INDEX

- Academy of Natural Sciences, 1  
acclivis, *Leodicites*, 256  
accuratus, *Palecononites*, 250, 252  
*Acestrura* *astreans*, 360  
    *heliodori*, 360  
    *mulsanti*, 360  
*acis*, *Strymon*, 390  
*Actitis* *macularia*, 423  
*acutirostris*, *Geospiza* *difficilis*, 438  
*addæ*, *Ocreatus*, 347  
*adelæ*, *Oreotrochilus*, 339  
*Adelomyia* *cervina*, 335  
    *floriceps*, 335  
    *inornata*, 335  
    *melanogenys æneosticta*, 335  
        *melanogenys*, 335  
*adorabilis*, *Paphosia*, 297  
*adpersus*, *Crypturellus* *undulatus*, 16  
*Aechmophorus* *major*, 413  
*aegitholides*, *Leptasthenura* *aegitholides*,  
    430  
*ænea*, *Glaucis*, 276  
*æneicauda*, *Chalybura* *buffoni*, 333  
*æneosticta*, *Adelomyia* *melanogenys*, 335  
*æneoviridis*, *Riccordia* *ricordi*, 306  
*æquatorialis*, *Androdon*, 273  
    *Campylopterus* *obscurus*, 288  
    *Heliodoxa* *rubinoides*, 336  
    *Lesbia* *victoriæ*, 347  
    *Popelairia* *conversi*, 298  
*æquinoctialis*, *Procellaria*, 414  
*affinis*, *Glaucis* *hirsuta*, 276  
*Agelaius* *thilius thilius*, 436  
*Aglæactis* *cupripennis cupripennis*, 339  
    *pamelæ*, 339  
*Aglaiocercus* *berlepschi*, 354  
    *caudatus*, 352  
    *emmæ*, 352  
    *kingi*, 353  
    *margarethæ*, 353  
    *smaragdinus*, 353  
*alba*, *Crocethia*, 423  
*albiventris*, *Spizitornis* *reguloides*, 433  
*albo-gularis*, *Pygarrhicus*, 430  
*albogularis*, *Schistes*, 354  
*alexandri*, *Archilochus*, 359  
*alicïæ*, *Amazilia* *tobaci*, 326  
    *Chlorostilbon*, 304  
*altera*, *Ammospiza* *caudacuta*, 205  
*amabilis*, *Amazilia* *amabilis*, 329  
*Amazilia* *amabilis amabilis*, 329  
    *costaricensis*, 330  
    *amazilia amazilia*, 328  
    *beryllina viola*, 329  
    *candida candida*, 324  
    *chionopectus chionopectus*, 319  
        *orienticola*, 319  
        *whitelyi*, 319  
    *cycnocephala guatemalensis*, 328  
    *decora*, 330  
    *edwardi edwardi*, 325  
    *fimbriata apicalis*, 322  
        *elegantissima*, 323  
    *fimbriata*, 321  
    *maculicauda*, 322  
    *nigricauda*, 321  
    *franciæ*, 323  
    *hoffmanni*, 325  
    *hollandi*, 320  
    *leucogaster*, 320  
    *milleri*, 320  
    *niveoventer*, 326  
    *rosenbergi*, 330  
    *rutila rutila*, 329  
    *saucerottei braccata*, 324  
        *saucerottei*, 324  
        *warsceviczi*, 324  
    *tobaci alicïæ*, 326  
    *erythronota*, 326  
    *feliciæ*, 326  
    *monticola*, 327  
    *tzacatli jucunda*, 327

- Amazilia tzacatli tzacatli*, 328  
     *versicolor nitidifrons*, 321  
     *violiceps violiceps*, 328  
     *viridigaster*, 325  
     *yucatanensis chalconota*, 329  
     *yucatanensis*, 328  
*amazilia*, *Amazilia amazilia*, 328  
     *Columbigallina minuta*, 425  
*Amazona ochrocephala panamensis*, 426  
*amazonicus*, *Phaethornis rupununii*, 282  
*American Museum of Natural History*, 1  
*amethysticollis*, *Heliangelus*, 345  
*amethystina*, *Calliphlox*, 357  
*ammon*, *Hemiargus*, 392  
*Ammospiza caudacuta altera*, 205  
     *nelsoni*, 207  
     *subvirgata*, 203  
*Anaea verticordia echemus*, 389  
*analoides*, *Catamenia analis*, 439  
*Anartia jatrophae jamaicensis*, 388  
*Anas flavirostris flavirostris*, 420  
     *galapagensis*, 420  
     *specularioides specularioides*, 420  
     *specularis*, 420  
     *spinicauda*, 420  
*Anatina lineata*, 51  
*andicola*, *Ramphomicron microrhynchum*, 348  
*andinus*, *Parajalysus*, 448  
*andraemon*, *Papilio andraemon*, 374  
*andrei*, *Crypturellus soui*, 14  
*Androdon æquatorialis*, 273  
*annæ*, *Calypte*, 359  
*Anthocephala floriceps*, 335  
*anthoides*, *Asthenes*, 430  
*anthophilus*, *Phaethornis anthophilus*, 281  
*Anthracothorax aurentus*, 295  
     *dominicus*, 295  
     *nigricollis iridescens*, 294  
     *nigricollis*, 294  
     *prevosti gracilirostris*, 295  
     *prevosti*, 294  
     *viridicordatus*, 295  
     *viridigula*, 295  
     *viridis*, 295  
*antofagastae*, *Zonotrichia capensis*, 439  
*Apateodus*, 45  
*Aphrastura spinicauda fulva*, 430  
*apicalis*, *Amazilia fimbriata*, 322  
     *Phaethornis guyi*, 277  
*Appias drusilla peregrina*, 376  
*Arabellites perpensus*, 260  
*araucana*, *Columba*, 425  
*Archilochus alexandri*, 359  
     *colubris*, 358  
*Ardea cocoi*, 416  
     *herodias cognata*, 416  
*Arenaria interpres morinella*, 423  
*armillata*, *Fulica*, 422  
*Arremonops conirostris striaticeps*, 439  
*assimilis*, *Chlorostilbon*, 303  
*astarte*, *Napeogenes*, 402  
*Asthenes anthoides*, 430  
*astreans*, *Acestrura*, 360  
*atacamensis*, *Troglodytes musculus*, 434  
*ater*, *Haematopus*, 422  
*Atlapetes nationi nationi*, 439  
*atriceps*, *Phalacrocorax atriceps*, 416  
*augusti*, *Phaethornis augusti*, 283  
*aureola*, *Dendroica petechia*, 435  
*aureoventris*, *Chlorostilbon aureoventris*, 298  
*aureoviridis*, *Eugenes fulgens*, 336  
*auriceps*, *Chlorostilbon*, 300  
*auriculata*, *Heliophryx auriculata*, 355  
     *Zenaidura auriculata*, 425  
*aurifrons*, *Psilopsiagon aurifrons*, 426  
*aurita*, *Heliophryx*, 254  
*aurentus*, *Anthracothorax*, 295  
*australis*, *Zonotrichia capensis*, 440  
*axanthus*, *Pseudobranchus striatus*, 183  
*baeri*, *Thalurania furcata*, 313  
*balzani*, *Thalurania furcata*, 312  
*barbatus*, *Leodectes*, 259  
     *Spinus*, 439  
*barroti*, *Heliophryx*, 355  
*bartletti*, *Crypturellus*, 19  
*batabano*, *Phocides pigmalion*, 394  
*Bates*, *Marston*, 371  
*batteryensis*, *Climacoconus*, 231  
*bauri*, *Nesomimus parvulus*, 435  
*bella*, *Cymella*, 52

- bellicosa*, *Pezites militaris*, 436  
*Belonopterus chilensis fretensis*, 422  
*berenice*, *Danaus gilippus*, 380  
*berlepschi*, *Aglaiocercus*, 354  
     *Crypturellus*, 10  
     *Phæochroa cuvieri*, 287  
*bocca*, *Oleria*, 404  
*Boissonneana flavescens flavescens*, 344  
     *matthewsi*, 344  
*boliviana*, *Cœligena*, 343  
     *Nothura maculosa*, 26  
     *Thalurania furcata*, 313  
*bolivianus*, *Phaethornis*, 279  
     *Schistes geoffroyi*, 354  
*bonapartei*, *Nothocercus bonapartei*, 8  
*bonariensis*, *Molothrus bonariensis*, 436  
*boraquira*, *Nothura*, 26  
*borealis*, *Hylocharis leucotis*, 317  
*bottnicus*, *Climacoconus*, 232  
*boucardi*, *Crypturellus boucardi*, 18  
     *Lepidopyga*, 309  
*bougainvillii*, *Phalacrocorax*, 415  
*bourcierii*, *Phaethornis*, 284  
*braccata*, *Amazilia saucerrottei*, 324  
*brammeri*, *Solenochilus*, 144  
*Brephidium exilis thompsoni*, 392  
*brevicauda*, *Muscigralla*, 32  
*brevirostris*, *Crypturellus*, 19  
*bromidus*, *Climacoconus*, 230  
*bryantæ*, *Calliphlox*, 357  
*buffoni*, *Chalybura buffoni*, 331  
*bulleri*, *Diomedea*, 413  
*Burke*, J. J., 41  
*burkei*, *Crenella*, 57  
*burmeisteri*, *Microstilbon*, 358  
*Buteo galapagoensis*, 421  
     *magnirostris ruficauda*, 421  
     *polysoma exsul*, 421  
     *polysoma*, 421  
*Butorides striatus striatus*, 418  
     *sundevalli*, 418  
  
*cabanidis*, *Colibri cyanotus*, 293  
*caducus*, *Ænonites*, 256  
*cæruleogaster*, *Chalybura*, 333  
*calliope*, *Stellula calliope*, 359  
*Calliphlox amethystina*, 357  
  
*Calliphlox bryantæ*, 357  
     *evelynæ*, 357  
     *lyrura lyrura*, 357  
     *mitchelli*, 357  
*Calothorax lucifer*, 358  
*Calypte annæ*, 359  
     *costæ*, 359  
     *helenæ*, 359  
*Camarhynchus parvulus parvulus*, 438  
*Campylopterus curvipennis curvipennis*, 288  
     *ensipennis*, 289  
     *falcatus*, 289  
     *hemileucurus*, 289  
     *largipennis*, 288  
     *obscurus æquatorialis*, 288  
     *obscurus*, 288  
*candida*, *Amazilia candida*, 324  
     *Gygis alba*, 425  
*caniveti*, *Chlorostilbon caniveti*, 300  
*Capella paraguaiaie magellanica*, 423  
     *stricklandii*, 423  
*capitalis*, *Spinus magellanicus*, 439  
*caquetæ*, *Crypturellus soui*, 13  
*Cardium kayi*, 54  
*caribæus*, *Chlorostilbon nitens*, 302  
*Carpenter*, G. D. Hale, A collection of  
     *Lepidoptera (Rhopalocera)* from  
     the Cayman Islands (C. B.  
     Lewis coll.), 371-396  
*casius*, *Turdus grayi*, 435  
*Casmerodius albus egretta*, 416  
*cassini*, *Phaethornis longirostris*, 280  
*castaneiceps*, *Tinamus major*, 5  
*castaneus*, *Crypturellus*, 10  
*catalina*, *Hemiargus*, 392  
*Catamenia analis analoides*, 439  
*Catharacta skua chilensis*, 424  
*Cathartes aura falklandica*, 421  
*caucæ*, *Crypturellus soui*, 12  
*caucensis*, *Haplophædia aureliæ*, 346  
*caudatus*, *Aglaiocercus*, 352  
*centralis*, *Sporophila minuta*, 438  
*Centurus rubricapillus wagleri*, 428  
*cephalus*, *Phaethornis longirostris*, 281  
*Certhidea olivacea mentalis*, 438  
     *olivacea*, 438

- cervina*, *Adelomyia*, 335  
*cerviniventris*, *Crypturellus*, 10  
*Chætocercus jourdani*, 360  
     *rosæ*, 360  
*chalconota*, *Amazilia yucatanensis*, 329  
*Chalcostigma heteropogon*, 351  
     *stanleyi vulcani*, 351  
*Chalybura buffoni æneicauda*, 333  
     *buffoni*, 331  
     *interior*, 332  
     *cæruleogaster*, 333  
     *melanorrhœa*, 334  
     *urochrysa urochrysa*, 333  
*Charadrius falklandicus*, 423  
*charithonia*, *Heliconius charithonia*, 381  
*chilensis*, *Anthus correndera*, 435  
     *Catharacta skua*, 424  
     *Cinclodes patagonicus*, 429  
     *Colymbus*, 412  
     *Elaenia albiceps*, 434  
     *Troglodytes musculus*, 435  
     *Turdus chiguanco*, 435  
     *Zonotrichia capensis*, 440  
*chionopectus*, *Amazilia chionopectus*, 319  
*Chloëphaga dispar*, 419  
     *hybrida hybrida*, 419  
     *picta*, 419  
     *poliocephala*, 419  
*Chloroceryle americana isthmica*, 428  
*chloronotus*, *Tyrannus melancholicus*, 432  
*chloropogon*, *Metallura tyrianthina*, 350  
*Chlorostilbon aliciaë*, 304  
     *assimilis*, 303  
     *aureoventris aureoventris*, 298  
     *auriceps*, 300  
     *caniveti caniveti*, 300  
     *salvini*, 300  
     *melanorhynchus*, 303  
     *nitens caribæus*, 302  
         *nitens*, 301  
         *orinocensis*, 302  
     *notatus*, 298  
     *poortmani euchloris*, 304  
     *poortmani*, 304  
     *prasinus phæopygus*, 303  
     *Chlorostilbon prasinus prasinus*, 303  
         *russatus*, 304  
         *stenurus ignotus*, 305  
         *stenurus*, 305  
*chrysoaster*, *Pheucticus chrysopeplus*, 437  
*Chrysolampis elatus*, 296  
*cillene*, *Colaenis julia*, 382  
*Cinclodes fuscus fuscus*, 429  
     *oustaleti oustaleti*, 429  
     *patagonicus chilensis*, 429  
     *patagonicus patagonicus*, 428, 429  
*cinerascens*, *Nothoprocta*, 24  
*cinereus*, *Crypturellus*, 10  
     *cinereus*, 8  
*cinnamominus*, *Falco sparverius*, 421  
*Cistothorus platensis hornensis*, 434  
*clarissæ*, *Heliangelus*, 344  
*clarki*, *Climacoconus*, 229  
*Climacoconus batteryensis*, 231  
     *bottnicus*, 232  
     *bromidus*, 230  
     *clarki*, 229  
     *humilis*, 228  
     *lanceolatus*, 233  
     *pumilus*, 231  
     *quadratus*, 226  
     *rallus*, 228  
     *scoticus*, 233  
*Coccyzus ferrugineus*, 426  
*cocoi*, *Ardea*, 416  
*Cœligena boliviana*, 343  
     *cœligena*, 343  
     *colombiana colombiana*, 343  
         *ferruginea*, 343  
     *conradi*, 342  
     *eos*, 342  
     *helianthea*, 341  
     *inca*, 342  
     *lutetiæ*, 342  
     *phalerata*, 342  
     *torquata*, 342  
     *violifera*, *violifera*, 342  
*cœligena*, *Cœligena*, 343  
*cœruleogularis*, *Lepidopyga*, 307  
*cognata*, *Ardea herodias*, 416  
*Colaenis julia cillene*, 382

- Colaptes pitius pitius*, 428  
*Colibri coruscans*, 292, 427  
     *cyanotus cabanidis*, 293  
     *crissalis*, 292  
     *cyanotus*, 293  
     *delphinae*, 293  
     *serrirostris*, 293  
     *thalassinus*, 293  
*colombiana*, *Cæligena colombiana*, 343  
*colombica*, *Thalurania colombica*, 309  
*Colorhamphus parvirostris*, 433  
*colubris*, *Archilochus*, 358  
*Columba araucana*, 425  
     *livia*, 425  
*columbianus*, *Myiozetetes similis*, 432  
*Columbigallina minuta amazilia*, 425  
     *elaeodes*, 425  
     *picui picui*, 425  
*columella*, *Strymon*, 391  
*Colymbus chilensis*, 412  
     *occipitalis occipitalis*, 413  
*concolor*, *Phoca vitulina*, 111, 117  
*confinis*, *Lepidopyga cæruleogularis*, 307  
*confusus*, *Crypturellus undulatus*, 16  
 Conemaugh Series, the Cephalopod fauna of, in western Pennsylvania, 127-174  
*conradi*, *Cæligena*, 342  
     *Leptosolen*, 50  
*constanti*, *Heliomaster constanti*, 356  
*Conularina irrasa*, 223  
     *narrowayi*, 224  
     *raymondi*, 223  
     *triangulata*, 220  
     *undosa*, 222  
*copiosus*, *Lumbriconereites*, 245  
*cora*, *Thaumastura*, 357  
 Corbet, Dr. A. S., 371  
*Corbulis xantho inturna*, 405  
*cornutum*, *Metacoceras*, 139  
*coruscans*, *Golibri*, 292, 427  
*coruscus*, *Phaethornis*, 277  
*costæ*, *Calypte*, 359  
*costaricensis*, *Amazilia amabilis*, 330  
*crassirostris*, *Platyspiza*, 438  
*Creagrus furcatus*, 424  
*creatopus*, *Puffinus*, 413  
*creditensis*, *Leodicites*, 257  
*Crenella burkei*, 57  
*crepitus*, *Ænonites*, 254  
 Cresson, E. T., 31  
*crestatus*, *Eudypetes*, 412  
 Creaceous, Upper, Fauna of the Asphalt Ridge, Utah, by I. P. Tolmachoff, 41-58  
*crissalis*, *Colibri cyanotus*, 292  
*Crocethia alba*, 423  
*Crotophaga sulcirostris sulcirostris*, 426  
*Crypturellus bartletti*, 19  
     *berlepschi*, 10  
     *boucardi boucardi*, 18  
     *brevirostris*, 19  
     *castaneus*, 10  
     *cerviniventris*, 10  
     *cinereus*, 10  
         *cinereus*, 8  
         *rufescens*, 9  
     *cinnamomeus mexicanus*, 20  
         *præpes*, 20  
         *vicinior*, 20  
     *erythropus erythropus*, 21  
         *garleppi*, 21  
     *griseiventris*, 11  
     *idoneus*, 20  
     *noctivagus*, 20  
     *obsoletus punensis*, 10  
     *parvirostris*, 22  
     *soui andrei*, 14  
         *caquetæ*, 13  
         *caucæ*, 12  
         *harterti*, 13  
         *hoffmannsi*, 15  
         *inconspicuus*, 15  
         *meserythrus*, 12  
         *modestus*, 12  
         *mustelinus*, 13  
         *nigriceps*, 13  
         *soui*, 14  
     *strigulosus strigulosus*, 22  
     *tataupa tataupa*, 23  
     *undulatus adpersus*, 16  
         *confusus*, 16  
         *undulatus*, 17

- Crypturellus undulatus yapura*, 16  
     *variegatus salvini*, 19  
     *transamazonicus*, 18  
     *variegatus*, 18  
*cupreovertris*, *Vestipedes*, 345  
*cupripennis*, *Aglæactis cupripennis*, 339  
*curaeus*, *Notiopsar*, 436  
*curtum*, *Poterioceras*, 133  
*curvipennis*, *Campylopterus curvipennis*, 288  
*curvirostris*, *Nothoprocta*, 24  
*cuspis*, *Staurocephalites*, 260  
*cyana*, *Hylocharis*, 314  
*Cyanocorax affinis zeledoni*, 434  
*cyanolæmus*, *Oxypogon*, 352  
*cyanopectus*, *Sternoclyta*, 337  
*cyanoptera*, *Anas cyanoptera*, 420  
*cyanopterus*, *Pterophanes cyanopterus*, 340  
*cyanotus*, *Colibri cyanotus*, 293  
*Cyclomyces Greenei*, 222  
*Cygnus melancoriphus*, 419  
*Cymaenes tripuncta tripuncta*, 395  
*Cymbophora*, 55  
*Cymella bella*, 52  
*Cynanthus latirostris latirostris*, 306  
     *sordidus*, 306
- Damophila julia julia*, 313  
*Danaus eresimus*, 381  
     *gilippus berenice*, 380  
     *plexippus plexippus*, 379  
*darienensis*, *Threnetes ruckeri*, 274  
*darwinii*, *Thraupis bonariensis*, 436  
*decora*, *Amazilia*, 330  
*deëmae*, *Hypothyris meterus*, 398  
*deflexus*, *Lumbriconereites*, 244  
*delattrei*, *Lophornis*, 297  
*delphinæ*, *Colibri*, 293  
*Dendroica petechia aureola*, 435  
*densus*, *Leodicites*, 259  
*desmuri*, *Sylviorthorhynchus*, 429  
*deuscula*, *Hyaliris*, 399  
*diaconus*, *Thraupis episcopus*, 436  
*Diomedea bulleri*, 413  
     *exulans exulans*, 413  
     *melanophris*, 413
- Dione vanillae*, 382  
*Diopatraites fustis*, 261  
*Discosura longicauda*, 298  
*districta*, *Metallura*, 351  
*Diuca diuca diuca*, 439  
*diuca*, *Diuca diuca*, 439  
*Domatoceras*, 144  
*dominicanus*, *Larus*, 424  
*dominicus*, *Anthracothonax*, 295  
*Doryfera ludovicæ ludovicæ*, 273  
     *veraguensis*, 273  
Doutt, J. Kenneth, A review of the Genus *Phoca*, 61-125  
*Dyctiopicus lignarius*, 428
- echemus*, *Anaea verticordia*, 389  
*edentulus*, *Paleænonites*, 251  
*edward*, *Saucerrotia edward*, 427  
*edwardi*, *Amazilia edwardi*, 325  
*egregia*, *Eupherusa*, 331  
*egretta*, *Casmerodius albus*, 416  
*Elaenia albiceps chilensis*, 434  
     *modesta*, 433  
     *flavogaster subpagana*, 433  
*elaodes*, *Columbigallina minuta*, 425  
*elathe*, *Eurema*, 377  
*elatus*, *Chrysolampis*, 296  
*elegantissima*, *Amazilia fimbriata*, 323  
*eliciæ*, *Hylocharis*, 315  
Eller, E. R., 41  
Eller, E. R., *Scolecodonts from the Erindale, Upper Ordovician, at Streetsville, Ontario*, 241-270  
*elutus*, *Thryophilus modestus*, 434  
*emmae*, *Aglaiocercus*, 352  
*Enchodus*, 45  
*Ensifera ensifera*, 343  
*ensifera*, *Ensifera*, 343  
*ensipennis*, *Campylopterus*, 289  
*ensis*, *Phaconotus*, 446  
*Eoasianites*, 148  
*eos*, *Cœligena*, 342  
*Ephippioceras ferratum*, 136  
*episcopus*, *Phaethornis ruber*, 286  
*eresimus*, *Danaus*, 381  
*Eribates magnirostris*, 432  
*eriensis*, *Stomatoceras rubra*, 31

- erythrolaema, *Habia gutturalis*, 437  
 erythronota, *Amazilia tobaci*, 326  
 erythropus, *Crypturellus erythropus*, 21  
 estellæ, *Oreotrochilus*, 338  
 etesiaca, *Sula leucogaster*, 415  
 euchloris, *Chlorostilbon poortmani*, 304  
*Eudypetes crestatus*, 412  
*Eugenes fulgens aureoviridis*, 336  
     *fulgens*, 336  
     *spectabilis*, 336  
*Eugralla paradoxa*, 431  
*Eunicites denticulatus*, 252  
*Eupetomena macroura*, 290  
*Eupherusa egregia*, 331  
     *eximia eximia*, 331  
     *nigriventris*, 331  
*Euptoieta hegesia*, 383  
*Eurema elathea*, 377  
     *lisa*, 378  
     *messalina messalina*, 377  
     *nicippe*, 378  
*euryptera*, *Opisthoprora*, 352  
*Eutoxeres aquila munda*, 286  
     *salvini*, 287  
 Evans, Brig. W. H., 371  
 evansi, *Yoldia*, 56  
 evelynæ, *Calliphlox*, 357  
 exilis, *Orthorhynchus exilis*, 296  
 eximia, *Eupherusa eximia*, 331  
 exortis, *Heliangelus*, 344  
 exquisitus, *Ildraites*, 248  
 exsul, *Buteo polysoma*, 421  
 exulans, *Diomedea exulans*, 413  
  
*falcatus*, *Campylopterus*, 289  
*Falco sparverius cinnamominus*, 421  
     *fernandensis*, 421  
*falklandica*, *Cathartes aura*, 421  
*falklandicus*, *Charadrius*, 423  
*fallax*, *Leucippus fallax*, 318  
*fannyæ*, *Myrtis*, 360  
*fannyi*, *Thaluranina fannyi*, 309  
*fasciata*, *Phoca*, 91  
*felicæ*, *Amazilia tobaci*, 326  
*fernandensis*, *Falco sparverius*, 421  
     *Sephanoides fernandensis*, 344  
     *Thaumaste fernandensis*, 427  
     *fernandezianus*, *Spizitornis*, 433  
     *ferratum*, *Ephippioceras*, 136  
     *ferruginea*, *Cœligena colombiana*, 343  
     *ferrugineus*, *Coccyzus*, 426  
     *filenus*, *Hemiargus*, 392  
     *fimbriata*, *Amazilia fimbriata*, 321  
     *fissilis*, *Thaluranina furcata*, 310  
     *fissirostris*, *Geositta cucularia*, 428  
     *Fissurella*, 49  
     *flammula*, *Selasphorus*, 361  
     *flavescens*, *Boissonneaua flavescens*, 344  
     *floriceps*, *Anthocephala*, 335  
     *floridanus*, *Pseudotriton montanus*, 175  
     *Florisuga mellivora*, 290  
     *fortis*, *Geospiza*, 437  
 Fox, Richard M., New and Rare Ithomiinae (Lepidoptera) in the Carnegie Museum, 397-408  
*franciæ*, *Amazilia*, 323  
*frantzi*, *Nothocercus bonapartei*, 8  
*fretensis*, *Belonopterus chilensis*, 422  
*Fricke*, Reinhold L., 409  
*fritzae*, *Ildraites*, 248  
*fulgens*, *Eugenes fulgens*, 336  
*Fulica armillata*, 422  
*fuliginosa*, *Geospiza fuliginosa*, 437  
*fuliginosus*, *Larus*, 424  
*fulva*, *Aphrastura spinicauda*, 430  
*furcata*, *Thaluranina*, 311  
     *furcata*, 311  
*furcatoides*, *Thaluranina furcata*, 312  
*furcatus*, *Creagrus*, 424  
*furcifer*, *Heliomaster*, 356  
*fuscipennis*, *Tinamus major*, 4  
*fusiformis*, *Orthocera*, 132  
*fustis*, *Diopatraites*, 261  
  
 Gahan, A. B., 31  
*gaimardi*, *Phalacrocorax*, 415  
*galapagensis*, *Anas*, 420  
     *Anous stolidus*, 425  
*galapagoensis*, *Buteo*, 421  
     *Nesopelia galapagoensis*, 425  
     *Oceanites gracilis*, 414  
*galbula*, *Icterus*, 436  
 Gale, H. S., 41  
*garleppi*, *Crypturellus erythropus*, 21

- garnotii*, Pelecanoides, 414  
*f. genoveva*, *Precis lavinia*, 384  
*geoffroyi*, *Schistes geoffroyi*, 354  
*Geositta cunicularia fissirostris*, 428  
*Geospiza difficilis acutirostris*, 438  
     *fortis*, 437  
     *fuliginosa fuliginosa*, 437  
     *magnirostris*, 437  
     *scandens intermedia*, 438  
*geronimensis*, *Phoca vitulina*, 117  
*gibsoni*, *Chlorostilbon*, 300  
*giganteus*, *Macronectes*, 413  
*Glaucidium nanum*, 426  
*Glaucis aenea*, 276  
     *hirsuta affinis*, 276  
         *hirsuta*, 275  
         *insularum*, 275  
*glaucopoides*, *Vestipedes*, 346  
Goin, Coleman J., Description of a new race of *Siren intermedia* LeConte, 211-217  
Goin, C. J. and Netting, M. G., Descriptions of two new Salamanders from Peninsular Florida, 175-196  
Goodson, F., 371  
*goudoti*, *Lepidopyga*, 309  
*gouldi*, *Lophornis*, 297  
*gracilirostris*, *Anthracothonax prevosti*, 295  
*gracilis*, *Lesbia gouldi*, 348  
*grayi*, *Hylocharis grayi*, 316  
*groenlandica*, *Phoca*, 87  
Griscom, Mr. Ludlow, 1  
*griseiventris*, *Crypturellus*, 11  
*griseogularis*, *Phaethornis*, 286  
*gryphus*, *Vultur*, 421  
*guainumbi*, *Polytmus guainumbi*, 317  
*guatemalensis*, *Amazilia cyanocephala*, 328  
*guerini*, *Oxypogon*, 351  
*guimeti*, *Klais*, 296  
*guttatus*, *Tinamus*, 7  
*Gygis alba candida*, 425  
*Gyrodes*, 48  
  
*Habia gutturalis erythrolaema*, 437  
  
*haeberlini*, *Chlorostilbon*, 300  
*Haematopus ater*, 422  
     *leucopodus*, 422  
     *ostralegus pitanay*, 422  
Hall, A., 371  
*hamus*, *Nereidavus*, 246  
*Haplophædia aureliæ caucensis*, 346  
Harris, Halbert M., New Neididae (Hemiptera) from South America, 443-450  
*harterti*, *Crypturellus soui*, 13  
*hegesia*, *Euptoieta*, 383  
*helenæ*, *Calypte*, 359  
     *Paphosia*, 297  
*Heliangelus amethysticollis*, 345  
     *clarissæ*, 344  
     *exortis*, 344  
     *mavors*, 344  
     *spencei*, 345  
*helianthea*, *Cœligena*, 341  
*Heliconius charithonia charithonia*, 381  
*heliodori*, *Acestrura*, 360  
*Heliodoxa jacula henryi*, 337  
     *leadbeateri leadbeateri*, 336  
         *parvula*, 337  
     *rubinoides æquatorialis*, 336  
*Heliomaster constanti constanti*, 356  
     *furcifer*, 356  
     *longirostris longirostris*, 356  
*Heliothyx auriculata auriculata*, 355  
     *phainolaema*, 355  
     *aurita*, 354  
     *barroti*, 355  
Hellmayr, Dr. C. E., 1  
*Hemiargus ammon*, 392  
     *catalina*, 392  
     *filenus*, 392  
*hemileucurus*, *Campylopterus*, 289  
*hemina*, *Oleria crispinella*, 404  
*henryi*, *Heliodoxa jacula*, 337  
*heteropogon*, *Chalcostigma*, 351  
*Heteroscelus incanus*, 423  
*hildrethi*, *Schistoceras*, 151  
*Himantopus himantopus mexicanus*, 423  
*hirsuta*, *Glaucis hirsuta*, 275  
*hirundinacea*, *Sterna*, 425



- hispida, Phoca, 89  
 hispidus, Phaethornis, 281  
 hoffmanni, Amazilia, 325  
 hoffmannsi, Crypturellus soui, 15  
 hollandi, Amazilia, 320  
 holosericeus, Sericotes holosericeus, 296  
 hornensis, Cistothorus platensis, 434  
 horridus, Ildraites, 250  
 hudsonicus, Numenius phaeopus, 423  
 humboldti, Spheniscus, 412  
 humilis, Climacoconus, 228  
 Hummingbirds, List of, in the collection of the Carnegie Museum, by W. E. C. Todd, 271-370  
 Hyaliris deuscula, 399  
   munda, 301  
 Hylephila phylaeus phylaeus, 395  
 Hylocharis chrysurus chrysurus, 315  
   cyana, 314  
     rostrata, 314  
     viridiventris, 314  
   eliciae, 315  
   grayi grayi, 316  
     meridionalis, 316  
   josephinae, 316  
   leucotis borealis, 317  
     leucotis, 316  
   oenone, 315  
   sapphirina, 314  
   xantusi, 317  
 hypoleucus, Leucippus chionogaster, 318  
 Hypothyris meterus deëmae, 398  
  
 Icterus galbula, 436  
 idoneus, Crypturellus, 20  
 ignobilis, Phaethornis striigularis, 284  
 ignotus, Chlorostilbon stenurus, 305  
 Ildraites exquisitus, 248  
   fritzae, 248  
   horridus, 250  
   patulus, 249  
   peramplus, 249  
 immaculatus, Myrmeleon, 31  
 inca, Cœligena, 342  
 incanus, Heteroscelus, 423  
 inconspicuus, Crypturellus soui, 15  
 ineptus, Nereidavus, 246  
 inornata, Adelomyia, 335  
   Pinaroloxias, 438  
 insignis, Panterpe, 313  
   Phaethornis, 278  
 insularis, Victorina stelenes, 388  
 insularum, Glaucis hirsuta, 275  
 interior, Chalybura buffoni, 332  
 intermedia, Geospiza scandens, 438  
 inturna, Corbulis xantho, 405  
 Ipocrantor magellanicus, 428  
 iridescens, Anthracothorax nigricollis, 294  
 Iridoprocne leucopyga, 434  
 irrasa, Conularina, 223  
 isthmica, Chloroceryle americana, 428  
 Ithomiinae, New and Rare, (Lepidoptera) in the Carnegie Museum by Richard M. Fox, 397-408  
  
 jamaicensis, Anartia jatrophae, 388  
 jamesoni, Oreotrochilus chimborazo, 339  
 Jordan, Dr. Karl, 371  
 josephinae, Hylocharis, 316  
 jourdani, Chaetocercus, 360  
 jucunda, Amazilia tzacatl, 327  
 juliae, Damophila juliae, 313  
 julius, Nothocercus julius, 8  
  
 Kay, J. LeRoy, 41  
 kayi, Cardium, 54  
 kingi, Aglaiocercus, 353  
 Kinnear, N. B., 1  
 Klais guimeti, 296  
 kleeci, Tinamus tao, 3  
 knoxense, Pseudorthoceras, 131  
  
 Lafresnaya lafresnayi lafresnayi, 340  
   liriope, 340  
   saülæ, 340  
 lafresnayi, Lafresnaya lafresnayi, 340  
 lanceolatus, Climacoconus ?, 233  
 landbecki, Rallus sanguinolentus, 422  
 largha, Phoca vitulina, 118  
 largipennis, Campylopterus, 288  
 Larus dominicanus, 424

- Larus fuliginosus*, 424  
     *maculipennis*, 424  
     *modestus*, 424  
     *pipixcan*, 424  
*latirostris*, *Cynanthus latirostris*, 306  
*latissimus*, *Paleconionites*, 251  
*leadbeateri*, *Heliodoxa leadbeateri*, 336  
*Leodicites acclivis*, 256  
     *barbatus*, 259  
     *creditensis*, 257  
     *densus*, 259  
     *streetsvillensis*, 257  
     *summus*, 258  
*Lepidopyga boucardi*, 309  
     *cœruleogularis*, 307  
         *confinis*, 307  
     *goudoti*, 309  
     *luminosa luminosa*, 307  
     *phœochroa*, 308  
*Leptasthenura aegitholides aegitholides*, 430  
*Leptosolen conradi*, 50  
*Leptotes theonus*, 394  
*Lesbia gouldi gracilis*, 348  
     *victoriæ æquatorialis*, 347  
     *victoriæ*, 348  
*Lessonia rufa rufa*, 431  
*Leucippus chionogaster hypoleucus*, 318  
     *fallax fallax*, 318  
*leucogaster*, *Amazilia*, 320  
*Leucophaeus scoresbii*, 425  
*leucopodus*, *Haematopus*, 422  
*leucopyga*, *Iridoprocne*, 434  
*leucorrhous*, *Smaragdites theresia*, 317  
*leucotis*, *Hylocharis leucotis*, 316  
*leucurus*, *Threnetes leucurus*, 273  
*Lewis*, C. B. with G. D. Hale Carpenter,  
     A collection of *Lepidoptera*  
     (*Rhopalocera*) from the Cay-  
     man Islands, 371-396  
*lignarius*, *Dyctiopicus*, 428  
*lindeni*, *Oxypogon*, 352  
*lineata*, *Anatina*, 51  
*liriopie*, *Lafresnaya lafresnayi*, 340  
*Liroceras*, 137  
*lisa*, *Eurema*, 378  
*livia*, *Columba*, 425  
*longicauda*, *Discosura*, 298  
*longirostris*, *Heliomaster longirostris*,  
     356  
     *Vestipedes derbyi*, 346  
*longuemareus*, *Phaethornis*, 284  
*Lophornis delattrei*, 297  
     *gouldi*, 297  
     *ornatus*, 297  
     *stictolophus*, 297  
*lucifer*, *Calothorax*, 358  
*Lucina*, 54  
*ludoviciæ*, *Doryfera ludoviciæ*, 273  
*Lumbriconereites copiosus*, 245  
     *deflexus*, 244  
     *marlenediesae*, 243  
     *proclivis*, 244  
*luminosa*, *Lepidopyga luminosa*, 307  
*luteicapilla*, *Tanagra*, 436  
*lutetiæ*, *Cœligena*, 342  
*lyrura*, *Calliphlox lyrura*, 357  
  
*Macronectes giganteus*, 413  
*macroura*, *Eupetomena macroura*, 289  
*macularia*, *Actitis*, 423  
*maculicauda*, *Amazilia fimbriata*, 322  
     *Phœochroa cuvieri*, 287  
*maculicollis*, *Rhynchotus*, 24  
*maculipennis*, *Larus*, 424  
*magellani*, *Pelecanoides*, 414  
*magellanica*, *Capella paraguaiae*, 423  
*magellanicus*, *Ipocrantor*, 428  
     *Phalacrocorax*, 415  
     *Scytalopus magellanicus*, 431  
     *Spheniscus*, 412  
     *Turdus falcklandii*, 435  
*magirostris*, *Eribates*, 432  
     *Geospiza*, 437  
*major*, *Aechmophorus*, 413  
     *Tinamus major*, 6  
*malagæ*, *Metallura*, 349  
*malaris*, *Phaethornis*, 280  
*Manacus vitellinus vitellinus*, 431  
*Mareca sibilatrix*, 420  
*margarethæ*, *Agelaiocercus*, 353  
*Margarita*, 49  
*marlenediesae*, *Lumbriconereites*, 243  
*martialis*, *Strymon*, 390

- matthewsi, Boissonneaua, 344  
 maugæa, Riccordia, 305  
 mavors, Heliangelus, 344  
 f. maya, Phyciodes phaon, 384  
 Mechanitis meterus, 398  
 meeki, Placenticerus, 47  
 Megaceryle torquata stellata, 427  
     torquata, 428  
 Megaglossoceras, 137  
 melancoriphus, Cygnus, 419  
 melanogenys, Adelomyia melanogenys,  
     335  
 melanophris, Diomedea, 413  
 melanopis, Theristicus, 418  
 melanorhynchus, Chlorostilbon, 303  
 melanorrhoea, Chalybura, 334  
 Melinaea maelus purusana, 397  
 mellivora, Florisuga, 290  
 Mellon, W. L., 409  
 mellonae, Phoca vitulina, 111  
 menstruus, Pionus, 426  
 mentalis, Certhidea olivacea, 438  
     Muscisaxicola macloviana, 431  
 meridionalis, Hylocharis grayi, 316  
 meserythrus, Crypturellus soui, 12  
 mesonauta, Phaëthon aethereus, 414  
 messalina, Eureka messalina, 377  
 Metacoceras cornutum, 139  
     perelegans, 141  
 Metallura districta, 351  
     malagæ, 349  
     smaragdinicollis smaragdinicollis,  
         349  
     tyrianthina chloropogon, 350  
         oreopola, 350  
         tyrianthina, 349  
     williamsi, 348  
 meterus, Mechanitis, 398  
 mexicanus, Crypturellus cinnamomeus,  
     20  
     Himantopus himantopus, 423  
 Microchera parvirostris, 330  
 Micropus andecolus parvulus, 427  
 microrhyncha, Topaza pella, 338  
 Microsittace ferruginea minor, 426  
 Microstilbon burmeisteri, 358  
 militaris, Pezites militaris, 436  
 Miller, A. K. and Unklesbay, A. C., The  
     Cephalopod fauna of the Cone-  
     maugh Series in western Penn-  
     sylvania, 127-174  
 milleri, Amazilia, 320  
 Milvago chimango temucoensis, 421  
 Mimus thenca, 435  
 minor, Microsittace ferruginea, 426  
 missouriense, Schistoceras, 155  
 mitchelli, Calliphlox, 357  
 modesta, Elaenia albiceps, 433  
     Progne modesta, 434  
 modestus, Crypturellus soui, 12  
     Larus, 424  
     Zonibyx, 422  
 Molothrus bonariensis bonariensis, 436  
 Momotus subrufescens conexus, 428  
 monachus, Muscivora tyrannus, 432  
 monilifer, Tainoceras, 142  
 monticola, Amazilia tobaci, 327  
 moorei, Phaethornis, 279  
 Mooreoceras normale, 132  
 morinella, Arenaria interpres, 423  
 mosquerae, Vestipedes, 346  
 muelleri, Phaethornis, 278  
 Muesebeck, C. F. W., 31  
 mulsanti, Acestrura, 360  
 munda, Eutoxeres aquila, 286  
     Hyaliris, 401  
 murina, Orochelidon, 434  
 Muscisaxicola macloviana mentalis, 431  
 mustelinus, Crypturellus soui, 13  
 Muscivora brevicauda, 432  
     tyrannus monachus, 432  
 Myiarchus ferox panamensis, 432  
 Myiotheretes striaticollis striaticollis,  
     432  
 Myiozetetes similis columbianus, 432  
 Myrmeleon immaculatus, 31  
 Myrtis fannyæ, 360  
 nannus, Parajalysus, 449  
 nanodes, Speotyto cunicularia, 427  
 nanum, Glaucidium, 426  
 nanus, Pyrocephalus rubinus, 432  
 Napeogenes astarte, 402  
 narrawayi, Conularina, 224

- nationi, *Atlapetes nationi*, 439  
 nebouxi, *Sula*, 415  
 Neididae, New, from South America, by  
 Halbert M. Harris, 443-450  
 neleis, *Phoebis*, 378  
 nelsoni, *Ammospiza caudacuta*, 207  
*Nereidavus hamus*, 246  
   *ineptus*, 246  
   *procurvus*, 247  
*Nesomimus parvulus bauri*, 435  
   *parvulus*, 435  
*Nesopelia galapagoensis galapagoensis*,  
 425  
*Nesotriccus ridgwayi*, 432  
 Netting, M. G. and Goin, C. J., De-  
 scriptions of two new Sala-  
 manders from Peninsular Florida,  
 175-196  
 nettingi, *Siren intermedia*, 211  
 nexu, *Protacanthus*, 446  
 nicippe, *Eurema*, 378  
 nigrescens, *Parajalysus*, 448  
 nigricauda, *Amazilia fimbriata*, 321  
 nigriceps, *Crypturellus soui*, 13  
 nigricollis, *Anthracothonax nigricollis*,  
 294  
 nigriventris, *Eupherusa*, 331  
 nigrocapillus, *Nothocercus nigrocapil-  
 lus*, 7  
 nigrofasciata, *Thalurania furcata*, 312  
 nitens, *Chlorostilbon nitens*, 301  
 nitidifrons, *Amazilia versicolor*, 321  
 niveoventer, *Amazilia*, 326  
 noctivagus, *Crypturellus*, 20  
 normale, *Mooreoceras*, 132  
 notatus, *Chlorostilbon*, 298  
*Nothocercus bonapartei bonapartei*, 8  
   *frantzii*, 8  
   *julius julius*, 8  
   *nigrocapillus nigrocapillus*, 7  
*Nothoprocta cinerascens*, 24  
   *curvirostris*, 24  
   *ornata ornata*, 24  
   *pentlandi pentlandi*, 24  
   *perdicaria perdicaria*, 25, 412  
*Nothura boraquira*, 26  
   *maculosa agassizi*, 25  
   *Nothura maculosa boliviana*, 26  
*Notiopsar curaeus*, 436  
*Numenius phaeopus hudsonicus*, 423  
*Nyctanassa violacea pauper*, 418  
*Nycticorax nycticorax obscurus*, 417  
   *tayazu-guira*, 416  
 Oberholser, Dr. Harry C., 197  
*obscurus*, *Campylopterus obscurus*, 288  
   *Nycticorax nycticorax*, 417  
   *Pyrocephalus rubinus*, 432  
*occipitalis*, *Colymbus occipitalis*, 413  
*Oceanites gracilis galapagoensis*, 414  
   *tethys tethys*, 414  
*ochraceiventris*, *Phaethornis*, 279  
*Ocreatus addæ*, 347  
   *underwoodi polystictus*, 347  
   *underwoodi underwoodi*, 347  
*oenone*, *Hylocharis*, 315  
*Ænonites caducus*, 256  
   *conterminus*, 254  
   *crepitus*, 254  
   *sinuatus*, 255  
*Oleria bocca*, 404  
   *crispinella hemina*, 404  
*olivacea*, *Certhidea olivacea*, 438  
*olivaceus*, *Phalacrocorax olivaceus*, 415  
*olivascens*, *Tinamus major*, 6  
*Opisthoprora euryptera*, 352  
*Oreopholus ruficollis*, 422  
*oreopola*, *Metallura tyrianthina*, 350  
*Oreotrochilus adelæ*, 339  
   *chimborazo jamesoni*, 339  
   *estellæ*, 338  
*orienticola*, *Amazilia chionopectus*,  
 319  
*orinocensis*, *Chlorostilbon nitens*, 302  
*ornata*, *Nothoprocta ornata*, 24  
*ornatus*, *Lophornis*, 297  
*Orochelidon murina*, 434  
*Orthocera fusiformis*, 132  
*Orthorhynchus exilis exilis*, 296  
*oustaleti*, *Cinclodes oustaleti*, 429  
*Oxyopogon cyanolæmus*, 352  
   *guerini*, 351  
   *lindeni*, 352  
   *stübeli*, 352

- Palecnonites accuratus*, 250, 252  
     *edentulus*, 251  
     *latissimus*, 251  
*pallidus*, *Parajalysus*, 449  
*pamelæ*, *Aglæactis*, 339  
*panamensis*, *Amazona ochrocephala*, 426  
     *Myiarchus ferox*, 432  
*Panoquina panoquinoides panoquinoides*, 395  
     *sylvicola sylvicola*, 396  
     *woodruffi*, 396  
*panoquinoides*, *Panoquina panoquinoides*, 395  
*Panterpe insignis*, 313  
*Paphosia adorabilis*, 297  
     *helenæ*, 297  
*Papilio andraemon andraemon*, 374  
     *tailori*, 373  
     *aristodemus temenes*, 373  
     *polydamas polydamas*, 373  
*paradoxa*, *Eugralla*, 431  
*Parajalysus andinus*, 448  
     *nannus*, 449  
     *nigrescens*, 448  
     *pallidus*, 449  
     *sobrinus*, 447  
*parulus*, *Spizitornis parulus*, 433  
*parvirostris*, *Colorhamphus*, 433  
     *Crypturellus*, 22  
     *Microchera*, 330  
*parvula*, *Heliodoxa leadbeateri*, 337  
*parvulus*, *Camarhynchus parvulus*, 438  
     *Micropus andecolus*, 427  
     *Nesomimus parvulus*, 435  
*patachonicus*, *Tachyeres*, 420  
*Patagona gigas peruviana*, 339, 427  
*patagonicus*, *Cinclodes patagonicus*, 428  
     *Phrygilus*, 439  
*patulus*, *Ildraits*, 249  
*pauper*, *Nyctanassa violacea*, 418  
*Pelecanoides garnotii*, 414  
     *magellani*, 414  
*Pelecanus occidentalis thagus*, 414  
*pella*, *Topaza pella*, 337  
*Pennoceras seamani*, 147  
*pentlandi*, *Nothoprocta pentlandi*, 24  
     *perdicaria*, *Nothoprocta perdicaria*, 25, 412  
*peregrina*, *Appias drusilla*, 376  
*perelegans*, *Metacoceras*, 141  
*perpensus*, *Arabellites*, 260  
*peruviana*, *Patagona gigas*, 339, 427  
     *Pygochelidon cyanoleuca*, 434  
*peruvianus*, *Pterophanes cyanopterus*, 341  
     *Talaphorus hypostictus*, 318  
*peruviensis*, *Volatinia jacarina*, 439  
*Peters*, James L., *The Canadian forms of the Sharp-tailed Sparrow*, *Ammospiza caudata*, 201-210  
*Pezites militaris bellicosa*, 436  
     *militaris*, 436  
*Phaconotus ensis*, 446  
*Phæochroa cuvieri berlepschi*, 287  
     *maculicauda*, 287  
*phæochroa*, *Lepidopyga luminosa*, 308  
*phæopygus*, *Chlorostilbon prasinus*, 303  
*Phaëthon aethereus mesonauta*, 414  
*Phaethornis anthophilus anthophilus*, 281  
     *augusti*, *augusti*, 283  
     *bolivianus*, 279  
     *bourcierii*, 284  
     *coruscus*, 277  
     *griseogularis*, 286  
     *guyi apicalis*, 277  
     *guyi*, 277  
     *hispidus*, 281  
     *insignis*, 278  
     *longirostris cassini*, 280  
     *cephalus*, 281  
     *susurrus*, 280  
     *longuemareus*, 284  
     *malaris*, 280  
     *moorei*, 279  
     *muelleri*, 278  
     *ochraceiventris*, 279  
     *philippii*, 284  
     *pretrei*, 282  
     *ruber episcopus*, 286  
     *ruber*, 286  
     *rupununii amazonicus*, 282  
     *rupununii*, 282

- Phaethornis striigularis ignobilis*, 284  
     *saturatus*, 285  
     *striigularis*, 285  
     *subrufescens*, 285  
*stuarti*, 286  
*subochraceus*, 283  
*supercilius*, 278  
*syrmatophorus*, 281  
     *yaruqui, sancti-johannis*, 278  
*phainolæma, Heliothyris auriculata*, 355  
*Phalacrocorax atriceps atriceps*, 416  
     *bougainvillii*, 415  
     *gaimardi*, 415  
     *magellanicus*, 415  
     *olivaceus olivaceus*, 415  
*phalerata, Cœligena*, 342  
*phaon, Phyciodes phaon*, 383  
*Pheucticus chrysopeplus chrysoaster*,  
     437  
*phileta, Pieris phileta*, 375  
*philippii, Phaethornis*, 284  
*Phoca groenlandica*, 87  
     *fasciata*, 91  
     *vitulina geronimensis*, 117  
*Phocides pigmalion batabano*, 394  
*Phoebis neleis*, 378  
     *sennae sennae*, 378  
*Phoenicopterus ruber*, 419  
*Phrygilus patagonicus*, 439  
*Phyciodes lavinia f. genoveva*, 384  
     *f. zonalis*, 384  
     *phaon f. maya*, 384  
     *phaon*, 383  
*phylæus, Hylephila phylæus*, 395  
*Phytotoma rara*, 434  
*Piaya cayana thermophila*, 426  
*picui, Columbina picui*, 425  
*Pieris phileta phileta*, 375  
*Pinaroloxias inornata*, 438  
*Pionus menstruus*, 426  
*pipixcan, Larus*, 424  
*Pipraeidea melanonota venezuelensis*,  
     436  
*pitanay, Haematopus ostralegus*, 422  
*pitius, Colaptes pitius*, 428  
*Placenticeras meeki*, 47  
*plancus, Polyborus plancus*, 421  
*platycercus, Selasphorus platycercus*,  
     360  
*Platypiza crassirostris*, 438  
*plexippus, Danaus plexippus*, 379  
*poliocephala, Chloëphaga*, 419  
*Polyborus plancus plancus*, 421  
*polydamas, Papilio polydamas*, 373  
*polysoma, Buteo polysoma*, 421  
*polystictus, Ocreatus underwoodi*, 347  
*Polytmus guainumbi guainumbi*, 317  
     *thaumantias*, 317  
*poortmani, Chlorostilbon poortmani*,  
     304  
*Popelairia conversi æquatorialis*, 298  
*Poterioceras curtum*, 133  
     *subellipticum*, 135  
*præpes, Crypturellus cinnamomeus*, 20  
*prasinus, Chlorostilbon prasinus*, 303  
*pretrei, Phaethornis*, 282  
*prevosti, Anthracothorax prevosti*, 294  
*princeps, Xenoloma*, 444  
*Procellaria æquinoctialis*, 414  
*proclivis, Lumbriconereites*, 244  
*procurvus, Nereidavus*, 247  
*Progne modesta modesta*, 434  
*propinqua, Geospiza conirostris*, 438  
*Protacanthus nexus*, 446  
*proteoides, Urbanus proteus*, 395  
*Pseudobranchus striatus axanthus*, 183  
*Pseudorthoceras knoxense*, 131  
*Pseudotriton montanus floridanus*, 175  
*Psilopsiagon aurifrons aurifrons*, 426  
*pteneres, Tachyeres*, 419  
*Pterophanes cyanopterus cyanopterus*,  
     340  
     *peruvianus*, 341  
*Pteroptochos tarnii*, 430  
*Puffinus creatopus*, 413  
     *griseus*, 414  
     *lherminieri subalaris*, 414  
*pumilus, Climacoconus*, 231  
*punensis, Crypturellus obsoletus*, 10  
*purus, Eunicites*, 253  
*purusana, Melinaea maelus*, 397  
*Pygarrhicus albo-gularis*, 430  
*Pygochelidon cyanoleuca peruviana*,  
     434

- Pyrocephalus rubinus nanus*, 432  
     *obscurus*, 432  
*pyrope*, *Xolmis*, 431  
  
*quadratus*, *Climacoconus*, 226  
  
*Rallus sanguinolentus landbecki*, 422  
*rallus*, *Climacoconus*, 228  
*Ramphomicron microrhynchum andicola*, 348  
     *microrhynchum*, 348  
*rara*, *Phytotoma*, 434  
*raymondi*, *Conularina*, 223  
*refulgens*, *Thalurania furcata*, 310  
*Rhynchotus maculicollis*, 24  
     *rufescens rufescens*, 23  
*richardii*, *Phoca vitulina*, 111, 117  
*Ricordia maugæa*, 305  
     *ricordi æneoviridis*, 306  
     *ricordi*, 306  
     *swainsoni*, 306  
*ricordi*, *Ricordia ricordi*, 306  
*ridgwayi*, *Nesotriccus*, 432  
*robustus*, *Tinamus major*, 4  
*rosæ*, *Chatocercus*, 360  
*rosenbergi*, *Amazilia*, 330  
*rostrata*, *Hylocharis cyana*, 314  
*rubecula*, *Scelorchilus*, 430  
*ruber*, *Phaethornis ruber*, 286  
     *Phoenicopterus*, 419  
*rufa*, *Lessonia rufa*, 431  
*rufescens*, *Crypturellus cinereus*, 9  
     *Rhynchotus rufescens*, 23  
*ruficauda*, *Buteo magnirostris*, 421  
*ruficollis*, *Oreopholus*, 422  
*rufus*, *Selasphorus*, 361  
*rupununii*, *Phaethornis rupununii*, 282  
*russatus*, *Chlorostilbon*, 304  
*rutila*, *Amazilia rutila*, 329  
  
*salvini*, *Chlorostilbon caniveti*, 300  
     *Crypturellus variegatus*, 19  
     *Eutoxeres aquila*, 287  
*sancti-johannis*, *Phaethornis yaruqui*, 278  
*Sapho sapho*, 348  
     *sparganura*, 348  
  
*sapho*, *Sapho*, 348  
*sapphirina*, *Hylocharis*, 314  
*sasini*, *Selasphorus sasini*, 361  
*saturatior*, *Upucerthia dumetaria*, 429  
*saturatus*, *Phaethornis strigularis*, 285  
     *Tinamus major*, 5  
*Saucerrotia edward edward*, 427  
*saucerrottei*, *Amazilia saucerrottei*, 324  
*saülæ*, *Lafresnaya lafresnayi*, 340  
*Scapanorhynchus*, 46  
*Scelorchilus rubecula*, 430  
*Schistes albogularis*, 354  
     *geoffroyi*, 354  
     *geoffroyi bolivianus*, 354  
*Schistoceras hildrethi*, 151  
     *missouriense*, 155  
*scintilla*, *Selasphorus*, 361  
*Scolecodonts from the Erindale, Upper Ordovician, at Streetsville, Ontario, E. R. Eller*, 241-270  
*scoresbii*, *Leucophaeus*, 425  
*scoticus*, *Climacoconus*, 233  
*seamani*, *Pennoceras*, 147  
*Selasphorus flammula*, 361  
     *platycercus platycercus*, 360  
     *rufus*, 361  
     *sasini sasini*, 361  
     *scintilla*, 361  
     *simoni*, 361  
*sennæ*, *Phoebis sennæ*, 378  
*Sephanoides fernandensis fernandensis*, 344  
     *sephanoides*, 344, 427  
*sephaniodes*, *Sephanoides*, 344, 427  
*septentrionalis*, *Tinamus tao*, 3  
*Sericotes holosericeus holosericeus*, 296  
*serratus*, *Tinamus major*, 6  
*serrirostris*, *Colibri*, 293  
*Sharp-tailed Sparrow, Ammospiza caudata*, The Canadian forms of, James L. Peters, 201-210  
*sibilatrix*, *Mareca*, 420  
*simoni*, *Selasphorus*, 361  
     *Thalurania furcata*, 312  
*Sinclair, G. Winston, The Chazy Conularida and their congeners*, 219-240

- sinuatus, *Ænonites*, 255  
*Siren intermedia* nettingi, 211  
*smaragdinicollis*, *Metallura smaragdinicollis*, 349  
*smaragdinus*, *Agelaiocercus*, 353  
*Smaragdites theresiaë leucorrhous*, 317  
     *theresiaë*, 317  
*sobrinus*, *Jalysus*, 447  
*Solenochilus brammeri*, 144  
*sordidus*, *Cynanthus*, 306  
*soui*, *Crypturellus soui*, 14  
*sparganura*, *Sapho*, 348  
 Sparrow, Sharp-tailed, Critical remarks on the races of, W. E. C. Todd, 197-199  
*spectabilis*, *Eugenes*, 336  
*specularioides*, *Anas specularioides*, 420  
*specularis*, *Anas*, 420  
*spencei*, *Heliangelus*, 345  
*Speotyto cunicularia nanodes*, 427  
*Spheniscus humboldti*, 412  
     *magellanicus*, 412  
 Spieker, E. M., 41  
*spinicauda*, *Aphrastura spinicauda*, 430  
*Spinus barbatus*, 439  
     *magellanicus capitalis*, 439  
*Sporophila minuta centralis*, 438  
     *centralis*, 438  
*Staurocephalites cuspis*, 260  
*stellata*, *Megaceryle torquata*, 427  
*Stellula calliope calliope*, 359  
*stenurus*, *Chlorostilbon stenurus*, 305  
*Sterna hirundinacea*, 425  
*Sternoclyta cyanopectus*, 337  
*stictolophus*, *Lophornis*, 297  
*Stomatoceras rubra eriensis*, 31  
*streetsvillensis*, *Leodicites*, 257  
*striaticeps*, *Arremonops conirostris*, 439  
*striaticollis*, *Myiotheretes striaticollis*, 432  
*striatus*, *Butorides striatus*, 418  
*stricklandii*, *Capella*, 423  
*strigulosus*, *Crypturellus strigulosus*, 22  
*striigularis*, *Phaethornis striigularis*, 285  
*Strymon acis*, 390  
     *columella*, 391  
*Strymon martialis*, 390  
*stuarti*, *Phaethornis*, 286  
*stübeli*, *Oxypogon*, 352  
*subellipticum*, *Poterioceras*, 135  
*subochraceus*, *Phaethornis*, 283  
*subpagana*, *Elaenia flavogaster*, 433  
*subrufescens*, *Phaethornis striigularis*, 285  
*subvirgata*, *Ammospiza caudacuta*, 203  
*Sula neboxi*, 415  
     *leucogaster etesiaca*, 415  
     *variegata*, 415  
*sulcirostris*, *Crctophaga sulcirostris*, 426  
*summus*, *Leodicites*, 258  
*sundevalli*, *Butorides*, 418  
*superciliosus*, *Phaethornis*, 278  
*susurrus*, *Phaethornis longirostris*, 280  
*swainsoni*, *Riccordia*, 306  
*sylvicola*, *Panoquina sylvicola*, 396  
*Sylviorthorhynchus desmuri*, 429  
*syrmatorophorus*, *Phaethornis syrmatorophorus*, 281  
*Tachyeres patachonicus*, 420  
     *pteneres*, 419  
*tailori*, *Papilio andraemon*, 373  
*Tainoceras monilifer*, 142  
*Talaphorus hypostictus peruvianus*, 318  
*Tanagra luteicapilla*, 436  
*tao*, *Tinamus tao*, 3  
*tarnii*, *Pteroptochos*, 430  
*tataupa*, *Crypturellus tataupa*, 23  
*tayazu-guira*, *Nycticorax nycticorax*, 416  
*telasco*, *Sporophila*, 438  
*Tellina*, 55  
*temenes*, *Papilio aristodemus*, 373  
*temucoensis*, *Milvago chimango*, 421  
*tethys*, *Oceanodroma tethys*, 414  
*thagus*, *Pelecanus occidentalis*, 414  
*thalassinus*, *Colibri*, 293  
*Thalurania colombica colombica*, 309  
     *venusta*, 310  
     *cyana rostrata*, 314  
     *fannyi fannyi*, 309  
     *furcata*, 311  
     *baeri*, 313



- Thalurania furcata balzani*, 312  
     *boliviana*, 313  
     *fissilis*, 310  
     *furcata*, 311  
     *furcatoides*, 312  
     *nigrofasciata*, 312  
     *refulgens*, 310  
*thaumantias*, *Polytmus guainumbi*, 317  
*Thaumaste fernandensis fernandensis*, 427  
*Thaumastura cora*, 357  
*thenca*, *Mimus*, 435  
*theonus*, *Leptotes*, 394  
*theresia*, *Smaragdites theresia*, 317  
*Theristicus melanopis*, 418  
*thermophila*, *Piaya cayana*, 426  
*thilius*, *Agelaius thilius*, 436  
 Thompson, Frederick O., 127  
*thompsoni*, *Brephidium exilis*, 392  
*Thraupis bonariensis darwini*, 436  
     *episcopus diaconus*, 436  
*Threnetes leucurus leucurus*, 273  
     *ruckeri darienensis*, 274  
     *venezuelensis*, 273  
     *ventosus*, 274  
*Thryophilus modestus elutus*, 434  
*Tinamous*, List of, in the collection of the Carnegie Museum, by W. E. C. Todd, 1-29  
*Tinamus guttatus*, 7  
     *major castaneiceps*, 5  
     *fuscipennis*, 4  
     *major*, 6  
     *olivascens*, 6  
     *robustus*, 4  
     *saturatus*, 5  
     *serratus*, 6  
     *zuliensis*, 5  
     *tao kleci*, 3  
     *septentrionalis*, 3  
     *tao*, 3  
 Todd, W. E. Clyde, List of the Tinamous in the collection of the Carnegie Museum, 1-29  
 Todd, W. E. Clyde, Critical remarks on the races of the Sharp-tailed Sparrow, 197-199  
 Todd, W. E. Clyde, List of the Hummingbirds in the collection of the Carnegie Museum, 271-370  
 Tolmachoff, Dr. I. P., 127  
*Topaza microrhyncha pella*, 338  
     *pella pella*, 337  
*torquata*, *Cœligena*, 342  
     *Megaceryle torquata*, 428  
*transamazonicus*, *Crypturellus variegatus*, 18  
*triangulata*, *Conularina*, 220  
 Trimble, Ruth, Birds collected during two cruises of the "Vagabondia" to the west coast of South America, 409-441  
*tripuncta*, *Cymaenes tripuncta*, 395  
*Troglodytes musculus atacamensis*, 434  
     *chilensis*, 435  
*tuidara*, *Tyto alba*, 426  
*Turdus grayi casius*, 435  
     *chiguanco chiguanco*, 435  
     *falcklandii magellanicus*, 435  
*Turritella*, 48  
 Twomey, Dr. Arthur C., 409  
*Tyrannus melancholicus chloronotus*, 432  
*tyrianthina*, *Metallura tyrianthina*, 349  
*Tyto alba tuidara*, 426  
*tzacatl*, *Amazilia tzacatl*, 328  
  
*underwoodi*, *Ocreatus underwoodi*, 346  
*undosa*, *Conularina*, 222  
*undulatus*, *Crypturellus undulatus*, 17  
 Unklesbay, A. G. and Miller A. K., The Cephalopod fauna of the Cone-maugh Series in western Pennsylvania, 127-174  
*Upucerthia dumetaria saturator*, 429  
*Urbanus proteus proteoides*, 395  
*urochrysa*, *Chalybura urochrysa*, 333  
  
 "Vagabondia," Birds collected during cruise of, by Ruth Trimble, 409-441  
*vanillae*, *Dione*, 382  
*variegata*, *Sula*, 415  
*variegatus*, *Crypturellus variegatus*, 18

- venezuelensis, *Pipraidea melanonota*, 436  
*Threnetes ruckeri*, 273  
*ventosus*, *Threnetes ruckeri*, 274  
*venusta*, *Thalurania colombica*, 310  
*veraguensis*, *Doryfera ludovicicæ*, 273  
*Vestipedes cupreiventris*, 345  
*derbyi longirostris*, 346  
*glaucopoides*, 346  
*mosqueraei*, 346  
*vestitus*, 345  
*vestitus*, *Vestipedes*, 345  
*vicinior*, *Crypturellus cinnamomeus*, 20  
*victoriae*, *Lesbia victoriae*, 348  
*Victorina stelenes insularis*, 388  
*viola*, *Amazilia beryllina*, 329  
*violiceps*, *Amazilia violiceps*, 328  
*violifera*, *Cœligena violifera*, 342  
*viridicordatus*, *Anthraco thorax pre-*  
*vesti*, 295  
*viridigaster*, *Amazilia*, 325  
*viridigula*, *Anthraco thorax*, 295  
*viridis*, *Anthraco thorax*, 295  
*viridiventris*, *Hylocharis cyana*, 314  
*vitulina*, *Phoca*, 89  
*vitulina*, 117  
*vitellinus*, *Manacus vitellinus*, 431  
*Volatinia jacarina peruviana*, 439  
*vulcani*, *Chalcostigma stanleyi*, 351  
*Vultur gryphus*, 421  
*wagleri*, *Centurus rubricapillus*, 428  
Wallace, George E., Observations on the life history of a new Chalcidoid Wasp, an internal parasite of Ant-lion Larvae, 31-40  
warscewicz, *Amazilia saucerottei*, 324  
Wasp, Chalcidoid, Observations on life-history, by George E. Wallace, 31-40  
Watson, Frank E., 371  
Webster, Howard, 127  
Wells, Dr. John W., 127  
whitely, *Amazilia chionopectus*, 319  
williams, *Metallura*, 348  
woodruffi, *Panoquina sylvicola*, 396  
xantusi, *Hylocharis*, 317  
*Xenoloma princeps*, 444  
*Xolmis pyrope*, 431  
yapura, *Crypturellus undulatus*, 16  
*Yoldia evansi*, 56  
*yucatanensis*, *Amazilia yucatanensis*, 328  
zeledoni, *Cyanocorax affinis*, 434  
*Zenaidura auriculata auriculata*, 425  
f. *zonalis*, *Precis lavinia*, 384  
*Zonibyx modestus*, 422  
*Zonotrichia capensis antofagastae*, 439  
*australis*, 440  
*chilensis*, 440  
*zuliensis*, *Tinamus major*, 5



*ms. 1*

















SMITHSONIAN INSTITUTION LIBRARIES



3 9088 00895 7706